

4906-17-05 Technical Data

(A) PROJECT AREA SITE

The following sections provide information on the location, major features, and the topographic, geologic, and hydrogeologic suitability of the Project area.

(1) Geography and Topography

The topography of the Project area is characterized as a relatively flat lying area and ranges from approximately 725 to 775 feet mean sea level (msl). Figure 5-1 depicts the geographic and topographic features of the Project area, as well as those features within a surrounding 5-mile radius of the Project area. This mapping was developed from the following United States Geological Survey (USGS) 7.5 minute, 1:24,000 topographic quadrangles, which occur within 5 miles of the Project area boundary: Convoy, Dixon (Ohio and Indiana), Glenmore, Latty, Middle Point, Oakwood, Payne, Scott, Van Wert, Wetsel, Woodburn South (Ohio and Indiana), and Wren. Due to the scale of the mapping, the edges of the proximity map also incorporate portions of other quadrangles that do not fall within a 5-mile radius, including: Continental, Delphos, and Ottoville. Among other information, Figure 5-1 shows the following features:

- The proposed Facility;
- Major population centers and geographic boundaries;
- Major transportation routes and utility corridors;
- Bodies of water which may be directly affected by the proposed Facility;
- Topographic contours;
- Major institutions, parks, and recreational areas;
- Residential, commercial, and industrial buildings and installations, and
- Air transportation facilities, existing or proposed.

(2) Aerial Photography

Figure 5-2 provides an aerial photograph of the Project area and includes the proposed location of turbines, access roads, the collection system, and other Facility components, in relation to surface features within a 1-mile radius of the Project area boundary. This mapping was developed using aerial photographs, available geographic information system (GIS) data for states, counties, and airports from Environmental Systems Research Institute (ESRI), available GIS data from the Ohio Department of Transportation (ODOT) for counties, townships, roads, active railroads, and cities, and available GIS data for local roads from Ohio Geographically Referenced Information Program (OGRIP).

(3) Site Mapping

Figure 5-3 depicts the proposed Project area and is presented at a scale of 1:12,000. The following features are presented on this figure:

- Topographic contours;
- Existing vegetative cover;
- Land use and classifications;
- Individual structures and installations;
- Surface bodies of water;
- Water and gas wells, and
- Vegetative cover that may be removed during construction.

(4) Geology and Seismology

The Facility is located within the Huron-Erie Lake Plain Section of the Central Lowland Physiographic Province (ODNR, 2009a). The Huron-Erie Lake Plain Section is further delineated into regions and districts, of which the Facility is situated within the Maumee Lake Plains district. The Maumee Lake Plains district varies in elevation from approximately 725 feet above msl to 775 feet above msl and is indicative of a flat-lying lake basin comprised of clay flats along with beach ridges, bars, dunes, and deltas.

The regional geology is characterized by Pleistocene sedimentary deposits comprised of silt, clay, and wave-plane clayey till overlying Silurian and Devonian age bedrock (ODNR, 2009a). Figure 5-4 presents a map depicting the glacial drift thickness of the Project area; Figure 5-5 presents the bedrock geology of the Project area.

Silurian age Salina Group bedrock is present beneath most of the site and consists of dolomite, anhydrite, gypsum, and shale (Barr Engineering Company [Barr], 2009). In the northwestern portion of the Project area, the Detroit River Group overlies the Salina Group and predominately consists of dolomite, sandstone, and shale (Barr, 2009). The Mesozoic and Cenozoic eras that followed this Paleozoic Era have been erased in Ohio's geologic record by the glacial events that occurred during the Pleistocene. The Wisconsinan glaciation was the most recent glacial event. This glaciation left two-thirds of Ohio covered with glacial tills and extensive ground moraines because of its several major advances and retreats. During the last glaciation, the Project area was covered by Glacial Lake Maumee, which resulted in the deposition of clay and silt. Near shore deposit of sand and silt bars formed due to wave action and water level fluctuations. In addition ground and end moraine deposit underlie glacial lake deposits in some areas (Barr, 2009). The impact of glaciation was further extended by glacial meltwater that deposited glaciofluvial deposits, such as sand and gravel deposits along major drainage channels. Dendritic drainage patterns were then re-cut as drainage was re-established (Schiefer, 2002).

(a) Site Geology

The Project area contains approximately 10 to 25 feet of unconsolidated glacial till and glaciofluvial deposits that overlie bedrock. The Applicant performed a preliminary geotechnical investigation of the Project area in order to determine soil and bedrock conditions, obtain geotechnical design data and undertake a preliminary foundation design. This geotechnical investigation included hollow stem auger drilling, rock coring, CPT, a DMT, and a preliminary karst risk evaluation. A copy of this report is presented in Appendix L.

Based on this investigation, the site geology was characterized as having less than 25 feet of unconsolidated deposits over lying bedrock. Approximately 2 feet of topsoil overlies glacially derived sediment. In the six hollow stem auger borings (T-22, T-42, T-71, T-103, T-120, and T-148), black topsoil was underlain by 0 to 5 feet of brown silt. A gray clay deposits ranging from 8 to 20 feet was present beneath the brown silt. Bedrock was encountered from 10 to 22 feet below ground surface (bgs) and was reported as a dolomite and dolomitic limestone in the boring logs. In order to evaluate rock quality, bedrock was cored from 9 to 12.5 feet in these boreholes. Shallow groundwater was encountered in all boreholes at depths ranging from 13 to 22 feet during drilling activities.

Near the proposed O&M building and batch plant area (in the southeastern portion of the Project area), borehole T-120 was advanced and encountered bedrock at 22 feet bgs. At this borehole location T-120, groundwater was encountered just above bedrock at 21 feet bgs.

Bedrock was shallower along the western side of the Project area. In borehole T-22 near Kilgore Road, bedrock was encountered at 10.5 feet bgs. During drilling, groundwater was encountered immediately above bedrock at 10 feet bgs. Shallow groundwater was encountered during site investigations and will need to be considered during foundation excavations. In addition, cone penetration tests (CPT) were performed at 12 locations at the Blue Creek site in order to obtain selected geotechnical engineering properties for soil in-situ. At turbine location 53, refusal was met at six feet while at other turbine locations refusal occurred at a deeper depth. (Barr, 2009)

Preliminary geotechnical design properties for soils were evaluated via laboratory testing that included grain size distribution with hydrometer analysis, moisture content, unconfined compressive strength, Atterberg Limit, Standard Proctor, and Thermal Resistivity and chemical analysis of soils (soluble chloride, soluble sulfate, and pH): Preliminary geotechnical parameters determined are identified in Table 5-1.

TABLE 5-1
Summary of Geotechnical Parameters for Foundation Design

Parameter	Value	Units
Undrained Soil Shear Strength (cohesive soil)	1,500	lb/ft ²
Soil Friction Angle (granular soil)	37	degrees
Min. Allowable Bearing Capacity, Normal Operating Load	3,100	lb/ft ²
Min. Allowable Bearing Capacity, Extreme Load	3,850	lb/ft ²
Min. Average Shear Wave Velocity	727	ft/s
Min. Design Small Strain Shear Modulus	2,235	kips/ft ²
Poisson Ratio	0.45	
Min. Foundation/Soil Friction Factor	0.4	
Backfill Density over Foundation (dry density = 95 pounds per cubic foot at moisture content = 12% minimum)	110	lb/ft ³
Frost Depth	40	Inches

Source: Barr, 2009.

The findings during the investigation indicate that the primary geological and soil suitability concerns include high groundwater table across the site and shallow bedrock in the western portion of the site. It is not anticipated that mitigation will be needed for geologic considerations based on the site conditions.

(b) Geologic Hazards

The potential geologic hazards examined in the Project area include potential hazards from landslides, seismicity, faults, soil liquefaction, and subsidence. Table 5-2 presents a summary of geological and geotechnical hazards as described in the geotechnical report.

TABLE 5-2
Geologic and Geotechnical Hazards Summary

Hazard	Present at Site?	Comment
Flooding/High groundwater	Yes	The site is relatively flat and poorly drained soils exist throughout much of the site and could be prone to localized flooding. Turbines 77-80 are located in a FEMA flood zone.
Slope failure	No	The site is relatively flat.
Subsidence – Pumping	Unlikely	Project area is underlain by bedrock with a framework capable of resisting subsidence due to production of oil, gas, or water.

TABLE 5-2
Geologic and Geotechnical Hazards Summary

Hazard	Present at Site?	Comment
Subsidence – Mining	No	Mining activity is limited to limestone quarry operation and no coal mining
Subsidence – Caves/Karst	Possibly	Bedrock is susceptible to dissolution, but no current karst hazards areas are presently known in the Project area.
Earthquake/Seismicity	Unlikely	The site is in a moderately low seismic area.
Swelling/shrinking soil	Yes	Lake origin (fat) clay soil is present throughout the site.
Corrosive soil	Possibly	Clay soils exist throughout the Project area, which are potentially corrosive to steel.
Made ground	Unlikely	No coal mining exists in the region and there does not appear to be any significant relief associated with raised grades. There is a small potential for filled areas associated with the low-lying swamp areas.
Collapsible soil	No	Collapsible soils are not known or likely to be present.
Volcanic activity	No	No current volcanic activity exists in the region.
Quick clay	No	Quick clay conditions are not known or likely to be present.

Source: Barr, 2009.

Due to these periods of glaciation, the Project area is relatively flat-lying with a relief of only about 50 feet across the Project area. Therefore, landslides are highly unlikely to occur within the Project area.

Ohio has experienced as many as 160 earthquakes since 1776, the majority of which have caused no injuries or property damage (Dart, 2008). According to the map *Earthquake Epicenters in Ohio and Adjacent Areas*, a cluster of earthquakes has occurred just southeast of the Project area (ODNR, 2009b). This area coincides with the largest earthquake on record in Ohio. This earthquake had an estimated magnitude of 5.4 and occurred on March 8, 1937 near Anna in Shelby County, Ohio (Dart, 2008). Two earthquakes of lesser intensity were felt in the area on March 2 and 3, 1937 (USGS, 2009a). The total felt area of the March 8, 1937 earthquake comprised approximately 150 square miles, encompassing all of Ohio and Indiana and parts of Illinois, Kentucky, Michigan, Missouri, Pennsylvania, West Virginia, Wisconsin, and Ontario, Canada (USGS, 2009a). In Anna, brick chimneys fell, and foundations were cracked (USGS, 2009b).

Approximately 7 miles south of Anna, in Sidney, damage was limited to a few fallen chimneys and cracked plaster walls. Productivity of oil and gas wells in the region was reduced after the event; alternately, flow from some water wells and springs was renewed or increased (USGS, 2009b). It is estimated that at least 40 earthquakes have been felt in this specific area since 1875 (Dart, 2008). A search was performed for historical earthquake epicenters and fault lines to determine if these geologic hazards pose any potential risks in the Project area. There are no known historic earthquake epicenters of quaternary faults within 5 miles of the Project area (Figure 5-6).

Soil liquefaction is a process whereby the strength and stiffness of a soil is reduced because of earthquake shaking or similar rapid loading (i.e., blasting) (Johannson, 2000). Liquefaction may occur in saturated soils (meaning soils in which soil pore space is completely filled with water) and sandy soils. Soil liquefaction is more likely to occur on areas of land reclamation. When liquefaction does occur, the strength of the soil decreases sharply, resulting in a reduced ability to support infrastructure such as foundations and similar structures. During liquefaction, these water-saturated soils essentially behave like fluids. The Facility possesses a low risk of a high intensity earthquake, and no land reclamation sites are within the Project area (ODNR, 2006). Additionally, sandy soils do not occur within the Project area (Figure 5-7). Therefore, soil liquefaction does not present a geologic hazard to this Facility.

Karst topography develops due to the dissolution of soluble limestone or dolomite bedrock layers. Subsidence may potentially result from the dissolution of this bedrock. The Project area is not situated in a probable karst area (ODNR, 2009c). In addition, the Applicant has performed a preliminary geotechnical evaluation (Appendix L) of the Project area and plans on conducting geotechnical investigations to evaluate foundations at each location in spring 2010. As part of this investigation, a karst evaluation of the site was performed and included a literature review; review of borehole rock cores and groundwater data; a visit and

inspection of the Scott Quarry 9 (a dolomite and dolomitic limestone quarry) for karst features and communication with local geological experts. This evaluation concluded that the potential risk from karst feature was low due to the bedrock being dolomitic; the limited fluctuation of groundwater levels due to the flat topography; a stable potentiometric surface in the overburden; and no evidence of karst features were observed or identified in consultation with local experts. Subsidence can also occur due to subsurface mining; however, no subsurface mines are situated beneath the Project area (ODNR, 2006).

(c) Soil Suitability

Soils form over time as the local climate and other environmental factors work on the parent material. Ohio soils formed in a generally humid temperate climate with a deciduous forest cover, leading to the development of Alfisols throughout much of the state (Schiefer, 2002).

In *Basin Descriptions and Flow Characteristics of Ohio Streams*, the Project area is situated within Soil Region 1 (Schiefer, 2002). According to this region's description, the Project areas soils will have developed from calcareous lake-deposited clay and silt beneath elm-ash swamp forests. Generally, these soils seem to have slow permeability and drainage.

Approximately 45 different soil types occur within the Project area. The textures of the Project area's soil associations include loam, silty clay loam, silt loam, silty clay, and clay. Of the soil associations in the Project area, the Defiance silty clay loam and the Shoals silt loam are occasionally flooded, and the Wabasha silty clay loam is frequently flooded. Hydric soils and wetland sites are discussed in Section 4906-17-08(B)(1), *Project Site Information*, and the potential risks associated with construction on frequently flooded soils is addressed in Section 4906-17-05(A)(5), *Hydrology and Wind*.

Soils in the Project area were reviewed for other potential hazards that may present challenges during construction of the Facility. Such hazards include high compaction potential, low revegetation potential, and erodibility concerns.

Soils that demonstrate the potential for shallow bedrock or restrictive layers occur within the Project area at a frequency of less than approximately one percent of the total area. Therefore, the potential impacts of soil restrictive layers or shallow bedrock on the Facility are minimal. Soils were considered to demonstrate this potential if a restrictive layer or bedrock was found within 6.5 feet bgs.

High compaction potential was determined to be present within the Project area at a frequency of approximately less than one percent. Soils were determined to possess the potential for high compaction if the soil texture was fine, fine loamy, very fine, or coarse loamy. Soils with high compaction potential will be monitored during construction within active agricultural lands in order to minimize potential impacts to arable land. An agricultural mitigation plan will be developed as part of the Facility and is discussed in more detail in Section 4906-17-08(F)(2)(b), *Irrigation*.

Low revegetation potential was examined to determine areas where soil stabilization may require increased effort as part of the implementation of a Stormwater Pollution Prevention Plan (SWPPP). Appendix M provides the SWPPP. Temporary and permanent seeding of cleared areas will be one method employed to stabilize soils and minimize erosion. An area was determined to be of low revegetation potential if its land capability class was III or below. The land capability class consists of 8 classes (I through VIII), and the criteria for placing a given area in a particular class involve its use as cropland, landscape location, slope of the field, depth, texture, and reaction of the soil. Class I through IV represent arable land capable for use as cropland, where limitations of use and conservation management practices increase from I through IV, while Classes V through VIII represent land not suitable for use as cropland but suitable for other uses such as pasture, woodland, range, grazing, recreational, or aesthetic

purposes. Soils within the Project area consist of land capability classes of I through III, and erosion and sedimentation control will be achieved through careful implementation of the SWPPP for the Facility.

Soils that possess the risk of high erodibility occur within the Project area represent approximately 0.6 percent of the total area. Therefore, there is minimal risk associated with highly erodible soils. An erosion control and sedimentation plan and SWPPP will be developed and implemented during construction in order to control stormwater and associated soil erosion and sedimentation during construction activities. The suitability of the Project area is discussed in more detail in the geotechnical investigation report (Appendix L). The geotechnical investigation report indicates that the site is suitable for construction of the Facility.

(5) Hydrology and Wind

(a) Water Budgets

(i) Surface Water Resources

The Facility is situated within the Maumee River Drainage Basin. The Maumee River is 105 miles in length and drains approximately 6,608 square miles (ODNR, 2001). The USGS maps the Facility within the Auglaize River Watershed, Hydrologic Unit Code (HUC) 041700004. The Auglaize River is approximately 102 miles in length and drains approximately 2,435 square miles (ODNR, 2001). The mapped perennial streams within the Project area include Blue Creek, Dry Creek, Hagerman Creek, Hoaglin Creek, Hog Run, Maddox Creek, Monkey Creek, Pottawatomie Creek, Prairie Creek, Town Creek, Middle Prairie Creek, and Upper Prairie Creek.

Average annual precipitation in vicinity of the Facility for the period 1931 to 1980 ranges from 33 to 37 inches (ODNR, 1992). No surface water

gauges are located within the Project area. However, a USGS gauge (04191500) is installed on the Auglaize River near Defiance, Ohio downstream of the Project area. The period of flow record is from 1915 to 2008. The annual 7-day minimum flow between water years 1915 and 2008 is 1.1 cubic feet per second (cfs). The annual mean flow between water years 1915 and 2008 is 1,855 cfs (USGS, 2009c). Furthermore, using the U.S. Environmental Protection Agency (USEPA) model for low flow analysis DFLOW (USEPA, 2009a) and daily flow values from October 1, 1915 to September 30, 2008 at USGS gauge 04191500 (USGS, 2009c), the estimated lowest 7-day flow in 10 years (7Q10 value) is 13.3 cfs. Historical records of water tables during the past 10 years are not available for the Project area or at USGS gauge 04191500. The proposed Facility will consume and discharge only minimum amounts of water; therefore, the Facility is not anticipated to cause any measurable impact to water tables within the Project area.

According to the *Ohio 2008 Integrated Water Quality Monitoring and Assessment Report* (2008 Integrated Report), none of the streams within the Project area are listed on the impaired waters list pursuant to Sections 303(d), 305(b), and 314 of the federal Clean Water Act (OEPA, 2009a). Appendix K of the Integrated Report (OEPA, 2009a) shows that the watershed contains insufficient data to due to the lack of monitoring sites within the Project area's watershed. However, there are sufficient monitoring stations to analyze water quality downstream of the Project area. The Auglaize and Maumee Rivers, to which the Project area drains, contains detailed water quality assessment information in the 2008 Integrated Report. Table 5-3 provides relevant data for the Project area

TABLE 5-3
Relevant Water Quality Data for the Project Area

Large River Assessment Unit	River Miles				Aquatic Life Use Assessment			Fish Consumption Assessment		Recreation Use Assessment	
	Total Length / Total Monitored	Non-Attainment	Partial Attainment	Attainment	Designation	High Magnitude Impairment Cause	High Magnitude Impairment Source	Impairment	Pollutant	Subcategory of Use	Impairment
Auglaize River Mainstem (downstream Ottawa River to mouth)	33.26 / 23.73	5.37	4.10	14.26	Warm Water Habitat	Flow Alteration	<ul style="list-style-type: none"> Flow Regulation / Modification Channelization 	Yes	Mercury	Primary Contact Recreation	Unknown
Prairie Creek *	N/A	N/A	N/A	N/A	Modified Warm Water Habitat – Channelized	Unknown if impaired	Unknown if impaired	Unknown	Unknown	Primary Contact Recreation	Unknown
Maumee River Mainstem (Indiana state border to Lake Erie)	107.87 / 95.67	45.35	26.72	23.60	Warm Water Habitat	<ul style="list-style-type: none"> Flow Alteration Habitat Alterations Turbidity Nutrients Unionized Ammonia Siltation Total Toxics 	<ul style="list-style-type: none"> Non-irrigated Crop Production Channelization Combined Sewer Overflow Major Municipal Point Source 	Yes	Polychlorinated Biphenyls	Primary Contact Recreation	No

Source: OEPA, 2009a.

* Prairie Creek is listed as Category 3 in the Integrated Assessment Report, indicating the OEPA has insufficient data for the waterbody segment to determine whether any designated uses are met.

(ii) Groundwater Resources

The western portion of Ohio is underlain by carbonate aquifer systems (limestone or dolomite), and the principal aquifer in the Project area is comprised of limestone bedrock. Middle Devonian and Silurian limestone and dolomite reach a total thickness of 300 to 600 feet and are capable of yielding from 100 to over 500 gallons per minute (gpm) of water (OEPA, 2009a). According to the map “Ground-Water Resources of Van Wert County,” a deep well within the Project area had an approximate yield 850 gpm at a depth of 258 feet (ODNR, 1982). This map also shows depth to bedrock is as little as 7 feet and as much as 28 feet within the Project area (ODNR, 1982; ODNR, 1986). Figure 5-8 provides a characterization of the carbonate aquifer systems within the Project area.

Unconsolidated aquifers in Project area generally consist of glacial till and yield less than 5 gpm (ODNR, 2009d; ODNR, 2009e). Domestic and agricultural supply wells typically access these unconsolidated aquifers and, in the Project area, generally range in depth from 40 to 90 feet bgs; yields are in the range of 5 to 15 gpm (ODNR, 1982; ODNR, 1986). Figure 5-8 illustrates unconsolidated aquifers in the Project area and the range of the aquifers’ typical yield in gallons per minute.

No sole source aquifers are located near the Project area. The Allen County Area Combined Aquifer System (ACACAS), situated approximately 8 miles to the southeast of the Facility, is the closest designated sole source aquifer by the USEPA. Observation well VW-1 is located approximately 3 miles south of the Project area in Van Wert County. For the period of record from 1957 to 2008, the maximum depth to groundwater was 33.2 feet bgs and the minimum depth was 18.4 feet bgs (ODNR, 2009f).

No adverse impacts are anticipated to the aquifer systems within the Project area, including the ACACAS. The Facility is not likely to pose any risk of contaminant release that will compromise the quality of the groundwater resources.

(iii) Construction Water Usage

Water use during construction of the Facility will entail such operations as temporary concrete batch plant operations and dust suppression.

The Applicant is evaluating the possibility of creating a temporary concrete batch plant for producing the concrete necessary during Facility construction. This plant will be located on a 20-acre property located in the southeastern portion of the Project area and will be the location of the future O&M building. It is estimated that the plant will operate 6 days a week and produce up to 1,500 cubic yards of concrete per day. Based on this production rate, the estimated water demand will be approximately 55,000 gallons per day (gpd) (about 115 gpm) and will be supplied from two onsite bedrock wells. These wells will be drilled and completed at a depth of several hundred feet. Available water well logs near this site indicate that the deepest local domestic well was 63 feet in depth and is completed in bedrock. If a batch plant is utilized, a production test well and associated observation wells will be installed in Spring 2010 and tested to determine the specific yield for the well. Depending on the production test well results, a water storage tank may be considered to reduce peak demand on the water supply wells. In addition to batch plant water use, water will be used for road watering. Construction water demands for the site will be temporary. Portable facilities will be used for construction workers; therefore, they will not require water.

(iv) Operation Water Usage

Operation of the wind farm will require minimal water usage, as wind turbines do not consume or use water for their operation. Water will be consumed as part of the regular potable water use for the O&M building and is estimated to be 1,000 gpd based on 20 full-time employees and an average per capita use of 50 gpd. Water discharges from the O&M building include both sanitary wastewater discharges from the O&M building and stormwater discharges. Sanitary wastewater from the O&M building will be discharged to a septic system constructed onsite in amounts similar to a residential structure.

The Facility entails construction of impervious surfaces, including turbine foundations and access roads; however, the additional impervious surface areas are insignificant when compared with the overall potential recharge zone. Therefore, the Facility is not anticipated to affect the water budget adversely within the Project area.

(b) Floods and High Winds**(i) Floods**

According to ODNR, a floodplain is divided into two categories for regulatory purposes: the floodway and the flood fringe (ODNR, 2009g). The floodway contains the channel and the adjacent portion of the floodplain required to pass the 100-year flood with no increase in flood height, while the flood fringe contains the remainder of the floodplain outside of the floodway (ODNR, 2009g). Generally, the floodway contains the fastest moving water during flooding conditions. As development will block the free flow of water and potentially increase the water's depth and velocity, most floodplain development regulations are focused on preventing development that will hinder the free flow of water within the floodway. Development in the flood fringe is allowed

under certain stipulations that may include construction of the structure above the base flood elevation or waterproofing the structure.

Figure 5-9 illustrates the 100-year floodplains that occur with the Project area, as mapped by the Federal Emergency Management Agency (FEMA). No turbines or access roads will be constructed within the mapped 100-year floodplain.

As currently proposed, underground collector lines will cross the 100-year floodplain associated with Blue Creek, Hoaglin Creek, and Prairie Creek, and an overhead collector line will cross the 100-year floodplain of Hoaglin Creek. The underground collector lines will have no permanent impacts on the 100-year floodplains of these waterbodies. Impacts within the floodplain will be temporary during construction activities, consisting of trenching for the collector lines and subsequent backfilling of the trenches. The topography within the floodplain will be restored to its pre-construction contours. Therefore, the flow pathway and the flood storage capacity within the floodplain will not be altered. Additionally, the overhead collector lines will have no permanent impacts on floodplains within the Project area, as foundations will be placed outside of the mapped 100-year floodplain resources. Foundations, if constructed within the floodplain, have the potential to alter flow depths and velocities by creating an obstruction to the free flow of water within the floodplain. The Applicant has minimized impact to floodplains to the greatest extent practicable, and according to the local floodplain managers, no permit is required for the construction of underground or overhead utilities within the floodplain.

(ii) Winds

Wind turbines are designed to withstand potential high winds and selected based on a turbine's capacity to tolerate a Project area's high wind force

potential. The Facility is likely to employ the use of the G-90 turbine model. Per the manufacturer, the G-90 model is certified to Class IIIA winds. According to the International Electrotechnical Commission (IEC), Class IIIA-qualified turbines are specified to withstand winds to 83.9 mph at hub height for an extreme 10-minute average wind speed (once per 50 years), also known as the Reference Wind Speed (IEC, 1999). These specifications constitute the minimum design standards to be achieved by the turbine and do not necessarily indicate a point of certain failure. Wind resources in the Project area have been classified as Class 2 at 164 feet, with average wind speeds of 12.5 to 14.3 mph as estimated by the U.S. Department of Energy, National Renewable Energy Laboratory (NREL, 2004). WindNavigator® from AWS Truewind, LLC (AWS) estimates the average wind speed at 328 feet (the hub height for the proposed Facility) to be between 14.5 mph and 15.7 mph (AWS, 2009). Therefore, damage to structures from high winds is not anticipated.

Additionally, the Facility will comply with Heartland Wind's internal guidelines, and local regulations for setbacks of wind turbines from residential and other structures, property lines, and public roads in order to minimize property damage and public safety concerns in the unlikely event of a structural failure due to high wind force.

(c) Maps

Figure 5-8 shows the existing groundwater aquifers in the Project area.

(B) LAYOUT AND CONSTRUCTION

This section describes the layout and construction of the Facility.

(1) Project Area Site Activities

The Applicant will develop a site layout with an adequate wind resource, suitable transmission in close proximity, land availability, and minimal environmental or

ecological constraints. This section discusses site preparation and reclamation operations anticipated as part of Facility development. Figure 5-10 presents a layout of the proposed Facility.

Several activities must be completed before the proposed commercial operation dates of December 2011 (Phase I) and December 2012 (Phase II). The majority of the activities relate to design and construction of the Facility. The list below summarizes the activities that will be completed in order to bring the Facility online.

- Final turbine micro-siting;
- Allocating wind turbine components, including towers, nacelles, and blades from IBR's standing order with its supplier;
- Ordering step-up transformers, circuit breakers, turbine switchgear, and other electrical equipment;
- Complete survey to establish locations of structures and roadways;
- Soil borings, testing, and analysis for proper foundation design and materials;
- Complete construction of access roads to be used for construction and maintenance;
- Installation of tower foundations;
- Installation of the underground collection system and aboveground 34.5 kV and 115 kV electrical lines;
- Tower placement and wind turbine setting;
- Install the substations;
- Install the O&M building;
- Install the met tower(s) and SODAR unit;

- Install the communication system, including supervisory control and data acquisition (SCADA) software and hardware, telephone and fiber optic cable;
- Acceptance testing of facility; and
- Commencement of commercial operation date.

Temporary disturbances during construction of the Facility include crane pads at each turbine site, temporary travel routes for the cranes, temporary laydown areas around each turbine, trenching for the underground electrical collection system, batch plant, construction offices, and storage/stockpile area. Details of the acreages of impacts for each of these components is discussed in Section 4906-17-03(A)(1)(b), *Land Area Requirements*.

During the construction phase, several types of light, medium, and heavy-duty construction vehicles will travel to and from the Project area, as well as private vehicles used by the construction personnel. The Applicant estimates the following will occur during peak construction periods when the majority of the foundation tower assembly is taking place:

- Approximately 20 large truck trips per day (delivering wind turbines and associated equipment);
- Up to 160 concrete trucks per day for related batch plant activities; and
- Up to 100 small vehicle (pickups and automobiles) trips per day within the Project area.

At the completion of the construction phase, this equipment will be removed from the site or reduced in number. Before construction, the Applicant will coordinate with state and local jurisdictions (counties and townships) in order to inspect the condition of local roads and bridges and to obtain the necessary road and driveway access and oversize vehicle permits.

The civil contractor will be the lead entity for site preparation and construction management of the Facility. The primary civil, erection and electrical contractors will use the services of local contractors, where possible, to assist in the construction of the Facility. The primary contractors, in coordination with local subcontractors, will undertake the following activities:

- Secure building, electrical, grading, road, and utility permits;
- Perform detailed civil, structural, and electrical engineering;
- Schedule execution of construction activities;
- Complete surveying and geotechnical investigations; and
- Forecast labor requirements and budgeting.

The primary contractors also serve as key contacts and interfaces for subcontractor coordination. The Applicant will have a site construction manager responsible for managing the overall coordination between contractors. The electrical contractor will oversee the installation of communication and electric collection lines as well as the substations. The civil contractor will oversee the installation of roads and foundations, as well as the coordination of aggregate and concrete materials receiving, inventory, and distribution. The construction consists of the following tasks:

- Site development, including roads;
- Foundation excavation;
- Concrete foundations;
- All electrical and communications installation;
- Substation construction;
- Tower assembly and machine erection; and
- System testing.

The construction team will be onsite to handle materials purchasing, deliveries, construction, and quality control. The primary contractors will select and manage their local subcontractors to complete all aspects of construction.

Throughout the construction phase, ongoing coordination occurs between the Applicant, Facility development, and the construction teams. The Applicant will have an onsite manager to coordinate all aspects of the Facility, including ongoing communication with local officials, citizens, and landowners. Even before the Facility becomes fully operational, O&M staff will be integrated into the construction phase of the Facility. The construction manager and the O&M staff manager work together to transition from construction through Facility commissioning and, finally, into operations.

Construction aspects or key Facility components are described below.

(a) Wind Turbine Foundation

The Facility will be constructed in groups of turbines. After access roads have been constructed for a particular group, vegetation will be removed for the crane pad and staging area. After the crane pad is constructed, a tower crane will be brought onsite. Delivery, storage, and assembly of turbine components will occur at each turbine staging area. Each turbine staging area will require a 150-foot radius during construction. This includes an approximately 40 foot by 60 foot area for the crane pad extending from the access road to the turbine foundation, and an area for component laydown and rotor assembly centered close to the turbine foundation.

The Applicant will contract with one or more construction companies to build the tower foundations and gravel aprons. An onsite batch plant is being considered and could provide concrete if the Applicant is not able to contract with local concrete suppliers. Appendix N provides a drawing of a typical batch plant. Figure 5-10 shows the location of the onsite batch plant.

Each turbine tower will be supported by a reinforced concrete foundation up to 65 feet wide. The foundation could be either a spread-foot or a caisson-type concrete foundation. The actual foundation design for each turbine will be determined based on site-specific geotechnical evaluations and structural loading requirements of the selected turbine model. The majority of the turbine

foundation will be underground, and only a portion of it will be covered with gravel for fire protection, up to 10 feet of nonflammable groundcover around the towers on all sides, referred to as the gravel apron. The turbine pad will be located within the graveled area. In the event the GE turbine model is used, a pad-mounted transformer will be located within the graveled area. For all other proposed turbine models, the transformer will be located in the nacelle. The area permanently disturbed during operations will be approximately 75 feet by 100 feet. The dimensions for the G-90 turbine include a steel tower with a diameter at the base of 13.4 feet and surrounding gravel area with a width of up to 10 feet.

The portion of the foundation that is above 3 feet below grade is called the pedestal. The bottom of the pedestal will be 3 feet below grade and the top of the pedestal will be 0.5 foot above grade. The pedestal will be up to 18 feet in diameter and will be approximately 3 feet in depth. Below the pedestal is the remainder of the spread foundation. The estimated amount of concrete in the foundation is 700 cubic yards.

During turbine foundation construction, dewatering may be required. Dewatering activities will be in accordance with the National Pollutant Discharge Elimination System (NPDES) permit approved by the OEPA. Control measures for dewatering activities will be included in the SWPPP.

After the turbine foundation is built, a tower crane will be brought onsite. Sections of the tower will be installed followed by the nacelle at the top. The blades are then fixed to the hub to create the rotor and lifted by crane onto the nacelle.

(b) Underground Electric Collection System

The underground collection system will be installed through direct burial methods, typically using a trench machine. The 20-foot wide temporary right-of-way (ROW) will be buried at approximately 4 feet deep. In areas where the two

or more sets of underground lines merge, pad-mounted junction boxes will be used to tie the lines together into larger feeder conductors. Junction box locations will be determined with farming operations in mind. Any excavated areas will be backfilled with native soil.

(c) Aboveground Collection Lines

Aboveground collection lines required for the Facility will include 34.5 kV and some 115 kV collection line. The 34.5 kV collection line will be supported by wood or steel monopole support structures, and will require the temporary disturbance of a 100-foot ROW. The structures will be buried to a depth of approximately 8.5 feet and will have a total height of approximately 56 feet above grade to the top of the poles. Construction of the aboveground collection line will require vegetation removal, assembly of the support structure, and stringing of the conductors. Permanent impacts will be limited to the support structure footings. Appendix D provides a drawing of a typical monopole support structure.

The 115 kV aboveground collection lines located between the collection substations and the Facility collection/interconnection substation will be approximate 6.0 miles in length and will require the temporary disturbance of a 100-foot ROW. The 115 kV line will be supported either by H-frame structures with two galvanized steel or wood poles; or by a galvanized steel or wood monopole structure. The structures will rise to a height of approximately 100 feet above grade. Construction of the aboveground electric line will require vegetation removal, assembly of the support structure, and stringing of the conductors. Permanent impacts will be limited to the support structure footings. Appendix D shows the dimensions of the 115 kV H-frame and monopole aboveground line support structure.

Overhead collector lines will be constructed in accordance with the recommendations of the Avian Power Line Interaction Committee (APLIC) for raptor protection on power lines. .

(d) Substations

Four new substations will be required for the Facility. Construction of the substations will require agricultural vegetation removal, assembly of the circuit breakers, switches, and associated bus work, cabling, and control and relaying systems. Approximately 5 acres will be required for each substation for construction and operation. Two of the substations (totaling approximately 10 acres) will be located within a 20-acre parcel in the southern portion of the Project area adjacent to the O&M building and temporary construction and staging area. Substations will most likely use concrete pier or slab foundations.

(e) O&M Building

A permanent O&M building will be constructed as part of the Facility and will be located on a 20-acre parcel in the southern portion of the Project area. The O&M building will be of sheet metal construction and be used to house equipment to operate and maintain the Facility. The O&M building will also include administrative offices, monitoring stations, and storage for wind turbine parts and other small equipment. The O&M building is anticipated to be approximately 6,000 square feet of enclosed space and include an office and workshop area, parts warehouse, kitchen, bathroom, shower and utility sink. The O&M building is anticipated to be approximately 20 feet high (to the roof peak). Construction of the building will require vegetation removal, pouring of the concrete foundation, assembly of the sheet metal exterior and interior walls, electrical and plumbing work, and other activities. The O&M building will most likely use a concrete slab foundation. Appendix A provides a drawing and photo of a typical O&M building.

(f) Test Borings and Cone Penetrating Test

A preliminary geotechnical investigation was performed by Barr to obtain information on the physical properties of the soil and rock within the Project area. A geotechnical engineer designed and conducted the geotechnical investigation to

determine the suitability of the site for construction of the Facility. All test borings were completed in accordance with the American Society for Testing and Materials (ASTM) standards. Soil samples collected during the investigation were analyzed at a qualified laboratory for particle size, moisture content, and Atterberg limits.

The information gathered during this investigation will assist the Applicant with the foundation design for the wind turbines and will help to identify geologic hazards. Six soil borings were obtained and in representative locations within the Project area. The borings extended to the depth of bedrock that ranged from 26 to 34.5 feet. Approximately 10.5 to 22 feet of soil overburden were encountered, including a couple feet of topsoil underlain by a brown silt and/or gray clay.

Cone Penetration Tests (CPT) were performed at 12 locations at the Blue Creek site in accordance with ASTM D5778 – Standard Test Method for Performing Electronic Friction Cone and Piezocone Penetration Testing of Soils. CPT is a method for obtaining selected geotechnical engineering properties for soil in-situ and involves pushing a cylindrical cone into the subsurface at a rate of 20 millimeters per second until the refusal for cone advancement was reached. During advancement, measurements of cone tip resistance, side friction and pore water pressure were obtained. At turbine location 53, refusal was met at six feet while at other turbine locations refusal occurred at a deeper depth. (Barr, 2009)

Appendix L provides a copy of a report summarizing the preliminary geological investigation. Turbine-specific final geotechnical studies will be conducted from April to May 2010, and the final geotechnical report submitted in June 2010.

(g) Removal of Vegetation

Construction of the Facility will require removal of vegetation at all turbine sites, access roads, collection system line routes, substations, temporary staging and construction laydown area, met tower(s) and SODAR facility, and O&M building locations. It is assumed that a 150-foot radius will be cleared for each turbine

footprint, a 40-foot wide corridor for access roads, a 20-foot wide corridor for the underground collection system, and 100-foot wide corridor for the aboveground 34.5 kV and 115 kV collection lines. Two of the substations will require 5 acres each for construction. Two substations will be constructed within a 20-acre area that will include the temporary staging construction laydown area, O&M building, and temporary concrete batch plant.

It is anticipated that 787.1 acres of vegetation (782.0 acres of cultivated crops and 4.7 acres of deciduous forest) will be temporarily removed during construction of the Facility; and of that, 234.0 acres (230.5 acres of cultivated crops and 3.5 acres of deciduous forest) will be removed permanently. Temporarily disturbed areas will be re-seeded to blend in with existing vegetation as needed. To the extent practicable, disturbance of wetlands during construction and operation of the Facility will be avoided. Applicable permit approvals will be obtained for any impacts to jurisdictional wetlands.

The majority of the Project area is agricultural land. The Facility has been designed to avoid forested areas; therefore, limited tree clearing is expected. The Applicant will use BMPs during construction and operation of the Facility to protect topsoil and adjacent resources and to minimize soil erosion. Practices may include containing excavated material, protecting exposed soil and stabilizing restored material, and revegetating areas.

The Applicant will dispose of all vegetation that has to be removed. The topsoil will be stripped and stockpiled within the construction area for later use during restoration activities. Trees cleared from the Project area will be cut into logs and either left for the landowner or removed. Limbs and brush will be buried, chipped, or otherwise disposed of as directed by the landowner and as required under federal, state, and local regulations.

(h) Grading and Drainage

After the removal of vegetation, the construction area will be uniformly graded, compacted, and sloped to drain. Site grading will be compatible with the general topography and use of the adjacent properties. As part of the NPDES General Permit for the Facility, a SWPPP will be developed. The SWPPP will be implemented to prevent erosion, sedimentation, and other potential discharges of soil-bearing water runoff to waterbodies and wetlands. Erosion control devices such as hay bales, berms, silt fencing, and other measures will be installed. The location of these measures will be identified on the construction drawings and will be approved by the OEPA as part of the NPDES review. A qualified individual will inspect these and other erosion control features throughout construction to ensure they are installed correctly and functioning properly.

The Facility will be constructed in a manner that will not drastically change the current site drainage patterns. During final design, a drainage plan will be developed. Culverts of sufficient size will be installed in appropriate access road locations so that natural drainage patterns are not impeded. Subsurface drainage features such as tile drains will be avoided where possible. Drain tiles found during the construction will be marked with labeled with highly visible lathe to ensure temporary and permanent repairs are made in accordance with the Applicant's mitigation measures as discussed in Section 4906-17-08(F), *Agricultural District Impact*.

(i) Access Roads

Wherever possible, existing roads will be upgraded for use as an access road during construction and maintenance activities. Where an existing road is not available, new temporary and permanent access roads will be constructed. The roads have been sited in consultation with local landowners. The roads will facilitate both construction and ongoing operation and maintenance. Siting roads in areas with unstable soil will be avoided. All roads will include appropriate

drainage and culverts while still allowing for the crossing of farm equipment. The applicant will select the location of these temporary and permanent access roads to minimize or avoid sensitive resources.

Private access roads will be built adjacent to the towers, allowing access to the turbine strings both during and after construction. During construction, the roads will be approximately 40 feet wide to accommodate safe crane movement, equipment delivery, and other construction vehicles. After construction is complete, permanent access roads will be utilized for maintenance activities. The 37.0 miles of access roads will be up to 20 feet wide (including the access road and drainage channels).

These roads will consist of graded dirt overlaid with geotechnical fabric (if needed) and covered with gravel. The roads will be prepared to support the size and weight of maintenance vehicles.

(j) Removal and Disposal of Debris

Facility construction will generate some solid waste, primarily consisting of packaging materials (i.e., plastic shrink wrap, wood and wooden pallets, cardboard, and metal packing), construction scrap (i.e., reinforcement bar scraps, excess concrete from washout stations, cable spools, and excess electrical cable), and general refuse (i.e., trailer office materials and debris from employees). The debris and solid waste generated will be collected from turbine sites and other Facility work areas and disposed of in dumpsters located at the construction staging area(s). A private contractor will then empty the dumpsters on an as-needed basis, and dispose of the refuse at a licensed solid waste disposal facility.

(k) Post-Construction Reclamation

After construction, Applicant will restore all temporary construction areas to preexisting contours and land use. Soil will be decompacted if needed and stockpiled topsoil will be spread where appropriate. All exposed soils will be

stabilized by re-seeding, as agreed to by landowners. Section 4906-17-08(F), *Agricultural District Impacts*, provides further discussion of post-construction reclamation activities and mitigation.

(2) Layout

Figure 5-10 provides a map that shows the various elements of the Facility.

(a) Wind-Powered Electric Generation Turbines

Figure 5-10 provides the location of the proposed 167 G-90 wind-powered electric generating turbines at the scale of 1:12,000.

(b) Transformers and Collection Lines

The proposed Facility will require approximately 78.6 miles of underground and 3.7 miles of aboveground 34.5 kV collection system and approximately 6.0 miles of aboveground 115 kV collection line. Figure 5-10 provides the location of the collection lines. In the event the GE turbine model is used, a pad-mounted transformer will be located near the base of the turbine. For all other proposed turbine models, the transformer will be located in the nacelle.

(c) Construction Laydown Areas

The proposed Facility will require one temporary staging and construction laydown area that will be located within a 20-acre parcel in the southern portion of the Project area that contains several Facility features, as detailed in Section 4906-17-03(A)(1)(b), *Land Area Requirements*. Figure 5-10 provides the location of the temporary staging and construction laydown area.

(d) Transmission Lines

No transmission lines in excess of 125 kV will be required for the Facility. Collector lines planned for the Facility include 34.5 kV underground and aboveground collector lines and 115 kV aboveground collector lines.

(e) Substations

Four substations will be built for the Facility. Each substation is anticipated to require a total of 5 acres of land for construction and operational purposes. Two of the substations will be located within a 20-acre parcel in the southern portion of the Project area that contains several Facility features, as detailed in Section 4906-17-03(A)(1)(b), *Land Area Requirements*. Appendix O provides a rendering of a typical substation. Figure 5-10 shows the location of the substations.

(f) Transportation Facilities and Access Roads

A total of 37.0 miles of access roads will be required for the Facility. Figure 5-10 provides the location of the access roads used during construction and maintenance activities.

(g) Security Facilities

Security includes fencing around all substations.

(h) Grade Elevations

Currently grade elevations are not available for the Project area; however, final site civil engineering will begin in the Summer of 2010. This information will be provided once it is completed.

(i) Other Pertinent Installations

An O&M building will be built for the Facility. The O&M building is expected to be approximately 6,000 square feet in size. Appendix A provides a rendering of a typical O&M building. Figure 5-10 shows the location of the O&M building.

(3) Structures

This section describes the major proposed structures of the Facility.

(a) Estimated Overall Dimensions

As discussed in Section 4906-17-03, *Project Description and Schedule*, the Applicant has not yet selected the turbine vendor and size for the Facility. For the purpose of this Application, the Applicant selected a G-90 turbine as the representative turbine for the various analyses. Turbine towers throughout the Facility will be tubular structures up to 328 feet tall at the turbine hub. With the nacelle and blades mounted, the total height of the wind turbine will be up to approximately 476 feet, from the base of the turbine to the blade (also called rotor) tip. The towers will be smooth, hollow steel structures, up to 13.4 feet in diameter at the base. Each tower will be mounted on a reinforced concrete foundation ranging up to 65 feet in diameter, depending on the turbine vendor selected. Appendix B provides a schematic of the typical wind turbine and tower. Appendix P shows the shape and layout of a typical tower foundation.

The O&M building will be on a 20-acre parcel of land in the southern portion of the Project area, on which two of the four substations will also be located (5 acres required for each, including setbacks).

The O&M building will require about one acre of land that will include adjacent parking. The O&M building is anticipated to be approximately 6,000 square feet of enclosed space and include an office and workshop area, parts warehouse, kitchen, bathroom, shower, and utility sink. The O&M building is anticipated to be approximately 20 feet high and constructed of sheet metal.

(b) Construction Materials

All materials will meet engineering and design standards. The turbine tower will be a steel structure manufactured in five sections. It is anticipated that the turbine blades will be of pre-impregnated epoxy glass fiber and carbon fiber.

The O&M building will be of metal construction, will be used to house equipment to operate and maintain the wind energy facility, and will include administrative offices, monitoring stations, and storage for parts and other small equipment.

(c) Color and Texture of Facing Surfaces

The proposed wind turbines will be uniformly painted in a non-reflective and unobtrusive off-white color approved by the Federal Aviation Administration (FAA) for daylight marking.

(d) Photographic Interpretation or Artist's Pictorial Sketches

A VIA has been prepared for the Facility that describes the Facility location, viewpoint selection process, assessment methodology and results, proposed visual mitigation measures, and photosimulations for views from eight viewpoints is included in Appendix J.

The viewpoints utilized for the VIA were selected through a process that included review of area maps on which the proposed locations of the turbines and other Facility features had been plotted, review of Google Earth air photos, and field investigations. A total of eight viewpoints were selected to provide for a range of views at different viewing distances and in a range of representative viewing contexts. Views located approximately 5 miles from the edge of the Project area demonstrate the range of potential turbine visibility in these more distant views. In mid-range views, the turbines will be visible along the horizon in places where they partially extend above the tree line located in the middle ground. In closer views, the turbines will become more visually prominent, and will have more of an effect on the character and composition of the landscape.

To maximize the visual integration of the Facility into the overall pattern of the Project area landscape, the Applicant will incorporate BMPs related to Facility appearance. These measures are presented in more detail in the VIA and include use of turbines with uniform appearance, use of muted gray or white colors, and

placement of as much of the Facility's electrical collection system underground, as practicable. These measures will be incorporated into Facility design to ensure an attractive appearance and good integration into its landscape setting.

(e) Unusual Features

No unusual features are expected as part of the Facility. Facility components will be consistent with a typical wind energy facility.

(4) Plans for Construction

It is anticipated that construction of the Facility will begin in September 2010. Construction activities will commence with the development of the staging area and construction laydown yard located on Fife Road near U.S. Route 127. At this same time, the site the civil construction contractors will begin mobilizing construction equipment to the staging area and construction laydown yard. Temporary construction trailers will be built and equipped as necessary to support workers during construction activities.

Following development of the staging area and construction laydown yard, the civil construction contractors will start general clearing and construction of turbine access roads, consisting of layers of various aggregate sizes and a geofabric. Once access roads are completed, excavation for the turbine foundations will begin. These construction activities will be performed in a series; once one area is complete, the construction team will move to the next area of the Facility. Road construction will continue through the fall until weather begins to prohibit work.

Turbine foundation excavation will be to a depth of approximately 8 feet below final grade. Some subsurface modification may be necessary to support the foundations, depending on final site-specific geotechnical investigations that will be completed in Spring 2011. Methods of foundation modification may include over-excavation and replacement with suitable fill, or use of Rammed Aggregate Pier® Systems (Geopier® System). Once the foundation excavation is complete, an approximate 2-inch layer of concrete will be poured for a working base. The turbine bolt cage will be assembled and

placed in the center of the foundation pit. Steel reinforcement bar will be constructed into a cage surrounding the bolt cage and conduit will be placed to house the electrical cables that run through the foundation. Concrete forms will then be set and concrete poured for the base of the turbine. After the base is poured, the concrete pedestal will be poured. After the concrete cures, the foundation will be backfilled and the soil compacted around the pedestal. Foundation work will continue through the fall until weather begins to prohibit work.

In Spring 2011, when weather permits, road and foundation work will begin again. The electrical contractors will mobilize and begin grading and other civil activities at the substation sites. Substation installation work will continue throughout the summer 2011. Collection system installation contractors will also begin trenching cable in spring and summer 2011. Tile repair crews will also mobilize and work alongside the collection system installers to repair drainage tile.

In early summer 2011, turbine components will begin to arrive. Turbine components will most likely be delivered directly to the location where they are to be installed. Turbines will be built throughout Summer and into Fall 2011. Once the turbines are erected, installation and commissioning teams will build the internal components of the turbine; testing of the turbines will follow.

After the substations are complete and are interconnected into the existing 345 kV transmission line, the substation will be energized and the electrical and mechanical systems will be tested. After these checks are complete, the turbines will be able to start producing electricity.

(5) Future Plans

The proposed Facility will likely be built in phases, with an initial project of approximately 190 MW to be put online in 2011 and a second set of approximately 160 MW to be put online in 2012 or later. Immediately to the north of the Facility is Heartland Wind's 200 MW Prairie Creek project and immediately to the south and east of Blue Creek is Heartland Wind's 300 MW Dog Creek project. Leasing continues on both

projects, but key factors such as wind resource, transmission access, harmony with aviation, low wildlife risk, and community support are shared with Blue Creek. Depending on the progress of leasing, economic factors, and other important factors, Prairie Creek and Dog Creek could be ready for permitting in 2010 or 2011 and could be ready for operation in 2012 to 2014.

(C) EQUIPMENT

As previously discussed, the equipment to be used for the Project area will include the following.

- 175 wind turbine generators¹;
- An electrical collection system using 34.5 kV underground and aboveground collection lines;
- Some 115 kV aboveground collection lines;
- Three intra-project collection substations;
- An interconnection substation;
- Up to two permanent met towers and a SODAR facility;
- A temporary concrete batch plant; and
- An O&M building.

The following sections provide a description for each Facility component.

(1) Wind Powered Generation Equipment

(a) Wind Energy Turbines

At the time of this submittal, the Applicant has not selected a specific turbine model for the Facility. For the purpose of this Application, specifics of the G-90 turbine are discussed. The G-90 is the most likely turbine to be used because of the Applicant's experience with this machine in other Midwestern sites and a

¹ The proposed Facility will have up to 175 turbines for a maximum potential output of 350 MW. Within this Application, specific locations for 167 turbines and other related Facility components are identified. An additional eight turbines will be located in an area along the eastern portion of the Project area boundary. The Applicant will provide the locations of the eight turbines in the shaded areas on an updated map (Updated Figure 3-1) by March 15, 2010 and appropriate site-specific information by April 1, 2010 in sufficient time for the OPSB Staff to consider the information in the Staff Report.

large-scale purchase commitment with Gamesa for the next few years. The turbines would be up to approximately 328 feet tall at the turbine hub. Depending on the selected turbine for this Facility, with the nacelle and blades mounted, the total height of the wind turbine to the turbine-blade tip would be up to approximately 476 feet. Appendix B shows a typical configuration for a wind turbine and tower. Appendix Q provides a brochure for the G-90 turbine.

The turbines utilized in this Facility will be new turbines and will not be used, experimental, or prototype equipment. Each wind turbine consists of four major components: the nacelle, the rotors, the tower, and foundation. Descriptions of the major turbine components are provided below.

(i) Nacelle

At the top of the tower section is the nacelle. The exterior is typically made of fiberglass with a structural steel frame to hold the internal components. The nacelle contains the generator, gearbox, transformer (except for the GE turbine model), electronic controls, and other components. Some of the nacelles will be furnished with lights visible to aircraft. The number of turbines that will be lit at night and the type of lighting will be determined in consultation with the FAA and is expected to be approximately 50 percent of the total number of turbines.

(ii) Rotors

The rotor diameter of the G-90 will be 295 feet. The rotor assembly consists of three blades and hub or nose cone that is mounted on a drive shaft. The shaft is connected to the gearbox and generator contained within the nacelle. All turbine rotors will rotate in the same direction and configured to rotate clockwise.

(iii) Tower

The proposed wind turbine will have a hub height of up to 328 feet. The towers used for this Facility are tubular steel structures manufactured in five sections that are bolted together using internal flanges. Each tower will have a locked access door at the base, internal lighting, control cabinets, and an internal ladder providing access to the nacelle for turbine maintenance. The towers will be uniformly painted in a non-reflective and unobtrusive off-white color approved by the FAA for daylight marking. No appurtenances will be connected to the outside of any of the wind towers.

(iv) Foundation

Turbines will be attached to a reinforced concrete spread footing type foundation with an approximate 65-foot diameter. A portion of the foundation will be covered with gravel for fire protection and weed control (approximately 10 feet of non-flammable groundcover around the towers on all sides). Appendix P shows a typical foundation design.

(b) Electrical Components

The Facility's electrical system will consist of an underground collection system, aboveground collection lines, and four substations. The sections below describe each component.

(i) 34.5 kV Electric Collection System

The turbines will be arranged in strings or linear groups, connected by an underground or aboveground collection cable system. Each wind turbine will generate power at 690 volts. A transformer within each turbine nacelle (except for the GE turbine model) will be used to convert the power to 34.5 kV. The power will then be transmitted down the tower into the underground 34.5 kV collection system. Where more than three

parallel underground collector lines will be necessary, aboveground collector lines will be constructed instead. Aboveground collector lines minimize impact on farm drainage tile, provide more efficient transmission of electricity, and are more cost effective. Approximately 78.6 miles of underground collector lines and approximately 3.7 miles of aboveground 34.5 kV collector lines will be required for the Facility. Appendix C provides a typical product data sheet for the underground line material.

The underground collection system will be buried in a trench approximately 10 inches wide and 4 feet deep.

All electrical components will conform to applicable local, state, and national codes, and relevant national and international standards.

(ii) 115 kV Electric Line

In locations where more than one set of aboveground 34.5 kV lines are needed, a small substation will be constructed to transform the electricity to 115 kV. By doing so, this will allow the use of only one set of poles. Approximately 6.0 miles of aboveground collection lines at 115 kV will be required. Appendix D provides typical drawings showing support structures for these aboveground lines.

(iii) Substations

Four new substations will be required for the Facility including an interconnection substation, project collection substation, collector station 1, and collector station 2.

The interconnection substation will function to connect the generated power with AEP's existing 345 kV transmission line for delivery of the power to the PJM transmission grid system. This substation will consist

of circuit breakers, switches, and associated bus work, cabling, and control and relaying systems.

Immediately adjacent to the interconnection substation is the project collection substation, which will gather the power from the turbines at 115 kV and transform it to 345 kV for interconnection. This substation will consist of circuit breakers, switches, voltage transformers (115 kV to 345 kV) and associated bus work, cabling, and control and relaying systems.

Collector substation 1 will gather power from approximately half of the turbines (the turbines constructed during Phase I) and transform the voltage from 34.5 kV to 115 kV for delivery to the interconnection substation. Collector substation 2 will consist of circuit breakers, switches, voltage transformers (34.5 kV to 115 kV) and associated bus work, cabling, and control and relaying systems.

Collector substation 2 will gather power from the remaining turbines (the turbines constructed during Phase II) and transform the voltage from 34.5 kV to 115 kV for delivery to the interconnection substation. This substation will consist of circuit breakers, switches, voltage transformers (34.5 kV to 115 kV) and associated bus work, cabling, and control and relaying systems.

Figure 5-10 depicts the location of these substations.

(2) Safety Equipment

The following section describes the proposed major public safety equipment in place during construction and operation of the Facility. The reliability of the equipment is discussed below. A copy of the confidential turbine manufacturer's safety standards will be made available at the offices of Bricker & Eckler LLP for OPSB staff review.

(a) Proposed Major Public Safety Equipment

All construction general contractors are required to meet strict safety qualifications. IBR has a very good environmental health and safety (EHS) record over the last 8 years that includes supporting EHS training programs, and a safety culture that is captured by the title of their EHS Policy: “People & the Environment First.” Through 2008, IBR and its predecessor PPM Energy, Inc. (PPM) have had one employee lost time accident for all company operations in the United States and Canada for 8 years. IBR’s Company Safety Director has also served as the Vice Chairman of the American Wind Energy Association (AWEA) Safety Committee for three years, and has presented numerous times at conferences on safety in the wind industry, including emergency preparedness and public safety. He recently received the AWEA Operations Award at the National Wind Power Conference for his leadership for safety in the wind industry.

IBR trains its wind technicians on technical qualifications for their jobs and for emergencies. IBR also trains its technicians in tower rescue, first aid, and CPR. Crews are equipped with tower rescue equipment, first aid kits, automatic external defibrillators, and fire extinguishers on company vehicles. IBR enjoys having excellent relations with local emergency services, and plans to meet periodically with them to be proactive on safety and inform them about the wind business and safety hazards associated with electricity.

Applicant will construct and operate the Facility consistent with IBR’s corporate commitment to meeting all applicable state and U.S Occupational Safety and Health Administration safety regulations. Each turbine and all electrical equipment will be inspected under rigorous commissioning procedures, as well as by the utilities (for grid and system safety), before being brought online. Once turbines are commissioned, qualified personnel will routinely inspect and repair them as necessary pursuant to preventive maintenance schedules.

Major public safety concerns can be grouped into issues that can arise during construction and operation activities. Each subsection below addressed these concerns.

(i) Construction

Public safety concerns primarily include issues associated with hazards during construction including moving construction vehicles, partially constructed wind turbines, storage areas, and other items. The items below summarize the safety equipment used during construction activities.

a) Fencing

During construction, there is a potential for the public to be exposed to construction hazards if individuals trespass into the construction area. During construction activities, temporary, highly visible plastic mesh fencing will be erected where construction obstacles are present.

b) Signage

Applicant will use signs to warn the public of potential dangers and provide emergency numbers, operator contact information, and instructions for emergency personnel. Unauthorized access will also be mitigated by fencing and signage where access roads and public roads meet. The signs will clearly inform the public that access is forbidden for the public and that access is only allowed for construction staff and personnel. The Applicant will work with the local county office to obtain 911 addresses for each wind turbine. These 911 addresses will be displayed outside turbine access roads prior to beginning construction to maximize safety during construction. Signs will be posted at the substation warning of high voltage.

(ii) Operation

Safety equipment utilized during the operation of the Facility is described below. Safety concerns regarding ice throw and blade shear are discussed in Section 4906-17-08(A)(4), *Ice Throw*, and Section 4906-17-08(A)(5), *Blade Shear*, respectively.

a) Gamesa Monitoring System

The turbines will be continuously monitored through the Gamesa monitoring system, a remote monitoring and control system with Web access. This system allows real-time operation and remote control of the wind turbines. In addition, the Gamesa turbines include the SMP Predictive Maintenance System for the early detection of potential deterioration or malfunctions in the wind turbines' main components, which is integrated within the control system. The Applicant will have an on-call local technician who can respond quickly in the event of emergency notification or critical outage. In addition to local staff, IBR has a control center located in Portland, Oregon that is staffed 24 hours a day, 7 days a week (the IBR Operations Center). Along with IBR's other projects located throughout the country, the IBR Operations Center will continuously monitor and control the proposed Facility.

b) Braking System

All turbines include control systems and brakes that are controlled with a process logic controller (PLC) system. The PLC system manages normal operations and can detect and control over-speed conditions via a redundant pitch/brake control system. The redundant pitch/brake system includes an aerodynamic variable pitch system where the wind turbine blades change angle (pitches)

and operates as a brake, as well as mechanical brakes operated in a fail-safe mode.

The wind turbines proposed for the Facility will be equipped with two independent braking systems that will automatically shut down the turbine blade at wind speeds over the manufacturers recommended threshold. The rotor speed ranges from 9.0 to 19.0 revolutions per minute (rpm). The cut-out wind speed for the G-90 is 21 m/s (47 mph), where the wind turbine would automatically shut down.

c) Lightning Protection

Each turbine will also use the “total lightning protection” system in accordance with standard IEC 61024-1. This system conducts lightning to the grounding system located in the foundation of each turbine.

d) Fire Prevention

The likelihood of turbine fires is very low. Before operation, each turbine and all electrical equipment will be inspected under rigorous commissioning procedures, as well as by the utilities (for grid connection and protection system safety). During operations, qualified personnel will routinely inspect equipment in accordance with preventive maintenance schedules. Built-in safety and design systems minimize the chance of fire occurring in the turbines or electrical equipment. For example, turbines have high temperature sensors and automatically shut down if they begin to overheat.

Although an extremely unlikely event, if a fire were to occur inside the nacelle, the SMP Predictive Maintenance System will detect it, the turbine will automatically shut down, and the problem will be

reported to both the O&M building and the IBR Operations Center. Facility maintenance personnel will immediately notify local officials and respond as appropriate. Power to the section of the wind farm with the turbine fire will be disconnected. IBR will provide training to local fire departments on electrical fires to ensure the safety of both firefighters and the public.

In instances where fires have broken out near IBR wind farms, the Facility access roads have served both as access to remote areas where firefighters could address the flames closer to the source. Additionally they have served as firebreaks saving additional land from the flames. In the rare situations when fires have broken out near wind farms, IBR employees have responded immediately and worked in tandem with the local departments to save lives and homes from destruction by fire.

A portion of the foundation around the towers will be covered with gravel for fire protection. This cleared area is approximately 10 feet of non-flammable groundcover around the towers on all sides. In addition, twistable cables (also known as triplexing) will be utilized on all underground power cables. This arrangement lends additional safety to the electrical system.

IBR will work with local fire departments and fire protection districts to notify them of construction plans, the location of and access to Facility components, and mutual assistance in the case of fire in or around the Project area. IBR will cooperate with the local fire department to develop the fire department's emergency response plan. Other applicable fire laws and regulations will be followed in accordance with state and local requirements.

e) Aeronautical

The turbines will be uniformly painted in a non-reflective and unobtrusive off-white color approved by the FAA for daylight marking. Some of the towers for this Facility will be furnished with lights visible to aircraft at night. The number of turbines that will be lit at night and the type of lighting will be determined in consultation with the FAA. The Applicant's consultant has already performed an aeronautical study, and the Project area boundary was reduced in size to have no impacts on local airports.

f) Fencing and Access Control

Permanent fencing will surround the substation, and may surround the O&M building. Signage indicating no trespassing will warn the public of potential dangers.

At the base of each turbine tower is a door to allow maintenance workers to access the nacelle and various components. This door will be locked to restrict unauthorized access.

g) Signage

Applicant will post signs at the substation warning of high voltage. Signs will also be placed at the turbine tower access door indicating no unauthorized access.

(b) Reliability of Equipment

The turbines will conform to all applicable industry standards, including the AWEA standards for wind turbine design, and applicable standards of the American National Standards Institute (ANSI), the Uniform Building Code, and Germanischer Lloyd (GL), the internationally recognized standards body for wind turbines. After the Applicant selects turbines for the Facility, and before

construction, IBR's quality control team will confirm that the wind turbines have been manufactured in compliance with these industry standards.

An Ohio-licensed professional engineer will design and certify the electrical system. Furthermore, the contractor will certify the mechanical and electrical completion of the turbine. Then, the turbine manufacturer will commission the turbines and certify that the turbines are complete and ready to operate.

A structural engineer, licensed in Ohio, will design the foundation and certify that it meets the turbine manufacturer's design requirements and is installed in soils that can support the turbine. Applicant or its contractors will inspect all components regularly to provide safe and reliable operation. All turbines will receive regular maintenance, including proper lubrication of key components to increase system reliability.

(c) Turbine Manufacturer's Safety Standards

The turbine manufacturer's confidential safety standards will be available at the offices of Bricker & Eckler LLP for OPSB staff review once the Applicant selects the final turbine for the Facility.

(3) Any Other Major Equipment

Other major equipment required for the Facility is described below.

(a) O&M Building

A permanent O&M building will be constructed as part of a joint substation and O&M facility and will be located on a 20-acre parcel of land in the southern portion of the Project area. The O&M building will be of metal construction, will be used to house equipment to operate and maintain the wind energy facility, and will include administrative offices, monitoring stations, and storage for parts and other small equipment. It will have approximately 6,000 square feet of enclosed space, including office and workshop areas, a kitchen, bathroom, shower, and

utility sink. A graveled parking area for employees, visitors, and equipment will be located adjacent to the building. Appendix A provides a drawing and photo of a typical O&M building.

(b) Met Tower(s)

Up to two permanent met towers will be located within the Project area for the collection of meteorological data. Permanent met towers will be freestanding (unguyed) structures and will be lighted as necessary to comply with FAA guidelines. The towers will be up to approximately 330 feet high with an equilateral triangle base, each side of which will be approximately 32 feet long. The met tower foundations will consist of three steel-reinforced concrete piles, each at a corner of the tower base.

(c) SODAR Unit

The Facility will include a SODAR unit located near a permanent met tower. A SODAR is a device that is used to measure wind speed and direction. The SODAR unit will be housed in a small trailer approximately 10 feet tall with an attached 20-foot wind sensor boom. The purpose of the unit is to remotely measure the vertical turbulence structure and wind profile up to 328 feet (100 meters). Appendix F shows a typical SODAR unit.

(d) Temporary Concrete Batch Plant

The Applicant is evaluating the option of constructing a temporary concrete batch plant for producing concrete required during construction. This temporary batch plant will be located in the southern portion of the Project area, adjacent to the future O&M building site. An aboveground storage tank may also be constructed at this location to provide for storage of water that will be required for batch plant operations during construction of the Facility. After construction is complete, the temporary concrete batch plant and associated water storage tank will be disassembled and removed.

(D) REGIONAL ELECTRIC POWER SYSTEMS

The following section provides details about the interconnection of the Facility to the regional power grid.

(1) Interconnection Queue

The Applicant submitted an Interconnection Request to PJM. PJM is a regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of 13 states and the District of Columbia (PJM, 2009).

(a) Name of the Queue

The name of the queue is Robison Park-Convoy 345 kV.

(b) Web Link of the Queue

Information about the status of the Applicant's Interconnection Request can be obtained through the following website:

<http://www.pjm.com/planning/generation-interconnection/generation-queue-active.aspx>

(c) Queue Number

The Applicant's Interconnection Request is identified as queue #R60.

(d) Queue Date

The Interconnection Request was submitted on January 8, 2007 (PJM, 2009).

(2) System Studies

Studies were performed by PJM in order to assess the impacts of the Facility on the regional power grid. The Applicant requested that PJM study the impacts of adding 350 MW of wind energy generation onto the AEP transmission system. Of the total

megawatts for the Facility, 70 MW was identified as a capacity resource with the remaining megawatts as an energy resource per PJM standards.

The Facility will connect to the grid via a new 345 kV interconnection substation onto the existing Convoy-Robison Park 345 kV AEP transmission line. The following sections summarize the results of the feasibility study and impact study prepared for the Applicant's interconnection request.

(a) Feasibility Study

The intent of the feasibility study is to determine estimated costs and construction timelines to connect to the network and to determine a plan for the interconnection. Appendix R provides the results of the feasibility study.

The proposed Facility was evaluated for compliance with reliability criteria for summer peak conditions in 2011. The feasibility study did not identify any potential network impacts.

(b) System Impact Study

The intent of the system impact study is to identify system reinforcements required in order to add the proposed new generation into the transmission system. The impact study also assesses the associated costs and construction time estimates to facilitate the addition.

The proposed Facility was evaluated for compliance with reliability criteria for summer peak conditions in 2012. The impact study did not identify any potential network impacts. Appendix S provides a copy of the impact study.

(c) Facilities Study

The facilities study began in January 2009 and is ongoing. Subsequent to the completion of the feasibility and system impact studies, the Applicant declared to PJM its intention to interconnect at a point approximately 8 miles east of the Convoy substation, on the Convoy-East Lima segment of the transmission line.

PJM agreed in January 2009 that this change would not be a material modification to the Applicant's interconnection request.