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Introduction

As per your letter of engagement dated March 2, 2018, Delta Waterfowl has provided an assessment of the potential impacts of the Sharp Hills Wind Farm (SHWF) on breeding and migrating/staging (hereafter staging) waterfowl. We have reviewed all of the documents that you provided and have mapped the locations and extent of the proposed industrial wind development (Figure 1), proposed industrial wind turbine (IWT) locations in relation to wetlands in the region (Figure 2), breeding waterfowl densities (Figure 3), land-cover types (Figure 4), and a figure showing the waterfowl exclusion zones, avoidance zones (based on European literature – see below) and potential barrier effects if the proposed IWTs are constructed (Figure 5).

Based on our assessment, we have concerns that the proposed wind farm will adversely impact a number of avian (displacement and direct mortality) and bat (mortality) species. Unlike many species of passerines, birds of prey and bats that are killed by IWTs, waterfowl generally avoid industrial wind developments (Larsen and Madsen 2000; Desholm and Kahlert 2005, Stewart et al. 2005, Larsen and Guillemette 2007, Masden et al. 2009, Fijn et al. 2012, Rees 2012) which is problematic when IWTs are placed in and close to important waterfowl habitats, and/or across migratory or feeding flight corridors. This review pertains to the potential barrier effects and habitat loss (due to avoidance) that would be imposed on ducks, geese and swans if the proposed IWT development was constructed. It is our professional opinion that if the proposed industrial wind development is constructed, it will adversely impact breeding as well as spring and fall staging waterfowl.

Mapping Methods

All maps for this report were created using ArcMap v10.6 from Environmental Systems Research Institute (ESRI). Delta Waterfowl staff plotted the coordinates of the 83 proposed wind turbine locations (provided by EDP Renewables Canada) and used the Buffer geoprocessing tool to delineate 150 m and 500 m areas around each IWT illustrating the waterfowl exclusion and avoidance zones, respectively (Fig 1). The area of these zones was measured using the Calculate Geometry tool.

Wetland basins within the waterfowl exclusion and avoidance zones were located using the World Imagery aerial photos provided on ArcMap. Each wetland margin was digitized by Delta Waterfowl staff, creating polygons of their outline (Fig 1). Undoubtedly, some class I, II, and III wetlands (ephemeral, temporary, and seasonal; Stewart and Kantrud 1971) were missed in this process due to their lack of distinguishing features at the time of the aerial photos. Thus, the number and size of the wetlands within the exclusion and avoidance zones should be considered a minimum estimate. ArcMap tools calculated wetland polygon size (Calculate Geometry Tool) and distance from turbines (Near-Dist Tool).

Characteristics of the Sharp Hills Wind Farm

The proposed Sharp Hills Wind Farm (SHWF) is located near Sedalia and New Brigden, Alberta, with its northwestern-most turbine location approximately 28 km southeast of Consort (Fig 2). At its longest and widest points, the SHWF project area extends 45 km from north to south and 32 km from west to east. The total project area is approximately 1,062 km^2.

Several studies have indicated that waterfowl are effectively excluded from utilizing areas within 150 m of IWTs and tend to avoid areas within 500 m of a turbine (Larsen and Madsen 2000; Desholm and Kahlert 2005, Stewart et al. 2005, Larsen and Guillemette 2007, Masden et al. 2009, Fijn et al. 2012, Rees 2012). The collective exclusion zones around the proposed IWT locations encompass 586 ha, 66 unique wetland basins, and 42 ha of wetland habitat (Fig 1, 4 and 5). The avoidance zones encompass an additional 5,046 ha, 533 wetland basins and 868 ha of wetland habitat. In total, waterfowl utilization of 599 wetland basins, 910 ha of wetland habitat, and 4,722 ha of upland (nesting and foraging) habitat (primarily pasture, native prairie, and cropland) could be impacted by the proposed IWTs (Fig 1, 4 and 5).

The project footprint includes 2,393 ha of various types of prairie wetlands. Prairie wetlands provide incredibly important habitat for waterfowl (and many other species of wildlife) and they are the most threatened habitat on the Canadian prairies due to a lack of protective regulations. All of the IWTs are closely associated with prairie wetlands (Figure 1; average distance from IWT to wetland is 156 m) despite the fact that Danish researchers advocate that

IWTs not be placed within 1 km of waterfowl roosting areas (see Stelling and Petrie 2013). All of the proposed IWTs would violate this recommendation.

The proposed SHWF IWT locations are primarily arranged in a series of rows consisting of two to nine units, oriented from the southwest to northeast, with each turbine in a row less than 1.5 km from its nearest neighbor (Fig 1 and 5). Including the avoidance zone, the proposed IWT rows create up to an 11 km-wide barrier to waterfowl moving through the area or moving between habitats (e.g., roost, feeding, or nesting sites; Masden et al. 2009, Rees 2012). However, given the juxtaposition of the IWTs from east to west and the overlapping layers going from north to south, this development could create a 32 km-wide barrier to migration and foraging flight (see Larson and Guillemette 2007).

Danish researchers also recommend that IWTs not be placed within agricultural fields traditionally used by field feeding waterfowl (see Stelling and Petrie 2013). All of the proposed IWTs are located within or are closely associated with cereal grain agricultural fields where waterfowl field-feed in spring and fall (Figure 4). Based on this, the known exclusion and avoidance zones caused by IWTs, and the location of the proposed IWTs, we have concerns about the reduction in field feeding opportunities afforded to ducks, geese and swans if the SHWF was to be constructed.

Importance of the Sharp Hills Wind Farm Project Area

The proposed SHWF is located in an ecoregion called the Prairie Pothole Region (PPR), the core of North America's Great Plains and home to millions of small, shallow wetlands created by the Wisconsin glaciers during the most recent ice age. Much of the grassland in the PPR has been converted to agriculture, but many of the wetlands remain and are extremely important habitat for waterfowl. Over 50% of all North American ducks are hatched in the PPR (Bellrose 1980, Greenwood et al. 1995), with wetlands and croplands also serving as critical migratory stopover habitat for waterfowl and other birds.

Breeding waterfowl numbers are closely tied to the number of wetlands, which varies significantly across the PPR (Johnson et al. 1992). The proposed SHWF site is located in stratum 27 of the annual Waterfowl Breeding Population and Habitat Survey conducted cooperatively by the Canadian Wildlife Service and U.S. Fish and Wildlife Service. Overall, the waterfowl breeding density in stratum 27 averaged 18.15 breeding pairs/km^2 in 2017, the second highest waterfowl density of the 10 strata in Alberta (USFWS 2017). However, wetland densities within the SHWF turbine avoidance areas averaged 10.6 wetland basins/km^2, well above average for stratum 27 and breeding waterfowl densities in the project area are up to 25 pairs/ km^2 (Figure 2). In North Dakota, Loesch et al. (2013) found reduced breeding waterfowl densities on 26 of 30 wind energy development sites, with up to a 56% reduction in breeding pairs when compared to sites without turbines. This study was based upon much smaller IWTs than are being proposed for the SHWF. Displacement of laying hens from the SHWF project area may result in movement to inferior sites, where reproductive success is reduced (Bellrose 1980, Loesch et al. 2013).

A significant concern is that insufficient monitoring has been conducted by the proponent. It has been recommended that 3 years of pre-construction monitoring is necessary to ascertain potential impacts of IWTs on waterfowl. We strongly recommend that this industrial development be relocated due to the importance of the region for breeding and staging waterfowl. In the unfortunate event that the project is not relocated, the proponent should delay the project until such time that they can provide 3-years of monitoring of breeding and spring and fall staging waterfowl. We would also request that the research be done by an independent organization and not by the proponent.

Furthermore, we have concerns that the SHWF would have a substantial impact on Alberta residents and non-residents that hunt waterfowl in that region. Strictly from a waterfowl and waterfowl hunting perspective, industrial wind development in other areas of Southern Alberta with lower wetland and breeding waterfowl densities would result in less damage to breeding and staging ducks and hunting opportunities. Suggested locations for relocation might include the area south of Fitzgerald Lake (35km west of currently proposed SHWF) or west of Sunnynook, Alberta.

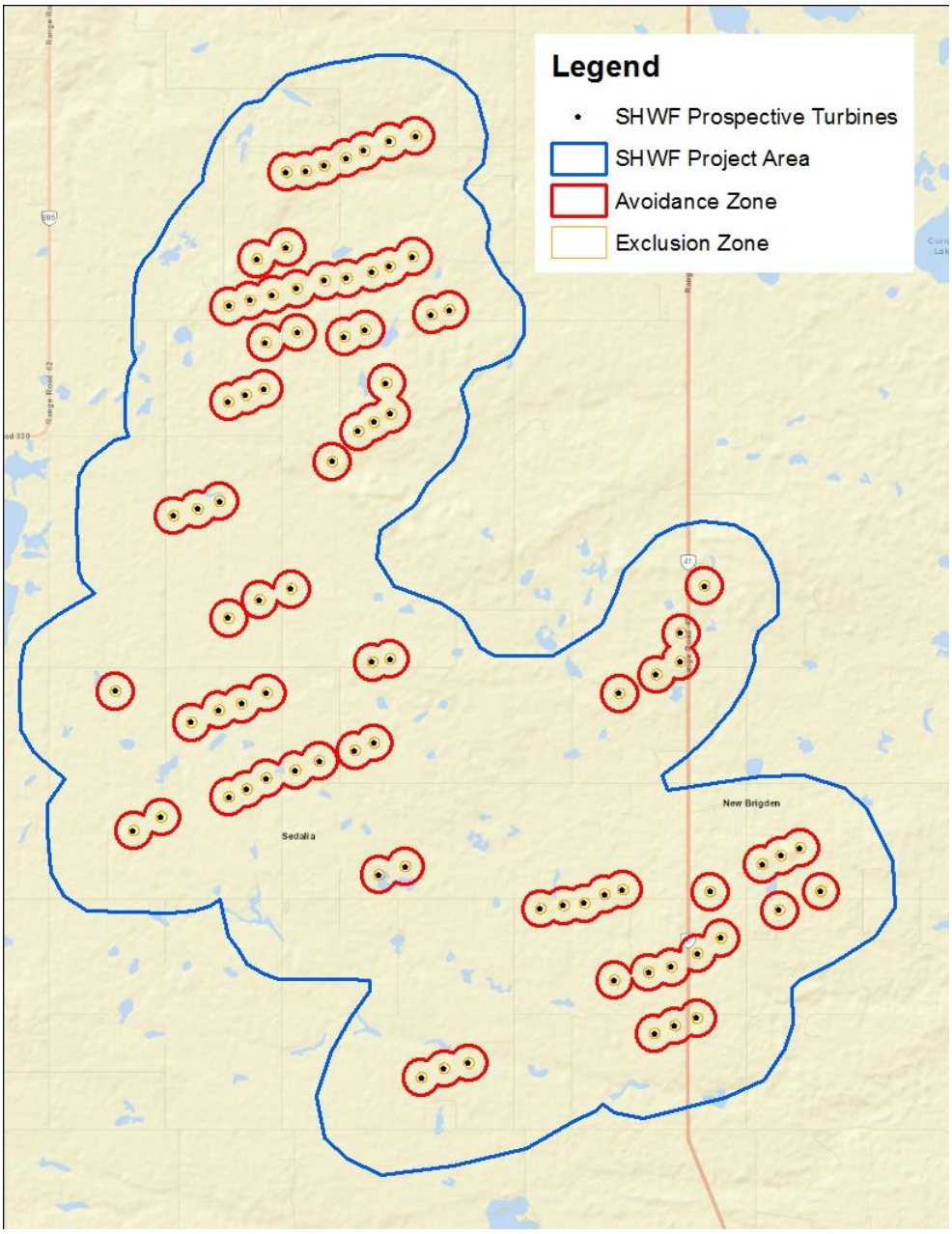

Figure 1. Sharp Hills Wind Farm Project Area with waterfowl exclusion and avoidance zones for each IWT.

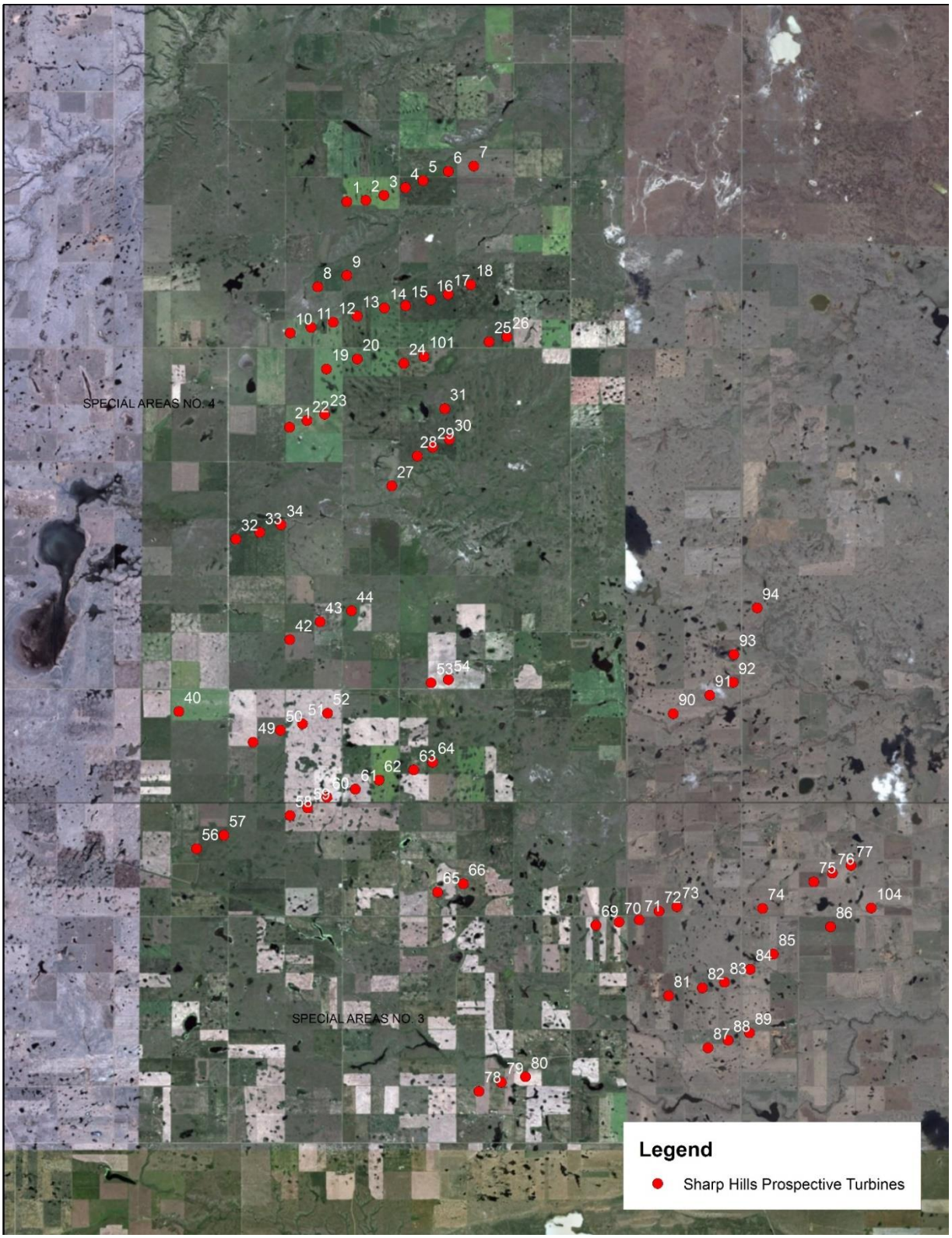

Figure 2. Sharp Hills Wind Farm Proposed Industrial Wind Turbine Locations and Associated Wetlands.

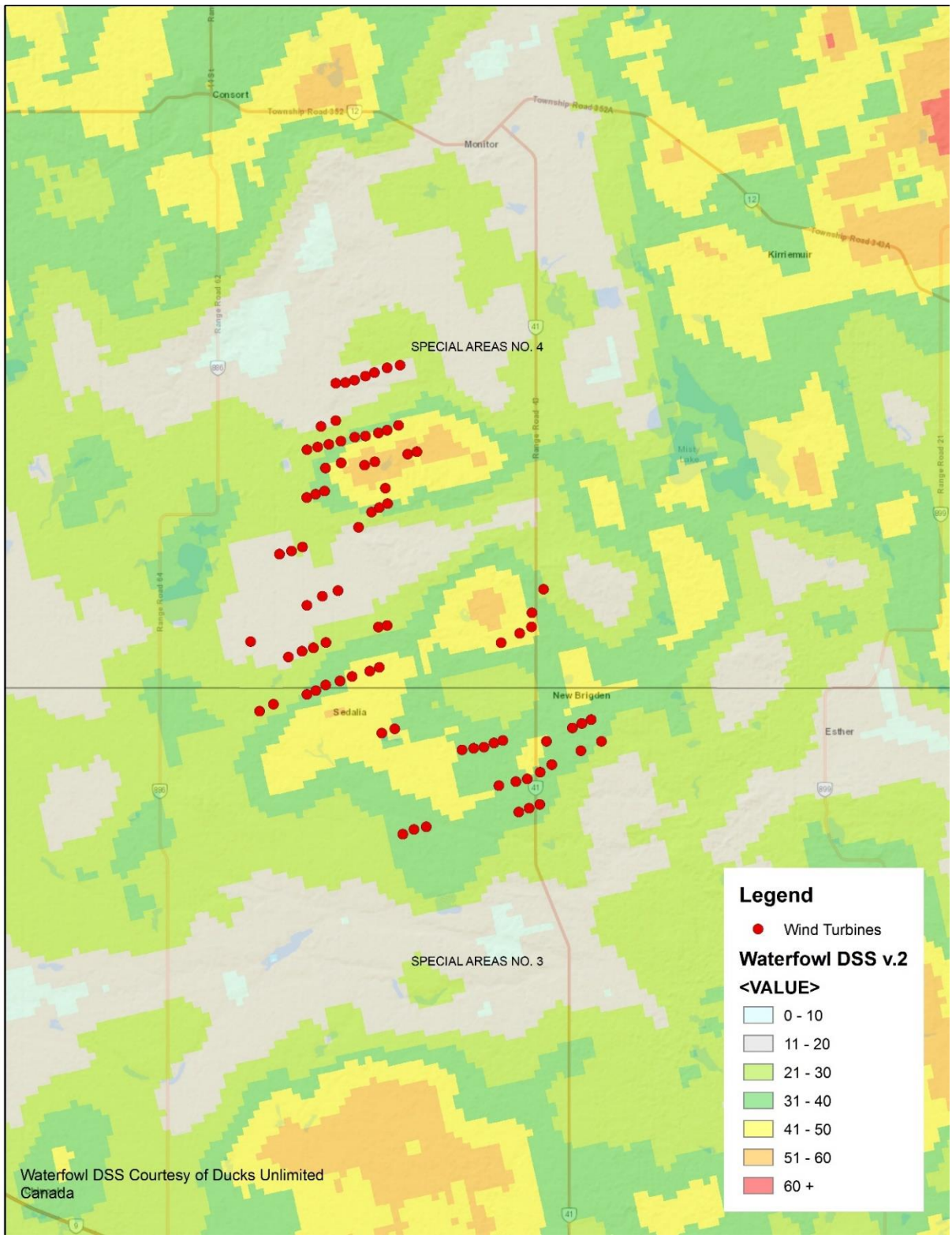

Figure 3. Sharp Hills Wind Farm Proposed Industrial Wind Turbine Locations and Estimated Breeding Duck Densities (pairs/mi^2).

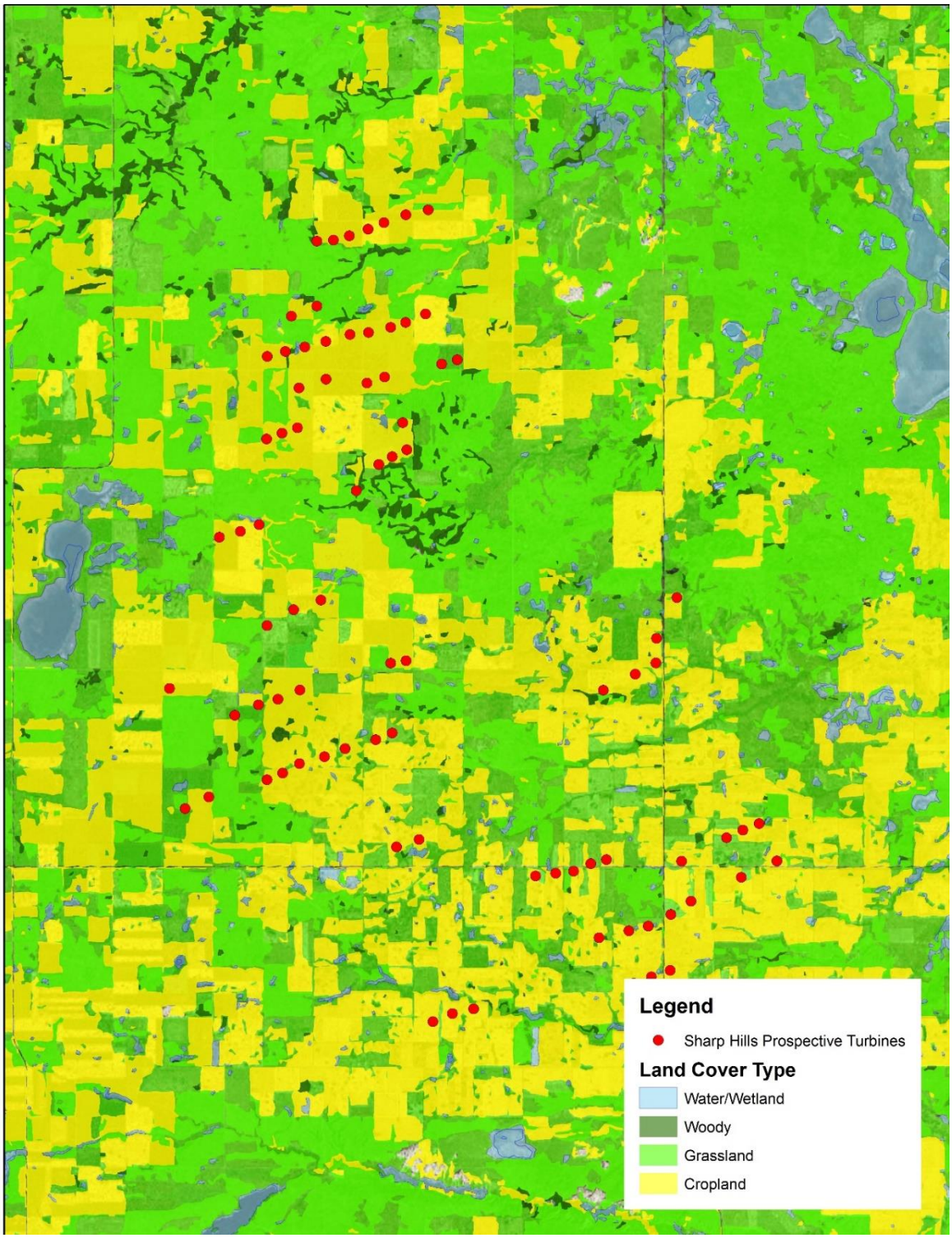

Figure 4. Sharp Hills Wind Farm Proposed Industrial Wind Turbine Locations and Associated Land Cover Type. Land cover layer courtesy of Natural Resources Canada (1999-2001).

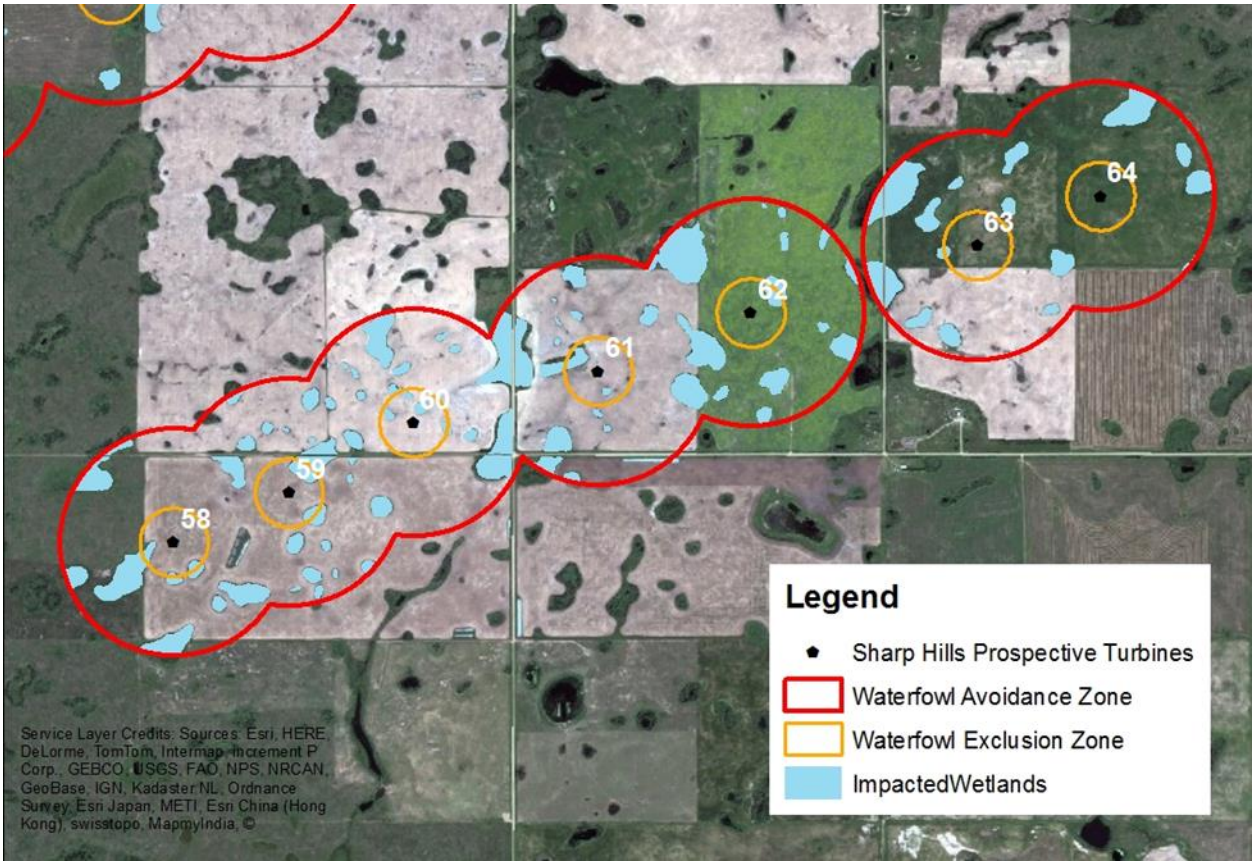

Figure 5. Aerial photo of prospective turbine sites 58-64 with examples of waterfowl exclusion and avoidance zones, and impacted wetlands. The linear arrangement of the turbines could serve as a barrier to waterfowl movement.

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