Cassadaga Wind Project

Case No. 15-F-0490

1001.15 Exhibit 15

Public Health and Safety

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EXHIBIT 15 PUBLIC HEALTH AND SAFETY

Wind generated power is in many ways safer and healthier than other forms of electricity generation. Unlike conventional power plants, wind farms produce energy without emitting pollutants that decrease air quality. In addition, unlike other sources of power generation, wind farms produce energy without impacts to surface and ground water quality. These benefits to air and water resources are a major public health benefit since the negative effects of air and water pollution and climate change are well understood.

New York State's 2015 State Energy Plan involves reducing GHG emissions from the energy sector, as this is critical to protecting the health and welfare of New Yorkers. Clean air is essential to New Yorkers' health and quality of life. New York's energy system is the source of many benefits for New Yorkers; however, it is also the cause of significant impacts on the State's natural resources and public health, principally because of emissions of a variety of substances, some of which find their way into water and other resources. Air pollutants emitted when carbon-based fuels are burned are associated with serious health conditions and contribute to the climate change that threatens New York's residents. Combustion of fossil fuels is the dominant source of energy-related emissions. The kinds of health risks associated with the combustion of carbon-based fuels are not associated with solar energy, wind, and hydroelectric power. While the use of these means of producing electric power is not risk-free, increasing the fraction of New York's electricity needs met by wind, solar, and water will, in general, decrease health risks associated with electricity production. The recognition of this has significantly contributed to New York's nation-leading commitment to renewable energy development through the Clean Energy Standard and is in part a leading reason for New York establishing the 50% by 2030 goal set forth in the New York State Energy Plan.

The Article 10 regulations require the assessment of potential risks associated with the operation of the Facility, which, in the case of wind projects such as the Facility are generally limited in nature to effects associated with movement of the blades and electrical components within the nacelle. Specific to wind power, ice shedding, tower collapse, blade failure, stray voltage, and fire in the turbines are all possible. However, to the best of the Applicant's knowledge, there are no known instances of a member of the general public being injured at an operating wind farm in the United States. Regardless, proper siting and setbacks from dwellings, roads, and other existing facilities minimize the potential risks from these types of incidents.

(a) Gaseous, Liquid, and Solid Wastes to be Produced During Construction and Operation

One of the advantages of producing electricity from wind is that it does not produce gaseous waste during operation, and a minimal amount of liquid (oil from wind turbine gearboxes and electrical transformers) and solid wastes (cardboard, packaging material, and general refuse) are produced during operation. With respect to construction, the generation of gaseous, liquid and/or solid waste is primarily limited to standard operation of construction equipment and will be handled by the BOP contractor in accordance with all applicable laws and regulations pertaining to such wastes.

During construction, sanitary facilities used by workers consist of portable toilets, which will be emptied on an as needed basis. During operation, if the O&M building is newly constructed at the identified site near the collection substation, sanitary facilities will be built into the building, which is anticipated to be served by a septic system. The new septic system will be appropriately permitted through the Chautauqua County Department of Health, Division of Environmental Health Services. If an existing building is used as the O&M facility, the Applicant will have the septic system inspected by Chautauqua County Environmental Health Services (given the location of the Facility, it is very unlikely the existing building would be on a community sewer system) to ensure the existing wastewater system is sufficient and no improvements and/or replacements are needed. If the existing system is not sufficient, the Applicant will upgrade it through the Onsite Wastewater Treatment System permit process through the Chautauqua County Department of Health, Division of Environmental Health Services.

Facility construction will generate relatively minor amounts of solid waste, primarily plastic, wood, cardboard and metal packing/packaging materials, construction scrap, and general refuse. This material will be collected from turbine sites and other Facility work areas, and disposed of in dumpsters. It is anticipated that there will be one or two 30-cubic yard dumpsters located centrally at the laydown yard next to the collection substation. A private contractor will empty the dumpsters on an as-needed basis, which is expected to be no less frequent than weekly, and dispose of the refuse at a licensed solid waste disposal facility. Neither the Towns of Cherry Creek, Charlotte, or Arkwright, or Chautauqua County provides a waste collection service for the Facility Site, but residents can hire private waste removal companies. There are four Chautauqua County transfer stations. The closest transfer station to the Facility is the landfill transfer station located in the Town of Ellery and accepts recyclables at no charge, as well as municipal solid waste at $37.50 per ton and construction debris at $47.50 per ton (Chautauqua County, 2016).

In addition, Facility construction will be initiated by clearing woody vegetation from all designated areas as indicated on the Final Construction Drawings (to be prepared following issuance of the Certificate). Trees cleared from the work area will be cut into logs and stockpiled on the edge of the work area or removed from the defined work area, while limbs and brush will be chipped and spread in upland areas (safely away from water resources) on-site so as not to interfere with existing land use practices. Landowners will have the right to any materials, including trees, taken from their property during site preparation, and any trees not claimed by the landowner will be sold to a timber buyer by the construction contractor.

(b) Anticipated Volumes of Wastes to be Released to the Environment

This is not applicable to the Facility. Please see (a) above and (e) below.

(c) Treatment Processes to Minimize Wastes Released to the Environment

This is not applicable to the Facility. Please see (a) above and (e) below.

(d) Procedures for Collection, Handling, Storage, Transport, and Disposal of Wastes

This is not applicable to the Facility. Please see (a) above and (e) below.

(e) Wind Power Facility Impacts

(1) Blade Throw and Tower Collapse

A potential public safety concern with wind power projects is the possibility of a wind turbine tower collapsing or a rotor blade dropping or being thrown from the nacelle. While extremely rare, such incidents have occurred; however, to the best of the Applicant's knowledge, no member of the public has ever been injured as a result of these incidents and local setbacks have proved to be sufficient to protect area homes and public roads.

The reasons for a tower collapse or blade throw vary depending on conditions and tower type. The main causes of blade and tower failure are a control system failure leading to an over speed situation, a lightning strike, or a manufacturing defect in the blade (Garrad Hassan America, Inc., 2010). Technological improvements and mandatory safety standards during turbine design, manufacturing, and installation have significantly reduced the instances of blade throw. The reduction in blade failures coincides with the widespread introduction of wind turbine design certification and type approval. The certification bodies perform quality control audits of the blade manufacturing facilities and perform strength testing of construction materials. These audits typically involve a dynamic test that simulates the life loading and stress on the rotor blade (Garrad Hassan America, Inc., 2010).

Modern utility-scale turbines are certified according to international engineering standards. These include ratings for withstanding different levels of hurricane-strength winds and other criteria (ASCE & AWEA, 2011). The engineering standards of the wind turbines ultimately used for this Facility will meet all applicable engineering standards. State of the art braking systems, pitch controls, sensors, and speed controls on wind turbines have greatly reduced the risk of blade throw. It is anticipated that the wind turbines to be used for the Facility will be equipped with two fully independent braking systems that allow the rotor to be brought to a halt under all foreseeable conditions. In addition, it is anticipated that the turbines will automatically shut down at wind speeds over the manufacturer's threshold (e.g., 50 mph for the 2.3 MW turbine). As described above, the turbines will also cease operation if significant vibrations or rotor blade stress is sensed by the monitoring systems. For all of these reasons, the risk of catastrophic blade throw is minimal.

Although the risk of blade throw is minimal, the Applicant will have procedures in place in the event of a blade throw incident. These procedures will include emergency shutdown procedures, post event site security measures, immediate notification of state and local officials, and the implementation of turbine manufacturer specific blade throw safety procedures, if any. In addition, the Applicant will conduct annual training for operating staff as well as local first responders on the procedures to be implemented in the event of a blade throw incident.

Given the low risk of tower collapse and blade throw, the potential impact is negligible. The Facility's current setback distances from permanent residences, adjacent property lines and other features will adequately protect the public from tower collapse and blade throw. Specifically, the Applicant proposes the following setbacks:

Table 15-1. Applicant's Setback Standards for the Proposed Facility

Feature	Basis for Setback	Setback Distance
Substation	1.5x total turbine height	750 feet
Transmission Line[1]	1.5x total turbine height	750 feet
Gas Well	Total turbine height	500 feet
Public Road	1.1x total turbine height	550 feet
State Land	1.1x total turbine height	550 feet
Non-Residential Structure[2]	1.1x total turbine height	550 feet
Non-Participating Residence[3]	3x total turbine height	1,500 feet
Participating Residence[3]	2x total turbine height	1,000 feet
Non-Participating Parcel	1.1x total turbine height	550 feet
Wetland	100 feet	100 feet

[1] This setback applies to larger transmission lines (i.e., 115 kV and greater) and is to be measured from the edge of the right-of-way.
[2] The Town of Arkwright requires a setback of 1.5x total turbine height setback to existing non-wind turbine structures, which would be 750 feet for a 500-foot turbine. There is only one proposed turbine site (T7) in the Town of Arkwright. Turbine T7 is located approximately 1,730 feet from the closest non-residential structure (i.e., has been sited in compliance with the Town's setback).
[3] Seasonal residences (i.e., camps/trailers classified as seasonal by Chautauqua County) have been included for the purposes of siting turbines appropriate distances from these structures.

(2) Audible Frequency and Low Frequency Noise

Infrasound is sound pressure fluctuations at frequencies below about 20 Hz. Sound below this frequency is only audible at very high magnitudes. Low frequency sound is in the audible range of human hearing, that is, above 20 Hz, but below 100 to 200 Hz depending on the definition. The Facility is not expected to result in any public health and safety issues due to infrasound and audible frequency noise. See Exhibit 19 for additional information on the proposed noise analysis.

Although concerns are often raised with respect to low frequency or infrasonic noise emissions from wind turbines, modern pitch-regulated wind turbines of the type proposed for this Facility do not generate low frequency noise to any significant extent. No impact of any kind, whether related to annoyance or health, is expected from Facility-related low frequency noise. Early wind turbines (designed with the blades downwind of the support tower) were prone to producing a periodic thumping noise each time a blade passed the tower, and the widespread belief that wind turbines generate excessive or even harmful amounts of low frequency noise likely originated with this phenomena. While modern wind turbines have been re-configured with blades arranged upwind of the tower, and therefore no longer produce the same magnitude of thumping noises, the myth of excessive low-frequency noise may have perpetuated due to confusion of low frequency sound with the amplitude modulation typical of wind turbines (i.e., the periodic swishing sound with a frequency of about 1 Hz). However, numerous studies show that the low frequency content in the sound spectrum of a typical modern wind turbine – like those proposed for this Facility – is no higher than that of the natural background sound level in rural areas (Sondergaard & Hoffmeyer, 2007; Hessler et al., 2008).

In addition, in response to concerns that sounds emitted from wind turbines cause adverse health consequences, AWEA and CanWEA established a scientific advisory panel to conduct a review of current literature pertaining to the perceived health effects of wind turbines (Colby et al., 2009). The multidisciplinary panel was comprised of medical doctors, audiologists, and acoustical professionals from the United States, Canada, Denmark, and the United Kingdom. The objective of the panel was to provide an authoritative reference document for legislators, regulators, and anyone who wants to make sense of the conflicting information pertaining to wind turbine sound. The panel evaluated peer-reviewed literature on sound and health effects, as well as sound produced by wind turbines. The panel concluded that there is no evidence that the audible or sub-audible sounds produced by operating wind turbines have any direct adverse physiological effects and the ground-borne vibrations from wind turbines are too weak to be detected by, or to affect, humans. In addition, based on the levels and frequencies of the sounds produced by operating wind turbines and the panel's experience with sound exposures in occupational settings, the sounds produced from operating wind turbines are not unique and therefore do not likely cause direct adverse health consequences (Colby et al., 2009).

The Chief Medical Officer of Health (CMOH) of Ontario also reviewed existing scientific evidence on the potential health impact of noise generated by wind turbines. The report concluded, "…the scientific evidence available to date does not demonstrate a direct causal link between wind turbine noise and adverse health effects. The sound level from wind turbines at common residential setbacks is not sufficient to cause hearing impairment or other direct health effects, although some people may find it annoying" (CMOH of Ontario, 2010).

In addition, the Massachusetts Department of Environmental Protection (MassDEP) and Massachusetts Department of Public Health (MDPH) assembled a team of independent experts to identify any documented or potential health impacts or risks that may be associated with exposure to wind turbines and discuss public health effects relating to wind turbines, based on scientific findings. To do this, the independent, expert panel conducted a literature review, including peer-reviewed scientific studies, other reports, and popular media, as well as reviewed public comments received by the MassDEP and/or MDPH. According to the report, there is insufficient evidence that the noise from wind turbines is directly causing health problems or disease (Ellenbogen et al., 2012).

(3) Ice Throw

Ice shedding and ice throw refer to the phenomena that can occur when ice accumulates on rotor blades and subsequently breaks free and falls to the ground. Although a potential safety concern, no serious accidents caused by ice being "thrown" from an operating wind turbine have been reported (Garrad Hassan Canada, Inc., 2007; Baring-Gould et al., 2012; Gipe, 2013). However, ice shedding and ice throw do occur, and could represent a potential safety concern.

Under certain weather conditions, ice may build up on the rotor blades and/or sensors, slowing the rotational speed, and potentially creating an imbalance in the weights of the individual blades. Such effects of ice accumulation can be sensed by the turbine's computer controls and would typically result in the turbine being shut down until the ice melts. Field observations and studies of ice shedding indicate that most ice shedding occurs as air temperatures rise and the ice on the rotor blades begins to thaw. Therefore, the tendency is for ice fragments to drop off the rotors and land near the base of the turbine (Morgan et al., 1998; Ellenbogen, et al., 2012). Ice can potentially be "thrown" when ice begins to melt and stationary turbine blades begin to rotate again; if ice falls from a stationary turbine during very high wind conditions that are strong enough to carry the ice some distance; or in the event of a failure of the turbine's control system.

The distance traveled by a piece of ice depends on a number of factors, including: the position of the blade when the ice breaks off, the location of the ice on the blade when it breaks off, the rotational speed of the blade, the shape of the ice that is shed (e.g., spherical, flat, smooth), and the prevailing wind speed. The risk of ice landing at a specific location is found to drop dramatically as the distance from the turbine increases. The European Union Wind Energy in Cold Climates research collaborative has studied ice throw at operational wind farms throughout Europe. The data gathered show that ice fragments typically land within 410 feet (125 meters) of the wind turbine (Seifert et al., 2003). Ice throw observations are also available from a wind turbine near Kincardine, Ontario, where the operator conducted approximately 1,000 inspections between December 1995 and March 2001. Thirteen of these inspections noted ice build-up on the turbine. No ice pieces were found on the ground further than 328 feet from the base of the turbine, with most found within 164 feet (Garrad Hassan Canada, Inc., 2007). Studies conducted in the Swiss Alps found that the maximum throwing distance was 302 feet (Cattin et al., 2008 and 2009). Almost fifty percent of the ice fragments weighed 0.1 pounds or less (Cattin et al., 2007) and the heaviest ice fragment weighed nearly four pounds (Cattin et al., 2008 and 2009). While the height of wind turbines is also a factor to be considered, the “Wind Turbine Health Impact Study” prepared by an independent expert panel for the Massachusetts Department of Public Health concluded that, “ice is unlikely to land farther from the turbine than its maximum vertical extent” (Ellenbogen et al., 2012).

Impacts related to ice shedding are unlikely because any ice shedding that could occur is likely to fall within established setbacks. The effects of ice accumulation can be sensed by the turbine's computer controls and typically result in the turbine being shut down until the ice melts. As ice builds up on the blades of an operating wind turbine, it can lead to vibration, caused by the mass of the ice or the aerodynamic imbalances. Modern commercial turbines are equipped with vibration monitors, which shut the machine down when vibrations exceed a pre-set level. Most modern wind turbines also monitor the wind speed to power output ratio. If ice accumulates on the blades, this ratio becomes too high and the turbine will stop itself.

The Facility’s proposed setback distances, the results of studies/field observations at other wind power projects, modern turbine technological controls, the limited public access to the turbine sites, and the fact that no serious accidents caused by ice being "thrown" from an operating wind turbine have been reported (Garrad Hassan Canada, Inc., 2007; Baring-Gould et al., 2012; Gipe, 2013), should adequately protect the public from falling ice, and therefore risk from ice throw or shedding is considered minimal in the Facility Site. In fact, recent data collected by the Global Wind Energy Council (2014) indicate that worldwide there were more than 268,000 turbines in operation by the end of 2014, and more have been constructed since. It is important to note that even with all of these turbines in operation, there has been no reported injury caused by ice being thrown from a turbine.

(4) Shadow Flicker

Shadow flicker refers to the moving shadows that an operating wind turbine casts over an identified receptor at times of the day when the turbine rotor is between the sun and a receptor's position. Shadow flicker is most pronounced in northern latitudes during winter months because of the lower angle of the sun in the winter sky. However, it is possible to encounter shadow flicker anywhere for brief periods before sunset and after sunrise (U.S. Department of the Interior, 2005). During intervals of sunshine, wind turbine generators will cast a shadow on surrounding areas as the rotor blades pass in front of the sun, causing a flickering effect while the rotor is in motion. Shadow flicker does not occur when fog or clouds obscure the sun, or when turbines are not operating.

The distance between a wind turbine and a potential shadow-flicker receptor affects the intensity of the shadows cast by the blades, and therefore the intensity of flickering. Shadows cast close to a turbine will be more intense, distinct, and focused. This is because a greater proportion of the sun's disc is intermittently blocked by the turbine (BERR, 2009). Obstacles such as terrain, vegetation, and/or buildings occurring between receptors and wind turbines may significantly reduce or eliminate shadow-flicker effects. At distances beyond roughly 10 rotor diameters (approximately 1,360 meters based on the Vestas V136 turbine model used in this case) shadow-flicker effects are generally considered negligible (BERR, 2009; DECC, 2011; DOER, 2011).

A Shadow Flicker analysis was conducted by EDR (2016) for the proposed Facility (see Appendix U). The analysis used *WindPRO 2.9.285* software and associated Shadow module, which is a widely accepted modeling software package developed specifically for the design and evaluation of wind power projects. Input variables and assumptions used for shadow flicker modeling calculations for the proposed Facility include:

- Latitude and longitude coordinates of 58 proposed wind turbine sites (provided by the Applicant).
- Latitude and longitude coordinates for 519 potential receptors located in the 10 rotor diameter (1,360 meters) Study Area (provided by the Applicant).
- USGS 1:24,000 topographic mapping and USGS 10-meter resolution digital elevation model (DEM) data.
- The rotor diameter (136 meters) and hub height (82 meters) for the Vestas V136.
- Annual wind rose data (provided by the Applicant), which is depicted in Appendix U Table A1 of Attachment A (to determine the approximate directional frequency of rotor orientation throughout the year).
- To account for the occurrence of cloudy conditions, the average monthly percent of available sunshine for the nearest NOAA weather station in Buffalo, New York was used. Data was obtained from NOAA's

"Comparative Climatic Data for the United States through 2012" (see Appendix U Table A2 of Attachment A) (http://www.ncdc.noaa.gov).

- No allowance was made for wind being below or above generation speeds. Blades are assumed to be moving during all daylight hours when the sun's elevation is more than 3 degrees above the horizon. Shadow flicker is generally considered imperceptible when the sun is less than 3 degrees above the horizon (due to the scattering effect of the atmosphere on low angle sunlight) (States Committee for Pollution Control, 2002).
- The possible screening effect of all existing trees and buildings adjacent to the receptors was not taken into consideration in the modeling. In addition, the number and/or orientation of windows in residential structures were not considered in the analysis.

Shadow-flicker effects on receptors are expressed in terms of predicted frequency (hours per year). These isolines define the theoretical number of hours per year that shadow flicker would occur at any given location within 10 rotor diameters (1,360 meters) of all proposed turbines. The model calculations include the cumulative sum of shadow hours for all Facility turbines. This omni-directional approach reports total shadow flicker results at a receptor regardless of the presence or orientation of windows at that particular residence (i.e., it assumes shadows from all directions can be perceived at a residence, which may or may not be true). A receptor in the model will be defined as a one square meter area located one meter above ground; consistent with industry standards, actual house dimensions are not taken into consideration.

No consistent national, state, county, or local standards exist for allowable frequency or duration of shadow flicker from wind turbines at the proposed Facility Site. In general, quantified limits on shadow flicker are uncommon in the United States because studies have not shown it to be a significant issue (USDOE, 2008, 2012; NRC, 2007). However, standards developed by some states and countries provide guidance in this regard. The New Hampshire Office of Energy and Planning (2008) issued a model ordinance for small wind energy systems (<100kW) that defines significant shadow flicker impacts as more than 30 hours per year on abutting occupied buildings. A model wind ordinance prepared by the North Carolina Wind Working Group in 2008 suggests a limit of 30 hours per year (generally less than 1% of annual daylight hours) at any occupied building on a non-participating landowner's property (NCWWG, 2008). The Wisconsin Administrative Code (WAC) specifies a limit of 30 hours per year at any non-participating residence or occupied community building (Wisconsin Public Service Commission, 2012). The WAC also requires mitigation for non-participating residences or occupied community buildings experiencing 20 hours or more per year of shadow flicker. The Ohio Power Siting Board uses 30 annual hours of shadow flicker as a threshold of acceptability in reviewing commercial wind power projects (OPSB, 2011a, 2011b, 2012, 2013, 2014). Additionally, international guidelines from Europe and Australia have suggested 30 hours of shadow flicker per year as the threshold of significant impact, or the point at which shadow flicker is commonly perceived as an annoyance (NRC, 2007; DECC, 2011; DPCD, 2012). In addition, 30 hours of shadow flicker per year is a common standard for SEQRA review in New York State. Accordingly, a threshold of 30 shadow flicker hours per year was applied to the analysis of the proposed Facility to identify any potentially significant impacts on identified non-participating receptors.

A summary of the projected shadow flicker at each of the 519 receptors located within a 10 rotor diameter radius of all proposed turbine locations is presented below. Because the shadow flicker analysis conducted for the proposed Facility was based on the conservative assumptions that 1) all 58 turbines will be built, 2) the turbines are in continuous operation during daylight hours, and 3) that shadow flicker can be perceived at a receptor structure regardless of the presence or orientation of windows or the screening effects of all surrounding trees and buildings, the analysis presented herein is a conservative projection of the shadow-flicker effects at ground level.

- 147 (28%) of the receptors are not expected to experience any shadow flicker,
- 10 (2%) of the receptors may be affected 0-1 hour/year,
- 167 (32%) of the receptors may be affected 1-10 hours/year,
- 95 (18%) of the receptors may be affected 10-20 hours/year,
- 45 (9%) of the receptors may be affected 20-30 hours/year,
- 55 (11%) of the receptors may be affected for more than 30 hours/year.

Results of the shadow flicker analysis for the Cassadaga Wind Project indicate that up to 55 receptors could exceed the 30-hour threshold. However, 32 of these receptors (58%) are located on properties owned by Facility participants. The details regarding anticipated shadow flicker at all structures predicted to receive in excess of 30 hours are summarized below in Table 15-2.

Table 15-2. Receptors Predicted to Exceed 30 Hours of Shadow Flicker

Receptor ID	Receptor Type[1]	Project Status	Predicted Shadow Flicker (days/year)	Predicted Annual Shadow Flicker (hh:mm/year)	Predicted Max Daily Shadow Flicker (hh:mm/day)
3740	Residential	Non-Participating	171	30:10	0:59
2774	Residential	Non-Participating	175	30:16	0:53
3304	Residential	Non-Participating	186	30:23	0:56
1554	Residential	Non-Participating	213	30:31	0:44
3739	Residential	Non-Participating	173	31:10	1:01

Receptor ID	Receptor Type[1]	Project Status	Predicted Shadow Flicker (days/year)	Predicted Annual Shadow Flicker (hh:mm/year)	Predicted Max Daily Shadow Flicker (hh:mm/day)
1464	Unknown[2]	Non-Participating	113	32:42	1:08
3083	Residential	Non-Participating	152	32:53	0:51
2735	Residential	Non-Participating	171	33:13	0:55
1461	Unknown[2]	Non-Participating	117	33:47	1:08
1589	Residential	Non-Participating	172	34:24	0:46
2734	Unknown[2]	Non-Participating	175	34:27	0:56
2730	Unknown[2]	Non-Participating	177	35:41	0:56
675	Residential	Non-Participating	142	35:56	1:05
2718	Unknown[2]	Non-Participating	179	36:31	0:59
3737	Residential	Non-Participating	181	39:27	1:08
720	Residential	Non-Participating	186	40:19	1:11
703	Residential	Non-Participating	171	40:22	1:13
2036	Unknown[2]	Non-Participating	118	41:38	1:03
2405	Residential	Non-Participating	168	42:07	1:10
1603	Residential	Non-Participating	234	44:05	1:02
2750	Residential	Non-Participating	219	46:04	1:08
2422	Residential	Non-Participating	247	58:55	1:04
3710	Unknown[2]	Non-Participating	295	70:07	1:11
2245	Residential	Participating	107	30:03	1:18
743	Unknown[2]	Participating	185	30:19	0:50
3337	Residential	Participating	196	30:31	0:53
1831	Unknown[2]	Participating	133	33:00	1:15
747	Residential	Participating	203	33:50	0:48
3154	Residential	Participating	147	34:02	0:44
1824	Unknown[2]	Participating	139	35:00	1:17
742	Residential	Participating	204	35:06	0:52
3016	Residential	Participating	163	36:29	1:24
3576	Residential	Participating	89	36:32	1:11
3319	Residential	Participating	237	37:50	0:52
2600	Unknown[2]	Participating	156	38:04	1:00
1606	Residential	Participating	199	39:15	0:51
2597	Unknown[2]	Participating	160	40:26	1:01
3170	Residential	Participating	184	40:27	1:15
3392	Residential	Participating	159	46:30	1:02

Receptor ID	Receptor Type[1]	Project Status	Predicted Shadow Flicker (days/year)	Predicted Annual Shadow Flicker (hh:mm/year)	Predicted Max Daily Shadow Flicker (hh:mm/day)
3589	Residential	Participating	109	47:31	1:24
2622	Residential	Participating	126	51:31	1:17
3380	Residential	Participating	181	51:41	1:48
2779	Unknown[2]	Participating	173	51:51	1:23
2623	Unknown[2]	Participating	124	56:04	1:22
1185	Residential	Participating	198	58:29	1:10
1379	Residential	Participating	238	61:18	1:10
2463	Residential	Participating	182	62:39	1:15
3265	Residential	Participating	274	62:49	1:20
1315	Unknown[2]	Participating	254	74:02	1:14
3318	Residential	Participating	274	79:13	1:26
1087	Residential	Participating	130	82:52	2:00
2276	Residential	Participating	249	100:44	2:02
2461	Residential	Participating	323	107:50	1:41
1199	Residential	Participating	311	113:07	1:41
3229	Residential	Participating	343	116:34	2:06

[1] There were no identified Schools, Office Buildings, or Storefronts within the Study Area.
[2] Structures in rural settings that are usually associated with agriculture or maintenance buildings.

Although shadow flicker at these receptors exceeds the 30-hour per year threshold, these calculations do not take into account the actual location and orientation of windows, or the screening effects associated with existing, site-specific conditions and obstacles such as trees (i.e., does not take into account the results of the viewshed analysis) and/or buildings. Further, this analysis assumes turbine rotors are continuously in motion. Given these assumptions, the predicted shadow-flicker frequency represents a conservative scenario, and almost certainly overstates the actual frequency of shadow flicker that would be experienced at any given receptor location. In addition, many of the modeled shadow flicker hours are expected to be low intensity because they would occur during the early morning or late afternoon hours when the sun is low in the sky. As the sun sinks below the horizon, more of its light is scattered by the atmosphere, which has the effect of dampening its brightness and therefore reducing its ability to cast dark shadows (EMD, 2013). As stated previously 58% of these receptors are on parcels owned by Facility participants. Details regarding shadow flicker effects predicted at the remaining non-participant receptors are presented in Table 15-3. Results of predicted shadow flicker at each receptor is provided in Attachment B of the Shadow Flicker Report (see Appendix U).

To provide a more realistic prediction of where shadow flicker will actually be perceived, *WindPRO* model results were compared to the results of a viewshed analysis conducted for the Facility. A viewshed map was created using ArcGIS modeling to define areas of potential Facility visibility within the study area. The viewshed map identified areas within the study area that could have an unobstructed line of sight to any portion of one or more of the proposed turbines. The viewshed analysis takes into consideration the screening effect of mapped forest vegetation with an assumed average height of 40 feet. Once the viewshed analysis was completed, the areas covered by the mapped forest vegetation layer were designated as "not visible" on the resulting data layer. In most forested areas, views will be well screened by the overhead tree canopy. The viewshed analysis indicates that 11 of the 23 non-participant receptors predicted to experience over 30 hours of shadow flicker will not have views of the Facility due to screening provided by mapped topography and vegetation (see Table 15-3 and Appendix U Figure 4).

Table 15-3. Daily Effect to Non-Participating Receptors Predicted to Exceed 30 Hours of Shadow Flicker

Receptor ID	Project Status	Predicted Annual Shadow Flicker (hh:mm/year)	Turbines Contributing Shadow Flicker	Approximate Times of Day Receptor Potentially Affected by Flicker[1]	Vegetation Viewshed Analysis Results
675	Non - Participant	35:56	1, 2, 22	6:00PM - 8:00PM	Turbine Screened
703	Non - Participant	40:22	1, 2, 9, 22	5:30PM - 7:45PM 8:00PM - 8:15PM	Turbine Screened
720	Non - Participant	35:56	1, 2, 9, 22	4:30PM - 8:15PM	Turbine Visible
1461	Non - Participant	33:47	50	6:30PM - 8:00PM	Turbine Visible
1464	Non - Participant	32:41	50	6:30PM - 8:00PM	Turbine Visible
1554	Non - Participant	30:31	28, 33, 38, 43	6:00AM - 7:00AM 7:15AM - 8:00AM	Turbine Visible
1589	Non - Participant	34:24	33, 38, 43	6:00AM - 7:00AM 7:15AM - 8:30AM	Turbine Visible
1603	Non - Participant	44:05	33, 38, 43	2:45PM - 4:00PM 5:45PM - 7:00PM 7:30PM - 8:30PM	Turbine Visible
2036	Non - Participant	41:38	31	6:15AM - 7:30AM	Turbine Visible
2405	Non - Participant	42:07	41, 54	6:15AM - 7:30AM 2:30PM - 4:00PM	Turbine Screened
2422	Non - Participant	58:55	26, 32, 34, 40	6:00AM - 8:30AM	Turbine Screened

Receptor ID	Project Status	Predicted Annual Shadow Flicker (hh:mm/year)	Turbines Contributing Shadow Flicker	Approximate Times of Day Receptor Potentially Affected by Flicker[1]	Vegetation Viewshed Analysis Results
2718	Non - Participant	36:31	5, 14, 17	5:00PM - 8:30PM	Turbine Screened
2730	Non - Participant	35:41	5, 14, 17	4:30PM - 8:15PM	Turbine Screened
2734	Non - Participant	34:27	5, 14, 17	4:30PM - 8:15PM	Turbine Visible
2735	Non - Participant	33:13	5, 14, 17	4:30PM - 8:15PM	Turbine Visible
2750	Non - Participant	46:04	5, 14, 17	3:30PM - 8:15PM	Turbine Visible
2774	Non - Participant	30:16	5, 14, 17	3:45PM - 8:15PM	Turbine Screened
3083	Non - Participant	32:53	36, 48	6:30AM - 7:45AM 7:15PM - 7:45PM	Turbine Visible
3304	Non - Participant	30:23	49, 51, 55	3:00PM - 4:15PM 5:00PM - 7:45PM	Turbine Visible
3710	Non - Participant	70:07	3, 7, 11	3:00PM - 5:00PM 6:30PM - 8:30PM	Turbine Screened
3737	Non - Participant	39:27	3, 7, 11	2:30PM - 3:15PM 4:30PM - 8:00PM	Turbine Screened
3739	Non - Participant	31:10	7, 11	3:30PM - 5:00PM 5:15PM - 7:00PM	Turbine Screened
3740	Non - Participant	30:10	7, 11	3:30PM - 5:00PM 5:15PM - 7:00PM	Turbine Screened
742	Participant	35:06	1, 2, 9, 22	3:30PM - 8:00PM	Turbine Visible
743	Participant	30:19	1, 2, 9, 22	3:30PM - 8:00PM	Turbine Visible
747	Participant	33:50	1, 2, 9, 22	3:30PM - 8:00PM	Turbine Visible
1087	Participant	82:52	44, 45, 46	6:15PM - 8:00PM	Turbine Visible
1185	Participant	58:29	28, 44, 46	5:00PM - 7:45PM	Turbine Visible
1199	Participant	113:07	28, 44, 45, 46	6:45AM - 8:30AM 1:30PM - 3:00PM 5:00PM - 7:45PM	Turbine Visible
1315	Participant	74:02	28, 33, 44	3:30PM - 4:45PM 6:00PM - 7:00PM	Turbine Screened
1379	Participant	61:18	28, 33, 43	3:00PM - 3:45PM 4:30PM - 6:30PM 7:00PM - 7:45PM	Turbine Screened

Receptor ID	Project Status	Predicted Annual Shadow Flicker (hh:mm/year)	Turbines Contributing Shadow Flicker	Approximate Times of Day Receptor Potentially Affected by Flicker[1]	Vegetation Viewshed Analysis Results
1606	Participant	39:15	28, 33, 38, 43	6:00AM - 8:45AM	Turbine Visible
1824	Participant	35:00	50, 52	7:15AM - 9:30AM	Turbine Screened
1831	Participant	33:00	50, 52	7:15AM - 9:30AM	Turbine Screened
2245	Participant	30:03	31	7:00AM - 9:00AM	Turbine Visible
2276	Participant	100:44	31, 34, 40	7:15AM - 9:30AM 6:15PM - 8:30PM	Turbine Visible
2461	Participant	107:50	26, 32, 34, 40	6:30AM - 9:15AM	Turbine Visible
2463	Participant	62:39	41, 54	6:45AM - 8:15AM 3:00PM - 3:30PM	Turbine Screened
2597	Participant	40:26	54, 58	7:00AM - 9:00AM	Turbine Screened
2600	Participant	38:04	54, 58	7:00AM - 9:00AM	Turbine Screened
2622	Participant	51:31	5, 14	6:45PM - 8:45PM	Turbine Screened
2623	Participant	56:04	5, 14	6:45PM - 8:45PM	Turbine Screened
2779	Participant	51:31	5, 14, 17, 42	6:30AM - 9:00AM 8:00PM - 8:30PM	Turbine Screened
3016	Participant	36:29	17, 23, 42	7:15AM - 9:15AM 6:45PM - 7:30PM	Turbine Visible
3154	Participant	34:02	21, 36	6:15AM - 8:15AM	Turbine Screened
3170	Participant	40:27	13, 23, 49, 55	8:45AM - 10:00AM 7:15PM - 8:30PM	Turbine Visible
3229	Participant	116:34	13, 23, 49, 55	7:00AM - 10:00AM 3:15PM - 8:15PM	Turbine Screened
3265	Participant	62:49	13, 49, 51, 55	8:15AM - 10:00AM 4:00PM - 5:45PM 6:45PM - 8:30PM	Turbine Visible
3318	Participant	79:13	19, 20, 57	6:00AM - 9:00AM	Turbine Visible
3319	Participant	37:50	19, 20, 21, 57	6:30AM - 9:00AM	Turbine Screened
3337	Participant	30:31	19, 20, 21, 57	7:00AM - 8:45AM	Turbine Visible
3380	Participant	51:41	53, 56, 57	8:30AM - 9:15AM 4:00PM - 6:45PM	Turbine Visible
3392	Participant	46:30	4, 56	6:30AM - 8:00AM 5:45PM - 6:00PM 6:15PM - 7:00PM	Turbine Screened
3576	Participant	36:32	3	6:00AM - 7:45AM	Turbine Screened

Receptor ID	Project Status	Predicted Annual Shadow Flicker (hh:mm/year)	Turbines Contributing Shadow Flicker	Approximate Times of Day Receptor Potentially Affected by Flicker[1]	Vegetation Viewshed Analysis Results
3589	Participant	47:31	3	7:00PM - 8:45PM	Turbine Visible

[1]The times of day presented in Table 15-3 represent the range of times during which each structure could potentially experience shadow flicker throughout the year; however, no structures will experience shadow flicker every day during all those hours. See Appendix U, Attachment B for detailed calendars that illustrate the specific times of year and day that each structure may experience shadow flicker.

A qualitative review of the potential impact from shadow flicker on recreational areas was also assessed. Recreational resources (parks, trails, campgrounds) were mapped in relation to the shadow flicker model results/isolines (see Appendix U, Figure 4). The Earl Cardot Eastside Overland Trail, the Equestrian Trail, the regional Snowmobile Trails, and the Boutwell Hill State Forest are located within the Study Area, and portions of these recreational areas will experience shadow flicker. In general however, the Facility will have minimal impact on recreational areas because viewers will not be subject to shadow flicker for extended periods of time. In addition, based on the viewshed analysis, a large portion of the recreational resources that are within the Study Area are anticipated to have limited to no views of Facility turbines, therefore, limiting and/or eliminating shadow flicker from these areas.

Although shadow flicker has been alleged to cause or contribute to health effects, blade pass frequencies for modern commercial scale wind turbines are very low. According to the Epilepsy Society (2012), approximately five percent of individuals with epilepsy have sensitivity to light. Most people with photosensitive epilepsy are sensitive to flickering around 16-25 Hz (Hertz or Hz = 1 flash per second), although some people may be sensitive to rates as low as 3 Hz and as high as 60 Hz. Modern wind turbines (including the proposed Vestas V136) typically operate at a frequency of 1 Hz or less, and there is no evidence that wind turbines can trigger seizures (British Epilepsy Association, 2007; Ellenbogen et al., 2012; Parsons Brinckerhoff, 2011; NHMRC, 2010).

In summary, adverse shadow flicker impacts are not anticipated. Of the 55 receptors predicted to exceed the 30-hour threshold, 32 are Facility participants, while the remaining 23 are non-participating property owners. Additional evaluation through viewshed analysis revealed that 11 of the 23 non-participating receptors are not anticipated to receive any shadow flicker due to the extent of the screening by intervening vegetation. If, based on the final turbine layout and model selected, there are non-participating receptors predicted to receive more than 30 hours/year of shadow flicker, the Applicant may perform a receptor specific shadow flicker model taking into account the actual location and orientation of windows, or the screening effects associated with existing, turbine operational data, site-specific conditions and obstacles such as trees (i.e., does not take into account the results of the viewshed analysis) and/or buildings to demonstrate that shadow flicker will not be greater than 30 hours/year in a more realistic shadow flicker model before considering mitigation options discussed below. Additionally, depending on the results of any additional shadow flicker assessment, the Applicant may pursue neighbor agreements with the owners of those receptors. The Applicant is committed not allowing shadow flicker to exceed 30 hours per year at any non-participating receptor.

As stated earlier, the shadow flicker analysis conducted for the proposed Facility was based on the conservative assumptions that 1) all 58 turbines will be built, 2) the turbines are in continuous operation during daylight hours, and 3) that shadow flicker can be perceived at a receptor structure regardless of the presence or orientation of windows or the screening effects of all surrounding trees and buildings. In addition, if a turbine model with a smaller rotor diameter is ultimately used (i.e., 120 meters) the shadow flicker analysis shows that there would be the potential for significantly less impact to receptors (i.e., model shows 28 receptors over the 30 hour threshold). However, because the final turbine model is not known, and to provide a conservative, worst-case analysis, this study evaluates the potential impact of 58 turbines with the largest rotor diameter. Therefore, it is anticipated that the number of hours per year that some receptors will experience shadow flicker will be less than modeled.

In addition, many of the modeled shadow flicker hours are expected to be of low intensity, as they will occur during the early morning or late afternoon hours when the sun is low in the sky. When the sun sinks low on the horizon, more of its light is scattered by the atmosphere, which has the effect of dampening its brightness and therefore reducing its ability to cast dark shadows. Where shadow flicker does occur from the Facility wind turbines, it is anticipated that it can be readily mitigated by planting of trees to screen the affected windows from the sun, or by the installing blinds or curtains. Closing blinds or curtains on windows that face the turbine(s) during periods of shadow flicker effectively mitigates shadow flicker impacts. These mitigation options can be easily implemented even after the Facility has been constructed, and will be documented through the complaint resolution process.

(f) Public Health and Safety Maps

See Figure 15-1 for Public Health and Safety maps, which depict publicly available data within a 5-mile radius of the Facility, including:

- Known public water supplies
- Fire stations/EMS stations
- Emergency services mobile land sites
- EPA regulated facilities
- Bridges
- Regulated dams

- Flood hazard areas

(g) Significant Impacts on the Environment, Public Health, and Safety

As indicated above in subsections (a) through (d), the Facility is not expected to result in any significant public health or safety concerns associated with gaseous, liquid, or solid wastes. Wind energy facilities are safer than other forms of energy production, since significant use and storage of combustible fuels are not required. Public safety concerns associated with the operation of a wind power project are somewhat more unique. As discussed in subsection (e) above, such concerns include blade throw and tower collapse, audible frequency and low frequency noise, ice shedding and ice throw, and shadow flicker. However, as discussed above, none of these concerns will result in significant impact on the environment, public health, or safety.

(h) Unavoidable Adverse Impacts and Appropriate Mitigation/Monitoring Measures

The proposed Facility will result in significant long-term economic benefits to participating landowners, as well as to the Towns of Cherry Creek, Charlotte, Arkwright, and Stockton, the local school districts, and Chautauqua County (see Exhibit 27). When fully operational, the Facility will provide up to 126 MW of electric power generation with no emissions of pollutants or greenhouse gases to the atmosphere. Despite the positive effects anticipated as a result of the Facility, its construction and operation will necessarily result in certain unavoidable impacts to the environment. The majority of these environmental impacts will be temporary, and will result from construction activities. However, long-term unavoidable impacts associated with operation and maintenance of the Facility includes turbine visibility from some locations within the area. While the presence of the turbines will result in a change in perceived land use from some viewpoints, their overall contrast with the landscape, as determined through evaluation by registered landscape architects, is moderate in most locations. Facility development will also result in an increased level of sound at some receptor locations (residences) within the study area (Facility sound levels are not expected to exceed 45 dBA at any non-participating residences), loss of forest land, wildlife habitat changes, and some level of avian and/or bat mortality associated with bird/bat collisions with the turbines. As evaluated through site-specific expert analyses, which are presented in Exhibit 22 of the Application, these impacts are not considered significant, and are outweighed by the benefits of providing a source of clean, renewable energy and displacing some of the energy (and emitted pollutants) created by fossil fuel generators, which result in significant environmental impacts (Driscoll et. al., 2007) and (NYSDEC, 2010).

Although adverse environmental impacts will occur, they will be minimized through the use of various general avoidance and minimization measures, as well as site-specific mitigation measures. With the implementation of these measures, the Facility is expected to result in positive, long-term overall impacts that will offset the adverse effects that cannot otherwise be avoided. Should avoidance mitigation measures fail and adverse impacts occur, the Applicant will evaluate the need for turbine specific scheduled curtailment of operations when it is deemed necessary to operate the project in a socially responsible manner.

(i) Irreversible and Irretrievable Commitment of Resources

The proposed Facility will require the irreversible and irretrievable commitment of certain human, material, environmental, and financial resources. For the most part, the commitment of these resources will be offset by the benefits that will result from implementation of the Facility. Human and financial resources will be expended by numerous entities including the Applicant, the State of New York (i.e., various state agencies), Chautauqua County, and the Towns of Charlotte, Cherry Creek, Arkwright, and Stockton for the planning and review of the Facility. The expenditure of funds and human resources will continue throughout the permitting and construction phases of the Facility (e.g., environmental reviews and Certification, environmental compliance monitoring and construction inspections).

The Facility also represents a commitment of land for the life of the Facility, proposed to be 20-25 years. Specifically, the land to be developed for wind turbines, access roads, the O&M building, the overhead collection and generator lead lines, collection and POI substations, a total of 85.7 acres, will not be available for alternative purposes for the life of the Facility. As a result of the implementation of the Facility, there will be relatively minor impacts to environmental resources such as soils, forest and wildlife habitat, wetlands and streams, agricultural land (see Exhibit 22 for additional detail). However, because the turbines/towers may be removed, and the land can be reclaimed for alternative uses upon Facility decommissioning (see Decommissioning in Exhibit 29), the commitment of this land to the Facility is neither irreversible nor irretrievable.

Various types of manufacturing and construction materials and building supplies will be committed to the Facility. The use of these materials, such as gravel, concrete, reinforcement steel, cables etc., will represent a long-term commitment of these resources, which will not be available for other projects. However, some of these materials (e.g., steel, gravel, cables) will be retrievable following the operational life of the Facility, and will likely be retrieved in accordance with Facility decommissioning.

Energy resources will be irretrievably committed to the Facility, during both the construction and operation of the Facility. Fuel, lubricants, and electricity will be required during turbine fabrication and activities associated with the manufacture of turbines and components of the electric collection/interconnect system, as well as operation of various types of construction equipment and vehicles on-site, and for the transportation of workers and materials to the Facility area. However, the energy resources utilized to construct and operate the Facility will be minor compared to the energy generated by the Facility (244,973 MWh) and made available to the state power grid.

(j) Impact Minimization Measures

General measures to minimize impacts from construction and operation of the Facility include compliance with the conditions of various local, state and/or federal regulations that will ultimately govern Facility development as well as the commitments made by the Applicant throughout this Application. The Facility has been sited in a manner to minimize potential impacts. Adherence to the setbacks presented in e(1) of this Exhibit is the chief measure used by the Applicant to minimize potential impacts resulting from the construction and operation of the Facility. For example, ice shedding, tower collapse, blade failure, stray voltage, and fire in the turbines, while unlikely, are all possible events that could pose a risk to public health and safety. However, by siting Facility components with setbacks from dwellings, roads, and other existing facilities, the risk from these types of incidents has been minimized. Adherence to the setbacks described in (e)(1) above also minimizes potential impacts resulting from noise and shadow flicker from the proposed Facility. The turbines are located on leased private property, therefore the public's access to the Facility is limited. In addition, the preferred alternative using taller turbines has minimized potential impacts to the environment by reducing the need for additional access roads and collection lines and disturbance of associated land areas that would be necessary to generate the same nameplate capacity from smaller and shorter turbines.

Article 10 regulations require public input into the environmental review of proposed development projects so that potential adverse impacts can be identified prior to implementation and avoided, minimized or mitigated to the greatest extent practicable. This Application was prepared in accordance with these regulations, and provides a primary means by which the potential costs and benefits of the Facility are described and weighed in a public forum. Facility alternatives are evaluated, and potential adverse impacts are identified, avoided, minimized and mitigated to the greatest extent practicable.

Beyond Article 10, compliance with the other regulations governing the development, design, construction and operation of the proposed Facility also will serve to minimize adverse impacts. For instance, federal permitting required by the U.S. Army Corps of Engineers will serve to protect water resources, along with implementation of a state-approved SPDES permit. Highway permitting at the local, county, and state level will assure that safety, congestion, and damage to highways in the area is avoided or minimized. For a detailed analysis of impact minimization measures to a given resource, please see the respective exhibit in this Application (e.g., for impact minimization measures associated with noise please see Exhibit 19, for impact minimization measures associated with wetlands please see Exhibit 22).

(k) Mitigation Measures

Facility development and operation will also include measures to mitigate potential impacts to public health and safety, which generally include the following:

- Adherence to the setbacks provided in section e(1) of this exhibit.
- Developing and implementing various plans to minimize adverse impacts to air, soil, and water resources (which can directly impact public health), including a dust control plan, sediment and erosion control plan, and Spill Prevention, Control, and Countermeasure (SPCC) plan.
- Documenting existing road conditions, and undertaking public road improvement/repair as required to mitigate impacts to local roadways.
- Development of an Emergency Action Plan with local first responders.
- Development of a Site Security Plan.
- Developing and implementing a complaint resolution plan to address landowner concerns throughout Project construction and operation.
- Preparing a compensatory wetland mitigation plan, as needed to mitigate impacts to streams and wetlands.

For a detailed analysis of impact mitigation measures to a given resource, please see the respective exhibit in this Application (e.g., for impact mitigation measures associated with noise please see Exhibit 19, for impact mitigation measures associated with wetlands please see Exhibit 22).

If additional, unanticipated mitigation is necessary as a result of unforeseen operational impacts, the Applicant will work with the Department of Public Service Staff, and the respective Towns, to develop an acceptable remedial plan to address any such impacts, with a timeline for implementation.

In addition, as previously mentioned the Applicant will implement a Complaint Resolution Plan (see Appendix T), which will consist of the following:

- Communications protocol and contacts for construction and operation
- Registering a complaint
- Process for gathering and analyzing information regarding the complaint

- Complaint Response and Tracking
- Complaint Response follow up

Each of these steps is described in the Complaint Resolution Plan in significant detail, and identifies all measures proposed by the Applicant to mitigate such impacts.

(l) Proposed Monitoring

The Applicant is committed to develop and operate its projects in a safe and environmentally responsible manner. In addition to the mitigation measures described/referenced above, an environmental compliance program will be implemented and the Applicant will provide funding for an independent, third party environmental monitor to oversee compliance with environmental commitments and permit requirements. The environmental compliance program will include the following components:

1. Planning – Prior to the start of construction, the environmental monitors will review all environmental permits and, based upon the conditions/requirements of the permits, prepare an environmental management document (Environmental Compliance Manual) that will be utilized for the duration of the construction and operation of the Project. This document will distill and clearly present all environmental requirements for construction and restoration included in all Project permits and approvals, and will be designed to aid in the management of environmental issues and concerns that may arise during construction of the Project. The Environmental Compliance Manual will include 1) copies of all issued environmental permits and approvals, 2) a compliance matrix that summarizes all relevant permit requirements and identifies the responsible party and time frame (if applicable), and 3) a Facility contact list and organizational chart.

2. Training – The environmental monitors will hold environmental training sessions that will be mandatory for all contractors and subcontractors before they begin working on the site. The purpose of the training sessions will be to distribute the Environmental Compliance Manual, explain the environmental compliance program in detail, prior to the start of construction, and to assure that all personnel on site are aware of the permitting requirements for construction of the Project.

3. Preconstruction Coordination – Prior to construction, the contractor(s) and the environmental monitors will conduct a walkover of areas to be affected by construction activities. The limits of work areas, especially in and adjacent to sensitive resource areas such as wetlands and forest land, will be defined by flagging, staking or fencing prior to construction, as needed. This walkover will identify landowner concerns, sensitive resources, limits of clearing,

proposed stream or wetland crossings, and placement of sediment and erosion control features. Specific construction procedures will be discussed amongst the group, and updated to become part of the Facility layout and construction sequence, as needed. The pre-construction site review will serve as a critical means of identifying any required changes in the construction of the Facility early enough in the process to avoid potential delays once construction has begun. Proposed changes to the construction plan will be identified as soon as possible, as changes may require an agency notification period and take time for approval to be received.

4. Construction and Restoration Inspection – The monitoring program will include daily inspection of construction work sites by the environmental monitor. The environmental monitor is the primary individual(s) responsible for overseeing and documenting compliance with environmental permit conditions on the Facility. The environmental monitor will conduct inspections of all areas requiring environmental compliance during construction activities, with an emphasis on those activities that are occurring within jurisdictional/sensitive areas, including cultural resource areas, wetland and stream crossings, forested areas, and active agricultural lands. When on site, the environmental monitor's schedule will include participation in a daily Plan of Day (POD) meeting with the contractors to obtain schedule updates, identify in-field monitoring priorities, and address any observed or anticipated compliance issues. During the course of each visit, multiple operations are likely to be occurring throughout the Facility Site, and will need to be monitored by the environmental monitor. Activities with the potential to impact jurisdictional/sensitive resources, or with greater potential for environmental impact, will receive priority attention from the environmental monitor. For instance, installation of an access road across a protected stream would likely receive greater attention than installation of buried electrical collection lines across a successional old field. However, some level of field inspection by the environmental monitor will occur at all earth-disturbing work sites during each site visit. The monitor will keep a log of daily construction activities, and will issue periodic/regular (typically weekly) reporting and compliance audits. Additionally, when construction is nearing completion in certain portions of the Facility Site, the monitor will work with the contractors to create a punch list of areas in need of restoration in accordance with all issued permits.

For monitoring associated with a given resource, please see the respective exhibit in this Application (e.g., for monitoring associated with avian/bat resources and agricultural land please see Exhibit 22). In addition, standard inspections will examine turbine components such as blades and towers for wear and tear and any issues or red flags that could cause a blade failure. Details regarding the inspection protocol and schedule is provided in the O&M plan attached as Appendix H.

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