Review of the Bull Hill Wind Project Visual Impact Assessment

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1. Introduction

On February 4, 2010, Blue Sky East LLC submitted a permit application for the proposed 34.2 megawatt (MW) Bull Hill Wind Project located on Bull Hill and Heifer Hill ridges in T16 MD, Hancock County, Maine. The project is within the area designated for expedited grid-scale wind development. The generation facilities include:

- **Turbines**. Nineteen Vestas V100 wind turbines with a nameplate capacity of 1.8 MW each. The height of each turbine is 95 meters (approximately 312 feet) to the hub center plus 50 meters (approximately 164 feet) for the rotor blades, resulting in a total potential height of 145 meters (476 feet) to the tip of an upright blade. The turbines will be painted white. Red warning lights will be installed according to Federal Aviation Administration (FAA) guidelines. Typically lights are placed on the two end turbines, and on alternating turbines between them.
- **Collector line**. A 34.5-kilovolt (kV) underground collector line system will join a new substation.

Associated facilities include:

- **Access road**. The access road will be 24 feet wide, and the crane path will be 36 feet wide. An existing network of haul roads will be used to the greatest extent possible. A total of 4.8 miles of new road will be constructed. The roadways will not be revegetated, since experience with other projects indicates that it did little to minimize erosion and created unstable soils along the road.
- **Building**. An approximately 7,000-square-foot Operations and Maintenance building located by the substation and Line 66. It will be painted in neutral colors.
- **Weather towers**. There will be three 95-meter (312-foot) lattice-type permanent meteorological towers.
- **Substation**. A new substation will be centrally located and connect the 34.5-kV collector line to Line 66, an existing 115 kV transmission line. No new transmission lines are required.

The report entitled *Visual Impact Assessment Bull Hill Wind Project* by Terrence J. DeWan and Associates was submitted as part of Blue Sky East's permit application (TJD&A 2010). This report was prepared to review the adequacy of the visual impact assessment (VIA).[1] In addition, it presents the findings of a field investigation and additional analyses of the Bull Hill Wind Project's potential visual impacts. This is followed by an independent evaluation of the potential visual impacts to state and nationally significant scenic resources, using the Evaluation Criteria presented in the Wind Energy Act. These criteria are described Appendix 1. The final section of this report presents the Conclusions of this review.

[1] For the purposes of this review, aesthetic, scenic and visual impacts will be considered synonymous.

2. Adequacy of the Report

There is a standard process that is followed by all VIAs, which includes: (1) project description, (2) landscape character, (3) visibility analysis, (4) significant scenic resources, (5) public use and expectations, and (6) evaluation of potential impacts. This section reviews what the *Visual Impact Assessment Bull Hill Wind Project* by Terrence J. DeWan & Associates (TJD&A 2010) reported for each portion of the standard VIA process. This will include the survey of recreation users at two locations in the Donnell Pond Public Reserved Land that was conducted over the Columbus Day weekend (Robertson & MacBride 2010). This review is supported by two days of fieldwork on March 17 and 18, 2011 visiting the identified scenic resources within 8 miles of the proposed project. In addition, the geographic information system (GIS) data used for the VIA were reviewed and additional analysis conducted. In particular, a standard visibility analysis was performed using ArcMap software, and the visual simulations were compared to a three-dimensional ArcScene model to determine representational accuracy.

2.1 Project Description

The project's elements are described (TJD&A 2010, page 2-3, 9-12). The visible characteristics of the turbines that are described include color, height to the hub center and tip of an upright blade, rotor movement, and hazard beacons. An existing transmission line that passes through the project area will be utilized. "Associated facilities" include the operations and maintenance building, access roads, and substation are also described. There are no scaled drawings of the turbines or other project elements, such as the extent of cut-and-fill associated with the roads. All Study Area and Viewshed Maps show the location of each turbine and the transmission line (TJD&A 2010).

2.2 Landscape Character

The VIA describes the landform, water resources, vegetative patterns and cultural character of the area surrounding the proposed project (TJD&A 2010, pages 12-15). The major features are identified, including each of the state or nationally significant scenic resources. This description is interspersed with comments about whether the project may be visible from particular areas.

2.3 Visibility Analysis

TJB&A used WindPRO to conduct the visibility analysis using the National Elevation Dataset 1/3 Arc-Second (NED 1/3), which is "the best available raster elevation data for the conterminous United States" (USGS 2009a). The NED 1/3 arc-second data has a resolution of about 10 meters with a with $\leq$ 4 meter absolute vertical height accuracy (USGS 2009b). The VIA includes a topographic viewshed map as Map E that indicates areas where as many as 1 to 5, 6 to 10, 11 to 14 and 15 to 19 turbine blade tips may be visible.

There is also a visibility map that takes into account the screening effect of forest trees. Few details are given, the VIA only states that "Conservative estimated heights of vegetation were assigned to the various cover types" and "Vegetation heights assumed an average tree height of 40‟ in most situations" (TJD&A 2010, page 5).

Additional information was provided in response to a data request (TJD&A 2011). Maine Land Cover Data (MELCD) were used rather than the National Land Cover Data (NLCD). While

comparable, MELCD includes classes for harvested forest, while the NLCD does not. “Assumed heights: Deciduous- 40’ (12.2m), Evergreen- 40’ (12.2m), Mixed 40’(12.2m), Wetland-30’ (9.1m), Light Partial Cut-40’ (12.2m), Heavy Partial Cut-40’ (12.2m), and Regenerating-20’(6.1m)” (TJD&A 2011). Forested Wetland is assumed to be 30 feet high. It is dominated by trees that are 16 feet high but the total vegetation coverage need only be 20 percent. One assumes that the 80 percent not covered by vegetation could be low wetland plants. In addition, Light and Heavy Partial Cuts are both assigned a height of 40 feet. Light Partial Cuts can have an overstory canopy as low as 50 percent, but Heavy Partial Cuts can have an overstory canopy of just a few percent. It seems quite possible that there are normal circumstances where these classes would provide little to no screening. Finally, Forest Regeneration is assigned a height of 20 feet, even though these trees are seedling to sapling sized, and could be below eyelevel. In addition, the text indicates that “in certain areas, e.g., where mature evergreens were observed at the margins of ponds, the assigned vegetation height was increased bines” (TJD&A 2010, page 5). However, where such changes were made is not documented. A truly “conservative” viewshed analysis would not include these harvested areas as a visual screen. A more appropriate way to demonstrate the screening effect of these four classes would be to measure the height of trees at specific locations in the field where their screening effect could be observed and then illustrate this screening effect by drawing a scaled cross-section.

One error was observed in Viewshed Map F Topography and Vegetation—the extensive visibility from Spectacle Pond is not indicated. While Spectacle Pond is not a state or nationally significant scenic resource, TJD&A has indicated that they will submit a corrected map.

In addition to the two visibility maps, Table 1 lists all of the great ponds with significant or outstanding scenic value and whether they have a potential view of the project, how many turbines are potentially visible, and the distance to the nearest turbine. The visibility reported in these tables seems to be informed by the field work as well as the visibility maps.

The concept of distance zones is presented in section 5.2 of the VIA. The thresholds that are listed were developed by the USDA Forest Service for the more arid western part of the country, and may not be appropriate for the more humid conditions in the northeast. In any case, the perceptual definition of distance zones is what really matters, and wind turbines confound these traditional thresholds. So, the foreground for a wind turbine may be less than a half-mile because they are composed of smooth materials without much apparent texture, and foreground is defined as the distance where “observers are able to detect surface textures, details, and a full spectrum of color (TJD&A 2010, p. 16). However, the middle distance may extend further than 4 miles because the basic elements of a turbine are so large that they remain recognizable at distances where most naturally occurring landscape elements (e.g., trees) have ceased to be individually recognizable. Objects, such as trees or buildings, or groupings of objects in the landscape are most obvious at this distance and create a characteristic visual pattern or texture—“within this zone the details found in the landscape become subordinate to the whole. … [and] development patterns are readily apparent” (TJD&A 2010, p. 16). I believe that this is fundamentally the reason why the threshold where wind turbines were determined to no longer have a significant potential impact was set at 8 miles by the Wind Energy Act. This is the beginning distance of the background for the current generation of grid-scale wind turbines, where atmospheric effects and distance result in a simplified image—“texture has disappeared and color has flattened, but large

patterns of vegetation or rock are still distinguished, and landform ridgelines and horizon lines are the dominant visual characteristics" (USDA 2000, p. 4-11). While turbines may be visible beyond 8 miles, they will be relatively indistinct and it may not be possible to detect the motion of the blades.

2.4 Significant Scenic Resources

As part of the Project Study Area, Existing Character of the Surrounding Area (section 5.1), the VIA identifies all of the state and nationally significant scenic resources within 8 miles of the proposed wind turbines. The state and nationally significant scenic resources includes five Great Ponds with outstanding and four with significant scenic quality (TJD&A 2010, Table 1) (TJD&A 2010, Table 2). In addition, there is one 1 site listed on the National Register of Historic Places, one area of Maine Public Reserved Land designated by the Department of Conservation as a scenic resource (DOC 2010), and one mountain peak designated a coastal scenic resource (HCPC & WCCG 2010). A brief description of those scenic resource within the topographic viewshed is included in the VIA section 6.0 Visual Impacts on Scenic Resources of State or National Significance, and located on the Study Area and Viewshed Maps. Table 1 below summarizes visibility information from the VIA for the state and nationally significant scenic resources, including name, distance to nearest turbine, and number of turbines potentially visible.

Table 1. Summary of Scenic Resources of State and National Significance within 8 Miles of the Generating Facilities as Identified by TJD&A

Scenic Resources of State or National Significance in the Surrounding Area	Distance to Nearest Turbine (miles)	Number of Turbines Visible w/in 8 miles
Historic Sites		
Eastbrook Baptist Church and Town House	5.0	Up to 5
Great Ponds		
Donnell Pond	5.3	Up to 12
Fox Pond	5.1	0
Little Long Pond	5.4	0
Lower Lead Mountain Pond	7.6	0
Middle Lead Mountain Pond	7.9	0
Myrick Lake	4.6	Blades of 6±
Narraguagus Lake	2.0	Up to 19
Spring River Lake	5.9	0
Tilden Pond †	5.8	0
Tunk Lake	7.3	0
Upper Lead Mountain Pond	7.0	0
Maine Public Reserve Land		
Donnell Pond Unit—Black Mountain	7.8	5
Donnell Pond Unit—Schoodic Beach	7.8	5
Coastal Scenic Resources		
Tunk Mountain ‡	4.9	19

† "Needs field checking due to positive public comment" (Giffen et al. 1987).

‡ The Tunk Mountain summit is said to be on private property (DOC BPL 2007, page 20) and apparently the public does not have a legal right of access so it does not qualify as nationally significant scenic resources under 35-A MRSA, § 3451, § 9. However, there is informal access to Tunk Mountain and BPL is investing in trails from the Blackwoods Scenic Byway (Route 182) that pass through the Donnell Pond PRL to access Tunk Mountain (Turner 2011a). It should be noted that the photograph viewpoint used for Photosimulation 2 appears within the boundary of the Donnell Pond Unit in our GIS data.

2.5 Visual Simulations

Visual simulations are a primary tool to investigate the impact to significant scenic resources. TJD&A prepared six photosimulations as part of their VIA. Each simulation is based on a photograph taken with a digital camera capable of capturing images 4288-by-2848 pixels. A prime lens was used to assure that all the images had the same focal length. In this case the lens' focal length was 35 mm with a 37.3° horizontal angle of view, which is very close to the convention for a "normal" lens. The location of each photograph is "tagged" using a Jobo photoGPS. Basic information about the photographs used in the simulations is presented in Table 2. Myrick Lake and the Eastbrook Baptist Church are the only state or nationally significant scenic resources with a potential view of some portion of the proposed turbines which are not represented among the simulations.

Table 2. Establishing Viewing Distance for the VIA Photosimulations

Simu-lation	Location	Camera	Focal Length	Equivalent Focal Lens†	Horizon-tal Angle	Simulation Width	Viewing Distance
1B	Narraguagus Lake	D300	35 mm	53.4 mm	37.3°	14.25"	21.1
2B	Tunk Mountain*	D300	35 mm	53.4 mm	37.3°	14.25"	21.1
3B	Black Mountain	D300	35 mm	53.4 mm	37.3°	14.25"	21.1
4B	Donnell Pond—southern viewpoint	D300	35 mm	53.4 mm	37.3°	14.25"	21.1
5B	Donnell Pond—northern viewpoint	D300	35 mm	53.4 mm	37.3°	14.25"	21.1
6B	Donnell Pond—Schoodic Beach	D300	35 mm	53.4 mm	37.3°	14.25"	21.1

† Using Nikon's DX format (23.6mm-by-15.7mm). http://www.isotton.com/misc/lens-angle-calculator/

* The Farmhouse Turnout (aka Overlook) was misnamed the Center Hill Overlook in the VIA.

TJD&A uses WindPRO to prepare a digital perspective drawing of the wind turbines and the horizon line as seen from the same location and using the same "lens" as the photograph used. This horizon line is based only on topography and is limited to the extent of the study area. This drawing is superimposed over the photograph and the simulation technician registers them by matching the topographic horizon line to the horizon line of the photograph, as shown in Figure 1. This registration must take into account the height of the trees that are typically covering topography in the photo. WindPRO has tools to assist in removing parts of the turbines that are behind landscape elements in the photograph and making other adjustments. Sometimes PhotoShop may also be used to graphically clean up the image.

The photosimulations presented in the VIA appear generally accurate and well constructed. An additional analysis of the simulations is presented in section 3.3 Visual Simulations.

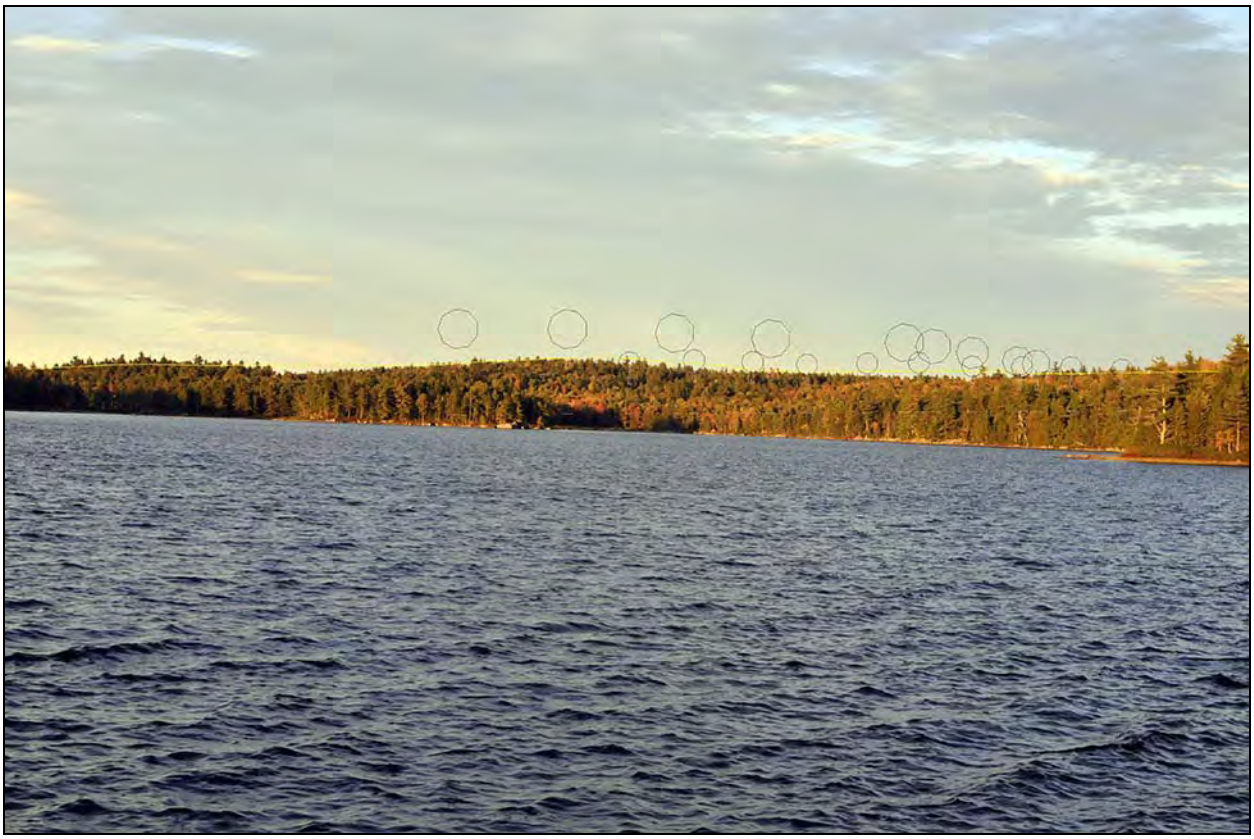

Figure 1. A draft of Photosimulation 1B from Narraguagus Lake showing how the WindPRO drawing is registered to the photograph by aligning the landform ridge line. In this case the alignment is at the top of the forest canopy, which is well above the landform ridgeline. Later drafts will remove the ridgeline, incorporate realistically rendered drawings of the turbines, and remove parts of the turbine that are not visible behind the mountain ridge. *Source:* TJD&A.

2.6 Public Use and Expectations

Section 6 of the VIA attempts to provide a description of the extent, nature, and duration of public uses, and the typical viewer's expectations for scenic resources that the topographic visibility analysis indicated had the potential of views to the Project. However, with one exception described below, these descriptions are very brief and do not include information about the number of users or their length of stay. The nature of the use appears to be based on common sense or perhaps brief descriptions located through an internet search. Similarly, the description of viewer expectations appears to be based on conventional wisdom rather than any systematic investigation—at least the VIA does not cite any sources to substantiate the assertions of public use and viewer expectations.

This lack of real information is not surprising. It is unusual to find a park or other scenic resource with accurate visitation numbers, let alone length of stay, types of activities, the nature of visitor expectations, or the quality of their experience. The Maine State Comprehensive Outdoor Recreation Plan (SCORP) primarily reports statewide statistics rather than statistics for specific parks (Maine DOC BPL 2009).

Recognizing the lack of information to responsibly address the Wind Energy Act's Evaluation Criteria concerning public use and expectations, the Land Use Regulation Commission has encouraged wind energy developers to conduct a survey from at least one scenically significant resource to better understand these issues. Blue Sky East, LLC commissioned a survey of visitors to Black Mountain over the Columbus Day weekend. This site was chosen because it has prominent views of the project, and it was anticipated that there might be more visitors than at other scenic resources where the project will be visible. In addition, interviews were conducted in the parking lot for Schoodic Beach and the trail to Schoodic Mountain. Large photographs of the existing and simulated future view from Black Mountain and the southern end of Donnell Pond were evaluated. Those interviewed on Black Mountain also evaluated their actual view. Eighty-one interviews were conducted by Market Decision on October 9 and 10, 2010 (Robertson and MacBride 2010). Their general reported findings include:

- 129 adults and 24 children were observed during the survey.
- In general, the scenic rating of the actual view from Black Mountain (mean rating of 6.26 out of 7.00) was comparable to the photograph of the view (mean rating of 6.24).
- The apparent scenic impact the proposed turbines reduces the scenic rating from Black Mountain by over 1.91 points on a 7-point scale.
- The apparent scenic impact the proposed turbines reduces the scenic rating from the southern end of Donnell Pond by over 0.88 points on a 7-point scale.
- In general, visitors thought that the proposed turbines would have a slight negative effect on their enjoyment of a recreation experience on Black Mountain (mean rating of 3.43 on a 7-point scale where 4 means no change in enjoyment at all).
- In general, visitors thought that the proposed turbines would have almost no effect on the likelihood that they would return to Black Mountain (mean rating of 3.43 on a 7-point scale where 4 means no change in enjoyment at all).
- In general, visitors thought that the proposed turbines would have almost no effect on the likelihood that they would return to Black Mountain (mean rating of 3.90 on a 7-point scale where 4 means no change in enjoyment at all).
- In general, visitors thought that the proposed turbines would have almost no effect on the likelihood that they would return to the Donnell Pond Unit (mean rating of 3.90 on a 7-point scale where 4 means no change in enjoyment at all).
- In general, visitors thought that the proposed turbines would have almost no effect on the likelihood that they would return to the Donnell Pond for water activities (mean rating of 3.87 on a 7-point scale where 4 means no change in enjoyment at all).

Further review and analysis of this study are included later in this review.

2.7 Evaluation of Potential Scenic Impacts

Logically, the information about the project, surrounding area, and scenic resources' character and use should be presented first in a VIA. Then the scenic impact and whether it is Not Adverse, Adverse, or Unreasonably Adverse can be systematically evaluated by applying the Evaluation Criteria to what is presented about each scenic area and their views of the proposed development. By and large this is the way that the *Visual Impact Assessment Bull Hill Wind*

Project presents the information and evaluation using the following framework, which rearranges the Evaluation Criteria slightly but retains their substance.

- **Context.** The existing character of the surrounding area and the context of the proposed activity. (§ 3452.3.B and 3452.3.D).
- **Significance**. The significance of the potentially affected scenic resource of state or national significance (§ 3452.3.A).
- **Public Uses**. The extent, nature and duration of potentially affected public uses of the scenic resource of state or national significance. (§ 3452.3.E).
- **Viewer Expectations**. The expectations of the typical viewer who would be using or enjoying the scenic resource of state or national significance. (§ 3452.3.C).
- **Project Impact.** The scope and scale of the potential effect of views of the Project on the scenic resource of state or national significance, including but not limited to issues related to the number and extent of turbines visible from the scenic resource of state or national significance, the distance from the scenic resource of state or national significance, and the effect of prominent features of the development on the landscape. (§ 3452.3.F).
- **Potential Effect on Public Use**. The potential effect of the generating facilities' presence on the public's continued use and enjoyment of the scenic resource of state or national significance. (§ 3452.3.E).
- **Conclusion**. A determination of whether the development significantly compromises views from a scenic resource of state or national significance such that the development has an unreasonable adverse effect on the scenic character or existing uses related to scenic character of the scenic resource of state or national significance. (§ 3452.1). (TJD&A 2010)

This approach is systematic and clearly drawn from the Wind Energy Act's evaluation criteria. However, it is recommended that each criterion be more clearly and completely defined. The identification of indicators for evaluating each criterion would be a desirable addition.

The VIA evaluates 5 of the 14 identified significant scenic resources within 8 miles of the project turbines. The primary criterion of whether to evaluate a scenic resource or not appears to be whether it was found to have potential views of the project based on TJD&A's Viewshed Map F and field verification.

The Eastbrook Baptist Church and Townhouse is not evaluated because the field verification determined that vegetation would screen the turbines. The view is photographically documented on page 5 of Appendix B, though there is no indication of where the project would be in the view and why it might not overtop the vegetation. A cross-section might be appropriate to further support this assertion.

2.7.1 Narraguagus Lake

Context: This resource is described as surrounded by low hills; the most distinctive is Tunk Mountain, which is in the opposite direction from the proposed project. The shore is mostly undeveloped forest. The importance of this description to evaluating potential impacts is not described.

Significance: The Maine *Wildlands Lakes Assessment* rates this lake as a "significant" scenic resource. The ratings from the State Planning Office's *Scenic Lakes Character Evaluation in Maine's Unorganized Towns* are presented. Its boulder-strewn character and vegetation diversity seem to be it primary visual attributes. It is noted in the section on Visual Impact that the presence of the turbines will not change the attributes that contribute to this scenic quality. However, there is a factor called "Inharmonious Development" which is described as "residential development, visible roads, power lines, etc." that can contribute up to -20 points. How this factor might be evaluated with the presence of the turbines is not discussed.

Public Uses: Use is thought to be light, in part because of poor access. There is no formal public boat launch. There is no documentation for the number of users, their activities, or the role scenic quality plays in their experience.

Viewer Expectation: They are stated to be moderate to high, though no documentation is given. The reasoning given is that the lake is largely undeveloped, tempered by local logging activity—though this raises the question of whether viewer expectation result from surrounding character or the viewer's activity and state of mind.

Project Impact: There are areas on the lake where all of the turbine will be visible from a distance of 2 to 6 miles. A photosimulation showing the hubs of 17 turbines and portions of blades from a couple more is presented. It is noted that no turbines will be visible from the area where most of the camps are located. There is no analysis, such as is given for the turbines as seen from Donnell Pond. For instance will the turbines present line, color, form and scale contrasts? Will turbines block or otherwise visually interfere with any of the prominent features that contribute to the lake's scenic quality as described in the Context and Significance sections? Would the lake still be rated "significant" in the *Scenic Lakes Character Evaluation in Maine's Unorganized Towns* if the turbines were considered in the rating as Inharmonious Development?

Potential Effect on Public Use: It is stated that there will be an effect on the character of the lake, and that the relatively low number of users will be impacted, but the effect how these users enjoy their recreation activities and whether it will discourage them from returning is not discussed.

Conclusion: I can agree that "the project will occupy a prominent position… but not block the southerly view toward Tunk Mountain, which is the focal point of the lake." However, this does not justify the conclusion that the project "should not significantly compromise views from Narraguagus Lake" (TJD&A 2010, page 22).

"The Project should not have an unreasonable adverse effect on its scenic character or the uses related to the scenic character of the lake" (TJD&A 2010, page 22). The use of the verb "should" is ambiguous here. It could mean that it "should not have an unreasonable adverse effect" because the Wind Energy Act so indicates or it could be because some reasoning has led the authors to believe that it will not have an Unreasonable Adverse effect. Since it is presented that the view of the project will be "prominent" one might assume that it will be Adverse (though this is not explicitly state), but no explicit reason is given why it is not Unreasonably Adverse.

2.7.2 Myrick Lake

Context: A very general description of the lake's surrounding is given without reference to scenic quality. The importance of this description to evaluating potential impacts is not described.

Significance: The Maine *Wildlands Lakes Assessment* rates this lake as a "significant" scenic resource. The ratings from the State Planning Office's *Scenic Lakes Character Evaluation in Maine's Unorganized Towns* are presented and show that it only just met the significance threshold. Features are identified as having moderate quality. The importance of this description to evaluating potential impacts is not described.

Public Uses: It is noted that there is no formal access. There is no documentation of the types of use or an estimate of the extent of use.

Viewer Expectations: Expectations are assumed to be high, but there is no documentation supporting this.

Project Impact: There is potential visibility of 6± turbines over an arc of 11 degrees, though vegetation may screen all but the tops. It is not noted that the pond is within 4.6 miles. No simulation or cross-section is provided.

Potential Effect on Public Use: Because the turbines are not expected to be highly visible, there is no anticipated significant effect on use. A simulation would help verify this conclusion.

Conclusion: No reasoning is presented why the project "should not significantly compromise views."

2.7.3 Donnell Pond

Context: The relationship of the pond to the state reserved lands and private lands is presented. The scenic nature of views from Donnell Pond and how they might be experienced is described.

Significance: The Maine *Wildlands Lakes Assessment* rates this lake as an "outstanding" scenic resource. The ratings from the State Planning Office's *Scenic Lakes Character Evaluation in Maine's Unorganized Towns* are presented and show that its physical features (islands, beaches, boulders, etc.) are especially important, but that all factors other than vegetation contribute to its rating. It was given a modest penalty for existing development, which has increased since the ratings were made.

Public Uses: The facilities for various types of use are described, but not the extent and duration of use. However, the general sense that is presented suggests this lake is experienced as having "remote to semi-remote natural character" while having relatively easy access. Swimming at one of the beaches, and various boating activities are apparently very popular.

The survey is mentioned here rather than under Visual Impact, though no results are given.

Viewer Expectations: It is assumed that users have "high expectations of natural scenic quality, mixed with human development," though no supporting documentation is provided. It is mentioned that in the survey respondents rated a view from the pond 5.5 out of a possible 7 points.

Project Impact: A description of the number of turbines that may be visible from different parts of the pond is given, but there is no mention if only the blade tips, the nacelle, or most of the turbine will be visible. The turbines are expected to occupy a horizontal arc of 7 to 8 degrees. "The primary impact will be on people who fish or boat on the lake," one assumes because the turbines will be most visible from the water.

The turbines are described as large human elements with contrasting form, line and color, which the simulations seem to support. It is also asserted that because of their distance, they "should not present an unacceptable contrast in scale." However, there is no indication of how this judgment is made. For instance, how is it determined that the scale contrast in Photosimulation 4 is acceptable? What about the scale contrast for Photosimulation 1 of Narraguagus Lake (which was not discussed)—is it acceptable or unacceptable? Would the lake still be rated "outstanding" in the *Scenic Lakes Character Evaluation in Maine's Unorganized Towns* if the turbines were considered in the rating as Inharmonious Development?

Potential Effect on Public Use: The survey results indicate that the rating of the view from Donnell Pond will drop from 5.50 to 4.62, or 0.88 points on a 7-point scale. A large majority of respondents said that the presence of the turbines would not affect their future enjoyment or the likelihood that they would return.

Conclusion: A summary is of the situation is presented: large artificial elements are introduced and will be visible from 20 percent of the lake when facing toward the project. The surrounding context includes some existing development, including a communications tower and seasonal homes. It is acknowledged that the impact is Adverse, but it "should not have an Unreasonable Adverse effect on the scenic character or uses related to the scenic character of Donnell Pond." The reasoning or thresholds that separate a judgment of Adverse from Unreasonably Adverse are not made clear.

2.7.4 Donnell Pond Unit, Maine Public Reserved Land

Context: The Donnell Pond Unit is described as a complex and growing set of resources, including conservation easements on adjacent private lands. It is large forested with several prominent mountains.

Significance: Several references are described that attest to the scenic quality of the Unit. The views from Black Mountain and Schoodic Mountain are described. No attempt is made to place its significance in the context of other significant scenic resources.

Public Uses: Schoodic Mountain is reputed to be a more popular hike than Black Mountain, which was supported by the survey results. The Bureau of Parks and Lands is developing a procedure to gather visitor use data.

Viewer Expectations: It is assumed that users have high scenic expectations. However, "while many people reported [in the survey] that the view was a reason for being in the Donnell Pond Unit, it was not the reason most often given." From Black Mountain, the view toward the ocean was rated 6.93, while the view toward the project was rated 6.26 on a 7-point scale. These are both very high ratings.

Project Impact: While all 19 turbines will be visible through a horizontal arc of 11 degrees, only 5 turbines will be within 8 miles, and they occupy an arc of 6 degrees.

It is recognized that "the turbines will have an Adverse effect on the view from the summit of Black Mountain" due to "contrast in form, line, and color." It is asserted that because the turbines are far away, "when compared with the surrounding low hills" they "should not present an unacceptable contrast in scale." How do we know this? The height of the Bull Hill ridge ranges from 450 to 620 feet while the height to the upright tip of a turbine will be 476 feet. Is there no scale contrast because Bull Hill and the wind turbines are of similar height? Does it matter that this is a comparison of a mountain (hill) and a man-made element? Or that the turbines will be sitting on top of Bull Hill? A better description of scale contrast and how to make this judgment needs to be given.

Potential Effect on Public Use: The survey respondents' rating of the view from Black Mountain toward Bull Hill was 6.26; the introduction of the turbines dropped it to 4.32. This is a very large drop. However, 45 percent of the respondents indicated that it would not affect their enjoyment one way or the other. It is not clearly presented that 47 percent indicated that it would have some negative effect on their enjoyment, while 9 percent indicated that it would have some positive effect. Nonetheless, 75 percent of respondents indicated that it would not affect the likelihood that they would return one way or another.

Conclusions: While it is recognized that the project will have an Adverse effect, it is concluded that "the project should not have an Unreasonable Adverse effect on the scenic character or the uses related to the scenic character of Black Mountain." The reasons given are that it will occupy a "relatively small portion of the 360 degree view" and that it "will have no effect on the most highly rated view (i.e., towards Mount Desert Island and Acadia National Park to the south)." This is a good start, but how do other Evaluation Criteria contribute to this judgment?

2.7.5 Tunk Mountain

Context: Tunk Mountain is the highest peak in the area with a distinctive character. The summit is said to be on land owned by The Nature Conservancy (DOC BPL 2007, page 20), but it is unclear whether the public has a legal right of access. However, there is informal access to Tunk Mountain and BPL is investing in trails from the Blackwoods Scenic Byway (Route 182) that pass through the Donnell Pond PRL to access Tunk Mountain (Turner 2011a). There is a panoramic 360 degree view. It should be noted that the photograph viewpoint used for Photosimulation 2 appears within the boundary of the Donnell Pond Unit in our GIS data.

Significance: It is significant because it is so indicated in the Downeast Coastal Scenic Inventory, but there is no discussion about why it is significant other than that the view is excellent.

Public Uses: There is no documentation of use, though the trail's condition indicates that it has much lighter use than Schoodic or Black Mountains.

Viewer Expectations: It is assumed that expectations are high because of the proximity to scenic resources.

Project Impact: All 19 turbines are within 8 miles and will be visible across a horizontal arc of 22 degrees.

Potential Effect on Public Use: The effect is assumed to be similar or slightly greater than the effect documented for Black Mountain—it would not affect the enjoyment or likelihood or returning for most people.

Conclusions: While it is recognized that the project will have an Adverse effect, it is concluded that "the project should not have an Unreasonable Adverse effect on the scenic character or the uses related to the scenic character of Tunk Mountain." The reasons given are that most of the views and the most scenic views are oriented toward the coast and away from the project. This is a good start, but how do other Evaluation Criteria contribute to this judgment?

2.7.10 Observations about the Application of the Evaluation Criteria in the VIA

Several observations can be drawn from this review of how the Evaluation Criteria have been applied in this VIA.

- The Evaluation Criteria as presented in the Wind Energy Act require refinement to be unambiguously understood, accurately applied and usefully interpreted.[2]
- This VIA does a good job of describing the number and extent of turbines visible and their distance from the significant scenic resource (Criterion F).
- Much more effective use can be made of the photosimulations when addressing the Evaluation Criteria. It is important that a "worst case" view from each state or nationally significant scenic resource be prepared if there is the potential view of the generating facilities (e.g., Eastbrook Baptist Church and Myrick Lake) and that they be discussed when considering the Evaluation Criteria.
- The information about public use (Criterion E), viewer expectations (Criterion C), and potential effect on public use (Criterion E), is generally not based on documented data. This is primarily because the data do not already exist. Blue Sky East is to be commended for conducting an original intercept survey of hikers on Black Mountain and in the parking area for Schoodic Mountain and Schoodic Beach.
- The Evaluation Criteria concerning significance (Criterion A) and existing character (Criterion B) need to better focus on scenic quality so that they will be useful in making a determination about scenic impact. It is helpful to reference the original detailed ratings where available.

[2] 35-A MRSA, § 3452, sub-§3

3. Field Review and Additional Analysis

The first section of this review describes how the standards and criteria established by the Wind Energy Act fit with a normal approach to visual impact assessment process. The second section of this review considers the adequacy with which the *Visual Impact Assessment Bull Hill Wind Project* follows this process. This, the third section, reports the findings of the fieldwork and additional analyses conducted as part of this review.

3.1 Determination of the Area of Potential Effects and State and Nationally Significant Scenic Resources

Area of Potential Effects (APE). The VIA must evaluate potential scenic impacts to all state or nationally significant scenic resources within 3 miles of generating facilities (i.e., turbines and transmission line). The permitting authority may require within 30 days of its acceptance of the application as complete for processing the evaluation of potential scenic impacts to state or nationally significant scenic resources within 8 miles of generating facilities. It may also require within the 30 day period the evaluation of scenic impacts from associated facilities (e.g., buildings, access roads, and substations).

In practice, VIAs have been using an APE of 8 miles from the wind turbines. Typically, the transmission line has not explicitly effected determination of the APE because it joined an existing transmission line well within this as is the case for this project.

State and Nationally Significant Scenic Resources. The VIA correctly identifies the potential scenic resources of state and national significances under the Wind Energy Act. These are listed in Table 1.

However, the Wind Energy Act states that "'scenic resources of state or national significance' means an area or place owned by the public or to which the public has a legal right of access."[3] The ownership of two resources is public: Eastbrook Baptist Church and Town House, and Tunk Mountain, which is owned by The Nature Conservancy for conservation purposes.[4] While both owners serve a community purpose and are typically open to the public, it is not at all clear whether the public has a legal right of access. **Guidance needs to be obtained from the State Attorney General's Office about how to interpret this requirement of the Wind Energy Act.**

3.2 Visibility Analysis

Visibility analysis determines whether a line-of-sight exists between two specified points. Typically a geographic information system (GIS) is used to map the viewshed from which specified targets are visible. In principle this is an objective exercise in geometry highly suited to a computer application. In practice however, since the data are only approximations of the actual condition and may include errors or require assumptions, the resulting viewshed maps are best considered a preliminary analysis of potential visibility under simplified conditions. The maps are useful for providing a preliminary investigation of the overall potential visual impact, and

[3] 35-A MRSA, § 3451, § 9

[4] The Tunk Mountain summit is on private property (DOC BPL 2007, page 20) and apparently the public does not have a legal right of access so it does not qualify as nationally significant scenic resources under 35-A MRSA, § 3451, § 9. However, there is informal access to Tunk Mountain and BPL is investing in trails from the Blackwoods Scenic Byway (Route 182) that pass through the Donnell Pond PRL to access Tunk Mountain (Turner 2011).

particularly for comparing alternatives. If potential visual impacts appear to exist for significant scenic resources, they need to be confirmed through field investigation and other visualization techniques.

For this review, visibility analyses were performed using ArcGIS 10 software (ESRI 2010). The digital data were provided by Terrence J. DeWan and Associates (2011) and appear to be the same as those available from the Maine Office of GIS. The original elevation data used for this review are based on a 10-by-10 meter grid, and have ≤ 4 meter absolute vertical height accuracy, the same as used in the VIA. However, in our visibility analysis, we resampled these data to correspond to the same 5-by-5 meter grid used for the Maine Land Cover Data dataset. The analysis procedure is relatively standardized, though analysts can reasonably make different assumptions about the analysis variables, and the results can be presented in a variety of ways.

In addition to investigating visibility limited only by landform, the VIA conducted a vegetated viewshed analysis that assigned vegetation heights to forested wetlands and recently harvested areas, as previously described in section 2.3 Visibility Analysis. For this review, the forested visibility analysis assumes a dense 40-foot high visual screen where forested land cover occurs—that is deciduous, evergreen and mixed forest, but not in areas recently harvested or wetlands. Forty feet is commonly used by professionals in the northeast as a conservative, but reasonable forest canopy height in a visibility analysis.

Visibility of the Bull Hill Wind Project. The six viewshed maps prepared to investigate several issues associated with the Bull Hill Wind Project are included in Appendix 1. The first two maps investigate the greatest possible area from which a part of any turbine could possibly be visible. In this case it is an upraised blade tip 443 feet (135 meters) above the ground. Three different constraints on visibility are considered: (1) just bare topography, (2) topography with forest cover, and (3) topography with forest cover, harvested forest, and forested wetlands as used by TJD&A in their VIA. The resulting viewshed maps are:

Map 1: Topographic Viewshed for Blade Tip

Map 2: Forested Viewshed for Blade Tip

Map 3: Forested Viewshed for Blade Tip Using TJD&A Forest Heights

While there may be a line-of-sight to just an upraised blade tip, it may not be noticeable and would certainly not be visually dominant. Therefore another analysis investigates the area from which a significant portion of a turbine could possibly be visible. In this case it is visibility of the turbine hub, located 317 feet (95 meters) above the ground. The same three constraints on visibility resulted in the following viewshed maps:

Map 4: Topographic Viewshed for Turbine Hub

Map 5: Forested Viewshed for Turbine Hub

Map 6: Forested Viewshed for Turbine Hub Using TJD&A Forest Heights

All six maps are included in Appendix 2 of this review.

Visual inspection indicates that this review's topographic viewshed of blade tips shows the same area as TJD&A's (2010) Viewshed Map A, and that this review's forested viewshed map using TJD&A's vegetation cover and height assumptions is the same as TJD&A's (2010) Viewshed Map B. However, the maps from the VIA include turbines that are further away from the viewer than 8 miles. For instance look at Middle Lead Mountain Lake, at the northern end of the study area. There are only 6 turbines that are within 8 miles of the southern portion of this lake—so there cannot be an impact from 15 to 19 turbines as the VIA's Viewshed Map E indicates. This is because the Wind Energy Act specifies that "the effects of portions of the development's generating facilities located more than 8 miles, measured horizontally, from a scenic resource of state or national significance" are "insignificant." [5] If the 8-mile threshold is incorporated into the analysis, then the edges of the viewshed map will appear "feathered" as turbines drop out of range for consideration as having a significant scenic impact.

Table 3 reports the size of the area from which the project may be visible given the assumptions used for each of the six visibility maps created for this review. Forty-two percent of the study area is screened from a potential view of an upright blade tip by landform topography. It is very unlikely that anyone at ground-level looking toward the Bull Hill will see any portion of a wind turbine from this area. Maine Historic Preservation Commission agreed that any potential historic resources within this area need not be surveyed for indirect effects from the proposed project (Jones 2010). **This guidance to only evaluate state or nationally significant scenic resources with potential views of a turbine tip as indicated by the topographic visibility analysis is reasonable and should be adopted by others.**

It is frequently argued that accounting for the screening effect of forest cover provides a more realistic assessment of a wind project's visibility. Approximately 10 percent of the study area has a potential to view of a turbine tip if one assumes the a screening effect from assigning a height of 40 feet to the deciduous, evergreen and mixed forest land cover types. TJD&A also assign screening effects to harvested areas that have significantly less canopy closure, as described above in section 2.3 Visibility Analysis. The visibility analysis using these screening assumptions from the VIA indicate that only 5.5 percent of the study area has potential views of blade tips. This difference demonstrates that assumptions about screening—what land cover types to include and what heights to assign to them—can significantly affect the results of a visibility analysis. This is the reason that we caution about relying heavily on the results of visibility analysis using forest screening to make decisions about visual impacts. **Potentially "worst case" viewpoints at all state or nationally significant scenic resource need to be investigated in the field, and should also be investigated though geometrically accurate visual simulations.**

[5] 35-A MRSA, § 3452, § 3

Table 3. Area of Bull Hill Wind Turbine Visibility*

Visibility Analysis	Potentially Visible Area (square miles)	Percent Study Area†
Turbine Tip Visible		
Topographic	151.6	58.0
Forested	25.8	9.9
TJD&A	14.4	5.5
Turbine Hub Visible		
Topographic	145.0	55.1
Forested	21.6	8.3
TJD&A	11.9	4.6

* Visibility is based on an ArcGIS analysis before field verification.
† The area within 8 miles of a turbine is 228 square miles.

Table 4 summarizes the maximum number of Bull Hill blade tips and turbine hubs that may possibly be visible from the significant scenic resources within 8 miles of the turbines using the following visibility constraints: topographic, forested, and forested with harvested areas as used by TJD&A in the VIA.

There are seven Great Ponds that will be screened by topography from the Bull Hill Wind Project: Fox Pond, Little Long Pond, Middle Lead Mountain Pond, Spring River Pond, Tilden Pond, Tunk Lake and Upper Lead Mountain Pond. In addition, there is the question of whether Tunk Mountain qualifies as a significant scenic resource under the Wind Energy Act because it is a privately owned without public right of access.

Table 4. Maximum Number of Bull Hill Wind Turbines Visible within 8 Miles of Significant Scenic Resources

Significant Scenic Resource	Nearest Turbine (miles)	Blade Tip Visible			Turbine Hub Visible		
		Topographic	Forested	VIA	Topographic	Forested	VIA
Historic Sites							
Eastbrook Baptist Church and Town House	5.0	8	0	0	5	0	0
Great Ponds							
Donnell Pond	5.2	8	6	6	7	5	5
Fox Pond †	5.1	0	0	0	0	0	0
Little Long Pond †	5.4	0	0	0	0	0	0
Lower Lead Mountain Pond	7.6	6	0	0	6	0	0
Middle Lead Mountain Pond †	8.0	0	0	0	0	0	0
Myrick Lake	4.6	11	4	4	8	4	4
Narraguagus Lake	2.0	19	19	19	19	17	17
Spring River Lake †	5.8	0	0	0	0	0	0
Tilden Pond †	5.8	0	0	0	0	0	0
Tunk Lake †	7.2	0	0	0	0	0	0
Upper Lead Mountain Pond †	7.0	0	0	0	0	0	0
State Parks							
Donnell Pond Unit—Black Mountain	7.8	5	5	5	5	5	5
Donnell Pond Unit—Schoodic Beach	8.0	1	1	1	1	1	1
Coastal Scenic Resources							
Tunk Mountain ‡	4.9	19	0	0	19	0	0

† Topography screens all visibility of the project from these sites.

‡ Tunk Mountain is on private property without public legal right of access, though informal access is being granted.

3.2 Field Review
I was able to visit some of the significant scenic resources on March 17 and 18, 2011. The weather was clear and temperate on March 18, though there was substantial snow on the ground in some places. It was overcast on the morning of March 18. The primary purpose of this field work was to check the landscape character and viewing condition from significant scenic resources with the greatest apparent visual impact (e.g., Black Mountain) and where photosimulations were not prepared, but there appeared to be a potential for turbine views (e.g., Eastbrook Baptist Church).

Historic Sites
3.2.1 Eastbrook Baptist Church and Town House. This church is privately owned, but as a community facility it is unclear whether there is a public legal right of access. From the front steps, a slightly elevated viewpoint, it appears that the turbines will be screened by local trees and a house.

Great Ponds
3.2.2 Donnell Pond. We were able to visit Schoodic Beach on the southern end of Donnell Pond (see below). However the lake had begun to thaw, so we did not attempt to walk out on the ice where the visibility analysis indicates more turbines would be visible.

3.2.3 Myrick Lake. The road from State Route 182 to Myrick Lake was not plowed and we were unable to investigate it.

3.2.64 Narraguagus Lake. We followed the road from State Route 182 to Narraguagus Lake for some way until we came to a drainage ditch across the road that we could not drive through. Therefore we were unable to investigate it. However we did observe one large log yarding area and several smaller landings.

Maine Public Reserved Land
3.2.1 Donnell Pond Unit—Black Mountain. The hike to Black Mountain was between 1.5 and 2.0 miles. It was slow hiking because of ice and snow in some places; however the day was sunny and quite beautiful. The trail was well marked with blazes and cairns. Black Mountain has three peaks. First we reached the south peak, and there was no apparent view of the project. We continued on to the east peak where the intercept survey was conducted. There is a magnificent 360 degree panorama from this peak. All of the turbines will be visible from this location, though only 5 will be within the 8 mile threshold for potentially significant scenic impact.[6] Today there is less haze than is captured in the VIA's Photosimulation 3. I would agree with the survey results that the higher quality view from this location is toward the south and Acadia National Park rather than north toward Bull Hill.

3.2.2 Donnell Pond Unit—Schoodic Beach. The road to Schoodic Beach was only partially plowed, and the walk in was about a mile through show. This is a deep beach that is about 900 feet long and is composed of coarse sand. There are a number of picnic tables located among the scattered trees at the back of the beach. This appears to be a beautiful swimming beach that could accommodate a large number of people. It is possible that some turbines will be visible at the far

[6] 35-A MRSA, § 3452, § 3

western end of the beach, but only one turbine has the possibility of being within the 8 mile threshold for potentially significant scenic impacts. The VIA's image used for Photosimulation 6 is an accurate representation of the view from the beach.

Scenic Turnout

3.2.4 Blackwoods Byway. State Route 182 has been designated the Blackwoods Byway, a scenic highway "by the Commissioner or Transportation pursuant to Title 23, section 4206, subsection 1, paragraph G."[7] We drove the length of this scenic road to verify that there was not a "scenic turnout constructed by the Department of Transportation pursuant to Title 23, section 954" [8] designated scenic highway. Only such scenic turnouts are considered state or nationally significant scenic resources under the Wind Energy Act.[9] None were found.

3.3 Visual Simulations

TJD&A constructed their photosimulations using WindPRO software, and checked them using Google Earth. The simulations appeared reasonable, but without access to WindPRO software, it is not possible to replicate their work. Therefore this review employs ArcScene software to provide an independent check of the reasonableness of the simulations and to explore the possibility of visibility from areas where photosimulations were not made. While not a photo-realistic image, ArcScene visualizations are accurate perspectives created with the same horizontal angle of view as the VIA photosimulations. These visualizations are located in Appendix 3: ArcScene Visualizations. They are created with the same GIS data used for the visibility analysis. In general the visualizations exaggerate the visual impact of the turbines because the tree heights are 40 feet and the turbines are a very dark color. While setting tree height to 40 feet is normal for visibility analysis purposes, it is lower than the normal forest canopy in this region.

3.3.1 Narraguagus Lake. Visualization 1 is to be compared to Photosimulation 1 from a point on the mid-eastern shore of Narraguagus Lake. The scope and scale of the project is similar in both representations; the simulation appears to be an accurate representation.

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[7] 23 MRSA, §4206. Duties of commissioner. 1. Duties. The commissioner shall have the following general powers, duties and responsibilities: … G. To establish a system of scenic highways in the State of Maine and preserve the scenic values along the system of highways; to develop and adopt procedures for the designation and development of that system of scenic highways and the preservation of the scenic value in the highway corridor and in the implementation of this intent and purpose consider the scenic value, safety aspects, economic implications, preservation of scenic value and compatibility with other national, regional and local conservation plans;

[8] 23 MRSA, §954. Picnic areas. The department is authorized to construct along state and state aid highways roadside picnic areas, roadside springs, scenic turnouts or other landscaping where in the opinion of the department it may seem advisable and place distinguishing signs upon the same. The department is authorized to use for the maintenance of the same such funds as are now available for maintenance of state and state aid highways. In any roadside area along any state or state aid highway where modern flush toilet facilities are provided for public use, there shall be provided toilet rooms which are accessible to and usable by the physically disabled, as defined in Title 25, sections 2701 and 2702 respectively. The department shall erect and maintain signs along the approach to any roadside area where toilet facilities accessible to the disabled are available which are designed to inform disabled persons that the facilities are available.

[9] 35-A MRSA, § 3451, §§ 9.G

3.3.2 Tunk Mountain. Visualization 2 is to be compared to Photosimulation 2 from a point on Tunk Mountain. This particular photograph is a bit hazy. While it is likely accurate, it does not represent the turbines as clearly as they could be seen. However the scope and scale of the project is similar in both representations; the simulation appears to be an accurate representation.

3.3.3 Black Mountain. Visualization 3 is to be compared to Photosimulation 3 from a point on Black Mountain. This particular photograph is a bit hazy. While it is likely accurate, it does not represent the turbines as clearly as they could be seen. However the scope and scale of the project is similar in both representations; the simulation appears to be an accurate representation.

3.3.4 Donnell Pond—Southern Viewpoint. Visualization 4 is to be compared to Photosimulation 4 from a point on the southern end of the western shore of Donnell Pond. The clouds that form the backdrop in this particular photograph reduce the contrast that makes the turbines visible. While it is likely accurate, it does not represent the turbines as clearly as they could be seen. However the scope and scale of the project is similar in both representations; the simulation appears to be an accurate representation.

3.3.5 Donnell Pond—Northern Viewpoint. Visualization 5 is to be compared to Photosimulation 5 from a point midway up the western shore of Donnell Pond. The scope and scale of the project is similar in both representations; the simulation appears to be an accurate representation.

3.3.6 Donnell Pond—Schoodic Beach. Visualization 6 is to be compared to Photosimulation 6 from Schoodic Beach. Only a tip of a turbine is visible in the Photosimulation, and it does not quite rise above the tree line in the Visualization. The difference is very slight; I would accept the simulation as an accurate representation.

3.4 Interviews with Visitors on Black Mountain and the Schoodic Beach Parking Lot

Visitors to the eastern summit of Black Mountain and the parking lot for Schoodic Beach and Schoodic Mountain trail were interviewed over Columbus Day weekend (October 9 and 10, 2010) to determine how seeing the Bull Hill Wind Project might affect their recreation experience. The intercept interviews were conducted by Marketing Decisions of Portland, Maine (Robertson and MacBride 2010).

The Evaluation Criteria mandated by Maine's Wind Energy Act require knowledge about visitors to state or nationally significant scenic resources and the potential impact to their experience that is not normally available. This study provides unique information directly relevant to the Bull Hill Wind Project, and indirectly relevant to other proposed wind projects in Maine. The sample has 81 respondents, essentially all hiking and not engaged in water activities. The survey is divided among two location and several destinations, making it difficult to conduct some of the simple tests reported in this review. However, these are the data that are available. While the value of the analysis presented here is limited, it illustrates the type of analysis that might be performed to address the Wind Energy Act's Evaluation Criteria.

The major limitations of the study are that only a few respondents were actually at the site of a photosimulation (28 people were interviewed on Black Mountain), respondents were rating scenes that were not destinations for them, the sample procedure is not strictly random, and it did not sample days throughout the recreation use season (only Saturday and Sunday over Columbus Day weekend). Nonetheless, similar limitations are commonly encountered in marketing research, and there do not appear to be any obvious biases being introduced into the study.

3.4.1 Public Use. The weather for these two days was very suitable for a day hike. A total of 66 groups with 158 adults and 34 children were observed for an average group size of 2.9 people.[10] The data were not collected in a way that would enable one to determine the relative number of people going to Black Mountain, Schoodic Beach, Schoodic Mountain or another destination.

Communications with Chuck Simpson, Public Lands Regional Manager, provided an estimate of 10,000 to 12,000 visitor days in 2008 for the camping and water sports activities (Simpson 2011). The BPL is in the process of developing a survey to collect more complete user data. BPL is also "developing much improved access to newly designated and upgraded trails and other recreation resources (such as water access and boating/fishing) along the section of the Blackwoods Scenic Byway running through the Donnell Pond Unit. …We can't say for certain what the impact on visitation will be, but it is only natural to assume that designating parking, improved trails, signage, and press/improved information should bump up the use in the general Tunk Mt./Spring River Lake/Tunk Lake area" (Turner 2011b).

3.4.2 Validity of Photograph. The viewpoint for the survey on Black Mountain is the same that was used for Photosimulation 3. The measurement of scenic impact is reliant on a static photosimulation with a limited horizontal cone of vision. It is therefore important to establish that the scenic value rating of the Actual View is comparable to the rating of the Photograph used in the Photosimulation—this is a question of validity. The mean rating is 6.26 for the Actual View and 6.04 for the Photograph (as judged by those respondents on Black Mountain), with 1.0 being the lowest and 7.0 being the highest scenic value. There is no statistically significant difference between these two values, which supports the validity of this study's methods (Paired $t = 1.49$, $p = .148$).

However respondents on Black Mountain rated the existing photograph lower than did the other respondents, though this difference is not significant ($F = 2.84$, $p = .096$). It may be that the rating of the existing photo by those on Black Mountain was slightly depressed by the greater scenic beauty of the view in other directions. For instance, the actual view toward Bull Hill was rated 6.26 while the actual view toward the ocean was rated 6.93, which is a significant difference (Paired $t = 4.12$, $p = .0002$). There may be other explanations for this difference too. This result suggests that people engaged in a recreation activity on site may evaluate photographs and simulations differently than people in other settings. While this issue warrants further investigation, it would seem that the best practice may be to emphasize surveys with users at actual viewpoints where impacts will be experienced.

The data were not collected to do a comparable validity test for the Donnell Pond viewpoint.

[10] Robertson and MacBride (2010) report 105 adults and 24 children, but the data indicated these higher numbers.

3.4.3 Apparent Scenic Impact. The difference between the scenic value of the Photosimulation and the Existing Condition photograph is the apparent Scenic Impact. It can range between negative impact of -6.0 and a positive impact of 6.0, with 0.0 indicating no scenic impact. The analysis of apparent scenic impact for the Black Mountain and Donnell Pond viewpoints is provided in Table 5. The results for respondents on Black Mountain are separated from the results for the other respondents; the results for respondents who indicated that their destination was the beach (i.e., Donnell Pond) were separated from the other respondents. Both groups evaluated the scenic impact form Black Mountain as being very high. While somewhat lower the scenic impacts to the view from Donnell Pond are also high. While the scenic impact perceived by those who said that the beach was their destination is greater than 1.0, it is not statistically significant. This is probably because there are only 12 people in this group.

Table 5. Ratings of Potential Scenic Impact from Black Mountain and Donnell Pond

	Black Mountain (Photosimulation 3)		Donnell Pond (Photosimulation 4)	
	On site	Other respondents	Beach destination	Other respondents
Existing Condition	6.04	6.38	5.75	5.46
Photosimulation	4.02	4.48	4.58	4.62
Scenic Impact	-2.02	-1.90	-1.17	-0.83
Test	$t = 5.78$, $p \leq .0001$	$t = 7.42$, $p \leq .0001$	$t = 2.13$, $p = .057$	$t = 5.04$, $p \leq .0001$
Number	28	53	12	69

3.4.4 Effect on Experience and Likelihood to Return. The relevant Evaluation Criterion from the Wind Energy Act is less the apparent Scenic Impact, *per se*, and more about its Effect on the Experience of users at significant scenic resources. Another possible indicator of how users of Black Mountain or Donnell Pond might be affected by the project is their Likelihood to Return if the project were built. The study report provides the simple mean values for ratings of Effect on Enjoyment (mean = 3.43), which is statistically significant from the "no change" rating of 4.0. Likelihood to Return to the Donnell Pond Unit (mean = 3.90), and Likelihood to Return to the Donnell Pond for water activities (mean = 3.87). Neither of these ratings differs significantly from a rating of "no change", as shown in Table 6.

Table 6. Ratings of Effect on Enjoyment and Likelihood of Returning

How will the proposed wind project affect your …	Mean	*t*	*p*
Enjoyment of views from Black Mountain?	3.43	4.11	≤ 0.0001
Likelihood of returning to the Donnell Pond Unit?	3.95	0.41	0.686
Likelihood of returning to Donnell Pond for water activities?	4.02	0.19	0.849

A useful additional analysis is to investigate the relationship of apparent Scenic Impact with Effect on the Experience and Likelihood to Return. Linear regression is one approach to such an analysis. There is a modest, but statistically significant relationship between apparent Scenic Impact to the view from Black Mountain and the Effect on the Enjoyment (adjusted $R^2 = -37.7\%$, $t = 6.94$, $p \leq .0001$). However the relationship between apparent Scenic Impact to the view from Black Mountain and the Likelihood to Return to the Donnell Pond Unit is much smaller

(adjusted R^2 = 14.5%, t = 3.8, p = .0003). In other words, those who see a very negative Scenic Impact believe that constructing the project would affect their Enjoyment; however it has less effect on their Likelihood to Return.

The Scenic Impact to the view from Donnell Pond has a very weak relationship to the Likelihood to Return for water-based activities, such as boating, swimming or fishing (adjusted R^2 = 3.0%, t = 1.87, p = .066)

Support for wind energy in Maine is moderately correlated with Scenic Impact to Black Mountain (Pearson r = .56) and Donnell Pond (Pearson r = .59), Effect on Enjoyment (Pearson r = .51) Likely to Return to the Donnell Pond Unit (Pearson r = .47) and Likely to Return to the Donnell Pond for water activities (Pearson r = .34).

4. Evaluation of Scenic Impacts

4.1 Evaluation Criteria

Ten places were identified as potential state or nationally significant scenic resources under the Wind Energy Act criteria. This section evaluates the scenic impact to these resources based on my understanding of the Wind Energy Act's scenic impact Evaluation Criteria. [11]

A **Significance of resource**: Consider the role of scenic quality in designation, and the level of significance relative to similar designations. Indicators may be obtained from the designation reports or forms, supplemented by descriptions from widely used guide books.

B **Character of surrounding area**: Consider contrasts with the existing landscape and the presence of other contrasting elements. User surveys may provide a direct measure of the existing scenic quality. This may also be based on a descriptive landscape characterization, typically prepared by a landscape professional.

C **Typical viewer expectation**: Consider the resource's scenic reputation, and the centrality of scenic quality in its designation. User surveys may provide an indicator of expectations. In the absence of direct empirical data, distance traveled or descriptions from widely used guide books may provide alternative indicators.

D **Development's purpose and context**: This criterion incorporates the Wind Energy Act's goal of achieving significant wind energy development into consideration of scenic impacts. Consider site quality—wind suitability, proximity to transmission line, and potential power generation if all potential turbine sites in the area are used. Low evaluation means that if all sites in the area are developed, it makes a major contribution to Wind Energy Act's goals. High evaluation means the area makes a minor contribution when all potential sites are developed.

E.1 **Extent, nature & duration of uses**: Consider the number of users, role of scenic quality in use of the resource, and typical length of stay. User surveys provide the most direct indicators, but trail logs or traffic counters may also be useful. Potential accessibility may be an indicator in the absence of empirical data.

E.2 **Effect on continued use and enjoyment**: If the project were built, what is the likelihood of users returning, and the impact on their enjoyment of the scenic resource? User surveys incorporation accurate photographic visual simulations may provide indicators.

F **Scope and scale of project views**: Consider the relative magnitude of project elements, and the proportion of total angle of view occupied by project. Accurate photographic simulations and visibility analyses may provide indicators.

The levels of severity for the Evaluation Criteria are as follows:

[11] 35-A MRSA, § 3452, sub-§3

- **None.** The Evaluation Criterion makes no contribution to scenic impact. For some criteria a rating of None means that there is No Adverse Impact (e.g., there are no people present—Criterion E, or the project is not visible—Criterion F).

- **Low**. The severity of the contribution is low. While the scenic impact may be Adverse, it appears to be within the acceptable range for any type of development (e.g., only one or two turbines will be partially visible at a distance of nearly 8 miles—Criterion F).

- **Medium**. The severity of the contribution is medium, which is Adverse but typical of wind energy development, and within the range of impacts that the Wind Energy Act anticipates (e.g., other towers or large scale structures are present that contrast highly with the surrounding landscape).

- **High**. The severity of the contribution is high from this criterion, which in association with other criteria may make the overall scenic impact Unreasonably Adverse (e.g., a possible scenario suggesting an Unreasonable Adverse impact might be that the scenic resource is a national icon—Criterion A is High, though there are only modest numbers of viewers—Criteria E.1 is Low—to a person their enjoyment will seriously decline—Criteria E.2 is High).

The Evaluation Criteria for each of the state or nationally significant scenic resources are discussed below, and summarizes in Table 6 the Evaluation Criteria ratings for the Bull Hill Wind Project.

4.2 Eastbrook Baptist Church and Town House
Public access. This church is privately owned, but as a community facility it is unclear whether there is a public legal right of access.

*Criterion F: Scope and scale of project views***.** From the front steps, a slightly elevated viewpoint, it appears that the turbines will be screened by local trees and a house.

Overall scenic impact. None, since there is no project visibility. It is also uncertain whether the public has a legal right of access.

4.3 Donnell Pond
Public access. This is a Great Pond largely surrounded by publicly owned property. The public has a legal right of access to all Great Ponds.

Criterion A: Significance of resource. Donnell Pond is rated as an outstanding scenic resource in the *Maine Wildlands Lakes Assessment*.

The detailed ratings for this assessment were not published, but the detailed ratings for the predecessor study *Scenic Lakes Character Evaluation in Maine's Unorganized Towns* were published. Donnell Pond received 60 points, and 50 points is the threshold for outstanding scenic

quality. Only one of the rating elements can be effected by the construction of a wind turbine project—Inharmonious Development. Inharmonious development noted in the field was “given a rating based on the feature’s character and dominance” (Jones 1986, page 7). “Twenty points were subtracted from the scores of lakes with drastic f1uctuations in water 1eve1. Lakes with other types of inharmonious development were given negative points on the basis, of dominance of the inharmonious feature as rated in the field (i.e. high, moderate or low). Ten points were subtracted if inharmonious development was rated as "high", and five points were subtracted if inharmonious development was rated as "moderate". No points were taken off the scores of 1akes where inharmonious development was rated as low or none” (Jones 1986, page 13). One assumes that points can accumulate if there are several inharmonious developments on a lake.

The upper portion of many Bull Hill wind turbines will be clearly visible from portions of the lake, as illustrated in Photosimulations 4 and 5. It is possible that this is sufficient to subtract 10 points for inharmonious development. Even so, this would be insufficient to move Donnell Pond out of the Outstanding scenic resource category.

Criterion B: Character of surrounding area. Donnell Pond is pinwheel shaped, with a complex shoreline and many small islands. It is surrounded by forested hills on the north and west, and forested mountains to the east and south. Because of its shape, the view is constantly changing as one moves around the lake.

Most of the shoreline is in the Donnell Pond Unit, and is managed to maintain a natural appearing state. Conversely the lake provides a complementary recreation resource to the Donnell Pond Unit, where the beach at the southern end of the lake is a primary recreation attraction.

Criterion C: Typical viewer expectation. It is assumed that viewer expectations for scenic quality are generally high for users of Donnell Pond. However, there is some evidence that scenic quality may be less important to people engaged in fishing or motor boating as compared to those engaged in hiking or nature study (Palmer 1999).

Criterion D: Development’s purpose and context. At 34.2 MW, the Bull Hill Wind Project is of moderate size. No plans are presented to expand this project.

Criterion E.1: Extent, nature & duration of uses. Schoodic Beach and The Bureau of Parks and Lands estimate that Donnell Pond and Schoodic Beach attracted 10,000 to 12,000 visitors in 2008 (Simpson 2011). There is a boat launch at the western tip of the lake. Swimming, boating canoeing, kayaking, and fishing are the dominate activities. This is a day-use facility.

*Criterion E.2: Effect on continued use and enjoyment***.** In the survey, respondents indicated that the wind turbines would be no effect on their likelihood of returning to Donnell Pond for water activities such as boating, canoeing, kayaking, swimming or fishing. There was no question concerning how the turbines might affect their enjoyment of being on the lake.

Criterion F: Scope and scale of project views. Most of the turbine visibility is concentrated in the southern arm and central are of Donnell Pond. Photosimulation 4 shows how the proposed

project will appear from a viewpoint on the southwestern shore; Photosimulation 5 is from a viewpoint located in the hub of the pinwheel. In both cases, the turbines are seen above the horizon as one looks down the lake to the north, which provides the longest viewing distance. As many as 5 or 6 turbines within 8 miles of the viewer could be visible, though more distant turbines may also be visible. However at a distance greater than 6 miles, even the closest turbine will have a diminished presence on the skyline.

The survey did ask respondents to rate Photosimulation 4 and a photograph of the existing conditions from the same viewpoint. The 12 people who identified Schoodic as their destination rated the existing condition 5.75 and the photosimulation 4.58; the mean ratings by the remaining 69 respondents were 4.58 and 4.26 respectively. The apparent scenic impact of the wind turbines was significant for both groups.

Overall scenic impact. The survey results indicate that the turbines will have a significant negative impact to Donnell Pond's scenic value. This is exacerbated by the approximately 10,000 potential viewers who use the lake each year, and this number may be increasing. However, scenic resources may not play a major role in enjoying the primary uses on the lake—fishing and boating. Similarly, scenic resources may have a diminished importance in the enjoyment of the more social activities—sunning, swimming and picnicking— that occur on the beach at the southern shoreline. The survey indicates that the turbines will not affect the likelihood that people will return to Donnell Pond engage in water based activities. As a result, the overall scenic impact is judged to be Medium.

4.4 Fox Pond

*Criterion F: Scope and scale of project views***.** Topography will screen views of the project. Without visibility there can be no visual impact. Therefore it will not be considered further.

Overall scenic impact. None, since there is no possible project visibility.

4.5 Little Long Pond

*Criterion F: Scope and scale of project views***.** Topography will screen views of the project. Without visibility there can be no visual impact. Therefore it will not be considered further.

Overall scenic impact. None, since there is no possible project visibility.

4.6 Lower Lead Mountain Pond

Criterion F: Scope and scale of project views. Only the southern tip of Lower Lead Mountain Pond is within the 8-mile study area. The topographic viewshed analysis indicates a possible visibility of 6 turbines; however the forested viewshed analysis indicates that they will all be screened by vegetation.

Overall scenic impact. None, since the possibility of project visibility is very remote and the closest turbine is 7.6 miles distant.

4.7 Middle Lead Mountain Pond

*Criterion F: Scope and scale of project views***.** Topography will screen views of the project. Without visibility there can be no visual impact. Therefore it will not be considered further. It is also uncertain whether the public has a legal right of access.

Overall scenic impact. None, since there is no possible project visibility.

4.8 Myrick Lake

Public access. This is a Great Pond largely surrounded by private property, which is conservation land. The public has a legal right of access to all Great Ponds.

Criterion A: Significance of resource. Myrick Lake is rated as a significant scenic resource in the *Maine Wildlands Lakes Assessment*.

The detailed ratings for this assessment were not published, but the detailed ratings for the predecessor study *Scenic Lakes Character Evaluation in Maine's Unorganized Towns* were published. Myrick Lake received 20 points, which is the lowest possible rating for significant scenic quality. Only one of the rating elements can be effected by the construction of a wind turbine project—Inharmonious Development. Inharmonious development noted in the field was "given a rating based on the feature's character and dominance" (Jones 1986, page 7). "Twenty points were subtracted from the scores of lakes with drastic f1uctuations in water 1eve1. Lakes with other types of inharmonious development were given negative points on the basis, of dominance of the inharmonious feature as rated in the field (i.e. high, moderate or low). Ten points were subtracted if inharmonious development was rated as "high", and five points were subtracted if inharmonious development was rated as "moderate". No points were taken off the scores of 1akes where inharmonious development was rated as low or none" (Jones 1986, page 13).

If the upper portion of several Bull Hill wind turbines were clearly visible from portions of the lake this might be sufficient to subtract 5 or 10 points for inharmonious development. This would be sufficient to remove Myrick Lake from the Significant scenic resource category.

Criterion B: Character of surrounding area. The surrounding area is managed forest land. Tunk Mountain is close by to the south.

Criterion C: Typical viewer expectation. It is assumed that viewer expectations for scenic quality are generally high for users of Myrick Lake. However, there is some evidence that scenic quality may be less important to people engaged in fishing or motor boating as compared to those engaged in hiking or nature study (Palmer 1999).

Criterion D: Development's purpose and context. At 34.2 MW, the Bull Hill Wind Project is of moderate size. No plans are presented to expand this project.

Criterion E.1: Extent, nature & duration of uses. This is unknown. However, there is no boat launch and access is by informal trails, which would indicate low use. In addition, fishing is anticipated to be the primary use and Palmer (1999) found that fishing was an activity where

people did not appear to place as high a value on scenic quality as people who hiked or were engaged in nature study.

*Criterion E.2: Effect on continued use and enjoyment***.** This is unknown. However the survey found that the wind turbines would be no effect on respondents' likelihood of returning to Donnell Pond for water activities such as boating, canoeing, kayaking, swimming or fishing. This may also be the case for Myrick Lake.

Criterion F: Scope and scale of project views. The nearest turbines are 4.6 miles distant. The viewshed analysis indicates that turbines will potentially be visible in the long narrow neck and southwestern corner of Myrick Lake. This GIS analysis indicates that anywhere from 1 to 4 turbine hubs may be visible over the forested shoreline, however it was not possible to verify this through field investigation. If the shoreline trees are significantly higher than 40 feet, they may screen all views of the turbines.

Overall scenic impact. It is possible that approximately 4 turbine hubs could be visible, though they may be screened by shoreline vegetation higher than 40 feet tall. Since it was not possible to get to Myrick Lake to verify it condition, this is an unknown. However, if turbine hubs are visible, this may be sufficient to remove the Significant scenic quality rating in the *Maine Wildlands Lakes Assessment*. Use of Myrick Lake is assumed to be low. It is assumed that use of Myrick Lake would not be affected, since the survey found that respondents' likelihood of returning to Donnell Pond to engage in water-based activities. The overall impact is judged to be Low.

4.9 Narraguagus Lake

Public access. This is a Great Pond largely surrounded by private property, some of which is conservation land. The public has a legal right of access to all Great Ponds.

Criterion A: Significance of resource. Narraguagus Lake is rated as a significant scenic resource in the *Maine Wildlands Lakes Assessment*.

The detailed ratings for this assessment were not published, but the detailed ratings for the predecessor study *Scenic Lakes Character Evaluation in Maine's Unorganized Towns* were published. Narraguagus Lake received 30 points, and 20 points is the threshold for significant scenic quality. Only one of the rating elements can be effected by the construction of a wind turbine project—Inharmonious Development. Inharmonious development noted in the field was "given a rating based on the feature's character and dominance" (Jones 1986, page 7). "Twenty points were subtracted from the scores of lakes with drastic f1uctuations in water 1eve1. Lakes with other types of inharmonious development were given negative points on the basis, of dominance of the inharmonious feature as rated in the field (i.e. high, moderate or low). Ten points were subtracted if inharmonious development was rated as "high", and five points were subtracted if inharmonious development was rated as "moderate". No points were taken off the scores of 1akes where inharmonious development was rated as low or none" (Jones 1986, page 13).

Many Bull Hill wind turbines will be clearly visible from portions of the lake. This might be sufficient to subtract 10 points for inharmonious development. However, this would be insufficient to remove Narraguagus Lake from the Significant scenic resource category.

*Criterion B: Character of surrounding area***.** Narraguagus Lake is surrounded by low forested hills. It is bordered to the east by the Spring River Matrix, which is owned by The Nature Conservancy. The area appears to be actively managed for timber, as we observed a large yarding area and several smaller log landings. There are a small number of cottages at the northern end of the lake.

Criterion C: Typical viewer expectation. It is assumed that viewer expectations for scenic quality are generally high for users of Narraguagus Lake. However, there is some evidence that scenic quality may be less important to people engaged in fishing or motor boating as compared to those engaged in hiking or nature study (Palmer 1999).

Criterion D: Development's purpose and context. At 34.2 MW, the Bull Hill Wind Project is of moderate size. No plans are presented to expand this project.

Criterion E.1: Extent, nature & duration of uses. This is unknown. However, there is no boat launch and access is by informal trails, which would indicate low use. In addition, fishing is anticipated to be the primary use and Palmer (1999) found that fishing was an activity where people did not appear to place as high a value on scenic quality as people who hiked or were engaged in nature study.

*Criterion E.2: Effect on continued use and enjoyment***.** This is unknown. However the survey found that the wind turbines would be no effect on respondents' likelihood of returning to Donnell Pond for water activities such as boating, canoeing, kayaking, swimming or fishing. This may also be the case for Narraguagus Lake.

Criterion F: Scope and scale of project views. Photosimulation 1 portrays how the project will appear from Narraguagus Lake. All 19 turbines will be seen reaching above the horizon line from 2.9 to 5.7 miles away. The turbines will occupy a horizontal angle of approximately 19°. To put this in perspective, the viewing angle of [the] thumb's width is about 2 degrees" when held at arm's length (O'Shea 1991). This is similar to the area that would be blocked if the fingers of both hands were held side-by-side at arm's length with the palms facing outward. As a unit, the Bull Hill Wind Project would have a very significant visual presence to a viewer facing toward them.

The turbines are substantially closer than they will be from Black Mountain, where the nearest turbine will be 7.8 miles distant, and substantially more visible than they will be from Donnell Pond, where the closest turbine will be approximately 6.6 miles distant. On Black Mountain the introduction of the wind turbines resulted in a loss of one third of the view's scenic value (a drop from 6.04 to 4.02 for the 28 respondents on the mountain). For respondents who indicated that their destination was Schoodic Beach, the introduction of turbines at the far end of Donnell Pond reduced the scenic value by 20 percent (a drop from 5.75 to 4.58). The wind turbines will have a

more significant visual presence for viewers on Narraguagus Lake than they do for users of Black Mountain or Donnell Pond. The

Overall scenic impact. Narraguagus Lake is sufficiently close to the Bull Hill Wind Project and the area of visibility is sufficiently extensive that the turbines will dominate views to the northern end of the lake. A major moderating circumstance is the expectation that Narraguagus Lake sees relatively few users, and most of those will be fishing, which is an activity where scenic quality may not be most central to the experience. So far surveys have indicated that people will continue to return to engage in their recreation activities, even if turbines will be part of the view. However, the magnitude of this impact is sufficiently greater than in views included in past surveys that the transferability of the result is less certain. Another major moderating circumstance is that the significance of Narraguagus Lake as a scenic resource is rather low. The overall impact is judged to be Medium.

4.10 Spring River Lake

Criterion F: Scope and scale of project views. Topography will screen views of the project. Without visibility there can be no visual impact. Therefore it will not be considered further.

Overall scenic impact. None, since there is no possible project visibility.

4.11 Tilden Pond

Criterion F: Scope and scale of project views. Topography will screen views of the project. Without visibility there can be no visual impact. Therefore it will not be considered further.

Overall scenic impact. None, since there is no possible project visibility.

4.12 Tunk Lake

Criterion F: Scope and scale of project views. Topography will screen views of the project. Without visibility there can be no visual impact. Therefore it will not be considered further.

Overall scenic impact. None, since there is no possible project visibility.

4.13 Upper Lead Mountain Pond

Criterion F: Scope and scale of project views. Topography will screen views of the project. Without visibility there can be no visual impact. Therefore it will not be considered further.

Overall scenic impact. None, since there is no possible project visibility.

4.14 Donnell Pond Unit

The 15,384 acre Donnell Pond Unit is a Maine Public Reserved Land that was identified by BPL as a significant scenic resource under the Wind energy Act Maine (Department of Conservation. 2010). It is bordered to the north by the Spring River Matrix, a 9,592 acre parcel held by The Nature Conservancy for wildlife and conservation purposes. It is adjacent to or surrounds several Great Ponds that are significant scenic resources: Donnell Pond, Little Long Pond, Spring River Lake, Tilden Pond, and Tunk Lake. Several distinctive mountains are within or adjacent to the Unit, including Schoodic (1,069 feet), the western summit of Black (1,049 feet), the eastern

summit of Black (1,094 feet), and Caribou (954 feet).[12] The Tunk Mountain (1,157 feet) summit is apparently just outside the park in the Spring River Matrix. In addition, the Blackwoods Scenic Byway along Route 182 passes east to west through the Unit.

The Bureau of Parks and Lands (2010) Downeast Management Plan indicates that "the scenic quality throughout the Unit is a valuable resource… Management for any purpose takes into consideration its importance with respect to the visual integrity of the surrounding area. Most of the unit can also be viewed from the ridgelines. There are also distant views of coastal bays and islands, lakes, ponds, cliffs, and forestland well beyond the Unit."

4.14.1 Black Mountain—East Summit

Public access. This is a publicly owned property.

Criterion A: Significance of resource. Donnell Pond Unit was identified as a Maine Public Reserved Land that was a state or nationally significant scenic resource Maine Department of Conservation 2010). No documentation supporting this decision is provided. However, Black Mountain is only one of several resources that contribute to the Donnell Pond Unit's scenic character.

*Criterion B: Character of surrounding area***.** Black Mountain has three interconnected peaks that are accessed by a train network from both the north and south sides. The trails are well blazed, and include numerous stone cairns, many of which have a sculptural quality. The east peak is 1,094 feet high and is free of trees, offering beautiful panoramic views in all directions. The Bull Hill Wind project will be clearly visible from the eastern summit.

There are several mountain summits within or adjacent to the Donnell Pond Unit that are serviced by a trail system that is continuing to be improved and extended. Within the Donnell Pond Unit, the most popular peak is Schoodic Mountain.

Criterion C: Typical viewer expectation. This is unknown, but one assumes that the expectation is for a scenic natural area with a highly scenic panoramic view from the summit.

Criterion D: Development's purpose and context. At 34.2 MW, the Bull Hill Wind Project is of moderate size. No plans are presented to expand this project.

Criterion E.1: Extent, nature & duration of uses. This is unknown. It is primarily a day hike. In the immediate area, Schoodic Mountain is reported to be the most popular hike—in the survey for every person who indication Black Mountain was their destination, there were four who indicated Schoodic Mountain.

*Criterion E.2: Effect on continued use and enjoyment***.** The 81 visitors to the Donnell Park Unit who participated in the survey indicated that the decrease in scenic value due to the presence of the turbines would have a modest but significantly negative effect on their enjoyment of Black Mountain's eastern summit (mean = 3.43). However, they indicated that this would not effect the likelihood that they would return to the Donnell Pond Unit (mean = 3.95).

[12] Elevations are from the DeLorme (2000) *Maine Atlas and Gazetteer*.

Criterion F: Scope and scale of project views. Photosimulation 3 portrays how the project will appear from Black Mountain. All 19 turbines will be seen from 7.8 to 10.5 miles away. The 5 turbines within 8 miles of the viewpoint will occupy a horizontal angle of approximately 6°, while all 19 turbines will occupy a horizontal angle of approximately 12°. To put this in perspective, the viewing angle of [the] thumb's width is about 2 degrees" when held at arm's length (O'Shea 1991). The 5 turbines within 8 miles of the viewer would occupy about three thumbs' width, while all 19 turbines cover the area that would be blocked if one hand was held at arm's length with the palm facing outward. As a unit, the Bull Hill Wind Project would have a significant visual presence to a viewer facing toward them on the eastern summit of Black Mountain.

A total of 28 people rated the actual view from Black Mountain, a photograph looking toward Bull Hill, and a photosimulation of the proposed project. The ratings for the actual view and photograph were very similar, which suggests that the photographic simulation can be used with some confidence. The existing view toward Bull Hill was highly rated, though the view toward the ocean was rated higher. The introduction of the wind turbines resulted in a loss of one third of the view's scenic value (a drop from 6.04 to 4.02). An additional 53 people in other parts of the Donnell Pond Unit rated just the existing photograph and photosimulation. While they rated both views slightly higher than did respondents on Black Mountain, their general patter was the same with a 30 percent drop in scenic value (6.38 to 4.48).

Overall scenic impact. There is one Evaluation Criterion that indicates the project has the potential for a very serious impact to Tunk Mountain: (F) Scope and scale of project views. However three Evaluation Criteria also suggest that the potential for Unreasonable impacts may not be serious: (A) Significance of resource, (E.1) Extent, nature and duration of use, and (E.2) Effect on continued use and enjoyment.

Effect from scale and scope. The Bull Hill Wind Project will occupy a moderate portion of the field of view for anyone facing the project. The survey results for the view from Black Mountain's eastern summit indicate that the turbines will have a very negative effect on the scenic value of this view.

Effect on significance. There is no detailed information about why Donnell Pond Unit was designated a significant scenic resource. However, there are many landscape features in the Unit that could contribute to this designation, and most of these have little or no visibility of the Bull Hill Wind Project. Black Mountain's eastern summit is the highest impacted viewpoint in the Unit. However, this impact is not expected to change the Unit's designation as a scenic resource.

Effect from extent and duration of use. At the present time, it appears that Black Mountain receives moderate use. The trails are formal and well-marked, there is no provision for parking, and it is not widely advertised as a destination. The Bureau of Parks and Lands is improving access in the Donnell Pond Unit, which is anticipated to increase overall use throughout the Unit.

Effect on enjoyment and continued use. The survey results for the view from Black Mountain's eastern summit indicate that the turbines will have a negative impact on the

enjoyment of hikers that reach the summit and find the turbines as a prominent element in their inland view. However, the respondents also indicated that this would not effect the likelihood of their return one way or the other.

Though the Bull Hill wind turbines will occupy a modest portion of the field of view from Black Mountain's eastern summit, survey respondents at this viewpoint indicated that it will be a very negative scenic impact that will also have a negative effect on their enjoyment. This indicates that the impact will be High. It is moderated somewhat by Black Mountain's eastern summit being the worst case viewpoint and there being other summits and scenic areas within the Unit that will have little or no visibility of the proposed project. In addition, these negative effects are only to the summit view and are not expected to be experienced along the trail to the summit. Viewers will also have the option to face toward the coastal view if they are bothered by the presence of the turbines. This is further mitigated by the moderate level of existing use and the probability that users will continue to visit the Black Mountain's eastern summit. The overall impact is expected to be Medium to High.

4.14.2 Donnell Pond Beach

Public access. This is a publicly owned property.

Criterion A: Significance of resource. Donnell Pond Unit was identified as a Maine Public Reserved Land that was a state or nationally significant scenic resource Maine Department of Conservation 2010). No documentation supporting this decision is provided. However, Schoodic Beach is only one of several resources that contribute to the Donnell Pond Unit's scenic character.

*Criterion B: Character of surrounding area***.** Schoodic Beach is long naturally sandy stretch at the southern end of Donnell Pond. It is surrounded by low lying forested hills to the north and west and higher mountains to the south and east. Donnell Pond is a popular recreation site for swimming, boating and fishing. Donnell Pond Unit is a managed to maintain its natural scenic quality.

Criterion C: Typical viewer expectation. It is assumed that viewer expectations for scenic quality are generally high for users of Donnell Pond Unit. However, there is a major social component to most of the recreation activities at Schoodic Beach that reduces the participants' reliance on the surrounding scenic quality for their enjoyment when compared to activities such as hiking or nature study.

Criterion D: Development's purpose and context. At 34.2 MW, the Bull Hill Wind Project is of moderate size. No plans are presented to expand this project.

Criterion E.1: Extent, nature & duration of uses. Schoodic Beach and Donnell Pond are the primary recreation destination in this area, attracting and estimated 10,000 to 12,000 visitors in 2008 (Simpson 2011). Water based activates, such as swimming, boating and fishing dominate, with the social aspects of recreating at a beach, such as picnicking and people watching. This is a day-use facility.

*Criterion E.2: Effect on continued use and enjoyment***.** In the survey, respondents indicated that the wind turbines would be no effect on their likelihood of returning to Donnell Pond for water activities such as boating, canoeing, kayaking, swimming or fishing. Since the turbines will not be visible from most of the beach, it is assumed that they will not affect enjoyment.

Criterion F: Scope and scale of project views. The wind turbines will not be visible from most parts of Schoodic Beach. At the far western end, a turbine blade and perhaps just the tip of one or two more blades may be visible. This is a very minor visual presence, and is substantially less than the existing communications tower that stands on a hill at the northern end of the Donnell Pond.

Overall scenic impact. From Schoodic Beach the overall scenic impact will be low. In most places the turbines will not be visible, and even at the worst case viewpoints only a portion of a couple blades will be seen. This is less visually intrusive than the existing communications tower at the northern end of Donnell Pond. While the beach attracts a large number of users, they are mostly engaged in activities for which scenic quality is not a primary requirement for their enjoyment. The overall scenic impact to Schoodic Beach will be low.

4.15 Tunk Mountain

Public access. The north slope facing the project is private owned conservation land, the south slope is public land. The summit is said to be on land owned by The Nature Conservancy (DOC BPL 2007, page 20), but it is unclear whether the public has a legal right of access. However, there is informal access to Tunk Mountain and BPL is investing in upgrading and developing new trails from the Blackwoods Scenic Byway (Route 182) that pass through the Donnell Pond PRL to access Tunk Mountain (Turner 2011a). It should be noted that the photograph viewpoint used for Photosimulation 2 appears within the boundary of the Donnell Pond Unit in our GIS data.

Criterion A: Significance of resource. Tunk Mountain is a scenic resource of statewide or national significance because it is received a rating of 81 points in the Downeast Coastal Scenic Inventory—70 points is the threshold for statewide or national significance (HCPS and WCCG 2010, DeWan 2008). The field sheet rating for Tunk Mountain provides some indication of how its scenic area designation might change if the view toward the proposed turbines were considered (which it might not be, since they are only visible if one looks away from the coast) (WCCG 2010). While the presence of wind turbines will not change the evaluation of most of the categories, two categories could change—Land Use and Composition & Effect.

The Land Use character category is strongly positive—all 7 possible points are given in this category. Examples of discordant land use include clearcuts, exposed mining operations, utility corridors, and incompatible commercial or industrial uses. If one is facing toward the project, the turbines will have a prominent visual presence that may be considered comparable to the discordant examples. While land use in the rest of the view may be strongly positive, the turbines may reduce the score by 4 points to minimally positive or even 7 points to no positive effect (DeWan 2008, page 37). However, it should be recognized that some respondents to the survey believe that wind turbines offer a point of visual interest that may be considered scenically positive or neutral.

The Composition & Effect category received 8 out of 9 possible points. While it is not explicitly noted, it is possible that the loss of a point was due to the of "a radio tower on the top that detracts somewhat from the view which is generally characterized as rustic with few imprints of man" (WCCG 2010). Again, the modern industrial visual quality of the turbines will contrast with the "rustic" natural character of the view, and may be seen to disrupt the cohesiveness of the landscape character. As a result, the number of points in this category may fall 2 points to positive or 5 points to minimally positive (DeWan 2008, page 43). However, it is possible that other may see the turbines as positive sculptural elements that add a point of interest to the composition.

According to the above considerations, Tunk Mountain's evaluation might be reduced by as much as 12 points, which would bring its total score down to 69 and reduce its status to regional rather than statewide or national significance.

*Criterion B: Character of surrounding area***.** Tunk Mountain is the highest peak in the area (1,157 feet) with a distinctive character. There is a panoramic 360 degree view.

Criterion C: Typical viewer expectation. This is unknown, but one assumes that the expectation is for a scenic natural area with a highly scenic panoramic view from the summit.

Criterion D: Development's purpose and context. At 34.2 MW, the Bull Hill Wind Project is of moderate size. No plans are presented to expand this project.

Criterion E.1: Extent, nature & duration of uses. This is unknown. The existing trails are informal, though BPL is in the process of upgrading them and adding associated facilities. There are a few campsites located along the trail to Tunk Mountain, but this is primarily a day hike. It is anticipated that Tunk Mountain receives substantially less use than Black Mountain, which in turn receives much less use than Schoodic Mountain.

*Criterion E.2: Effect on continued use and enjoyment***.** The recreation opportunities and viewing conditions from the summit of Tunk Mountain are similar to the eastern summit of Black Mountain; however the turbines will occupy a substantially greater proportion of the view. The 81 visitors to the Donnell Park Unit who participated in the survey indicated that the decrease in scenic value due to the presence of the turbines would have a modest but significantly negative effect on their enjoyment of Black Mountain's eastern summit (mean = 3.43). However, they indicated that this would not affect the likelihood that they would return to the Donnell Pond Unit (mean = 3.95). It may be that the increased proximity of the turbines to Tunk Mountain will increase the negative effect on enjoyment of the view from the summit. It is unknown whether it would effect the likelihood that they would hike to the Tunk Mountain summit again.

Criterion F: Scope and scale of project views. Photosimulation 2 portrays how the project will appear from Tunk Mountain. All 19 turbines will be seen from 4.9 to 7.2 miles away. The turbines will occupy a horizontal angle of approximately 23°. To put this in perspective, the viewing angle of [the] thumb's width is about 2 degrees" when held at arm's length (O'Shea 1991). This is similar to the area that would be blocked if both hands were held side-by-side at

arm's length with the palms facing outward. As a unit, the Bull Hill Wind Project would have a very significant visual presence to a viewer facing toward them.

The turbines are substantially closer than they will be from Black Mountain, where the nearest turbine will be 7.8 miles distant. On Black Mountain, 28 people rated the actual view, a photograph looking toward Bull Hill, and a photosimulation of the proposed project. The ratings for the actual view and photograph were very similar, which suggests that the photographic simulation can be used with some confidence. The existing view toward Bull Hill was highly rated, though the view toward the ocean was rated higher—this is also the probable situation from Tunk Mountain. The introduction of the wind turbines resulted in a loss of one third of the view's scenic value (a drop from 6.04 to 4.02). An additional 53 people in other parts of the Donnell Pond Unit rated just the existing photograph and photosimulation. While they rated both views slightly higher than did respondents on Black Mountain, their general patter was the same with a 30 percent drop in scenic value (6.38 to 4.48).

Overall scenic impact. There are two Evaluation Criteria that indicate the project has the potential for a very serious impact to Tunk Mountain: (A) Significance of resource, and (F) Scope and scale of project views. However two Evaluation Criteria also suggest that the potential for Unreasonable impacts may not be serious: (E.1) Extent, nature and duration of use, and (E.2) Effect on continued use and enjoyment.

Effect on significance. It is possible that the turbines could change Tunk Mountain's status as a state or nationally significant coastal scenic resource to one that is of only regional significance. The landscape character attributes that might change are Land Use and Composition and Effect.

Effect from scale and scope. The Bull Hill Wind Project will occupy a substantial portion of the field of view for anyone facing the project. The survey results for the view from Black Mountain's eastern summit, which is further away from the project, indicate that the turbines will have a very negative effect on the scenic value of the view.

Effect from extent and duration of use. At the present time, it appears that Tunk Mountain receives very light use. The trails are informal and not marked, there is no provision for parking, and it is not widely advertised as a destination. In addition, it is not clear that the public has a legal right of access to the summit and northern slopes. However, it is plausible to expect this situation to begin changing soon. The Bureau of Parks and Lands is in the process of upgrading existing and designating new trails to Tunk Mountain and providing parking and other facilities. This is part of an investment to improve access in the Donnell Pond Unit.

Effect on enjoyment and continued use. The survey results for the view from Black Mountain's eastern summit, which is further away from the project, indicate that the turbines will have a negative impact on the enjoyment of hikers that reach the summit and find the turbines as a prominent element in their inland view. However, the respondents on Black Mountain also indicated that this would not effect the likelihood of their return one way or the other.

The potentially negative effect on Tunk Mountain's status as a significant scenic resource, the prominence of the turbines in the inland view and the probability that it will be considered a very

negative scenic impact that will have a negative effect on enjoyment all indicate that the impact will be High. This is moderated somewhat by the low level of existing use (though this may change in the near future to a more moderate level of use) and the probability that users will continue to visit the Trunk Mountain summit, as they indicated that they would continue to visit the Black Mountain summit. In addition, these negative affects are only to the summit view and are not expected to be experienced along the trail to the summit. Viewers will also have the option to face toward the coastal view if they are bothered by the presence of the turbines. The overall impact is expected to be Medium to High.

4.12 Summary of Impacts

Table 5 summarizes the above findings from applying the scenic impact evaluation criteria to the 14 resources identified within 8 miles of a turbine and possibly having state or national significance as a scenic resource.

Table 5. Summary of Evaluation Criteria Ratings for the Bull Hill Wind Project

Scenic Resources of State or National Significance in the Surrounding Area	Scenic Impact Evaluation Criteria							Overall Scenic Impact
	A	B	C	D	E.1	E.2	F	
Historic Sites								
Eastbrook Baptist Church and Town House †	*	*	*	*	*	*	0	None
Great Ponds								
Donnell Pond	Med-Hi	Med-Hi	Med-Hi	Medium	Medium	Low-Med	Medium	Medium
Fox Pond	*	*	*	*	*	*	0	None
Little Long Pond	*	*	*	*	*	*	0	None
Lower Lead Mountain Pond	*	*	*	*	*	*	0	
Middle Lead Mountain Pond	*	*	*	*	*	*	0	None
Myrick Lake	Low	Medium	Med-Hi	Medium	Low	Low	Low-Med	Low
Narraguagus Lake	Low	Low-Med	Med-Hi	Medium	Low	Low	High	Medium
Spring River Lake	*	*	*	*	*	*	0	None
Tilden Pond	*	*	*	*	*	*	0	None
Tunk Lake	*	*	*	*	*	*	0	None
Upper Lead Mountain Pond	*	*	*	*	*	*	0	None
Maine Public Reserved Land								
Donnell Pond Unit—Black Mountain	Medium	High	High	Medium	Low–Med	Low–Med	Med–Hi	Med–Hi
Donnell Pond Unit—Schoodic Beach	Medium	Med–Hi	Med–Hi	Medium	Med–Hi	Low	Low	Low
Coastal Scenic Resources								
Tunk Mountain †	Med–Hi	High	High	Medium	Low	Low–Med	High	Med–Hi

Notes: The Evaluation Criteria are: (A) Significance of resource, (B) Character of surrounding area, (C) Typical viewer expectation, (D) Development's purpose and context, (E.1) Extent, nature & duration of uses, (E.2) Effect on continued use and enjoyment, and (F) Scope and scale of project views.

† Privately owned place with undetermined public legal right of access.

* Since there is no project visibility, there is no scenic impact.

5. Summary and Conclusions

This review evaluates the adequacy of the *Visual Impact Assessment: Bull Hill Wind Project, Carthage, Maine* (TJD&A 2010). Overall this VIA is accurate and clearly presented. Additional fieldwork and analysis completed for this review. A framework based on the Wind Energy Act's evaluation criteria is systematically applied to all of the state and nationally significant scenic resources. While there are slight difference, the Summary of Evaluation Criteria presented above is similar to the Summary of Evaluation Criteria presented in the VIA (TJD&A 2010, page 38). This suggests that there may be general agreement about the Evaluation Criteria and how to apply them. The difference may simply be due to a lack of information. However, there does appear to be some real differences about how to synthesize the criteria into a final judgment of the Overall Scenic Impact.

The scenic impact to the state and nationally significant scenic resources is Adverse at some locations, and may be Very Adverse at a very few specific viewpoints. However, these areas are very limited and the Overall Scenic Impact from the proposed Bull Hill is not appear to be Unreasonably Adverse within the guidance given by the Wind Energy Act.

- Of 14 scenic resources of state or national significance, 8 will have no scenic impact because there is no visibility of the project.
- Whether the wind turbines will be visible from Myrick Lake is in question and I was unable to do the fieldwork necessary to verify the visual condition. However, any visibility will be of a modest segment of a relatively few turbines. In addition, Myrick Lake is anticipated to have very low use. Together these two Evaluation Criteria lead to the judgment that the Overall Scenic Impact is Low.
- The scenic resource where the turbines will be visually most dominant is Narraguagus Lake. However this is moderated by an anticipated low use of Narraguagus Lake for activities where scenic value is a central part of the experience. As a result I judged that the Overall Scenic Impact is Medium, and well within the level of scenic impact anticipated by the Wind Energy Act.
- Donnell Pond is in a different situation. The turbines will not be visually dominant on Donnell Pond, actually the communications tower at the northern end of the lake has as much visual prominence as the turbines when they are most visible. However Donnell Pond is a more significant scenic resource and receives much more use than Narraguagus Lake. As a result, I also judged that the Overall Scenic Impact is to Donnell Pond is Medium.
- The Donnell Pond Unit is a significant scenic resource that surrounds or abuts several Great Ponds that are significant scenic resources; the Backwoods Scenic Byway also passes through the Donnell Pond Unit. The Bureau of Parks and Lands is investing in upgrading and developing new trails and facilities in the Donnell Pond Unit. The Bull Hill wind turbines will be visible from a very limited area within the Donnell Pond Unit. The "worst case" viewpoint is the eastern summit of Black Mountain. The most visited place in the Unit is Schoodic Beach, which may have very minor views of few turbine blades or tips at its western end. An intercept survey found that the turbines would have a significant scenic impact from Black Mountain's eastern peak, but this location receives relatively few visits in a year. And while the scenic impact seems real, and respondents thought it would have a negative effect on their enjoyment, they did not think that it would keep them from returning to the Donnell Pond Unit. While the scenic impact to

visitors on Black Mountain's eastern summit is severe if they are looking toward the proposed project, they have the option to look at a higher rated view. This scenic impact also affects a very limited area; the vast majority of scenic areas within Donnell Pond Unit will not have any visibility of the turbines. As a result the scenic impact to the eastern summit of Black Mountain is judged Medium to High, but not Unreasonably Adverse, and the scenic impact to the whole of the Donnell Pond Unit is judged to be Low.

- Tunk Mountain is a scenic resource that has been identified as having state or national significance. The Bull Hill wind turbines will have a stronger visual presence than they had from Black Mountain, because they will be much closer. However it is expected that users will focus on the superior view toward the coast (it is a coastal visual resource after all). In addition, Tunk Mountain has no formal access and use is thought to be very light. This may change because the Bureau of Parks and Lands is planning on upgrading and developing trail access, parking and other facilities supporting Tunk Mountain. The combination of very high visual presence from a highly ranked scenic resource and low current use with survey results that indicate that the impact would not affect the likelihood that users would return lead to the judgment that the Overall Scenic Impact is Medium to High, a very Adverse scenic impact, but not Unreasonable.

The preparation of this review has resulted in several observations and recommendations are worth repeating.

1. The Wind Energy Act's evaluation criteria are so succinct as to be somewhat ambiguous. **The primary permitting authorities should further refine the evaluation so they are unambiguously understood, accurately applied and usefully interpreted. This should include identifying indicator thresholds that distinguish between Unreasonably Adverse, Adverse, and Not Adverse scenic impacts. Particular attention needs to be given to forming guidance about synthesizing the Evaluation Criteria into an Overall Scenic Impact evaluation.**

2. The VIA correctly identifies all state or nationally significant scenic resources based on the Wind Energy Act's standards. However, it also includes privately owned sites where the public may not have a legal right of access, and would therefore not qualify as significant scenic resources. **Future VIAs must clarify whether the public has a legal right of access on privately owned sites that would otherwise qualify as significant scenic resources**.

3. Assumptions made about vegetation height significantly affect a visibility analysis. The VIA chose to assign heights to certain wetlands and harvested areas that could have few canopy trees to screen views. As a result, the visibility analysis may indicate that areas are screened, when they are not. **Visibility analysis should be used primarily to guide the fieldwork. As such primary emphasis should be placed on the topographic visibility man and assumptions about screening should be used cautiously so as not exclude sites with potential visibility from field investigation.**

4. Photosimulations were not prepared for every significant scenic resource from which potential views of the project were identified, in particularly Myrick Lake. **Photosimulations must be prepared from a "worst case" viewpoint for all state and nationally significant scenic resources which have a potential view of Generating Facility components.**

5. No apparent effort is made to obtain information about "extent, nature and duration of potentially affected public uses of scenic resources." **Future VIAs need to obtain or develop reasonable estimates of the extent, nature and duration of use for location in significant scenic resources with potential views of Generation Facility components**.

6. The developer is to be commended for retaining a reputable survey research firm to conduct a user survey at a sensitive viewpoint. However, the survey primarily addressed one type of user (hiker), at a significant distance from the project (nearly 8 miles), for primarily one type of scenic resource (mountain summit in a state park), at the very end of the hiking season. There is little to no information about the scenic sensitivity to grid-scale wind power projects for other users (e.g., people fishing, boating, swimming, ice skating, skiing, attending an outdoor interpretive program, stopping at a scenic turnout, or using a historic site), at closer distances, during other seasons, and other types of scenic resources. **Future VIAs need to increase knowledge about how grid-scale wind energy projects effect the expectations, scenic perceptions, enjoyment and likelihood to return for a greater variety of scenic resource users, at different distances, in different seasons, and for a variety of significant scenic resources**.

7. The survey seems to work well to provide information to address some of the Evaluation Criteria:

    - Criteria E.1 Nature of user activities
    - Criteria E.2 Effect on continued use (i.e., likelihood of returning)
    - Criteria E.2 Effect on enjoyment of scenic resources
    - Criteria F Scope and scale of potential effect of views (i.e., apparent scenic impact)

    However there are other Evaluation Criteria that currently are not being addressed by the survey data and should be:
    - **Criteria C Expectations of the typical viewer**
    - **Criteria E.1 Extent (i.e., numbers of users) and duration of user activities**

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Appendix 1

Maine's Wind Energy Act and the Evaluation of Scenic Impacts

Maine's Wind Energy Act and the Evaluation of Scenic Impacts

James F. Palmer

On April 18, 2008, Governor John Baldacci signed *An Act to Implement Recommendations of the Governor's Task Force on Wind Power Development* (the Wind Energy Act). It establishes a favorable State policy encouraging grid-scale wind energy development in appropriate locations. In particular, it designates a large portion of the state for expedited grid-scale wind energy development. While most environmental impacts are evaluated in the same manner as previously, special provisions are made for scenic impacts.

While the provisions of the Wind Energy Act can be viewed as an effort to simplify and clarify visual impact assessments, questions of interpretation still remain. There are several major determinations that effect how a visual impact assessment is to be conducted. This Q&A presents the Wind Energy Acts' approach to scenic impact evaluation.

What is the standard of scenic impact evaluation? The standard is "Unreasonably Adverse," and it only applies to views from significant scenic areas. "The primary siting authority shall determine…whether the development significantly compromises views from a scenic resource of state or national significance such that the development has an unreasonable adverse effect on the scenic character or existing uses related to scenic character of the scenic resource of state or national significance;"[13] whether the development "fits harmoniously into the existing natural environment" is explicitly not required.[14]

Is this standard applied to all proposed facilities? It is clear that this standard applies to "generating facilities"—turbines and transportation lines. However, there is the possibility of an exception for certain "associated faculties," making it somewhat less clear how to approach them.[15] Associated facilities include "elements of a wind energy development other than its generating facilities that are necessary to the proper operation and maintenance of the wind energy development, including but not limited to buildings, access roads, generator lead lines and substations."[16]

> "If the primary siting authority determines that application of the standard [unreasonably adverse, not harmonious fit] to the development may result in unreasonable adverse effects due to the scope, scale, location or other characteristics of the associated facilities"[17] then "the primary siting authority shall evaluate the effect of associated facilities of a wind energy development in terms of potential effects on scenic character and existing uses related to scenic character in accordance with Title 12, section 685-B, subsection 4, paragraph C or Title 38, section 484,

[13] 35-A MRSA, § 3452, sub-§1
[14] 35-A MRSA, § 3452, sub-§1
[15] 35-A MRSA, § 3452, sub-§2
[16] 35-A MRSA, § 3451, sub-§1
[17] 35-A MRSA, § 3452, sub-§2

subsection 3, in the manner provided for development other than wind energy development."[18]

In other words, if the primary siting authority determines that there may be unreasonably adverse impacts under the Wind Energy Act's standard due to the associated facilities, then they shall evaluate the associated facilities using the standards for non-wind projects. Further, "The primary siting authority shall make a determination pursuant to this subsection within 30 days of its acceptance of the application as complete for processing."[19]

What evaluation criteria are to be used? The Wind Energy Act lists six evaluation criteria:[20]

A. **"Significance of…affected scenic resource;"** The Wind Energy Act does not explicitly describe how significance should be considered. One possible interpretation is that all scenic resources are equally significant. Another interpretation might be to distinguish between state and nationally designated scenic resources. However, this difference does not seem to have much to do with scenic quality, *per se*. Perhaps the most appropriate interpretation of this criterion is the significance of scenic quality to the identification and designation of a particular scenic resource. Sometimes the level of significance is indicated in the report responsible for the designation (e.g., designation as significant or outstanding scenic quality in the *Maine's Finest Lakes* or *Maine Wildlands Lakes Assessment* studies, or local, state or national significance on a Nation Register of Historic Places nomination form).

B. **"Existing character of surrounding area;"** The Wind Energy Act explicitly states that whether "a wind energy development fits harmoniously into the existing natural environment in terms of potential effects on scenic character and existing uses related to scenic character is not required."[21] Since harmonious fit cannot be the criterion, perhaps it is whether perception of the landscape's character type is significantly changed. For instance, does the visible presence of many wind turbines change the perceived landscape character from "wooded hillside with scattered residences," to "industrial facility"?

C. **"Expectations of the typical viewer;"** Viewers may have certain expectations for the visible character of certain scenic resources. For instance, they may expect that views from a particular state park or hiking trail be predominately natural appearing. However, it is reasonable to question the appropriateness of viewer expectations, such as when people describe lands intensively managed for timber as "wilderness." In addition, viewer expectations change in reaction to changed circumstances. A few turbines may be approved because the project is small—once built people's expectations change, making it possible to build additional turbines. Consideration of this incremental cumulative change may be the point of the next criterion.

D. **"Expedited wind energy development's purpose and…context;"** The Wind Energy Act makes it clear that the Legislature believes tapping the state's wind resource is desirable, and has set substantial wind energy generation goals.[22] In addition, the

[18] 35-A MRSA, § 3452, sub-§2
[19] 35-A MRSA, § 3452, sub-§2
[20] 35-A MRSA, § 3452, sub-§3
[21] 35-A MRSA, § 3452, sub-§1
[22] 35-A MRSA, § 3402, sub-§2

Legislature recognizes that "wind turbines are potentially highly visible landscape features that will have an impact on views."[23] It seems reasonable that the Legislature intended that areas determined to be suitable for grid-scale energy development be utilized to their full capacity. This criterion may require consideration of the wind energy potential of the surrounding context, and evaluating the scenic impacts of fully building-out the area's capacity to produce wind energy. The greatest impact comes from the initial wind turbines built in an area; additional turbines will add a smaller incremental scenic impact, making it very difficult to determine where to stop further development. It may be most responsible to consider potential cumulative wind development impacts to an area as part of an initial proposal.

E. **"Extent, nature and duration of the… public use of the scenic resource… and the… effect… on the public's continued use and enjoyment of the scenic resource;"** This evaluation criterion says that we need to know what activities are occurring at significant scenic resource sites, how many people engage in these activates, for how long, and what the impact of seeing the project will have on the enjoyment of these activities. Said another way, "Is an Adverse scenic impact Unreasonable if turbines are only visible from a rarely visited viewpoint, or is visible only to people engaged in an activity for which scenic quality is not central to its enjoyment?"

F. **"Scope and scale of the… effect of views of the generating facilities… including… number and extent of [visible] turbines, … distance [to visible facilities]… and effect of prominent features of the development on the landscape"** The issue is whether the generating facilities become dominating elements in the landscape, primarily because of their proximity to the viewer and the area they occupy in the visual field.

What constitutes a significant scenic resource? The Wind Energy Act specifies that only designated state or nationally significant scenic resources be evaluated and provides a list of qualifying designations. In this review further reference to scenic resources will assume that they are state or nationally significant.

- A national natural landmark, federally designated wilderness area or other comparable outstanding natural or cultural feature.
- A property listed on the National Register of Historic Places.
- A national or state park.
- A great pond identified as having outstanding or significant scenic quality in the *Maine's Finest Lakes* study or *Maine's Wildlands Lakes Assessment*.
- A segment of a river or stream identified as having unique or outstanding scenic attributes in the *Maine Rivers Study*.
- Viewpoints from state public reserve land or on a trail that is used exclusively for pedestrian use, as designated by the Department of Conservation.
- Scenic turnouts on scenic highways constructed by the Department of Transportation.
- Scenic viewpoints located in coastal areas that are ranked as having state or national significance in terms of scenic quality in inventories published by the Executive Department, State Planning Office.

[23] 35-A MRSA, § 3402, sub-§2(C)

While a major step toward specificity, it is anticipated that interpretation of this list will be contested. For instance, this list includes resources typically designated for non-scenic reasons (e.g., national landmark or listed historic place), and only minor portions of resources that are designated for scenic reasons (e.g., only the turnouts of a scenic byway). In addition, "the public [must have] a legal right of access" if the significant scenic resources is not on public land (e.g., listed historic place or coastal viewpoint).[24]

What is the area of potential effects (APE)? The regulations presume that potential scenic impacts to scenic resources must be evaluated within 3 miles of generating facilities (i.e., turbines and transmission lines). The primary siting authority may also require the evaluation of potential scenic impacts to state and nationally significant scenic resources located between 3 and 8 miles from generating facilities if there is substantial evidence that it is needed.[25] Interested parties have 30 days after the acceptance of the application to submit such information.[26] The Wind Energy Act states that scenic impacts from generating facilities (i.e., turbines or transmission lines) located 8 or more miles from a scenic resource are "insignificant."[27]

What is the Process of Conducting a Visual Impact Assessment?
While the Wind Energy Act has identified specific resources from which views are to be considered and established criteria and a standard for their evaluation, there is no apparent reason that the process by which a visual impact assessment (VIA) is conducted would be changed. While there are slight variations, a professionally conducted VIA includes the following:

1. **Project Description**. The purpose and context of the project must be described, as it is one of the evaluation criteria.[28] In addition it is necessary to describe the visible attributes of the generating and associated facilities.
2. **Landscape Character**. The description of the landscape character establishes the context for evaluating any visual change from introducing the proposed development.[29] What is the visual character of the landform and vegetation? What is the visual character of the settlement pattern and road network? How does the project site relate to the larger regional landscape context—is it unusual or mundane? The US Forest Service describes landscape character this way:

   > Landscape Character descriptions are a combination of the objective information contained within ecological unit descriptions and the cultural values that people assign to landscape. Together they help define the meaning of "place", and its scenic expression (USDA FS 1995, page 1-1).

   The regional landscape character is described first. Often there are several distinct landscape units to describe. The character (e.g., ecological zone) and scenic attractiveness (e.g., vividness, intactness, unity) of each landscape unit is summarized (USDA FS 1995, page 1-15). A somewhat more detailed description is given for the project site and its APE.

[24] 35-A MRSA, § 3451, sub-§9
[25] 35-A MRSA, § 3452, sub-§4
[26] 35-A MRSA, § 3452, sub-§4
[27] 35-A MRSA, § 3452, sub-§3
[28] 35-A MRSA, § 3452, sub-§3,criterion D
[29] 35-A MRSA, § 3452, sub-§3, criterion B

3. **Visibility Analysis**. A visibility or viewshed analysis identifies those areas with potential views of the proposed development. The minimum professional standard is to map the topographic viewshed for the highest point of each major project element. This shows those areas that have a potential view of the tip of an upright turbine blade if all land cover were removed. Since it is possible that views to a project could be opened by the removal of land cover, a topographic viewshed is considered a useful conservative assessment of the maximum area of potential project visibility.

   Typically, a second visibility analysis includes the screening effect of forest cover. However such analyses should be used with caution and carefully field checked, since vegetation data can change quickly. The three forest classes (deciduous, evergreen and mixed) of the National Land Cover Database are most commonly used. Forest height is typically set to a regionally appropriate 40 feet for the analysis, though the minimum tree height for the three forest classes is 16 feet. This use of generalized rather than location specific tree heights is another reason to use the vegetated visibility analysis with caution.

   Addition visibility analyses might show how many turbines are visible, or the viewshed for larger portions of each project element (i.e., the nacelle rather than the upright blade tip). Current practice has been to only evaluate visibility of the turbines, but the transmission line must also be considered. It may also be appropriate to include associated facilities, such as access roads, substation, maintenance building and other structures.

   Normally only views from scenic resources within the topographic viewshed are evaluated in detail (though the accuracy of the analysis must field checked). A visibility analysis may also be helpful in describing the potential number, extent, and distance of visible turbines.[30]

4. **Significant Scenic Resources**. Identify the state or nationally significant scenic resources within the study area, based on the list in the statute.[31] A description of each identified scenic resource needs to be presented in sufficient detail that the criteria for evaluating scenic impacts can be applied.[32] Each scenic resource will be documented as part of the fieldwork, include the general scenic character of the resource, the "worst case" potential views of the proposed development, and perhaps other views.

5. **Public Use and Expectations**. The extent, number and duration of public uses of the identified scenic resources, and the expectations of the "typical viewer" must be described.[33]

6. **Evaluation of Potential Impacts**. The findings from applying each of the criteria for evaluating scenic impacts should be reported.[34]

   Accurate visual simulations are particularly useful when conducting this evaluation. The selection of viewpoints for the visual simulations is frequently a source of controversy. Opponents are likely to want simulations that represent "worst case" views, while the

[30] 35-A MRSA, § 3452, sub-§3, criterion F
[31] 35-A MRSA, § 3451, sub-§9
[32] 35-A MRSA, § 3452, sub-§3, criterion A
[33] 35-A MRSA, § 3452, sub-§3, criteria E and C
[34] 35-A MRSA, § 3452, sub-§3

developer and other proponents will argue that “typical views” provide a fairer representation. Worst case views are closer, show larger portions of the project, represent situations where the project appears less compatible with its surroundings. Typical views normally do not show the project at its worst, but are at viewpoints that might have may viewers, or that are selected to represent a diversity of viewing conditions (e.g., distances from the project, types of screening, and levels of incompatibility). It is very unusual for a scientific method (i.e., random sampling) to be used to select the typical viewpoints—normally they are simply declared “typical” by the analyst. Both types of simulations are useful to decision makers. However, it is difficult to imagine why they would not want to be aware of the very worst case situations.

7. **Mitigation**. It is normal in a professional VIA that the approaches taken to mitigate adverse effects are described. Typically, if Unreasonably Adverse scenic impacts were found, approaches to further mitigation would be discussed. This might include revisions to project siting or design, or screening at impacted viewpoints. However, mitigation is not one of the evaluation criteria for scenic impacts.[35] The Attorney General’s Office has advised both DEP and LURC that it does not believe mitigation can be required for scenic impacts—if scenic impacts are Unreasonably Adverse, the project should be denied, otherwise it should be approved.

[35] 35-A MRSA, § 3452, sub-§3

Appendix 2

Review Maps

Map 1: Topographic Viewshed for Blade Tip

Map 2: Forested Viewshed for Blade Tip

Map 3: Forested Viewshed for Blade Tip Using TJD&A Forest Heights

Map 4: Topographic Viewshed for Turbine Hub

Map 5: Forested Viewshed for Turbine Hub

Map 6: Forested Viewshed for Turbine Hub Using TJD&A Forest Heights

Visibility analysis determines whether a line-of-sight exists between two specified points. A geographic information system (GIS) is used to map the viewsheds from which the Bull Hill turbines are potentially visible. In principle this is an objective exercise in geometry highly suited to a computer application. In practice however, since the data are only approximations of the actual condition and may include errors and assumptions, the resulting viewshed maps are best considered a preliminary analysis of potential visibility under specified conditions. The maps are useful for providing a preliminary investigation of the overall potential visual impact. If potential visual impacts appear to exist for significant scenic resources, they need to be confirmed through field investigation and other visualization techniques.

Map 1
Topographic Viewshed for Blade Tip

Bull Hill Wind Project

Middle Lead Mountain Pond
Upper Lead Mountain Pond
Lower Lead Mountain Pond
T28 MD
Aurora
T22 MD
Beddington
Osborn
Mariaville
Deblois
T16 MD
Eastbrook
Waltham
Cherryfield
Eastbrook Baptist Church and Town House
T10 SD
T9 SD
Franklin
Myrick Lake
Narraguagus Lake
Donnell Pond Public Reserved Land
Tunk Mountain
Little Long Pond
Tilden Pond
Spring River Lake
Tunk Lake
Fox Pond
Donnell Pond

GIS viewshed mapping is a preliminary means of visual analysis. While beneficial for preliminary orientation and investigation, because of data assumptions and omissions, viewshed maps are not a definitive indication of visibility. Potential visibility needs to be confirmed through field investigation and other visualization techniques.

Legend

* **Turbine Locations**

Number of Blade Tips Visible

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

Scenic Resources of State or National Significance

- Great Ponds
- Public Reserved Land
- Coastal Resource
- National Register of Historic Places

N

0 1 2 4 6 8

Miles

Map 2
Forested Viewshed for Blade Tip

Bull Hill Wind Project

GIS viewshed mapping is a preliminary means of visual analysis. While beneficial for preliminary orientation and investigation, because of data assumptions and omissions, viewshed maps are not a definitive indication of visibility. Potential visibility needs to be confirmed through field investigation and other visualization techniques.

Legend

- **Turbine Locations**

Number of Blade Tips Visible

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

Scenic Resources of State or National Significance

- Great Ponds
- Public Reserved Land
- Coastal Resource
- National Register of Historic Places

N

0 1 2 4 6 8

Miles

Middle Lead Mountain Pond
Upper Lead Mountain Pond
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T28 MD
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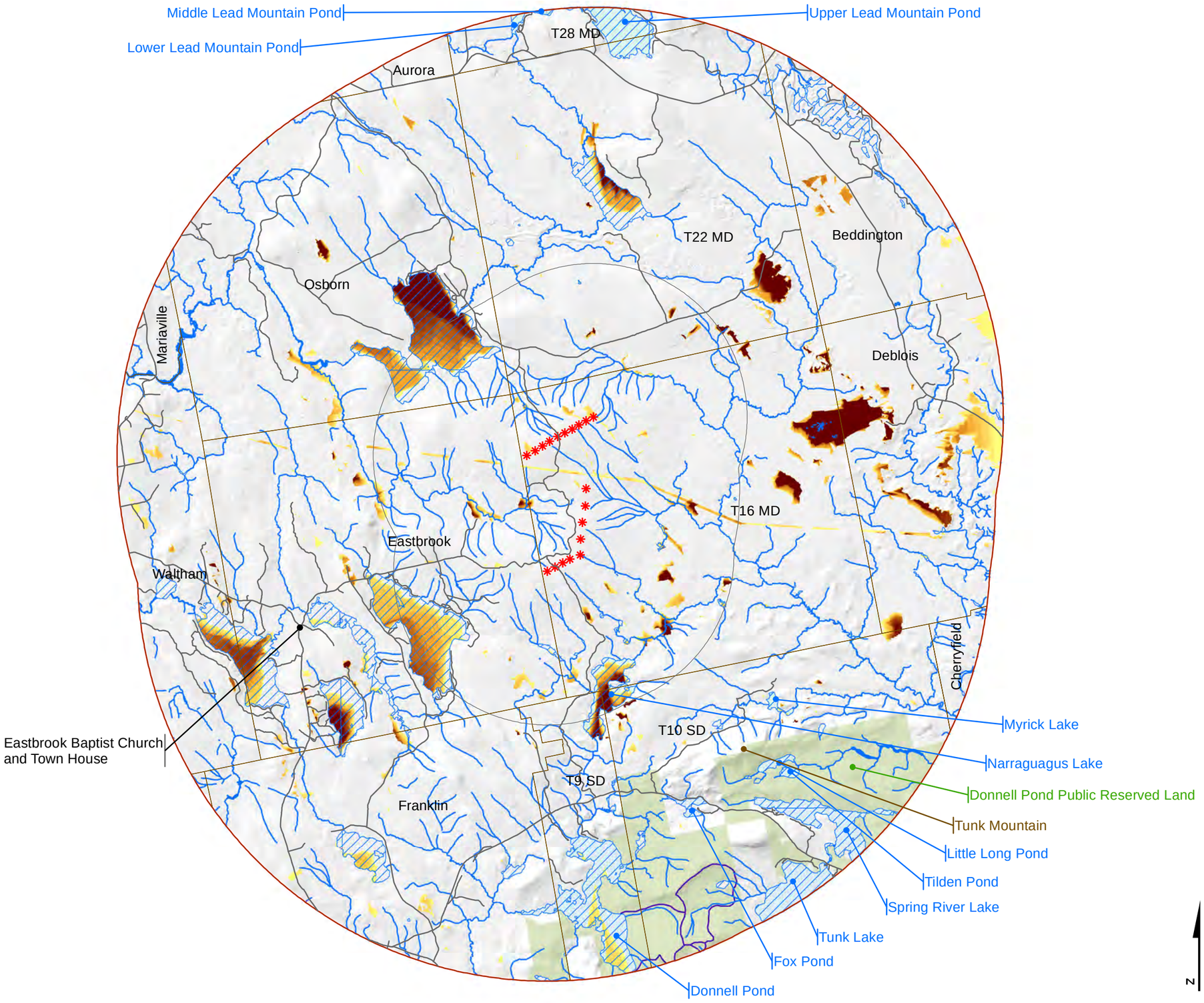
Little Long Pond
Tilden Pond
Spring River Lake
Tunk Lake
Fox Pond
Donnell Pond



Map 3
Forested Viewshed for Blade Tip Using TJD&A Forest Heights

Bull Hill Wind Project

GIS viewshed mapping is a preliminary means of visual analysis. While beneficial for preliminary orientation and investigation, because of data assumptions and omissions, viewshed maps are not a definitive indication of visibility. Potential visibility needs to be confirmed through field investigation and other visualization techniques.

Legend

- **Turbine Locations**

Number of Blade Tips Visible

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

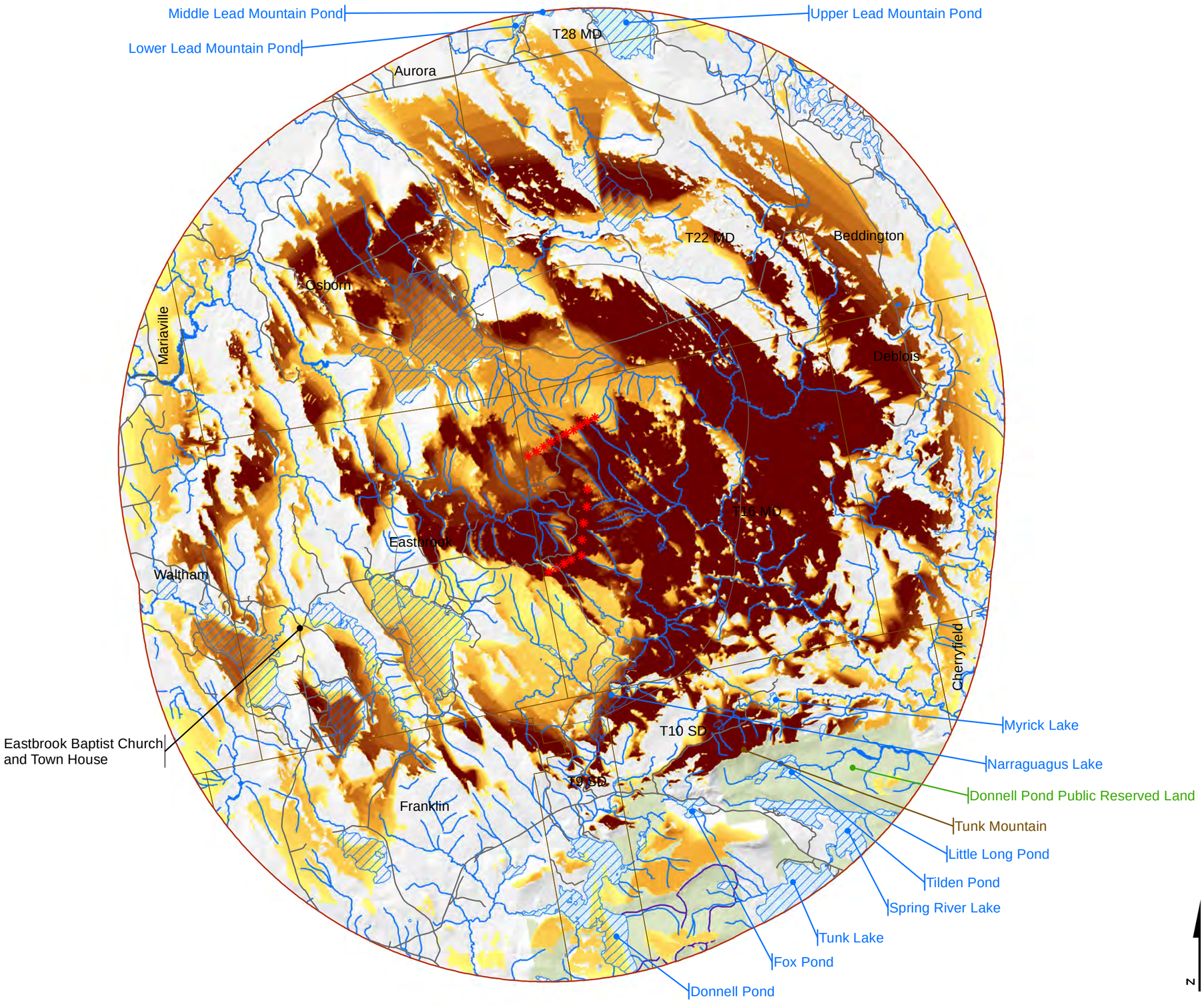
Scenic Resources of State or National Significance

- Great Ponds
- Public Reserved Land
- Coastal Resource
- National Register of Historic Places

N

0 1 2 4 6 8

Miles



Map 4
Topographic Viewshed for Turbine Hub

Bull Hill Wind Project

GIS viewshed mapping is a preliminary means of visual analysis. While beneficial for preliminary orientation and investigation, because of data assumptions and omissions, viewshed maps are not a definitive indication of visibility. Potential visibility needs to be confirmed through field investigation and other visualization techniques.

Legend

Turbine Locations

Number of Blade Tips Visible

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

Scenic Resources of State or National Significance

- Great Ponds
- Public Reserved Land
- Coastal Resource
- National Register of Historic Places

N

0 1 2 4 6 8

Miles

Map 5
Forested Viewshed for Turbine Hub

Bull Hill Wind Project

GIS viewshed mapping is a preliminary means of visual analysis. While beneficial for preliminary orientation and investigation, because of data assumptions and omissions, viewshed maps are not a definitive indication of visibility. Potential visibility needs to be confirmed through field investigation and other visualization techniques.

Legend

- **Turbine Locations**

Number of Blade Tips Visible

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

Scenic Resources of State or National Significance

- Great Ponds
- Public Reserved Land
- Coastal Resource
- National Register of Historic Places

N

0 1 2 4 6 8

Miles

Middle Lead Mountain Pond
Upper Lead Mountain Pond
Lower Lead Mountain Pond
T28 MD
Aurora
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Waltham
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T9 SD
Franklin
Myrick Lake
Narraguagus Lake
Donnell Pond Public Reserved Land
Tunk Mountain
Little Long Pond
Tilden Pond
Spring River Lake
Tunk Lake
Fox Pond
Donnell Pond

Map 6
Forested Viewshed for Turbine Hub Using TJD&A Forest Heights

Bull Hill Wind Project

GIS viewshed mapping is a preliminary means of visual analysis. While beneficial for preliminary orientation and investigation, because of data assumptions and omissions, viewshed maps are not a definitive indication of visibility. Potential visibility needs to be confirmed through field investigation and other visualization techniques.

Legend

- Turbine Locations

Number of Blade Tips Visible

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

Scenic Resources of State or National Significance

- Great Ponds
- Public Reserved Land
- Coastal Resource
- National Register of Historic Places

N

0 1 2 4 6 8

Miles

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Deblois
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Eastbrook
Waltham
Cherryfield
Eastbrook Baptist Church and Town House
T10 SD
T9 SD
Franklin
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Narraguagus Lake
Donnell Pond Public Reserved Land
Tunk Mountain
Little Long Pond
Tilden Pond
Spring River Lake
Tunk Lake
Fox Pond
Donnell Pond

Appendix 3

ArcScene Visualizations

Visualization 1: Narraguagus Lake

Visualization 2: Tunk Mountain

Visualization 3: Black Mountain

Visualization 4: Donnell Pond—southern viewpoint

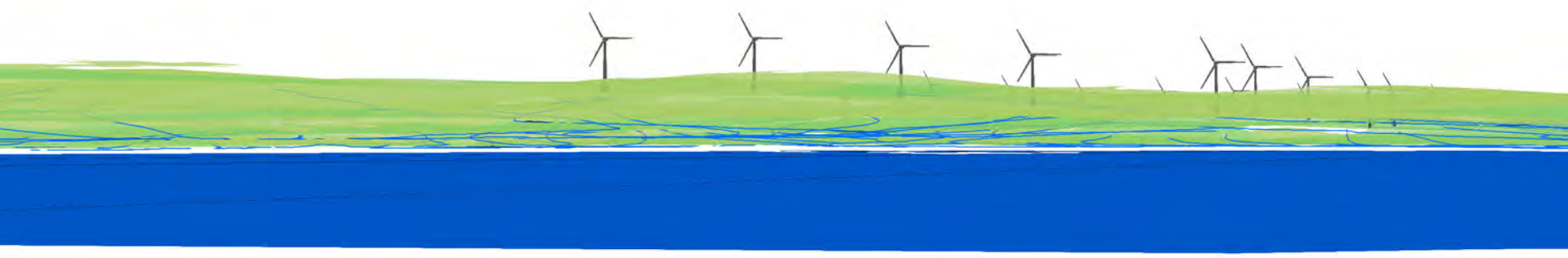
Visualization 5: Donnell Pond—northern viewpoint

Visualization 6a: Donnell Pond—Schoodic Beach

The purpose of these visualizations is to validate the relative accuracy of the *Visual Impact Assessment Bull Hill Wind Project, T16 MD, Maine* photographic simulations (TJD&A 2010). They are created using the location and camera information from the photograph metadata and GIS database that were used to prepare the *Visual Impact Assessment Bull Hill Wind Project*. Forest cover is set to at 40 feet. The representation of foreground vegetation may not be accurate. The horizontal angle of view is 40 degrees, and the visualizations are in proper perspective when viewed from a distance of approximately 1.5 times it width.

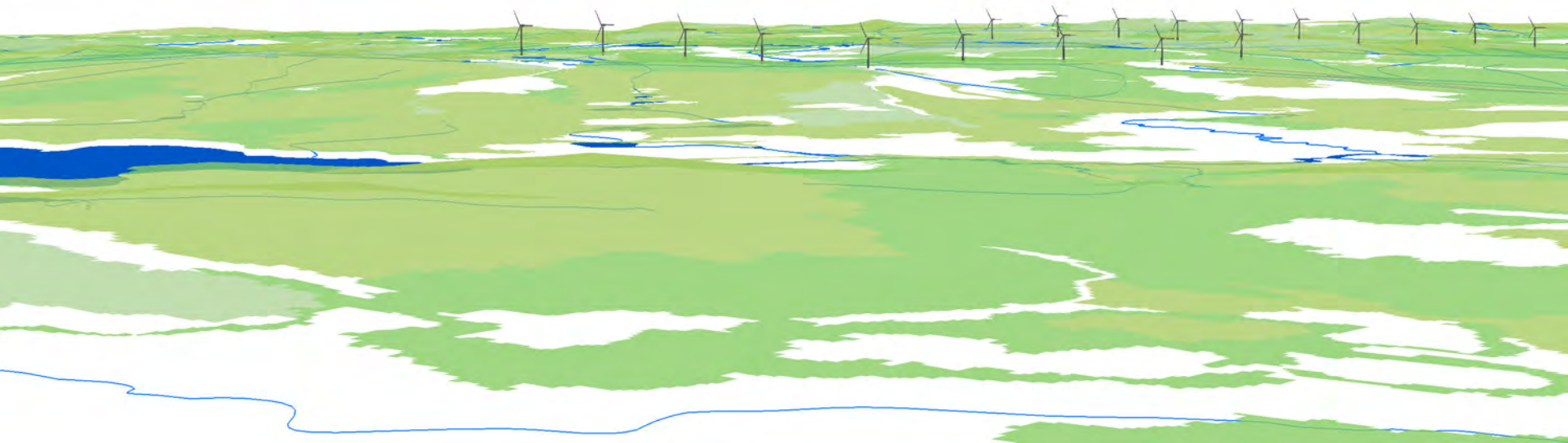
ArcScene Visualization 1: Narraguagus Lake Viewpoint

The purpose of this visualization is to validate the relative accuracy of a photographic simulation. It is created using the location and camera information from the photograph metadata and GIS database that were used to prepare the *Visaul Impact Assessment Bull Hill Wind Project, T16 MD, Maine.* Forest cover is set to 40 feet; the representation of foreground vegetation may not be accurate. The horizontal angle of view is 40 degrees, and the visualization will be in proper perspective when viewed from a distance of approximately 1.5 times it width.



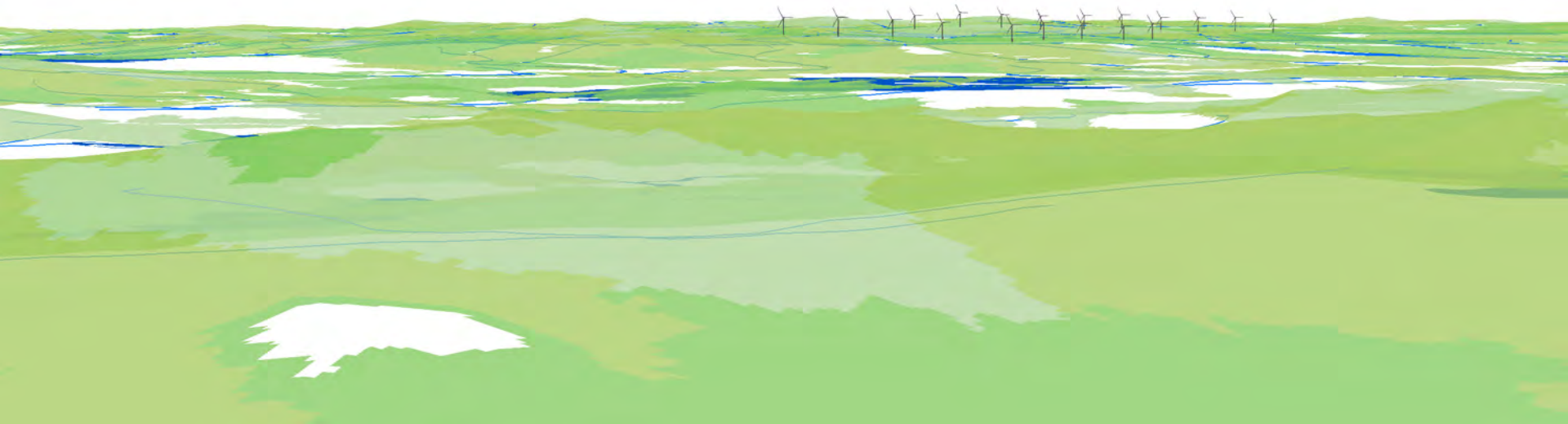
ArcScene Visualization 2: Tunk Mountain Viewpoint

The purpose of this visualization is to validate the relative accuracy of a photographic simulation. It is created using the location and camera information from the photograph metadata and GIS database that were used to prepare the *Visaul Impact Assessment Bull Hill Wind Project, T16 MD, Maine.* Forest cover is set to 40 feet; the representation of foreground vegetation may not be accurate. The horizontal angle of view is 40 degrees, and the visualization will be in proper perspective when viewed from a distance of approximately 1.5 times it width.



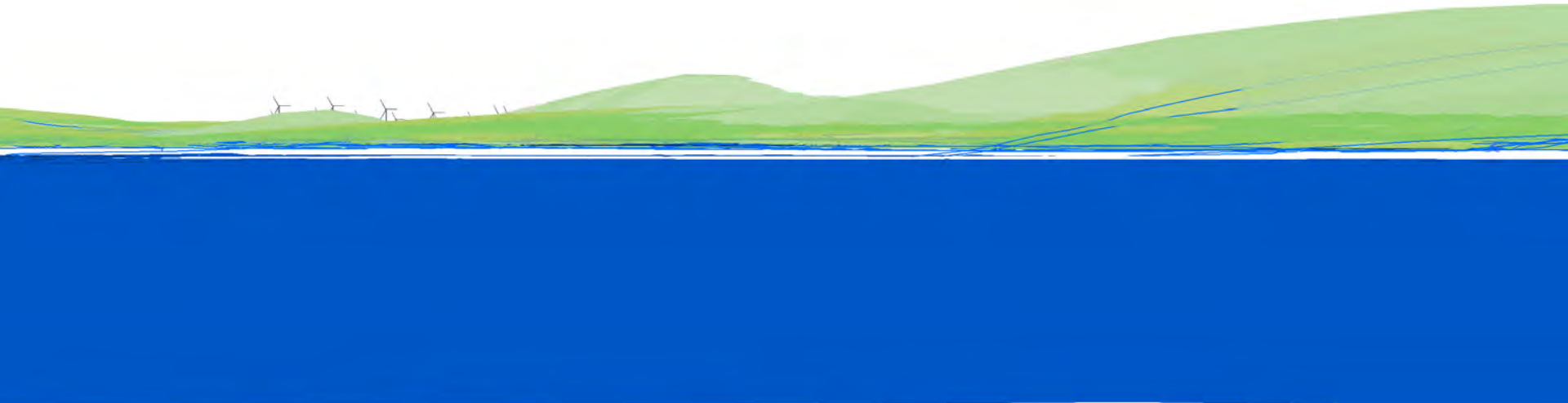
ArcScene Visualization 3: Black Mountain Viewpoint

The purpose of this visualization is to validate the relative accuracy of a photographic simulation. It is created using the location and camera information from the photograph metadata and GIS database that were used to prepare the *Visaul Impact Assessment Bull Hill Wind Project, T16 MD, Maine.* Forest cover is set to 40 feet; the representation of foreground vegetation may not be accurate. The horizontal angle of view is 40 degrees, and the visualization will be in proper perspective when viewed from a distance of approximately 1.5 times it width.



ArcScene Visualization 4: Donnell Pond--Southern Viewpoint

The purpose of this visualization is to validate the relative accuracy of a photographic simulation. It is created using the location and camera information from the photograph metadata and GIS database that were used to prepare the *Visaul Impact Assessment Bull Hill Wind Project, T16 MD, Maine.* Forest cover is set to 40 feet; the representation of foreground vegetation may not be accurate. The horizontal angle of view is 40 degrees, and the visualization will be in proper perspective when viewed from a distance of approximately 1.5 times it width.



ArcScene Visualization 5: Donnell Pond--Northern Viewpoint

The purpose of this visualization is to validate the relative accuracy of a photographic simulation. It is created using the location and camera information from the photograph metadata and GIS database that were used to prepare the *Visaul Impact Assessment Bull Hill Wind Project, T16 MD, Maine.* Forest cover is set to 40 feet; the representation of foreground vegetation may not be accurate. The horizontal angle of view is 40 degrees, and the visualization will be in proper perspective when viewed from a distance of approximately 1.5 times it width.

ArcScene Visualization 6: Donnell Beach Viewpoint

The purpose of this visualization is to validate the relative accuracy of a photographic simulation. It is created using the location and camera information from the photograph metadata and GIS database that were used to prepare the *Visaul Impact Assessment Bull Hill Wind Project, T16 MD, Maine.* Forest cover is set to 40 feet; the representation of foreground vegetation may not be accurate. The horizontal angle of view is 40 degrees, and the visualization will be in proper perspective when viewed from a distance of approximately 1.5 times it width.