5.0 ENVIRONMENTAL ASSESSMENT AND RESIDUAL EFFECTS

The following section assesses the potential interactions between the proposed addition of five turbines to the existing 50-turbine, 150 MW Kent Hills Wind Farm Project and the biophysical and socio-economic environment. This section also addresses the potential for cumulative environmental effects, effects of the environment on the Project, and potential effects of accidents and malfunctions.

The potential effects are described for the construction, operation and decommissioning phases of the Project. Mitigation is proposed to reduce or eliminate these potential effects.

The potential interactions between the Project and the VCs are summarized in Table 5.1.

Table 5.1 Potential Interactions between the Project and Valued Components

Project Activities	Valued Components										Section of EA Document
	Soil	Aquatic Environment	Terrestrial Vegetation	Wetlands	Birds and Other Wildlife	Heritage Resources	Land Use	Visual Aesthetics	Noise	Health and Safety	
Construction											
Land Clearing	X	X	X	X	X	X			X		5.1.1
Road Construction/ Modification and Site Preparation	X	X		X	X	X	X		X		5.1.2
Delivery of Equipment					X		X		X		5.1.3
Temporary Storage Facilities	X		X		X		X		X		5.1.4
Foundation Construction	X	X			X	X			X		5.1.5
Tower and Turbine Assembly and Installation					X				X		5.1.6
Interconnection (Turbine to Existing Collector System)	X	X		X	X	X	X		X		5.1.7
Commissioning											5.1.8
Operation & Maintenance											
Wind Turbine Operation & Maintenance					X		X	X	X	X	5.2.1, 5.2.2
Decommissioning											
Removal of Turbines and Ancillary Equipment	X	X	X		X		X	X	X		5.3.1
Removal of Power Line	X	X	X		X		X	X	X		5.3.2

Table 5.1 Potential Interactions between the Project and Valued Components

Project Activities	Valued Components										Section of EA Document
	Soil	Aquatic Environment	Terrestrial Vegetation	Wetlands	Birds and Other Wildlife	Heritage Resources	Land Use	Visual Aesthetics	Noise	Health and Safety	
Site Remediation/ Reclamation	X	X			X		X	X	X		5.3.3
Note: Accidents and Malfunctions are discussed in Section 5.4, along with information on TransAlta's corporate environmental management framework and it's components.											

5.1 PROJECT CONSTRUCTION ACTIVITIES – ENVIRONMENTAL EFFECTS

The following sections describe the main construction activities and the potential effects associated with each activity. All activities associated with the Project construction, including equipment maintenance and refuelling, will be controlled through standard mitigation to reduce effects associated with the construction of the Project. Most effects of Project activities will be limited to the WFSA and specifically the PDA.

In general, potential environmental effects of construction will be mitigated using the standard practices as outlined in the Project Environmental Management Plan (EMP), as discussed in Section 5.4.4.

5.1.1 Land Clearing

Currently, the WFSA is largely forested with many active logging operations. The forest is in various states of succession. Estimates of the Project footprint area by component are presented in Table 5.2 and includes areas requiring clearing. New roadway RoWs are anticipated to be 18 m wide, while upgraded roads (with posts and overhead wires) are anticipated to be 21 m wide (overhead wires are anticipated to require 3 m of additional RoW adjacent to the roads). Current roadway RoWs requiring upgrades range from 3 to 10 m cleared width. As underground cables will be installed within the roadway RoWs where practicable, they are anticipated to result in no additional change in land cover. The assumption for area cleared for turbines and laydowns is approximately 1 ha, with turnarounds requiring a 10 m RoW. The main temporary workspace and staging area is assumed to use the same area as was used (and remains cleared) for the construction of Kent Hills 1 and 2, located south of Turbine D4 (Figure 1.1). The requirement for additional temporary work space is not known at this time; however, if required, would likely make use of existing cleared and disturbed areas within the WFSA.

Table 5.2 Estimate of Area Requiring Clearing

Project Attribute	Area within Preferred Turbine Locations (ha)		Area within Alternate Turbine Locations (ha)		Total (ha)	
	Total	Requiring Clearing	Total	Requiring Clearing	Total	Requiring Clearing
Upgraded Roads and Overhead Cables	10.29	6.75	3.51	2.68	13.81	9.43
New Roads and Underground Cables	1.47	1.00	1.74	1.69	3.21	2.68
Turbine (including laydown and turnarounds)	8.76	3.50	4.92	4.92	13.68	8.43
Temporary facilities	3.42	0.00	0.00	0.00	3.42	0.00
Total:	23.94	11.25	10.18	9.29	34.11	20.54

Most of the WFSA land will require limited alteration, and forestry activities can continue to occur within close proximity of the turbines. Areas exist, however, where land clearing and vegetation removal will be required for the construction of access roads, installation of interconnection cables, turbine foundation construction, and laydown areas around the turbines. Four of the five preferred turbine locations are located in partially harvested forest (T9), regenerating clear cuts (T7, T4), or young plantations (T3). The fifth preferred turbine (T5) is located in young-immature hardwood forest.

The potential environmental effects of land clearing activities are summarized in Table 5.3, following discussions below of potential effects of and mitigation for land clearing activities below for the following VCs: aquatic environment, terrestrial vegetation, wetlands, birds and other wildlife, and heritage resources.

5.1.1.1 Aquatic Environment

Watercourses will be avoided to the extent practicable. Where land clearing is required within 30 m of a watercourse for the construction of new access roads or widening of existing road, and the associated collection system along roads, appropriate sediment control structures, use of existing roadways for watercourse crossings, relocating brush and woody debris to areas where it cannot enter watercourses, and the limited use of machinery adjacent to watercourses, will likely not result in significant environmental effects to the aquatic environment. Appropriate approvals and permits will be obtained for any work within 30 m of a watercourse in consultation with NBDELG. No significant residual environmental effect on watercourses is expected.

5.1.1.2 Terrestrial Vegetation

The amount of clearing for the Project has been reduced by using existing forest access roads to the extent practicable (up to 7 km or more than 70% of required roads, including alternatives), and

adjusting turbine locations where feasible to use existing harvested areas. Of the nine turbine locations included in the PDA, two are located (at least partially) within clear cuts. Assuming a 18 m wide cleared RoW for roads with underground electrical collection system and 21 m for aboveground, and considering many of the roads are existing, a total of 20.5 ha of forest habitat would be cleared (excluding 6.9 ha of recently clear cut areas that may require some limited clearing) for the construction of turbines, new roads, and associated collection system along the new roads, for all nine potential turbine locations. Of this 20.5 ha requiring clearing, 4.9 ha are within mature hardwood forest, representing 0.2% of the mature hardwood forest within the WFSA. The remaining forest habitat loss includes 3.9 ha of other mature forest, 4.6 ha of young-immature forest, and 6.4 ha of regeneration-sapling. The remaining (non-forest) habitat loss will include 6.9 ha of recently clear cut (last six years) forest, 0.8 ha of wetland, 3.5 ha of industrial land class, and 3.2 ha of anthropogenic land class, which includes existing roadways which may require marginal widening and electrical collector lines. In total, including existing cleared areas and roadways, the Project footprint is conservatively estimated at just over 34.1 ha, including both preferred and alternate turbines and related facilities, and including anthropogenic/industrial lands (e.g. road surfaces).

The Upham Brook Class II PNA, established following the construction of the existing and expanded wind farm, is located within the overall WFSA, borders the existing wind farm 138 kV transmission line, and is more than 400 m from the proposed upgrade to the alternate turbine locations T1, T2 and T6 access road. Therefore, interaction with this PNA is unlikely.

Two individual observations of necklace spike sedge (*Carex ormostachya*, S3) were made within the PDA, one within the footprint of T2, and one near the edge of a cleared construction laydown area. Although the plant at the T2 location would be lost if this alternate turbine location was developed, it is expected that the plant near the edge of the cleared construction laydown area can be flagged and avoided. As a result, and because this species likely also occurs at other areas within the WFSA, this species is expected to be maintained at the regional level. No significant residual environmental effects on vascular plant SOCC are expected.

The effective mapping and avoidance of natural habitat hosting vascular plant species of conservation concern during facility layout design, micrositing of turbines and ancillary structures and infrastructure, combined with successful restoration measures during the Project's construction, operation, and decommissioning stages, will not likely result in significant environmental effects to native habitat and vascular plant species of conservation concern from the wind farm development.

5.1.1.3 Wetlands

Potential interactions with GeoNB-mapped wetlands were reduced during facility layout design and micrositing of turbines, ancillary structures and infrastructure, and by using existing forest roads and cleared areas to the extent possible. One partially GeoNB-mapped wetland and two unmapped wetlands are within the road upgrade PDA, and two unmapped wetlands are within turbine footprints. Turbine T7 is located in a wetland area that was recently harvested. Clearing will result in the loss of some wetland functions, but will not have substantial effects on wetland area (approximately 0.8 ha of wetland would be cleared, if both the T7 and T8 locations were developed, 0.3 ha for the preferred T7

location). A compensation plan for GeoNB-mapped wetlands will be developed in consultation with NBDELG, and potential environmental effects on unmapped wetlands will be reduced through on-site mitigation (e.g., avoidance, if practical). As a result, land clearing is not expected to result in significant environmental effects to wetlands.

5.1.1.4 Birds and other Wildlife

The discussion above on habitat loss for Terrestrial Vegetation is also relevant to habitat for birds and other wildlife. The amount of clearing for the Project has been reduced by using existing forest roads and cleared areas to the extent possible. Much of the habitat loss is along existing roads and near previously disturbed or harvested areas, with limited losses of intact (i.e. no harvesting activities in at least the past 10 years) mature forest and interior forest. Interior forest are areas relatively free from fragmentation and defined as patches of mature forest greater than 10 ha in size, and at least 100 m from an "edge" (e.g., clearcut, industrial or other anthropogenic area, linear features such as roads or transmission lines, or waterbodies and open wetlands). The only part of the PDA to reduce interior forest is alternate turbines T2 and T6 (Figure 4.7).

It is intended to conduct clearing outside of mid-April to mid-August, if possible, to avoid sensitive times for breeding bird species, and reduce the chance of unintentional mortality, thereby complying with the *Migratory Birds Convention Act*. Bird SAR recorded near the PDA include Canada warbler and olive-sided flycatcher (near the existing access road to the T5/T7/T9 cluster; Figure 4.8), common nighthawk near T4 and T7 (Figure 4.8), and eastern wood-pewee near alternate turbine T1 (Figure 4.7 and 300 m from T9 (Figure 4.8). The disturbance to Canada warbler and olive-sided flycatcher habitat is limited to the edge of an existing roadway. Given that current forest harvesting in the WFSA is creating habitat for common nighthawk, land clearing of limited habitat is unlikely to influence habitat availability for this species.

Land clearing is not expected to result in significant environmental effects to birds and other wildlife.

5.1.1.5 Heritage Resources

The PDA was subject to background research and an AIA conducted by a permitted archaeologist. The assessment reviewed the landforms within the PDA for areas of elevated archaeological potential. No visible signs of surface features, artifacts, or deposits of heritage significance were identified during the assessment survey.

The proposed turbine locations are sufficiently far from watercourses (i.e., greater than 100m) and do not fall within the elevated archaeological potential watercourse buffers. However, some of the proposed turbine locations (i.e., alternate turbine locations T2 and T6) are in areas that may be potential paleo-shorelines for time periods shortly after the melting of the glaciers from this part of New Brunswick. These locations are of note since they occur on ridges and knoll tops which are considered areas of elevated archaeological potential for Paleoindian habitation sites in other areas of southern New Brunswick as well as other areas in northeast North America. Archaeological sites have been identified in these contexts (Bonnichsen et al. 1991; Ferguson 2004; MacDonald 1968). It is speculated

that high ground may have served as strategic vantage points in the Paleoindian Period and thus these areas warrant additional investigation to confirm no such sites are present in areas anticipated for development of the Project.

Aside from turbine locations, subsurface segments of the interconnection system and access roads within the wind farm may require ground disturbance; where these areas come within 100 m of watercourses shovel testing will be necessary. Project-related activities which may come close to areas of potential Historic Period features include clearing for new access road construction and existing access road upgrades. Existing roads to be upgraded and new road alignments have also been assessed in the AIA.

Based on this, shovel testing recommendations by a qualified archaeologist have been made to ASB for some areas of the PDA identified during the AIA. These recommendations should be implemented before any ground-breaking activities occur. In other areas, archaeological monitoring during construction activities is recommended. These mitigation strategies were designed by the permit-holding archaeologist in consultation with ASB. Shovel testing is recommended in fall 2017 for those areas identified as having elevated archaeological potential, including small areas near an unnamed tributary to Forty-Five River (KHWF-05) and one area at an unnamed tributary to Rat Tail Brook. Monitoring recommendations include areas associated with the proposed alternate turbine sites around Hayward's Pinnacle, specifically the new-build access road leading to turbine T2, the pad location for T2, and the pad location for T6, should these alternate locations be required.

The net effects of construction activities will be spatially limited to specific, small areas within the Project footprint. Overall, with the implementation of the AIA and the recommended mitigation of shovel testing prior to any ground disturbance and archaeological monitoring, it is anticipated that there will be no adverse residual effects to heritage resources. Standard mitigation measures to protect heritage resources will be adequate to effectively avoid residual effects.

5.1.1.6 Summary of Potential Effects of Land Clearing

Table 5.3 Potential Effects of Land Clearing

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Soils	Soil Erosion and Compaction	• Limit access to the turbine sites via established access roads. • Keep size of access roads to the minimum required for the safe construction,	2	1	2/1	R	2	Implementation of mitigation measures will preserve soil quality within the WFSA; no residual effects are anticipated.

Table 5.3 Potential Effects of Land Clearing

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		operation and decommissioning of the equipment. • Whenever practicable, time clearing activities to periods when the ground surface is best able to support construction equipment (winter or dry season). • Restore land to its original condition using topsoil stored on-site and by revegetation.						
Aquatic Environment	Surface Water Contamination	• Watercourses will be avoided to the extent practicable. • Construction material, excess material, construction debris, and empty containers will be stored at least 30 m away from watercourses and watercourse banks.	2	1	2/1	R	2	By following mitigation measures, negative interactions with surface water quality and fish habitat in the WFSA will be avoided and no significant residual effect is anticipated. Only one watercourse is crossed by the PDA, at an existing access road and using planned overhead lines.
	Sediment Loading	• Disturbance to watercourses will be avoided to the extent practicable • Follow conditions of WAWA permits • Clearing, grubbing and uprooting of riparian vegetation will avoided to the extent practicable. • Temporary erosion and sediment control measures (e.g., silt fence, straw bales) will be used, maintained and kept in place until all work within or near a watercourse has been completed and buffer zones are stable.	2	1	2/1	R	2	By following mitigation measures, adverse interactions with surface water quality and fish habitat in the WFSA will be avoided and no significant residual effects are anticipated.

Table 5.3 Potential Effects of Land Clearing

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		• Temporary sediment control measures will be removed when work is completed and once permanent erosion control measures, as may be specified in the contract, have been established.						
Terrestrial Vegetation	Loss of Plant SOCC	• Vascular plant SOCC will be flagged and avoided to the extent practicable.	2	1	2/1	R	2	Mitigation will avoid significant residual environmental effects on vascular plant SOCC.
Wetlands	Loss of wetland area and/or function	• Avoid wetlands, where possible. • If interaction is unavoidable, reduce effects to wetlands to the extent practicable. • Compensation may be required for loss of GeoNB-mapped wetlands.	1	1	2/1	R	2	No residual effects are anticipated along existing access roads adjacent to wetlands which are not expected to require upgrades. Up to 0.8 ha of field-identified wetland would be lost if both T7 and the alternate T8 were both developed. Wetland loss at T7 would be 0.3 ha.
Birds and Other Wildlife	Sensory Disturbance	• Work will be conducted in compliance with the *Migratory Birds Convention Act*.	2	1	2/1	R	2	Sensory disturbance may cause habitat avoidance but this will be temporary in nature, low in magnitude and restricted to within several hundred meters of the Project footprint. The area to be subject to this disturbance is forested land of various age and composition, and disturbance will be reversible. No significant residual effects are anticipated.

Table 5.3 Potential Effects of Land Clearing

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
	Habitat Alteration and Loss	• Habitat loss may be mitigated by limiting clearing of land to what is necessary for construction activities and by limiting the overall land disturbance to within designated workspaces.	2	1	2/1	R	2	Project has been planned to make use of existing roads and cleared areas where feasible. The area of habitat that will be altered due to land clearing activities for access roads, and turbines will be a very small proportion of what is available and therefore the effects will be limited in geographic extent, magnitude, and duration. No significant residual effects are anticipated.
	Mortality	• In order to reduce the potential of bird mortality, land clearing will be performed, to the extent practicable, outside of critical time periods for breeding birds, which is from mid-April to mid-August. • Where residual vegetation may require removal during the breeding season, nest sweeps will be conducted within 7 days of the clearing, and follow the guidance from ECCC • Work will be conducted in compliance with the *Migratory Birds Convention Act*.	2	1	2/1	I	2	Land clearing activities mirror current forestry operations on the site. Due to timing of activities, and with the application of mitigation, no significant residual effects are anticipated.
Heritage Resources	Disturbance	• An AIA has been completed by a permitted archaeologist and included research and consultation with ASB, Historic Places, and local historical societies, as well as fieldwork (i.e., walkover and judgmental testing). Recommended shovel testing is planned for fall	2	1	2/1	R	2	Implementation of mitigation measures will be adequate to resolve concerns for heritage resources within the WFSA. No significant residual effects to archaeological and cultural resources are anticipated.

Table 5.3 Potential Effects of Land Clearing

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		2017. Should resources be found that may be effected by Project-related activities, these areas will be fenced off and excluded from construction activities or resources will be recovered. • Areas of significance will be avoided to the extent practicable.						
Noise	Increases to sound pressure levels due to the transportation and operation of clearing equipment	• Equipment will be transported to the site only within daylight hours. • Construction equipment will have mufflers that comply with guidelines for sound and emission levels. • Noise abatement equipment, in good working order, will be used on all heavy machinery used on the Project.	3	2	2/1	R	2	Increased sound pressure levels caused by land clearing will be temporary in nature and will be caused by activities conducted during working, daylight hours. Due to the short nature of this disturbance and its limited geographic range, and the distance from residents, the residual effect is considered acceptable and no significant residual effects are anticipated.

Note

1	Geographic Extent	1 = <500 m², 2 = 500 m² – 1 km², 3 = 1 –10 km², 4 = 11 – 100 km², 5 = 101 – 1000 km², 6 = >1000 km²
	Magnitude	1 = Low: e.g., specific group or habitat, localized one generation or less, within natural variation, 2 = Medium: e.g., portion of a population or habitat, one or two generations, rapid and unpredictable change, temporarily outside range of natural variability, 3 = High: e.g., affecting a whole stock, population or habitat outside the range of natural variation.
	Duration	1 = <1 month, 2 = 1-12 months, 3 = 13-36 months, 4 = 37-72 months, 5 = >72 months.
	Frequency	1 = <11 events/year, 2 = 11-50 events/year, 3 = 51-100 events/year, 4 = 101-200 events/year, 5 = >200 events/year, 6 = continuous.
	Reversibility	R = reversible, I = irreversible.
	Ecological Context	1 = Pristine area or area not adversely affected by human activity, 2 = evidence of adverse effects.

Overall, it is anticipated that with the implementation of the proposed measures, the residual environmental effects associated with land clearing activities will, at most, be Minimal and not significant.

5.1.2 Road Construction/Modification and Site Preparation

Access roads on Crown land will be installed to provide access routes for vehicles and equipment. They will be created, first by scraping the topsoil, and then by building up gravel roads bounded with drainage channels (see Section 2 for more details). Where new roads are constructed, the junctions with existing roads may have to be built up to provide adequate turning radii. Turnaround areas are also required at selected turbines.

Improvements in existing Crown land roads is necessary in some areas to enable access to the site by articulated (multi-axle) trucks carrying the turbine components, the heaviest component of which is the nacelle. These improvements include widening the turning radius of the corners by adding fill to the ditches. The infilling would occur during dry conditions, or culverts would be installed where warranted. None of these modifications are expected to be permanent and the corners will be remediated following construction at the site.

Turbine pads and temporary laydown areas will be graded following clearing, to prepare the sites for foundation construction and erection of the turbines. Potential effects of this site preparation is similar to road construction.

The potential environmental effects associated with road construction include effects to soils, aquatic environment, wetlands, birds and other wildlife, heritage resources, land use and noise.

The *Fisheries Act* (2016) protects the productivity of commercial, recreational and Aboriginal (CRA) fisheries through the prevention of "serious harm" to fish (e.g., death of fish or any permanent alteration to, or destruction of, fish habitat).

Watercourses will be avoided to the extent practicable; however, upgrades to existing forestry roads and the collection system are anticipated to cross or be within 30 m of the headwaters of three watercourses: tributaries to Hayward Brook (access to alternate sites), a tributary to Rat Tail Brook (existing road within 30 m), and Forty Five River (existing crossing). There is one watercourse crossing (KHWF-05) and one watercourse that parallels (KHWF-04) and is associated with the construction or modification of existing access roads. If construction is necessary in or near watercourses, mitigation measures are proposed to: reduce soil erosion and downstream sediment transport; respect sensitive timing windows to protect fish; conduct instream work at low flow periods and limit clearing of riparian vegetation (e.g., selective cutting, pruning or topping vegetation) to avoid disturbing stream banks. Appropriate approvals and permits such as a Watercourse and Wetland Alteration Permit will be obtained for in-water work or work within 30 m of a watercourse in consultation with NBDELG, DFO and NBDERD, as required.

There is no potential loss of fish habitat expected as a result of road construction/modification at this time. If in-water works are required, the DFO measures to avoid serious harm will be followed as

applicable, such as, appropriate sediment control structures, isolating the stream channel and rescuing fish from in-water work areas. Where serious harm cannot be mitigated or avoided, under the *Fisheries Act* DFO can authorize, and require measures to offset, serious harm to fish and fish habitat. If a road upgrade is required, the potential loss of fish habitat is estimated to be 51 m² for KHWF-05. The interactions between the Project and fish and fish habitat are Minimal and not likely to result in significant environmental effects to the aquatic environment.

There are three wetlands (WL1, WL4 and WL5) along the existing access road to preferred turbines T5, T7 and T9 that may be affected by road construction, up to 0.28 ha in total area within the PDA. However, limited requirements for disturbance of road upgrades beyond right-of-way clearing are anticipated, as the road surface may currently be suitable for planned construction traffic. Other wetlands that may be disturbed by site preparation are field-identified wetlands at turbine locations T7 and T8 (an alternate location), resulting in a residual habitat loss of softwood treed swamp of 0.29 ha at T7 and 0.25 ha at T8. The wetland at T7 that would be affected has already been disturbed from harvesting activities and roadbuilding on site. The potentially affected wetlands in the PDA represent less than 3% of the mapped wetland within the WFSA, which likely underrepresents the actual amount of wetland in the WFSA.

Site preparation and construction of new access roads on Crown land is limited to the turbine sites and short connections from existing roads to turbines. Limited widening of existing roads will comprise a relatively small portion of the land, and thereby should not jeopardize species habitat. Bird SAR potentially affected by road construction and site preparation are limited to few records of Canada warbler, olive-sided flycatcher and common nighthawk recorded during field surveys near existing disturbed areas. The area's birds and wildlife already experience a certain level of sensory disturbance due to ongoing forestry activities, wind turbine operation and associated human activities. Any post-construction alterations to access roads built on Crown Land will be conducted as per the requirements of the Crown Land Branch. Overall, it is anticipated that with the implementation of the above-stated mitigation measures, the residual environmental effect associated with site preparation and access road construction and modification activities on wildlife will be Minimal and considered not significant.

The potential environmental effects of road construction/modification activities are summarized in Table 5.4.

Table 5.4 Potential Effects of Road Construction/Modification and Site Preparation

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Soils	Soil Erosion and Compaction	• Trucks and equipment will remain in designated workspaces. • Whenever practicable, this activity will be limited to periods when the ground surface is best able to support construction equipment (dry season). • Compacted soil will be reclaimed as required (e.g. in laydown areas).	2	1	2/1	R	2	Implementation of mitigation measures will preserve soil quality within the WFSA. No residual effects are expected.
Aquatic Environment	Surface Water Contamination	• Watercourses will be avoided to the extent practicable • Construction material, excess material, construction debris, and empty containers will be stored away from watercourses and watercourse banks.	1	1	2/1	R	2	By following mitigation measures, negative interactions with surface water quality and fish habitat in the WFSA will be avoided and no significant residual effect is anticipated. Only one watercourse is crossed by the PDA, at an existing access road and using planned overhead lines.
	Sediment Loading	• Watercourses will be avoided to the extent practicable • Road work within watercourses (if required) will occur between June 1 and September 30 to avoid sensitive fish life stage timing windows. • Temporary erosion and sediment control measures (e.g., silt fence, straw bales) will be used, maintained and kept in place until work within or near a watercourse has been completed is stable.	1	1	2/1	R	2	Only one watercourse is expected to be crossed by an existing road that may be upgraded. By following mitigation measures, adverse interactions with surface water quality and fish habitat in the WFSA will be avoided and no significant residual effects are anticipated.

Table 5.4 Potential Effects of Road Construction/Modification and Site Preparation

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		• Temporary sediment control measures will be removed when work is completed and once permanent erosion control measures, as may be specified in the contract, have been established.						
	Surface Water Flow	• Watercourses will be avoided to the extent practicable. • A WAWA Permit will be obtained for all required watercourse crossings, and the conditions of such permits will be followed.	1	1	2/1	R	2	No residual effects are expected if culvert at watercourse crossing does not require extension.
	Fish Mortality	• Watercourses will be avoided to the extent practicable • Watercourse crossings, where required, will be constructed between June 1 and September 30 to protect fish and/or the organisms upon which they feed. • Where practicable and if required, culverts will be installed when during low flow periods. If water is present, watercourses will be isolated and flow will be pumped around using water pumps of appropriate size. In this case, a biologist will be on-site to facilitate fish rescue within the isolated area.	1	1	2/1	I	2	As currently planned, no instream work is anticipated. No residual effects are expected, given these mitigation measures.

Table 5.4 Potential Effects of Road Construction/Modification and Site Preparation

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
	Loss of Fish Habitat	• If applicable, authorization from DFO will be obtained in advance should it be deemed that serious harm to fish could occur; approval would include requirements, if applicable, for mitigation and offsetting	1	1	5	I	2	No residual effects are anticipated given mitigation through offsetting, if required.
Wetlands	Loss of wetland area and/or function	• Interactions with wetlands will be avoided, where practicable. • A WAWA Permit will be obtained for any required construction activities conducted within 30 m of an applicable wetland, and the conditions of such permits will be followed. • Wetlands within the footprint of turbines and road upgrades will be compensated for when necessary, under a plan developed in consultation with NBDELG.	1	1	2/1	R	2	Wetland loss at T7 would be 0.3 ha. No residual effects are anticipated given mitigation and compensation, if required.
Birds and Other Wildlife	Sensory Disturbance	• Overall disturbance during access road construction will be limited to designated workspaces.	3	1	2/1	R	2	Sensory disturbance may cause habitat avoidance, which would likely be temporary in nature, low in magnitude and restricted to within several hundred meters of the Project footprint. The area to be subject to this disturbance is forested land, and disturbance will be reversible. No significant residual effects are anticipated given mitigation to be applied.

Table 5.4 Potential Effects of Road Construction/Modification and Site Preparation

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
	Habitat Loss/ Alteration	• Habitat loss may be mitigated by reducing, to the extent practicable, the footprint of access roads to the minimum size required for safe transport.	2	1	2/1	R	2	The area of habitat that will be altered due to access road construction will be a small proportion of what is available. No significant residual effects are anticipated given avoidance mitigation.
	Mortality	• Should there be potential for nesting birds in previously cleared areas subject to construction activities during the breeding bird season, nest surveys will be performed to confirm there is no active nesting.	2	1	2/1	I	2	No residual effects are expected.
Heritage Resources	Disturbance	• An AIA has been completed by a licensed archaeologist. The AIA involved research and consultation with ASB, Historic Places and local historical societies, as well as fieldwork (i.e., walkover and judgmental testing). Recommended shovel testing is planned for fall 2017. Should resources be found that may be disturbed or destroyed by Project activities, these areas will be fenced off and excluded from construction activities or resources will be recovered. • A contingency plan for the discovery of archaeological resources during construction will be	2	1	2/1	R	2	No residual effects are expected.

Table 5.4 Potential Effects of Road Construction/Modification and Site Preparation

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		included in the Project Environmental Management Plan (see Section 5.4.4).						
Land Use	Reduction of forested land	• Existing forest roads will be used as access roads to the extent practicable. New access roads in PDA will be minimized	2	2	2/1	R	2	The area of forested land that will be lost due to access road construction will be a very small proportion of what is available and therefore the significant residual effects are not expected.
	Hazards and/or inconvenience to forestry operations, snowmobile operation, and recreational activity.	• Road construction schedule will consider planned forestry operations in the area such that required access is maintained. • No road construction is planned during winter months when snow is present. • Recreational access along existing trails and roads will be maintained to the extent practicable. • Notification to public and recreational stakeholders regarding construction schedule. • Prominent stop signage will be installed at four-way intersections. • Project road construction design will avoid steep ditches where practicable.	2	2	2/1	R	2	There may be minor delays to unscheduled land use activities, however these will be of short duration. No residual effects are expected. Safety issues are addressed in Section 5.2.1.7.

Table 5.4 Potential Effects of Road Construction/Modification and Site Preparation

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Noise	Increases to sound pressure levels due to the transportation and operation of road construction equipment	• Heavy equipment will only be transported to the site during daylight hours unless absolutely necessary. • Construction is planned for daylight ours only. • Construction equipment will have mufflers that comply with guidelines for sound and emission levels. • Noise abatement equipment will be used on all heavy machinery used.	3	2	2/1	R	2	Increased sound levels caused by tower and turbine assembly and installation will be temporary in nature and will be conducted during working, daylight hours. Due to the short nature of this disturbance, and available mitigation the residual effect is not considered to be significant.

Note

1	Geographic Extent	1 = <500 m², 2 = 500 m² – 1 km², 3 = 1 –10 km², 4 = 11 – 100 km², 5 = 101 – 1000 km², 6 = >1000 km²
	Magnitude	1 = Low: e.g., specific group or habitat, localized one generation or less, within natural variation, 2 = Medium: e.g., portion of a population or habitat, one or two generations, rapid and unpredictable change, temporarily outside range of natural variability, 3 = High: e.g., affecting a whole stock, population or habitat outside the range of natural variation.
	Duration	1 = <1 month, 2 = 1-12 months, 3 = 13-36 months, 4 = 37-72 months, 5 = >72 months.
	Frequency	1 = <11 events/year, 2 = 11-50 events/year, 3 = 51-100 events/year, 4 = 101-200 events/year, 5 = >200 events/year, 6 = continuous.
	Reversibility	R = reversible, I = irreversible.
	Ecological Context	1 = Pristine area or area not adversely affected by human activity, 2 = evidence of adverse effects.

5.1.3 Delivery of Equipment

Traffic patterns within the WFSA are largely related to forestry and wind farm operations. With the exception of its boundary roads, the WFSA receives relatively little traffic other than movements of local residents and occasional visits by tourists, hunters, trappers and other outdoor enthusiasts.

The trucks used for the heavy loads have multiple axles and have steering capability at the back end, allowing them to turn corners much tighter than trucks without such rear steering capability. A large mobile crane will also be required, approximately the size of a standard semi-trailer. To date, TransAlta has assumed to date that such a crane will be able to use current routes, without modification to such routes.

The planned delivery route will be along Prosser Brook Road, via Route 910, Pine Glen Road, the Petitcodiac Causeway, Route 15, Berry Mills Road, Route 2 and Route 1, originating in Saint John (Appendix A). The transportation of the turbine components to the site is the responsibility of the manufacturer, who will determine the ideal method and routing through consultation with NBDTI, utility, communication and cable companies, the GMDPC, and the RCMP. Approvals for transporting these materials will be sought from NBDTI, and permit requirements will be followed. The planned route avoids the Turtle Creek Reservoir Dam. Environmental protection measures will be in place to allow for safe transport through the Turtle Creek Watershed.

During construction of Kent Hills 1 and Kent Hills 2, private property at the intersection of Route 910 and Prosser Brook Road required modification, rehabilitation, and monetary compensation. This may also be required for the Kent Hills 3 Project.

The tower sections, the nacelle (which houses the gearbox and the generator) and rotor parts for the five turbines will be moved to each turbine site within the WFSA by flatbed truck and placed into an exact position for picking using a combination of cranes ranging from 50-tonne to 700-tonne capacity. One flatbed truck will be used for each of the six tower sections. A flatbed truck will be used for the nacelle, and one flatbed truck will be required to transport each of the three rotor blades. An additional three truckloads will be required for the rotor hub, small parts and the erection equipment for each turbine. All the equipment at the site will be cleaned using a pressure washer and biodegradable truck wash, more than 30 m from watercourses and wetlands.

There is the potential for effects to local sound levels and traffic due to the transportation of materials. The potential increase in sound levels may also cause sensory disturbance to birds and other wildlife. The potential environmental effects of activities associated with the delivery of equipment to the site are summarized in Table 5.5.

Table 5.5 Potential Effects of Delivery of Equipment

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Birds and Other Wildlife	Sensory Disturbance	• Delivery vehicles will remain on designated local and access roads.	3	1	2/3	R	2	Sensory disturbance may cause habitat avoidance but it likely will be temporary in nature, low in magnitude and restricted to the Project footprint and public roads along the delivery route. The area to be subject to this disturbance is forested land however disturbance will be reversible. Significant residual effects are not expected.
Land Use	Hazards and/or inconvenience to traffic on public roads	• Modifications to existing roads will be non-permanent, and will be remediated upon completion of construction. • Additional mitigation, if required by NBDTI on NBDTI roads, will be used to reduce potential hazards and/or inconveniences to traffic. Timing of deliveries will take into consideration likely peak traffic periods.	2	1	2/3	R	2	Traffic along most of the haul route is generally light, with the exception of the section in Moncton. With mitigation, significant residual effects are not expected.
Noise	Increase in sound pressure levels	• Equipment will be delivered during daylight hours.	3	2	2/3	R	2	Increased sound pressure levels caused by delivery of equipment will be temporary in nature and will be conducted during working, daylight hours. Due to the short nature of this disturbance, and the rural/remote nature of the site, significant residual effects are not expected.

Table 5.5 Potential Effects of Delivery of Equipment

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	

Note

1	Geographic Extent	1 = <500 m², 2 = 500 m² – 1 km², 3 = 1 –10 km², 4 = 11 – 100 km², 5 = 101 – 1000 km², 6 = >1000 km²
	Magnitude	1 = Low: e.g., specific group or habitat, localized one generation or less, within natural variation, 2 = Medium: e.g., portion of a population or habitat, one or two generations, rapid and unpredictable change, temporarily outside range of natural variability, 3 = High: e.g., affecting a whole stock, population or habitat outside the range of natural variation.
	Duration	1 = <1 month, 2 = 1-12 months, 3 = 13-36 months, 4 = 37-72 months, 5 = >72 months.
	Frequency	1 = <11 events/year, 2 = 11-50 events/year, 3 = 51-100 events/year, 4 = 101-200 events/year, 5 = >200 events/year, 6 = continuous.
	Reversibility	R = reversible, I = irreversible.
	Ecological Context	1 = Pristine area or area not adversely affected by human activity, 2 = evidence of adverse effects.

It is anticipated that with implementation of mitigation measures listed in Table 5.5, the residual effects of the delivery of equipment will be Minimal and not significant. Modifications will be required to existing municipal roads in order to handle the delivery of heavy equipment. All road modifications are reversible, and roads will be restored upon completion of construction. Existing traffic rates are relatively low (below capacity) along the potential access routes, and therefore it is unlikely that there will be significant inconvenience to local motorists or emergency services.

5.1.4 Temporary Storage Facilities

Temporary storage facilities will comprise a small portion of the WFSA, will use previously cleared areas where feasible, and should therefore have limited interaction with soils, terrestrial vegetation, birds and other wildlife, land use and noise, as discussed below, and assessed in Table 5.6.

A 3.4 ha cleared area immediately adjacent the main site access road south of existing turbine D4, was used for temporary storage during the construction of Kent Hills 1 and 2. Following use, the area was not required by Crown lands to be rehabilitated, and is proposed to be used again as the main storage facility during construction of the Project. The site was included in biophysical and archaeology investigations in 2017.

During site visits to the cleared area south of turbine D4, no bird use was noted. There is some potential for use by open habitat species; however, the site is less than ideal for sensitive species given it is

bisected by the main forestry/access road through the wind farm. The vegetation survey recorded a single SOCC, necklace spike sedge (*Carex omostachya*, S3), observed near the southeastern edge of the cleared planned laydown area. This species typically grows in rich hardwood stands (Hinds 2000); the habitat at the proposed temporary work space site is not ideal for this species. The location of the plant SOCC will be flagged so the habitat will not be disturbed during construction.

A site visit by the archeological team to the potential temporary workspace south of existing turbine D4 revealed that the entire area had already been stripped and quarried out from prior construction operations. No walkover survey was required as there is no potential for encountering archaeological resources.

The area's birds and wildlife already experience a certain level of sensory disturbance due to ongoing forestry, wind turbine operation and recreational activities. Activity at the site is likely to start before potential nesting by open habitat species and is expected to be occupied for the duration of construction.

Table 5.6 Potential Effects of Temporary Storage Facilities

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Soils	Soil disturbance and erosion	• Limited soil disturbance (grading) is anticipated	2	1	2/6	R	2	By implementing these standard mitigation measures, the residual effects on soils will be Minimal and not significant.
Terrestrial Vegetation	Loss of Plant SOCC	• Vascular plant SOCC will be flagged and avoided to the extent practicable.	1	1	2/1	R	2	Mitigation will avoid significant residual environmental effects on vascular plant SOCC.
Birds and Other Wildlife	Sensory Disturbance	• Overall disturbance will be limited to designated workspaces.	2	1	2/6	R	2	Residual effects include habitat avoidance by birds and other wildlife but it would be temporary in nature, low in magnitude and restricted to within several hundred metres of the temporary storage facilities. No significant residual effects are expected.

Table 5.6 Potential Effects of Temporary Storage Facilities

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
	Mortality	• The establishment of temporary storage facilities is expected prior to the use of open habitats by breeding bird species. If there is potential for the establishment of nesting by open habitat species within the footprint; the area will be checked for the presence of active bird nests prior to use. • A contingency plan will be developed as part of the Project Environmental Management Plan (EMP) to address the discovery of active nests during construction.	2	1	1/2	I	2	Despite timing of activities scheduled for the breeding season planned mitigation will reduce or avoid potential effects. Therefore, it is predicted that there will be no residual effect on bird mortality.
Heritage Resources	Disturbance	• An AIA has been completed by a licensed archaeologist. No shovel testing is planned for the identified temporary storage facility. • A contingency plan for the discovery of archaeological resources during construction will be included in the Project EMP.	2	1	2/1	R	2	No residual effects are expected.
Land Use	Reduction of forested land	• none identified.	2	2	2/6	R	2	Due to the limited footprint, its reversibility after construction, no residual effect is anticipated.

Table 5.6 Potential Effects of Temporary Storage Facilities

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Noise	Increases to sound pressure levels due to operation of equipment	• Construction equipment will have mufflers that comply with guidelines for sound and emission levels. • Noise abatement equipment, in good working order, will be used on all heavy machinery used on site..	2	2	2/6	R	2	Increased sound pressure levels caused construction vehicles and equipment will be temporary in nature and will be conducted during working, daylight hours. Due to the short nature of this disturbance, and available mitigation the residual effect is not considered to be significant.

Note

1	Geographic Extent	1 = <500 m², 2 = 500 m² – 1 km², 3 = 1 –10 km², 4 = 11 – 100 km², 5 = 101 – 1000 km², 6 = >1000 km²
	Magnitude	1 = Low: e.g., specific group or habitat, localized one generation or less, within natural variation, 2 = Medium: e.g., portion of a population or habitat, one or two generations, rapid and unpredictable change, temporarily outside range of natural variability, 3 = High: e.g., affecting a whole stock, population or habitat outside the range of natural variation.
	Duration	1 = <1 month, 2 = 1-12 months, 3 = 13-36 months, 4 = 37-72 months, 5 = >72 months.
	Frequency	1 = <11 events/year, 2 = 11-50 events/year, 3 = 51-100 events/year, 4 = 101-200 events/year, 5 = >200 events/year, 6 = continuous.
	Reversibility	R = reversible, I = irreversible.
	Ecological Context	1 = Pristine area or area not adversely affected by human activity, 2 = evidence of adverse effects.

Upon completion of construction, the temporary storage facilities will be removed and the ground will be graded to remediate any soil compaction, and will be hydroseeded, if required by Crown lands. The environmental effects of temporary storage facilities are principally due to land clearing (not currently expected) and delivery of equipment, and are discussed in Sections 5.1.2 and 5.1.4. Overall it is anticipated that with the implementation of the above-stated mitigation measures, the environmental effect associated with the temporary storage facilities will be Minimal and not significant.

5.1.5 Foundation Construction

Turbine foundations will leave a small footprint on the landscape that will last the extent of the Project's life. Excavation of soils and installation of the engineered foundations have the potential to interact

with several environmental components. The potential environmental effects of activities associated with foundation construction including soils, aquatic environment, birds and other wildlife, heritage resources, and noise are summarized below and in Table 5.7.

The turbine foundations will comprise a relatively small portion of the WFSA land which will have already been disturbed by previous Project construction activities (land clearing and site preparation) thereby previously assessed. Their presence, while permanent during operation, should not jeopardize species habitat. Sensory disturbance for birds and other wildlife will be temporary in nature, with foundation work in any one area expected to be of short duration (i.e. each foundation will take about three to four days to complete). The area's birds and wildlife already experience a certain level of sensory disturbance due to ongoing forest harvesting activities and associated human activities, and the area will have been already cleared and graded. Although there is low potential for potentially acid generating rock to be present, given the low quantities of rock that could be potentially generated during foundation excavation, where rock is encountered, no mitigation for potential acid rock drainage is warranted. During construction of Kent Hills 1 and Kent Hills 2, rock was not encountered during foundation development.

Table 5.7 Potential Effects of Foundation Construction

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Soils	Soil disturbance and erosion	• Topsoil and subsurface soils will be separated and stored on-site to be replaced appropriately after the pouring of concrete foundation. When the soils are stored they will be protected from erosion and runoff.	1	1	1/1	R	2	By implementing these standard mitigation measures, the residual effects on soils will be not significant.
Aquatic Environment	Surface Water Contamination	• Due to Crown Land lease requirements, no turbines will be sited within 270 m of a watercourse. • Equipment maintenance (e.g. washing of concrete trucks) will be controlled to prevent entry of concrete material into a watercourse. • Construction material, excess material,	1	1	1/1	R	2	No residual effects are expected.

Table 5.7 Potential Effects of Foundation Construction

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		construction debris, and empty containers will be stored away from watercourses and watercourse banks.						
	Sediment Loading	• Due to Crown Land lease requirements, no turbines will be sited within 270 m of a watercourse.	1	1	1/1	R	2	No residual effects are expected.
	ARD	• Low quantities of rock excavation expected.	1	1	1/1	R	2	No residual effects are expected.
Birds and Other Wildlife	Sensory Disturbance	• Overall disturbance will be limited to designated workspaces.	3	1	1/2	R	2	Residual effects includes habitat avoidance by birds and other wildlife but it would be temporary in nature, low in magnitude and restricted to within several hundred metres of the foundations. No significant residual effects are expected.
	Mortality	• As foundation construction is planned for June, there is potential for nesting by open habitat species within the footprint; the area will be checked for the presence of active bird nests prior to construction. • A contingency plan will be developed as part of the Construction Environmental Management Plan (CEMP) to address the discovery of active nests during construction, as well as to address the rescue of wildlife that fall into the excavation.	1	1	1/2	I	2	Despite timing of activities scheduled for the breeding season, planned mitigation will reduce or avoid potential effects. Therefore, it is predicted that there will be no residual effect on bird mortality.

Table 5.7 Potential Effects of Foundation Construction

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Heritage Resources	Disturbance	• An AIA has been completed by a licensed archaeologist. The AIA involved research and consultation with ASB, Historic Places and local historical societies, as well as fieldwork (i.e., walkover and judgmental testing). No shovel testing is planned for preferred turbine locations, which are located in low-potential areas. Should resources be found that may be disturbed or destroyed by Project activities, these areas will be fenced off and excluded from construction activities or resources will be recovered. • A contingency plan for the discovery of archaeological resources during construction will be included in the CEMP.	1	1	1/1	R	2	No residual effects are expected.
Noise	Increases to sound pressure levels due to operation of equipment	• Construction equipment will have mufflers that comply with guidelines for sound and emission levels. • Noise abatement equipment, in good working order, will be used on all heavy machinery used on the Project.	3	2	1/2	R	2	Increased sound pressure levels caused by foundation construction will be temporary in nature and will be conducted during working, daylight hours. Due to the short nature of this disturbance, and available mitigation the residual effect is not considered to be significant.

Table 5.7 Potential Effects of Foundation Construction

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	

Note

1	Geographic Extent	1 = <500 m², 2 = 500 m² – 1 km², 3 = 1 –10 km², 4 = 11 – 100 km², 5 = 101 – 1000 km², 6 = >1000 km²
	Magnitude	1 = Low: e.g., specific group or habitat, localized one generation or less, within natural variation, 2 = Medium: e.g., portion of a population or habitat, one or two generations, rapid and unpredictable change, temporarily outside range of natural variability, 3 = High: e.g., affecting a whole stock, population or habitat outside the range of natural variation.
	Duration	1 = <1 month, 2 = 1-12 months, 3 = 13-36 months, 4 = 37-72 months, 5 = >72 months.
	Frequency	1 = <11 events/year, 2 = 11-50 events/year, 3 = 51-100 events/year, 4 = 101-200 events/year, 5 = >200 events/year, 6 = continuous.
	Reversibility	R = reversible, I = irreversible.
	Ecological Context	1 = Pristine area or area not adversely affected by human activity, 2 = evidence of adverse effects.

Overall, it is anticipated that with the implementation of the above-stated mitigation measures, the residual effects associated with foundation construction will be Minimal and not significant.

5.1.6 Tower and Turbine Assembly and Installation

Cranes will be used to assemble the rotor blades with the rotor hub. Control and switching equipment will be placed on each turbine pad by a crane. Cranes will be used to install each tower section. Each tower section will be lifted and secured with bolts to the section below, followed by the nacelle secured to the top tower section. Finally, the assembled rotor will be lifted and attached to the nacelle. This work takes one to two days of work per turbine.

Sensory disturbance for birds and other wildlife will be temporary in nature, and not significant. The area's birds and wildlife already experience a certain level of sensory disturbance due to forest and recreational activities.

This phase of construction could potentially have effects on birds and other wildlife, and noise and this is summarized in Table 5.8.

Table 5.8 Potential Effects of Tower and Turbine Assembly and Installation

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Birds and Other Wildlife	Sensory Disturbance	• Overall disturbance will be limited to designated workspaces.	3	1	2/1	R	2	Sensory disturbance likely will be temporary in nature, low in magnitude and restricted to the WFSA. The residual effect is not significant.
Noise	Increases to sound pressure levels due to the transportation and operation of equipment	• Heavy equipment will only be operated during daylight hours. • Construction equipment will have mufflers that comply with guidelines for sound and emission levels. • Noise abatement equipment, in good working order, will be used on all heavy machinery used on the Project.	3	2	2/1	R	2	Increased sound levels caused by tower and turbine assembly and installation will be temporary in nature and will be conducted during working, daylight hours. Due to the short nature of this disturbance, and available mitigation the residual effect is not considered to be significant.

Note

1	Geographic Extent	1 = <500 m², 2 = 500 m² – 1 km², 3 = 1 –10 km², 4 = 11 – 100 km², 5 = 101 – 1000 km², 6 = >1000 km²
	Magnitude	1 = Low: e.g., specific group or habitat, localized one generation or less, within natural variation, 2 = Medium: e.g., portion of a population or habitat, one or two generations, rapid and unpredictable change, temporarily outside range of natural variability, 3 = High: e.g., affecting a whole stock, population or habitat outside the range of natural variation.
	Duration	1 = <1 month, 2 = 1-12 months, 3 = 13-36 months, 4 = 37-72 months, 5 = >72 months.
	Frequency	1 = <11 events/year, 2 = 11-50 events/year, 3 = 51-100 events/year, 4 = 101-200 events/year, 5 = >200 events/year, 6 = continuous.
	Reversibility	R = reversible, I = irreversible.
	Ecological Context	1 = Pristine area or area not adversely affected by human activity, 2 = evidence of adverse effects.

Overall it is anticipated that, with the implementation of the above-stated mitigation measures, the residual effects associated with the tower and turbine assembly and installation will be Minimal and considered not significant.

5.1.7 Interconnection from Turbines to Existing Collector System

Underground 34.5 kV power lines are to be installed from each turbine to the nearest existing road allowance, largely following constructed access roads. A combination of ploughing and trenching will be used, depending on terrain. Where insufficient soil depth is encountered, aboveground cabling may be required. Above-ground, pole-mounted 34.5 kV electrical cables will be used primarily along the existing (modified) roads to tie into the nearest above-ground or buried cables of the existing wind farm.

There are two locations where watercourses may be crossed by electrical cables; however, overhead cables on poles are planned at these locations, where the watercourses will be spanned. Watercourses will be avoided to the extent practicable; however, if required, the installation of these cables will use poles to span the watercourse. Any loss of wetland, beyond required clearing of trees and shrubs adjacent the road, will be limited to pole placement where wetlands cannot be spanned.

Potential effects to soils, aquatic environment, wetlands, birds and other wildlife, heritage resources, land use and noise are summarized in Table 5.9.

Table 5.9 Potential Effects of the Interconnection from Turbines to Existing Collector System

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Soils	Soil Erosion and Compaction	• Whenever practicable, this activity will be limited to periods when the ground surface is best able to support construction equipment (dry season). • Land will be restored/reclaimed using topsoil stored on-site. • Standard erosion and sediment control measures will be integrated with the construction operation schedule as determined by the Contractor and TransAlta.	2	1	2/1	R	2	By implementing these standard mitigation measures, the residual effects on soils will be Minimal and not significant.

Table 5.9 Potential Effects of the Interconnection from Turbines to Existing Collector System

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Aquatic Environment	Surface Water Contamination	• Watercourses will be avoided to the extent practicable. • Where watercourse crossings are required, cables will be aboveground and watercourses will be spanned.	1	1	2/1	R	2	By following mitigation measures, negative interactions with surface water quality and fish habitat in the WFSA will be avoided and no significant residual effect is anticipated. Only one watercourse is crossed by the PDA, at an existing access road and using planned overhead lines.
	Sediment Loading	• Watercourses will be avoided to the extent practicable. • Temporary erosion and sediment control measures (e.g., silt fence, straw bales) will be used, maintained and kept in place until work within or near a watercourse has been completed and is stable. • Temporary sediment control measures will be removed at the completion of the work only when permanent erosion control measures, as may be specified in the contract, have been established. • Clearing, grubbing, and uprooting of vegetation near watercourses will be avoided or reduced to the extent practicable.	1	1	2/1	R	2	By following mitigation measures, adverse interactions with surface water quality and fish habitat in the WFSA will be avoided and no significant residual effects are anticipated.
Wetlands	Loss of wetland area and/or function	• Pole placement will be designed to span wetlands where practicable.	1	1	2/1	I	2	Given the mitigation measures to be applied, residual effects are expected to be Minimal and not significant.

Table 5.9 Potential Effects of the Interconnection from Turbines to Existing Collector System

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		• A WAWA Permit will be obtained for any required construction activities conducted within 30 m of an applicable wetland, and the conditions of such permits will be followed.						
Birds and Other Wildlife	Sensory Disturbance	• Overall disturbance will be limited to designated workspaces	3	1	2/1	R	2	Sensory disturbance will be temporary in nature, low in magnitude and restricted to already disturbed road edges within the PDA. The residual effect is considered Minimal.
Heritage Resources	Disturbance	• An AIA has been completed by a licensed archaeologist. The AIA involved research and consultation with ASB, Historic Places and local historical societies, as well as fieldwork (i.e., walkover and judgmental testing). Recommended shovel testing is planned for fall 2017. Should resources be found that may be disturbed or destroyed by Project activities, these areas will be fenced off and excluded from construction activities or resources will be recovered. • A contingency plan for the discovery of archaeological resources during construction will be included in the CEMP.	1	1	2/1	R	2	No residual effects are expected.

Table 5.9 Potential Effects of the Interconnection from Turbines to Existing Collector System

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Land Use	Hazards and/or inconvenience to forestry operations, trapping, and recreational activity.	• Roads will be passable during trenching to maintain required access. • Recreational access along existing trails and roads will be maintained.	2	1	2/1	R	2	There may be minor delays to unscheduled land use activities, however these will be of short duration and therefore the effect is expected to be Minimal and not significant.
Noise	Increases to sound pressure levels due to the transportation and operation of clearing equipment	• Heavy equipment will only be transported to the site and operated during daylight hours. • Trenching and ploughing equipment will have mufflers that comply with guidelines for sound and emission levels. • Noise abatement equipment, in good working order, will be used on all heavy machinery used on the Project.	3	2	2/1	R	2	Increased sound levels caused by trenching and ploughing will be temporary in nature and will be conducted during working, daylight hours. Due to the short nature of this disturbance and available mitigation, the residual effect will be not significant.

Note

1	Geographic Extent	1 = <500 m², 2 = 500 m² – 1 km², 3 = 1 –10 km², 4 = 11 – 100 km², 5 = 101 – 1000 km², 6 = >1000 km²
	Magnitude	1 = Low: e.g., specific group or habitat, localized one generation or less, within natural variation, 2 = Medium: e.g., portion of a population or habitat, one or two generations, rapid and unpredictable change, temporarily outside range of natural variability, 3 = High: e.g., affecting a whole stock, population or habitat outside the range of natural variation.
	Duration	1 = <1 month, 2 = 1-12 months, 3 = 13-36 months, 4 = 37-72 months, 5 = >72 months.
	Frequency	1 = <11 events/year, 2 = 11-50 events/year, 3 = 51-100 events/year, 4 = 101-200 events/year, 5 = >200 events/year, 6 = continuous.
	Reversibility	R = reversible, I = irreversible.
	Ecological Context	1 = Pristine area or area not adversely affected by human activity, 2 = evidence of adverse effects.

Overall it is anticipated that, with the implementation of the proposed mitigation measures, the residual effects of the interconnection from turbines to existing collector system will be Minimal and considered not significant.

5.1.8 Commissioning

Commissioning will involve testing and inspection of electrical, mechanical, and communications operability. A detailed set of operating instructions will be followed in order to connect with the electrical grid. This final stage of construction is a transition between construction and operation. This activity is limited to activities within the turbines and substation, and generally only involves transportation of workers and presence at the turbine sites. Other than minor vehicle noise and travel to the turbine locations, the potential effects on the identified VCs are negligible and not significant.

5.2 OPERATION AND MAINTENANCE ACTIVITIES – ENVIRONMENTAL EFFECTS

The environmental components that may be adversely affected by the operation of the Project include birds and other wildlife (primarily bats), land use, visual aesthetics, noise, and health and safety. Project operation may also raise health and safety issues, both for Project personnel and landowners. Table 5.10 provides a general overview of these components and associated effects. The remainder of Section 5.2 describes these interactions and potential effects in greater detail. Due to the separate concerns of birds and other wildlife, these have been separated into two valued components in Table 5.10.

Table 5.10 Summary of Potential Effects of Operation and Maintenance Activities

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Birds	Sensory Disturbance	• The turbines selected are quieter than the Vestas V90s currently in use at the Kent Hills Wind Farm.	3	2	5/6	R	2	It is anticipated that sensory disturbance during Project operations may cause birds to change their flight patterns in order to avoid the towers and rotating blades. This may, however, have a positive effect, as it serves to reduce the number of bird collisions. Changes in flight patterns could lead to long distances traveled and increase energetic costs.,

Table 5.10 Summary of Potential Effects of Operation and Maintenance Activities

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
								though the changes would not likely be long enough to be significant. There is also potential for lower density of nesting birds close to turbines. Residual effects are expected to be limited to a lower density of nesting birds near the turbines; however the habitats near the preferred turbine locations are common in the landscape.
	Mortality	• Lighting will be the minimum allowed by Transport Canada for aeronautical safety, and white or red strobe lights may be used with the minimum intensity and flashes per minute allowable. • Electrical cables will be buried underground within the wind farm to the extent practicable, and thereby reduce perching opportunities for birds and to reduce the likelihood of collision with the wires. Where aboveground electrical lines are necessary, they will be to the minimum extent required. • Post-construction monitoring will direct the need and form of further turbine operation mitigation measures.	2	2	5/1	I	2	Given existing information from operating wind energy facilities elsewhere in North America, it is anticipated that fatalities due to avian collision with wind turbines will not cause significant bird fatalities, either of sensitive species or of large numbers of birds. The WFSA does not contain any landform features or other human-made features that would concentrate birds, and existing information on the area's birds does not indicate the presence of breeding bird colonies or concentrations. Post-construction monitoring will be implemented to confirm that the residual effect of the Project on bird mortality rates is not significant.
Other Wildlife	Sensory Disturbance	• The turbines selected are quieter than the Vestas V90s currently in	3	2	5/6	R	2	Studies of effects of wind turbines on large terrestrial mammals are few, however Helldin et al. (2012) indicates large

Table 5.10 Summary of Potential Effects of Operation and Maintenance Activities

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		use at the Kent Hills Wind Farm.						mammals are either unaffected by wind energy facilities, given their small footprint and the preservation of existing land use, or that they can readily adapt to the presence of wind turbines. Habitat avoidance will be intermittent during periods of operation, when on-site human activities occur (short-term). However wildlife in the area are subjected to other commercial and recreational activities such as forestry and ATV use , and are likely habituated to such activity. Residual effects include temporary avoidance from sensory disturbance and habitat fragmentation.
	Mortality	• None required. Post-construction monitoring of bats (i.e. casualty surveys) will direct the need and form of further post-construction mitigation measures.	2	2	5/1	I	2	Based on existing information from monitoring programs elsewhere in North America, onsite pre-construction monitoring, and 4 years of post construction monitoring at the existing wind farm, it is anticipated that the effect of wind farm operations on bat mortality will be not significant, Post-construction monitoring will be implemented to confirm this prediction. However, in the unlikely instance of the death of a bat species at risk, the effects would be considered significant.

Table 5.10 Summary of Potential Effects of Operation and Maintenance Activities

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Land Use	Disruption to forested lands	• None required.	2	2	5/1	R	2	The effect of wind turbines on forested lands is negligible with less than 2% of the available land required for wind turbines, ancillary equipment and access roads. Forestry activities can continue near the site and related buildings, leaving the vast majority of the land available for forestry purposes. The primary land use in the area can continue around Project facilities. As a result, residual effects are the loss of land available for forestry due to the operation of the Project. This residual effect is considered Minimal and is not expected to be significant.
	Effect to tourism and recreation	• Turbines are sited well away from the Fundy shoreline. • Prominent stop signage will be installed at new four-way stop intersections and existing stop signage will be upgraded to increase traffic safety for snowmobiles and ATVs • Snowplowing will not block snowmobile crossings at intersections with access roads.	5	2	5/1	R	2	There is very little commercial tourism-related activity in the immediate WFSA Existing tourism and recreation within the RSA will not be adversely affected by the Project. Tourism in the area has increased since the wind farm development, with the public visiting the turbines.

Table 5.10 Summary of Potential Effects of Operation and Maintenance Activities

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
	Effect on local economy	• Local residents will be employed to the extent practicable during the construction, operation and decommissioning of the Project. • Municipal taxes will be paid, thus increasing the local tax base, which could be used to increase funding of local municipal initiatives.	5	1	5/1	R	2	A positive residual effect would be realised by the construction and operation of the Project, through increases in employment opportunities, increases in private spending due to an influx of Project personnel, and an increase in the municipal tax base.
	Effect on Property Values	• None required	5	1	5/1	R	2	Existing information indicates that property values are not adversely affected by the construction and operation of wind farms. No residual effects are expected.
Visual Aesthetics	Change to Visual Landscape	• Turbines will be painted an off-white color designed to reduce reflection in a wide range of light conditions.	4	2	5/6	R	2	Given the viewing distances of approximately greater than 500 m, sparse population, and the presence of vegetation which will visually block major portions of the facility, the visual effect on nearby residents is expected to be not significant. Many landowners within the WFSA will have views of the wind turbines from the residences, but most views will be obstructed by existing human structures, existing vegetation and distance.

Table 5.10 Summary of Potential Effects of Operation and Maintenance Activities

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
	Lighting	• Lighting will be the minimum allowed by Transport Canada to allow for the appropriate level of aeronautical safety.	4	2	5/1	R	2	Given the viewing distance of approximately greater than 500 m, combined with the elevation and vegetation obstructions from the nearest neighbours, the presence of the lights will not place excessive nighttime visual pollution within several kilometers of the WFSA. Residual effects are expected to be not significant.
	Shadow Flicker	• None required.	4	2	5/1	R	2	Modeling of shadow flicker indicates the maximum number of shadow hours cast per year at any receptor within the Kent Hills Wind Farm is below the acceptable thresholds recognized by the wind industry.
Noise	Increases to Sound Pressure Levels	• Turbines are designed to be quieter than previous models. • Turbines are located more than 1 km from residential receptors.	4	2	5/1	R	2	Modelling to predict sound pressure levels caused by the operation of wind turbines indicated that all the receptors within the WFSA are expected to receive sound exposures from the proposed wind farm below the acceptable sound limits in the NB Guidance. Any increase in sound levels due to the operation of the Project is therefore expected to be not significant.

Table 5.10 Summary of Potential Effects of Operation and Maintenance Activities

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Health & Safety	Electromagnetic Fields (EMFs)	• None required.	2	1	5/1	R	2	The EMF produced by the equipment within the turbines will be very weak, reduced not just by distance, but also by objects such as trees and other objects that conduct electricity. Overall the EMF is not anticipated to have negative effects on human health and safety.
	Infrasound Energy	• None required.	3	1	5/1	R	2	There is no evidence that the wind turbine technology proposed for this Project presents any potential problems related to the generation of infrasound energy. No residual effects are expected.
	Ice Throw	• Turbine design will reduce the potential for ice throw. • During site visits, vehicles will be parked up-wind of the turbines. • Warning signs will be posted near the turbines, to discourage the public from approaching the turbines.	2	1	5/1	R	2	Due to the setback distance to the nearest residence of at least 1200 m, it is extremely unlikely that ice throw would present a risk to landowners. Turbines will be at least 100 m from designated snowmobile trails. For maintenance personnel, the potential of ice throw presents a risk to health and safety. With the implementation of the mentioned mitigation measures, the risk of injury and property damage will be reduced. Residual effects are expected to be not significant.

Table 5.10 Summary of Potential Effects of Operation and Maintenance Activities

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	

Note

1	Geographic Extent	1 = <500 m², 2 = 500 m² – 1 km², 3 = 1 –10 km², 4 = 11 – 100 km², 5 = 101 – 1000 km², 6 = >1000 km²
	Magnitude	1 = Low: e.g., specific group or habitat, localized one generation or less, within natural variation, 2 = Medium: e.g., portion of a population or habitat, one or two generations, rapid and unpredictable change, temporarily outside range of natural variability, 3 = High: e.g., affecting a whole stock, population or habitat outside the range of natural variation.
	Duration	1 = <1 month, 2 = 1-12 months, 3 = 13-36 months, 4 = 37-72 months, 5 = >72 months.
	Frequency	1 = <11 events/year, 2 = 11-50 events/year, 3 = 51-100 events/year, 4 = 101-200 events/year, 5 = >200 events/year, 6 = continuous.
	Reversibility	R = reversible, I = irreversible.
	Ecological Context	1 = Pristine area or area not adversely affected by human activity, 2 = evidence of adverse effects.

5.2.1 Wind Turbine Operation

The following sections discuss the potential effects of the operation of the Kent Hills 3 Wind Project on the natural and socio-economic environment.

5.2.1.1 Effects to Birds

The existing Kent Hills Wind Farm has been in operation with 32 turbines since 2008 and an additional 18 turbines since 2010. Post-construction monitoring was conducted during the first four years of operation, with carcass searches conducted at representative turbines twice per week over six months from 2009 to 2012. The monitoring results confirmed low mortality rates, as was predicted following preconstruction surveys conducted over two spring monitoring and two fall monitoring periods between 2006 and 2009.

Given the time that has passed since pre-construction surveys conducted for Kent Hills 1 and 2, spring and fall migration surveys were requested by the TRC for the Project.

To direct the information requirements for bird populations, ECCC was consulted and guidance was obtained through a review of federal guidance for wind energy projects as they relate to birds (Environment Canada 2007a;b). In particular, Tables 1 to 3 of Environment Canada (2007a) were consulted to identify the sensitivity, facility size, level of concern and information expectations in the

context of these guidelines. The sensitivity of the area is assessed to be low to medium, based on available information to date. The size of the facility, although only five turbines are being added, will cumulatively be 55 turbines, and is therefore is considered "large" (41 to 100 turbines). According to the criteria identified in the aforementioned tables, the level of concern would be considered Category 2 or 3.

Table 5.11 identifies the information that ECCC expects for projects with a level of concern of Category 2 or 3.

Table 5.11 Questions for Consideration as per Environment Canada (2007a)

Question	Answer *
Identify the species that breed and winter at the site and in the surrounding area, and indicate their relative abundance.	See Section 4.3.3.1, 4.3.4.1 and Appendix F.
Identify any species at risk, including species listed under the *Species at Risk Act* (SARA), provincially or territorially designated species, species designated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), or species designated as priority species by the Conservation Data Centres (CDC), Partners in Flight (PIF) or the CWS.	See Section 4.3.4.1 and Appendices B and C.
Identify bird colonies (note species, size, location).	None.
Identify raptors, shorebird concentrations.	None.
Identify species that give aerial flight displays.	See Section 4.3.3.1
Identify the species that congregate at significant migration staging areas at or near the site.	None.
Identify the species that frequently migrate through or near the area.	See Section 4.3.3.1. and Appendix E.
Identify the species that commute (i.e., between breeding and foraging habitats) through or near the area, as compared to other locations within the region.	See Section 4.3.3.1.
What habitat types occur on the site and in the surrounding area?	See Section 4.3.2.
Do these habitats typically support habitat-sensitive or habitat specialist species, e.g., forest-interior species, grassland species, or shrubland species?	Forest habitat, hosting species of forest birds
What is the relative density of breeding birds in these habitats?	See Section 4.3.3.1 and below.
What breeding or migrating birds do these habitats typically support?	See Section 4.3.3.1 and Appendix E and F.
How much of each habitat type or function will be lost or altered as a result of this development?	The Project footprint will be primarily on logged and forested Crown Land. Only a very small proportion (approximately 2%) of the area within the WFSA will be altered. Much of the footprint will be within presently disturbed areas, including

Table 5.11 Questions for Consideration as per Environment Canada (2007a)

Question	Answer *
	existing access roads and clearings. See Sections 4.3.1 and 5.1.2
What topographical features, such as islands, peninsulas, and ridges, are located on or near the site that may influence bird activity and movement?	None.
What is the expected amount and type of human presence (vehicles, pedestrians, tourism, etc.) at the site at different times of the year, during and following construction?	See Section 2.5.
What are the relevant meteorological data, such as wind speed, wind direction and visibility (e.g., number of days during migration period with visibility <200m or cloud bases <200m) for the site?	See Section 4.5.
* May refer to section or appendix of this Report.	

The potential environmental effects resulting from Project-related activities on birds include sensory disturbance and mortality. Section 4.3.3.1 provides detailed information on the breeding, wintering and migrating birds of the WFSA. Approximately 90 species of birds have been recorded as possible, probably or confirmed breeders in the four MBBA squares (20LR46, 20LR47, 20LR56 and 20LR57) that overlap the WFSA. These squares include portions adjacent to the Bay of Fundy coastline, including wetland habitats not found in the WFSA. However, 57 species were detected during the breeding season in the WFSA in 2017, with four SAR (common nighthawk, eastern wood-pewee, olive-sided flycatcher and Canada warbler) and one SOCC (red crossbill) observed in low numbers. While Figures 4.6 to 4.8 show multiple observations of bird SAR in clusters, these are typically multiple detections of the same individuals over several days. The estimated numbers of each SAR detected during 2017 field surveys are two common nighthawk, two eastern wood-pewee, one to two olive-sided flycatcher and two to three Canada warbler.

Sensory Disturbance

Indirect habitat loss may continue to affect wildlife habitat availability during operation through sensory disturbance. The operation of the wind turbines may result in visual and auditory disturbance of wildlife, including birds; during post-construction monitoring of the existing Kent Hills Wind Farm there was some evidence of lower breeding bird densities close to turbines (Stantec 2013).

Wind turbines will emit noise during operation that may result in reduced use of adjacent areas by wildlife (Habib et al. 2007, Bayne et al. 2008, Francis and Barber 2013, Read et al. 2014). The behaviour of birds and other wildlife are known to be influenced by noise (Francis et al. 2009), though Brumm (2004) reported that birds may adapt behaviourally to noise disturbance by increasing their song volume. Wildlife behavioural changes associated with wind-energy facilities appear to be species- and site-specific. Many species will not avoid habitat near to rotating wind turbines, as has been noted by James (2003) and James and Coady (2003); but other species show a reduction in breeding densities near turbines (Johnson et al. 2000). Depending on season and species, an avoidance distance of less

than 100 m has been observed in the United States, and avoidance distances of 0 to 800 m were observed in similar studies in Europe (Kingsley and Whittam 2005; Devereux et al. 2008). Leddy et al. (1999) reported lower densities of nesting grassland birds within 100 to 200 m of turbines, with densities decreasing by more than 50% within 50 m of the turbines. However, results from other studies suggest that wind farms do not affect bird distribution (Powlesland 2009; Niemuth et al. 2013). We would expect smaller sensory disturbance areas for forested landscapes because noise dissipates faster. The visual disturbance is also less in forested areas compared to open grasslands because of visual obstruction by trees.

Noise disturbance to birds will decrease with increasing distance from wind turbines, as noise dissipates over distance, particularly in forested landscapes. While there was some evidence of lower breeding bird densities within several hundred metres of the existing wind turbines at Kent Hills, the effect was not measurable at greater distances. The zone of influence may be lower for the five proposed additional turbines as they are expected to be quieter than the existing turbines, as indicated in the noise impact assessment (Appendix L).

Mortality

A possible effect of this Project on birds is an increase in mortality due to collisions with the operating wind turbines. It is often perceived that wind turbines cause a great many bird deaths, and it has been highlighted by regulatory agencies and non-governmental agencies as an important issue of concern. There remains some uncertainty regarding factors influencing bird-turbine interactions; however general information and references are presented below regarding scientific knowledge on these interactions.

Kingsley and Whittam (2007) provide a detailed review of available information regarding turbine-related bird fatalities in North America and elsewhere. Numerous studies during the last 20+ years have been conducted to estimate bird mortality at wind farms, from a single turbine or small wind farms such as the present proposal, to larger wind farms with thousands of wind turbines (Gill et al. 1996, Erickson et al. 2001, Percival 2001, Zimmerling et al. 2013, Erickson et al. 2014). This level of study effort is principally due to the circumstances at one large site in California, Altamont Pass, which alerted the industry, government and the public to this issue.

North American mortality rates published by Rydell et al. (2012) are comparable to some other reviews of bird mortality at wind-energy facilities in North America (Erickson et al. 2001; Arnett et al. 2007). Erickson et al. (2001) compared estimates of bird mortality caused by different human sources in the United States, and estimated that an average of 2.19 birds per turbine, or between 10,000 and 40,000 birds are killed each year. Rydell et al. (2012) reported that the median value of bird mortalities at wind-energy facilities in North America was 1.6 birds/turbine/year, with the majority of North American wind-energy facilities being located in high-elevation grasslands. However, Zimmerling et al. (2013) completed a review of mortality rates at 43 wind farms, reporting mortality rates from 0 to 26.9 birds/turbine/year, (averaging 8.2), which included wind farms from a variety of landscapes and corrected for detection bias. New Brunswick wind farms (including Kent Hills) were assessed and reportedly averaged the lowest number of bird mortalities per turbine annually, at 2.4, and

representing only 1% of the estimated total annual mortality from wind turbines in Canada as of the end of 2011(Zimmerling et al. 2013).

Analysis of mortality monitoring from 116 studies at more than 70 wind-energy facilities indicate that small passerines accounted for 62.5% of all bird fatalities (Erickson et al. 2014). Most bird fatalities reported at wind farms are during spring and fall migration and involve migrating passerines (Erickson et al. 2014). Factors contributing to the collision of nocturnal migrants with wind turbines include the height of the structure, lighting and weather (Kingsley and Whittam 2005).

An analysis of post-construction monitoring reports in Canada suggest that Atlantic Canada has lower reported bird mortalities than Alberta and Ontario, at 1.17 ± 1.01 non-raptor birds/turbine (BSC et al. 2016). Mortality for non-raptors ranged between 0 and 7.09 birds/turbine (BSC et al. 2016), which puts Kent Hills at the low end, which ranged from 0.39 to 1.41 bird fatalities per turbine (Stantec 2013). As of December 2015 Kent Hills represents 10% of the installed turbines in Atlantic Canada (BSC et al. 2016).

Although fatalities occur at wind energy facilities, the number of fatalities is generally small. This is especially noticeable when compared to the fatalities caused by other sources, such as communication towers, roads and buildings. Compared to other sources, such as buildings (98-980 million birds killed each year), communication towers (4-50 million birds killed each year) and vehicles (60-80 million birds killed each year), the mortality caused by wind turbines is significantly less (Erickson et al. 2001). Each house in North America kills on average between 1 and 10 birds each year, and tall buildings kill many more (Dunn 1993, Kingsley and Whittam 2007). Kingsley and Whittam (2007) indicate that the effects are small considering the millions of birds that travel through existing wind power developments in the U.S. each year. This has been noted for two sites in Washington and one site in Minnesota, where conservative estimates of mortality, using surveillance radar and carcass surveys to determine passage rates and fatality rates, respectively, are less than 0.01% of birds passing through each wind farm (Erickson 2003).

In Canada, existing wind farms in Alberta were included in a research study examining the movement of nocturnal migrant birds (and bats) using radar and sound recording technology. This research, conducted during the fall of 2004, compared the behaviour and abundance of birds and bats between operating wind farms and comparable sites without wind turbines. Millikin (2005) estimated that approximately 0.02% of the individuals (birds and bats combined) observed on radar may have resulted in a collision with a turbine. This research identified that these nocturnally migrating birds exhibited avoidance behaviour, with individuals reducing their speed and increasing their flight height to avoid the turbines (Millikin 2005). The results of this study indicate that simply identifying increased numbers of birds at a particular site prior to the construction of a wind farm may not equate to increased fatalities once the wind farm is operating. Geese may be able to avoid collisions with wind turbines or may change flight direction to avoid wind farms altogether (Pendlebury 2006; Arnett et al. 2007). Rydell et al. (2012) reported that 62 % of birds encountering wind turbines changed their flight direction or altitude.

These data provide a better understanding of potential effects on birds, which indicate that fatalities caused by wind turbines is actually very low (Erickson et al. 2001, Percival 2001, Erickson et al. 2002,

Kingsley and Whittam 2007). However, it is important to reduce or eliminate fatalities to the extent practicable, and it is important to understand what factors may increase the collision risk of birds at a wind farm. A number of factors may influence the potential for bird-turbine interactions that lead to bird kills, including weather and lighting, landscape features, turbine design, facility design and bird abundance and behaviour. These are described further in the following discussion. The addition of five turbines within the existing wind farm would not be expected to result in a significant increase in bird mortality rates.

Weather and Lighting

When conditions are clear, there is low likelihood that birds will collide with wind turbines (Crockford 1992, Kingsley and Whittam 2007). However, low visibility (<200 m) may cause nocturnal migrants to fly at lower altitudes, and lights may attract individuals (Jones and Francis 2003, Kingsley and Whittam 2007). While the Bay of Fundy coastline is known for persistent fog, the Kent Hills area is located 15 km inland from the coast, and is expected to have a similar number of fog days to nearby cities such as Moncton, which averaged 60 fog days per year. The season with the greatest contrast in temperature between sea surface and overriding air produces the greatest fog. At Saint John, located at the coast, fog occurs on more than one quarter of the days of the year with an average of 98 fog days, and 36% of the time in July. Sea fog is much more prevalent during the night and early morning than during the day. At Saint John early morning fog occurs on 60% of the fog days; by 2 p.m. the fog frequency drops to 18%. Elsewhere across New Brunswick, the fall is the foggiest season, with occurrences on 4 or 5 days each month, but overall conditions are not unusually foggy (Environment Canada 2004). Therefore, while visibility of <200 m likely occurs in the Kent Hills Area, it is not expected to be a factor leading to a significant number of bird fatalities. Bird casualty surveys at Kent Hills did not indicate a higher collision rate in the fall compared to the other seasons.

There undoubtedly will be weather conditions besides fog that will result in low visibility, such as blowing snow, and driving rains. Blowing snow conditions are not likely to result in increased collisions with turbines, as migration typically occurs outside of the winter season when blowing snow would most likely be present, there are fewer birds present, and wintering birds would likely be seeking protection from the elements, rather than flying at high elevations. Periods of heavy precipitation effectively ground migrants.

Birds may be attracted to red visibility beacons or other lighting associated with turbine structures. Lighting that attracts birds can increase the probability of bird-turbine collisions and result in kills. ECCC recommends that white strobe lights be used on towers at night and that their number and light intensity be minimized. It is also recommended that the number of flashes per minute be minimized within allowable parameters. However, in mortality studies of TransAlta's 220 wind turbines in western Canada, a number of which are equipped with steady burning red lights, there is no correlation with lit towers versus unlit towers (TransAlta, unpublished data). No correlation could be made regarding lit vs unlit turbines in the casualty monitoring of turbines at Kent Hills due to low numbers of casualties (Stantec 2010, 2011, 2012 and 2013). Lighting for this Project will be based on the standards and requirements of Transport Canada, with the intent to install the minimum amount of lighting required. Lighting elsewhere within the Project will be the minimum necessary for safety.

Landscape Features

Siting a wind farm near landforms that concentrate birds, such as high ridges, slopes and mountaintops, may increase the risk of avian collision. The WFSA, although located in an area of high elevation, does not appear to be an important bird migration route, based on five-seasons of bird surveys conducted at the site in 2006/2007/2017. The proposed Project is sited more than 15 km from the Bay of Fundy (Rocher Bay), and 10 km from the Shepody National Wildlife Area – Germantown Marsh Unit. The preferred turbine locations are also sited on relatively flat areas within the WFSA, generally away from steeply sloped areas. Landscape features are therefore not expected to be a factor leading to a significant number of bird fatalities. Moreover, post-construction casualty searches also indicates significant bird fatalities are unlikely at Kent Hills.

Turbine Design

Turbine height is believed to be a strong influence on the likelihood of collision with taller structures having an increased risk of collision, while structures below 150 m cause limited mortality (Kerlinger 2000, Crawford and Engstrom 2001, Kingsley and Whittam 2007). Migratory birds typically fly at altitudes greater than 150 m such that structures lower than 150 m in height do not usually obstruct migratory bird movements or result in bird mortality (Kingsley and Whittam 2007). While the existing turbines at Kent Hills are less than 150 m, the new turbines at the Kent Hills Wind Farm will be at 117 m hub height and the rotor length will be approximately 60 m. As a result, the blade-tip height of the turbines will be approximately 177 m. This height could obstruct the movements of some migratory birds that frequent the region or increase the risk of collision. However, results from a research project in Alberta indicate that migrating birds will modify their flight paths to increase in flight height when approaching an operating wind farm (Millikin 2005). Nevertheless, pre-construction surveys do not indicate the wind farm location is on a significant migration route.

Facility Design

The scale of the wind farm has a direct influence on the potential for bird-turbine collisions. Facilities of 100 turbines or more are believed to have a greater effect on bird mortality due to the increased number of vertical obstacles (potential collision hazards) in the landscape (Environment Canada 2007a). Following the installation of the five additional turbines, the Kent Hills Wind Farm will consist of 55 turbines, and will not be of a size that should cause concern for elevated collision risk to local populations.

Bird Behaviour and Abundance

When considering the results of the avian pre-construction monitoring programs conducted at Kent Hills in the past, and most recently in spring 2017, the vast majority of birds observed during the study were flying within 40 m (or 60 m) of the ground, which roughly corresponds to the air space below the rotor-swept area (i.e., below where the turbine blades would be turning). Of the 6,114 birds observed during spring and fall migration surveys in 2006 and 2007, the majority of birds observed (95% of individual birds) were seen at a height of less than 40 m (Section 4.3.3.1). This is because most of the birds observed were foraging in the area and not actively migrating. In subsequent migration surveys in 2008 and 2009, all birds observed were at a height of less than 40 m. In Spring 2017, out of a total of 1,115

birds observed, the majority of birds observed (96% of individual birds) were within 60 m of the ground. Three percent of the birds were observed flying at 60 – 180 m, or within the blade sweep of the proposed new turbines. At night, nocturnal migrants typically fly hundreds of metres above the ground, well above the turbines.

As described in Section 4.3.3.1, the breeding bird community of the WFSA is typical of a multi-aged forested landscape in Southern New Brunswick. Overall, point count data collected for this Project suggest a breeding bird density of between 4 and 5 breeding pairs of birds per hectare. No raptors are known to breed near the PDA, although bald eagle, sharp-shinned hawk, turkey vulture and red-tailed hawk were observed in the WFSA, and are likely breeding in the region.

Although SAR occur in the WFSA, it is unlikely that they are at risk of collision or sensory disturbance, due to the very low use of the site near the preferred turbine locations by these species, the general absence of habitat suitable near turbines for their breeding or staging, and the expected low number of fatalities overall, based on previous studies undertaken elsewhere in North America and within the WFSA. An exception is common nighthawk and eastern wood-pewee which are not limited for habitat in the region. Therefore, no specific mitigation measures or monitoring programs have been identified to address potential effects to SAR, as SAR would be included in the casualty monitoring and breeding bird surveys required as follow-up.

Mitigation

The results of the pre-construction and post-construction bird survey programs from Kent Hills 1 and Kent Hills 2, and the collection of more recent and site-specific data, indicates that the bird use of the WFSA does not cause concern with regards to increasing risk of collision, disturbance or habitat alteration. However, there are further mitigation and monitoring measures that are included within this Project that will help reduce effects to bird populations. To the extent practicable given the local conditions, collection lines within the wind farm will be buried underground. However, there will be sections of collection line that must be pole-mounted. These above ground, small distribution lines are not known as a significant cause of mortality (APLIC 2012).

To determine the accuracy of the predicted environmental effects and validate all mitigation measures are successful, post-construction monitoring will be conducted, which will include carcass monitoring below the turbines, with associated studies examining carcass removal and methods for correcting potential undercounting. Post-construction monitoring of breeding birds at the site will also be conducted. The detailed protocol and subsequent results of the post-construction monitoring will be used to assess the success of the mitigation measures in consultation with ECCC and NBDELG.

Taking into account the mitigation measures, there likely will be residual effects of the Project on the area's birds. Overall, sensory disturbance will be infrequent, temporary in nature, reversible, low in magnitude and restricted to the WFSA given the mitigation measures proposed. Residual effects of sensory disturbance are not predicted to be significant. Bird mortality as a result of colliding with structures within the Project will be irreversible, but is expected to be infrequent and minor in magnitude and in geographic extent. Residual effect of mortality is considered Low and not considered to be significant. In the unlikely event of mortality of a SARA-listed bird species, the residual

effect would be considered significant. However, given the low likelihood of such an event, significant effects on birds is considered unlikely.

5.2.1.2 Other Wildlife

Other wildlife species of the WFSA include mammals, reptiles and amphibians. Most species are year-round residents of the WFSA and adjacent lands, although certain local or long-distance migrations of some species occur. Many of these species are also seasonally active and undergo hibernation or periods of torpor during winter and cold weather. Potential environmental effects of the Project on the WFSA's wildlife include habitat alteration, mortality and sensory disturbance. Given the small footprint of the turbines and associated equipment, the residual effects of the Project on local wildlife are expected to be low.

Habitat Alteration

Wildlife habitat in the WFSA consists primarily of forest. Migrating bats will use the habitats temporarily or will fly over or through the WFSA, but the site's resident wildlife species (and some migratory bats) will use the resources available on the site. These general resources, such as food and shelter, are abundant and widespread across the WFSA and on adjacent lands. The area of habitat that will be altered due to construction of access roads, and turbines will be a very small proportion of what is available (less than 2% of the area will be used for electrical cabling, access driveways, and turbines; see Section 2) and most of the habitat for the preferred turbine locations is recently harvested and regenerating forest. Therefore the effect on habitat fragmentation during operation is limited, especially for the preferred turbine locations and associated access.

Sensory Disturbance

Sensory disturbance of wildlife will potentially occur during all phases of Project development as a result of on-site human activities such as surveying, clearing, trenching, turbine assembly, equipment operation, site inspections and site decommissioning. Wildlife in the area has already been affected by sensory disturbance from ongoing forestry and recreational activities. The operation of the wind turbines may also result in visual and auditory disturbance of wildlife. However, studies in the western United States have shown that there has been no significant effect of the construction and operation of wind farms on large ungulates (Strickland and Erickson 2003), indicating that species are either unaffected by these developments, given their small footprint and the preservation of existing land use, or that they can readily adapt to the presence of wind turbines. A more recent synthesis of available literature on the effects of wind farms on terrestrial mammals has not changed that conclusion (Helldin et al. 2012). At this site, habitat avoidance will most likely occur during periods of construction, and may be more intermittent during periods of operation, when human activities on-site are less frequent and would occur on a short-term basis. Terrestrial mammals are likely to habituate to the noise generated by the new turbines, or the potential effect is likely to be limited to several hundred metres from the turbines, based on the noise assessment (Section 5.2.1.5).

Mortality

Mortality of wildlife has the potential to occur during all phases of Project development. Bats have been identified as animals with the greatest risk to be affected by wind energy facilities resulting in mortality; this is discussed in the following subsections.

Bat-Turbine Collisions

Results of previous bat surveys conducted for the wind farm, both pre- and post-construction, are described in Stantec (2013) and summarized below.

Following the construction of the Kent Hills Wind Farm in 2008, and the expansion in 2010, collision monitoring of birds and bats at representative turbine locations was conducted annually during spring, summer, and fall beginning in the spring of 2009, and continuing until the fall of 2012. Casualty searches were not conducted in winter because bat activity drops to zero during winter months in New Brunswick. Summary results of the surveys for bats are presented in Table 5.12.

Table 5.12 Bat Collison Monitoring Data from 2009-2012

Survey Year	Number of Bat Carcasses Located	Estimated Total Bat Fatalities per Turbine per Year[1]	Estimated Total Bat Fatalities per MW per Year
2009	4	0.41	0.14
2010	1	0.13	0.03
2011	3	0.95	0.32
2012	1	0.25	0.08
[1] Mortality estimate correction has been applied, accounting for scavenger impact and searcher efficiency .			

Bat species recorded during casualty surveys included eastern red bat (August 2012), silver-haired bat (spring 2009), and little brown myotis (fall-2009/2010/2011, and one in April 2011, on the first day of carcass searches, and one in July 2011).

Effects to migrating bats from operating turbines were expected to be low following the results of pre-construction bat activity monitoring at the Kent Hills Wind Farm. Post-construction monitoring results supported this prediction, with an estimated bat mortality rate of between 0.03 to 0.32 per megawatt (MW) per year across the four years of post-construction monitoring; this rate is at the low end for wind farms across North America, as reported by the National Wind Coordinating Collaborative (NWCC 2010). In a study conducted by Strickland et al. (2011), 66 wind farms provided estimates of bat casualties and most of them (54) reported fewer than ten casualties per megawatt (MW) per year and the range was from 0.07 to 39.7 per MW. Preliminary bat monitoring conducted at Kent Hills in Spring 2017 suggest low numbers of migratory bats in the WFSA, with only five bats detected in the month of June at four detectors, and no myotis bats detected.

Bat mortality is generally more commonly observed than bird mortality at operational wind-energy facilities (BSC et al. 2016 and AWWI 2014). In Canada, 70% of the casualties found were bats (4,020 bats of nine species found at 1,367 turbines included in the monitoring results; BSC et al. 2016). However, in

Atlantic Canada, bat casualty rates appear to be much lower than the rest of the country, and are lower than bird casualty rates (BSC et al. 2016).

The greatest risk to bats is likely due to a lack of change in their foraging behavior in the presence of wind turbines. Available literature suggests that operational wind-energy facilities do not displace bats from adjacent habitat. Horn et al. (2008) found that bats continue to forage near operating wind turbines, both when blades were rotating and not rotating. Bat foraging in proximity to operational wind turbines has also been reported in various other studies (Kerns and Kerlinger 2004; Brinkmann et al. 2006; Arnett et al. 2007).

Migratory bats (i.e., long distance migratory tree roosting bats; hoary, silver-haired and eastern red bats) forage at higher altitudes within the blade sweep of turbines compared to most resident species (e.g., myotis species), which generally forage below tree top heights (Cryan and Barclay 2009; Strickland et al. 2011). This increases the mortality risk of migratory species at wind energy developments; 80% of bat mortality at such developments is associated with migratory species in North America (Arnett et al. 2008). A review of fatality data between 2000 and 2011 in Canada and the United States of America by Arnett and Baerwald (2013) indicates that approximately six percent of wind-caused bat fatalities are little brown myotis. Limited studies in Atlantic Canada indicate a higher percentage of little brown myotis compared to migratory species (BSC et al. 2016); however, as noted above, total casualty rates are apparently much lower in Atlantic Canada, as are estimates of absolute losses.

Quantifying the potential risk to resident bats is undermined because of uncertainties in correlating bat passes to actual density of bats as a result of much greater potential for repeated detections of individuals (i.e., double-counting), which is not the case for migrants.

While bats are susceptible to mortality from wind energy developments, the greatest threat to the viability of myotis bat populations is the widespread expansion of the fungus *Geomyces desrtuctans* responsible for White-nose syndrome (WNS) that causes mortality rates of over 90% in hibernacula (Lorch et al. 2011).

Resident bats include the little brown myotis, which is *endangered* under SARA, primarily due to effects of WNS on populations. Resident bats are considered less susceptible to bat strikes because they typically forage at lower altitudes (not within the blade sweep). Increases in mortality risk to bats during operation will be of moderate magnitude because of use of this area by those species groups. Should further pre-construction bat monitoring and the results of post-construction casualty surveys indicate an elevated risk, action will be undertaken to reduce this risk, along with a monitoring program to validate that mitigation measures are effective and to modify as needed.

In the unlikely event of mortality of a SARA-listed bat spp (myotis), the residual effect would be considered significant. At this stage, the potential for an effect of the proposed addition of five turbines on bats is considered Medium and not significant.

5.2.1.3 Land Use

It is unlikely that Project operation will have a significant adverse effect on current land use practices. During construction, some disruption to these activities will likely occur. However, during operation, forestry and recreational activities will be able to continue to within 75 m of the base of towers, leaving the vast majority of the land available for traditional forestry and recreational activities (only <1% of land use within the WFSA required to house turbines and their ancillary equipment).

There is the potential for snow clearing activities along the Project access roads to create snow banks that act as barriers where these roads intersect with snowmobile trails. At these intersections gaps will be left in the snow banks such that the snowmobile trails are not blocked. Steep ditches will be avoided in the design and construction of roadways to reduce hazards for snowmobiles. Prominent stop signage will also be installed at new four-way stop intersections and existing stop signage will be upgraded to increase traffic safety.

The primary land uses in the area can continue around Project facilities and collection system lines. Land use effects associated with operation of the Project will not impair current land uses. No issues regarding land use have been identified with the operation of the existing wind farm to date, with the exception of the site access road from Prosser Brook Road, also used by other industries such as forestry. TransAlta will continue to work with the adjacent commercial sugarbush operation regarding concerns related to erosion.

The Dobson Trail Association and Fundy Hiking Trail Association indicated that the existing wind farm has attracted more hikers to the trail. The installation of additional turbines visible from Dobson Trail may lead further increases in hiking activity. Project operation is unlikely to have an affect on other local tourism activities.

Given the design and nature of operation, and given the steps to mitigate effect to existing land use (see Section 5.1.2 and 5.1.3), the residual effect is considered to be Minimal and not significant.

Property Values

Sterzinger et al. (2003) undertook a study to examine the effect of wind farms on property values. Sterzinger et al. (2003) found that property values increased with the same rate in wind farm communities within 8 km of a wind farm compared to similar communities without wind farms.

The United States Department of Energy's Berkeley National Laboratory conducted a comprehensive study in 2013 which examined data from over 50,000 home sales within 10 miles (16 km) of 67 separate wind energy facilities in the United States. The results of the study indicated that there was no statistical evidence of changes to home values near these facilities (Hoen et al. 2013).

A 2010 study conducted in Ontario found there was no statistically relevant relationship between the presence of a wind facility and negative effects on property values (Canning Consultants Inc. and John Simmons Realty Services Ltd. in CANWEA 2013). The Ontario Municipal Property Assessment Corporation has conducted studies on the effect of wind energy facilities on property assessment and

sale values in Ontario in 2008, 2012, and 2016. The results of these studies indicated that there was no statistically significant effect on property values as a result of proximity to wind energy facilities (MPAC 2017).

The proposed Kent Hills Wind Farm is located in a rural setting, and it is surrounded by forest land. The WFSA is located nearly entirely on Crown land, with no residential dwellings on or near the immediate Project boundary. Residential areas can be found in the Project vicinity, and a search of the Greater Moncton Real Estate Association indicated that the average retail price for a single family detached home in a rural area was approximately 154,800, in May 2017(Canadian Real Estate Association 2017).

Turbines may be visible from nearby residential areas, such as Prosser Brook; however, topography and forest cover will limit the affected areas. The limited number of surrounding residential properties, and experience at other sites, suggest that residual effects on property values as a result of the wind farm are unlikely.

5.2.1.4 Visual Effects

A visual impact assessment was completed for all nine potential turbine sites (Appendix J). The visual analysis conducted for the Kent Hills Wind Farm uses techniques that illustrate potential visual impacts and are generally based on the "Guidelines for Landscape and Visual Impact Assessment" (1st Edition, The Landscape Institute, Institute of Environmental Management and Assessment 2002).

The approach to conducting the assessment involved the creation of Zone of Visual Influence (ZVI) maps of the landscape and photomontage simulations from selected vantage points in and around the RSA.

Zone of Visual Influence

ZVI is based on line of sight between gridded viewpoints and the various wind turbines that comprise the wind farm. The model relies on information from digital elevation models (DEM) and turbine locations to generate a ZVI map. Full details related to this analysis for the Kent Hills 3 Wind Project can be found in Appendix J.

Photographic Viewshed Analysis

A viewshed analysis was completed to support the overall visual impact assessment for the Kent Hills 3 Project. Visualizations (photomontage or computer-altered photographs) were used to illustrate the anticipated change to characteristic landscapes within the RSA resulting from the installation of the Project. The viewshed analysis included nine additional turbine locations under consideration (5 preferred, 4 alternate) to be appended to the exiting 50 wind turbines operating at Kent Hills 1 and Kent Hills 2. All photographs were taken from public road allowances.

A selection of 11 representative views is presented in Figure 5.1. Photomontage visualizations from where Project turbine(s) could be visible from various viewpoints are presented in Appendix J.

In Viewpoints 1 to 6, the Project will mostly affect the visual landscape along Prosser Brook Road and Hayward Road where the three alternate turbine locations [T1Alt, T2-Alt, T6-Alt] would be prominent for nearby residents. The impact on the landscape could be qualified as medium as the size of the proposed turbines become a prominent part of the field of view for the observer.

However, these viewpoints are already partially impacted by pre-existing wind turbines. No concerns were raised on the cumulative impact of these viewpoints during the Open House. TransAlta is aware of the sensitivity for this potential visual impact and ranked these proposed turbine locations [T1Alt, T2-Alt, T6-Alt] as 'alternate' with medium-low risk of being selected for construction.

In Viewpoint 7 to 9, the Kent Hills 3 Project will slightly affect the landscape for those road and cabin users on New Ireland Road, Ferndale Road and Blackwood Lake Road. Land users in this area mostly consist of snowmobilers, ATV's, hikers and local residents accessing their nearby leased lands or cabins. Turbines observed from these viewpoints [T3, T4, T5, T7, T9] are the five preferred turbine locations currently selected for construction and present minimal impact on the landscape and are considered to blend with the existing turbines already seen from these locations. No concerns were raised on the cumulative impact of these viewpoints during the Open House held on June 20, 2017.

As per the results presented in Appendix J, the cumulative impact of adding the Kent Hills 3 Project - a five turbine expansion - to the existing Kent Hills Wind Farm is low considering the most likely selection of turbine locations T3, T4, T5, T7 and T9. The cumulative impact could be considered medium if any of the proposed Kent Hills 3 Project alternate turbine locations were inevitably selected for construction.

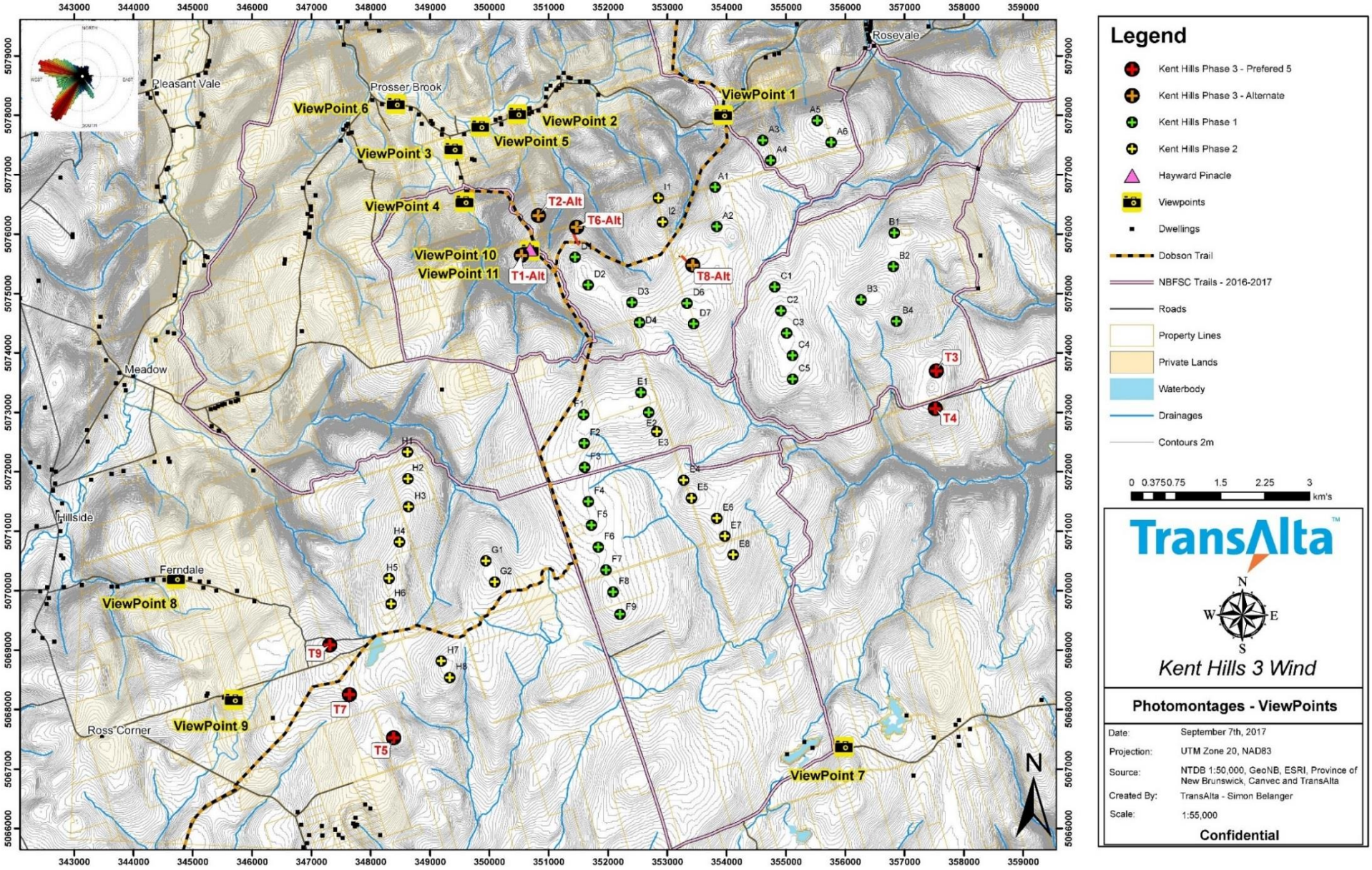


Figure 5.1 Photomontage Locations

The proposed Project has been planned and designed to reduce visual impacts to scenic resources within the RSA. Its geographical location on higher ground mostly surrounded by forested hills contained the visual impact to surrounding hills with similar elevations. Most roads and dwellings in the area are in valleys and the steep sides of the plateau block views of all but the nearest turbines. At most vantage points in the area, only a few turbines (if any) are visible at any one time due to this effect and the screening effects of vegetation along the roads.

Lighting

The wind turbines will be lit to meet the requirements of Transport Canada's *Canadian Aviation Regulations* (CAR 621.19. Lighting will be the minimum required to allow for the appropriate level of aeronautic safety, and red lights (CL-865) may be used with the minimum intensity and flashes per minute allowable.

The viewing distances from the locations analyzed in this report indicate that all of the residences within the WFSA will be greater than 1.2 km from the nearest wind turbine, and at these closest locations, few turbine lightss, if any, will be visible. Given the viewing distance of greater than 1.2 km combined with topography and forest cover, the presence of these lights will not impose excessive nighttime visual pollution in the WFSA.

Shadow Flicker

Shadow flicker caused by wind turbines is defined as alternating changes in light intensity due to the moving blade shadows cast on the ground and objects (including through windows of residences). There are obstacles such as terrain and vegetation which are located between the wind turbine and a potential shadow-flicker receptor; hence shadow-flicker will be either significantly reduced or eliminated at such shadow-flicker receptors.

A shadow flicker analysis was completed based on the cumulative impact of the potential shadow flicker to occur at the Kent Hills 3 Wind Project considering the nine additional turbine locations (5 preferred, 4 alternates) and the existing 50 turbines already in operation from the previous two phases. A more detailed review of the shadow flicker modelling analysis can be found in Appendix K.

Using software from WindPro Version 3.1.617 incorporating variables such as turbine location, receptor location, topography, rotor diameter, hub height and time zone information the model assumes a "worst case" scenario including the following conditions: : the sun is fully shining all year (no clouds or fog), the rotor plane is perpendicular to the sun (biggest shadows), and the rotor is always turning (causing shadow movements) and no visual obstructions (trees, buildings).

Current best industry practices tend to consider the guideline of maximum 30 hours per year and 30 minutes per day as an acceptable threshold of shadow flicker impact using "worst case" scenarios (WEA-Schattenwurf-Hinweise, 2002). Shadow hours is the sum of the duration of all daily occurrences of shadows being cast on the receptor throughout the year. A shadow day is any day in which a shadow occurrence is cast on the receptor. Shadow minutes is the maximum number of minutes for the day of the year a shadow occurrence is the longest of the year.

The maximum number of shadow hours cast per year at any receptor within the Kent Hills Wind Farm is at 22 hours (22 hours, 06 minutes) spread over 82 days during the year. The maximum number of shadow minutes per day at any receptor is 23 minutes. As a result, based on a conservative analysis (inclusion of both preferred and alternate turbine locations) the cumulative shadow flicker impact from the addition of the nine turbine locations to the existing Kent Hills Wind Farm will be below the acceptable threshold recognized by the industry.

No mitigation measures are required for the residential receptors evaluated for the Visual Impact Assessment beyond design features such as colour of turbines. If the impacts require mitigation after construction of the Kent Hills 3 Project, they could be addressed through mitigation measures such as tree planting. The residual effect of the Project on the area's visual aesthetics is considered to be Minimal and not significant.

5.2.1.5 Noise Effects

Noise may be defined as unwanted sound and is often present at several different frequencies. The audible frequencies for humans are in the range 500-20,000 Hertz (Hz). The sound pressure level or noise level is measured in decibels on three different scales: A, B and C. The A-weighted scale is generally used for most sound measurements, since it measures sound levels which come closest to approximating loudness in the frequency range of human hearing. Measured sound parameters are generally expressed as an "equivalent sound level" (Leq) over a specified period of time (e.g., 1 hour).

New Brunswick has recommended sound criteria for wind turbines in the EIA Sector Guidelines for Wind Turbines, "Additional Information Requirements for Wind Turbines" document (Government of New Brunswick n.d.). This guidance suggests that a Noise Impact Assessment, to show compliance with the criteria as per Table 5.13, is required for all noise sensitive locations (including recreational, residential, and institutional uses) within 1 km of the nearest turbine.

Table 5.13 Recommended Sound Criteria for Wind Turbines

Wind Speed (m/s)	4	5	6	7	8	9	10	11
Sound Criteria (dBA)[1]	40	40	40	43	45	49	51	53
[1] Values obtained from the "Additional Information Requirements for Wind Turbines" document, NBDELG, n.d.								

Sound will be produced from the wind turbines during operation as a result of the machinery operating within the nacelle at the top of the turbine, and as a result of the turning blade cutting through the air. Sound emissions of operating wind turbines were measured by the manufacturer using accepted international standard protocols. These sound levels were incorporated into a computer model that estimated how the sound from each turbine traveled across the landscape and what the resulting ground-level sound pressures would be. The model assumes an unrealistic and conservative worst-case scenario, assuming that the wind is blowing from every direction at the same time. Since sound emissions from the turbines changes with wind speed, a number of wind speed scenarios were

modeled to predict what sound levels would be across the landscape as a result of the operation of the turbines.

The WFSA and surrounding region is rural with very little road traffic. Although forestry and agricultural operations are widespread in the region and forestry occupies the majority of the WFSA, the area is relatively quiet, with the sounds of nature dominant on the landscape.

There are no major highways near the WFSA. Prosser Brook Road is a local road with minor traffic. Apart from this road, provincial, county and rural roads are numerous in the RSA and serve the rural residents, as well as forestry, agricultural and mineral aggregate operations. Forestry operations are located throughout. Noises emitted from the forestry operations conducted within and near the WFSA include harvesting and transportation of the logs. Wind and residential activities also contribute to background sound levels.

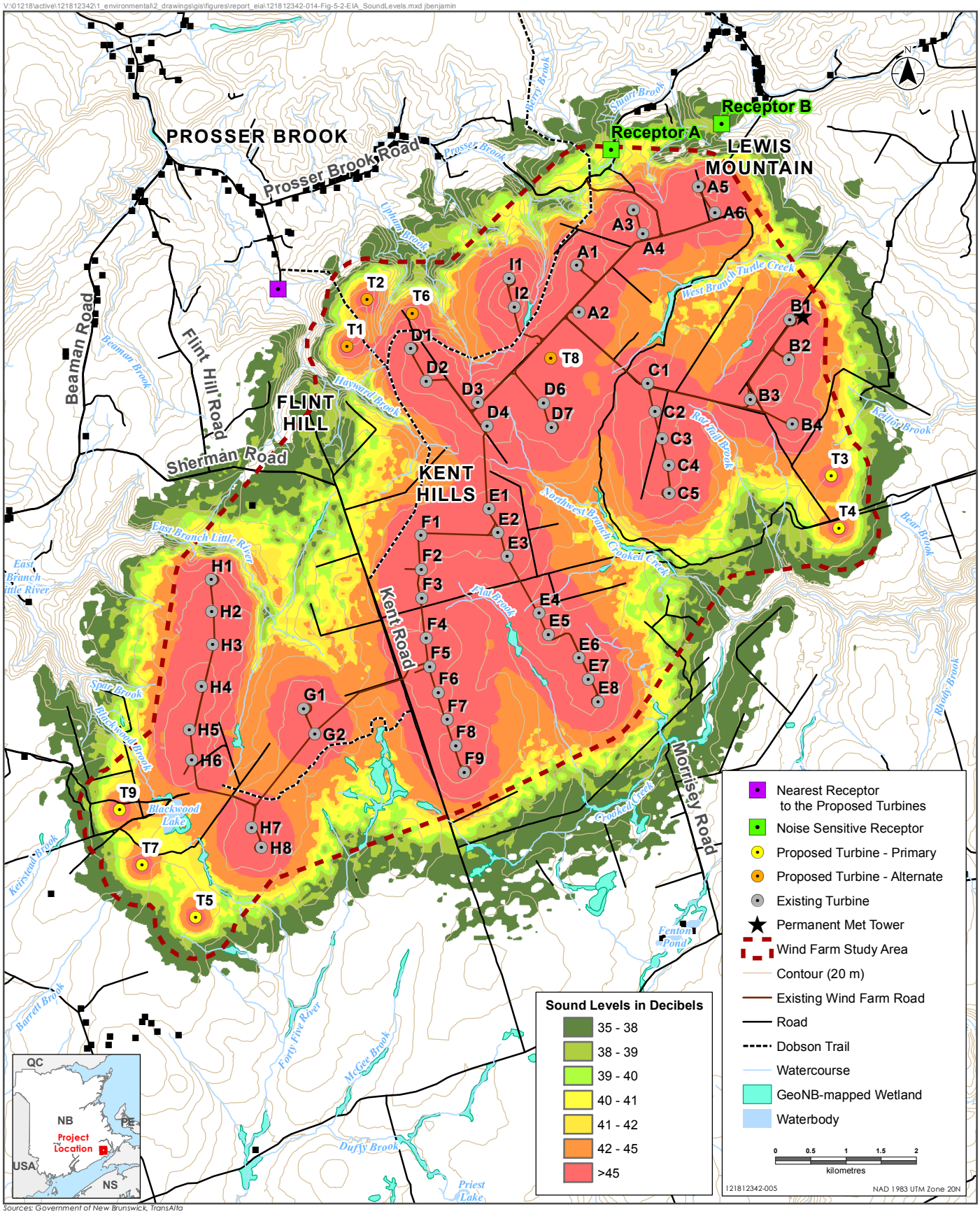
Increases to sound levels will occur during normal operation of the wind farm. As detailed in the Noise Impact Assessment Report (Appendix L), sound pressure levels adjacent to all known receptors (households) are predicted to be below 40 dBA over a ten minute period. The very back of some long, narrow, plots behind some residences on Prosser Brook Road (north of A-row) have sound levels over 40 dBA. The nearest residence (900 m from the existing wind farm) has a predicted sound level of under 40 dBA. The nearest receptors from a new proposed turbine (including alternate locations) is 1.2 km.

These predictions overestimate noise levels due to the assumption that receptors will always be downwind of the turbines. At any given time, some receptors would be crosswind, and in some cases upwind from the Project. Under conditions other than downwind conditions, any receptor could experience up to 5 to 10 dBA less sound compared to the worst case scenario shown in Figure 5.2, as further discussed in Appendix L. Under such conditions, the wind turbine sound would be expected to be inaudible against the background sound levels. Based on information contained in the Noise Impact Assessment Report, it can be concluded that:

- In the worst case scenario, all receptors are expected to receive sound exposures from the proposed wind farm below 40 dBA
- When a receptor experiences conditions other than downwind, there is the potential for lower sound exposure levels than indicated in the analysis

Figure 5.2 represents the noise contours for the highest expected noise levels, modelled with windspeeds of 8 m/s. The contours show that noise levels will be below the criteria (45 dBA) within approximately 200 meters of the new turbines, and 500-600 meters of the existing turbines.

No additional measures are deemed necessary to mitigate long-term increases to sound levels. As a result, the potential residual effect of the Project on noise is Minimal and not significant.



Kent Hills Wind Farm Expansion Sound Levels –
Maximum Facility Sound Levels at 8 m/s Wind Speed

Stantec

Figure 5.2

5.2.1.6 Health and Safety

Lands within the WFSA do not present safety issues, such as steep cliffs, deep or steep ravines and waterways. There currently exists clear, safe access to the WFSA. Safety issues are typically associated with construction and decommissioning activities associated with the wind farm. However, safety issues must also be considered as they pertain to the operational phase and the potential interaction with the local populace and public access issues. Health and safety concerns related to electromagnetic fields (EMFs) and ice throw are issues that have been raised by the public for other wind power projects in Canada, and are considered here. The following sections provide a discussion on the potential environmental effects associated with electromagnetic fields, infrasound and ice throw, and general health and safety issues, where the additional turbines proposed warrant further discussion.

Electromagnetic Fields

Concerns related to the potential negative effects of EMFs on children were raised during the original EIA. However, the EMFs created by the expanded wind farm will be localized and become weaker with distance. The EMF produced by the equipment within the turbines will be very weak, reduced by distance and by objects such as trees and other objects that conduct electricity. EMFs from buried cables can be 5 to 10 times less than overhead transmission systems carrying comparable currents at similar voltages. Previous studies have shown that magnetic field levels as a result of the cable distribution system are a fraction of those found in household appliances such as hairdryers, blenders or televisions (National Institute of Environmental Health Sciences 2002). As a result, there is no evidence that the proposed Kent Hills 3 Project will present any human health effects related to EMFs. The five new turbines proposed for this Project do not pose any additional risk from EMF to humans. No issues have been reported to date with the existing wind farm.

Infrasound

Infrasound is very low frequency energy, well below the lowest frequencies that are audible to humans. Concern about infrasound has been raised historically as an issue at several other projects in Canada. However, there is no evidence that the current wind turbine technology that is proposed for this Project presents any potential problems related to the generation of infrasound energy. Research in Alberta has identified that wind turbines may actually reduce infrasound by extracting energy from the wind, thus reducing the amount of infrasound generated by strong winds (Hepburn 2005). Noises from infrasound/inaudible sounds have been attributed to wind turbines but there is no scientific evidence to verify any health concerns (Rideout et al. 2010, Lopper et.al. 2014). Proposed turbine locations are a minimum of approximately 1.2 km from the nearest residence and no effects to human are expected from infrasound associated with the Project.

Ice Throw

Ice throw can result in health and safety issues for on-site personnel during maintenance and operation of the wind turbines. Due to the distance of the proposed turbines to the nearest residence of approximately 1.2 km, it is extremely unlikely that ice throws would affect these land uses. The wind turbines have sensors that will detect an unbalanced condition of the blades if the turbine blades have a buildup of ice and thus shut them down. Ice chunks typically thrown are relatively small and are

unlikely to result in health and safety issues for adjacent landowners due to the setback distances. Ice forming on the blades is likely to occur when blades are not turning, and accumulated ice would drop straight down rather than thrown any appreciable distance. Operation and maintenance personnel are at risk from ice throw; however, due to their close proximity to the wind turbines during periods when ice may fall from the turbines. There have been no reported incidents of human injury or harm in the operating history of the wind farm. The following protocols are in place with regards to ice throw:

- Severe Weather Code of Practice for TransAlta Renewable Operations (Wind), sets out the standards of practice relating to severe weather conditions at their facilities
- Overhead Ice Hazard Identification Protocol provides direction to workers when overhead icing hazards are identified which may affect work activities around turbines

The new Vestas V126 turbines proposed for Kent Hills 3 Wind Project will include the Vestas Ice Detection™ and Vestas De-Icing™ systems, which are designed to reduce the build-up of ice on the blades. The Vestas Ice Detection™ system detects ice build-up on turbine rotors and helps to limit the risk of ice throw. When ice forms on the blade, sensors detect changes in the natural frequency flow oscillation, and measure ice thickness to the millimetre (Vestas 2016). Critical ice build-up puts the turbine into safe mode. The Vestas De-Icing™ System uses air heaters to capture, heat and propel air within the turbine blades.

Other potential uses of Crown land in the vicinity of the turbines during the cold weather conditions when ice throw could potentially occur include forest harvesting, snowmobiling, and ATV operation. Forest harvesting is unlikely to occur in close enough proximity to turbines, and at the time of year when ice throw may occur. Forest harvesting planning by the Crown land licensee will consider this risk. The closest that groomed snowmobile trails are likely to be to the nearest preferred turbine location is 120 m. Existing snowmobile trails cross proposed access roads near T4 and T9, as well as the alternate turbine locations near Hayward Pinnacle. TransAlta has consulted with the SENBSA regarding turbine placement near snowmobile route 34; at the time of the consultation there was another alternate site proposed off Kent Road, which has since been dropped.

There are prominent warning signs at each entrance to the site and warning labels regarding the potential for ice shedding on each tower. As winter approaches newspaper and radio ads are used to remind the public about hazardous icing conditions and advisories are provided to the local snowmobile club to highlight the risks. Additional warning signs will be erected near the new turbines and at new entry points.

Health and Safety

Health and safety issues typically associated with construction and operational activities are a priority for TransAlta. During construction and operation activities, access to the wind turbine facility (i.e. inside the turbine tower) will be restricted to authorized personnel wearing proper personal protective equipment and who have had appropriate safety training. TransAlta has a written safety policy for operators and technicians including a detailed safety manual for staff, as well as an extensive occupational health and safety protocol for wind energy facilities, which will be implemented. When these mitigation measures are employed, no residual effects are anticipated.

To date, no notable health and safety issues have been reported during the operation and maintenance phases of the operating wind farm at Kent Hills. On August 8, 2009 a single turbine fire occurred. The fire was contained in the nacelle, there were no workers present at the turbine and no injuries resulting from the fire. Access to the site area was restricted and there was no 3rd party damage to property. An investigation into the cause of the fire was conducted by the equipment manufacturer and was determined to be equipment defect. The incident was reported to New Brunswick Occupational Health and Safety authorities.

Turbine Blade and Structural Failure

A tower collapse and/or blade detachment is considered to be highly improbable. If this was to occur, there is potential for the collapse zone to be damaged by the impact. During high wind events (>22.5 m/s or 81 km/h) the turbines will cease operations. The blade of a turbine weighs nearly 15 metric tonnes; therefore, in the unlikely event where a blade detaches from a rotor, it would drop to the ground rather than be flung a great distance. Given the built-in safety features of turbine operation, and maintenance of equipment, the likelihood of tower collapse and/or blade detachment is remote, and is not predicted to result in a significant adverse effect on public health and safety.

Electromagnetic Interference

A potential effect of a wind farm is interference with radioelectric signals, such as television, radio, cellular telephone, microwave transmission and radar. Consideration was given for this potential effect during the original EIAs of Kent Hills 1 and Kent Hills 2, and TransAlta consulted with companies with radio communication systems in the province (including cellular telephone communications, television and radio broadcast signals) to identify radioelectric signals within the RSA that could be affected by the installation and operation of the Kent Hills Wind Farm's up to 43 wind turbines planned at the time. Communication companies with towers in the area include Bell Aliant, Allstream, Rogers, and Rogers Wireless. Letters providing information on the Project were sent to these companies to request feedback on the potential for Project interaction with the communications towers at the time.

Satellite television and radio, cable television and AM and FM radio signals should not be affected by the Kent Hills Wind Farm, and there have been no reported problems to date with respect to the operating wind farm. It is expected that there may have been be a residual effect on analog television signals, but since the development of the Kent Hills Wind Farm, local broadcasters have decommissioned their over-the-air analogue television transmission network (CBC/CTV/Global).

A concern with interference with navigational radar was expressed by NAV CANADA during the construction of Kent Hills 1 Wind Farm. These concerns were addressed during an Aviation Safety-risk Assessment, facilitated by SMS Aviation Safety Inc. and undertaken by a group of representatives from NAV CANADA, TransAlta and groups within the aviation industry. The assessment concluded that aviation safety-risks related to the wind turbines at the Kent Hills Wind Farm were of low significance. The Kent Hills Wind Farm has been operational since December 2008 and no further concerns or comments have been received from NAV CANADA to date. No further concerns were expressed with the expansion in 2010, which increased the number of turbines but to the same area, so additional aviation-safety risk concerns related to the Expansion were not expected. The proposed turbine

locations are within 1 km of the Kent Hills 1 study area and additional aviation-safety risks are also not expected. A Land Use Submission Form has been submitted to Nav Canada; review times are in the order of 12 weeks or longer so this information is not available for this report. There was no subsequent request for study for the Expansion. TransAlta has not received any notification from Nav Canada of an ongoing issue relating to the wind farm and navigational interference during the Kent Hills Wind Farm operating history.

5.2.2 Maintenance Activities

The wind turbines will be visited annually for routine servicing. The facility includes a sophisticated wind energy oriented Supervisory Control and Data Acquisition (SCADA) data analysis program, as well as alarm and notification protocols. With such a system, faults can be instantly detected and addressed, operations can be monitored, equipment performance can be analyzed, trend analyses can be performed and long-term records maintained. For service-oriented visits the site will be accessed via light trucks, as is currently done at the existing facility. Although noise from vehicles during maintenance operations can result in temporary sensory disturbance of wildlife using areas adjacent to access roads, it will be short in duration, infrequent, in a small geographic area and will not be noticeable above the existing disturbance created by existing and ongoing forestry and recreational activities.

To date, no notable maintenance activities issues have been reported during the operation and maintenance phases of the operating wind farm at Kent Hills.

5.3 DECOMMISSIONING ACTIVITIES

TransAlta expects individual wind turbines to perform for 25 to 35 years with an appropriate service and maintenance program. Transformer facilities, underground wiring and substation facilities are designed for at least a 50 year lifespan. Individual wind turbines may be replaced or repaired as their useful life comes to an end, or if more efficient and cost-effective technology becomes available. TransAlta makes commitments regarding decommissioning to the landowners on whose land the equipment is placed.

Upon a decision to decommission a single wind turbine or the entire wind farm, all equipment above ground, including towers, nacelles, transformers and controllers will be removed. Wind turbines that are operational and have market value would be carefully removed using a crane, essentially in a reverse process to assembly and installation.

While the decommissioning activities are described and assessed herein, the exact process and mitigation measures for decommissioning will reflect the state of current science and best management practices at that time to reduce or avoid effects to VCs, which is unpredictable for 25-35 years in the future.

5.3.1 Removal of Turbine and Ancillary Equipment

Inoperative wind turbines have high salvage value. Steel and copper components are easily recycled, and there is a ready market for such materials. The remaining materials are primarily fibreglass and plastic. These may be sold to recycling facilities, or crushed and deposited in landfill sites. Experience in the U.S. with decommissioning of wind turbines has shown that the salvage value of wind turbines typically exceeds the costs of decommissioning (Gipe 1995).

Laydown areas originally cleared for construction would again need to be temporarily cleared, outside of the breeding bird season. Compaction of soil will be minimized to the extent practicable, with compacted soil recovered following turbine removal. Temporary fencing will be used during decommissioning, where appropriate, to temporarily exclude wildlife from construction areas. Silt fencing will be erected if required to help prevent erosion of bare lands caused by decommissioning activities. The laydown areas will be permitted to regenerate back to forest. Other above-ground equipment in the wind farm, including transformers and wiring, would be sold for reuse where markets exist or sold for salvage.

Where foundations must be removed, standard demolition practices will be employed to remove the foundations to a depth that is well below that which has the potential for future erosion and exposure. Resulting material will be removed and appropriately disposed.

Environmental components that could potentially be effected as a result of turbine and ancillary equipment removal include soils, aquatic environment, terrestrial vegetation, birds and other wildlife, land use and noise. The potential environmental effects of activities associated with the removal of turbines and ancillary equipment are summarized in Table 5.14.

Table 5.14 Potential Effects of Turbine and Ancillary Equipment Removal

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Soils	Soil disturbance, erosion and compaction	• Soils around the excavation that will be disturbed will be managed to avoid erosion and runoff. • Trucks and equipment will remain in designated workspaces. • Compacted soil will be reclaimed as required (e.g. laydown areas).	2	1	2/1	R	2	No residual effects are expected, with the application of mitigation.

Table 5.14 Potential Effects of Turbine and Ancillary Equipment Removal

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Aquatic Environment	Surface Water Contamination	• Construction material, excess material, construction debris, and empty containers will be stored away from watercourses and watercourse banks.	1	1	2/1	R	2	No residual effects are expected.
	Sediment Loading	• Temporary erosion and sediment control measures (e.g., silt fence, straw bales) will be used, maintained and kept in place if required until work within or near a watercourse is complete and stable. • Temporary sediment control measures, if required, will be removed only when work is completed and permanent erosion control measures, as may be specified in the contract, have been established.	1	1	2/1	R	2	No residual effects are expected.
Terrestrial Vegetation	Loss of Plant SOCC	• Vegetation to be disturbed will be surveyed for vascular plants. SOCC will be flagged and avoided to the extent practicable.	1	1	2/1	R	2	No residual effects are expected.
Wetlands	Loss of wetland area and/or function	• Wetlands will be avoided, where practicable.	1	1	2/1	R	2	No residual effects are expected.
Birds and Other Wildlife	Sensory Disturbance	• Overall disturbance will be limited to designated workspaces, and will be conducted in compliance with the *Migratory Birds Convention Act*.	3	1	2/1	R	2	Sensory disturbance may cause habitat avoidance but it likely will be temporary in nature, low in magnitude and restricted to the Project footprint. Residual effects are expected to be not significant.

Table 5.14 Potential Effects of Turbine and Ancillary Equipment Removal

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
	Mortality	• In order to reduce the potential of bird mortality, land clearing during decommissioning activities will be performed, to the extent practicable, outside of critical time periods for breeding birds, which is from mid-April to mid-August. . • Should there be potential for nesting birds in previously cleared areas subject to decommissioning activities during the breeding bird season, nest surveys will be performed to confirm there is no active nesting.	2	1	2/1	I	2	Residual effects are expected to be not significant.
Land Use	Remediation of Land	• The small footprint that will be disturbed but remediated and reclaimed/restored in accordance with Crown land requirements at the time of decommissioning.	2	2	2/1	R	2	No residual effects are expected.
Noise	Increases to sound levels due to the operation of equipment	• Construction equipment will have mufflers that comply with guidelines for sound and emission levels. • Noise abatement equipment, in good working order, will be used on all heavy machinery used on the Project.	3	2	2/1	R	2	Residual effects are expected to be not significant .

Table 5.14 Potential Effects of Turbine and Ancillary Equipment Removal

Valued Component	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	

Note

1	Geographic Extent	1 = <500 m², 2 = 500 m² – 1 km², 3 = 1 –10 km², 4 = 11 – 100 km², 5 = 101 – 1000 km², 6 = >1000 km²
	Magnitude	1 = Low: e.g., specific group or habitat, localized one generation or less, within natural variation, 2 = Medium: e.g., portion of a population or habitat, one or two generations, rapid and unpredictable change, temporarily outside range of natural variability, 3 = High: e.g., affecting a whole stock, population or habitat outside the range of natural variation.
	Duration	1 = <1 month, 2 = 1-12 months, 3 = 13-36 months, 4 = 37-72 months, 5 = >72 months.
	Frequency	1 = <11 events/year, 2 = 11-50 events/year, 3 = 51-100 events/year, 4 = 101-200 events/year, 5 = >200 events/year, 6 = continuous.
	Reversibility	R = reversible, I = irreversible.
	Ecological Context	1 = Pristine area or area not adversely affected by human activity, 2 = evidence of adverse effects.

Overall it is anticipated that with the implementation of the above-stated mitigation measures, the environmental effect associated with turbine and ancillary equipment removal during decommissioning will be Minimal and not significant.

5.3.2 Removal of Power Line

Underground cabling will be removed to suitable depths and any disturbance to the soil will be remediated or repaired upon completion. Aboveground poles and cabling will also be removed and recycled/disposed of as required. Environmental components that could potentially be affected as a result include soils, aquatic environment, birds and other wildlife, land use, and noise. See Table 5.14 for a summary of the potential environmental effects of activities. Overall it is anticipated that the residual environmental effects associated with the removal of power lines during decommissioning will be Minimal and not significant.

5.3.3 Site Remediation/Reclamation

Wind energy facilities do not use or produce harmful waste products and residual contaminants are not likely to be present.. Aside from normal recovery of lubricants from the gearbox and yaw mechanism, decommissioning activities are not required for waste. Lubricants will not contain any PCBs. Site remediation/reclamation will be conducted in accordance with crown land agreements and in accordance with applicable regulations at the time. Environmental components that could

potentially be effected as a result include soils, aquatic environment, birds and other wildlife, land use, and noise. See Table 5.14 for a summary of the potential environmental effects of activities. Overall it is anticipated that the residual environmental effects associated with site remediation/reclamation during decommissioning will be Minimal and not significant.

5.4 ACCIDENTS AND MALFUNCTIONS

The largest risks associated with construction and operation of the wind farm involve vehicles and machinery in forested areas, and include the loss of petroleum products and waste, and the risk of fire, causing damage if not controlled quickly.

A spill of hydrocarbons or other deleterious substance associated with equipment during construction or maintenance activities could cause a variety of adverse effects on the environment, in particular to watercourses within the WFSA, of which there are few within 30 m, all near existing access roads. Spill prevention is the most important way to prevent these potential effects. Strategies are out lined in existing environmental management plans. Spills that could reasonably be expected to occur would be limited to small quantities that are easily contained and remediated. Procedures are in place for the operation of the existing Kent Hills Wind Farm that address response to spills and for fires. Environmental awareness training is provided to contractors and workers involved in the Project. That training covers the handling, clean-up, reporting and disposal of contaminated material. A thorough inventory of hazardous materials to be used at the construction site, e.g., fuels, lubricants, solvents, paints and wastes such as waste oil will be maintained on-site and updated as needed.

Best management practices prescribe the presence of spill kits on location and are mandated by procedures in place for the Project. Spill management procedures as outlined in the Operations Environmental Management Plan (OEMP) will be followed when a spill occurs. Any discharge will be cleaned immediately with notification of appropriate authorities. For the Kent Hills 3 Wind Project, the regional office of NBDELG in Moncton would be contacted to notify them of reportable levels of spills. TransAlta is committed to update the existing OEMP that includes contingency measures to address potential accidents and malfunctions, environmental management, worker health and safety, emergency response and environmental protection plans to handle any accidents or malfunctions that may occur. The following sections detail these plans. These plans described below are expected to mitigate potential accidents and malfunctions that may occur. Therefore, the level of impact is considered low and not significant.

5.4.1 Corporate Environmental Management Framework

TransAlta is committed to ensuring that the construction, operation, and decommissioning of the proposed Kent Hills 3 Project are conducted in an environmentally responsible manner. TransAlta has implemented a life cycle environmental management strategy to facilitate the recommended mitigation measures for Kent Hills 1 and 2; these were successfully implemented in the context of TransAlta's corporate sustainable development framework. To accomplish this objective, the following initiatives were addressed for the original facility, and will be implemented for the additional proposed turbines:

- Integration with the corporate environmental management framework
- Compliance with worker health and safety rules
- Emergency response planning
- Environmental protection planning and environmental monitoring

TransAlta will continue its commitment to integrating environmental principles into daily business activities and to reducing the environmental effects associated with the ongoing development and production of energy.

On an operational level, TransAlta has developed an environmental, health and safety management framework, based on industry best practices, in order to achieve compliance with regulations, manage risks to business activities and to the environment, and to encourage continuous improvement in environmental performance within the company.

TransAlta's Environment, Health and Safety Management System (EHS MS) has been structured to meet the requirements of CAN/CSA-ISO 14001-2004 "Environmental Management Systems - Specification with Guidance for Use" and BSI OHSAS 18001 "Occupational Health and Safety Management Systems - Specification".

The scope of the Environment Health and Safety Management System includes all personnel, contractors, departments and functions that report to the Managing Director of TransAlta Gas and Renewables Operations and their related operations, activities and facilities. Physical boundaries include pre- and post-construction wind farm operational activities related to the wind turbines, collection system, road and related infrastructure. Pre-development activities include met tower installations and environmental monitoring.

TransAlta Wind has established an EHS Management System to confirm that EHS affairs are managed in a systematic and sustainable manner. The following is a high-level overview of the structure of the management system. The system is a Plan-Do-Check-Act process based on the ISO 14001-2004 and BSI 18001 international standards. It consists of eighteen (18) elements:

1. TransAlta's EHS Policies – TransAlta Wind's statement of intent and principles with respect to EHS management
2. EHS Risks - a comprehensive EHS risk assessment of all site activities
3. Legal & Other Requirements - an assessment of the laws, regulations, standards, etc. that TransAlta Wind must follow or chooses to follow
4. Objectives and Targets - each site sets EHS performance objectives and targets that all personnel are expected to work toward
5. EHS Management Programs - each site establishes and implements plans for achieving the Objectives and Targets
6. Structure and Responsibility - responsibilities have been assigned for all aspects of the management system - all personnel have a role to play
7. Training, Awareness and Competence – TransAlta Wind provides training to make all personnel are aware of relevant EHS hazards and controls and to provide employees with the skills and knowledge required to carry out their jobs competently
8. Communications - each site establishes channels of communication to make essential information available where and when needed

9. Documentation - each site maintains written procedures to guide personnel on the proper ways of carrying out tasks
10. Document Control - each site keeps documentation up to date and available where and when needed
11. Operational Control - each site establishes controls to reduce EHS risks. Controls include procedures, personal protective equipment (PPE), engineered controls, etc
12. Emergency Preparedness & Response - each site has emergency response procedures, materials and equipment in place to address potential emergencies. Drills and exercises are periodically conducted to test procedures
13. Monitoring and Measurement - each site tracks EHS performance and the effectiveness of operational controls through a combination of environmental monitoring, workplace inspections, occupational hygiene monitoring and other methods
14. Non-conformance and Corrective and Preventive Action - all incidents, near misses, audit findings and other deviations from planned arrangements are recorded, investigated and acted upon to prevent recurrence
15. Records - records are kept to provide proof of a functional management system
16. Audits - each site is audited annually to validate that the management system is implemented and functioning as intended
17. Management Review – annual management review of the management system to find ways of improving it
18. Evaluation of Compliance - procedure for evaluating compliance with legislation

5.4.2 Worker Health and Safety Rules

TransAlta Wind has developed a comprehensive set of health and safety rules that governs the activities of all employees and contractors working on TransAlta Wind sites. Employees and contractors receive an orientation to these rules before entering TransAlta Wind sites for the first time.

The health and safety rules cover a range of aspects, including the following:

- Clothing and protective equipment
- Confined space entry
- Alcohol and illegal drugs
- Overhead work
- Welding and burning
- Chemicals
- Smoking, matches, and lighters
- Compressed gas cylinders
- Housekeeping
- Air hoses
- Respiratory protection
- Ladders
- Scaffolds and platforms
- Fires and other emergencies
- Guard rails, platforms, and barricades
- Manual material handling
- Grinding tools
- Lifting equipment
- Reporting accidents/incidents
- Excavation and trenching
- Investigating accidents/incidents
- Locking out equipment

- Working alone

These health and safety rules will be adhered to at the expanded Kent Hills Wind Farm site at all times. A copy of the Health and Safety Rules for Contractors document will be included in the contract specifications to the primary construction contractor. All sub-contractors will be required to acknowledge and comply with the health and safety rules by signing an acknowledgement form.

5.4.3 Emergency Response Planning

TransAlta Wind will update its emergency response plan as part of an updated CEMP for the facility related to Kent Hills 3, to address the unlikely event of a site emergency during construction of the Project. Included in the emergency response plan will be a report form and a map of the Project site, showing the most direct route from the site to an emergency resource such as a hospital. TransAlta will consult with First Responders and determine if any special training may be required.

5.4.4 Construction Environmental Management Plan

The Kent Hills Wind Farm Construction Environmental Management Plan (CEMP) was completed prior to construction of Kent Hills 1 and updated for Kent Hills 2 in 2009 (current revision date January 2010). The plans were submitted to the Technical Review Committee (TRC) for review and approval. This Plan will be revised and applied to Kent Hills 3 Wind Project, following approval by the TRC. The CEMP will be used on-site during all construction and follow-up monitoring activities.

The updated CEMP for Kent Hills 3 will outline the commitments of TransAlta and their Contractor(s) to environmental protection, and will facilitate compliance with all relevant environmental legislation, policies and permitting requirements for those potential environmental issues anticipated during and following construction. This includes accidents, malfunctions and unplanned events associated with construction; and a protocol for post-construction of birds and bats at the Kent Hills 3 Wind Project.

5.4.5 Operations Environmental Management Plan

TransAlta will update its project-specific Operations Environment Management Plan (OEMP), previously developed for the previous phases, that will be used on-site during the operations phase of the Project. The OEMP has been created as a means of identifying the environmental commitments made for the operations phase of the Kent Hills Wind Farm (all three phases) and providing details on how to implement those commitments. The purpose of the OEMP is to provide a consistent approach to environmental issues and concerns common across all of TransAlta's wind farms within Canada.

The overall goal of the OEMP is to help the Project use environmentally sound and responsible practices. TransAlta will adhere to federal, provincial, municipal, and other applicable regulations, guidelines, standards, policies, permits and authorizations, and will mitigate for Project environmental effects where they cannot be avoided. This OEMP is based on a philosophy of continuous improvement of environmental protection practices through a program of inspection, monitoring, and review.

The objectives of this Kent Hills OEMP are to:

- Outline TransAlta's corporate environmental policies
- Identify the relevant environmental legislative, regulatory and approval requirements
- Identify environmental commitments in contracts
- Facilitate compliance with the commitments as set forth in the EIA for the Project
- Facilitate compliance with environmental legislation, regulations, and conditions of approval
- Identify the specific environmental sensitivities associated with the Project
- Allow that potential environmental issues that might arise during the operations phase of the Project are anticipated as much as possible, and that immediate action necessary to prevent and/or mitigate environmental effects is outlined
- Outline contingency plans for unplanned events
- Outline the roles and responsibilities of operations employees for environment management

5.4.6 History of Accidents and Malfunctions at Kent Hills Wind Farm

No chemical or petroleum spills have been recorded during operations, nor have there been any significant vehicle accidents recorded. On August 8, 2009, a single turbine fire occurred. The fire was contained in the nacelle, there were no workers present at the turbine and no injuries resulting from the fire. Access to the site area was restricted and there was no 3rd party damage to property. An investigation into the cause of the fire was conducted by the equipment manufacturer and was determined to be equipment defect. The incident was reported to New Brunswick Occupational Health and Safety authorities.

5.5 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

The following section outlines the effects of the environment on the Project, which includes climatic fluctuations and extreme events that are likely to occur in the WFSA.

During construction of Kent Hills 1 and Kent Hills 2, there were days when extreme weather such as high winds and/or precipitation resulted in temporary shutdown of construction. These delays were allowed for in the schedule, and the timeline of the construction of Kent Hills 1 and Kent Hills 2 permitted the project to be completed on schedule. The events did not impact significantly on the budgets.

During operation of the Kent Hills wind farm, there have been few days of extreme weather events that have compromised operation or maintenance. There has been no damage attributed to lightning strikes, which are fairly common.

Based on the onsite meteorological data the highest sustained winds on site were 26 m/s, gusting to 37 m/s. Icing affects the turbines up to 6% of the time over the course of a year.

Taking into consideration the design features that will be used in Kent Hills 3, a significant environmental effect is unlikely to occur. In the event of a lightning strike that hits a wind turbine, severe damage could occur and repairs would be required. However, based on operational data from TransAlta's fleet and from the turbine manufacturer, such an event is extremely rare, and has yet to occur at Kent Hills.

5.5.1 Climatic Fluctuations

The Kent Hills Wind Farm experiences consistently high wind speeds on an annual basis, which is why this specific area was selected as a potential site for wind power generation. At nearby Moncton, average annual wind speeds (1971-2000) were roughly 17 km/h, although seasonal differences exist. Average wind speeds during the summer months are lower than winter wind speeds. Prevailing winds consistently originated from the southwest during the period of 1971-2000.

Climatic fluctuations also occur within the region. Wind occurring along the coast is frequent; however calm winds are experienced between 1 to 5% of the time depending on local exposure of the area. Strong winds exceeding 50 km/h blow mainly from the west and severe winds approaching hurricane force occur for an approximate duration of 1-2 hours each year along the coast. Gale force winds (63 km/h or greater) can occur during any month. They occur at sea about 10-15% of the time during winter months but are extremely uncommon in summer months. Storms associated with low pressure areas can take place at any point during the year, but are typically more severe and more frequent during the winter months. Winter storms often have strong winds accompanied by precipitation, changing from snow to rain (Environment Canada 2004).

5.5.2 Extreme Events

5.5.2.1 Lightning

The wind turbines will be the highest features in the surrounding landscape, and therefore it is necessary that a lightning protection system be incorporated into each turbine. For the Project, each turbine blade material is fibreglass-reinforced epoxy resin with integral lightning protection supply. Each blade and each turbine tower are grounded to prevent adverse effects from lightning strikes. Most effects from a lightning strike would be dissipated. If lightning were to strike the generator at the top of the tower, serious damage could occur and the generator may be damaged. Wind turbine blades selected for use on the Kent Hills 3 Wind Farm are equipped with lighting arrestors that provide direct-strike protection while electrical ground systems play a critical role guarding against catastrophic damage to blades, electronics, transformers, nacelles, and collector systems and substations.

5.5.2.2 Extreme Weather

Advance warning systems for extreme weather or environmental conditions comprise part of the site monitoring program by TransAlta's Wind Control Centre. The Indji Watch service that is integrated into this monitoring uses large amounts of data gathered from diversely located sensors and systems and provides real time data monitored geographically. Lightning alerting and storm monitoring parameters are triggered at 80 km and 50 km proximities and protocols for site evacuation are assessed at those intervals. Other approaching severe weather conditions are similarly monitored and alerted through Indji service to the Wind Control Service from which response protocols are assessed and directed when necessary.

The turbine is designed to automatically shutdown at wind speeds that exceed 25 m/s (90 km/h). The turbine tower is designed to withstand excessive wind speeds. Comprehensive geotechnical work at each site will enable for proper design of wind turbine foundation. Extreme wind conditions are used as a parameter in this design.

Extreme wind events, such as hurricanes are rare, but have been known to occur in the region. An extreme wind event would be defined as winds in the range of 100 to 140 km/hr. In the spring and summer seasons, thunderstorms and electrical storms occur occasionally.

5.5.2.3 Cold Temperature Operations and Ice Formation and Ice Shedding

Under certain weather conditions, ice can build up on wind turbine blades, even while operating. This ice can be thrown off the blades, which poses a hazard to workers on-site, as well as land users in the vicinity of the turbines. Typically blade icing slows down the rotation which is sensed in the turbines control system, and causes the turbine to shut down. Procedures that address turbine operations, site access and safe approach during these conditions form part of TransAlta's Safety Management System procedures. All Operations personnel are trained to recognize hazards of icing conditions on turbines and turbine blades and will be required to follow these established procedures.

The turbine model selected for the Project is equipped with ice detecting sensors and in blade heaters to mitigate icing conditions and minimise down time due to icing. Additionally a Low Temperature package allows the turbine to continue to operate down to temperatures of -30°C and structural endurance down to -40°C will be supplied. In general all steel, welds, casts, and cables are specified to meet these requirements, this also includes hydraulic oils and lubricants.

5.6 CUMULATIVE EFFECTS

A cumulative effects assessment determines whether the Project under review adds to the combined adverse effects of past, existing and imminent projects and activities. Specifically, the assessment determines the degree to which a single project is contributing to the total cumulative effects of human activities and developments in the region.

The evaluation of cumulative environmental effects follows five steps:

- Step 1 Identify Project-related residual effects on VCs
- Step 2 Identify other projects or activities that could interact with Project-related residual effects
- Step 3 Exclude residual effects of other projects or activities that are not likely to act in combination with the residual effects of the Project
- Step 4 Identify the likely cumulative environmental effects that could result from the interaction of Project-related residual effects with other past and future projects and activities
- Step 5 Evaluate the significance of likely cumulative environmental effects

Environmental effects resulting from Project-related activities were identified and assessed in Sections 5.1 to 5.4. Residual effects of the Project that may interact with effects of other past, present

and reasonably foreseeable future project were identified for birds and other wildlife, visual aesthetics and noise. This section outlines cumulative environmental effects that may result from the Project in combination with other projects or activities that have been or will be carried out, within the RSA, including Kent Hills 1 and 2.

5.6.1 Past, Present and Future Projects in the Regional Study Area

Past and present projects and activities that have occurred in the RSA prominently include the past phases of the Kent Hills Wind Farm, in commercial operation since December 31, 2008 and expanded in 2009/2010 to 50 turbines. In addition to the Wind Farm the area is mainly used for forestry and some agriculture, tourism and recreational activities. There are no other wind power projects that have been proposed to be developed in the RSA (NBDELG 2017b). The nearest known wind power project that has been registered and approved (with conditions in 2010) is the Acciona Wind farm near Aulac in Westmorland County, approximately 40 km WNW of the WFSA, outside the RSA. This project was to involve 43 turbines; however, there is no indication that the project is likely to proceed. The conditions of approval included an additional 2 years of bird studies, which have not likely proceeded. Besides wind power projects, additional considerations for cumulative effects include the presence of forestry, agricultural and recreational activities, communication towers, and vehicle traffic.

5.6.2 Interactions between Projects and Description of Cumulative Environmental Effects

Identifying interactions between Project activities and potential cumulative effects is considered through a comparison of the temporal and spatial scope of the additional projects identified in the RSA. The assessment of cumulative effects here is primarily qualitative, relying primarily on professional judgement. Past, present and likely future projects and activities within the RSA are considered to be relevant to this cumulative effects assessment.

5.6.2.1 Birds and Other Wildlife

Past and ongoing forestry and agricultural development in the RSA has likely resulted in effects (e.g., loss) of forest and wetland habitat, and the active forestry of much of the WFSA has reduced the area of contiguous mature forest. Kent Hills Phases 1 and 2 has also resulted in the loss of habitat within a the RSA. Additional loss of high quality habitat is not expected to result from the development of the proposed Project. The Kent Hills 3 Project is not expected to contribute substantively to the cumulative environmental effects of loss of wildlife habitat within the RSA. The preferred turbine locations and infrastructure cover an area of 24 ha; however only approximately 11 ha are areas requiring clearing, and mostly near existing roads and cleared habitats. No mapped wetlands are expected to be lost.

Wildlife mortality, specifically bird and bat mortality, is a residual environmental effect associated with the proposed Project. In consideration of the existing wind farm, the five additional turbines may be expected to increase the bird and bat mortality by approximately 5% of the mortality from the existing wind farm, which is already considered relatively low based on post-construction monitoring results. Bird and bat mortality may also occur as a result of collisions with overhead power lines, communication

towers, vehicles and buildings in the RSA. Whether these features, in combination with the proposed Project will produce any significant bird kills such that there may be a population effect is uncertain. Overall, the Project's contribution to bird and bat mortality, when considered in relation to other existing structures in the area (including existing 50 wind turbines), is predicted to incrementally increase wildlife mortality but not be significant, although the unlikely mortality of bird and bat SAR would be considered significant.

5.6.2.2 Visual Aesthetics

The development of the Project, taken into consideration with forest harvesting activities, existing wind turbines, existing and future power lines, and communication towers, will be considered a further change to visual aesthetics compared to pristine forest. However, due to the presence of these structures currently (particularly the existing Kent Hills Wind Farm) and landscape changes to the forest from forestry activities, the visual impact that the addition of the five preferred wind is expected to be low. The cumulative impact could be considered medium if any of the proposed Kent Hills 3 Project alternate turbine locations were inevitably selected for construction. There have been no documented complaints to TransAlta regarding the visual presence of the Kent Hills Wind Farm. No cumulative effects are expected with respect to shadow flicker, and the preferred wind turbines will generally not be seen from residents surrounding the site. As a result, the cumulative effect of the Project with the other existing structures in and alterations of the landscape is predicted to be not significant.

5.6.2.3 Noise

The noise impact assessment for the Project (Appendix L) considered the existing turbines in calculating overall noise levels, and is therefore a cumulative assessment by nature. Acceptable sound levels are expected to be produced by the Project, in combination with the existing turbines. An incremental increase in sound, above the existing sound of forestry and motorized recreational activities, road noise and the existing wind farm, is expected for the area in close proximity to the turbines, but is not considered to be significant.

5.7 SUMMARY OF POTENTIAL ENVIRONMENTAL EFFECTS AND MITIGATION MEASURES

A summary of recommended measures for managing and mitigating effects of the Project, based on the preceding analysis, is provided in Table 5.15. Potential interactions, effects and mitigation for the construction and decommissioning phases are generally the same, therefore, where applicable, the two phases were combined here to be concise.

Table 5.15 Summary of Potential Effects and Proposed Mitigation Measures

Valued Component	Project Phase	Potential Effects	Mitigation Measures
Soils	Construction & Decommissioning	Soil Erosion and Compaction	• Access to the turbine sites will be limited to established access driveways, where practicable. • Size of access driveways will be limited to the minimum required for safe construction, operation and decommissioning of the equipment. • When practicable, land clearing activities will be limited to periods when the ground surface is best able to support construction equipment (winter or dry season). • Topsoil and subsurface soils will be separated and stored on-site to be replaced appropriately after the pouring of concrete foundation. When the soils are stored they will be protected from erosion and runoff. • Compacted soil will be reclaimed as required (e.g. in laydown areas). • Land will be restored using topsoil stored on-site.
Aquatic Environment	Construction & Decommissioning	Surface Water Contamination	• Watercourses will be avoided to the extent practicable. • Construction material, excess material, construction debris, and empty containers will be stored at least 30 m away from watercourses and watercourse banks. • Equipment maintenance (e.g. washing of concrete trucks) will be controlled to prevent entry of concrete material into a watercourse • Where watercourse crossings are required, cables will be aboveground and watercourses will be spanned.
		Sediment Loading	• Clearing, grubbing and uprooting of riparian vegetation will avoided to the extent practicable. • Road work within watercourses (if required) will occur between June 1 and September 30 to avoid sensitive fish life stage timing windows. • Temporary erosion and sediment control measures (e.g., silt fence, straw bales) will be used, maintained and kept in place until all work within or near a watercourse has been completed and buffer zones are stable. • Temporary sediment control measures will be removed when work is completed and once permanent erosion control measures, as may be specified in the contract, have been established.

Table 5.15 Summary of Potential Effects and Proposed Mitigation Measures

Valued Component	Project Phase	Potential Effects	Mitigation Measures
		Surface Water Flow	• Watercourses will be avoided to the extent practicable. • A WAWA Permit will be obtained for all required watercourse crossings, and the conditions of such permits will be followed.
		Fish Mortality	• Watercourses will be avoided to the extent practicable • Watercourse crossings, where required, will be constructed between June 1 and September 30 to protect fish and/or the organisms upon which they feed. • Where practicable, and if required, culverts will be installed when during low flow periods. If water is present, watercourses will be isolated and flow will be pumped around using water pumps of appropriate size. In this case, a biologist will be on-site to facilitate fish rescue within the isolated area.
		Loss of Fish Habitat	• If applicable, authorization from DFO will be obtained in advance should it be deemed that serious harm to fish could occur; approval would include requirements, if applicable, for mitigation and offsetting
		ARD	• Low quantities of rock excavation expected.
Terrestrial Vegetation	Construction & Decommissioning	Loss of Plant SOCC	• Vascular plant SOCC will be flagged and avoided to the extent practicable.
Wetlands	Construction & Decommissioning	Loss of wetland area and/or function	• Avoid wetlands, where practicable. • Pole placement will be designed to span wetlands where practicable. • If interaction is unavoidable, reduce effects to wetlands to the extent practicable. • A WAWA Permit will be obtained for any required construction activities conducted within 30 m of an applicable wetland, and the conditions of such permits will be followed. • Wetlands within the footprint of turbines and road upgrades will be compensated for when necessary, under a plan developed in consultation with NBDELG.
Birds and Other Wildlife	Construction & Decommissioning	Sensory Disturbance	• Overall disturbance will be limited to designated workspaces • Work will be conducted in compliance with the *Migratory Birds Convention Act*. • Delivery vehicles will remain on designated local and access roads. • The turbines selected are quieter than the Vestas V90s currently in use at the Kent Hills Wind Farm.

Table 5.15 Summary of Potential Effects and Proposed Mitigation Measures

Valued Component	Project Phase	Potential Effects	Mitigation Measures
		Habitat Alteration and Loss	• Habitat loss may be mitigated by limiting clearing of land to what is necessary for construction activities and by limiting the overall land disturbance to within designated workspaces.
		Mortality	• To reduce the potential of bird mortality, land clearing and construction activities will be performed, to the extent practicable, outside of critical time periods for breeding birds, which is from mid-April to mid-August. • Where residual vegetation may require removal during the breeding season, nest sweeps will be conducted within 7 days of the clearing, and follow the guidance from ECCC • Should there be potential for nesting birds in previously cleared areas subject to construction activities during the breeding bird season, nest surveys will be performed to confirm there is no active nesting. • A contingency plan will be developed as part of the Construction Environmental Management Plan (CEMP) to address the discovery of active nests during construction, as well as to addresses the rescue of wildlife that fall into excavations.
	Operation	Sensory Disturbance	• The turbines selected are quieter than the Vestas V90s currently in use at the Kent Hills Wind Farm.
		Mortality	• Lighting will be the minimum allowed by Transport Canada for aeronautical safety, and white or red strobe lights may be used with the minimum intensity and flashes per minute allowable. • Electrical cables will be buried underground within the wind farm to the extent practicable, to reduce perching opportunities for birds and to reduce the likelihood of collision with the wires. Where aboveground electrical lines are necessary, they will be to the minimum extent required. • Post-construction monitoring of birds and bats will direct the need and form of further turbine operation mitigation measures.
Heritage Resources	Construction	Disturbance	• An AIA has been completed by a permitted archaeologist and included research and consultation with ASB, Historic Places, and local historical societies, as well as fieldwork (i.e., walkover and judgmental testing). Recommended shovel testing is planned for fall 2017. Should resources be found that may be effected by Project-related activities, these areas will be

Table 5.15 Summary of Potential Effects and Proposed Mitigation Measures

Valued Component	Project Phase	Potential Effects	Mitigation Measures
			fenced off and excluded from construction activities or resources will be recovered. • A contingency plan for the discovery of archaeological resources during construction will be included in the Construction Environmental Management Plan.
Land Use	Construction and Decommissioning	Reduction of forested land	• Existing forest roads will be used as access roads to the extent practicable. New access roads in PDA will be minimized.
		Hazards and/or inconvenience to forestry operations, snowmobile operation, and recreational activity.	• Road construction schedule will consider planned forestry operations in the area such that required access is maintained. • No construction is planned during winter months when snow is present. • Access along existing trails and roads will be maintained to the extent practicable. • Prominent stop signage will be installed at four-way intersections. • Project road construction design will avoid steep ditches where practicable.
		Hazards and/or inconvenience to traffic on public roads	• Modifications to existing roads will be non-permanent, and will be remediated upon completion of construction. • Additional mitigation, if required by NBDTI on NBDTI roads, will be used to reduce potential hazards and/or inconveniences to traffic. Timing of deliveries will take into consideration likely peak traffic periods.
	Operation	Disruption to forested lands	• None required.
		Effect to tourism and recreation	• Turbines are sited well away from the Fundy shoreline. • Prominent stop signage will be installed at four-way intersections. • Snowplowing will not block snowmobile crossings at intersections with access roads.
		Effect on local economy	• Local residents will be employed to the extent practicable during the construction, operation and decommissioning of the Project. • Municipal taxes will be remunerated, thus increasing the local tax base, which could be used to increase funding of local municipal initiatives.
		Effect on Property Values	• None required.
Visual Aesthetics	Operations	Change to Visual Landscape	• Turbines will be painted an off-white color designed to reduce reflection in a wide range of light conditions.
		Lighting	• Lighting will be the minimum allowed by Transport Canada to allow for the appropriate level of aeronautical safety.

Table 5.15 Summary of Potential Effects and Proposed Mitigation Measures

Valued Component	Project Phase	Potential Effects	Mitigation Measures
		Shadow Flicker	• None required.
Noise	Construction and Decommissioning	Increases to sound pressure levels	• Equipment will be transported to the site only within daylight hours. • Construction is planned for daylight ours only. • Construction equipment will have mufflers that comply with guidelines for sound and emission levels. • Noise abatement equipment, in good working order, will be used on all heavy machinery used on the Project.
	Operation	Increases to sound pressure levels	• Turbines are designed to be quieter than previous models. .
Health and Safety	Operation	Electromagnetic Fields (EMFs)	• None required.
		Infrasound Energy	• None required.
		Ice Throw	• Turbine design will reduce the potential for ice throw. • During site visits, vehicles will be parked up-wind of the turbines. • Warning signs will be posted near the turbines, to discourage the public from approaching the turbines.