

# **Review of the Visual Impacts from the Proposed Turbine Change for the Canton Mountain Wind Project**

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## 1. Introduction

On May 21, 2012 Patriot Renewables and Canton Mountain Wind, LLC submitted an application to amend the permitted Canton Mountain Wind Project (Application L-25557-24-A-N/L-25558-TB-B-N). The permitted project specified two possible turbine layouts. The visual impact assessment assumed the use of seven GE2.75-103 and one GE 2.75-100 turbines. The application is substitute a new, larger turbine, the Siemens SWT-3.0-113. The general dimensions for these turbines are listed in Table 1. The Siemens turbine will be an 8.5 percent increase in the height to an upraised blade tip compared to the GE 2.75-100 turbine, and a 7.3 percent increase over the GE 2.75-103 turbine.

**Table 1. Dimensions of Canton Mountain Turbines in Meters**

|                     | GE 2.75-100 | GE 2.75-103 | Siemens SWT-3.0-113 |
|---------------------|-------------|-------------|---------------------|
| Hub                 | 85          | 85          | 90                  |
| Rotor Diameter      | 100         | 103         | 113                 |
| Blade               | 50.0        | 51.5        | 56.5                |
| Height to Blade Tip | 135.0       | 136.5       | 146.5               |

In updating the visual impact assessment, Terrence J. DeWan & Associates (TJD&A) discovered an error in the width of the turbine towers portrayed in the previous visual simulations. Taking both factors into account, TJD&A (2012) concluded:

Based upon these analyses we determined that there would be no appreciable change in visibility between the GE turbines and the Siemens turbines throughout the 8-mile study area. The proposed change in turbines does not affect our conclusion that the Project will not have an unreasonable adverse impact on scenic values and existing uses of scenic resources of state or national significance.

This review evaluates TJD&A's conclusion by considering two issues: (1) the credibility of the claimed error in the previous visual simulations, and (2) the potential impact of the proposed change in wind turbines.

## 2. Error in Previous Visual Simulations

### 2.1 Description of Error in Simulations

In the process of remodeling the three simulations presented in the visual impact assessment (TJD&A 2011), it was noticed that in the visual simulations the width of the towers for the GE wind turbines was substantially greater than for the new Siemens wind turbines (TJD&A 2012). This identification and significance of this error was described this way (TJD&A 2012, footnote i):

All photosimulations were prepared using WindPRO software, which has an extensive library of turbines that are selected by the user. When comparing the details in WindPRO for both the GE 2.75-103 and Siemens 3.0-113 turbines, we noticed a discrepancy in the original turbine base dimensions. The WindPRO model for the GE 2.75-103 depicts a turbine tower that is significantly wider than what the actual manufacturer's specifications indicate. GE's specifications show a base diameter of 4.3 meters (14.1 feet) and a top diameter of 3.1 meters (10.1 feet); whereas the WindPRO model depicts a turbine base of nearly 7.6 meters (25 feet) in diameter and a top diameter of 5.1 meters (17 feet). Therefore, the original photosimulations overstate the diameter of the GE 2.75-103 turbine tower base by nearly 11 feet. The WindPRO model for the Siemens 3.0-113 depicts tower dimensions consistent with the manufacturer's specifications; i.e., 4.5 meters (14.7 feet) at the base and 2.7 meters (8.8 feet) at the top. Photosimulations were not revised to show the corrected GE 2.75-103 turbines, as the difference is not discernible on the scale of the photosimulations for the Canton Mountain Wind Project. In reviewing the differences between the photosimulations, we based our conclusions for this memo on the difference between the corrected GE 2.75-103 and the Siemens 3.0-113.

In response to this statement, I requested by email that TJD&A provide documentation for the dimensions in question (Palmer 2012b). I verified the facts of the situation in a follow up phone interview with the landscape architect who supervised the creation of the simulations in question (Bell 2012).

I further investigated the simulations in question. A simple visual inspection of the simulations makes it clear that the towers on the GE turbines were wider than the towers on the Siemens turbines, as TJD&A indicated they would be. The amended visual impact assessment presents the simulations from the Jay-Niles Memorial Library, North Jay Grange Store and Forest Pond with the original GE turbine and Siemens turbines (TJD&A 2012). The only dimensions of interest that are consistently visible in the simulations are the length of a blade and the width of the tower at its top. The ratio of these dimensions should be the same whether taken from the specification sheet or from the simulations. The actual dimensions are taken from the amended visual impact assessment (TJD&A 2012); the simulation measurements are for a clearly visible turbine viewed, highly enlarged and measured in inches.<sup>1</sup> It is apparent in Table 2 that the diameter of the tower top is approximately 5 percent of the length of a blade for the Siemens turbine, whether the data come from the product specification sheet or the simulations. However, the results for the GE turbine show that the tower tops as a percentage of the blade length in the simulations is nearly twice the actual relationship—as TJD&A described, the towers are too thick in the simulations of the GE turbine towers.

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<sup>1</sup> The Jay-Niles Memorial Library simulation is enlarged 800 percent; the North Jay Grange Store and Forest Pond simulations are enlarged 1,600 percent. Measurements are made with the measuring tool in Adobe Acrobat.

**Table 2. The Ratio of Blade Length to Tower Top Diameter**

|                        | <b>Actual turbine</b> | <b>Jay-Niles<br/>Memorial Library</b> | <b>North Jay<br/>Grange Store</b> | <b>Forest Pond</b> |
|------------------------|-----------------------|---------------------------------------|-----------------------------------|--------------------|
| <b>GE 2.75-103</b>     |                       |                                       |                                   |                    |
| Blade                  | 51.5                  | 0.19                                  | 0.18                              | 0.17               |
| Tower top              | 3.1                   | 0.02                                  | 0.02                              | 0.02               |
| Tower top/Blade*100    | 6.0                   | 10.5                                  | 11.1                              | 11.8               |
| <b>Siemens 3.0-113</b> |                       |                                       |                                   |                    |
| Blade                  | 56.5                  | 0.21                                  | 0.18                              | 0.19               |
| Tower top              | 2.7                   | 0.01                                  | 0.01                              | 0.01               |
| Tower top/Blade*100    | 4.8                   | 4.8                                   | 5.6                               | 5.3                |

## 2.2 How Did This Occur?

In most cases WindPRO software includes detailed dimensions for individual wind turbines, such as the diameter of the tower at its base and top, the dimension of the blade's root chord and tip chord, and the nacelle's length, height and width. I obtained access to WindPRO 2.7 and 2.8 in order to verify the dimensions provided for the GE 2.75-100 and GE 2.75-103 turbines.<sup>2</sup> In contrast to most other turbines, including the Siemens turbines, the dimensional data for the GE 2.75 turbines are limited to hub height and rotor diameter.

One of WindPRO's major selling points is that the turbine library includes detailed dimensions; therefore it was reasonable for TJD&A to have expected this to be the case for these GE turbines. Further, it is not normal for the base and top diameter of the turbine's tower to be listed in the publicly available specifications, so it is normally possible easy to verify WindPRO's data.

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<sup>2</sup> Thanks to TJ Boyle Associates of Burlington, Vermont for allowing me access to this software.

### **3. Impact of Proposed Change**

This section summarized how the change in the turbine used for the Canton Mountain Wind Project will impact scenic quality.

#### **3.1 Previous Findings**

Table 3 summarizes the my previous review's findings as a result of applying the scenic impact evaluation criteria to the eight scenic resources of state or national significance identified within 8 miles of a turbine and possibly having state or national significance as a scenic resource (SRSNS) (Palmer 2012a). Of these eight, four would not have visibility due to screening from topography or local vegetation, and two are privately owned listed historic sites where the public does not have a legal right of access. The remaining two SRSNSs are the Jay-Niles Memorial Library and Forest Pond.

#### **3.2 Visual Effects of the Change**

The height to the turbines' hub will only change by 5.9 percent with the use of the new Siemens turbines, while the turbine blade length will increase 9.7 percent for the seven GE 2.75-103 and 13.0 percent for the single GE 2.75-100 turbine.

Visualizations of the original GE turbines and the proposed Siemens turbines are included in Appendix 1 for the Jay-Niles Memorial Library, the North Jay Grange Store and Forest Pond. An examination of the computer visualizations indicates that the change was difficult to discern. Changes of this magnitude for landscape elements are generally not recognized by viewers (Watzek and Ellsworth 1994).

**Table 3. Summary of Evaluation Criteria Ratings for the Canton Mountain 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      |                       |
| <b>Listed Historic Sites</b>   |                                   |         |        |     |     |         |        |                       |
| Bass Boarding House †  | *                                 | *       | *      | *   | *   | *       | 0      | None                  |
| Goodspeed Memorial Library   | *                                 | *       | *      | *   | *   | *       | 0      | None                  |
| Holmes-Crafts Homestead †  | *                                 | *       | *      | *   | *   | *       | 0      | None                  |
| Jay-Niles Memorial Library   | Low                               | Low-Med | Low    | Low | Low | Low     | Low    | Low                   |
| North Jay Grange Store †   | —                                 | —       | —      | —   | —   | —       | —      | None                  |
| Nelson Family Farm †   | —                                 | —       | —      | —   | —   | —       | —      | None                  |
| <b>Great Ponds</b>   |                                   |         |        |     |     |         |        |                       |
| Forest Pond  | Low                               | Medium  | Medium | Low | Low | Low-Med | Medium | Low-Med               |
| Nelson Pond  | *                                 | *       | *      | *   | *   | *       | 0      | None                  |

**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 and duration of uses, (E.2) Effect on continued use and enjoyment, and (F) Scope and scale of project views.

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

† The public does not have a legal right of access to these sites listed on the national Register of Historic Places, and therefore they are not scenic resources of state or national significance as defined by the Wind Energy Act (§ 3451 (9)).

#### **4. Summary and Conclusions**

This review has two purposes, to evaluate the credibility of the claimed error in the previous visual simulations, and the potential impact of the proposed change in wind turbines. It appears that the original simulations of the GE turbines did exaggerate the width of the tower, as described by TJD&A (2012a). The source of this error appears to be embedded in the WindPRO database and not something that one would normally be able to catch. However, the consequence of the error was to exaggerate the visual presence of the GE turbines.

The new Siemens turbines will be less than ten percent larger than the previously proposed GE turbines. As can be seen by comparing the visualizations in the Appendix, or the simulations submitted by TJD&A (2012a), the change is barely noticeable. There is some research to suggest that viewers who were not informed of the change would be unable to discern a difference (Watzek and Ellsworth. 1994).

As a result of these findings, the evaluations shown in Table 3 remain unchanged. The Canton Mountain Wind Project will have a low visual impact to the Jay-Niles Memorial Library and a low to medium visual impact to Forest Pond. Neither of these impacts are considered Unreasonably Adverse.

#### 4. References

Bell, Amy Segal. 2012. Phone interview with James F. Palmer on June 27, 2012.

ESRI. 2010. *ArcGIS Desktop*. Redlands, CA: ESRI.

Palmer, James F. 2012a. Review of the Canton Mountain Wind Project Visual Impact Assessment.

[http://www.maine.gov/dep/ftp/WindPowerProjectFiles/CantonMountainWind/NIS\\_And\\_VIA\\_Peer\\_Reviews/2012-03-20\\_Canton\\_VIA\\_review.pdf](http://www.maine.gov/dep/ftp/WindPowerProjectFiles/CantonMountainWind/NIS_And_VIA_Peer_Reviews/2012-03-20_Canton_VIA_review.pdf) (Accessed June 28, 2012).

Palmer, James F. 2012b. New Canton Mountain wind turbines. Email to Terry DeWan and copied to Erle Townsend, dated June 18, 2012.

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[http://www.maine.gov/dep/ftp/WindPowerProjectFiles/CantonMountainWind/Third alternate turbine submissions/Section 30 CMW Visual Impact Assessment SWT 3.0-113 05.21.12.pdf](http://www.maine.gov/dep/ftp/WindPowerProjectFiles/CantonMountainWind/Third_alternate_turbine_submissions/Section_30_CMW_Visual_Impact_Assessment_SWT_3.0-113_05.21.12.pdf) (Accessed May 30, 2012).

Terrence J. DeWan and Associates. 2011. *Section 30. Visual Impact Assessment Canton Mountain Wind Project*. [http://www.maine.gov/dep/ftp/WindPowerProjectFiles/](http://www.maine.gov/dep/ftp/WindPowerProjectFiles/CantonMountainWind/section_30_visual_quality_scenic/section_30_generating_facility.pdf)

[CantonMountainWind/section\\_30\\_visual\\_quality\\_scenic/section\\_30\\_generating\\_facility.pdf](http://www.maine.gov/dep/ftp/WindPowerProjectFiles/CantonMountainWind/section_30_visual_quality_scenic/section_30_generating_facility.pdf) (Accessed December 28, 2011).

Watzek, Kurt A. and John C. Ellsworth. 1994. Perceived scale accuracy of computer visual simulations. *Landscape Journal* 13(1):21-36.

# Appendix 1

## ArcScene Visualizations

Visualization 1a: GE Turbines from the Jay-Niles Memorial Library

Visualization 1b: Siemens Turbines from the Jay-Niles Memorial Library

Visualization 2a: GE Turbines from the North Jay Grange Store

Visualization 2b: Siemens Turbines from the North Jay Grange Store

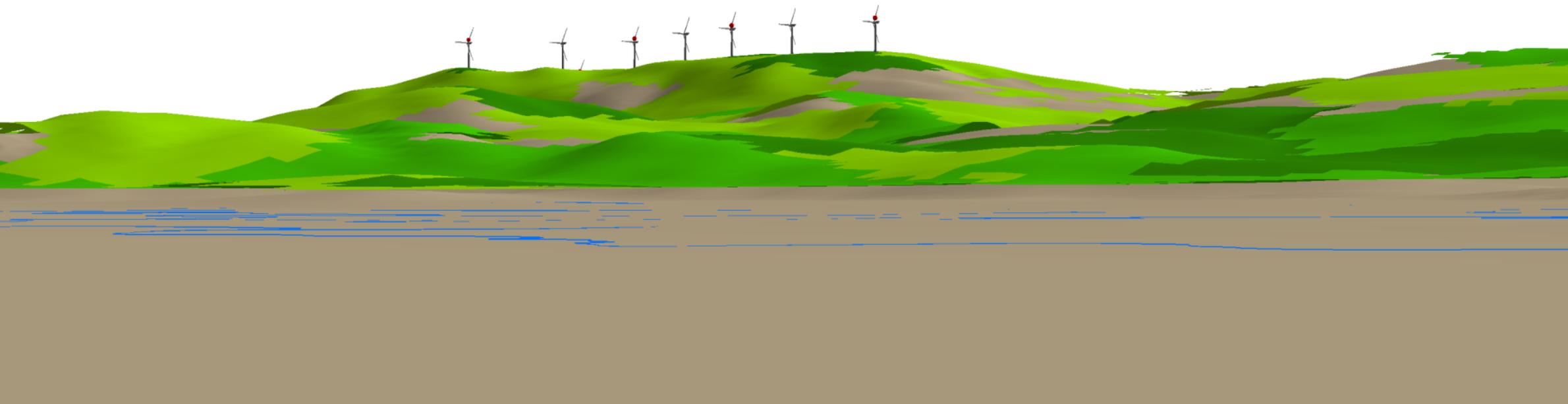
Visualization 3a: GE Turbines from Forest Pond

Visualization 3b: Siemens Turbines from Forest Pond

The purpose of these visualizations is to validate the relative accuracy and comparative magnitude of the *Visual Impacts of Proposed Turbine Change Canton Wind Project* photographic simulations (TJDA 2012). They are created using the location and camera information from the photograph metadata and GIS database that were used to prepare the photosimulations. Forest cover is set to 40 feet and does not include forested wetlands or areas harvested since 1995. The representation of foreground vegetation may not be accurate. Turbines marked with a red dot have FAA warning lights. The horizontal angle of view is 40 degrees, which is similar to the VIA photosimulations, and the visualization will be in proper perspective when viewed from a distance slightly greater than its width.

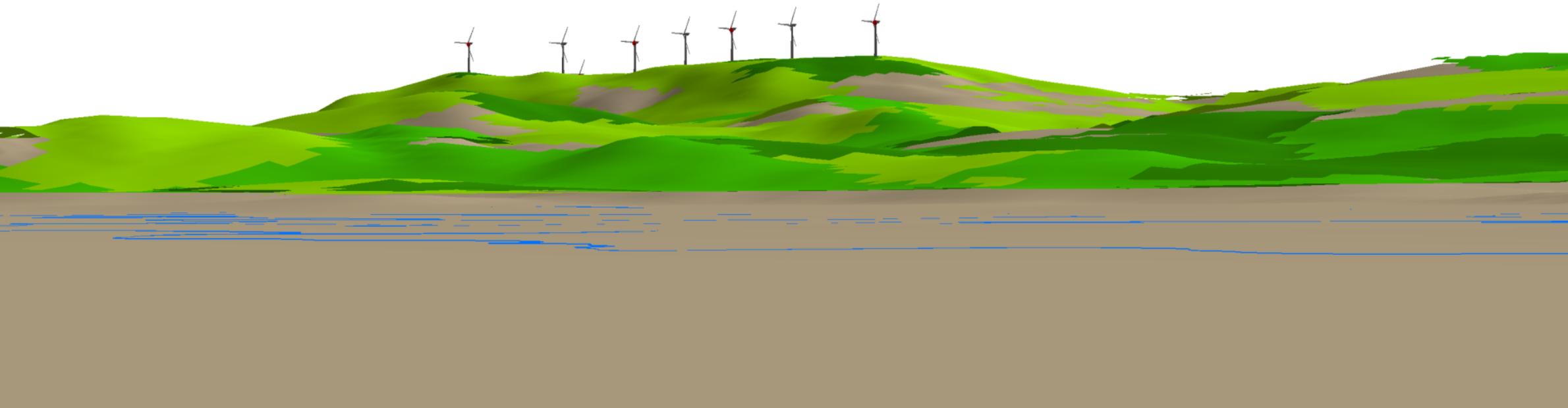
## Visualization 1a: GE Turbines from the Jay-Niles Memorial Library

The purpose of this visualization is to validate the relative accuracy of a photographic simulation representing GE-2.75 turbines. It is created using the location and camera information from the photograph metadata and GIS database that were used to prepare the *Visual Impact Assessment Canton Mountain wind Project*. Forest cover is set to 40 feet and does not include forested wetlands or areas harvested since 1995; the representation of foreground vegetation may not be accurate. Turbines marked with a red dot have FAA warning lights. 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 its width.



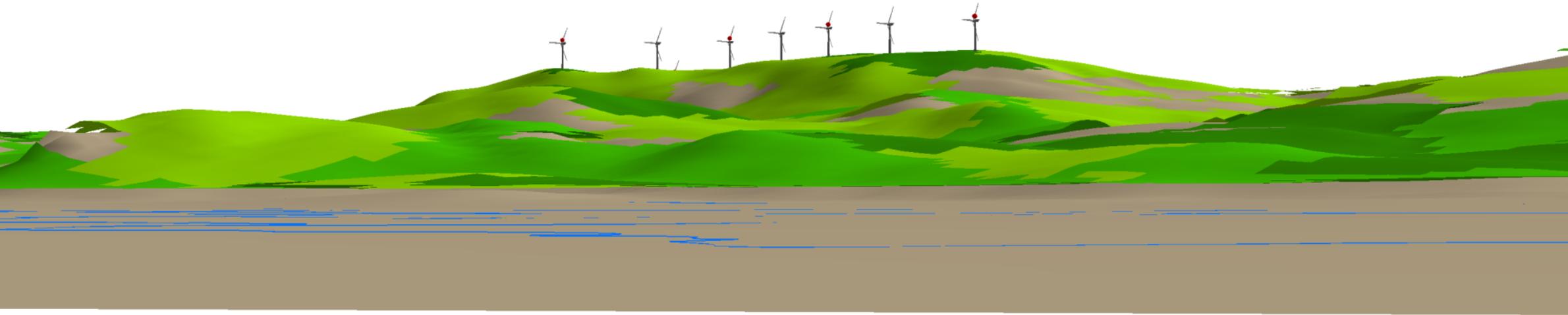
## Visualization 1b: Siemens Turbines from the Jay-Niles Memorial Library

The purpose of this visualization is to validate the relative accuracy of a photographic simulation updated to represent the use of Siemens 3.0-113 turbines. It is created using the location and camera information from the photograph metadata and GIS database that were used to prepare the *Visual Impact Assessment Canton Mountain Wind Project* simulations. Forest cover is set to 40 feet and does not include forested wetlands or areas harvested since 1995; the representation of foreground vegetation and buildings may not be accurate. Turbines marked with a red dot have FAA warning lights. 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 its width.



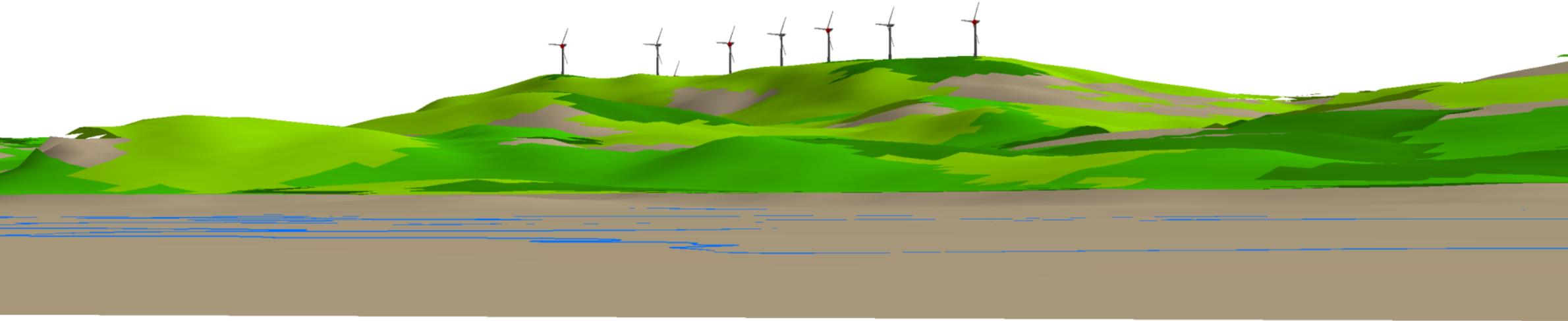
## Visualization 2a: GE Turbines from the North Jay Grange Store

The purpose of this visualization is to validate the relative accuracy of a photographic simulation representing GE-2.75 turbines. It is created using the location and camera information from the photograph metadata and GIS database that were used to prepare the *Visual Impact Assessment Canton Mountain wind Project*. Forest cover is set to 40 feet and does not include forested wetlands or areas harvested since 1995; the representation of foreground vegetation may not be accurate. Turbines marked with a red dot have FAA warning lights. 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 its width.



## Visualization 2b: Siemens Turbines from the North Jay Grange Store

The purpose of this visualization is to validate the relative accuracy of a photographic simulation updated to represent the use of Siemens 3.0-113 turbines. It is created using the location and camera information from the photograph metadata and GIS database that were used to prepare the *Visual Impact Assessment Canton Mountain Wind Project* simulations. Forest cover is set to 40 feet and does not include forested wetlands or areas harvested since 1995; the representation of foreground vegetation and buildings may not be accurate. Turbines marked with a red dot have FAA warning lights. 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 its width.



### Visualization 3a: GE Turbines from Forest Pond

The purpose of this visualization is to validate the relative accuracy of a photographic simulation representing GE-2.75 turbines. It is created using the location and camera information from the photograph metadata and GIS database that were used to prepare the *Visual Impact Assessment Canton Mountain wind Project*. Forest cover is set to 40 feet and does not include forested wetlands or areas harvested since 1995; the representation of foreground vegetation may not be accurate. Turbines marked with a red dot have FAA warning lights. 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 its width.



### Visualization 3b: Siemens Turbines from Forest Pond

The purpose of this visualization is to validate the relative accuracy of a photographic simulation updated to represent the use of Siemens 3.0-113 turbines. It is created using the location and camera information from the photograph metadata and GIS database that were used to prepare the *Visual Impact Assessment Canton Mountain Wind Project* simulations. Forest cover is set to 40 feet and does not include forested wetlands or areas harvested since 1995; the representation of foreground vegetation and buildings may not be accurate. Turbines marked with a red dot have FAA warning lights. 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 its width.

