The Impact of the Wild Meadows Wind Farm on Local Residential Property Values

Matthew Magnusson, MBA
Seacoast Economics
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1 Executive Summary

As the number of wind farms increase in New Hampshire, an area of concern has been whether there are any potential impacts on the values of residential properties that are located in close proximity to wind turbines or that have significant views of wind turbines. This study was undertaken to determine the potential impact of the proposed Wild Meadows Wind Farm in Grafton and Merrimack counties on local real estate values.

A study released in 2013 by the Lawrence Berkley National Laboratory (LBNL) assembled a national data set of over 50,000 property transactions within 10 miles of a wind turbine with 1,200 sales having occurred within 1-mile of a turbine. The 2013 LBNL study reported no statistically significant difference in the sales price for transactions at any distance, including within bands of 0.5-miles and 1-mile of a wind turbine. The 2013 LBNL study was of a sufficient data transaction size to provide strong statistical evidence that there was no relationship between wind farms and real estate property values.

Since the completion of the Lempster Wind Farm and Groton Wind Farm in New Hampshire, there have been 132 arms-length single family home property transactions at a value of $22.5 million in the immediate communities surrounding the wind farms.[1] For these property transactions, there was no statistically significant difference found between the sales price and pre-sale assessed value for NH homes within 0-1 mile of a turbine, 1-3 miles of a turbine, and 3-10 miles to a turbine. There also was no statistically significant change observed in the assessed values of properties sold in these regions from 2008 through 2013.

A limitation of this study is the relatively small number of property transactions that have occurred since construction of the wind farms and this can limit the ability of statistical analysis to indicate differences. Nevertheless, the finding of no statistically significant impact observed change in property value at any distance from the wind turbines is consistent with the findings of the 2013 LBNL study.

Since completion of the two wind farms, there have been 14 arm's-length single family home transactions totaling $6.1 million for waterfront residential properties located on bodies of water that are within 10 miles of a turbine and that feature visibility of a turbine from areas on the body of water and areas of the shoreline. In general, these properties have sold at assessed value; which is noteworthy, as the overall trend in Grafton and Sullivan counties has been for properties to sell on average slightly below assessed value since 2008.

A separate analysis of real estate market value based on total assessed residential values did not indicate that the real estate market activity of the communities surrounding the Lempster Wind Farm or the Groton Wind Farm was different from that experienced throughout Grafton or Sullivan counties overall.

Based on the similarities in topography, demographics, and regional location, it is not expected that the property value experience at the proposed Wild Meadows Wind Farm would be different than the property value experience observed at the Lempster Wind Farm or the Groton Wind Farm. Given the findings of the 2013 LBNL study, supported by the property transactions observed around the two wind farms reviewed, it is not expected there will be any consistent differences in the sales prices relative to assessed values for post-construction property transactions around the Wild Meadows Wind Farm including those properties in close proximity to the turbines or properties with significant views of the turbines.

[1] The communities analyzed around the Lempster Wind Farm were: Goshen, Lempster, and Washington. The communities analyzed around the Groton Wind Farm were: Groton, Hebron, Plymouth, and Rumney. The methodology section of the report discusses the choice of towns for analysis.

2 Introduction

Real estate is the largest contributor to wealth in our society with housing being the single largest household asset category, accounting for 25% of all U.S. household assets. [2] Changes in real estate value significantly impact the economic health of individuals, families, and businesses.[3] Real estate markets are an essential contributor to the NH economy. In 2012, the real estate sector alone directly contributed $9 billion to NH Gross State Product.[4]

New Hampshire has implemented a Renewable Portfolio Standard (RPS) that calls for 13% of electricity consumed in NH to be produced by renewable resources in 2013 growing to 24.8% by 2025.[5] In 2011, 16% of New Hampshire electricity consumed came from renewable energy (9% when hydroelectric power is excluded).[6] New Hampshire currently has 171 megawatts (MWs) of wind capacity installed.[7] Wind resource estimates show that New Hampshire has the potential to grow its installed wind capacity. [8] Wind can potentially serve as one energy resource to help New Hampshire meet its RPS requirements.

However, an area of concern with the growth of New Hampshire's wind farms is whether or not they may have an impact on property values, specifically those properties that are in close proximity to wind turbines or that have views of wind turbines. Given NH's commitment to renewable energy, it is important to review and understand how efforts to expand renewable energy in the state may positively or negatively impact economic activity, including real estate markets.

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[2] In 2012, total assets for households and non-profit organizations were $80.7 trillion and real estate at market value was $20.0 trillion. Source: Federal Reserve, "B.100 Balance Sheet of Households and Nonprofit Organizations," Flow of Funds Accounts of the United States (accessed September 18, 2013).

[3] Ling, D., & Archer, W. (2012). "The Nature of Real Estate and Real Estate Markets". "In Real Estate Principles: A Value Approach". McGraw-Hill/Irwin; 4th edition.

[4] The real estate sector accounted for $8.9 billion of the $64.7 billion of NH gross state product in 2012. This does not include exclude construction activity, and other related professional services, nor does it include indirect and induced economic impacts from real estate activity. Source: U.S. Bureau of Economic Analysis, "Gross Domestic Product by State (millions of current dollars)" (accessed September 18, 2013).

[5] "New Hampshire Incentives/Policies for Renewables & Efficiency," Database of State Incentives for Renewables & Efficiency, Retrieved fromhttp://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=NH09R&re=0&ee=0 (accessed September 18, 2013).

[6] In 2011, total electricity consumed in New Hampshire was 196.6 trillion BTU with hydroelectric accounting for 15.5 trillion BTU, biomass at 16 trillion BTU, and wind at 0.6 trillion BTU. Source: U.S. Energy Information Administration, "Table C9 Electric Power Sector Consumption Estimates, 2011 ," New Hampshire State Profile and Energy Estimates. Retrieved from: http://www.eia.gov/state/seds/data.cfm?incfile=/state/seds/sep_sum/html/sum_btu_eu.html&sid=NH (accessed September 18, 2013). Also please note that not all renewable resources in New Hampshire are eligible for the NH RPS and that renewable resources from other New England states and other regions can be used to meet NH's RPS requirements.

[7] American Wind Energy Association, "U.S. Wind Power Capacity Installations by State," AWEA U.S. Wind Industry Second Quarter 2013 Market Report, Released July 30, 2013.

[8] Wind capacity is estimated to be between 5,000 and 9,000 MW even when excluding areas such as wilderness areas and parks. Source: National Renewable Energy Laboratory, "New Hampshire Wind Resource Potential Cumulative Rated Capacity vs. Gross Capacity Factor (CF),"

Iberdrola Renewables, LLC is proposing its third project in the state, the Wild Meadows Wind Farm. This study was undertaken to build on a previous study co-authored by this study's author and released in 2012 entitled "Impact of the Lempster Wind Power Project on Local Residential Property Values" to better understand the potential economic impact of the Wild Meadows Wind Farm on local residential property values. This study seeks to do this by building on the author's economic evaluation experience with NH wind farms including: the Lempster Wind Farm, the Granite Reliable Wind Farm, the Groton Wind Farm, and the proposed 30 MW wind farm by Antrim Wind Energy, LLC.

The original study of the Lempster Wind Farm reviewed a total of 2,593 arms-length single family home sales transactions throughout Sullivan County occurring between January 2005 and November 2011 to observe whether the Lempster Wind Farm (on-line in November 2008) may have had any broad or focused impacts on residential property values in the local area economy. Furthermore, the original study specifically focused on 16 arms-length single family home property transactions in Lempster and 72 arms-length single family home property transactions in the bordering towns of Goshen, Marlow, Unity and Washington.

There was not a statistically significant difference between the sales price and average presale assessed value of properties with no view, an obscure view, or a clear view of one or more turbines nor was there a relationship observed between turbine distance and sales price. While the original study did not exclude the possibility of isolated cases of sales impact in the Lempster market area, the study found no evidence that the wind farm caused a consistent impact on residential property values in Lempster or the nearby surrounding communities.

In November 2012, NH Public Radio ran a story on the Lempster Wind Farm. As one part of the story, the author of that story stated that he randomly called four realtors to determine their experience in the Lempster area real estate market compared to the findings of the study. The author stated "their experiences back up that study."[9] While not based on direct data analysis, this story is one example of an independent, external verification of the study's findings.

This new study builds on the original study to help inform the potential economic impact of the proposed Wild Meadows Wind Farm on real estate values in four ways: (1) performance of a literature review of relevant regional, national, or international studies that have occurred since the release of the original study, (2) analysis of all post-construction arms-length single family home transactions in the immediate communities surrounding the Lempster Wind Project from November 2008 through July 2013, (3) analysis of all post-construction arms-length single family home transactions in the immediate communities surrounding the Groton Wind Farm in Grafton county, NH from December 2012 through July 2013, and (4) analyzed town and county property assessment data. The findings of this study will be discussed in the context of potential residential property value impacts around the proposed Wild Meadows Wind Farm to be located in Merrimack and Grafton counties.

[9] "Lessons From Lempster: Town Has Found Wind Farm To Be Neither Blessing Nor Curse," NHPR, November 2012, available online at http://nhpr.org/post/lessons-lempster-town-has-found-wind-farm-be-neither-blessing-nor-curse

2.1 NH Wind Farms

The next section will discuss the characteristics of the Lempster Wind Farm and the Groton Wind Farm. Both of these wind farms are in the general region of the proposed Wild Meadows Wind Farm. A third section discusses the proposed Wild Meadows Wind Farm and the final section compares and contrasts the three wind farms discussed. The other major commercial wind farm currently operating in New Hampshire is the Granite Reliable Wind Farm located in Coos County which came on-line in 2011. The Granite Reliable Wind Farm was not included in the analysis as its inclusion was not expected to enhance the analysis or impact its findings; one specific factor considered was the distance of the Granite Reliable Wind Farm from the other wind farms.

2.1.1 Lempster Wind Farm

The Lempster Wind Farm—owned by Iberdrola Renewables, LLC— is New Hampshire's first modern, commercial-scale wind farm. The project is a 24 megawatt (MW) wind farm that came online in November 2008. The wind farm is located in the eastern portion of the Town of Lempster in Sullivan County on approximately 1,500 acres of privately owned land. The farm consists of 12 Gamesa G87 (2 MW) wind turbines stretching over several connected ridgelines on Lempster Mountain and Bean Mountain.

The Gamesa G87 turbines stand 398 feet to the tip of blade and have a tower hub height of 256 feet and a blade length of 139 feet. Each of the turbines is located within 700 to 850 feet of another turbine and the turbines are accessible via 5 miles of gravel surfaced roads. The Lempster Wind Farm is interconnected to the Public Service of New Hampshire (PSNH) Newport substation by a 10.5-mile 34.5 kilovolt (kV) distribution line and features a 34.5 kV switchyard with pole mounted equipment and a 34.5 kV underground collector feeder system.[10]

PSNH has a power purchase agreement with Iberdrola for 100% of the electricity generated from the Lempster Wind Farm. PSNH resells a portion of the power purchased to the New Hampshire Electric Cooperative, a local electric service provider that includes the town of Lempster in its service territory.[11]

[10] "Lempster Wind Power Project Fact Sheet," Iberdrola Renewables, Available online at http://www.iberdrolarenewables.us/cs_lempster.html

[11] "Twelve New Wind Turbines Nearing Completion at New Hampshire's First Wind Project," Iberdrola Renewables, October 7, 2008. Available online at http://www.iberdrolarenewables.us/rel_08.10.07.html

Figure 1: Town of Lempster with wind turbines

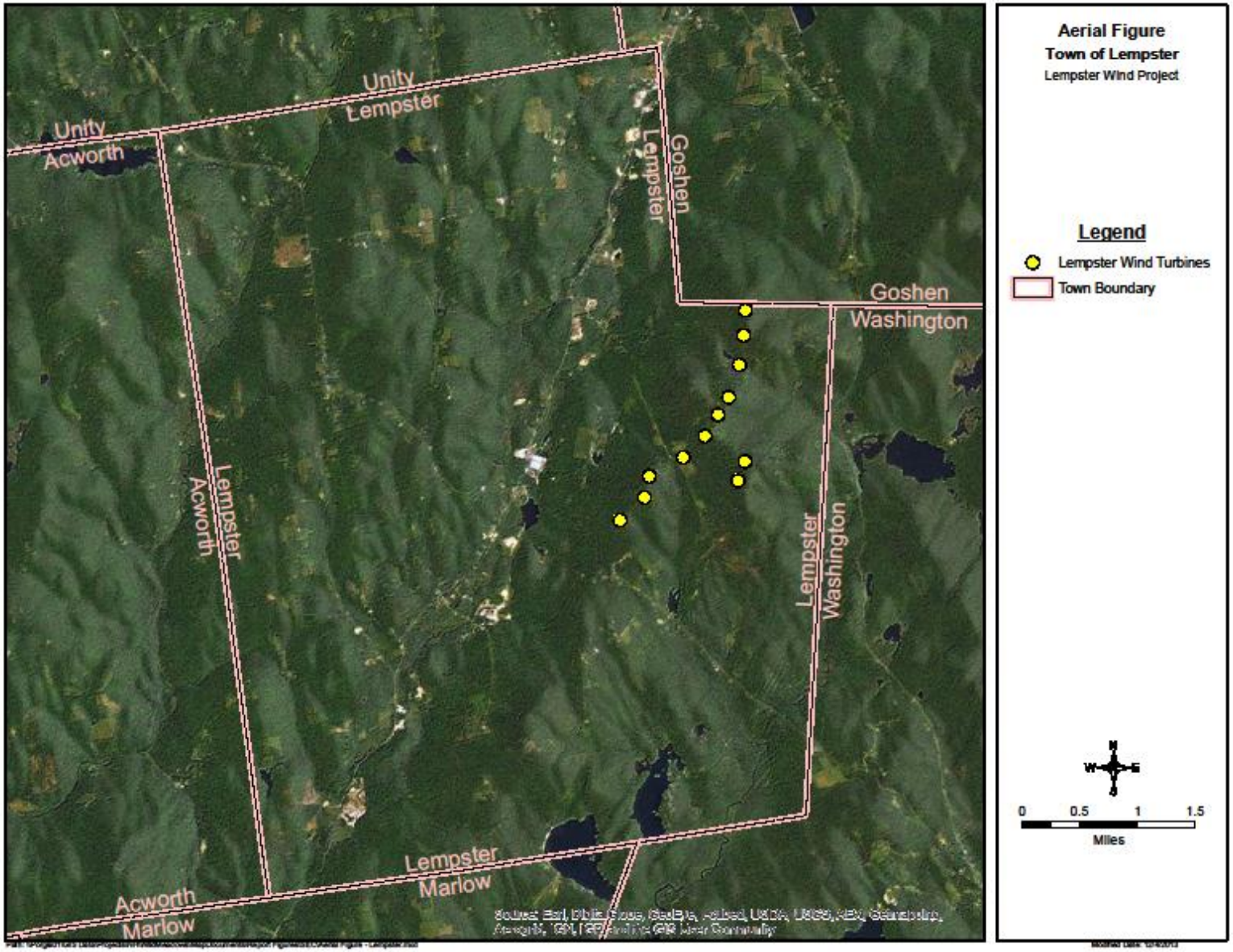


Figure 2: Lempster turbines from Skyline Drive, Unity NH (5.5-6.5 Miles) – Fall 2013

Source: Seacoast Economics

Two bodies of water in the area of the Lempster Wind Farm that are highlighted in this report: Long Pond and Ashuelot Pond in the waterfront analysis section. Located in the Town of Lempster, Long Pond is a 114 acre pond with public water access providing boating recreation and fishing opportunities. This area features conservation land including the 1,826 acre Ashuelot River headwaters conserved by the Society for the Protection of New Hampshire Forests and the Long Pond Town Forest. Housing and rental units are located on the eastern shore. The pond is located 2-3 miles directly south of the Lempster Wind Farm.

Ashuelot Pond is a 368-acre water body located in the town of Washington. It is situated along the Ashuelot River, a tributary of the Connecticut River. Ashuelot pond is located 3.5 to 5.5 miles south of the nearest turbine of the Lempster Wind Farm. The pond is bordered to the west by the Washington Town Forest and to the east and south by housing units. A boat ramp provides public water access and the pond features fishing recreation.

2.1.2 Groton Wind Farm

The Groton Wind Farm is the second wind farm owned by Iberdrola Renewables, LLC in NH and is NH's third commercial-scale wind farm. The project is a 48 MW wind farm that came online in December 2012. The wind farm is located in the northeastern portion of the Town of Groton in Grafton County and consists of 24 Gamesa G87 (2 MW) wind turbines along two ridge features ranging in peak elevation from 1,850 to 2,300 feet. The site is rural, located entirely on private timber land parcels that are set back from residences, roads and other public

Figure 3: Town of Groton with turbine locations

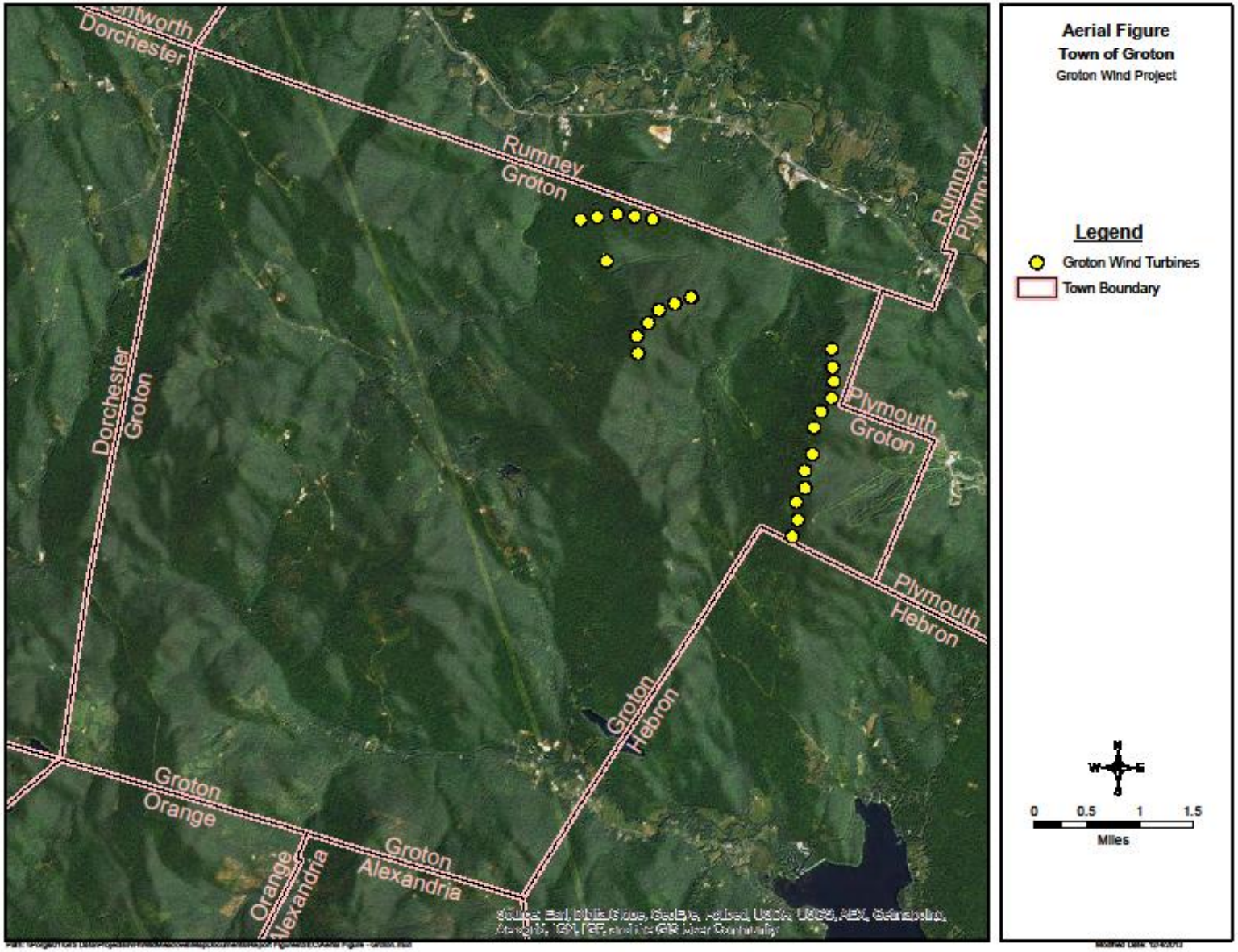


Figure 4: View of Groton Wind Farm turbines from Newfound Lake southern shore (8.5 miles) – Fall 2013

Source: Seacoast Economics

areas.[12] The Town of Groton has a 15-year PILOT (payment in lieu of taxes) with Iberdrola at $22,000 per year per turbine with an additional 2.5% increase per year.

Newfound Lake is a 4,451 acre lake with 22 miles of shore line located in Grafton County, bordered by the Towns of Alexandria, Bridgewater, Bristol, and Hebron. It's the fourth largest lake in New Hampshire. Newfound Lake is located between 3-8.5 miles from nearest turbine of the Groton Wind Farm. It provides recreational boating opportunities and Wellington State Park, New Hampshire's largest freshwater beach, and is located on its western shore. Along its shores are residential, lodging, and rental housing units.

2.1.3 Wild Meadows Wind Farm

Iberdrola Renewables, LLC has proposed the Wild Meadows Wind Farm, a 75.9 MW wind farm, to be located in the Town of Alexandria in Grafton County and the Town of Danbury in Merrimack County. The wind farm is proposed to have 23 Vestas V112 (3.3 MW). Wild Meadows will include collector lines, access roads, a substation, a permanent meteorological tower, and an operations and maintenance building. The western portion of the wind farm includes Tinkham Hill (2,270') and Braley Hill (2,083'), the central portion of the wind farm includes the Pinnacle (1,981'), and the eastern portion of the wind farm includes Forbes Mountain (2,159') and Pine Hill (2,091').[13]

[12] "Groton Wind Farm," Iberdrola Renewables, available online at http://iberdrolarenewables.us/groton.html
[13] "Wild Meadows Wind Farm," Iberdrola Renewables, LLC, Available online at http://iberdrolarenewables.us/wildmeadows/

Figure 5: Proposed turbine locations for Wild Meadows Wind Farm

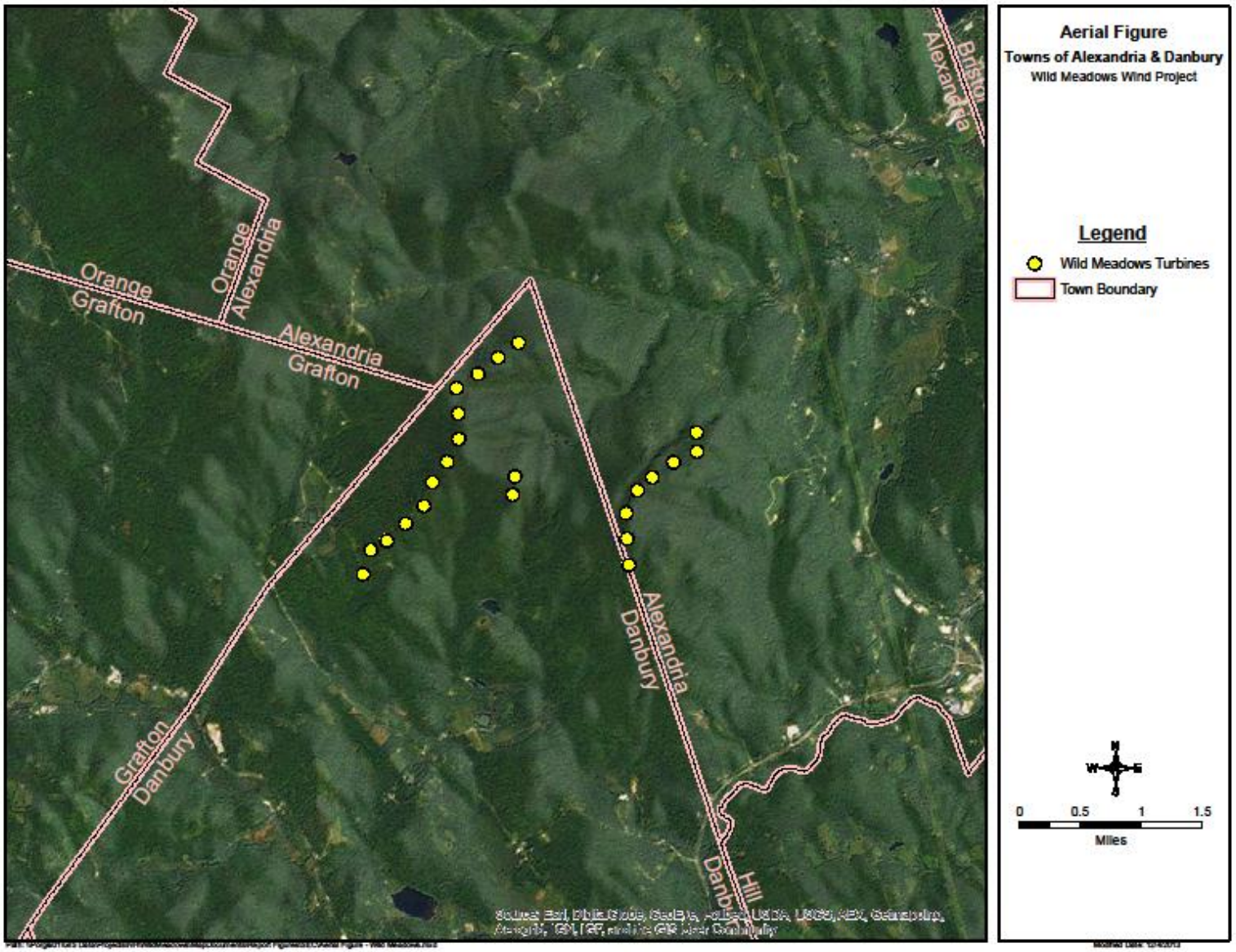


Figure 6: Simulated viewpoint #226 of the Wild Meadows Wind Farm from Brad Chase Road in Danbury (1.6 miles from wind farm)

Source: Iberdrola Renewables, LLC

Figure 7: Simulated viewpoint #46 of the Wild Meadows Wind Farm from Newfound Lake (4.7 miles from wind farm)

Source: Iberdrola Renewables, LLC

The Vestas V112 turbines will be placed on 308 foot (94 m) towers. Each blade will be 179 feet (54.6 m) long. The total turbine height from foundation to blade tip will be 492 feet (150 m).[14]

2.1.4 Comparison of the Wind Farms

The geography of the Lempster Power Project, the Groton Wind Farm, and Wild Meadows Wind Farm are similar in that they are rural with hilly terrain and significant forestation and they are all located in the western portion of New Hampshire. All areas feature recreational bodies of water in the nearby region with waterfront housing. The Wild Meadows Wind Farm would be located approximately 9 miles south and slightly west of the Groton Wind Farm and just over 25 miles north and east of the Lempster Wind Farm. The Wild Meadows Wind Farm would range between 3.5 to 7.5 miles from Newfound Lake.

The towns hosting the wind farms all have land-size area ranging between 32 to 43 square miles. These towns also all have a population density at approximately 35 people per square mile; this is far below the state average population density of 147 people per square mile. The population in these communities tends to be older as measured by median age and the percentage of the population that is age 18 or older. The income in these communities tends to be below the state average. The average assessed value of housing also tends to be below the state average.

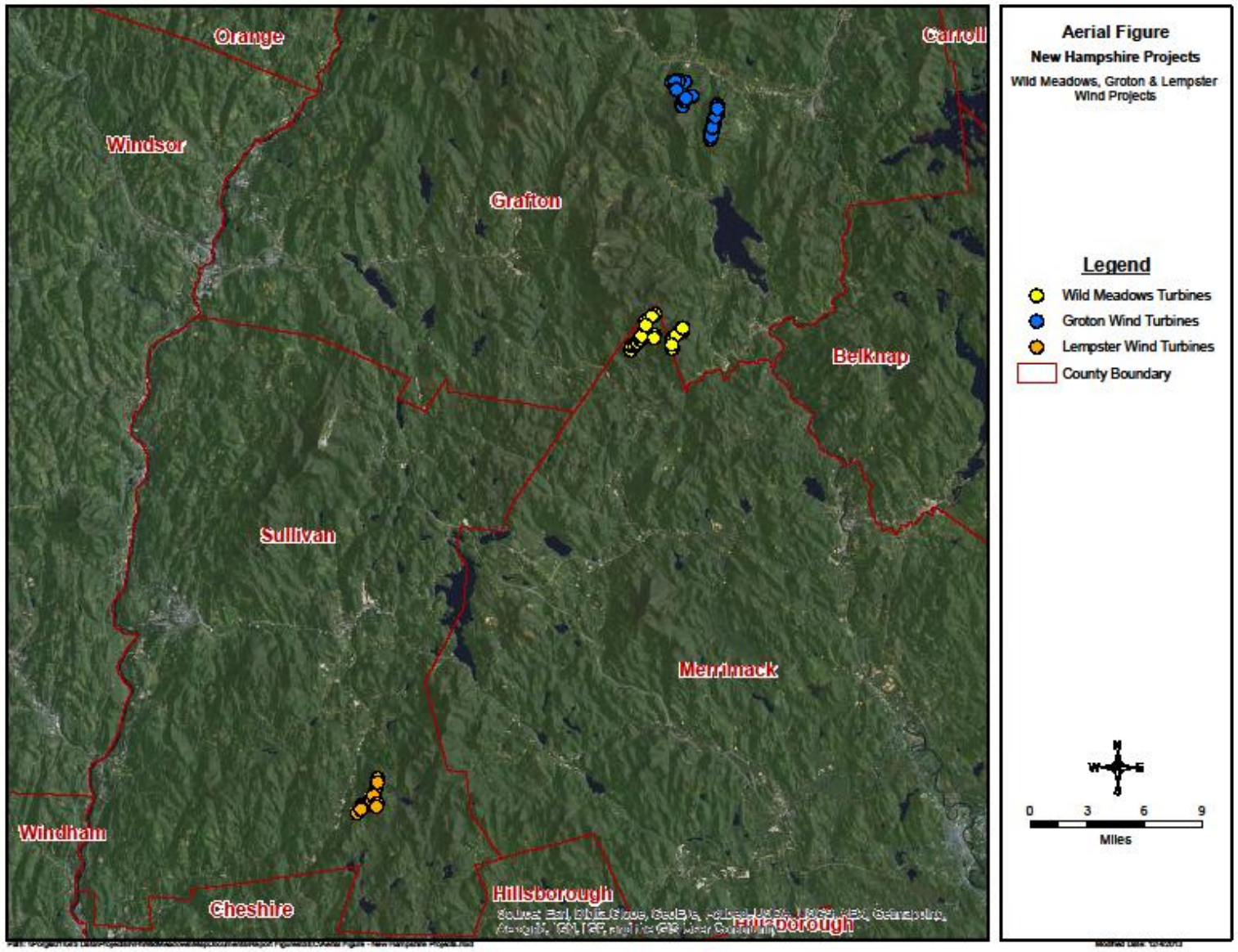
Table 1: Demographic information for towns hosting wind farms

Town	Lempster	Groton	Danbury	Alexandria	State of NH Totals
Wind Farm	Lempster Wind Farm	Groton Wind Farm	Wild Meadows Wind Farm	Wild Meadows Wind Farm	n/a
Number of Turbines	12	24	15	8	n/a
Turbine Hub Height (feet)	256	256	308	308	n/a
County	Sullivan	Grafton	Merrimack	Grafton	n/a
Population (2010)	1,154	593	1,164	1,613	1,316,470
Land Area (SQ Miles)	32	41	38	43	8,932
Density (People per SQ MI)	36	15	31	38	147
Median Age (2010)	46	48.5	44	45	41
Percentage of population 18 or older (2010)	81%	84%	80%	79%	78%
Housing units (2010)	679	436	684	967	614,754
Income (2007-2011)	$ 58,594	$ 40,750	$ 46,845	$ 56,667	$ 64,664
Total Assessed Residential and Manufactured Housing Value (2012)	$ 70,855,500	$ 36,461,800	$ 63,529,110	$ 110,134,700	$ 76,046,711,137
Average Assessed Residential and Manufactured Housing Value per housing unit	$104,353	$83,628	$92,879	$113,893	$123,703

Source: U.S. Census Bureau American Fact Finder, NH Department of Revenue

[14] "3 MW Platform," Vestas, Available online at http://nozebra.ipapercms.dk/Vestas/Communication/Productbrochure/3MWbrochure/3MWProductBrochure/

Figure 8: Proposed Wild Meadows Wind Farm relative to the Groton Wind Farm and the Lempster Wind Farm



2.2 Study Sponsor

Iberdrola Renewables, LLC, is a US company headquartered in Portland, Oregon, with nearly $10 billion in operating assets in the United States. Iberdrola Renewables is the second-largest wind operator in the U.S., with more than 50 renewable energy projects and an operating capacity of more than 5,800 MW of wind and solar energy. Through its U.S. investments and footprint in dozens of communities from coast to coast, Iberdrola Renewables has developed considerable experience in energy and economic development with landowners and communities across the U.S.[15]

This study builds on previous work performed in 2012 ("The Impact of the Lempster Wind Power Project on Local Residential Property Values") in which Seacoast Economics Owner, Matthew Magnusson, was a co-author. Mr. Magnusson has performed economic research on each of the three commercial wind farms currently operating in New Hampshire as well as the previously-proposed 30 MW wind farm by Antrim Wind Energy, LLC. He has also performed economic analysis on energy policy in the state of New Hampshire, including the NH Renewable Portfolio Standard, the Regional Greenhouse Gas Initiative, the NH Greenhouse Gas Emissions Reduction Fund, and the NH BetterBuildings program.

This study is intended to inform the members of the New Hampshire Site Evaluation Committee of the potential impacts on local property values from the proposed Wild Meadows Wind Farm based on the experience nationally and in New Hampshire.

As part of the study, Dr. Charles Colgan of the University of Southern Maine independently reviewed a completed draft version of the study and provided comments that were considered and integrated into the final version of the report. Dr. Scott Mantie of Plymouth State University reviewed the statistical analysis and methodology performed and provided comments. Appendix A provides biographies for Matthew Magnusson, Dr. Charles Colgan, and Dr. Scott Mantie.

[15]" The US business of an international energy leader," Iberdrola Renewables, LLC, available online at http://iberdrolarenewables.us/business-overview.html

3 Previous Studies

The impact of wind energy projects on residential properties has been researched in both the United States and in other countries. Reviewing previous research can help provide context for the analysis results of property transactions occurring around wind farms in NH and to help inform conclusions on the potential impact of the Wild Meadows Wind Farm on local residential property values.

Past studies have used a variety of research techniques including: homeowner surveys, expert surveys (e.g. surveys of real estate appraisers), and statistical analysis of property transactions. Almost unanimously, statistical analysis of actual property transactions has not revealed any statistically significant change in property values resulting after the construction of wind energy projects. Surveys of homeowners and experts have been more mixed as evidenced in some pre- and post-wind farm construction surveys. Some surveys have found statistically significant expectations by survey respondents that property values will decline as a result of a wind power project. [16] While surveys can reveal homeowners' expectations of residential property value impacts from wind projects, the most reliable way to determine property value impact is not through surveys, but through analyzing actual market transactions. More in-depth discussions of previously performed studies can be found at Carter (2011), Hinman (2010), and Hoen et al. (2009). [17,18]

To date, two studies performed by the Lawrence Berkley National Laboratory have been among the most noteworthy investigations of the topic in the United States in terms of statistical analysis and number of property transactions: (1) "A Spatial Hedonic Analysis of the Effects of Wind Energy Facilities on Surrounding Property Values in the United States" (2013), and (2) "The Impact of Wind Power Projects on Residential Property Values in the United States: A Multi-Site Hedonic Analysis" (2009). [19] Both of these studies did not indicate a statistically significant impact on property values due to wind turbines and are discussed further below in this study. Another recent study that did report mixed results for property values (as witnessed

[16] Hoen et al., "The Impact of Wind Power Projects on Residential Property Values in the United States: A Multi-Site Hedonic Analysis," Lawrence Berkeley National Laboratory, December 2009, Available online at http://eetd.lbl.gov/ea/ems/reports/lbnl-2829e.pdf

[17] Carter, J., "The Effect of Wind Farms on Residential Property Values in Lee County, Illinois," Illinois State University, Spring 2011, Available online at http://renewableenergy.illinoisstate.edu/wind/publications/2011%20Wind%20Farms%20Effect%20on%20Property%20Values%20in%20Lee%20County.pdf

[18] Hinman, J., "Wind Farm Proximity And Property Values: A Pooled Hedonic Regression Analysis Of Property Values In Central Illinois," Illinois State University, May 2010, Available online at http://friendsofwind.ca/wp-content/uploads/2011/07/USA-2010-Hinman-Wind-Farm-Proximity-and-Property-Values.pdf

[19] Hoen et al., "A Spatial Hedonic Analysis of the Effects of Wind Energy Facilities on Surrounding Property Values in the United States," Lawrence Berkeley National Laboratory, August 2013, Available online at http://eetd.lbl.gov/ea/ems/reports/lbnl-6362e.pdf

through 11,331 sales transactions in NY) was Heintzelman and Tuttle (2012).[20] These three studies are discussed in greater detail below.

Both of the studies performed by LBNL and the study by Heintzelman and Tuttle rely on a statistical approach called Hedonic Price Modeling which involves developing an equation to explain a specific value—or in the case of these studies, the expected selling price of a house. While there are many different approaches (types of equations) that one can use in hedonic price modeling, they all involve a statistical technique called regression. Regression uses computer software to estimate the relationships between a dependent variable (in the case of these studies, the housing price) and one or more independent variables (such as square footage or age of the home).

Hedonic modeling is very common in housing markets because residential properties can be thought of as a bundle of characteristics that have value (square footage, number of bedrooms and bathrooms, plot size, condition, etc.). [21] Location and the characteristics of that location also have value. The view from a property is a characteristic that has been shown to have positive value when it is perceived to be pleasant or desirable (such as waterfront property or mountain vista) and negative value when it is perceived to be unpleasant or undesirable (such as a landfill).[22] The "bundled" value of all of the characteristics of a property is expected to be revealed when a buyer and a seller engage in a market-based transaction for that property.

In considering these statistical approaches, including hedonic modeling, as applied to observed property transactions in these studies, it is important to remember that it only shows correlation—the relationships between variables, but does not demonstrate cause and effect. The rationale for the application of hedonic modeling in the impacts of property values and wind farms is that one would expect to see a variation in the price of properties sold after the construction of wind turbines when none of the other variables in the model show a relationship that could be attributed to that variation, leaving only the presence of the wind turbines.

This is a logical approach, but also one that is not criticism-free. Some critiques of hedonic modeling, specifically in regards to studies of wind farms and property values, include that it is not standardized and are dependent on the accuracy and reliability of the underlying regression analysis.[23] However, given that any attempt to model the real world mathematically will have limitations, the ability to identify otherwise unobservable attributes has made hedonic modeling a frequently chosen statistical approach in real estate analysis.[24]

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[20] Hintzelman, M. and Tuttle, C., "Values in the Wind: A Hedonic Analysis of Wind Power Facilities," Land Economics, August 2012

[21] Champ, P A., Boyle, K J., and Brown, T C. "A Primer on Nonmarket Valuation: The Economics of Non-Market Goods and Resources," Kluwer Academic Publishers, Volume 3, 2003.

[22] Simons, R. A. and Saginor, J. D., "A Meta-Analysis of the Effect of Environmental Contamination and Positive Amenities on Residential Real Estate Values," Journal of Real Estate Research. 2006, 28(1): 71-104. Available online at http://business.fullerton.edu/finance/journal/papers/pdf/past/vol28n01/05.71_104.pdf

[23] Wilson, A., "Wind Farms, Residential Property Values, and Rubber Rulers"

[24] Coulson, E., "Chapter 1: Introduction," Hedonic Estimation and Housing Markets, available online at http://www.econ.psu.edu/~ecoulson/hedonicmonograph/monog.htm

With any regression, an average value is calculated, as well as the variation around that value, which is commonly measured in the standard deviation of the value. Standard deviation indicates the dispersion of observed values compared to the average value. When evaluating regression models, a statistical measure called the coefficient of determination is calculated. This measure shows how well the variation in the dependent variable of the model—also known as the goodness of fit—is explained by the model and ranges between 0 and 1. With a value of 0 indicating that the model explains no relationship the observed variation and a value of 1 indicating that the model explains all of the variation in the model. This means that models that are closer to 1 do a better job of explaining the observed variation than ones with lower values.

Table 2: Summary of studies

Study	Property Transactions	Wind farms	Average turbines per wind farm	Max turbines per wind farm	Average Hub height (feet)	Max hub height (feet)	Maximum coefficient of determination	Finding
Hoen et al. (2009)	7,459	24	135	582	216	262	0.77	No statistically-significant impacts for view or proximity to turbines
Heintzelmen and Tuttle (2012) study	11,331	6	78	194	262	263	0.33	Statistically-significant proximity for two counties; no statistically-significant in one county
Hoen et al. (2013)	51,276	67	48	150	256	328	0.67	No statistically-significant impacts for proximity to turbines

Study: A Spatial Hedonic Analysis of the Effects of Wind Energy Facilities on Surrounding Property Values in the United States (2013)

Hoen et al. (2013) represents one of the most comprehensive studies of this topic to date and features both a discussion of relevant, previously conducted studies and statistical analysis of more than 50,000 property transactions from 27 different counties across 9 states (Illinois, Iowa, Minnesota, New Jersey, New York, Ohio, Oklahoma, Pennsylvania, and Washington).

The literature review by Hoen et al. includes studies that focused on wind farms, but also other potentially similar structures such as high-voltage transmission lines. Hoen et al. state that the published research about wind farms and property values has largely centered around a finding that homes sold after nearby wind turbines have been constructed do not experience statistically significant property value impacts. They did note that a limitation of previous studies was that there was a limited number of property transactions located within close proximity of turbines. The small sample sizes in these areas are problematic as this is where impacts would be expected to be the largest.

Hoen et al. specifically addressed this limitation by nationally constructing the largest single family property transaction data set in any study to date. Of the 50,000 total transactions, there

were over 18,000 post-construction single family home property transactions analyzed that were within 10 miles of 67 different wind facilities with 376 of those sales within 1-mile of a turbine. To add to the robustness of the statistics model, when selecting property transactions, they required each selected county to have at least 250 transactions with at least one post-construction transaction occurring within a half mile of a turbine in each county. The average numbers of turbines at a wind farm were 48 and ranged from 1 to 150; the average turbine hub height was approximately 256 feet and ranged from 197 to 328 feet.

The average home price in this study was $122, 475 with a standard deviation of $80, 367 and a maximum value of $690,000. This shows that there is considerable variability about the average value. Hoen et al. developed two different hedonic models; one model had a coefficient of determination of 0.64 and the other had a coefficient of determination of 0.67. This means that the model developed had a reasonably good fit to the data and explained 64% to 67% of the variation observed.

The study found no statistical evidence that home values near turbines were affected in either the period of time between when a project was announced through the construction period or the period of time post-construction. This finding was based on a sample-size adequate to detect even small differences in selling prices for properties located closer to wind turbines.

Table 3: Post –construction property transactions by distance in LBNL 2013 study and NH 2013 study

Study		Miles				Total
		0-0.5	0.5-1	1-3	3-10	
LBNL (2013)	Sales	104	272	3,182	14,549	18,107
	Percentage	0.6%	1.5%	17.6%	80.4%	100%
NH (2013)	Sales	2	3	30	97	132
	Percentage	1.5%	2.3%	22.7%	73.5%	100%

In comparing the distributions of post-construction sales in NH with national post-construction sales, NH had slightly more sales within 1-mile of a turbine at 3.8% compared to 2.1%. The sales within 1-3 miles of a turbine were also higher at 22.7% compared with 17.6%. This indicates that NH property transactions are occurring with a similar frequency as what might be expected at the national level for property transactions.

Study: The Impact of Wind Power Projects on Residential Property Values in the United States: A Multi-Site Hedonic Analysis (2009)

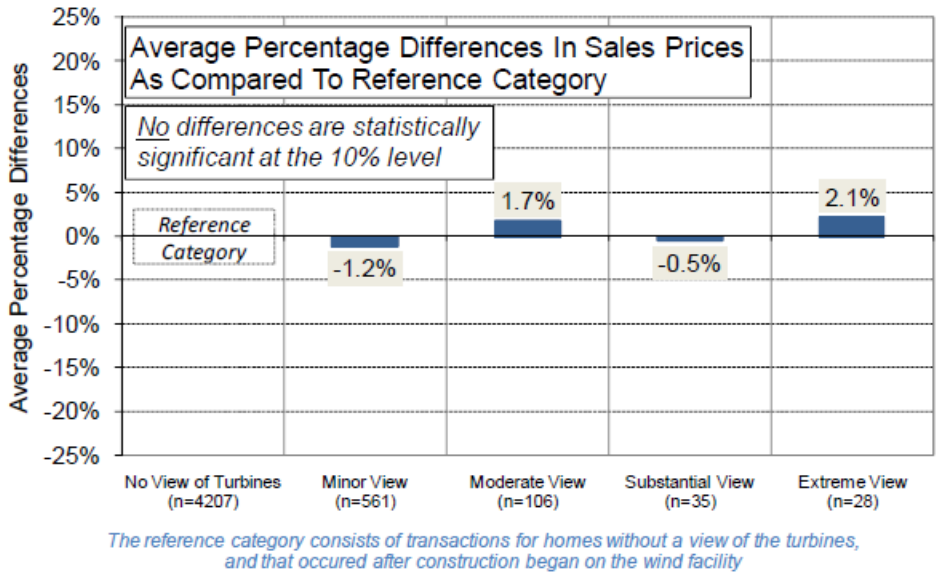
Hoen et al. (2009) analyzed almost 7,500 single family home sales within a 10 mile range of 24 existing wind projects in 9 U.S. states (Illinois, Iowa, New York, Oklahoma, Oregon, Pennsylvania, Texas, Washington, and Wisconsin). Sales occurred between January 1996 and June 2007. The average number of turbines at the wind farms reviewed were135 and ranged from 7 to 582. The average turbine hub height was 216 feet and ranged from 197 to 262 feet. While Hoen et al. (2013) utilizes a far larger data set to address the question of proximity to a higher level of certainty than that performed in the 2009 study; the 2009 study is noteworthy in

terms of discussion of statistical models and its work with regards to view impact, an area the 2013 study does not address.

The average home price in this study was $102,968 with a standard deviation of $64,293. This shows that there is considerable variability about the average value. Hoen et al. developed a base hedonic model which showed no statistically significant difference attributable to the presence of wind turbines. The model had a good fit to the actual property transactions observed with a coefficient of determination of 0.77; this means that the model explained 77% of the variation in housing prices observed.

Also in this study, statistical modeling was employed to investigate whether the sales prices of homes were impacted with varying wind turbine views, based on a data set of just under 5,000 property transactions (730 transactions with views of turbines)—it was found that there was no statistically significant difference in selling prices between homes with minor, moderate, substantial, or extreme views of wind turbines.

Figure 14: View impact reported in LBNL (2009) study



Source: LBNL (2009) Study

Study: Values in the Wind: A Hedonic Analysis of Wind Power Facilities

Heintzelmen and Tuttle (2012) performed a study that had mixed results. They stated that in Clinton and Franklin counties of NY, proximity to turbines had a usually negative and often significant impact on property values, while, in Lewis County, turbines appear to have had little effect and, in some specifications, a positive effect. This would mean that proximity to wind farms increased property values. Their analysis included 9,414 arms-length property transactions in Franklin and Clinton County, NY and it considered 5 wind energy facilities consisting of 271 GE (1.5 MW) turbines with a hub height of 263 feet that were constructed between 2008 and 2009. They also looked at 1,955 property values around the Maple Ridge

Wind Farm located in Lewis County, NY, a wind project completed in 2006 which consists of 194 Vestas V82 (1.65 MW) with a hub height of 260 feet turbines.

The Heintzelmen and Tuttle (2012) study did not report one value for average sales price and standard deviation, but provided values for each county researched. In Clinton County, the average sale price was $122,645 with a standard deviation of $83,603 on 6,142 transactions. In Franklin County, the average sale price was $120,466 with a standard deviation of $354,556 on 3,251 transactions. In Lewis County, the average sale price was $81,740 with a standard deviation of $63,207 on 1,938 transactions. Specifically in Franklin County, the highest standard deviation of any study discussed is present in this study and it was almost three times the average selling price.

Heintzelmen and Tuttle developed two models and the coefficient of determination for the models across the three counties ranged from 0.28 to 0.33. This means that their hedonic models only explained about 28% to 33% of the variation observed in the data. This indicates that while the model did help explain some of the variation observed, it was not as strong a predictor of property transaction values as seen in other studies of property values and wind farms. This was the lowest coefficient of determination out of any of the studies reviewed in this study.

Hoen et al. (2013) discusses some flaws with the methodology of the Heintzelmen and Tuttle (2012) study. Specifically, there was a low number of transactions within 1-mile (35 transactions) and very few to none in areas of estimates (1/10 and ¼ mile). Their model also uses the inverse of continuous distance. This is problematic in this analysis as it causes the model to estimate effects at the average distance, which in the case of their model is greater than 10 miles from the turbines. This approach weakens the ability of the model to quantify effects near the turbines where they would be expected to be stronger if present.[25]

Overall, while Heintzelment and Tuttle did report some instances of statistically significant negative impacts on property values, they also showed statistically significant positive impacts on property values. From a common sense perspective, this seems to be an unlikely situation where sometimes wind farms reduce property values and other times it raises them. Furthermore, there are noteworthy flaws and limitations of their hedonic model that draw into question the quality and reliability of the findings and conclusions reached by Heintzelmen and Tuttle in their study.

[25] See footnote 18

4 Methodology

While more recent studies appear to prefer the use of hedonic price models as the basis of their statistical analysis for explaining the relationship between wind farms and property values, this study takes a different approach from those studies.[26] In a similar manner as the original study undertaken of property transactions around the Lempster Wind Farm, this study utilized analysis of variance (ANOVA) as the primary statistical test. The use of statistical tests other than hedonic price models in examining the relationship between wind farms and property values has been utilized in other studies; in Table 1 of Hoen et al. (2009), the authors highlight other research studies performed. Hoen et al. highlights four other studies of wind farms and property transactions that have used hedonic models and 10 studies that utilized statistical tests other than hedonic models.

This study follows the approach of utilizing assessed value as the "expected" value to compare to sales price. Assessors would be viewed as local market experts with in-depth knowledge of the unique characteristics and dynamics of the properties in the communities they assess and the expectation is that assessed value should show a strong relationship to fair market value.

This study takes a three step approach. The first step is to determine if pre-sale assessed values showed a relationship to sales prices using the statistical technique called linear regression for all arm's-length sales around the wind farms from January 2008 through July 2013. The second step is to conduct a single factor ANOVA test on assessed values for sales occurring during this time period when grouped by year. The third step is to calculate the sales price to pre-sale assessed value ratio for each property transaction and conduct a single factor ANOVA test on post-construction property transactions for both wind farms combined based on distance.

An arm's-length transaction is one in which the parties are independent, have no relationship to each other, and are on equal footing (meaning the parties have equal bargaining power and equal information about the transaction). This type of transaction reveals the true and fair market value of a real estate property. An arm's-length transaction—in this study— is defined as one that was a warranty deed transaction and that did not have any of the exclusion codes listed by the NH Department of Revenue associated with the transaction. This is a similar process to that which the NH Department of Revenue used in calculating equalization rates of town property taxes with the intention of identifying true market transactions.[27]

In this study approach, Step 1 is passed if there is a strong relationship shown between assessed value and sales price. This indicates that the assumption that using assessed value as an indicator of fair market value is valid. Step 2 tests to see, if at any annual period between 2008 and 2013, there were any significant changes in assessed value for the property transactions that occurred. If there is not a significant difference, then step 2 is passed—this indicates that there weren't any broad scale changes in assessed valuation during that time period for the properties that sold. In step 3, if there is no statistically significant difference in any of the groups, then it indicates the average sales price to pre-sale assessed was the "same" across all three distance categories. It

[26] Hedonic price models and the rationale for their use are discussed in Section 3 Previous Studies
[27] "New Hampshire Equalization Manual," NH Department of Revenue, 2006, available online at http://www.revenue.nh.gov/munc_prop/equalization/2006/documents/equalization_manual_2006.doc

would be expected that if the turbines were having a negative impact on property values that its impact would be experienced closest to the turbines and that property sales in the 0-1 mile distance and potentially the 1-3 mile distance categories would have a lower average ratio. This would then be expected to show in step 3 as a statistically significant difference between the groups.

Property sales records for the towns of Goshen, Groton, Hebron, Lempster, Plymouth, Rumney, and Washington were obtained from January 2008 through July 2013 (which was the most current data available). Real Data Corporation, located in Manchester, NH, provided the data for property transactions. For the past 30+ years, Real Data has been providing sales data to the New Hampshire Department of Revenue for its statewide property tax equalization program. A total of 382 arm's-length sales transactions were used in this analysis.

Specifically for the analysis of waterfront properties, post-construction property records around the Groton Wind Farm (after December 2012) were obtained for Alexandria (0 sales), Bristol (0 sales), and Bridgewater (3 sales) were obtained.

Property transactions for the towns of Marlow, Unity, and Acworth were also obtained, but not used in formal analysis of post-construction property transactions around the Lempster Wind Farm, even though they do border the Town of Lempster. The reason is because, based on preliminary geocoding, it was determined that given the location of these towns from the turbines, and the extremely limited opportunities for views of the turbines based on their topography, it would not enhance the analysis.

These properties were geocoded utilizing Google Earth from the address provided. In several cases, Google Earth did not correctly map the property location or the address information was not matched. In these circumstances, town tax maps were consulted to identify or verify the geographic coordinates of property sales locations. In the previous study performed, Antrim Wind Energy, LLC provided a 10-mile vegetated view shed map of the Lempster Wind Farm; Antrim Wind Energy gave permission to reuse the view shed for this analysis. A 3-mile and 10-mile vegetated view shed map of the Groton Wind Farm were provided by Iberdrola Renewables. Viewshed maps were used to indicate areas where properties may have views of turbines.

The statistical test family (ANOVAs) was selected for this analysis because it a well-established type of statistical analysis that specifically looks for differences among the averages of groups. This analysis utilized single factor ANOVA tests which is one of the most basic forms of analysis of variance and tests whether or not the averages of several groups are equal. ANOVA tests are robust statistical tests that have been used in numerous other studies to evaluate factors that may have an impact on property values.[28] A single factor ANOVA test is specifically useful when you have three or more groups and works by comparing the averages of groups and then indicates if there is a statistically significant difference in any of the groups. It does not indicate

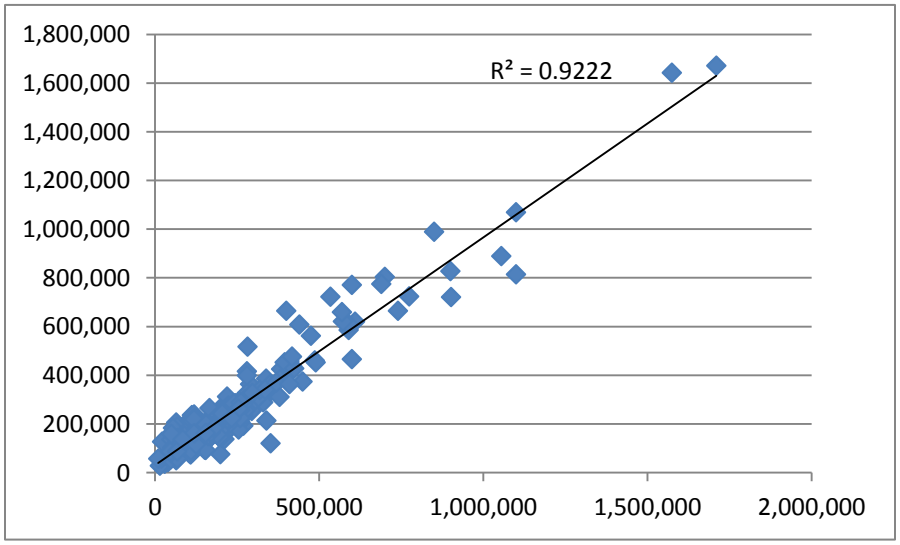
[28] Examples include: Mulley, C. and Chi-Hong, T., "How much does new transport infrastructure add to land values? Evidence from the bus rapid transit system in Sydney, Australia" Institute Of Transport And Logistics Studies, September 2013; McGrew, Jr., J C., and Monroe, C. B., "An introduction to statistical problem solving in Geography" Waveland Press, Inc., Second Edition, 2009.

which group or groups are different. It only indicates that there is a statistically significant difference. This is the same type of test that was used in the original study of the Lempster Wind Farm.

This study does differ from the previous study conducted on the Lempster Wind Farm, by testing the ratio of the sales price to pre-sale assessed value, as opposed to the difference in dollar value between sales price and pre-sale assessed value. This serves to treat each property transaction as equal (not weighted differently based on price) and indicates difference relative to an expected value. This is similar to the approach used by the NH Department of Revenue Administration (NHDRA). Each year, property inventory and transaction data are collected by the NHDRA Property Appraisal Division for the purpose of equalizing the local assessed valuation of each municipality for the purpose of adjusting them to market value for property tax rate calculation. The NHDRA calculates a median ratio of assessed value to sales for arm's-length transactions as part of the property tax equalization process.[29] This median ratio serves as an indicator of real estate fair market values against assessors' expectations of fair market values.

In the current study, 382 arms-length property transactions were analyzed. Linear regression showed a very strong relationship between sales price and pre-sale assessed value with a coefficient of determination of 0.92. This means that assessed values explained 92% of the variation observed in sales prices and among all of the studies reviewed in this study, showed the best fit of any of the statistical models constructed. This strongly supports the use of assessed values for this type of analysis. This finding passed Step 1. This statistical test and all other statistical tests are shown in Appendix C.

Figure 10: Scatter plot of sales price to pre-sale assessed value for all arms-length single family home sales between 2008 and July 2013

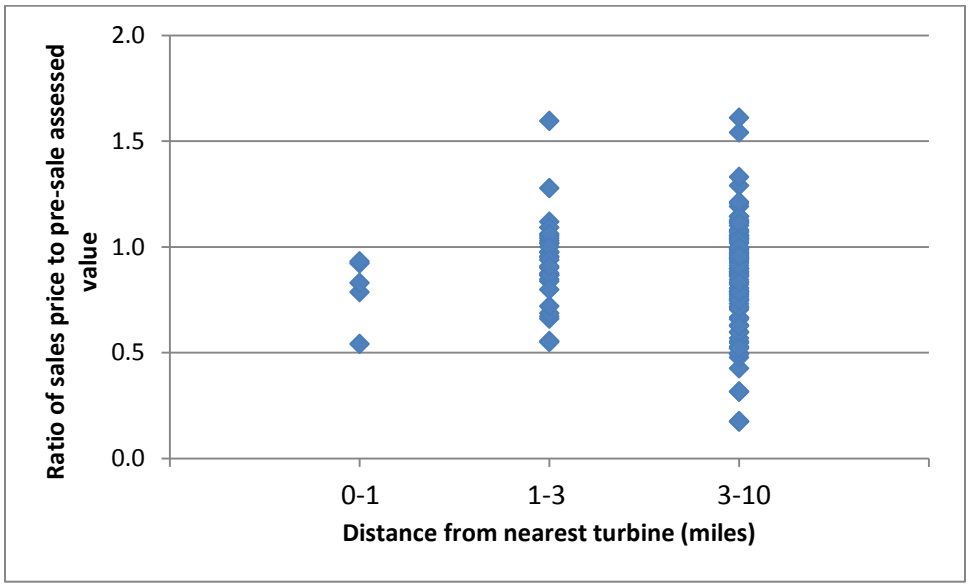


[29] The NH Department of Revenue Administration median ratio is actually Assessed value/Sales price. In this analysis, it is believed to be easier to understand if this ratio is reversed and stated as sales price/assessed value. It is the same value used by the NH Dept. of Revenue Administration just stated as the reciprocal. For example, a NH Dept. of Revenue median ratio of 0.95 is stated in this analysis as 1.05. This ratio would be observed for a property transaction that was assessed at $100k but sold for $105k or a property transaction that was assessed at $200k and sold for $210k.

In testing the difference between any of the average assessed values for property transactions, the ANOVA F-test is utilized. It provides a value of whether the expected values of a variable (in this case, assessed value) within several pre-defined groups (in this case, annual periods) differ from each other. A value is calculated and if a "critical" value is exceeded then it indicates statistical significance. In this case, the calculated value for the F-test was 0.89 and the critical value was 2.24. This indicates that there was not a statistically significant difference between any of the average assessed values for property transactions when grouped by annual period and this finding passed Step 2.

The final step was to compare the average sales price to pre-sale assessed ratio for each distance category. Again the ANOVA F-test was utilized and the calculated value was 0.93 and the critical value was 3.07. This final step showed no statistically significant difference between the average sales price to pre-sale assessed value for post-construction property transactions at any distance and is discussed further in the analysis section.

Figure 11: Post-construction single family home sales price to pre-sale assessed ratio by distance



Separately, each waterfront property was visually observed from the nearest road in the fall of 2013 and reviewed via satellite imagery. Based on this review, it is highly likely that for each body of water, at least one property (and potentially more) have a view of the turbine from some location on the property or at the immediate shoreline of the property.

Also, this study reviewed NH community assessed values and median ratios to illustrate the overall trend in assessment values for communities in Grafton and Sullivan counties and to calculate an implied market value for each community. This market value is implied because houses are not like the stock market where you can look up prices or even consult indexes to see

how the prices of houses are changing on an hourly, daily, or even monthly basis. Housing prices are only revealed when a sale occurs, so one could infer that the market value of a community by taking the assessed value of all property in that community and adjusting that value based on the median ratio reported for that town.

The median ratio can be a useful tool for providing an indication of market value vs. expectations of value. For example, in 2008—the end of the housing market bubble—the weighted median sales to assessed value in Grafton County was 1.07 and Sullivan County was 1.05. This is an indicator of rising housing market values relative to expected home values (as viewed through assessed values). In 2009, as the Great Recession took hold, the average weighted median sales to assessed value declined in both counties (0.99 in Grafton, 0.98 in Sullivan); this is an indicator of declining housing market value relative to expected home value.[30]

Implied market value was calculated for Grafton and Sullivan counties based on each town's total assessed residential value and the town's median ratio for each year. The assessed residential value fluctuates each year, but typically is far less volatile than the annual change in median sales prices reported by the NH Association of Realtors. For example, in Sullivan County from 2008 to 2009, the median sales price declined 13% from $171,700 to $150,000, however, the total assessed value for the county actually rose 3%. Appendix B lists the median ratio, total assessed residential value, and calculated implied market value for each community in Grafton and Sullivan counties.

[30] Weighting is based on assessed market value of each community in that county for any given year.

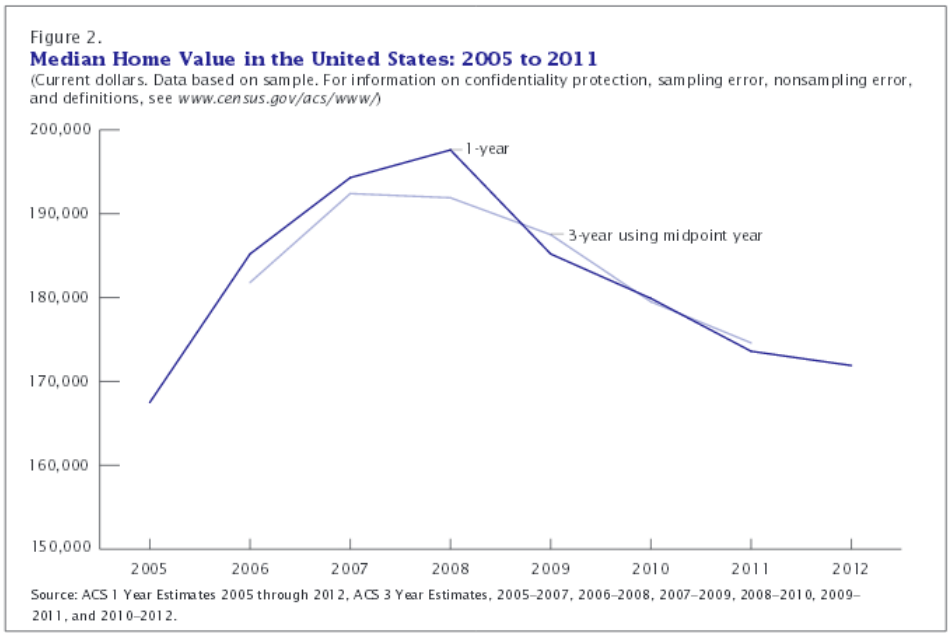
5 Grafton and Sullivan County Real Estate Markets

Overall, 2008 represented the end of a significant rise of the housing market in NH as the state and the U.S. entered the Great Recession that officially began in December 2007, but took a particularly sharp downward turn in September 2008. Grafton and Sullivan counties mirrored this real estate trend by showing strength in real estate prices through 2008, followed by a decline in median single family home prices and relatively flat sales volume relative to 2008 levels. There was some recovery in 2012 in regards to sales volume and the trend in 2013 indicates strong transaction volume but mixed pricing indicators. Grafton County appears to be showing some strength in pricing in 2013 while Sullivan County continues to show weak housing prices.

The Grafton residential real estate market is over 2.5 times the size of the Sullivan county market in terms of assessed value ($6.3 billion vs. $2.4 billion in 2012) and 2 times the market transaction level (830 vs. 421 transactions in 2012).

This trend in declining median prices was not unique to these counties, but was also experienced at the state level, across New England and nationally. In NH, the median value of property from 2007-2009 was $257,600 and in 2010 to 2012 was $239,100 for a decline of 7%. During the same time period, the median value in the U.S from 2007-2009 was $191,900 and in 2010 was $174,600 or a decline of 9%. [31]

Figure 12: Median Home Value in the United States: 2005 to 2011



Source: U.S. Census Bureau

[31] Home Value and Homeownership Rates: Recession and Post-Recession Comparisons From 2007–2009 to 2010–2012," U.S Census Bureau, available online at http://www.census.gov/prod/2013pubs/acsbr12-20.pdf

5.1 Sales

Sales data from the New Hampshire Association of Realtors was reviewed to help provide additional context for the residential real estate market in New Hampshire overall and Grafton and Sullivan counties specifically.

The median sales price in Grafton County has declined from a high of $195,000 in 2008 to $169,000 in 2012.[32] Based on transactions through August 2013, the median sales price in Grafton County is down 10% from the 2008 level at $176,000. Grafton County has recently shown strength in transaction volume with approximately the same number of single family homes sold through August 2013 as the number of homes sold in Grafton County in all of 2008.

The median sales price in Sullivan County has declined from a high of $171,700 in 2008 to $141,900 in 2012.[33] Based on transactions through August 2013, the median sales price in Sullivan County is down 20% from the 2008 level at $134,750. Sullivan County has recently shown strength in transaction volume with the number of single family homes sold through August of 2013 already exceeding the number sold in Sullivan County in all of 2008.

The trend of sales in these two counties is similar to those observed overall in New Hampshire overall as viewed in sales price and transaction volume. The median sales price in New Hampshire has declined from a high of $235,000 in 2008 to $202,000 in 2012. Based on transactions through August 2013, the median sales price in New Hampshire is down 11% from the 2008 level at $210,000. What does distinguish both of these counties from the state is that while the trend in price movement and transactions are of a similar nature, the median price from 2008 to 2012 in NH has been approximately $36,000 greater than Grafton County and over $60,000 greater than Sullivan County.

Table 4: Single family home sales for Grafton and Sullivan counties and NH by year

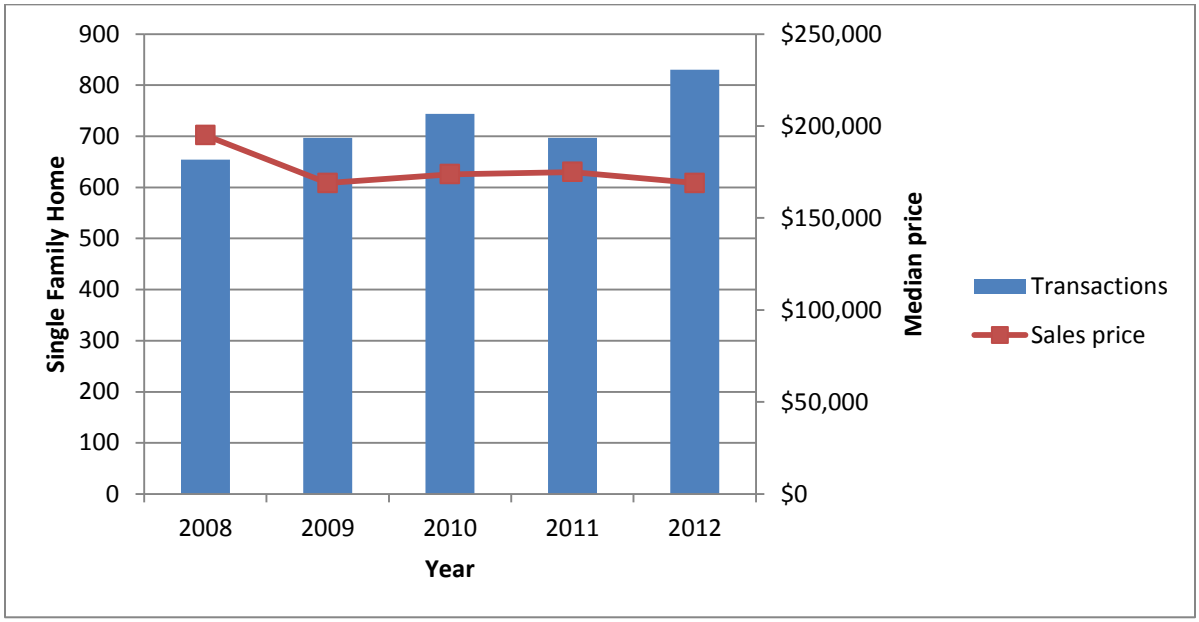
County/State	Measure	Year					
		2008	2009	2010	2011	2012	2013 (through August)
Grafton	Transactions	654	697	744	697	830	634
	Median Price	$195,000	$169,000	$173,775	$175,000	$169,000	$176,000
Sullivan	Transactions	360	372	352	355	421	377
	Median Price	$171,663	$150,000	$155,500	$139,500	$141,900	$134,750
New Hampshire	Transactions	10,208	10,810	10,525	10,722	12,961	10,090
	Median Price	$235,000	$212,000	$215,000	$201,700	$202,000	$210,000

Source: NH Association of Realtors

[32] "New Hampshire/Grafton county single-family residential home sales," New Hampshire Association of Realtors, Available online at http://www.nhar.org/filemanager/download/52735/

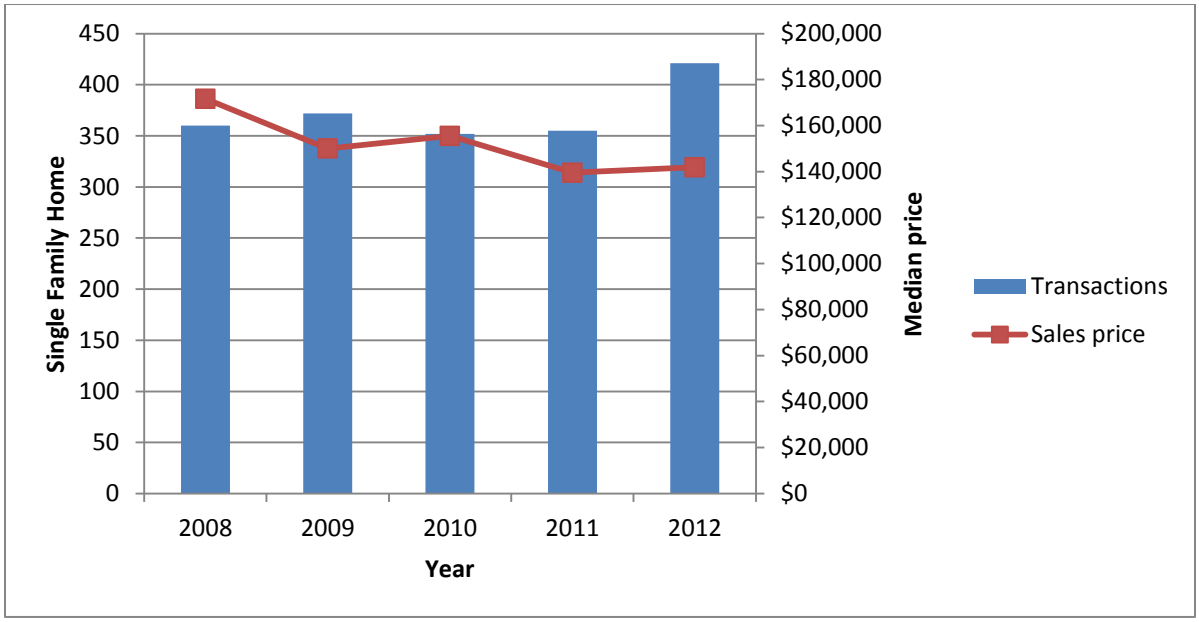
[33] "New Hampshire/Sullivan county single-family residential home sales," New Hampshire Association of Realtors, Available online at http://www.nhar.org/filemanager/download/52740/

Figure 13: Grafton County annual single family home sales



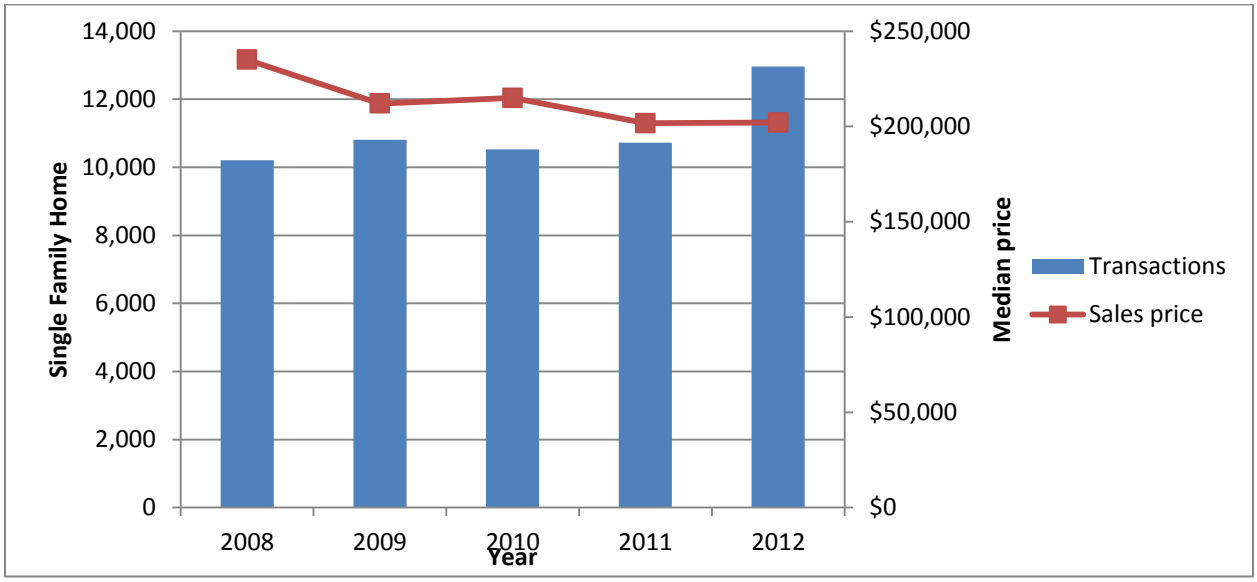
Source: NH Association of Realtors

Figure 14: Sullivan County annual single family home sales



Source: NH Association of Realtors

Figure 15: New Hampshire single family home sales



Source: NH Association of Realtors

5.2 Town Assessment Data

Town assessed data collected by the NHDRA provides another set of data to consider when reviewing communities for potential impact from wind farm facilities. A trend from 2008 to 2012 has been that, in general, market transactions in 2008 tended to be higher than assessed value in Grafton and Sullivan counties; and from 2009 through 2012, market transactions have tended to be lower than assessed value.

The implication of this is that while the sales to assessed ratio for transactions around the two wind farms have tended to be lower than expected value, they are not out of character for the overall market for these counties. In 2012, 13 out of 15 towns in Sullivan County and 26 out of 40 towns in Grafton County had median sales to assessed ratios that were below 1.0. [34]

Implied market value allows for benchmarking of communities. One application of implied market value is to observe if towns hosting the wind farms or towns that are located nearby performed better or worse than the overall region. For example, the Town of Lempster's implied market value in residential properties declined 6% from $65.4 million in 2008 to $61.6 million in 2012. Sullivan County's implied market value in residential properties declined 11% from $2.7 billion to $2.4 billion during the same time period. So while the Town of Lempster did decline in market value, based on this data, it actually declined at a lower rate than the overall county market. This is not what one would expect if the presence of the Lempster Wind Farm had an adverse impact on the overall local residential real estate market.

[34] "2012 Equalization Median Ratios," NH Dept of Revenue Administration, Available online at http://www.revenue.nh.gov/munc_prop/equalization/2012/documents/median-ratio-lists.pdf

In Grafton County, while the Groton Wind Farm just became operational at the end of 2012, the project was active with the NH Site Evaluation Committee starting in 2010 and construction was active in 2012. The towns of Groton, Hebron, Plymouth, and Rumney experienced the respective changes in implied residential market value from 2008 to 2012 (+2%,-7%,-9%,and -10%) which in total are roughly in-line with the overall change in implied market value in Grafton county of -9%. This does not indicate any residential market activity that was out of character with the overall market in these communities prior to the Groton Wind Farm coming on-line.

Table 5: Implied market value for communities about the Groton Wind Farm and Grafton County (Millions)

Town	2008	2009	2010	2011	2012	% Change 2008 -2012
Groton	$ 33.1	$ 34.4	$ 28.6	$ 33.8	$ 33.7	2%
Hebron	$ 112.2	$ 104.1	$ 98.7	$ 99.8	$ 104.0	-7%
Plymouth	$ 196.3	$ 180.3	$ 191.1	$ 177.4	$ 178.2	-9%
Rumney	$ 92.6	$ 86.5	$ 87.0	$ 85.9	$ 83.5	-10%
Grafton County	$ 6,897	$ 6,548	$ 6,448	$ 6,317	$ 6,253	-9%

In reviewing all towns that border the Town of Lempster in Sullivan County, the Town of Lempster appears to have had better market performance. Goshen, immediately north of the Lempster Wind Farm, declined by 13% from 2008 to 2012, or roughly on-par with the overall market decline of 11% in Sullivan County. The towns of Unity and Washington appear to have performed worse than the overall market (-23% and -18% respectively) however, both of these communities also tended to have sales that were not near the turbines and because of terrain and topography, would have limited view potential. The Town of Acworth, located immediately west of Lempster, experienced similar market performance as the Town of Lempster, and because of topography and terrain, has virtually no potential for experiencing any type of impact from the Lempster Wind Farm.

Table 6: Implied market value for communities about the Lempster Wind Farm and Sullivan County (Millions)

Town	2008	2009	2010	2011	2012	% Change 2008 -2012
Acworth	$ 58.7	$ 52.3	$ 57.0	$ 52.8	$ 54.5	-7%
Goshen	$ 46.8	$ 41.2	$ 41.7	$ 42.4	$ 40.9	-13%
Lempster	$ 65.4	$ 66.9	$ 61.4	$ 66.3	$ 61.6	-6%
Unity	$ 86.5	$ 65.9	$ 71.9	$ 71.2	$ 66.4	-23%
Washington	$ 112.0	$ 96.8	$ 103.1	$ 110.5	$ 91.3	-18%
Sullivan county	$ 2,685	$ 2,573	$ 2,519	$ 2,494	$ 2,386	-11%

6 Analysis

Since the completion of the Lempster Wind Farm and Groton Wind Farm in New Hampshire, there have been 132 arms-length single family home property transactions at a value of $22.5 million in the immediate communities (Goshen, Groton, Hebron, Lempster, Plymouth, Rumney, and Washington) surrounding the wind farms. Five (4%) were within a 1-mile radius of the nearest turbine, 30 (23%) were within 1-3 miles of the nearest turbine, and 97 (73%) were within 3-7 miles of the nearest turbine.

Over a four year post-construction period, 102 arms-length single family home transactions have occurred in the towns of Goshen, Lempster and Washington totaling $16 million. Thirty (30%) of those sales were between 1-3 miles of a turbine and 5 (5%) were within less than 1 mile of a turbine. During the eight-month post-construction period, 30 arms-length single family home transactions have occurred in the towns of Groton, Hebron, Plymouth, and Rumney totaling $6.5 million. Ten (33%) of those sales were between 1-3 miles of a turbine and there were no sales within less than 1 mile of a turbine.

Table 7: Single family home sales by distance to nearest turbine for the Lempster Wind Farm and the Groton Wind Farm (Post-construction through July 2013)

Distance(miles)	Number of Sales	Total Sales	Average Sale	Average Assessed Value	Average Mile to Nearest Turbine	Average Sales to Assessed Ratio
0-1	5	$ 713,066	$ 142,613	$173,202	0.6	0.80
1-3	30	$ 5,510,066	$ 183,669	$196,283	2.1	0.92
3-10	97	$ 16,028,782	$ 165,245	$204,067	4.9	0.87
Total	**132**	**$ 22,251,914**	**$ 168,575**	**$201,194**	**4.1**	**0.88**

Figure 16: Post-construction single family home sales in Goshen, Lempster, and Washington (November 2008 – July 2013)

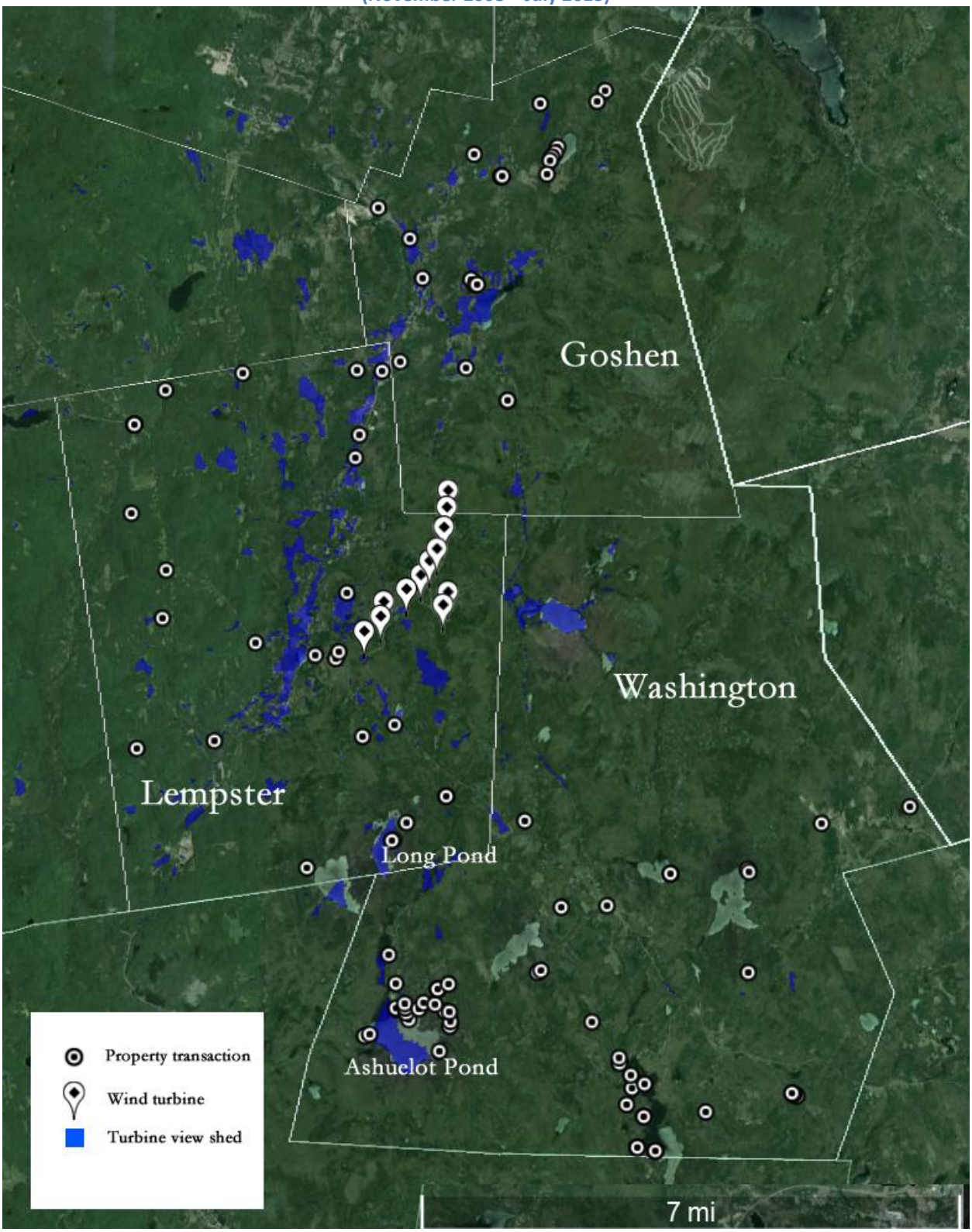


Figure 17: Post-construction single family home sales in Groton, Hebron, Plymouth and Rumney from December 2012 – July 2013 (with 3-mile vegetated view shed)

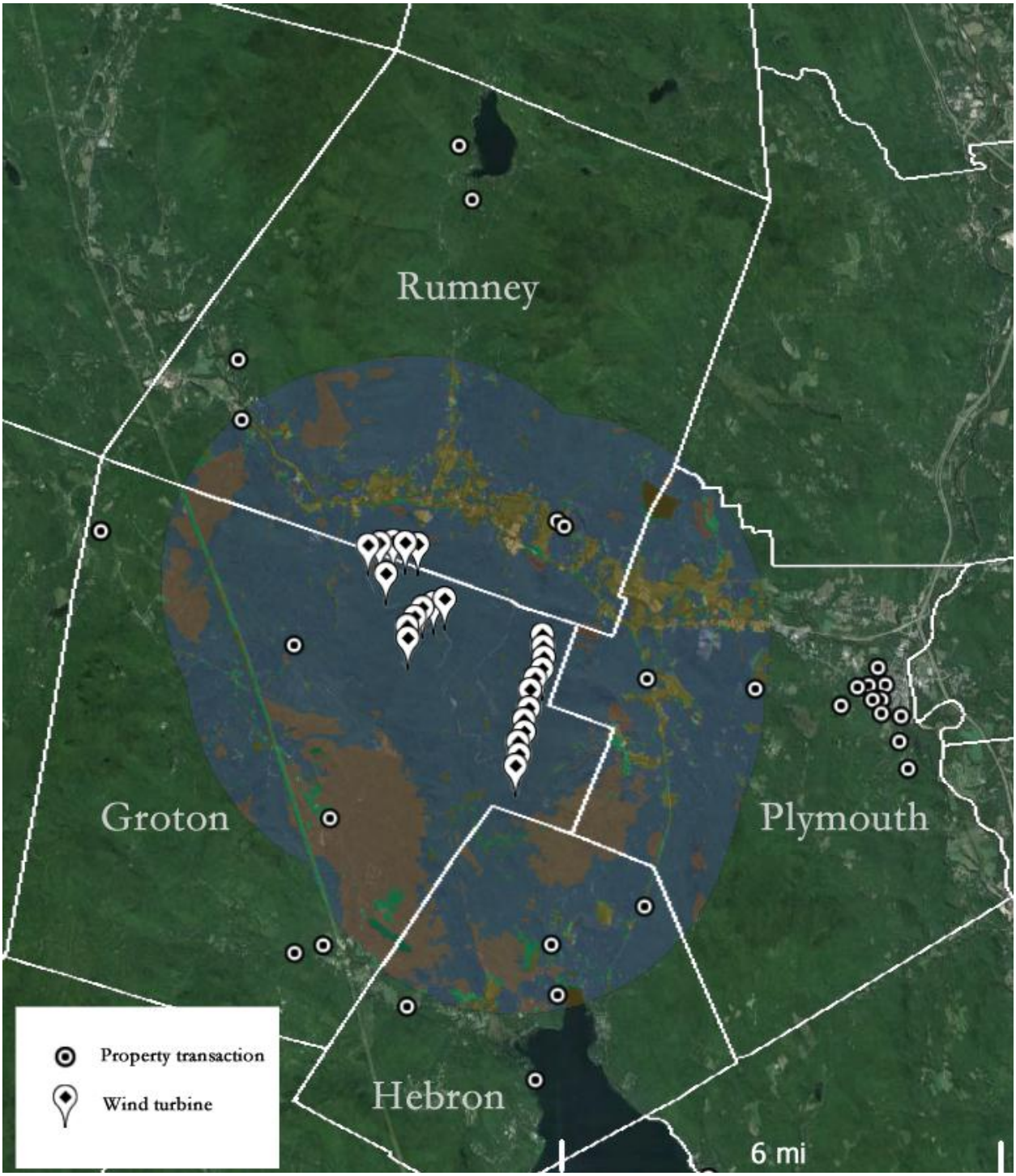


Table 8: Post-construction single family home sales and mileage statistics by distance

Wind Farm	Distance (miles)	Sales	Miles to Nearest Turbine		
			Average	Min	Max
Groton Wind	0-1				
	1-3	10	2.2	1.4	2.9
	3-10	20	4.3	3.2	6.0
	Total	**30**	**3.6**	**1.4**	**6.0**
Lempster Wind Farm	0-1	5	0.6	0.3	0.9
	1-3	20	2.1	1.0	2.8
	3-10	77	5.1	3.0	7.5
	Total	**102**	**4.3**	**0.3**	**7.5**
Total	0-1	5	0.6	0.3	0.9
	1-3	30	2.1	1.0	2.9
	3-10	97	4.9	3.0	7.5
	Total	**132**	**4.1**	**0.3**	**7.5**

Table 9: Post-construction single family home sales statistics by distance

Wind Farm	Distance (miles)	Sales	Sales		
			Average	Min	Max
Groton Wind	0-1				
	1-3	$ 2,232,533	$ 223,253	$ 42,000	$ 570,000
	3-10	$ 3,982,532	$ 199,127	$ 50,000	$ 740,000
	Total	**$ 6,215,065**	**$ 207,169**	**$ 42,000**	**$ 740,000**
Lempster Wind Farm	0-1	$ 713,066	$ 142,613	$ 64,000	$ 206,000
	1-3	$ 3,277,533	$ 163,877	$ 47,533	$ 265,000
	3-10	$ 12,046,250	$ 156,445	$ 10,000	$ 425,000
	Total	**$ 16,036,849**	**$ 157,224**	**$ 10,000**	**$ 425,000**
Total	0-1	$ 713,066	$ 142,613	$ 64,000	$ 206,000
	1-3	$ 5,510,066	$ 183,669	$ 42,000	$ 570,000
	3-10	$ 16,028,782	$ 165,245	$ 10,000	$ 740,000
	Total	**$ 22,251,914**	**$ 168,575**	**$ 10,000**	**$ 740,000**

Table 10: Post-construction single family home sales price to pre-sale assessed ratio by distance

Wind Farm	Distance (miles)	Sales to Assessed Ratio		
		Average	Min	Max
Groton Wind	0-1			
	1-3	0.89	0.55	1.59
	3-10	0.86	0.32	1.11
	Total	**0.87**	**0.32**	**1.59**
Lempster Wind Farm	0-1	0.80	0.54	0.93
	1-3	0.94	0.55	1.28
	3-10	0.87	0.17	1.61
	Total	**0.88**	**0.17**	**1.61**
Total	0-1	0.80	0.54	0.93
	1-3	0.92	0.55	1.59
	3-10	0.87	0.17	1.61
	Total	**0.88**	**0.17**	**1.61**

Figure 18: Scatter plot of sales price to pre-sale assessed value vs. miles to nearest turbine for post-construction sales around the Groton Wind Farm (December 2012 – July 2013)

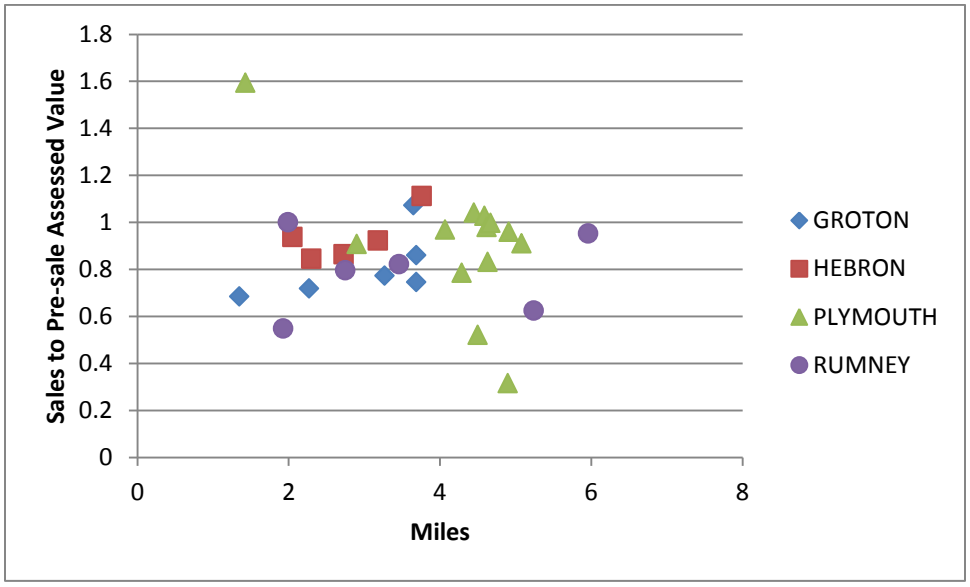
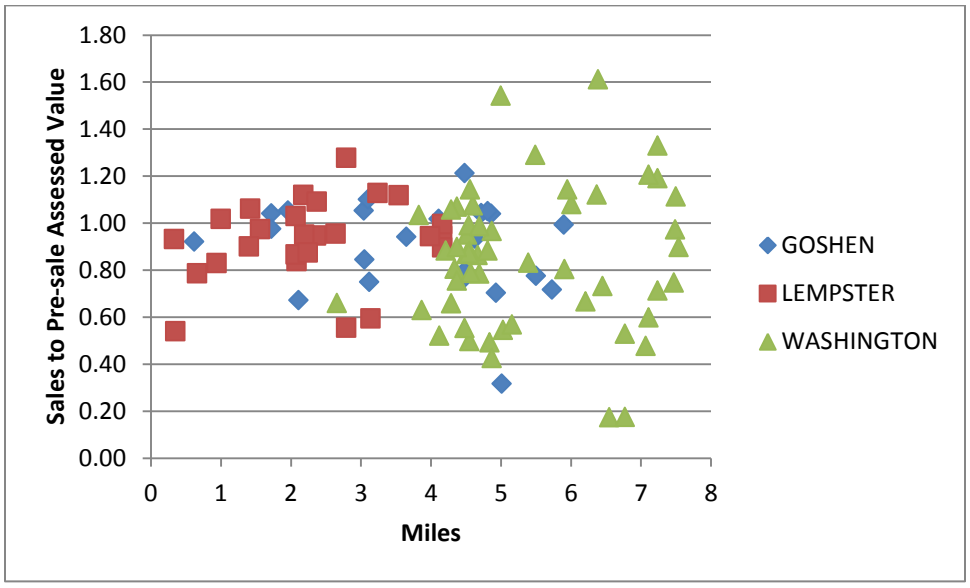


Figure 19: Scatter plot of sales price to pre-sale assessed value vs. miles to nearest turbine for post-construction sales around the Lempster Wind Farm (November 2008– July 2013)



6.1 Waterfront Properties

An area of interest in NH has been whether or not waterfront properties may experience a unique impact from views of wind turbines. A separate analysis of NH property transactions within close proximity to the two wind farms was conducted.

These bodies of water in the Lempster region are: 1) Long Pond (2-3 miles from nearest turbine located in the Town of Lempster, and 2) Ashuelot Pond (3.5 – 5.5 miles from nearest turbine) located in the Town of Washington ; and in the Groton region is: 1) Newfound Lake (3-8.5 miles from nearest turbine) surrounded by Alexandria, Bridgewater, Bristol, and Hebron. While Hebron and Bridgewater did have waterfront sales on Newfound Lake post-construction of Groton Wind Farm, Alexandria and Bristol did not have any waterfront sales on Newfound Lake from December 2012 through July 2013.

Since the completion of construction of the two wind farms, there have been 14 arms-length transactions totaling $6.1 million for waterfront residential properties located on bodies of water that are within 10 miles of a turbine and that feature visibility of a turbine from areas on the body of water and areas of the shoreline. In general, these properties have sold at assessed value; this is especially noteworthy given that the overall trend in Grafton and Sullivan counties has been for properties to sell on average slightly below assessed value.

Table 11: Waterfront post-construction single family home transactions at Newfound Lake, Long Pond, and Ashuelot Pond

Body of Water	Town(s)	Number of Sales	Total Sales	Average Sale	Average Mile to Nearest Turbine	Median Sales to Assessed Ratio
Newfound Lake	Bridgewater, Hebron	5	$ 3,875,000	$ 775,000	4.9	1.13
Long Pond	Lempster	3	$ 664,000	$ 221,333	2.3	1.09
Ashuelot Pond	Washington	6	$ 1,549,200	$ 258,200	4.6	0.91
Total		**14**	**$ 6,088,200**	**$ 434,871**	**4.2**	**1.01**

Figure 20: Post-construction waterfront single family home sales about Newfound Lake (December 2012 – July 2013)

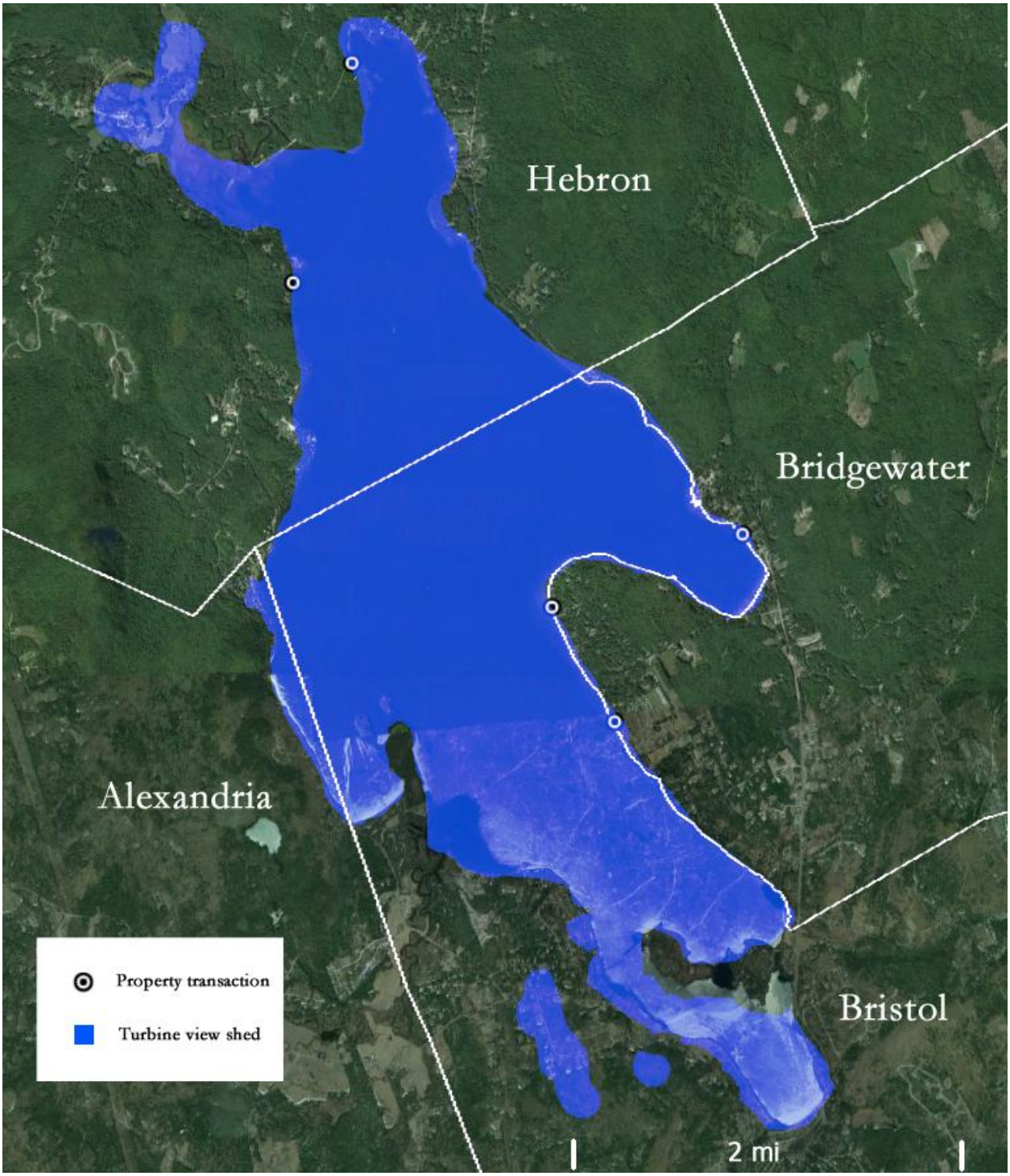


Figure 21: Post-construction waterfront single family home sales at Long Pond (November 2008 – July 2013)

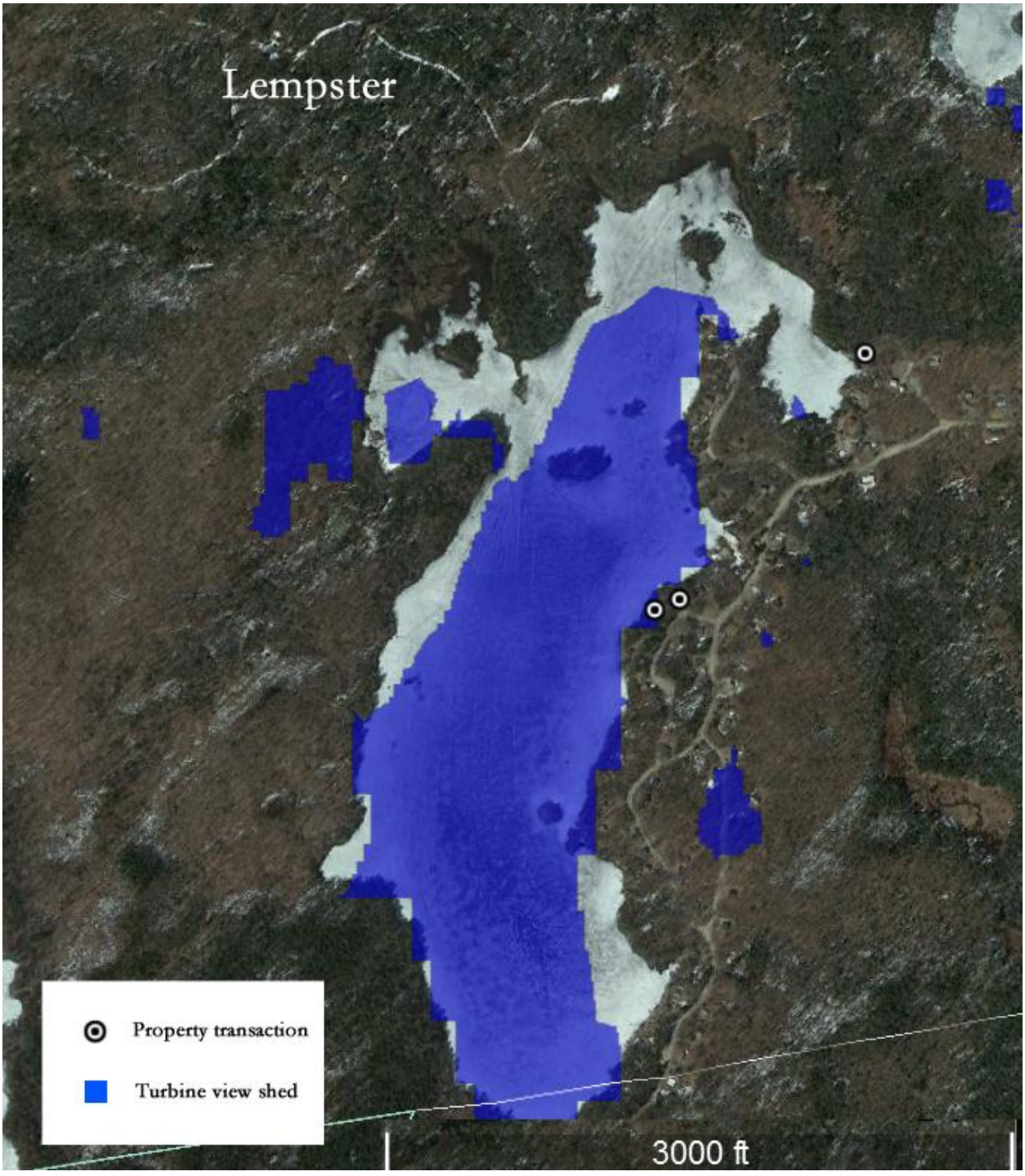


Figure 22: Post-construction waterfront single family home sales at Ashuelot Pond (November 2008 – July 2013)

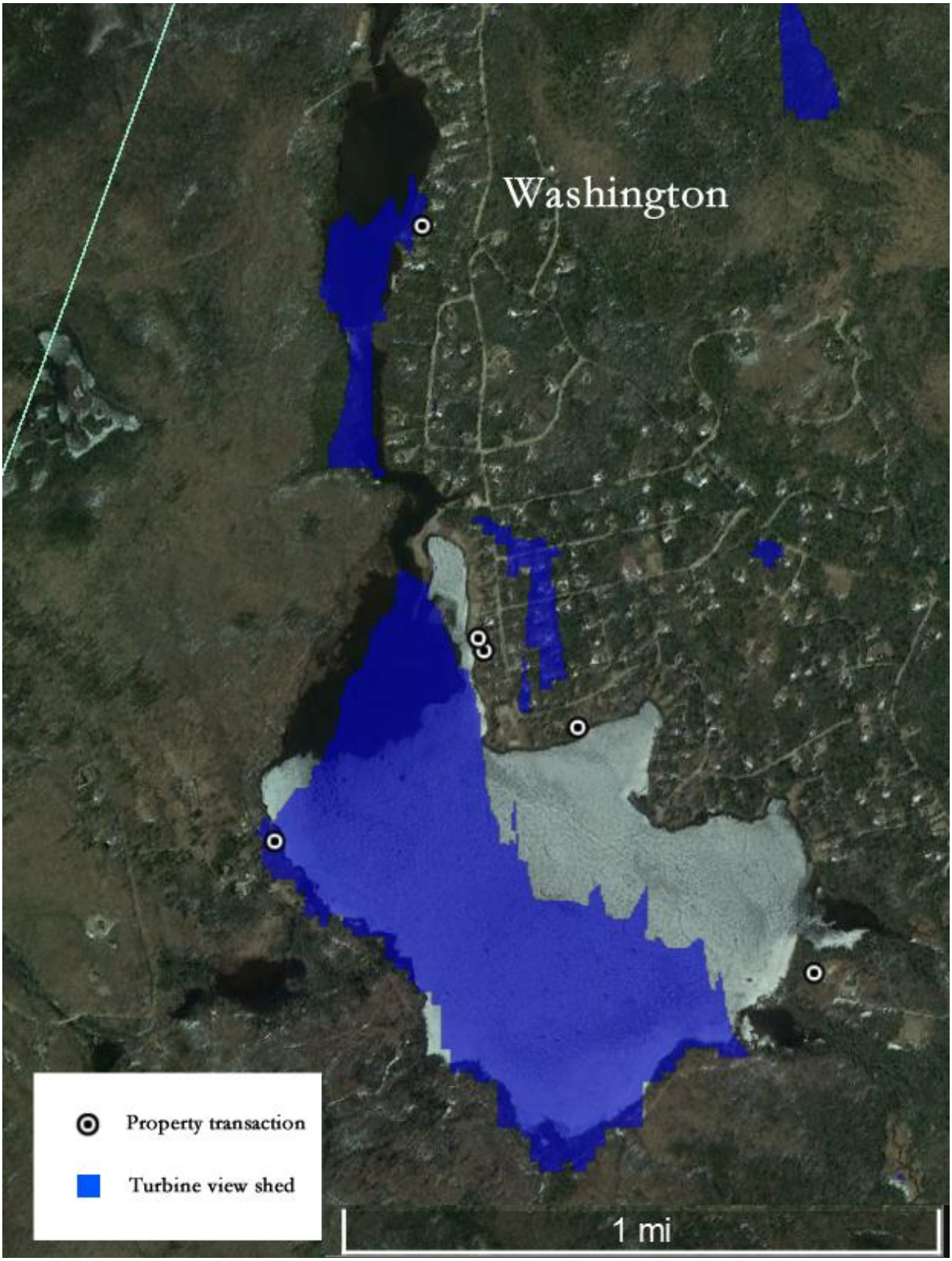


Table 12: Post-construction waterfront single family home sales and mileage statistics by body of water

Body of Water	Town(s)	Sales	Miles to Nearest Turbine		
			Average	Min	Max
Newfound Lake	Bridgewater, Hebron	5	4.9	2.7	6.4
Long Pond	Lempster	3	2.3	2.2	2.4
Ashuelot Pond	Washington	6	4.6	3.8	5.2
Total		**14**	**4.2**	**2.2**	**6.4**

Table 13: Post-construction waterfront single family home sales statistics by body of water

Body of Water	Town(s)	Sales	Sales		
			Average	Min	Max
Newfound Lake	Bridgewater, Hebron	$ 3,875,000	$ 775,000	$ 410,000	$ 1,100,000
Long Pond	Lempster	$ 664,000	$ 221,333	$ 180,000	$ 265,000
Ashuelot Pond	Washington	$ 1,549,200	$ 258,200	$ 100,000	$ 341,533
Total		**$ 6,088,200**	**$ 434,871**	**$ 100,000**	**$ 1,100,000**

Table 14: Post-construction waterfront single family home sales price to pre-sale assessed ratio statistics

Body of Water	Town(s)	Sales to Pre-sale Assessed Ratio		
		Median	Min	Max
Newfound Lake	Bridgewater, Hebron	1.13	0.9	1.4
Long Pond	Lempster	1.09	0.9	1.1
Ashuelot Pond	Washington	0.91	0.5	1.0
Total		**1.0**	**1.01**	**1.4**

7 Conclusion

Iberdrola Renewables has proposed that the 23 turbine 75.9 MW Wild Meadows Wind Farm be located in the Town of Alexandria in Grafton County and in the Town of Danbury in Merrimack County. This study was undertaken to help understand the potential impacts that the Wild Meadows Wind Farm may have on real estate values in the local economy. Given the similarity of Iberdrola's two other wind farms in NH— the Lempster Wind Farm and the Groton Wind Farm—in terms of general location in the state, the local topography and demographics—analyzing the real estate markets in these regions helps inform what the potential impact of the Wild Meadows Wind Farm on local real estate values may be.

This study reviewed 135 post-construction property transactions around the Lempster Wind Farm and the Groton Wind Farm. This study did not find any consistent or statistically significant differences in property transactions in close proximity to the Lempster Wind Farm or the Groton Wind Farm as determined by the ratio between sales price and pre-sale assessed value. While this is a relatively small sample size (135 post-construction property transactions),which can limit the magnitude of difference that can be detected, the finding of no relationship between wind farms and local property values is consistent with previously published research on this topic which has tended to indicate that wind farms produce little or no effect on home values.

Furthermore, this study did not find any evidence to support that waterfront properties (ranging from 2.2 to 6.4 miles from the nearest turbine) were impacted by the presence of the wind farms. While this is also a small sample size (14 property transactions), this is consistent with the finding from a 2009 study performed by Hoen et al. which specifically investigated view impact—with a data set of just under 5,000 single family home property transactions (730 transactions with views of turbines) — and found no statistically significant relationship between wind turbine view and property values.

A separate supporting analysis of real estate market value based on the NHDRA median ratio and assessed residential values did not indicate that the real estate market activity of the communities surrounding the Lempster Wind Farm or the Groton Wind Farm was different from that experienced throughout the communities in Grafton or Sullivan counties from 2008 through 2012.

Based on the similarities in topography, demographics, and regional location, it is not expected that the property value experience at the proposed Wild Meadows Wind Farm would be different than the property value experience observed at the Lempster Wind Farm or the Groton Wind Farm. Given the findings of the 2013 LBNL study, supported by the property transactions observed around the two wind farms reviewed, it is not expected there will be any consistent differences in the sales prices relative to assessed values for post-construction property transactions around the Wild Meadows Wind Farm including those properties in close proximity to the turbines or properties with significant views of the turbines.

Appendix A: Biographies

Matthew Magnusson is owner of Seacoast Economics. Seacoast Economics— formed in 2012— provides project-based economic analysis consulting services. These projects often involve collaboration with outside experts who assist with an aspect of the project. Matthew is a graduate of the University of New Hampshire's Whittemore School of Business and Economics with a Masters of Business Administration and currently is earning his Ph.D. in Natural Resources and Environmental Studies at the University.

Relevant, recent research while employed as a Research Scientist at the University of New Hampshire includes economic modeling for a study sponsored by NRDC and Protect Our Winters "Climate Impacts on the Winter Tourism Economy in the United States," "New Hampshire's Green Economy and Industries: Current Employment and Future Opportunities" performed for the Rockingham Economic Development Committee (REDC), "Economic Impact of Granite Reliable Power Wind Power Project in Coos County, New Hampshire" performed for Granite Reliable Power, LLC and the economic analysis of policies proposed in "The New Hampshire Climate Action Plan" performed for the NH Climate Change Task Force.

Dr. Charles Colgan is a Professor of Public Policy and Management in the Muskie School at the University of Southern Maine where he teaches economics, policy analysis, economic development, and courses in analytic methods. He is chair of the Community Planning & Development Program and Associate Director of the Maine Center for Business and Economic Research He is Maine model manager for the New England Economic Partnership. He also currently holds positions as a Research Fellow at the United States Bureau of Labor Statistics. Prior to coming to USM, he served 12 years in the Maine State Planning Office, including positions as Maine State Economist and Special Assistant to the Governor for International Trade.

Dr. Scott Mantie teaches statistics and statistics related courses at Plymouth State University. Dr. Mantie is the Administrator of the Bureau of Assessment and Accountability for the New Hampshire Department of Education and serves as a member of the Commissioner of Education's Cabinet. Previous work experience includes Associate Dean of Institutional Effectiveness at Plymouth State University. Dr. Mantie has the unusual background of holding a double major Ph.D. in Educational Research Methodology and Higher Education Administration. He has participated in numerous research projects, data analysis presentations and institutional accreditations all of which required application of multiple method data collection and analysis and reporting (i.e. using multiple-method research design to combine information collected from focus groups, surveys and culling information from institution's administrative data systems to arrive at institution specific analysis and recommendations.).

Appendix B: Grafton and Sullivan County Assessment Data

Grafton County Median Ratio[35]

Town	2008	2009	2010	2011	2012
Alexandria	0.94	0.89	0.84	1.01	0.95
Ashland	0.99	0.96	0.91	0.84	0.87
Bath	0.95	0.92	0.91	1.03	0.99
Benton	1.00	1.00	1.05	1.04	0.68
Bethlehem	1.08	0.96	0.95	1.04	0.93
Bridgewater	1.09	1.03	0.96	0.98	0.96
Bristol	1.00	0.87	0.86	1.01	1.02
Campton	1.30	1.00	0.96	0.93	0.84
Canaan	1.02	0.99	0.92	1.06	1.08
Dorchester	1.31	0.95	0.95	0.93	0.96
Easton	1.12	1.02	1.01	1.01	0.99
Ellsworth	0.93	0.86	1.02	1.00	0.98
Enfield	1.20	1.06	1.01	0.98	0.94
Franconia	0.97	0.94	0.93	1.00	0.94
Grafton	0.97	0.98	1.01	1.01	0.97
Groton	1.04	1.06	0.86	1.02	1.01
Hanover	1.06	1.03	1.03	0.99	0.98
Haverhill	1.07	0.95	0.84	1.02	0.99
Hebron	1.06	0.97	0.92	0.95	0.98
Holderness	1.07	1.06	1.03	1.00	1.02
Landaff	1.16	1.19	1.14	0.99	0.94
Lebanon	1.07	1.03	1.03	0.99	0.99
Lincoln	1.01	0.92	0.84	1.04	1.02
Lisbon	1.17	0.98	1.10	1.08	1.08
Littleton	1.13	0.98	1.02	0.93	0.92
Livermore					
Lyman	1.08	1.10	1.00	0.99	0.90
Lyme	1.07	1.06	1.00	1.04	1.03
Monroe	0.99	0.99	0.98	0.91	0.73
Orange	1.22	1.10	1.23	1.19	1.03
Orford	1.01	1.02	1.00	1.02	0.99
Piermont	1.06	0.96	1.00	1.00	1.00
Plymouth	0.99	0.91	0.95	0.88	0.88
Rumney	1.08	0.95	0.95	0.93	0.90
Sugar hill	1.17	1.02	1.04	1.02	0.97
Thornton	1.14	1.01	0.98	0.96	0.96
Warren	1.07	0.99	0.99	0.96	1.05
Waterville valley	0.94	1.01	0.95	0.91	1.03
Wentworth	1.07	0.88	0.94	1.02	1.03
Woodstock	1.00	0.92	1.04	1.02	1.01
Weighted County Median	**1.07**	**0.99**	**0.97**	**0.99**	**0.98**

[35] Reciprocal of ratio reported by NH Department of Revenue. See footnote 21

Sullivan County Median Ratio[36]

Town	2008	2009	2010	2011	2012
Acworth	0.99	0.88	0.94	1.03	1.05
Charlestown	1.00	0.96	0.98	1.00	0.99
Claremont	1.17	1.00	0.96	0.94	0.90
Cornish	1.11	0.97	1.00	1.01	1.01
Croydon	1.01	1.03	1.04	0.96	0.98
Goshen	1.08	0.93	1.02	1.04	0.99
Grantham	0.96	0.93	1.02	0.98	0.90
Langdon	1.00	0.93	0.84	0.94	0.99
Lempster	0.95	0.95	0.95	1.01	0.93
Newport	0.99	0.92	0.90	0.91	0.98
Plainfield	1.02	1.00	1.00	0.97	0.93
Springfield	1.03	0.95	1.00	0.94	0.93
Sunapee	1.08	1.07	1.06	1.04	0.99
Unity	1.07	0.95	1.03	1.00	0.93
Washington	0.97	0.83	0.94	0.99	0.81
Weighted County Median	**1.05**	**0.98**	**0.99**	**0.98**	**0.95**

Source: NH Department of Revenue

[36] Reciprocal of ratio reported by NH Department of Revenue. See footnote 21.

Grafton County Assessed Residential Value

Town	2008	2009	2010	2011	2012	% Change 2008-2012
Alexandria	$ 122,627,400	$ 124,037,400	$ 124,762,200	$ 105,652,600	$ 106,214,400	-13%
Ashland	$ 130,804,700	$ 131,564,500	$ 137,622,900	$ 136,163,850	$ 136,317,200	4%
Bath	$ 63,915,082	$ 65,753,682	$ 65,855,782	$ 65,595,433	$ 66,394,533	4%
Benton	$ 13,726,500	$ 14,160,400	$ 14,760,100	$ 15,179,600	$ 15,276,100	11%
Bethlehem	$ 142,435,000	$ 146,589,150	$ 148,765,140	$ 126,633,400	$ 126,370,200	-11%
Bridgewater	$ 162,872,300	$ 164,979,400	$ 165,020,100	$ 155,254,400	$ 158,240,300	-3%
Bristol	$ 280,986,770	$ 290,665,150	$ 293,216,520	$ 267,229,000	$ 267,690,000	-5%
Campton	$ 225,759,900	$ 236,709,700	$ 238,825,000	$ 240,311,000	$ 242,693,100	8%
Canaan	$ 168,009,860	$ 171,323,839	$ 173,523,964	$ 142,422,415	$ 143,238,618	-15%
Dorchester	$ 17,263,300	$ 18,457,800	$ 18,958,100	$ 19,477,400	$ 19,567,900	13%
Easton	$ 34,118,100	$ 34,883,900	$ 35,172,500	$ 36,245,500	$ 36,813,598	8%
Ellsworth	$ 9,018,200	$ 9,174,600	$ 7,748,300	$ 7,747,200	$ 7,909,600	-12%
Enfield	$ 241,595,500	$ 275,066,400	$ 276,203,400	$ 279,102,700	$ 281,549,300	17%
Franconia	$ 157,351,120	$ 160,535,080	$ 162,716,880	$ 152,933,238	$ 155,185,238	-1%
Grafton	$ 74,037,434	$ 74,733,800	$ 69,094,700	$ 69,898,750	$ 70,562,950	-5%
Groton	$ 31,768,300	$ 32,331,300	$ 33,148,200	$ 33,271,600	$ 33,456,800	5%
Hanover	$ 919,983,000	$ 935,000,500	$ 941,842,200	$ 923,104,000	$ 929,140,000	1%
Haverhill	$ 209,778,000	$ 207,114,630	$ 214,846,679	$ 192,837,679	$ 193,072,579	-8%
Hebron	$ 106,013,700	$ 106,996,700	$ 106,801,400	$ 104,924,900	$ 106,048,321	0%
Holderness	$ 237,069,600	$ 243,283,100	$ 245,992,000	$ 252,577,600	$ 254,795,100	7%
Landaff	$ 23,685,277	$ 24,071,192	$ 24,741,662	$ 30,698,500	$ 31,179,105	32%
Lebanon	$ 650,576,844	$ 677,467,444	$ 699,528,070	$ 713,520,307	$ 711,310,557	9%
Lincoln	$ 587,180,882	$ 592,439,934	$ 592,172,394	$ 469,851,930	$ 470,341,150	-20%
Lisbon	$ 61,335,800	$ 56,338,319	$ 56,158,919	$ 55,934,780	$ 56,147,722	-8%
Littleton	$ 244,861,400	$ 246,970,800	$ 250,133,800	$ 247,859,600	$ 249,608,400	2%
Livermore	$ 28,040	$ 28,040	$ 28,040	$ 28,040	$ 28,040	0%
Lyman	$ 38,299,600	$ 38,726,000	$ 37,239,300	$ 37,847,800	$ 38,293,900	0%
Lyme	$ 181,595,900	$ 184,358,400	$ 185,711,800	$ 181,737,100	$ 183,380,700	1%
Monroe	$ 56,256,400	$ 56,882,600	$ 58,475,600	$ 57,061,600	$ 56,875,200	1%
Orange	$ 16,139,390	$ 16,401,881	$ 17,590,700	$ 17,589,200	$ 17,528,800	9%
Orford	$ 86,172,798	$ 87,097,998	$ 82,420,097	$ 82,835,097	$ 82,973,697	-4%
Piermont	$ 50,295,830	$ 50,544,020	$ 51,122,680	$ 57,174,100	$ 58,084,200	15%
Plymouth	$ 198,078,250	$ 198,493,840	$ 200,472,075	$ 201,217,165	$ 202,959,695	2%
Rumney	$ 85,443,166	$ 90,999,750	$ 91,500,250	$ 91,958,300	$ 92,505,400	8%
Sugar hill	$ 74,832,200	$ 75,362,300	$ 77,074,900	$ 77,603,300	$ 78,754,500	5%
Thornton	$ 235,183,500	$ 241,774,900	$ 244,872,100	$ 248,581,300	$ 251,353,200	7%
Warren	$ 43,787,900	$ 44,796,500	$ 45,298,300	$ 40,624,000	$ 41,052,300	-6%
Waterville valley	$ 296,611,200	$ 270,704,200	$ 271,916,600	$ 273,341,200	$ 245,631,600	-17%
Wentworth	$ 54,561,683	$ 56,502,300	$ 56,913,200	$ 49,731,500	$ 50,726,000	-7%
Woodstock	$ 175,508,064	$ 176,699,554	$ 154,678,710	$ 155,844,860	$ 156,037,600	-11%
County total	**$ 6,509,567,890**	**$ 6,630,021,003**	**$ 6,672,925,262**	**$ 6,417,601,944**	**$ 6,425,307,603**	**-1%**

Source: NH Department of Revenue

Sullivan County Assessed Residential Value

Town	2008	2009	2010	2011	2012	% Change 2008-2012
Acworth	$ 59,160,000	$ 59,552,000	$ 60,799,100	$ 51,220,100	$ 51,893,700	-12%
Charlestown	$ 163,873,924	$ 165,043,724	$ 165,989,924	$ 157,401,842	$ 157,459,542	-4%
Claremont	$ 411,270,400	$ 455,926,200	$ 455,928,500	$ 456,379,600	$ 453,376,000	10%
Cornish	$ 114,665,510	$ 108,898,710	$ 108,805,884	$ 109,082,533	$ 109,996,633	-4%
Croydon	$ 43,837,610	$ 53,715,470	$ 48,989,500	$ 49,539,100	$ 49,743,300	13%
Goshen	$ 43,359,410	$ 44,372,170	$ 40,811,920	$ 40,879,070	$ 41,221,570	-5%
Grantham	$ 404,953,400	$ 407,758,800	$ 349,869,200	$ 354,561,200	$ 356,699,800	-12%
Langdon	$ 33,692,000	$ 34,778,700	$ 35,516,900	$ 34,983,000	$ 35,201,600	4%
Lempster	$ 68,800,900	$ 70,283,400	$ 64,478,900	$ 65,880,100	$ 66,135,500	-4%
Newport	$ 217,619,700	$ 219,560,300	$ 221,469,200	$ 221,646,728	$ 188,349,700	-13%
Plainfield	$ 172,233,489	$ 174,478,289	$ 176,905,789	$ 178,044,157	$ 179,177,857	4%
Springfield	$ 106,068,900	$ 109,085,800	$ 102,038,400	$ 103,804,500	$ 104,836,150	-1%
Sunapee	$ 533,980,700	$ 549,282,700	$ 532,716,460	$ 537,700,860	$ 542,894,760	2%
Unity	$ 80,977,980	$ 69,385,200	$ 70,088,960	$ 71,244,630	$ 71,551,420	-12%
Washington	$ 114,869,666	$ 116,488,631	$ 109,905,677	$ 111,556,435	$ 113,388,387	-1%
County total	**$ 2,569,363,589**	**$ 2,638,610,094**	**$ 2,544,314,314**	**$ 2,543,923,855**	**$ 2,521,925,919**	**-2%**

Source: NH Department of Revenue

Grafton County Implied Residential Market Value

Town	2008	2009	2010	2011	2012	% Change 2008-2012
Alexandria	$ 115,577,191	$ 110,846,649	$ 105,373,480	$ 106,719,798	$ 101,253,003	-12%
Ashland	$ 130,024,553	$ 126,870,299	$ 125,339,617	$ 114,712,595	$ 118,846,731	-9%
Bath	$ 60,525,646	$ 60,435,369	$ 60,197,241	$ 67,277,367	$ 65,413,333	8%
Benton	$ 13,754,008	$ 14,188,778	$ 15,488,038	$ 15,746,473	$ 10,370,740	-25%
Bethlehem	$ 153,485,991	$ 140,545,686	$ 141,411,730	$ 131,498,858	$ 117,009,444	-24%
Bridgewater	$ 177,227,748	$ 169,906,694	$ 157,763,002	$ 151,615,625	$ 151,281,358	-15%
Bristol	$ 281,549,870	$ 251,658,139	$ 250,826,792	$ 270,748,734	$ 273,432,074	-3%
Campton	$ 292,814,397	$ 236,709,700	$ 229,639,423	$ 222,716,404	$ 202,751,128	-31%
Canaan	$ 171,965,056	$ 169,292,331	$ 159,342,483	$ 150,552,236	$ 154,518,466	-10%
Dorchester	$ 22,536,945	$ 17,545,437	$ 18,003,894	$ 18,084,865	$ 18,707,361	-17%
Easton	$ 38,248,991	$ 35,595,816	$ 35,563,701	$ 36,574,672	$ 36,557,694	-4%
Ellsworth	$ 8,373,445	$ 7,848,246	$ 7,898,369	$ 7,747,200	$ 7,739,335	-8%
Enfield	$ 290,728,640	$ 290,460,824	$ 279,558,097	$ 272,295,317	$ 265,863,362	-9%
Franconia	$ 153,214,333	$ 150,173,134	$ 150,663,778	$ 152,933,238	$ 146,401,168	-4%
Grafton	$ 71,672,250	$ 73,340,334	$ 69,651,915	$ 70,462,450	$ 68,707,838	-4%
Groton	$ 33,126,486	$ 34,358,448	$ 28,551,421	$ 33,812,602	$ 33,658,753	2%
Hanover	$ 974,558,263	$ 961,934,671	$ 968,973,457	$ 911,257,651	$ 913,608,653	-6%
Haverhill	$ 225,325,456	$ 196,131,278	$ 180,543,428	$ 197,377,358	$ 191,730,466	-15%
Hebron	$ 112,183,810	$ 104,082,393	$ 98,707,394	$ 99,833,397	$ 103,968,942	-7%
Holderness	$ 253,009,178	$ 257,988,441	$ 254,123,967	$ 251,320,995	$ 260,793,347	3%
Landaff	$ 27,413,515	$ 28,622,107	$ 28,308,538	$ 30,334,486	$ 29,166,609	6%
Lebanon	$ 694,318,937	$ 699,863,062	$ 719,679,084	$ 707,857,447	$ 702,182,189	1%
Lincoln	$ 591,320,123	$ 545,524,801	$ 497,623,861	$ 487,398,268	$ 481,413,664	-19%
Lisbon	$ 71,990,376	$ 55,396,577	$ 61,713,098	$ 60,535,476	$ 60,634,689	-16%
Littleton	$ 276,992,534	$ 241,654,403	$ 254,718,737	$ 230,567,070	$ 229,841,989	-17%
Livermore	$ -	$ -	$ -	$ -	$ -	
Lyman	$ 41,404,973	$ 42,649,780	$ 37,313,928	$ 37,436,004	$ 34,655,113	-16%
Lyme	$ 194,428,158	$ 195,502,015	$ 186,270,612	$ 188,328,601	$ 189,247,368	-3%
Monroe	$ 55,699,406	$ 56,152,616	$ 57,160,899	$ 51,921,383	$ 41,575,439	-25%
Orange	$ 19,682,183	$ 18,063,746	$ 21,610,197	$ 21,014,576	$ 17,978,256	-9%
Orford	$ 86,780,260	$ 89,148,411	$ 82,091,730	$ 84,439,446	$ 82,152,175	-5%
Piermont	$ 53,110,697	$ 48,553,333	$ 50,969,771	$ 57,174,100	$ 58,142,342	9%
Plymouth	$ 196,311,447	$ 180,285,050	$ 191,107,793	$ 177,440,181	$ 178,191,128	-9%
Rumney	$ 92,571,144	$ 86,501,663	$ 86,977,424	$ 85,942,336	$ 83,488,628	-10%
Sugar hill	$ 87,217,016	$ 76,665,615	$ 79,870,363	$ 79,430,194	$ 76,758,772	-12%
Thornton	$ 268,474,315	$ 243,970,636	$ 238,899,610	$ 237,422,445	$ 240,759,770	-10%
Warren	$ 46,831,979	$ 44,221,619	$ 44,716,979	$ 38,800,382	$ 42,941,736	-8%
Waterville valley	$ 280,086,119	$ 272,338,229	$ 257,253,169	$ 247,591,667	$ 252,447,688	-10%
Wentworth	$ 58,230,185	$ 49,650,527	$ 53,742,398	$ 50,643,075	$ 52,133,607	-10%
Woodstock	$ 174,983,115	$ 163,308,275	$ 160,455,093	$ 159,677,111	$ 157,613,737	-10%
County total	**$ 6,897,748,737**	**$ 6,547,985,134**	**$ 6,448,104,511**	**$ 6,317,242,082**	**$ 6,253,938,095**	**-9%**

Sullivan County Implied Residential Market Value

	2008	2009	2010	2011	2012	% Change 2008-2012
Acworth	$ 58,748,759	$ 52,284,460	$ 57,034,803	$ 52,804,227	$ 54,510,189	-7%
Charlestown	$ 163,383,773	$ 158,543,443	$ 162,099,535	$ 156,618,748	$ 156,209,863	-4%
Claremont	$ 481,581,265	$ 454,109,761	$ 437,131,831	$ 427,321,723	$ 409,924,051	-15%
Cornish	$ 127,123,625	$ 105,216,145	$ 108,588,707	$ 110,519,284	$ 111,107,710	-13%
Croydon	$ 44,146,636	$ 55,319,743	$ 51,137,265	$ 47,315,282	$ 48,624,927	10%
Goshen	$ 46,773,905	$ 41,161,568	$ 41,687,354	$ 42,449,709	$ 40,894,415	-13%
Grantham	$ 387,886,398	$ 377,205,180	$ 355,558,130	$ 346,928,767	$ 322,222,042	-17%
Langdon	$ 33,624,750	$ 32,442,817	$ 29,921,567	$ 32,909,690	$ 34,853,069	4%
Lempster	$ 65,400,095	$ 66,936,571	$ 61,350,048	$ 66,277,767	$ 61,636,067	-6%
Newport	$ 215,465,050	$ 202,359,724	$ 199,342,214	$ 202,787,491	$ 185,019,352	-14%
Plainfield	$ 175,034,034	$ 175,003,299	$ 176,200,985	$ 172,356,396	$ 166,213,225	-5%
Springfield	$ 109,124,383	$ 103,105,671	$ 102,242,886	$ 97,469,014	$ 97,703,774	-10%
Sunapee	$ 579,154,772	$ 587,468,128	$ 562,530,581	$ 557,202,964	$ 539,656,819	-7%
Unity	$ 86,514,936	$ 65,892,877	$ 71,886,113	$ 71,244,630	$ 66,374,230	-23%
Washington	$ 111,958,739	$ 96,831,780	$ 103,101,010	$ 110,451,916	$ 91,294,998	-18%
County Total	**$ 2,685,921,120**	**$ 2,573,881,167**	**$ 2,519,813,029**	**$ 2,494,657,607**	**$ 2,386,244,731**	**-11%**

Appendix C: Statistical tests

Table 15: Linear regression of sales price to pre-sale assessed value for all arms-length single family home sales between 2008 and July 2013

Regression Statistics	
Multiple R	0.960318
R Square	0.922211
Adjusted R Square	0.922007
Standard Error	51635.81
Observations	382

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1.2E+13	1.2E+13	4505.03	8E-213
Residual	380	1.01E+12	2.67E+09		
Total	381	1.3E+13			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-12678.3	4302.509	-2.94672	0.00341	-21138	-4218.56	-21138	-4218.56
Analysis_Assessed	0.985837	0.014688	67.11952	8E-213	0.956957	1.014716	0.956957	1.014716

Table 16: Summary statistics of assessed values for arms-length single family homes sold by year from nearest turbine

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
2008	64	13368392	208881.1	1.41E+10
2009	65	15329953	235845.4	4.31E+10
2010	58	15669566	270164.9	6.89E+10
2011	66	14276081	216304.3	1.82E+10
2012	88	19764814	224600.2	2.34E+10
2013	41	9910726	241725	3.57E+10

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	1.44E+11	5	2.89E+10	0.888757	0.488585	2.237992
Within Groups	1.22E+13	376	3.25E+10			
Total	1.24E+13	381				

Table 17: Statistical analysis performed for post-construction single family home sales in communities about wind farms

Groups	*Count*	*Sum*	*Average*	*Variance*
0-1	5	4.005925	0.801185	0.025094
1-3	30	27.81614	0.927205	0.044109
3-10	97	84.2421	0.868475	0.065358

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.110721	2	0.055361	0.933051	0.39599	3.066391
Within Groups	7.65395	129	0.059333			
Total	7.764671	131				

Figure 23: Post-construction waterfront single family home sales to pre-sale assessed ratio by distance

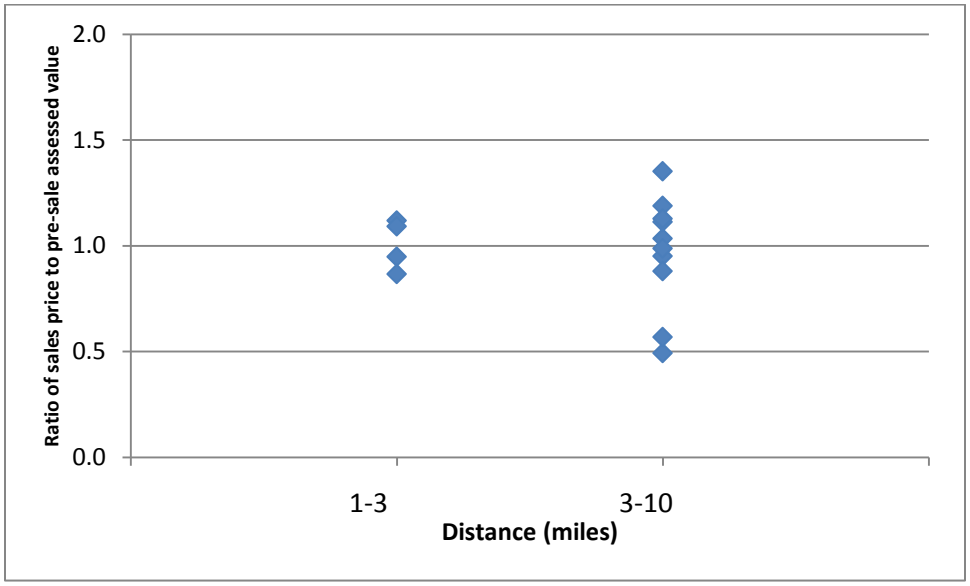


Table 18: Statistical analysis performed for post-construction waterfront single family home sales at identified bodies of water

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
1-3	4	4.020432	1.005108	0.014402
3-10	10	9.685889	0.968589	0.071176

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.00381	1	0.00381	0.06687	0.800332	4.747225
Within Groups	0.683785	12	0.056982			
Total	0.687596	13				