

VISUAL AND SOUND IMPACTS FROM THE WOLFE ISLAND WIND PROJECT ON RESIDENTS OF TIBBETTS POINT ROAD, CAPE VINCENT, NY

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SUMMARY

This report outlines the acoustic and visual impacts of the Wolfe Island Wind Project on residents 2 miles (3.2 km) across the St. Lawrence River along the Tibbetts Point Road, Cape Vincent. Sound levels measured in January-February 2010, when the wind farm was operating, were 3 to 4 dBA greater than background sound levels measured in 2008, prior to construction of the wind farm. A mail-questionnaire was sent to 43 residents of the Tibbetts Point Road to assess their reaction to noise and visual impacts from the Wolfe Island Wind Project. Twenty-seven questionnaires were returned for a 63% response rate. Most respondents did not notice wind turbine noise, but at times, 38% were annoyed by the wind turbine sound. For the level of sound increase over background levels, respondents were more annoyed than New York DEC noise policy predicted. Those respondents that heard the turbines described the noise as a low frequency/low pitched sound that is louder on summer evenings when winds were weak or non-existent. This supports other research linking annoyance with wind turbine noise and atmospheric stability.

Far more respondents (88%) were annoyed by the change in landscape view than with noise. Ninety-two percent said these changes were for the worst and the blinking lights at night were especially disturbing; some comparing them with a commercial airport. Policy makers should know that visual and acoustic impacts for non-participating, waterfront residents are likely more negative than they may have initially thought. Furthermore, current NYSDEC noise guidelines may not adequately predict human response to wind turbine sound levels. (Note respondent comments in Appendix A)

INTRODUCTION

Commercial wind developers began offering lease agreements to land owners in Cape Vincent beginning around 2004. Formal application for two commercial wind project proposals were submitted to town authorities beginning in 2006. The initial projects proposed nearly 250, four-hundred foot (122m) wind turbines, which would have covered nearly the entire geographic footprint of the town. Opposition to these projects has been

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widespread and has focused on visual and noise impacts, as well as potential conflicts of interest for a number of town elected and appointed officials.

In 2009, operations began for the Wolfe Island Wind Project located directly across the St. Lawrence River from Cape Vincent (Figure 1). The project includes 86, 2.3 MW wind turbines for a rated capacity of nearly 200 MW. The wind project is located on the western end of Wolfe Island and is closest, and has greatest visual impact, to Cape Vincent residents living along Tibbetts Point Road (Figure 1). The closest wind turbine is approximately 1.9 (3.1 km) miles away.

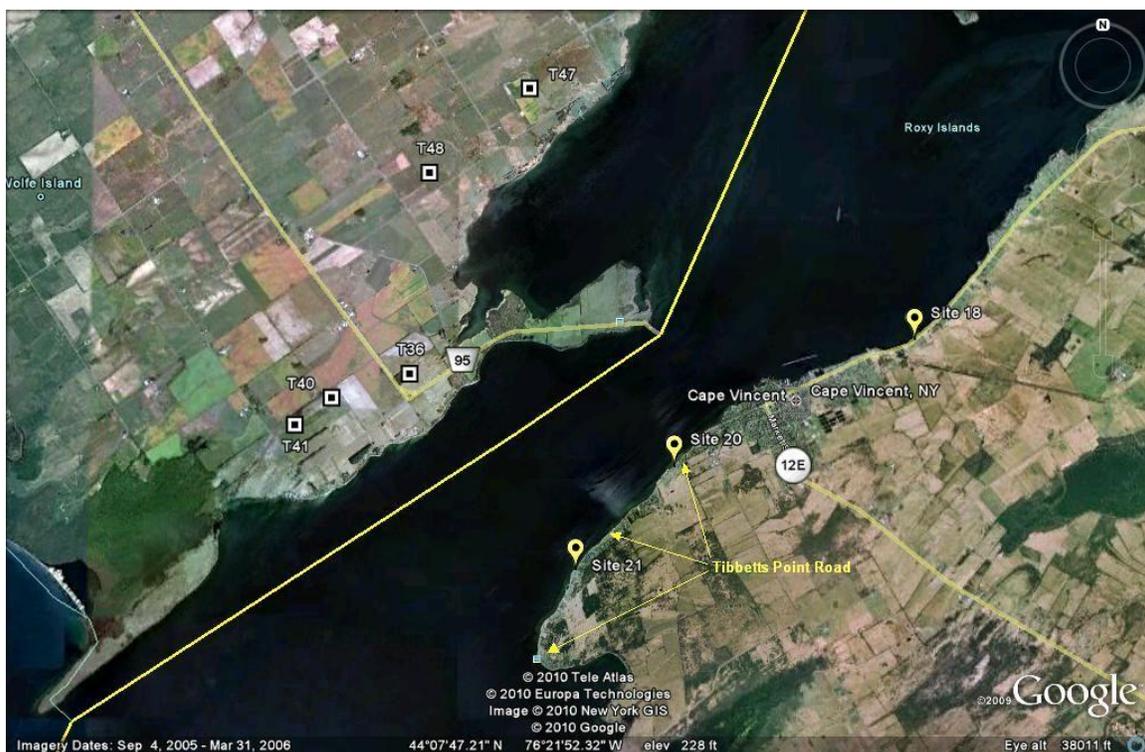


Figure 1. Cape Vincent, New York, U.S.A. and Wolfe Island, Ontario, Canada with Wolfe Island Wind Project's closest turbines, sound monitoring sites and bounds of the Tibbetts Point Road.

Cape Vincent is a community that has been struggling to find a way to integrate the proposed commercial electric power production complex into its rural landscape and tourism-based local economy. To say it has not been easy is to understate the extent of the problem. The Wolfe Island Wind Project probably did more to help Cape Vincent and

Jefferson County, NY residents understand the potential visual impacts than any of the visual simulation reports that were submitted with the environmental impact statements for the two project proposals in Cape Vincent. Although wind turbine noise impacts were expected to be minimal to non-existent, a number of residents were able to hear the nearest wind turbine nearly 1.9 miles (3.1 km) away.

In Europe, where commercial wind projects have had a longer, more studied history, there have been several studies of human responses to wind project operations. One of the most comprehensive reports was a mail-questionnaire-based investigation conducted in the Netherlands by a group of Dutch and Swedish researchers², who focused their assessment on the visual and noise impacts of commercial wind projects. This report was especially useful because in an appendix it included a copy of the questions included in the questionnaire, thereby providing a simple, vetted instrument to assess similar impacts in Cape Vincent.

The objective of this study was to understand the attitude of Cape Vincent residents who lived across from the Wolfe Island Wind Project during its first year of operation. Visual impacts were expected to predominate, but my principal interest was to see if residents noticed any noise impacts, and if so, to measure any changes in noise levels and relate those to established New York State DEC guidelines.

METHODS

Questionnaire - The Dutch questionnaire was adopted for my use by eliminating those questions that pertained to assessing health impacts. I assumed the Wolfe Island project was not operating long enough for any noticeable health impacts to surface. All the other questions were included without modification, however I did modify the format. The questionnaire along with a stamped return envelope and cover letter were mailed to all

2 Van den Berg, F., Pedersen, E, Bouma, J. and R. Bakker. 2008. WINDFARMperception - visual and acoustic impact of wind turbine farms on residents. FP6-2005-Science-and-Society-20 Specific Support Action, Project no. 044628. 99p.

Tibbetts Point Road residents noted on county tax maps (n= 43). Twenty-seven questionnaires were returned (response rate = 63%); one was omitted due to errors and inconsistencies. The questionnaire and the raw results are listed in Appendix A.

Noise Assessment – Background sound levels Cape Vincent were measured in summer 2008 and reported at a conference of the Institute of Noise Control Engineering in Ottawa in August 2009³. Two acoustic surveys were conducted along roadways within the Town of Cape Vincent. One of the surveys traversed NYS Rte 12E, which runs parallel to the shoreline of the St. Lawrence River. This survey also included three monitoring sites directly across from the Wolfe Island Wind Power Project (Figure 1). Sound levels from ten of the eleven monitoring sites were used to calculate an average baseline background sound level. Site no. 19, located in the middle of the Village of Cape Vincent, was excluded from the estimate because the noise at this site was 10 dBA above the other site's average. Ventilation fan noise dominated this site coming from a grocery and an American Legion post.

In January and February 2010 sound levels were measured at three monitoring sites adjacent to the Wolfe Island Wind Project. The data collection methods were identical to the 2008 study except the sampling period was 1-minute compared to 5-minutes in 2008. In a few instances passing vehicles contaminated the measurements; in these cases I deleted the data and waited for a time when there were no extraneous noises. Twenty estimates of ambient sound levels were made on five, calm nights between January 23 and February 11, 2010 (Appendix B). Wind speeds during 2008 and 2010 sound measurements were all below cut-in speed for turbines, e.g., 7 mph (3 m/s), but at the same time turbines were operable. Operation (e.g., revolutions per minute) was determined using 7 x 50 binoculars to view turbines silhouetted against the dimly lit city of Kingston, Ontario 9.3 miles (15 km) north of Tibbetts Point Road. Proximity of turbines to monitoring sites was determined first

3 Schneider, C.P. 2009. Measuring background noise with an attended, mobile survey during nights with stable atmospheric conditions. InterNoise 2009 Conference. Institute of Noise Control Engineering. Ottawa, CA. 12pp.

by using the Wolfe Island Wind Project's sound study to locate the nearest turbines on a Google Earth satellite image (Figure 1), and then using the measure function to estimate distances: turbine no. 47 was 3.2 miles (5.2 km) from site no. 18 and turbine no. 36 was 1.9 miles (3.1 km) from both site no. 20 and 21.

RESULTS and DISCUSSION

I. Exposure and Response Rate

Background sound levels for 2008 along NYS Rte 12, including two sites along Tibbetts Point Road, averaged 27.6 dBA and 28.9 dBA for L90A and LeqA, respectively (Table 1). These levels represent a baseline for background sound along the New York shoreline of the river. The average level measured at sites closest to the Wolfe Island Wind Project, numbers 18, 20 and 21 (Figure 1) was no different from the average sound levels measured for the other sites in the 2008 NYS Rte 12E survey. Therefore, sound levels for all ten sites were used in the calculation of baseline averages. The range in sound levels, e.g., difference between minimum and maximum levels, was little more than 7 dBA for both L90A and LeqA sound metrics.

Table 1. Descriptive statistics for L90A and LeqA sound levels measured in 2008 and 2010.

			L90A	L90A	L90A	LEQA	LEQA	LEQA
Year	Condition	Samples	Min	Mean	Max	Min	Mean	Max
2008	Baseline	10	25.2	27.6	32.2	26.1	28.9	32.6
2010	Wind Farm Operating	20	26.7	30.7	37.4	27.2	32.8	38.6
	Difference		1.6	3.1	5.2	1.1	3.9	6.0

Sound levels measured during January and February 2010 at monitoring sites closest to Wolfe Island were all greater than background levels measured in 2008. Average sound levels for sites 18, 20 and 21 were 30.7 dBA and 32.8 dBA for L90A and LeqA, respectively. The range of sound levels was also greater than 2008; near 11 dBA for both metrics. Comparing 2010 and 2008 sound levels, the average L90A was 3.1 dBA higher

and the average LeqA was 3.9 dBA higher in 2010 (Table 1.) An analysis of variance (AOV) indicated these differences were statistically significant⁴. These results indicate a noticeable, measurable increase in sound levels, presumably attributable to wind turbine operations on Wolfe Island. The 3-4 dBA increase in sound levels is within current New York DEC guidelines, which indicates exposures to new sounds less than 5 dBA above pre-development background sound levels will be “unnoticeable to tolerable.”

II. Living conditions

Respondents spent an average of 32.6 weeks at their Tibbett's Point Road residence (Table 2). Most (64%) were satisfied with their home environment, however 92% believed their were changes for the worst in their living environment. In Appendix A the raw survey results are presented for each question in the questionnaire; as well as comments from respondents. The comments associated with the question on “changes for the worst” were almost entirely related to the Wolfe Island Wind Project.

Table 2. Characterization of respondents and their living environment.

	Weeks at residence in 2009	Satisfaction with living environment	Changes for the better	Changes for the worst
Mean	32.6			
Satisfied or very satisfied		64		
Not satisfied		36		
No			70	8
Yes			30	92
Total		100	100	100

The general attitude of respondents towards wind turbines was negative (73%) and they were even more negative (88%) toward the wind turbines impact on their view and the river scenery (Table 3). The large majority of respondents (85%) described themselves as rather sensitive to very sensitive to noise exposure. In comparison, Dutch respondents were far

4 L90A: F=6.48, P=0.017; LeqA: F=9.57, P= 0.004 (See Appendix C)

less negative (36%) and more positive (21%). They also described themselves as far less sensitive to noise – only 30% were rather sensitive or very sensitive to noise.

Table 3. Attitude and noise sensitivity of respondents. (%)

	Rather or very negative/sensitive	Not negative/sensitive	Total
Attitude to wind turbines in general	73	27	100
Attitude to the impact of wind turbines on the landscape	88	12	100
Noise sensitivity	85	15	100

The respondents were asked to judge several aspects of wind turbines on 5-point scales with 3 representing a neutral attitude. Respondents judgments were overwhelmingly negative; maintaining turbines were inefficient, not environmentally friendly, ugly, unnecessary, repulsive and unnatural (Table 4). They also judged they were somewhat annoying (mean = 2.0) and were relatively neutral about whether they were dangerous or harmless (mean = 2.6).

Table 4. Judgments of wind turbines. (%)

	Mean
Efficient - inefficient	4.0
Environmentally friendly – not friendly	4.1
Pretty - ugly	4.6
Necessary - unnecessary	4.2
Inviting - repulsive	4.4
Natural - unnatural	4.6
Annoying – blends in	2.0
Dangerous - harmless	2.6

III. Response to exposures from wind turbines

Respondents were asked a number of questions about their attitude toward several types of

exposure from wind turbines in their living environment. Due to the fact that the nearest wind turbine to Tibbetts Point Road was 1.9 miles (3.1 km) distant, a majority of respondents (69%) did not notice moving shadows (shadow flicker) or the sound from rotor blades (Table 5). The biggest source of annoyance (77%) was from the changed view and about half the respondents were rather annoyed to very annoyed at the movement of wind turbine rotor blades. Although blinking lights on wind turbines at night were not a part of the Dutch questionnaire, comments from Tibbetts Point Road respondents showed this was a very important issue and source of annoyance (Appendix A).

Table 5. Response to different types of exposures from wind turbines. (%)

	Do not notice	Notice but not annoyed	Slightly annoyed	Rather annoyed	Very annoyed	Total
Blinking shadows indoors	69	8		4	19	100
Moving shadows outdoors	69	12	4	4	11	100
Sound of rotor blades	69	4	11	8	8	100
Rotor movement	27	8	19	15	31	100
Changed view		8	4	11	77	100
Vibrations	89		7		4	100

Annoyance at the changed view and rotor blade movement was also supported in responses to a question related to the frequency of annoyance, with 88% and 58% indicating daily annoyance, respectively (Table 6). Surprisingly, blinking shadows indoors were a source of annoyance at higher levels than moving shadows outdoors (Tables 5 and 6). Considering the distance to Wolfe Island wind turbines, these impacts were probably not related to wind turbines.

Table 6. Frequency of perceived annoyance with different exposures from wind turbines.

	Almost never	At least once in past year	At least once a month	At least once a week	Almost daily	Total
Blinking shadows indoors	77				23	100
Moving shadows outdoors	77	4	4		15	100
Sound of rotor blades	69	8	8	4	11	100
Movement of rotor blades	35			7	58	100
Changed view	4		8		88	100
Vibrations	88	4	4		4	100

IV. Response to wind turbine sound

The preponderance of respondents (58%) did not notice Wolfe Island wind turbine sounds. However, 23% were slightly annoyed and 15% were rather annoyed to very annoyed (Table 7). Indoors, not unexpectedly, a greater percentage of respondents did not notice the sound (77%), but some were still annoyed (19%).

Table 7. Response to wind turbine sound, outdoors and indoors. (%)

	Do not notice	Notice but not annoyed	Slightly annoyed	Rather annoyed	Very annoyed	Total
Sound outdoors	58	4	23	11	4	100
Sound indoors	77	4	11	4	4	100

Respondents who could hear wind turbine sounds were asked under what conditions the sounds were loudest. Two conditions were identified where turbine noise was substantially louder, during warm summer evenings (58%) and at nighttime (55%, Table 8). There was also a suggestion that sounds were louder when the wind was blowing toward their dwelling (25%) and when winds were weak or non-existent (27%). These responses were similar to those from the Dutch respondents.

Table 8. Perception of loudness in different situations. Only for respondents who could hear wind turbines from their dwelling. (%)

	Less loud	Louder	No difference	Do not know	Total
Wind from turbine towards dwelling	16	25	33	26	100
Wind from dwelling towards turbine	33		33	34	100
Weak or no wind	18	27	37	18	100
Strong wind	17	8	25	50	100
Warm summer evenings		58	17	25	100
Nighttime		55	27	18	100
Sideways		18	36	46	100

For those respondents who heard turbine sounds, most (44%) described their sound as a low frequency, low pitched sound and many (34%) as a thumping/throbbing (Table 9). These descriptions are compatible with what would be expected, since the nearest wind turbines were two miles distant. At these distances, high and mid-frequency sounds are attenuated to a far greater degree than lower frequency noise. In contrast, Dutch respondents who lived much closer to wind turbines most often (75%) described the sound as a swishing/slashing.

Table 9. Characteristics of wind turbine sound. Only respondents who could hear wind turbines from their dwelling. (%)

How would you describe wind turbine sound?	Yes
A pure tone	11
Thumping/throbbing	34
Low frequency/low pitched sound	44
Resound	11
Total	100

CONCLUSIONS

Sound levels measured in 2010 along the Tibbetts Point Road confirmed what a number of Cape Vincent residents reported, that at times they could hear the Wolfe Island Wind Project more than two miles away. Sound levels were measured during worst case situations when ground level winds were calm, but where winds aloft at hub-height were sufficient to operate turbines and generate noise as well as power (phenomena called atmospheric stability). The average L90A and LeqA sound levels were 3.1 and 3.9 dBA greater than background levels measured in 2008, respectively, and were attributable to added noise from the Wolfe Island Wind Project.. Moreover, the LeqA sound level was 3.2 dBA less than what was predicted (e.g., 36 dBA) for shoreline residents of Wolfe Island in their sound study. This seemed to be a reasonable loss across 1.5 miles of frozen river. According to New York DEC guidelines⁵, sound levels up to 5 dBA above background levels are considered “unnoticed to tolerable.” Responses from some Tibbetts Point residents, however, suggest wind turbine sounds may be somewhat more objectionable than DEC predicts.

Most of the Tibbetts Point Road residents reported they did not notice wind turbine sounds, but a considerable proportion did notice. Fifty-eight percent reported they did not notice wind turbine sounds. But for the others, 23% were “slightly annoyed” and 15% were “rather to very annoyed.” Only 11%, however, were annoyed on a daily basis. This suggests there are certain environmental conditions when wind turbine sounds are more noticeable and annoying. For those respondents who indicated they heard the Wolfe Island wind turbines, most (44%) described the sound as low frequency/low pitched, which given the distances away from turbines was a predictable response, (i.e., high and mid-frequencies are more attenuated than low frequencies). Regarding the perception of wind turbine loudness, respondents reported wind turbine sounds loudest: at night (55%), during summer evenings (58%), with weak or no wind (27%), and with the wind blowing towards their dwelling (25%). These descriptions were all compatible with what was reported by Dutch

⁵ NYSDEC. 2001. Assessing and Mitigating Noise Impacts. Program Policy. Albany, NY

researchers and they confirm the view that atmospheric stability at night represents worst case conditions for wind turbine noise impacts⁶⁷.

Although wind turbine sound was my principal interest in this study, visual impacts were clearly the dominant negative impact for Tibbetts Point Road residents. Although most residents (64%) were satisfied with their living environment, 92% indicated it had recently changed for the worst. Eighty-eight percent were “rather to very negative” about the impact of wind turbines on the landscape views, and the same percentage said they were annoyed by the changed view everyday. Moreover, 65% were annoyed by rotor movement, but the factor that may have been most annoying was not a part of the actual questionnaire – the blinking lights at night. Many negative comments were directed toward the blinking lights; comparing them to living next to an airport.

The fact so many residents were so negatively affected by the changed view is not unexpected when you consider waterfront residents paid a premium for property with a view and pay a premium each year in additional taxes to continue to enjoy that view. This report underscores the obvious, that policy makers should be aware that waterfront property owners are very sensitive to any changes in their view and very careful consideration should be given to undertaking any policies that may adversely affect those views. Regarding New York's noise policy, the increased sound levels due to wind turbine noise may have been acceptable by State guidelines, but a number (9 of 26) of Tibbetts Point Road residents said they were annoyed by the sound, more so than the “unnoticed to tolerable” response predicted by the DEC guideline. Wind turbine sounds have been described as more annoying than other noise sources, and at greater distances perhaps low frequency components are more noticeable and more annoying. Another factor to explain the unexpectedly high annoyance may be the overall negative view these residents have toward wind turbines and wind farms. However, at a similar sound levels, researchers who studied

6 Van den Berg, G.P. 2006. The sounds of high winds: the effect of atmospheric stability on wind turbine sound and microphone noise. PhD Dissertation. University of Groningen. Groningen, The Netherlands

7 Schneider, C.P. op.cit.

human responses to wind turbine noise in Sweden⁸, found the noise was more annoying than other types of transportation noise and speculated, “This could be due to the presence of amplitude modulation in the noise, making it easy to detect and difficult to mask by ambient noise.”

⁸ Pedersen, E. and K. Persson-Waye. 2004. Perception and annoyance due to wind turbine noise—a dose–response relationship. *J. Acoust. Soc. Am.* 116 (6), December 2004. 11pp.

APPENDIX A – QUESTIONNAIRE AND RESPONSES

TIBBETTS PT. ROAD LIVING ENVIRONMENT

SURVEY and RESULTS⁹

1. On what date did you fill in this questionnaire? Mo **Feb** day ____ yr **2010**
2. How many people live in your Cape Vincent household (including yourself)? **2.8 individuals**
3. Since March 2009, approximately how many weeks did you stay at your Cape residence? **32.6 wks.**
4. How satisfied are you with your Cape living environment? (check one)
very satisfied **28.0%**
satisfied **36.0%**
not so satisfied **28.0%**
not satisfied **8.0%**
not at all satisfied **0%**

5. Have there been any changes *for the better* in your living environment during the last years?

Yes **30.4%** No **69.6%**

If yes, which positive changes have occurred?

COMMENTS

Our cottage continues to be our family's place of connection and renewal.

Improvement to property and building owned.

Main street development and new town board.

We obtained village water and cable.

We've done a lot to make the place attractive.

Election of a supervisor who is more sensitive and responsive. He is more interested in representing the people of Cape Vincent vs. the prior administration.

6. Have there been any changes *for the worse* in your living environment during the last years?

Yes **92.3%** No **7.7%**

If yes, which negative changes have occurred?

COMMENTS

Wind turbines on Wolfe Island and prospect of more in the Town of Cape Vincent.

Windmills across from us on Wolfe Island.

Wolfe Island wind farm is truly an eye sore.

The windmills on Wolfe Island – an eyesore – noise especially at night when the wind blows directly toward Tibbetts Pt Rd.

9 Forty-three (43) surveys mailed to all Tibbett's Point Road residents; 27 returned with one omitted.

The dinosaurs on Wolfe Island.
 Windmills on Wolfe Island.
 Wolfe Island wind farm.
 The blinking red lights on top of the windmills on Wolfe Island.
 Not necessarily worse – different. Re:: view-scape of Wolfe Island via turbines.
 Cell towers that destroyed TV reception; unsightly wind towers on Wolfe Island; declining restaurants;
 unsanitary conditions in market (flies in and about the meat counter, slicing machine and sale)
 Windmills on Wolfe Island and the discord among residents over turbines.
 Wind turbines on Wolfe Island; oler, large trees have been taken down; development on the road.
 View changed with advent of 80+ windmills on Wolfe Island.
 View of Wolfe Island has changed.
 Wind turbines on Wolfe Island.
 Wolfe Island wind turbines.
 The windfarm on Wolfe Island and two barking dogs.
 Wolfe Island turbine development – Tibbetts Pt Rd traffic increase – volume and speed.
 The destroying of the natural beauty of the St. Lawrence River with the flashing red lights on top of the wind
 generators.
 The view has changed and we haven't gotten the grant to become a water district yet.
 View of wind turbines and on quiet evenings humming from generators and windmills.

7. To what extent do you agree or disagree with the statements below about your dwelling and your living environment? (Percent in each box; rows total 100%)

ITEM	Do not agree at all	Do not agree	Neither agree or disagree	Agree	Totally Agree
I spend a lot of time at home if possible.			11.5	23.1	65.4
When outside on a calm summer morning, I can hear only bird song and other nature sounds.	7.7	15.4	23.1	38.5	15.4
Background sounds from road traffic are almost always present outdoors.	25.4	29.6	11.1	29.6	3.7
I have renovated major parts of my dwelling since I moved in.	11.5	19.2	3.8	23.1	42.3
The area where I live is suitable for economical growth.	30.8	15.4	11.5	26.9	15.4
I feel a sense of community with people living in this area.	7.7	3.8	15.4	38.5	34.6
I like to personalize my dwelling.			3.8	46.2	50.0
I have many friends in the neighbourhood that I socialize with.		16.0	20.0	36.0	28.0
It is never really quiet in the area.	34.6	42.3	11.5	11.5	
I am concerned about keeping the garden/the balcony tidy.	4.2	4.2	8.3	33.3	50.0

8. Below are a number of items that you may notice or that could annoy you when you spend time **OUTDOORS** at your dwelling. Could you indicate whether you have noticed these or whether these annoy you? (Percent in each box; rows total 100%)

ITEM	Do not notice	Notice but not annoyed	Slightly annoyed	Rather annoyed	Very annoyed
Odour from industries	92.0	8.0			
Odour from manure	72.0	20.0	8.0		
Flies and/or gnats	19.2	46.2	15.4	3.8	15.4
Sound from agricultural machinery	38.5	50.0	11.5		
Airplane sound	50.0	50.0			
Road traffic sound	20.0	48.0	20.0	4.0	8.0
Railway sound	100.0				
Sound from wind turbines	57.7	3.8	23.1	11.5	3.8
View on power lines/pylons	64.0	20.0		4.0	12.0
View on factories	95.8		4.2		
View on wind turbines	3.8	19.2	3.8	11.5	61.5
View on busy road	28.0	36.0	20.0	8.0	8.0
Other, namely: (please indicate below)					

COMMENTS

Constant blinking, red lights at night on wind turbines on Wolfe Island.
 Viewing the river and seeing wind turbines along with red blinking lights at night.
 Ship sound is extremely louder than any noise in Cape; so is vibration in rock.
 Cars that drive too fast.
 Odour from the sea which is dead fish, dead sea weed and other things. Very normal for sea coast living.
 Speeding traffic.
 Lights on turbines on Wolfe Island!!
 Jet skis make a lot of noise on the river; motorcycles without mufflers seem to be more frequent on the road, and they always ride in groups.
 Barking dogs.
 Hunters, firecrackers and fireworks.
 Red lights on wind turbines at night.
 People who speed over our road.
 Generator of the water plant.

9. Below are a number of items that you may notice or that could annoy you when you spend time **INDOORS** at your dwelling. Could you indicate whether you have noticed these or whether these annoy you? (Percent in each box; rows total 100%)

ITEM	Do not notice	Notice but not annoyed	Slightly annoyed	Rather annoyed	Very annoyed
Odour from industries	100.0				
Odour from manure	100.0				
Flies and/or gnats	61.5	23.1	11.5		3.8
Sound from agricultural machinery	73.1	26.9			
Airplane sound	69.2	30.8			
Road traffic sound	46.2	38.5	7.7	7.7	
Railway sound	100.0				
Sound from wind turbines	76.9	3.8	11.5	3.8	3.8
View on power lines/pylons	69.2	15.4	3.8		11.5
View on factories	100.0				
View on wind turbines	8.0	12.0	4.0	8.0	68.0
View on busy road	28.0	40.0	16.0		16.0
Other, namely: (please indicate below)					

COMMENTS

Constant blinking, red lights at night on wind turbines on Wolfe Island.
 Ship noise and vibration.
 Lights on turbines on Wolfe Island.
 Barking dogs.
 Hunters, firecrackers and fireworks.
 Red lights on wind turbines at night.
 Sounds of turbine and water (plant) generator; bright lights when summer windows are open.

10. How would you describe your sensitivity to the environmental factors below? (not sensitive at all, hardly sensitive, slightly sensitive, rather sensitive, very sensitive).

ITEM	Not sensitive	Hardly sensitive	Slightly sensitive	Rather sensitive	Very sensitive
Air pollution	19.2		11.5	34.6	34.6
Odours	19.2		19.2	30.8	30.8
Noise	7.7	7.7		50.0	34.6
Littering	7.7		3.8	7.7	80.8

11. In your area there are wind turbines. What is your opinion on the impact of wind turbines on the landscape scenery? (Check one)

- very positive **0%**
- positive **3.8%**
- neither positive nor negative **7.7%**
- negative **19.2%**
- very negative **69.2%**

If very positive or very negative, please explain below.

COMMENTS

They ruin the entire landscape sunsets at night time looks like a commercial airport.
 There is no more landscape scenery! When we look across the river to Wolfe Island all we see are windmills and even at night we have constant blinking of red lights.
 They detract from the natural beauty of the area.
 They totally spoil the river view! The red lights at night blink every few seconds and I have to keep the shades down in the bedroom or it is a big bother.
 Complete desecration of the beautiful natural scenery.
 Ruined the view on the river.
 Towers detract from the landscape and red lights on towers are annoying.
 The lights at night are very disturbing inside and outside of our home.
 We bought our place because of its simplicity and closeness to nature and natural beauty. The turbines look industrial, and at night the blinking red lights make us feel like we're near an airport.
 View over the river to island destroyed; red lights at night.
 We live in a very scenic area. View of turbines during the day and their lights during the night is very negative. Their height and number overtake the surroundings. Add to that, flashing red strobe lights and rotating props and you have a visual blight.
 The windmills have changed our river views – formerly panoramic and gorgeous – irretrievably. One windmill close up may look graceful; 80 seen at a glance looks like industrial power or oil rigs. Our paradise is gone. Against a dark sky with the sun shining on the blades they are very striking (said in a positive way)
 They are industrial in appearance and the red lights at night are very incongruous to the pastoral setting of Cape Vincent.
 Disrupt the natural beauty distracting when viewing the night sky, don't mesh at all into a scenic setting.
 Blinking red lights all night. Visual horizon distracted by these huge monsters in the air.

12. To what extent are you affected by wind turbines in your living environment? Please indicate for each factor whether you notice it or are annoyed by it in your living environment. (Percent in each box; rows total 100%)

FACTOR	Do not notice	Notice but not annoyed	Slightly annoyed	Rather annoyed	Very annoyed
Blinking shadows indoors	69.2	7.7		3.8	19.2
Moving shadows outdoors	69.2	11.5	3.8	3.8	11.5
Sound from rotor blades	69.2	3.8	11.5	7.7	7.7
Movement of rotor blades	26.9	7.7	19.2	15.4	30.8
Changed view		7.7	3.8	11.5	76.9

Vibration	88.5		7.7		3.8
Other (please indicate what)					

COMMENTS

Constant blinking, red lights at night on wind turbines on Wolfe Island.
 Red blinking lights especially at night.
 Blinking lights at night.
 Lights!!!
 Lights at night.
 The blinking red lights at night; so many; so bright!
 Flashing lights at night.

13. How often are you affected by the factors in the previous question? (Percent in each box; rows total 100%)

FACTOR	Almost never	At least once in past year	At least once per month	At least once per week	Almost daily
Blinking shadows indoors	76.9				23.1
Moving shadows outdoors	76.9	3.8	3.8		15.4
Sound from rotor blades	69.2	7.7	7.7	3.8	11.5
Movement of rotor blades	34.6			7.7	57.7
Changed view	3.8		7.7		88.5
Vibration	88.5	3.8	3.8		3.8
Other (please indicate what)					

COMMENTS

Constant blinking, red lights at night on wind turbines on Wolfe Island.
 Reflections from red lights off water when its calm.
 Lights!
 Lights.
 The lights at night are horrible. I can no longer sit peacefully on our porch and gaze at them for long without feeling like I've been at Best Buy too long. All that blinking!
 Flashing lights at night

14. Can you hear the sound of wind turbines from within your house or from your garden/balcony?

Yes **34.6%** No **65.4%**

15. How would you describe the sound of the wind turbines? (you can check more than one answer category)

A pure tone **11.1%** Thumping/throbbing **33.3%** Swishing/lashing__
 Whistling/screeching__
 Rustling__ Scratching/squeaking__ A low frequency/low pitched sound **44.4%**
 Resounding **11.1%**

Other, namely: (please indicate what)

16. To what extent are you annoyed by the sound of wind turbines when you are **OUTDOORS** at your dwelling? Please encircle a number on the scale between 0 and 10; if you are not at all annoyed you encircle a 0, if you are extremely annoyed you encircle a 10. If the perceived annoyance is in between, please encircle the most appropriate number

1 2 3 4 5 6 7 8 9 10 **Average = 1.88**

17. To what extent are you annoyed by the sound of wind turbines when you are **INDOORS**? Please encircle a number on the scale between 0 and 10; if you are not at all annoyed you encircle a 0, if you are extremely annoyed you encircle a 10. If the perceived annoyance is in between, please encircle the most appropriate number.

1 2 3 4 5 6 7 8 9 10 **Average = 1.00**

18. Are there conditions when the sound of these wind turbines is more distinct? (I hear it less loud than usual, I hear it louder than usual, it makes no difference, I do not know whether it makes a difference). (Percent in each box; rows total 100%)

FACTOR	I hear it less loud than usual	I hear it louder than usual	It makes no difference	I do not know if it makes a difference
When the wind blows from the turbine to my dwelling	16.7	25.0	33.3	26.0
When the wind blows from my dwelling towards the turbine	33.3		33.3	33.3
When there is weak/no wind	18.2	27.3	36.4	18.2
When the wind is strong	16.7	8.3	25.0	50.0
On warm summer evenings		58.3	16.7	25.0
At night time		54.5	27.3	18.2
When I see turbines sideways		18.2	36.4	45.5
Other (please indicate what)				

COMMENTS

When windy sound of wind covers turbine noise.
[louder than usual] Quiet winter mornings.

19. What is your general opinion on wind turbines? (Check one)

- Very positive **3.8%**
- positive **7.7%**
- neither positive nor negative **15.4%**
- negative **15.4%**
- very negative **57.7%**

COMMENT

[from the very positive respondent] But not on the water in a tourist area. Put them on a hill or a farm and I think they are great!

20. What is your opinion on the statements below about wind turbines? Please encircle the number that corresponds best to your opinion: 1 through 5 for each of the following pairs. For no-opinion circle 3.

(average score in bold & underlined)

efficient	1	2	3	<u>4</u>	5	inefficient
environmentally friendly	1	2	3	<u>4</u>	5	not environmentally friendly
pretty	1	2	3	4	<u>5</u>	ugly
necessary	1	2	3	<u>4</u>	5	unnecessary
inviting	1	2	3	<u>4</u>	5	repulsive
natural	1	2	3	4	<u>5</u>	unnatural
annoying	1	<u>2</u>	3	4	5	blends in
dangerous	1	2	<u>3</u>	4	5	harmless

21. Can you see a wind turbine from your dwelling or your garden/balcony? Yes **100.0%**

No__

If yes, how many wind turbines can you see? **Average = 42**

22. If there are wind turbines in your environment, is your bedroom situated at the side of the house where those wind turbines are? Yes **80.0%** No **20.0%**

COMMENTS

Home was built to view the river, not turbines. Bedrooms, kitchen and living room all face the river. Of course our bedroom looks over the water – can't even see nearby land while lying in bed – only river and Wolfe Island.

**GENERAL COMMENTS INCLUDED AT THE END OF THE SURVEY
QUESTIONNAIRE:**

I think people choose and select what they want to bother them. Ship noise is louder than any windmill I've ever stood by, they vibrate more and cause pollution.

After 30 years at the point, the change of view is extreme. As with any change, we're leary to live with them. It would be a shame if Cape Vincent makes the mistake the Wolfe Islanders did. With the abundance and unused capacity for hydro-electric generation in our region, it's frustrating to see the rush to a "fad" technology. The wind turbines on Wolfe Island will soon be technology obsolete. What happens to them then? This entire controversy is about money – not the environment. I'm surprised that our Canadian neighbors allowed the turbines. My guess is that they'd make a different decision today.

APPENDIX B – SOUND LEVEL DATA

Note: SAMPLE = minutes of data collection, WIND_SPD = wind speed in m/s,
 WIND_DIR= wind direction (from), WT_REV= wind turbine revolutions/min.

SITE	DATE	YEAR	TIME	SAMPLE	WIND_SPD	WIND_DIR	WT REV	L90A	LEQA
11	13-Jun-08	2008	12:10 PM	5	0			27.3	28.2
12	13-Jun-08	2008	12:25 PM	5	0.1			30.5	30.4
13	13-Jun-08	2008	12:40 PM	5	0			25.1	27.4
14	13-Jun-08	2008	12:55 PM	5	0			32.2	32.6
15	13-Jun-08	2008	1:12 AM	5	0			26.5	28.6
16	13-Jun-08	2008	1:27 AM	5	0.1			26.7	29.3
17	13-Jun-08	2008	1:43 AM	5	0			26.5	27.3
18	13-Jun-08	2008	2:00 AM	5	0			25.7	26.1
20	13-Jun-08	2008	2:52 AM	5	0			29.2	30.8
21	13-Jun-08	2008	2:40 AM	5	0			26.7	28.2
18	23-Jan-10	2010		1	1.4	NE		31.9	34.2
20	23-Jan-10	2010		1	1.4	NE		33.2	36.2
21	23-Jan-10	2010		1	1.4	NE		36.1	38.6
18	31-Jan-10	2010	4:32 AM	1	0.6	SW	8.1	26.9	28.6
20	31-Jan-10	2010	4:08 AM	1	0.9	SW	8.1	37.4	38.6
20	31-Jan-10	2010	5:46 AM	1	1.4	SW	8.1	35.3	38.2
21	31-Jan-10	2010	4:16 AM	1	0.2	SW	8.1	28.2	31.9
21	31-Jan-10	2010	5:54 AM	1	0.9	SW	8.1	30.1	34.4
18	2-Feb-10	2010	4:10 AM	1	1.6	NW	7.5	27.3	28.8
20	2-Feb-10	2010	3:55 AM	1	1.4	NW	7.5	29.9	30.9
21	2-Feb-10	2010	4:04 AM	1	1.7	NW	7.5	27.4	29.4
18	4-Feb-10	2010	9:55 PM	1	0		7.7	26.7	27.2
20	4-Feb-10	2010	9:37 PM	1	0		7.7	28.3	29.3
21	4-Feb-10	2010	9:44 PM	1	0		7.7	26.9	27.6
18	11-Feb-10	2010	3:20 AM	1	2.7	N	12.3	30.8	32.1
18	11-Feb-10	2010	4:15 AM	1	1.4	N	12.3	28.8	30.4
20	11-Feb-10	2010	3:00 AM	1	1.9	N	12.3	33.7	35.8
20	11-Feb-10	2010	4:20 AM	1	2.1	N	12.3	35.4	36.4
20	11-Feb-10	2010	4:30 AM	1	2.1	N	12.3	32.1	34.5
21	11-Feb-10	2010	4:40 AM	1	2.2	N	12.3	28	32.8

APPENDIX C – STATISTICAL TESTS OF SOUND LEVELS

STATISTIX FOR WINDOWS
 10:11:23 AM

4/26/2010,

DESCRIPTIVE STATISTICS FOR YEAR = 2008

VARIABLE	N	MEAN	MINIMUM	MAXIMUM
L90A	10	27.640	25.100	32.200
LEQA	10	28.890	26.100	32.600

DESCRIPTIVE STATISTICS FOR YEAR = 2010

VARIABLE	N	MEAN	MINIMUM	MAXIMUM
L90A	20	30.720	26.700	37.400
LEQA	20	32.795	27.200	38.600

STATISTIX FOR WINDOWS
 10:13:25 AM

4/26/2010,

ONE-WAY AOV FOR L90A BY YEAR

SOURCE	DF	SS	MS	F	P
BETWEEN	1	63.2427	63.2427	6.48	0.0167
WITHIN	28	273.296	9.76057		
TOTAL	29	336.539			

	CHI-SQ	DF	P
BARTLETT'S TEST OF EQUAL VARIANCES	1.87	1	0.1720

COCHRAN'S Q	0.7001
LARGEST VAR / SMALLEST VAR	2.3342

COMPONENT OF VARIANCE FOR BETWEEN GROUPS	4.01116
EFFECTIVE CELL SIZE	13.3

YEAR	MEAN	SAMPLE SIZE	GROUP STD DEV
2008	27.640	10	2.2633
2010	30.720	20	3.4580
TOTAL	29.693	30	3.1242

CASES INCLUDED 30 MISSING CASES 0

BONFERRONI COMPARISON OF MEANS OF L90A BY YEAR

YEAR	MEAN	HOMOGENEOUS GROUPS
2010	30.720	I
2008	27.640	.. I

ALL 2 MEANS ARE SIGNIFICANTLY DIFFERENT FROM ONE ANOTHER.

CRITICAL T VALUE 2.048 REJECTION LEVEL 0.050
 STANDARD ERRORS AND CRITICAL VALUES OF DIFFERENCES
 VARY BETWEEN COMPARISONS BECAUSE OF UNEQUAL SAMPLE SIZES.

STATISTIX FOR WINDOWS
 10:04:48 AM

4/26/2010,

ONE-WAY AOV FOR LEQA BY YEAR

SOURCE	DF	SS	MS	F	P
BETWEEN	1	101.660	101.660	9.57	0.0044
WITHIN	28	297.318	10.6185		
TOTAL	29	398.979			

	CHI-SQ	DF	P
BARTLETT'S TEST OF EQUAL VARIANCES	4.17	1	0.0410

COCHRAN'S Q 0.7890
 LARGEST VAR / SMALLEST VAR 3.7393

COMPONENT OF VARIANCE FOR BETWEEN GROUPS 6.82812
 EFFECTIVE CELL SIZE 13.3

YEAR	MEAN	SAMPLE SIZE	GROUP STD DEV
2008	28.890	10	1.9273
2010	32.795	20	3.7268
TOTAL	31.493	30	3.2586

CASES INCLUDED 30 MISSING CASES 0

BONFERRONI COMPARISON OF MEANS OF LEQA BY YEAR

YEAR	MEAN	HOMOGENEOUS GROUPS
2010	32.795	I
2008	28.890	.. I

ALL 2 MEANS ARE SIGNIFICANTLY DIFFERENT FROM ONE ANOTHER.

CRITICAL T VALUE 2.048 REJECTION LEVEL 0.050
STANDARD ERRORS AND CRITICAL VALUES OF DIFFERENCES
VARY BETWEEN COMPARISONS BECAUSE OF UNEQUAL SAMPLE SIZES.