Environmental Impacts of the Proposed Heartland Transmission Project

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1.0 Introduction

This report considers the potential impacts of the proposed Heartland Transmission Project (HTP) on the environment, primarily for the applicants' preferred route. Report components are as follows:

2.0 Legal Concerns

The proposed double circuit 500 kilovolt Heartland transmission line will be the largest ever built in Alberta, with towers and lines up to 75m tall, twice the height of existing high voltage towers in Alberta. This is a classic example of a project that requires the most rigorous of environmental impact assessments (EIAs) because it is so massive, will have major environmental impacts, and because this is the first of the projects labeled as "critical transmission infrastructure" in the *Electric Statutes Amendment Act, 2009* to be reviewed and built.

However, amendments passed by the Alberta Government to the *Environmental Assessment (Mandatory and Exempted Activities) Regulation* in April 2008 exempted all electricity transmission lines from the requirement for an environmental impact assessment. Previously, lines of 500kV or greater were mandatory and those less than 130kV were exempt. The Environment Minister retains the authority under the *Environmental Protection and Enhancement Act* to require an EIA even with the exemption.

From April 2008 and on, it has been at the discretion of the Alberta Utilities Commission to determine how much or how little environmental information needs to be submitted by companies planning to build new high voltage power lines. To quote from a January 10, 2011 letter to RETA from the Alberta Environment Minister, "The level of detail (environmental information) expected is determined by the Alberta Utilities Commission on a project-by-project basis."

These recent changes mean that electricity transmission facility operators (TFOs) do not need to submit the detailed types of studies and assessments that they did in the past to determine the impacts of their proposed power lines on the environment.

The proposed Heartland line is a perfect case in point. Had the proponents been required to submit a formal EIA under provincial legislation, which would have been the case prior to the Alberta Government's exemption amendments in 2008, there would have been significantly more detail and assessment than included in the applicants' current environmental assessment. And consequently, there would have existed greater review and scrutiny opportunities for the public.

And, as importantly, the Alberta Government's own opportunities for, and legal obligations to, review the environmental impacts of new high voltage power lines under the formal EIA process have been eliminated through legislation amendments passed by the provincial government in 2008.

3.0 <u>Public Consultation Regarding Environmental Impacts</u>

The Heartland Project Team's public consultation process is problematic in a number of areas specific to obtaining landowner and other stakeholder input on environmental matters and concerns.

For example, with respect to the landowner *Contact Information* form, many of the comments requested under "Topics of interest most frequently raised by stakeholders" included the reading of a statement by the interviewer before the comment was requested.

The statement under the "Environment" topic on the *Contact Information* form is as follows:

> "Major environmental features, such as protected areas and national and provincial parks, have been identified on our routing maps as constraints to be avoided. As routes are refined with input from stakeholders, adjustments in the centre line location and tower placement will assist in avoiding smaller environmental features, such as ponds and trees."

This statement, as is the case with many others in the *Contact Information* form, attempts to provide assurances to the landowner being interviewed that environmental impacts have been and will be adequately addressed by the applicant. Such premature assurances in many cases deter landowners from raising any serious concerns with the interviewer about environmental impacts. If the *Contact Information* form had included a few statements on reported impacts of overhead high voltage lines on bird collisions and animal health (wildlife, pet and livestock), respondents might well have raised more concerns.

With respect to the type and severity of environmental and other impacts, it is important that landowners and other stakeholders know exactly what kind of infrastructure is being proposed. When the Heartland Project Team (HPT) first presented the public with its plans, the towers proposed were up to 75m tall. Then during the landowner surveys when *Contact Information* forms were filled out, the HPT proposed towers up to 60m tall. In late July 2010, the HPT proposed 73m-tall towers. And, within its facility application, the HPT has proposed 75m-tall towers.

The difference between a 60m-tall tower and a 75m-tall tower is 15m or 49 feet. If landowners and other stakeholders surveyed had known the towers would be 49 feet taller than they had been led to believe, there is a good chance they would have raised additional environmental and other concerns during their interviews.

As well, for the 2009 landowner surveys, the *Contact Information* form indicated the towers would be spaced approximately 360m apart, whereas for the 2010 landowner surveys the *Contact Information* form indicated towers would be spaced 330m apart within the Sherwood Park Greenbelt and 365m apart elsewhere.

With respect to tower height and spacing, the public, and particularly directly impacted stakeholders, have been confused by changing tower heights and spacing distances, all of which may very well have changed their responses to questions about environmental and other impacts.

Certainly through reading the HTP facility application, the reader is left with the impression that many stakeholders were interviewed and their environmental input and concerns were fairly reflected in the final decisions made on routing and recommended technologies. Based on the manner in which landowners were asked questions, and information presented in section 6.2 of this report, this may well not have been the case.

4.0 Baseline Data on Natural Resources

Had the Alberta Environment Minister required an Environmental Impact Assessment for the HTP, which he has the authority to do under the *Environmental Protection and Enhancement Act*, the Heartland applicants would have been required to submit baseline environmental data. However, the baseline data on natural resources, especially wildlife, is very limited within the facility application. Considering the fact that the proposed Heartland towers and lines will be up to 75m tall, twice the height of any currently in Alberta, an EIA for this project could have provided a good opportunity for the public and the Alberta Government to closely scrutinize the project from an environmental perspective.

Given the dearth of baseline data on wildlife within the facility application, I attach some data to this report that I have gathered and prepared over the past 32 years while residing within the Bretona Pond wetland complex, the applicants' preferred route. I had provided these data to the applicants on several occasions early in the Heartland public consultation process, but they have chosen to ignore it. As well, I had made the AUC aware of these data in 2009. By presenting the data as part of my expert testimony, I hope to convince the AUC that, from an environmental perspective, the Edmonton and Sherwood Park Greenbelts are inappropriate locations for an overhead Heartland line.

Significant sections of the applicants' preferred route lie within the western edge of the Cooking Lake Moraine. This area contains many waterbodies and has been referred to as the Prairie Parkland "Duck Factory" because so many ducks and other waterfowl breed, nest, rear their broods here, stage, and stop over during Spring and Fall migration (Kristensen 1993a). Nowhere else in Alberta, except the Peace-Athabasca Delta and Hay-Zama Lakes area, contains such a large block of high-quality waterfowl habitat (Kemper 1976).

Some of the waterbodies and natural spaces in this area that are important habitat for waterfowl and many other bird species, and that would be directly impacted by an overhead Heartland power line in the preferred route, include: North Saskatchewan River, Sturgeon River, Strathcona Science Provincial Park, Bretona Pond Buck-for-Wildlife Area, Mill Creek, Fulton Creek Marshland, Fulton Pond, Fulton Creek, Crosswhite's Pond, Bretona ConservAction Area, Baseline Slough, and many other ponds, sloughs and wetland complexes (Figure 1).

Bretona Pond is a popular wetland with hundreds of birdwatchers and natural historians annually (Kristensen 1993b). Significant research has been conducted within the Bretona Pond wetland complex. In the early 1980s, I approached the Alberta Fish and Wildlife Division with a proposal to protect Bretona Pond for wildlife conservation.

Subsequently, Green and Koski (1984) recommended the establishment of a Buck-for-Wildlife project at Bretona Pond. In 1985, the Alberta Government and Strathcona County entered into a joint Buck-for-Wildlife project and established interpretive facilities at Bretona Pond (Kristensen 1990). Other participants in this initiative were the Colchester Agriculture Society and Edmonton Natural History Society.

The pond was identified as having "good opportunities for wildlife viewing and wetland interpretation" (Westworth and Knapik 1987) and as critical wetland habitat (Griffiths 1987). As a result, the Strathcona County Recreation and Parks Outdoor Master Plan (1987) listed Bretona Pond as a significant natural feature, primarily as a productive wetland for nesting, moulting, staging and migrating waterfowl. The Bretona Pond Buck-for-Wildlife Area is situated within 800m of the proposed Heartland preferred route.

The Strathcona County ConservAction Program was an innovative wildlife habitat conservation program initiated in 1989. Our local and provincial governments entered into a joint project which included encouraging private landowners to dedicate parcels of private land as wildlife habitat. In the first three years following its inception, the ConservAction Program grew into a larger initiative that included Environment Canada and the Sherwood Park Fish and Game Association.

Our family participated in the ConservAction Program by dedicating the first parcel of land to the program in 1989. This dedication further recognized the ecological significance of the Bretona Pond wetland complex (Kristensen 1990). The area, known as the Bretona ConservAction Area, is a 100-acre parcel of land that my family bought in 1987 with the intention of setting it aside for wildlife conservation. We continue to own the land, and it is an excellent example of private land conservancy through a partnership among the following players (in 1989): Strathcona County; Sherwood Park Fish and Game Association; Alberta Environmental Protection; Alberta Career Development; Recreation, Parks and Wildlife Foundation; Alberta Fish and Wildlife Division; Alberta Conservation Association; Environment Canada; and Ducks Unlimited.

My children and I have recorded several hundred plant species, three amphibian species, 182 bird species (Table 1) and 26 mammal species (Table 2) within the Bretona Pond wetland complex (Kristensen 1981, 1982, 1993a, 1997, 1998; Kristensen and Kristensen 1997, 1998, 2003; Kristensen et al. 1997, 1998, 1999). A few of the more interesting bird species are: eared grebe, horned grebe, pied billed grebe, American white pelican, tundra swan, trumpeter swan, snow goose, ruddy duck, Barrow's goldeneye, bald eagle, peregrine falcon, great blue heron, sandhill crane, American avocet, Wilson's phalarope, long-eared owl, and short-eared owl. Many of these species are listed by the Alberta and federal governments as "Sensitive", "Special concern", "At risk", or "Threatened" (Table 1).

Many bird species breed and rear their young within the Bretona Pond wetland complex. I have found nests of red-necked grebe, horned grebe, eared grebe, Canada goose, mallard, American wigeon, northern shoveler, blue-winged teal, green-winged teal, common goldeneye, Barrow's goldeneye, ruddy duck, red-tailed hawk, Swainson's hawk, ruffed grouse, gray partridge, American bittern, sora, American coot, American avocet, killdeer, Wilson's phalarope, common snipe, black tern, rock dove, great horned owl, long-eared owl, hairy woodpecker, downy woodpecker, eastern kingbird, barn swallow, tree swallow, purple martin, black-billed magpie, American crow, black-capped chickadee, house wren, American robin, mountain bluebird, cedar waxwing, European starling, house sparrow, yellow-headed blackbird, red-winged blackbird, Brewer's blackbird, Baltimore oriole, savannah sparrow, clay-coloured sparrow and song sparrow. As well, I have recorded several brown-headed cowbird eggs that were laid in other species' nests. (Brown-headed cowbirds are parasitic nesters.)

In addition to these nesting records, I have seen the very young of many other bird species within the Bretona Pond wetland complex, which means those species almost certainly nest there as well. And, I have heard the territorial males of many other bird species singing during the Spring which likely also denotes breeding of those species.

Some interesting observations of birds have been made in the 32 years we have lived next to Bretona Pond. Long-eared owls have nested in the Bretona Pond wetland complex (Kristensen and Kristensen 2003), and the open grassland meadows provide excellent hunting habitat for great horned and short-eared owls (Kristensen et al. 1998). In 1997, we observed a Barrow's goldeneye building a nest in a duck tunnel nest structure we had erected in the Bretona ConservAction Area, a very unusual place for this species to nest (Kristensen and Kristensen 1998). We have also studied use of bluebird nest boxes over several decades; the most common birds using these boxes are tree swallows and house wrens (Kristensen et al. 1997).

Eared grebes nest in colonies, including on Bretona Pond and several other neighbouring ponds. In 1996, I recorded a colony of 101 eared grebe nests on Bretona Pond, the highest number I have recorded during the past 32 years (Kristensen and Kristensen 1997). The majority of these nests were built within a 45m by 70m area in shallow water. It is important to note that eared grebes have been reported to be particularly vulnerable to power line collisions (Malcolm 1982).

In 1989, I found a gray partridge (also known as Hungarian partridge) nest in the Bretona ConservAction Area that contained 22 eggs, one of the highest clutch sizes ever recorded for this species (Kristensen 1993a). Black terns have nested in small colonies at Bretona Pond and on a large pond in the Bretona ConservAction area.

Of the 182 bird species I have recorded within the preferred route landscape area, there are 34 species that are of provincial and/or federal concern (Table 1). Following are the various status categories for species of concern, and the number of species per category for the Heartland preferred route:

Sensitive (Alberta Government, Sustainable Resource Development)…………30
Special Concern (Committee on the Status of Endangered Wildlife in Canada)...4
At Risk (Alberta Government, Sustainable Resource Development)……………..2
Threatened (Committee on the Status of Endangered Wildlife in Canada)………2
Threatened (Federal Species at Risk Act)…………………………………………1
Special Concern (Federal Species at Risk Act)…………………………………...1
May Be at Risk (Alberta Government, Sustainable Resource Development)…….1

Several species such as the horned grebe and short-eared owl are of concern under more than one category. Both of these species nest in the preferred route landscape area.

Many of the amphibians, birds and mammals that I have recorded in the Bretona Pond complex are susceptible to mortality or injury during construction of the Heartland line; and to mortality, injury and health problems during operation and maintenance of the line. There are 45-50 bird species reported on the preferred route landscape area that are not particularly maneuverable and would be most susceptible to collision with an overhead Heartland line; however, all bird species listed in Table 1 would be susceptible under certain situations (e.g., during night, fog or other periods of poor visibility; while hunting for prey; while flying in flocks).

Research that I have conducted within the preferred route landscape area suggests there will be significant bird collision mortality due to the abundance and diversity of bird species. It is not uncommon during Spring and Fall migration for between 3,000 and 5,000 waterbirds to land each evening to overnight at Bretona Pond. Most of these birds land within an hour following sunset. Depending on the weather and time of year, 1,000 to 2,000 waterbirds may remain on the pond during the day, feeding, courting and resting before continuing their migration north or south.

I have also observed several thousand waterbirds on each of Fulton Creek Marshland and Baseline Slough in the evenings and early mornings. When these birds land and take off in large numbers, they tend to be preoccupied with staying together in their respective flocks, and would easily be distracted from paying attention to high voltage power lines. This is particularly the case during periods of poor visibility including at dusk and dawn. The waterbodies within the Bretona Pond wetland complex lie on either side of the proposed Heartland preferred route, and flights between and among these ponds could be deadly from a collision perspective.

I have recorded a total of 26 species of mammals in the southern segment of the preferred route (Table 2). They range in size from the tiny pygmy shrew to the moose that weighs up to 720 kilograms. Many mule deer, white-tailed deer and moose frequent the preferred route landscape area. Just this past Summer, a moose gave birth to twin calves in the Bretona ConservAction Area. An abundance of rodents (voles and mice), snowshoe hares and white-tailed jackrabbits attracts many predators including hawks, owls, coyotes, red fox, and three species of weasel.

One of the more common weasels of the area is the long-tailed weasel (Kristensen 1997) which is a very efficient hunter, and moults a white coat in the winter to camouflage itself as it hunts for prey. The long-tailed weasel is listed as “May be at risk” by the Alberta Government (Table 2). Another carnivore that is fairly common in the area and preys heavily on Richardson’s ground squirrels and northern pocket gophers is the American badger which is listed as "Sensitive" by the Alberta Government (Table 2).

All of these mammals, especially those that live closer to the proposed Heartland route, would be susceptible to the effects of power line electromagnetic fields, the corona effect, and the very annoying humming, buzzing and hissing noises that emanate from overhead high voltage lines (see section 5.3).

Wood frogs, striped chorus frogs and tiger salamanders are the three amphibian species I have recorded in the Bretona Pond wetland complex. I have often found tiger salamanders living in northern pocket gopher burrows near Bretona Pond (Kristensen 1981). Amphibians would be particularly susceptible to mortality during construction of the Heartland line because they are generally slow-moving animals and would be run over by construction equipment and trucks.

Table 3 is a list of plant species (21) I have recorded in the Bretona Pond wetland complex that are not included in the facility application plant list (Table C.2-1, Appendix J1). Had a proper Environmental Impact Assessment been required of the applicants, a more thorough review of the literature and discussion with local landowners would have been necessary. This is one more example of the deficiency in the applicants' baseline natural resource data. It is difficult to conduct an appropriate environmental assessment in the absence of adequate baseline data on natural resources.

5.0 Impacts of Overhead Transmission Lines on Wildlife

Impacts of overhead transmission lines on wildlife discussed in this section would apply to wildlife along the applicants' preferred and alternate routes.

5.1 Bird Collisions with Transmission Lines

Bird injury and mortality associated with transmission lines is primarily due to collision with lines (conductors), shield wires and towers. However, birds are also killed by electrocution and the health of birds is negatively impacted by electromagnetic fields and the corona effect associated with overhead transmission lines. This section deals with collision mortalities.

The electricity utility industry is poorly monitored for both bird collisions and electrocutions (Manville 2005). The vast majority of transmission facility operators do not conduct mortality studies, or if they do they do not release the results because it is generally not in their best interest to do so.

Bird deaths resulting from collision with overhead transmission and telegraph lines have been reported for over one hundred years (Coues 1876, Cohen 1896, Emerson 1904). Species reported killed during some of these earlier studies included horned larks, phalaropes, ruddy ducks and rails. (All of these species have been recorded within the HTP environmental assessment landscape area along the Sherwood Park Greenbelt, the applicants' preferred route.)

Many studies have been conducted of bird collisions with transmission lines. As the facility application states, mortality from collisions with lines has been recorded in approximately 350 bird species and numerous studies have identified a potential for population-level impacts, especially for sensitive species and species at risk.

Interestingly, the facility application refers to Erickson et al. (2005) who estimated that 500 million to 1 billion birds are killed annually every year in the United States from collisions with man-made structures, of which 13.7% can be attributed to collisions with transmission lines.

On the other hand, the United States Fish and Wildlife Service (2002) estimated up to 174 million bird deaths annually in the U.S. from collisions with overhead transmission lines, which is greater than the total number of bird deaths from hunting in the same country. Applying the Erickson et al. (2005) data to that collected by the U.S. Fish and Wildlife Service, bird collision deaths attributable to transmission lines would actually range from 17% to a staggering 35%, much higher than suggested (13.7%) in the Stantec literature review within the facility application.

Transmission line collisions resulted in 36% mortality of fledged (able to fly) sandhill cranes in the Rocky Mountains (Drewien 1973), 44% mortality of fledged trumpeter swans in Wyoming (Lockman 1988), and 40% mortality of endangered fledged whooping cranes in the Rocky Mountains (Lewis 1993).

Based on a wetlands study in North Dakota, waterbirds (46% documented mortality), waterfowl (26% mortality), shorebirds (8% mortality) and perching birds (5% mortality) were most vulnerable to strikes with transmission lines (Faanes 1987). The author used these data to estimate 124 bird deaths per kilometre of power line per year. It is important to note that the prairie habitats described by this author are similar to those in Alberta. If we apply this statistic to the preferred route, close to 8,200 birds could be killed annually by an overhead Heartland line.

In the Netherlands, Koops (1987) examined 4,666km of bulk transmission line, and estimated 750,000 to one million birds killed per year, or from 161 to 214 birds per kilometre per year. If this statistic is applied to the preferred route, between 10,600 and 14,100 birds could be killed annually colliding with an overhead Heartland line. There are undoubtedly some variables that would affect these calculations; however, in any case, the mortality figures would be significant.

The HTP facility application suggests that some of these mortality estimates are high based on possible biases inherent in how mortality data are collected. Although I would agree that there may well be biases in the estimated mortality rates, I would disagree with the facility application's contention that the estimated rates are high, and this is because the biases generally tend to underestimate mortality rates rather than overestimate them.

Bird mortality counts are generated by counting dead birds under and near overhead transmission lines. In many cases, birds killed by colliding with power lines are quickly scavenged by mammals and other birds that become quite accustomed to feeding on these dead birds. As well, many birds that are injured crashing into power lines fall to the ground and then crawl away from the area and are not counted. And, many smaller species such as passerines (perching birds) are often difficult to spot on the ground. In areas where ground vegetation is dense, often the case in wetlands, it is very difficult to find dead birds of any size, but particularly smaller species. In summary, mortality rates estimated in reported studies are most probably underestimates, perhaps significant underestimates of the actual bird mortality caused by collision with power lines.

Drewitt and Langston (2008) report that estimates by researchers who have calculated some of the highest bird mortality estimates are actually underestimates of true mortality rather than overestimates because searcher and scavenger biases were not accounted for. Suffice it to say, overhead high voltage transmission lines cause very significant bird collision mortalities, and in some cases can seriously affect population stability of some species.

Mortality of birds colliding with lines varies and is dependent on a number of variables. Generally, mortality is highest where there is an abundance of birds, near wetlands and open bodies of water, where power lines bisect regular flight paths of birds, and along major migration pathways such as along the applicants' preferred route.

Huckabee (1993) and Bevanger (1998) found that large, less maneuverable birds are more vulnerable to collisions with power lines, including herons, cranes, swans, and pelicans. Canada geese, larger duck species and grouse are also less maneuverable. Eared grebes were particularly vulnerable to power line collisions (Malcolm 1982). (All of these species are also recorded along the applicants' preferred route.)

Although larger less maneuverable bird species may be particularly vulnerable to collision with power lines, there are many other situations that create collision hazards for other more agile bird species as well. Hawks, falcons and owls that are engaged in hunting activities can easily be distracted from paying attention to nearby transmission lines. Shorebirds and passerines that often fly in large flocks can also easily be distracted as they focus their attention on remaining with the flock. As indicated in section 4.0 of this report, there are many species of hawks, owls, falcons, shorebirds and passerines that breed, rear their young, feed and stage on the Heartland preferred route.

Based on my personal observations over a 32-year period, the Heartland line would also bisect regular flight paths of many bird species which fly between and among ponds, creeks, marshes and swamps within the Bretona Pond wetland complex. And, again based on my personal observations and bird records, the Bretona area lies along a major Spring and Fall migration path for many bird species. Please refer to section 4.0 of this report for details.

During the entire open-water season, and particularly during Spring and Fall migration, I have observed several thousand waterbirds at a time landing on Bretona Pond at dusk, and taking off from the pond at early dawn. During these crepuscular hours, visibility is poor, and birds would be particularly susceptible to collision with an overhead Heartland line.

Because it is situated at a somewhat lower elevation in relation to the surrounding area, the Bretona Pond wetland complex is often subject to fog and mist, especially in the mornings and evenings. These conditions create very poor visibility conditions, particularly at the very time of day when most birds land and take off from ponds, creeks, rivers and other wetlands. Poor visibility would most certainly result in an increased frequency of collision with an above ground Heartland line built there. Fog and mist are also very common in the North Saskatchewan River valley and east Sturgeon River valley, and would pose a similarly increased hazard to birds where the Heartland line would cross those rivers.

The Bretona Pond wetland complex is significantly larger than shown and considered in the facility application. Crosswhite's Pond at the Ellerslie Road–17th Street intersection, Fulton Pond just east of the preferred route and south of Whitemud Freeway, Fulton Creek, Fulton Creek Marshland, plus many small and medium-sized standing waterbodies within 800m of the proposed Heartland line, most of which are essentially ignored within the facility application, are all part of the Bretona Pond wetland complex (see Figure 1). Collectively, all of these ponds and wetlands attract thousands of waterbirds.

The above-mentioned factors and field observations essentially result in a "Perfect Storm" scenario for bird mortality at numerous locations along the preferred route. For example, based on my personal observations over a 32-year period at the Bretona Pond wetland complex near the southern end of the preferred route, there is an abundance of bird species that exhibit poor maneuverability, and thereby are particularly susceptible to transmission line collision mortality. I have counted several thousand waterbirds of many species on Bretona Pond every evening just after the sun has set during Spring and Fall migration. The Stantec environmental consultants even recorded large numbers of less maneuverable species here during their surveys. Less maneuverable species that are abundant in this area include several species of grebes, several species of swans and geese, many species of ducks, coots, rails, several species of herons, and ruffed grouse.

Another “Perfect Storm” scenario exists where the Heartland preferred line would cross the North Saskatchewan River. Large river valleys such as the North Saskatchewan River comprise major components of Spring and Fall migration routes for many bird species. River valleys provide land marks for migrating birds and often create thermal air currents that provide ideal routes for bird movement.

To further exacerbate the situation at and near the North Saskatchewan River Heartland power line crossing, the Clover Bar landfill is situated immediately adjacent to the crossing. The landfill attracts thousands of gulls during the Spring, Summer and Fall (that is, most of the year). These gulls (several species) fly back and forth between the landfill where they feed during the day and larger standing waterbodies nearby and often some distance from the landfill where they roost at night. Large numbers of gulls were even observed here by the Stantec consultants during their surveys of the preferred route. Although not the least maneuverable bird species, gulls are certainly not the most agile either, and would be very susceptible to collision with lines strung across and along the North Saskatchewan River.

To date the majority of the studies of bird mortality caused by collision with transmission lines have involved transmission lines and towers less than 45m in height. The proposed Heartland line towers will be up to 75m (246 ft.) tall, the tallest ever built in Alberta, and amongst the tallest ever built in North America. They will be higher than a 20-story building. These towers will be about twice the height of the average transmission towers we are used to seeing in North America.

With towers and lines as tall as the proposed Heartland line, the hazard posed to birds is anticipated to be significantly greater than reported for most of the studies to date of bird collisions with transmission lines. This increased hazard would be created not only because the towers and lines are so much taller per se and the lines are spread over a greater vertical distance than for more conventional transmission lines, but also because they would affect bird flight for greater distances from the line. In other words, birds landing and taking off from waterbodies and other wetlands located greater distances from the line are at risk of colliding with the Heartland line. This increases the total number of birds susceptible to mortality by the Heartland line. As a result, the applicants’ primary focus on impacts for birds within 800m of the line and secondary focus on impacts for birds within 1.6km of the line (identified as the “landscape area” within the facility application) are underestimates of the real impact zone.

The proposed Heartland towers and lines are so tall they will pose a hazard to not only local bird flight, but quite likely as well to birds migrating through the area either during the day or at night (especially when visibility is poor).

The consultants suggest in the facility application that they can mitigate the mortality rates of birds that collide with overhead high voltage lines by fastening any number of bands, swinging plates, fireflies, bird flight diverters, spirals, or coloured aviation balls to overhead shield wires located on top of the towers. (Shield wires are the thin wires strung over the conductor wires in an attempt to ground the lines in the event of lightning strikes.) These markers are fastened every 5m to 10m along the shield wire. The applicants indicate, for several reasons, that they do not fasten these markers to conductor lines.

Even if these markers reduce bird collisions to some extent, markers hung along the very top of a power line system every 5m to 10m would significantly exacerbate the negative visual impacts of the towers and lines to humans. The 75m-tall Heartland towers and lines would already be eyesores for many kilometres, and then to add these brightly coloured markers flapping in the wind would only make things worse. I have personally seen some of these markers on high voltage power lines, and depending on how close the markers are hung, they can give the transmission line the appearance of being a Christmas tree.

The negative visual impacts attributed to the flapping and waving of colourful bird diversion products on the shield wires will be exacerbated by markers the applicant plans to place on towers to warn air traffic. On page 2-19 of Appendix J1 the applicant states, "….markers will be placed on the towers to warn pilots to increase altitude to reduce sensory disturbance." These "markers" presumably include lights that will blink and flash at night and will be visible for dozens of kilometres because the towers are so tall (75m or 246 ft). It is difficult to anticipate how these aircraft warning markers and lights might impact wildlife.

It goes without saying that high voltage transmission lines pose a hazard to birds only when they are built above ground. If lines are buried, they pose no collision hazard. Ainley et al. (2001) recommended burying high voltage power lines in areas where there were larger concentrations of birds to eliminate collision deaths.

Other experts appearing on behalf of RETA at this hearing present evidence on the merits and benefits of burying high voltage power lines to address health, safety, aesthetic and property value concerns. With respect to the impacts of overhead high voltage power lines specifically on bird collision mortality, it is my opinion, based on my personal bird observations over a 32-year period, the published literature, and information presented in this report, that an above ground double circuit 500kV Heartland line with 75m-tall towers and lines would create a significant risk to birds. Burying the Heartland line would eliminate thousands of needless bird deaths every year.

5.2 Impacts of High Voltage Line Electromagnetic Fields on Birds

Most studies on the effects of overhead high voltage transmission lines on birds focus on mortality caused by collision with the lines. Some also discuss the impacts of electrocution. For example, Manville (2005) reported that overhead power lines electrocute tens to hundreds of thousands of birds annually in the United States. Bevanger (1998) found that herons, falcons, owls and perching birds were frequently electrocuted by power lines.

This section discusses a few of the reviews and studies conducted specifically on the impacts of overhead high voltage power line electromagnetic fields (EMFs) on birds.

Fernie and Reynolds (2005) conducted an extensive review of the scholarly literature on the effects of power line EMFs on birds. EMF exposure, either in the field or in laboratories, has negatively altered the behavior, physiology, gland secretion, and the immune system of birds, which resulted in negative effects on their reproduction and development. Such effects were observed in passerines (perching birds), birds of prey, and chickens. The authors also reported that EMF exposure resulted in significantly reduced egg size, eggshell thinning, reduced egg laying and reduced hatching success (supported by Fernie et al. 2000).

Tree swallows nesting under high voltage power lines had significantly lower reproductive success than swallows nesting elsewhere (Doherty and Grubb 1998). Many tree swallows nest within the Bretona Pond wetland complex (Kristensen et al. 1997) along the Heartland preferred route.

Melatonin is an antioxidant hormone produced in the brain, and is one of the body's natural defenses against a whole array of diseases and other health problems. As well, in animals, melatonin affects the circadian rhythms of numerous biological functions such as reproduction, behaviour, fur and feather growth and migration. Exposure to EMFs causes a reduction in the production of melatonin and thereby weakens the body's immune system and can significantly alter circadian rhythms.

Within the context of EMF effects on melatonin production, Fernie and Reynolds (2005) suggested that the timing of bird reproduction, mate selection, several aspects of migration, feeding and sleeping patterns, and overall stress levels would be negatively affected by exposure to EMFs. Given the similarity in the functioning of some life processes between birds and humans, the authors discussed how these studies on birds could help in understanding how EMF exposure also negatively affects humans.

The negative effects of EMFs emanating from an overhead Heartland line would be particularly pronounced for those birds that lived in habitat under or very near the power line, or frequented the area often. Birds that would unknowingly perch on lines or towers, or build their nests on towers, would be exposed to extremely strong EMFs that would have negative impacts even with short periods of exposure.

5.3 Impacts of Overhead High Voltage Power Lines on Mammals

Although the thousands of studies on the impacts of overhead high voltage power line EMFs on health are primarily epidemiological studies of humans, many studies have involved laboratory animals, livestock and pets. Results of these studies can certainly be extrapolated to wildlife in the natural setting.

Many mammals are negatively affected by high voltage power lines. Nicholls and Racey (2007) found significantly reduced bat activity in areas with higher EMF levels. Bats are not only an important element of a healthy ecosystem, but they also eat large numbers of insect pests.

In addition to the many laboratory studies on the negative effects of EMFs on animals, important studies have been conducted on EMF effects on dairy cattle. Dairy cattle are not only a significant agricultural and economic resource, but are also important indicators of how EMFs probably affect other large mammals in the wild (e.g., moose, mule deer and white-tailed deer, all of which are found in high numbers within and near the Sherwood Park Greenbelt).

Exposure to electric and magnetic fields resulted in an average decrease of 5.0% in milk yield, 13.8% decrease in fat corrected milk yield, and 16.4% decrease in milk fat among Holstein cows in Quebec (Burchard et al. 2003). Other studies show a weakening of the blood-brain barrier (Burchard et al. 1998) and negative changes in response to daylight hours (Rodriguez et al. 2004) in Holstein cows exposed to EMFs.

A study of pet dogs and cats exposed to above-normal EMF levels in Michigan (Marks et al. 1995) reported deformities in stillborn and surviving puppies and kittens. Female dogs ceased cycling or had abnormal “unbreedable” seasons. Male dogs revealed a lack of sperm. Neither Persian nor mongrel female cats showed signs of reproductive cycling.

Pet dogs that lived in homes with above-normal magnetic field levels had risks of canine lymphoma (cancer of the lymph system) up to 6.8 times greater than the expected rate (Reif et al. 1995).

Birth malformations among pig litters whose mothers had been exposed to 60-Hz electric fields for 18 months were 2.6 times more numerous than among litters whose mothers had not been exposed, the difference being statistically significant (Sikov et al. 1987). This increased risk of birth malformations was passed on to first generation female pigs as well.

A laboratory study of rats was conducted to determine the effects of EMFs on development of sexual characteristics of embryos (McGivern et al. 1989). Data indicated that EMF exposure during this critical period of sexual development in male embryos resulted in several negative sexual abnormalities once animals reached adulthood.

Effects of EMF exposure on male rat sexual organ development were studied by Khaki et al. (2008a, 2008b). In one of the studies, male rats were exposed to 50-Hz EMFs while they were embryos and for five weeks following birth. Prostate gland cells of animals were negatively abnormal in several ways. In the second study, when male rats were exposed to 50-Hz EMFs for two months following birth, cells in their seminal vesicles (glands that secrete part of the semen) were seriously altered. The authors concluded with the suggestion that EMFs are able to interrupt the normal production of sperm and can cause sterility in men.

AltaLink and EPCOR (2009) indicate, “After construction is complete, the transmission line will produce a low frequency hum.” This loud harsh and raspy hum or buzz can be heard 24 hours a day, 365 days a year. The noise is annoying and often causes headaches and hearing problems in humans. This annoying hum or buzz is bound to have an even greater impact on animals in the wild which have significantly more sensitive hearing than humans. For example, transmission line noise is considered an obstacle for migrating reindeer (Reimers et al. 2000). Once the Heartland line is energized, the noise would likely cause many animals to leave the area permanently.

As well, animals that lived near an overhead line would be subject to the negative impacts of the corona effect.

Overhead high voltage power lines ionize the air, emitting trillions of so-called corona ions into the air per second (Abdel-Salam and Abdel-Aziz 1994, Henshaw and Fews 2004). These ions attach to aerosol-sized particles of air pollution including those that are carcinogenic (e.g., diesel exhaust), increasing the electric charge state on these aerosols. The resulting cloud of corona ions and charged aerosols is carried by the wind for significant distances, varying from several hundred metres up to 7 kilometres downwind of power lines (Chalmers 1952, Mühleisen 1953, Henshaw and Fews 2004). When inhaled, electrically charged pollutant aerosol particles deposit in the lungs at a far greater rate than uncharged aerosols (Cohen et al. 1998, Fews et al. 1999, Melandri et al. 1983).

Although most of the studies on the negative impacts of the corona effect have been on humans, results can certainly be extrapolated to other animals as well. In addition to those studies listed above, additional studies on the corona effect include Henshaw (2002), Preece et al. (2001) and Hussein et al. (2001).

The negative overhead high voltage power line impacts on mammals would be most pronounced for those species and individuals that spent prolonged periods of time under or near these lines. As stated above, many animals may well leave the area permanently due to the annoying noise of an overhead line. Those that continued to live on or near the power line right-of-way would be subject to very strong EMFs and animals living within several hundred metres up to 7km downwind of an overhead high voltage line would be susceptible to the negative health impacts associated with the corona effect.

6.0 Review of Lattice Tower Option

6.1 Weaknesses and Deficiencies of Environmental Assessment

Although the applicants refer throughout the environmental assessment to baseline data, they have not reviewed the available literature on the baseline environmental conditions along the preferred and alternate routes. And, the few field surveys conducted for wildlife by the applicants' consultants do not provide a sufficient basis upon which to assess the environmental impacts of a project the magnitude of the HTP.

On page 3-11, Appendix J1, it states, "The route comparison discussion is based on a qualitative evaluation of the merits of each route and is not reliant on any quantitative ranking or weighting of effects." This is a serious deficiency of the applicants' environmental assessment and means, for example, that soil compaction during power line construction is weighted equally with bird mortalities caused by collisions with overhead power lines. As well, very key decisions have been made on environmental impacts to be considered for the HTP based on missing data and subjective analyses.

The rare plant survey data may be questionable considering almost twice as many rare plant surveys were conducted for the alternate route as for the preferred route (page 5-16, Appendix J1). Usually, the more surveys that are conducted, the more examples of whatever one is looking for are actually found (to a point of course).

It is not clear why the environmental consultants did not at least conduct a literature search to determine what species of wildlife are found along both the preferred and alternate routes. Had the applicants been required to submit an Environmental Impact Assessment under the *Environmental Protection and Enhancement Act*, they would have been required to include baseline natural resource data in their assessment.

In the absence of such a literature search by the applicants' consultants and in the absence of anyone contacting me to discuss wildlife and other biophysical data for one of the routes (even though I had submitted some of these data to the applicants), I have provided some of my baseline research data in this report. Without baseline data on the variety and abundance of natural resources that exist within an area of proposed development, it is very difficult to conduct a meaningful environmental assessment, and it is therefore difficult to determine the potential impacts of the proposed development.

There are many errors on many maps contained within the environmental assessment. For example, Figure 6-4 in Appendix J1 shows the Bretona Pond Buck-for-Wildlife Area and the Bretona ConservAction Area as agricultural or disturbed land. Bretona Pond Buck-for-Wildlife Area has been natural grassland and woodland since 1985, and Bretona ConservAction Area has been mixed grassland and woodland since 1989.

6.2 Stakeholder Input

In numerous sections of the environmental assessment, the consultants state how much they relied on stakeholder input to determine the potential effects of the HTP on the environment. For example, on page 3-7, the consultants write, "These potential effects were identified based on stakeholder input……".

Based on my personal experience with the HTP public consultation process, I have serious concerns about the extent to which public input was considered.

I had raised on numerous occasions, first with the Alberta Electric System Operator (AESO) between 2007 and 2009, then with the Heartland Project Team in 2009 and 2010, examples of environmentally sensitive areas that the AESO and the Heartland proponents had not identified on their maps as environmentally sensitive. These maps were used throughout the public consultation process as a basis for reviewing, discussing and determining the potential environmental impacts of the HTP. And perhaps more importantly, these maps were used by the applicants as a basis for first selecting their initial four potential routes, and then short-listing these to their preferred and alternate routes.

On one occasion, May 5, 2009, I had even received written assurances from the Heartland Project Team that they would add six environmentally sensitive areas along the Sherwood Park Greenbelt that had not been identified as such on their public maps and that I had requested several times be identified. To this day, these areas are not identified as environmentally sensitive areas on any of the Heartland maps.

On numerous occasions, I also forwarded to the AESO, AltaLink and EPCOR, copies of reports and articles that were very specific to the baseline environmental resources along the southern portion of what eventually became the applicants' preferred route. More precisely, I forwarded copies of 12 reports and publications on the mammals, birds, amphibians and flora of the Bretona Pond wetland complex that I had authored between 1981 and 2003.

Not once were any of these reports or publications referenced in the applicants' environmental assessment, and not once was I interviewed by any of the applicants' environmental consultants. How can AltaLink and EPCOR ignore environmental baseline data that is so specific to an environmentally sensitive component of their preferred route? And, the applicants' environmental consultants did not even have to search for the data because I had already provided it to the applicants and some of these data were even posted on RETA's www.RETA.ca website. This would have been unacceptable had the applicants' been required to submit an Environmental Impact Assessment pursuant to the Alberta *Environmental Protection and Enhancement Act*.

6.3 **Physical Environmental Factors**

I find it interesting that, during the public consultation process, the applicants downplayed the impacts of 75m-tall towers and lines on the natural landscape features. However, within the environmental assessment, the applicant does admit an impact by writing on page 2-10 of Appendix J1, "The route selection process and the tower spotting process consider environmental factors to reduce or avoid effects on landscape features."

On page 2-14 of Appendix J1 the consultants write, "Construction equipment and vehicles will avoid fording waterbodies with defined bed and bank." As someone who is familiar with the waterbodies and wetlands along the southern part of the preferred route, I find this statement by the applicant frightening because the vast majority of the waterbodies and other wetlands on the preferred route do not have "defined bed and bank", in fact most wetlands other than lakes and rivers anywhere do not have "defined bed and bank". Does this then mean that the applicants' contractors will be permitted to drive vehicles and construction equipment right through any wetlands they encounter, including the Baseline Slough wetland complex near Baseline Road? This would not bode well for mitigating environmental impacts to sensitive wetlands.

Slope and erodable soils are a challenge with the preferred route. On page 4-15, the consultants write, "The areas at high risk for water erosion are generally associated with longer, steeper slopes such as the slopes of river banks." Page 4-1 refers to the North Saskatchewan River crossing on the preferred route traversing a 30m high steep colluvial slope (greater than 60%), with evidence of mass movement on its northern side. Page 4-2 refers to the preferred route having a larger proportion of highly erodable soils.

On page 4-8, with respect to the North Saskatchewan River, the consultants write, "….it is expected that the entire slope will be unstable during large flood events and that the shoreline will erode northward and northwestward when this happens." This does not paint a positive picture with respect to stability of Heartland tower footings in and near the North Saskatchewan River valley.

The consultants indicate on page 4-6, “There is no potential for effects on soil quality during routine operations and scheduled maintenance….Therefore, the effect of operations and maintenance activities on soil quality is not carried forward in the evaluation.” I would suggest that the continual suppression of vegetation along the entire Heartland ROW has the potential to alter soil quality over the 50-year life of the line, and therefore, this biophysical component should be moved forward in the environmental evaluation.

The preferred route is at much greater risk for wind erosion and water erosion. Table 4-5 indicates that about 14% of the preferred route is at high risk for wind erosion, and about 2% of the preferred route is at high risk for water erosion. Both of these factors are extremely important considering the Heartland line’s expected life cycle of at least 50 years. Over time, wind and water erosion along the preferred route could have serious impacts on the stability of tower foundations, access roads and trails, and river slopes. Unfortunately, the consultants understate these major impacts in their Environmental Effects Summary Table 4-9, and contradict these quantitative impacts in other parts of section 4.0, Appendix J1.

6.4 Vegetation

The consultants discuss the application of herbicides to control vegetation within the entire right-of-way of the overhead Heartland line. On page 2-19, the consultants write, “Herbicides are an effective method of selectively controlling woody vegetation that re-grows on the right-of-way.” Spraying of herbicides can potentially have a very negative impact on the many wetlands and associated vegetation and animals found within and adjacent to the preferred route. More specifically, vegetation suppression will have major impacts on vegetation communities, wildlife habitat, soil conditions and quality, wind erosion and water erosion.

Tree and bush suppression will involve managing or killing any vegetation that has the potential to grow taller than 3m. While this is understandable for transmission line safety purposes, such suppression will have major impacts on the vegetation within the entire Heartland ROW. As a result, it is difficult to understand why Table 5-2, Appendix J1 indicates that overhead line operations have no potential environmental effects on vegetation.

6.5 Wildlife and Wildlife Habitat

The HTP would have the following impacts on wildlife:

- Direct mortality:
    - Bird collisions with transmission lines, shield wires, towers. This impact would occur throughout the life of the power line
    - Slow-moving animals killed by construction equipment (e.g., frogs, salamanders)

- Driving wildlife away: This impact would occur both during construction and throughout the life of the power line
- Negative health effects:
    - Electromagnetic field impacts throughout the life of the line
    - Corona effects throughout the life of the line
- Negative impacts on wildlife habitat thereby decreasing wildlife abundance and species diversity:
    - During construction, most habitat would be destroyed or seriously altered
    - Throughout the life of the line, suppressing woody vegetation growth and spraying of herbicides

Quarter sections ranked as moderate or high quality woodland habitat cover close to one-half of the construction footprint for the preferred route. Woodland habitat provides good cover for many wildlife species. The extent of wetland coverage along the preferred route is about twice that for the alternate route. Wetland areas are environmentally sensitive and are particularly rich in plant and animal diversity and abundance. They are highly productive systems, providing food sources and areas for shelter and cover, nesting, moulting, staging, and migration (page 6-45, Appendix J1).

The environmental assessment notes that two of the three areas of potential importance to grassland wildlife species are found along the preferred route landscape area.

The transmission line construction footprint would disturb (new disturbance) more wildlife habitat on the preferred than the alternate route, in particular grassland, wetland and riparian habitat. As indicated earlier, wetland and riparian habitat are the most environmentally sensitive.

The key wetland and riparian habitats within the preferred route landscape area are: North Saskatchewan River, Bretona Pond wetland complex, Baseline Slough wetland complex, and east Sturgeon River. The applicants' assessment describes the waterfowl abundance and diversity and high quality habitat at the Bretona Pond wetland complex, and the high bird counts at the North Saskatchewan River crossing.

Throughout the environmental assessment, the consultants describe how the construction team will try to avoid construction activities within sensitive areas and during sensitive periods for wildlife, particularly nesting and rearing periods for birds. However, every once in a while a short cryptic statement appears in the environmental assessment that seems to completely ignore the commitments made somewhere else in the assessment. For example, the following quote from page 2-20, "Some construction might be required during restricted activity periods in sensitive areas." does not give the reader confidence that the applicants are serious about minimizing construction impacts on sensitive areas or sensitive wildlife activities.

Field surveys of wetlands were conducted by the applicants' consultants in Fall 2009 and Summer 2010. Unfortunately, water levels in fall 2009 were very low; for example, water levels in Bretona Pond were the lowest in 32 years. The wetland data collected during the Fall 2009 surveys are therefore not representative of more typical wetland conditions, and would seriously under-estimate the number and extent of wetlands in the Bretona Pond and Baseline Slough wetland complexes on the preferred route. This is very important because wetlands are considered sensitive habitats, and will have been under-represented in the consultant's data, and the more typical or normal wetland scenarios will not have been properly evaluated.

Permanent wetlands, including open water, are important areas for plants and animals, and usually contain higher numbers of plants and animals and a greater number of different species (biodiversity). The preferred route landscape area has over 92 ha of permanent wetland including open water, close to 10 times that for the alternate route.

As explained earlier, wetlands are generally considered to be environmentally sensitive areas. Considering the fact that the preferred route contains close to 10 times the area of permanent wetlands along the alternate route, it is difficult to understand how the applicants can state in the environmental assessment that the preferred route is the more suitable transmission line route from a vegetation perspective because it "affects no sensitive communities" (quote taken from page 5-1).

An environmental impact that is very specific to constructing overhead high voltage power lines is the use of explosives. Appendix J1, page 2-15 states,

"Line segments will be joined by an industry-typical process that uses explosives (implosives) to fuse the lines together. This process involves joining two conductor ends together, inserting each end into a metal sleeve, wrapping explosive around the sleeve and then detonating the explosive. The implosive force compresses the sleeve tightly against the conductor and joins the line together. The explosion produces a small fire flash and a loud noise."

It is difficult to guess what the effects this process might have on local wildlife, but it is anticipated it will not be positive.

6.6 <u>Birds</u>

The preferred route crosses two major rivers, the North Saskatchewan River and the Sturgeon River. The North Saskatchewan River valley is classified as an Environmentally Significant Area (ESA) and a Class C watercourse by the

Alberta Government, and the Sturgeon River within the preferred route is also classified as a Class C watercourse. The North Saskatchewan River along the preferred route is the only ESA that is intersected by the HTP along either route (page 5-21).

Although the applicants indicate in Appendix J1 that they can minimize the impacts of a 75m-tall lattice tower Heartland line on these two river crossings, it is my opinion that an overhead line of this magnitude will have major impacts on bird collision mortalities.

High numbers of birds utilize these two river valleys for breeding, rearing of young, feeding, staging and Spring and Fall migration (see section 4.0 of this report). Impacts of an overhead line are particularly exacerbated at the proposed Heartland crossing of the North Saskatchewan River because the Clover Bar landfill is located immediately adjacent to this crossing. The landfill attracts thousands of gulls during Spring, Summer and Fall which feed at the landfill during the day and then fly to many standing waterbodies in all directions from the landfill to roost at night. As they fly back and forth daily between their overnight roosting locations and the Clover Bar landfill, they will be highly susceptible to collision with a Heartland line strung across the river.

Large rivers are often major bird migration routes because they serve as landmarks to the birds and create warm thermal currents that are ideal for migration. The North Saskatchewan River valley is one such migration pathway in both Spring and Fall. An overhead transmission line the magnitude of the proposed Heartland line will pose a major hazard to many species of migrating birds.

Proposed 75m-tall lattice towers for the majority of the preferred and alternate routes will be spaced approximately every 365m. However, within the Edmonton and Sherwood Park Greenbelt (TUC) segments of the preferred route, towers will be spaced every 270m to 330m, anywhere from 35m to 95m closer than along the alternate route and the remainder of the preferred route. Hence, many more towers will be required which may well pose additional risks to bird collision. In addition to potential increase in bird collision, extra lattice towers may invite more birds to perch thereby exposing them to very concentrated electromagnetic fields and corona effect, both of which are health hazards (see section 5.2 of this report).

The preferred route has a high number and large total area of wetlands directly impacted by the HTP. Many bird species and an abundance of birds have been recorded on and along the preferred route. The thousands of birds that utilize the Baseline Slough wetland complex and the Bretona Pond wetland complex, including Fulton Creek Marshland, Fulton Pond, Crosswhite’s Pond, and many smaller unnamed ponds (Figure 1), will be very susceptible to mortality through collision with an overhead Heartland line.

This situation is exacerbated by the fact that the proposed overhead lattice tower option fragments and bisects much of both the Baseline Slough and Bretona Pond wetland complexes. This will create the “Perfect Storm” for bird collisions when they fly back and forth between and among the many waterbodies on either side of the Heartland line. I note that even the applicants’ consultants admit that transmission lines fragment wildlife habitat (page 6-22, Appendix J1).

The Heartland line will have a particularly pronounced impact on bird collision mortality due to the magnitude of the HTP with its 75m-tall towers. Towers and lines this height will affect birds landing and taking off from wetlands and ponds at greater distances from the line. A detailed discussion of bird mortality due to collision with transmission lines is found in section 5.1 of this report.

The consultant notes that the potential for avian mortality from collisions with overhead wires is expected to be higher on the preferred route, “as it passes through more key wetland and riparian areas where numerous waterfowl were observed and more quarter sections that have been assessed as having moderate or high suitability for wetland and riparian species (17 quarter sections compared to 12 on the alternate route). The North Saskatchewan River and east Sturgeon River crossings may present higher mortality risk, as these areas may be flight corridors for waterbirds moving up and down the valleys. As noted in the baseline, waterbird usage of many wetlands is moderate to high, including wetlands in the Bretona area (along the preferred route), where higher mortality may result.”

It is interesting that the consultants write positively about the new perching and nesting opportunities provided by the massive Heartland towers. It is true that the towers will provide new perching and nesting opportunities for a number of species, including birds of prey, but they will utilize these towers at their own peril. Any birds that perch or nest on the new towers will be exposed to extremely strong electromagnetic fields and the corona effect, both deleterious to their health. Prolonged exposure to EMFs results in significantly reduced egg size, eggshell thinning, reduced egg laying and reduced hatching success (see section 5.2 of this report).

Not only birds are negatively impacted by overhead high voltage power lines but wildlife, livestock and pets are as well through EMF and corona effect exposure and noise disturbance. Scientific studies report reduced milk production by dairy cows, increased incidence of cancer, and breeding impairment to name a few (see section 5.3 of this report).

Although the environmental consultants did appear to see an abundance of birds within the preferred route landscape area during their brief field surveys, the timing of the bird surveys (May, June, July and October 2009) is rather unfortunate. Spring, Summer and Fall of 2009 were very dry, especially Summer and Fall; in fact, water levels in Bretona Pond during the 2009 Summer and Fall were the lowest in 32 years. Water level conditions and the associated bird counts would have been very atypical.

I saw and counted very few birds and very few bird species at Bretona Pond in 2009 due to the low water levels, when compared to observations in previous years. I am convinced that the applicants would have seen and counted many more birds and bird species had the surveys been conducted in a more typical year. As a result, I would suspect the applicants' consultants would have ranked the Bretona Pond and Baseline Slough wetland complexes (including birds and vegetation) even higher than they did if field data had been based on a more typical year.

The assessment also reports that the only Sprague's pipits recorded in the 2009 surveys were along the preferred route, and that the only quarter sections with high potential for grassland-dependent wildlife species were along the preferred route. Sprague's pipit is a threatened species (Committee on the Status of Endangered Wildlife in Canada).

The only historical red-tailed hawk nests reported in the assessment were seven nests within the preferred route landscape area. And, two long-eared owl nests were also reported within the landscape area of the preferred route. I can personally add three red-tailed hawk nests, one Swainson's hawk nest, two long-eared owl nests, and two great horned owl nests to the list within the southern segment of the preferred route landscape area.

Both the alternate and preferred route landscape areas include the Sturgeon River. The east Sturgeon River crossing on the preferred route is "broader and more extensive than the riparian corridor at the west Sturgeon crossing" (page 6-44, Appendix J1) and very high bird counts were obtained during Spring and Fall surveys at the Sturgeon River where the preferred route crosses it (page 6-51, Appendix J1).

6.7 Attracting Birds to Collide with Power Lines

During construction of the Whitemud Freeway and Southeast Anthony Henday Drive, large ponds were built as part of regional stormwater management systems. These ponds are located either within or immediately adjacent to the Sherwood Park Greenbelt and the HPT's preferred route for the Heartland line.

Fulton Creek Marshland, one of these man-made ponds, is located just off Whitemud Freeway only about 1,300m west of the proposed Heartland line. Since completion of the Whitemud Freeway, Fulton Creek Marshland has grown into a productive wetland for many species of birds, mammals, and amphibians.

During Spring and Fall migration, I have often seen several thousand waterbirds on the Fulton Creek Marshland pond in the early morning or at dusk. As well, the marshland is now providing excellent nesting habitat for many species of waterfowl and other birds. White-tailed and mule deer, red foxes, coyotes and muskrats are frequently seen here as well. There is a hiking trail around the marshland, islands have been incorporated into the pond, native vegetation has been planted, and a small parking area provides access to outdoor enthusiasts. The marshland has become quite popular with nearby residents.

One of the other larger stormwater management ponds located about 1,400m south of Fulton Creek Marshland and less than 500m from the proposed Heartland line is only about three years old and vegetation is in the process of growing around the pond. Already, this unnamed pond is attracting many waterfowl and shorebirds.

Both of these man-made ponds have become an integral part of the regional wetland complex associated with nearby Bretona Pond, Fulton Pond and Mill Creek.

It is rather ironic that the Alberta Government (Alberta Infrastructure) has participated in development of these stormwater management ponds which are attracting many species of birds and other wildlife, and is now supportive of a double circuit 500 kilovolt power line with 75m-tall towers and lines being built nearby that will pose a major hazard to bird flight.

As birds fly to and from these two ponds and between ponds located on either side of the proposed Heartland line, they will be susceptible to collision with the power line. All wildlife attracted to these ponds will be susceptible as well to the negative impacts of power line EMFs and corona ion-charged toxic aerial pollutants.

6.8 Conclusions

Based on my experience and knowledge, it is my opinion that the assessment report summary Table 8-1, Appendix J1 misrepresents the data in the environmental assessment. Based on my reading of the data in the environmental assessment and my personal knowledge, the preferred route is not suitable for an overhead line from a biophysical perspective because:

- Greater impact on soil quality on preferred route.
- Higher risks of wind erosion on preferred route.
- Higher risks of water erosion on preferred route.
- The preferred route is unique in crossing right over an Environmentally Significant Area (ESA), the North Saskatchewan River, where construction of the HTP would likely increase slope instability and bank erosion.
- There are more wetlands and riparian areas that would be disturbed on the preferred route both during construction and throughout the life of the power line. Wetland and riparian areas are the most environmentally sensitive of all the habitat types described in the environmental assessment.

- Because there are more wetlands and riparian areas on the preferred route, there is likely a higher risk of deep augering for tower footings intersecting shallow groundwater. As a result, there may well be a greater requirement for pumping to de-water augered holes. The overall risk to the natural hydrogeology in the preferred route would be greater.
- More grassland habitat occurs in the preferred route.
- The construction footprint passes through more key wetland/riparian areas on the preferred route.
- More quarter sections with moderate to high wetland/riparian habitat suitability on preferred route.
- Greater wildlife habitat disturbance and alteration on the preferred route.
- Longer off-right-of-way access required through wildlife habitat on preferred route, thereby impacting more wildlife habitat.
- Higher risk of mortality of slow-moving animals on preferred route during construction due to construction footprint passing through better wildlife habitat. This could be a major factor considering that many of the slower-moving animal species are found in wetlands (e.g., amphibians). There are more wetlands on the preferred route.
- Higher bird counts were recorded on the preferred route by the applicants' consultants at the North Saskatchewan River, Sturgeon River and Bretona Pond wetland complex. The preferred route crosses right over all three of these wetlands/riparian areas as well as right over Baseline Slough wetland complex.
- Although the consultants did count more birds on the preferred route landscape area, these counts were an underestimation of the actual avian adundance and species diversity because water levels in the preferred route wetland complexes were the lowest in 32 years (especially during the consultants' Fall 2009 surveys). In a more typical year, bird counts have been significantly higher throughout the open-water season.
- Baseline data presented in section 4.0 of this report indicate that several thousand waterbirds overnight on each of several large ponds in the preferred route landscape area.
- These birds would fly back and forth across the proposed Heartland preferred route.
- Higher bird mortalities through collision with overhead lines, shield wires and towers on the preferred route due to greater avian abundance and species diversity, and close proximity of ideal avian habitat.
- Greater expected impact on overall animal health due to greater abundance of birds on preferred route and prolonged exposure of very strong electromagnetic fields and corona effect.
- Significantly higher counts of historical and more recent raptor nests in the preferred route landscape area.
- Only observations by consultants of Sprague's pipit were on the preferred route. Sprague's pipit is a threatened species (Committee on the Status of Endangered Wildlife in Canada).

- Baseline data presented in section 4.0 of this report indicate 34 bird species on the preferred route are of provincial and/or federal concern, ranging from “Sensitive” to “Threatened”.
- Baseline data presented in section 4.0 of this report indicate two mammal species on the preferred route are of provincial concern.
- Because there are more wetlands and riparian areas on and along the preferred route, there will be a greater impact on amphibians which depend primarily on wetlands and riparian areas.

7.0 <u>Review of Monopole Option</u>

Although there are obviously differences between the lattice tower option and the monopole option, it is difficult to assess what the differences between the two might be with respect to environmental impacts.

The monopole footprint for each pole is smaller at the base (ground level) than for the lattice towers; however, the tower footings for the monopole option need to be augered to a much greater depth. There may be less environmental impact from the smaller total tower base area for the monopoles, but there may be greater hydrogeological risks because the deeper monopole footings required may result in underground aquifers being intersected.
Some people may argue that monopoles are less unsightly than lattice towers; however, more monopoles are required because, according to the applicant, they must be spaced closer together than lattice towers.

Overall, from an environmental perspective, impacts of the lattice tower option and monopole tower option are probably similar.

8.0 <u>Review of Underground Option and Lattice Tower Option Comparison</u>

The applicants have compared the potential environmental effects of the 75-metre-tall above ground lattice tower recommended option with the underground option for the southern-most 20-kilometre segment of their preferred route. Many of the comments below comparing an underground and an overhead line would apply equally to either the preferred or alternate routes.

8.1 <u>Data Interpretation Bias</u>

Within the environmental assessment reports for the lattice tower, monopole and underground options, the consultants use a potential interaction ranking process to screen a variety of biophysical components. Although the ranks of “0”, “1” and “2” are assigned on a subjective basis, there is merit in attempting to quantify these data to some point. However, ranking processes such as these are only as good as the input. There is significant inconsistency by the consultants in what biophysical components are moved forward for environmental evaluation based on these rankings. Sometimes those components ranked “1” and “2” are moved forward for environmental evaluation, and other times only those components ranked "2" are moved forward. I must note that the inconsistencies appear to almost always favour the suitability of the lattice over the underground option.

This type of approach would not have been acceptable had the applicants been required to submit an Environmental Impact Assessment under the *Environmental Protection and Enhancement Act*.

When one reads Appendix J4 of the facility application in detail and keeps track of the major statements made by the writers in the text, one is certainly left with the impression that the underground option would entail far less environmental risk and damage than would the overhead lattice tower option. However, when one then reads the tabulated summaries within Appendix J4, especially Table 9-1 Environmental Effects Summary (by Option) on page 9-3, the writers suggest the lattice tower option is relatively more suitable from an environmental impact perspective.

8.2 Right-of-Way and Temporary Workspace Requirements

Several of the assumptions made in the underground environmental assessment are extremely suspect. First, the applicants' assumption that a 65m-wide right-of-way (ROW) plus an additional 30m off-right-of-way temporary workspace is required for the entire length of the underground option (20km) is an over-estimate of what common sense and an understanding of the pipeline industry requirements would suggest. This assumption by the applicant is an important one because it then serves as the basis for their calculation of the total surface area that would be disturbed during construction of the underground 500kV line.

The applicants have suggested that they require a full 30m of temporary workspace in addition to the 65m ROW to temporarily store topsoil and subsoil (for a total construction ROW width of 95m). The total work space recommended by the applicants for temporary storage of topsoil and subsoil is 50m. This is significantly more than the pipeline industry requires. Further, the applicant has suggested that a full 10m distance is required for a haul road between each trench and the temporarily stored subsoil. Both of these are wider than would appear to be necessary.

The rationale by the applicant for the additional 30m temporary work space is weak at best, and I quote from page 2-5 of Appendix J4,

> "Most workspaces will be located within the right-of-way. However, for the underground option, it is <u>expected</u> that off-right-of-way temporary workspaces <u>might be needed</u> for the full length of the right-of-way…..In general, for the purposes of this evaluation, right-of-way temporary workspace <u>is assumed to be</u> an average of 15m either side of the right-of-way for the entire length of the underground option."

I have underlined several words in this quote to highlight how weak the rationale is for this additional temporary workspace. Based on this wording, the probability of the additional workspace actually being required appears rather low, in which case the construction footprint for the underground option would be reduced by 30m, just based on this one variable. And, this would further decrease the overall environmental impact of the underground option in relation to the overhead lattice tower option.

The applicants indicate that about 34% of the 20-km underground option will involve trenchless construction (boring). That being the case, the temporary workspace required for this 7km of the 20km total distance would be far less than in the remaining 13km where workspace would be required for storage of topsoil and subsurface soil.

As well, the applicant has suggested that a full 10m is required between each set of three buried conductors which appears to be an over-estimate. In addition, and this is very difficult to understand, the applicant has added a full 12m to the ROW width at this point in time for a future third trench and separation distance to the next trench. It may be prudent planning to consider this third cable trench, should the electricity demand ever warrant it, but to propose to clear an extra 12m of vegetation and topsoil for the majority of the 20km underground route during construction of only two trenches at this point in time appears completely unnecessary.

In Appendix J1, pages 3-4 and 3-5, the applicants indicate they require additional ROW to construct the tall lattice towers and to tension, string and fuse conductors. On page 2-5 the applicants state, “Due to the alignment required for tensioning, the majority of workspace will be located off-right-of-way.” This additional ROW will increase the total construction footprint significantly for the lattice tower option when compared to the underground option.

The original Cable Consulting International Ltd. (CCI) underground feasibility study commissioned by the AESO recommended trenches for the buried cables 1.5m deep. The applicants’ facility application recommends cable trenches 1.8m deep. Although the 0.3m difference may appear minor, it translates into an increased amount of trench subsoil to temporarily pile on the surface until the trench is back-filled, and may well require additional temporary work space ROW.

Any over-estimation of the actual amount of ROW and temporary work space required for the underground option results in anywhere from a minor to a significant inflation in the calculation of the total surface area disturbed by the underground option, which translates directly to an inflated environmental footprint during construction. And any under-estimation of the amount of ROW required for the lattice tower option (e.g., for tower construction and stringing purposes) will result in an under-estimation of the environmental footprint during construction.

Based on the above discussion, it would appear that the total underground option right-of-way, including temporary workspace, can be significantly reduced in width to the point where the overall area of ground disturbance would be less than for the lattice tower option. This would then mean that, from the perspectives of surface area of soil and vegetation disturbance and consequent disturbance to some wildlife, the impacts would be lower for the underground option than for the lattice tower option (see summary Table 9-1 in Appendix J4).

8.3 Stripping of Topsoil and Vegetation

The applicants recommend stripping topsoil for the entire width of the 20km ROW before digging the cable trenches. Why would you strip topsoil within the 20m on each side of the two cable trenches that is designated for haul road and temporary storage of subsoil? The less topsoil that is stripped, the lower the impact on soil and vegetation. Also, if the ROW width has been over-estimated, and less is actually required, less topsoil would need to be stripped, thereby decreasing the overall impacts on soils and vegetation even more.

The applicants recommend clearing vegetation on not only the entire ROW but also on the entire temporary workspace. Although any trees and shrubs would certainly need to be cleared (there are very few along the proposed underground route), there is no reason why the ground cover (grasses and other flora) needs to be cleared as well. If the short vegetative ground cover was left in place within the temporary workspace, revegetation and reclamation would be much more successful following construction, and would pose less impact on the natural vegetative cover. Even though the vegetative cover would be compacted by construction activities, it would regenerate more quickly than if all of it was removed and then reseeded.

8.4 Introduction of New Variables – Noise and Hydrogeology

The applicants have decided to consider noise a potential environmental impact for the construction of the 20-km underground option. The applicant did not consider construction noise a potential impact for building the entire 66-km overhead lattice tower option. This seems odd, and I wonder why this distinction was made.

A similar new impact variable for the underground option is the applicants' addition of potential hydrogeological impacts. The applicant did not consider this variable for construction of the entire 66-km lattice tower option. The applicant appears to rationalize this difference by suggesting that trench construction for the underground option might impact subsurface ground water, potentially including nearby residents' well water quantity and quality.

This appears strange considering that the cable trench will only be 1.8m deep and trenchless construction (boring) will be to a maximum depth of 8m, whereas concrete footings for the 75m-tall lattice towers may be dug to 15m depths. It would appear that 15m footing depths might accidentally intersect ground aquifers to at least the same extent as would shallow 1.8m trenches or 8m bored holes for trenchless construction.

One could also suggest that focusing on the potential hydrogeological impacts of burying the Heartland line through the Sherwood Park Greenbelt is a red herring, considering how many pipelines have already been buried in the Greenbelt. The HTP will likely cause no more disturbance to the local hydrogeological scenario than has already been incurred (if at all) by the existing pipelines.

8.5 Baseline Road Transition Station

The applicants have recommended building the Baseline Road Transition Station at the north end of the underground option right next to the rather large pond north of Baseline Road. Considering the applicants' correct reiteration in the application of how important wetlands are to wildlife and vegetation, and how environmentally sensitive they are, it would seem to make sense to build this transition station further from this or any other ponds, even if doing so would add a few hundred metres to the total length of the underground option.

8.6 Soil Quality

Inconsistencies prevail throughout the applicants' Appendix J4 with respect to several soil quality risks. In Table 4-4 of Appendix J4, the wind erosion, compaction and water erosion risk factors are markedly higher for the lattice tower option than for the underground option. This translates into the underground option being more suitable because it is has a lower negative environmental impact. However, in the summary Table 9-1, the lattice tower is shown as more suitable. When one looks closely at the surface areas and associated risk factors, the underground option is clearly more suitable because it impacts these factors the least.

Section 7.3.2.1 of Appendix J4 discusses surficial deposits in the southern segment of the applicants' preferred route. This is the only part of the facility application (that I am aware of) that describes a number of sandy locations along the preferred route. It is unfortunate that the presence of significant sand deposits along the preferred route was not also discussed in Appendix J1, where a lot of discussion was devoted to the presence of sand along the alternate route. The reason this is fairly important is that in Appendix J1, the applicant considered the presence of sandy areas as a negative component of an area's suitability for hosting the Heartland line.

8.7 <u>Vegetation</u>

There is better consistency in Appendix J4 with respect to the discussion on impacts to vegetation. The underground option affects the smallest area of wetland communities (3 ha) compared to 14 ha for the lattice tower option. This is primarily because the applicants propose to cross the wetland areas with trenchless construction (i.e., they will bore under the wetlands). The fact that the lattice tower option will affect close to five times as much wetland as the underground option is significant because wetland communities are generally the most sensitive and in relatively short supply in Alberta. These data were fairly consistent in the Appendix J4 text and summary table.

As well, there appears to be consistency regarding the discussion on impacts to wetland vegetation communities. The lattice tower option negatively impacts over three times the area of wetland vegetation communities compared to the underground option with respect to project footprint.

The potential for occurrence of rare plants is usually higher in wetlands, and because wetlands are far less impacted for the underground option, this option should also be considered more suitable from this perspective. However, this is not the case in summary Table 9-1.

The applicants' description in Appendix J4 of the effects of vegetation control for the underground and lattice tower options is questionable. The applicant suggests that vegetation will be controlled to a greater extent on the ground over the buried cables than under the lattice towers. Yet in Appendix J1, the applicant discusses at great length how vegetation must be carefully controlled under the overhead option because they cannot let any woody vegetation grow to interfere with the overhead lines and towers.

From a common sense perspective, it would appear that once the cables are buried underground, it is not as critical to ensure that woody vegetation does not grow to specific heights over the underground cables. However, if woody vegetation was permitted to grow under the overhead lines, they could easily interfere with the transmission lines, especially on hot days when the mid-span sag could bring the conductors quite close to the ground, or on windy days when the conductors sway back and forth.

Based on the above discussion on vegetation management during the operation and maintenance phase for the 50-year life of the line, summary Table 9-1 should show the underground option as more suitable than the lattice tower option. This component needs to be added to Table 9-1.

8.8 Habitat Quality

Habitat quality is generally highest for wildlife species at larger wetland complexes such as Bretona Pond and Baseline Slough. Bird counts at these two wetland complexes over the last 32 years have certainly been high. Mammals and amphibians are also abundant at these sites. The fact that the lattice tower option negatively impacts about five times the area of high quality wetland, when compared to the underground option, means the underground option is far more suitable. This is not currently reflected in summary Table 9-1, Appendix J4.

8.9 Bird Mortality Due to Collisions with Overhead Lines

The study areas selected for reviewing environmental impacts of the underground and lattice tower options differ in size. The landscape area for the lattice tower option is larger to recognize the potential for bird mortality to occur during operations. The landscape area used for the underground option is smaller and reflects the more localized disturbance effects and lack of mortality risk related to bird collisions with overhead wires.

The most significant environmental impact of the lattice tower option is the bird mortality caused by collisions with overhead lines, shield wires and towers (see section 5.1 of this report.) Of course, no birds would be killed if the underground option was selected.

Because the bird collision mortality factor is so important, it should be statistically weighted for the comparison between the underground and lattice tower options. However, we note there is no statistical weighting of any of the environmental data presented by the applicants. This is unfortunate because it results in relatively minor impacts being statistically weighted equally (by default) with more major impacts. For example, short-term soil compaction during construction would be weighted equally with long-term bird mortality due to collisions with overhead lines.

8.10 Conclusions

Taking into account the discussion above, a comparison of the environmental impacts of the lattice tower option and underground option can be summarized as follows:

- The width of the ROW, including temporary workspaces, for the underground option appears to have been over-estimated by the applicant, and can probably be reduced significantly (by at least 30m).
- The total construction ROW for the lattice tower option will be significantly increased because the majority of the workspace will be located off-ROW.
- A reduced total ROW for the underground option, together with an increased construction ROW for the lattice tower option, would mean the overall

construction footprint of disturbance to soil, vegetation and wildlife habitat for the underground option would be less than for the lattice option.

- There appears to be no reason for the applicants to strip the topsoil within the entire underground option ROW. Stripping as little soil as is absolutely required would decrease the overall impacts on soil.
- There appears to be no reason for the applicants to clear short ground vegetation within the entire underground option ROW and entire temporary workspace. Clearing as little as is absolutely required would decrease the overall impacts on ground vegetation. Minimal vegetation clearing would also assist in speeding up revegetation and reclamation.
- If the applicants wish to consider noise a potential impact for construction of the 20-kilometre underground option, they should also consider construction noise as a potential impact for the entire 66-kilometre lattice tower option.
- From a hydrogeological perspective, digging holes up to 15m deep for the concrete footings of the 75m-tall lattice towers may well have a greater potential to intersect underground aquifers than digging 1.8m deep trenches for underground cables.
- The Baseline Road Transition Station associated with the underground option should be built farther away from any ponds or sloughs than currently recommended in the facility application to minimize impacts on sensitive wetlands.
- Wind erosion, compaction and water erosion risks are markedly higher for the lattice tower option than for the underground option.
- The underground option affects the smallest area of wetland communities; in fact, the lattice tower option affects close to five times more wetland than the underground option. This is significant because wetland communities are generally the most sensitive, provide the highest quality of habitat to wildlife, and are in short supply in Alberta.
- The underground option is more suitable with respect to impacting potential rare plant occurrences because wetlands are far less impacted than for the lattice tower option.
- It is more important to control woody vegetation under overhead lattice towers than over a buried line. Therefore, the underground option is more suitable.
- Because the lattice tower option impacts close to five times the wetland habitat, the underground option is more suitable with respect to minimizing impacts on this important wildlife habitat.
- The 75m-tall lattice tower option has significantly greater impact on bird collision mortality than the underground option. In fact the underground option will result in no bird deaths during the 50-year operation and maintenance phase. Because the bird collision mortality factor is so important within the environmental impact context, it should be statistically weighted for purposes of comparing the lattice tower option with the underground option.

It is my opinion that, based on the data presented by the applicants and my 32 years of experience and knowledge of the environment within and along the

Sherwood Park Greenbelt, the underground option is far more suitable than the lattice tower option from an environmental impact perspective.

9.0 <u>Overall Conclusions</u>

- The Heartland Project Team's public consultation process was inadequate. Environmental information provided by public stakeholders appeared to play little role in the applicants' route selection and in the applicants' recommendation to build an above ground line in spite of the overwhelming data indicating the negative environmental impacts of an overhead line.
- The applicants' environmental assessment is deficient in many respects: poor baseline data, very limited literature review, misrepresentation of the data, bias toward favouring the preferred route, and bias toward favouring the lattice tower option over the underground option within the preferred route.
- It is unfortunate that, in 2008, the Alberta Government exempted all high voltage power lines from the requirement for an Environmental Impact Assessment (EIA) pursuant to the Alberta *Environmental Protection and Enhancement Act*.
- Had an EIA been required, many of the deficiencies in the current environmental assessment would have been unacceptable under provincial legislation.
- On the basis of the environmental assessment deficiencies alone, the Alberta Utilities Commission should not have ruled the application complete on January 11, 2011.
- The environmental assessment deficiencies are particularly unfortunate considering this application is the first under the *Electric Statutes Amendment Act, 2009*, and the fact that the Heartland line is the largest line ever to be built in Alberta.

9.1 <u>Applicants' Preferred Route</u>

Based on the facts, the applicants' preferred route is an inappropriate location for an above ground double circuit 500kV transmission line because:

- The preferred route is unique in crossing right over an Environmentally Significant Area (ESA), the North Saskatchewan River, where construction of the HTP would likely increase slope instability and bank erosion.
- There are more wetlands and riparian areas on the preferred route which are the most sensitive environments along either route.
- The construction footprint with respect to new disturbance to wildlife habitat is greater on the preferred route.
- There are higher risks of wind erosion and water erosion on the preferred route.
- Higher bird counts were recorded on the preferred route by the applicants' consultants at the North Saskatchewan River, Sturgeon River and Bretona Pond wetland complex. The preferred route crosses right over all three of

these wetlands/riparian areas as well as right over Baseline Slough wetland complex.
- Bird counts by the applicants' consultants would have been even higher on the preferred route because water levels during the 2009 surveys were atypically low (lowest in 32 years).
- Baseline natural resource data presented in this report indicate that several thousand waterbirds overnight on each of several large ponds in the preferred route landscape area, and that many bird species nest there.
- Baseline data presented in this report indicate 34 bird species on the preferred route are of provincial and/or federal concern, ranging from "Sensitive" to "Threatened".
- Baseline data presented in this report indicate two mammal species on the preferred route are of provincial concern.
- There will be a significantly higher mortality rate for birds through collisions with overhead lines, shield wires and towers on the preferred route due to greater avian abundance and species diversity, and proximity of prime avian habitat.
- Significantly higher counts of historical and more recent raptor nests in the preferred route landscape area.
- Only observations by consultants of Sprague's pipit were on the preferred route. Sprague's pipit is a threatened species (Committee on the Status of Endangered Wildlife in Canada).

When you consider the above, together with information on baseline natural resources and anticipated bird collision mortality presented in this report, it would be unfortunate if an overhead line the magnitude of the proposed HTP was built over the Bretona Pond wetland complex, Baseline Slough wetland complex, North Saskatchewan River and east Sturgeon River.

9.2 Underground vs. Overhead

From an environmental impact perspective, the underground option is far superior to the lattice tower option because:
- The width of the ROW, including temporary workspaces, for the underground option appears to have been over-estimated by the applicant, and can be reduced significantly (by at least 30m).
- The total construction ROW for the lattice tower option will be significantly increased because the majority of the workspace will be located off-ROW.
- A narrower ROW for the underground option and a wider construction ROW for the lattice tower option would result in a comparatively lower environmental impact for the underground option.
- There appears to be no reason for the applicants to strip the topsoil within the entire underground option ROW. Stripping as little soil as is absolutely required would decrease the overall impacts on soil.
- There appears to be no reason for the applicants to clear vegetation within the entire underground option ROW and entire temporary workspace.

Clearing as little as is absolutely required would decrease the overall impacts on ground vegetation. Minimal vegetation clearing would also assist in speeding up revegetation and reclamation.

- Wind erosion, compaction and water erosion risks are markedly higher for the lattice tower option than for the underground option.
- The underground option affects the smallest area of wetland communities; in fact, the lattice tower option affects close to five times more wetland than the underground option. This is significant because wetland communities are generally the most sensitive and provide the highest quality of habitat to wildlife.
- The 75m-tall lattice tower option has significantly greater impact on bird collision mortality than the underground option. In fact the underground option would result in no bird deaths during the 50-year operation and maintenance phase. Bird mortality from collisions with an overhead Heartland line would be significant due to high numbers of species and overall abundance on the preferred route. Several thousand waterbirds overnight on each of several ponds on the preferred route during Spring and Fall migration. Because the bird collision mortality factor is so important within the environmental impact context, it should be statistically weighted for purposes of comparing the lattice tower option with the underground option.

10.0 <u>References</u>

Abdel-Salam, M., E.Z. Abdel-Aziz. 1994. A charge simulation based method for calculating corona loss on AC power transmission lines. J. Physics D: Applied Physics 27:2570-2579.

Ainley, D.G., R. Podolsky, L. DeForest, G. Spencer, N. Nur. 2001. The status and population trends of the Newell's shearwater on Kauai: insights into modeling. Studies in Avian Biology 22:108-123.

Alberta Environmental Protection. 1994. A guide for transmission lines pursuant to the *Environmental Protection and Enhancement Act* and regulations. 61 pp.

AltaLink and EPCOR. 2009. Heartland Transmission Project. Summary of Heartland considerations. April 2009 brochure. 3 pp.

Bevanger, K. 1998. Biological and conservation aspects of bird mortality caused by electricity power lines: a review. Biol. Conserv. 86:67-76.

Burchard, J.F., H. Monardes, D.H. Nguyen. 2003. Effect of 10 kV, 30μT, 60 Hz electric and magnetic fields on milk production and feed intake in nonpregnant dairy cattle. Bioelectromagnetics 24:557-563.

Burchard, J.F., D.H. Nguyen, L. Richard, S.N. Young, M.P. Heyes, E. Block. 1998. Effects of electromagnetic fields on the levels of biogenic amine metabolites, quinolinic acid, and ß-endorphin in the cerebrospinal fluid of dairy cows. Neurochemical Research 23:1527-1531.

Chalmers, J.A. 1952. Negative electric fields in mist and fog. J. Atmospheric Terrestrial Physics 2:155- 159.

Cohen, B.S., J.Q. Xiong, C-P. Fang, W. Li. 1998. Deposition of charged particles on lung airways. Health Physics 74:554-560.

Coues, E. 1876. The destruction of birds by telegraph wires. Am. Nat. 10:734-736.

Doherty, P.F., T.C. Grubb. 1998. Reproductive success of cavity-nesting birds breeding under high-voltage powerlines. Am. Midland Nat. 140:122-128.

Drewien, R.C. 1973. Ecology of Rocky Mountain greater sandhill cranes. Ph.D. thesis. University of Idaho. 152 pp.

Drewitt, A.L. and R.H.W. Langston. 2008. Collision effects of wind-power generators and other obstacles on birds. Annals of the New York Academy of Sciences 1134: 233-266.

Emerson, W.O. 1904. Destruction of birds by wires. Condor 6:37-38.

Erickson, W.P., G.D. Johnson, D.P. Young, Jr. 2005. A summary and comparison of bird mortality from anthropogenic causes with an emphasis on collisions. USDA Fores Service General Report PSW-GTR-191.

Faanes, C.A. 1987. Bird behavior and mortality in relation to power lines in prairie habitats. U.S. Fish and Wildlife Service General Technical Report 7. 24 pp.

Fernie, K.J., D.M. Bird D, R.D. Dawson, P.C. Lague. 2000. Effects of electromagnetic fields on the reproductive success of American kestrels. Physiological Biochem. Zoology 73:60-65.

Fernie, K.J., S.J. Reynolds. 2005. The effects of electromagnetic fields from power lines on avian reproductive biology and physiology: a review. J. Toxicol. Environ. Health 8:127-140.

Fews, A.P., D.L. Henshaw, R.J. Wilding, P.A. Keitch. 1999. Corona ions from powerlines and increased exposure to pollutant aerosols. Int. J. Radiation Biol. 75:1523-1531.

Green, J.E., W.R. Koski. 1984. Land management plans for six properties of the Fish and Wildlife Division in the St. Paul Region of Alberta – Bretona Pond. Report prepared for Alberta Fish and Wildlife Div. pp 70-84.

Griffiths, D.E. 1987. A survey of wetland wildlife resources, Strathcona County #20, Alberta. Report prepared for Strathcona County Recreation and Parks. 120 pp.

Henshaw, D.L. 2002. Does our electricity distribution system pose a serious risk to public health? Med. Hypothesis 59:39-51.

Henshaw, D.L., A.P. Fews. 2004. Health effects of high voltage powerlines. Chapter 15 ; 295-305. In: Electromagnetic environments and health in buildings. Edited by D Clements-Croone. Spon Press London.

Huckabee, J.W. 1993. Proceedings: avian interactions with utility structures, international workshop, 1992, Miami, FL. Electric Power Research Institute, Project 3041, EPRI TR-103268.

Hussein, T.F., L. Kakko, P. Aalto, K. Hämeri, M. Kulmala. 2001. Indoor-outdoor aerosols: particle size characterisation in a suburban area. J. Aerosol. Sci. 32:S149-150.

Kemper, J.B. 1976. Implications for waterfowl and migratory birds. In: Cooking Lake area study. Vol 4. 129 pp.

Khaki, A.A., A. Khaki, S. Garachurlou, F. Khorshidi, N. Tajadini, N. Madinei. 2008a. Pre and post natal exposure of 50 Hz electromagnetic fields on prostate glands of rats: an electron microscopy study. Iranian J. Reprod. Med. 6:77-82.

Khaki, A.A., S. Zarrintan, A. Khaki, A. Zahedi. 2008b. The effects of electromagnetic field on the microstructure of seminal vesicles in rats: a light and transmission electron microscope study. Pakistan J. Biol. Sci. 11:692-701.

Koops, F.B.J. 1987. Collision victims of high-tension lines in the Netherlands and effects of marking. KEMA Report 01282-mob 86-3048.

Kristensen, J. 1998. Bretona ConservAction Area – private land conservancy. Alberta Naturalist 28(4): 69-71.

Kristensen, J. 1997. Observations of long-tailed weasels. Alberta Naturalist 27(3): 61-62.

Kristensen, J. 1993a. Preliminary baseline inventory of flora and vertebrate fauna in Southeast Edmonton, Colchester and vicinity. Submission to City of Edmonton; County of Strathcona; City of Fort Saskatchewan; Capital Region Waste Management Commission; Edmonton Board of Health; Leduc-Strathcona Health Unit; Alberta Environmental Protection; Alberta Forests, Parks and Wildlife. 21 pp.

Kristensen, J. 1993b. Bretona Pond, a treasure. Sherwood Park This Week – June 4, p.26.

Kristensen, J. 1990. Bretona Pond Buck-for-Wildlife Area and Bretona ConservAction Area. Proceedings of an Endangered Spaces Workshop, Federation of Alberta Naturalists: 12-13.

Kristensen, J. 1982. Selected biota of Bretona Pond and vicinity. Alberta Naturalist 12(4): 167-171.

Kristensen, J. 1981. Tiger salamanders “rooming in” with northern pocket gophers. Alberta Naturalist 11(4): 171-172.

Kristensen, J. and K. J. Kristensen. 2003. Long-eared owl nesting at Bretona ConservAction Area. Alberta Naturalist 33(2): 55-56.

Kristensen, J. and K. J. Kristensen. 1998. Unusual nesting attempt by Barrow’s goldeneye. Alberta Naturalist 28(1): 20.

Kristensen, J. and T. J. Kristensen. 1997. Flooding of eared grebe nesting colony. Alberta Naturalist 27(2): 23-24.

Kristensen, J., T. J. Kristensen and K. J. Kristensen. 1999. Eared grebe nesting and behaviour. Alberta Naturalist 29(3): 44-46.

Kristensen, J., K. J. Kristensen and T. J. Kristensen. 1998. Great horned and short-eared owls at Bretona Pond. Alberta Naturalist 28(1): 14-15.

Kristensen, J., T. J. Kristensen, K. J. Kristensen and S. L . Kristensen. 1997. Nest box use by tree swallows, house wrens and mountain bluebirds. Alberta Naturalist 27(4): 76-79.

Lewis, J.C. 1997. Alerting the birds. Endangered Species Bulletin XXII:2.

Lockman, D.C. 1988. Trumpeter swan mortality in Wyoming 1982-1987. Proceedings and papers 11th Trumpeter Swan Society conference:12-13.

Malcolm, J.M. 1982. Bird collisions with a power transmission line and their relation to botulism at a Montana wetland. Wildl. Soc. Bull. 10:297-304.

Manville, A.M. 2005. Bird strikes and electrocutions at power lines, communication towers, and wind turbines: state of the art and state of the science – next steps toward mitigation. Bird conservation implementation in the Americas: Proceedings 3rd international partners in flight conference 2002:1051-64.

Marks, T.A., C.C. Ratke, W.O. English. 1995. Stray voltage and developmental, reproductive and other toxicology problems in dogs, cats and cows: a discussion. Vet. Hum. Toxicol. 37:163-172.

McGivern, R.F., R.Z. Sokol, W.R. Adey. 1989. Prenatal exposure to a low-frequency electromagnetic field demasculinizes adult scent marking behavior and increases accessory sex organ weights in rats. Teratology 41:1-8.

Melandri, C., G. Tarroni, V. Prodi, T. De Zaiacomo, M. Formignani, C.C. Lombardi. 1983. Deposition of charged particles in the human airways. J. Aerosol. Sci. 14:657-669.

Moss, E.H. 1971. Flora of Alberta. University of Toronto Press. 546 pp.

Mühleisen, R. 1953. Die luftelektrischen elemente im GroBstadt Bereich. Z Geophysics 29:142-160.

Nicholls, B., P.A. Racey. Bats avoid radar installations: could electromagnetic fields deter bats from colliding with wind turbines? PLoS ONE 2007;2(3):e297. doi: 10.1371/journal.pone.0000297.

Preece, A.W., M.G. Wright, G.R. Iwi, E. Dunn, D.J. Etherington. 2001. Cancer and high voltage powerlines with respect to wind direction. 23rd annual meeting of The Bioelectromagnetic Society Minnesota.

Reif, J.S., K.S. Lower, G.K. Ogilvie. 1995. Residential exposure to magnetic fields and risk of canine lymphoma. Am. J. Epidemiol. 141:352-359.

Reimers, E., K. Flydal, R. Stenseth. 2000. High voltage transmission lines and their effect on reindeer: a research programme in progress. Polar Research 19:75-82.

Rodriguez, M., D. Petitclerc, J.F. Burchard, D.H. Nguyen, E. Block. 2004. Blood melatonin and prolactin concentrations in dairy cows exposed to 60 Hz electric and magnetic fields during 8 h photoperiods. Bioelectromagnetics 25:508-515.

Sikov, M.R., D.N. Rommereim, J.L. Beamer, R.L. Buschbom, W.T. Kaune, R.D. Phillips. 1987. Developmental studies of Hanford miniature swine exposed to 60-Hz electric fields. Bioelectromagnetics 8:229-242.

Strathcona County Recreation and Parks. 1987. Outdoor Master Plan 1987. Technical report. 248 pp.

U.S. Fish and Wildlife Service. 2002. Migratory bird mortality. Information bulletin. 2 pp.

Westworth, D.A., L.J. Knapik. 1987. Significant natural features and landscapes of Strathcona County. Report prepared for Strathcona County Recreation and Parks.

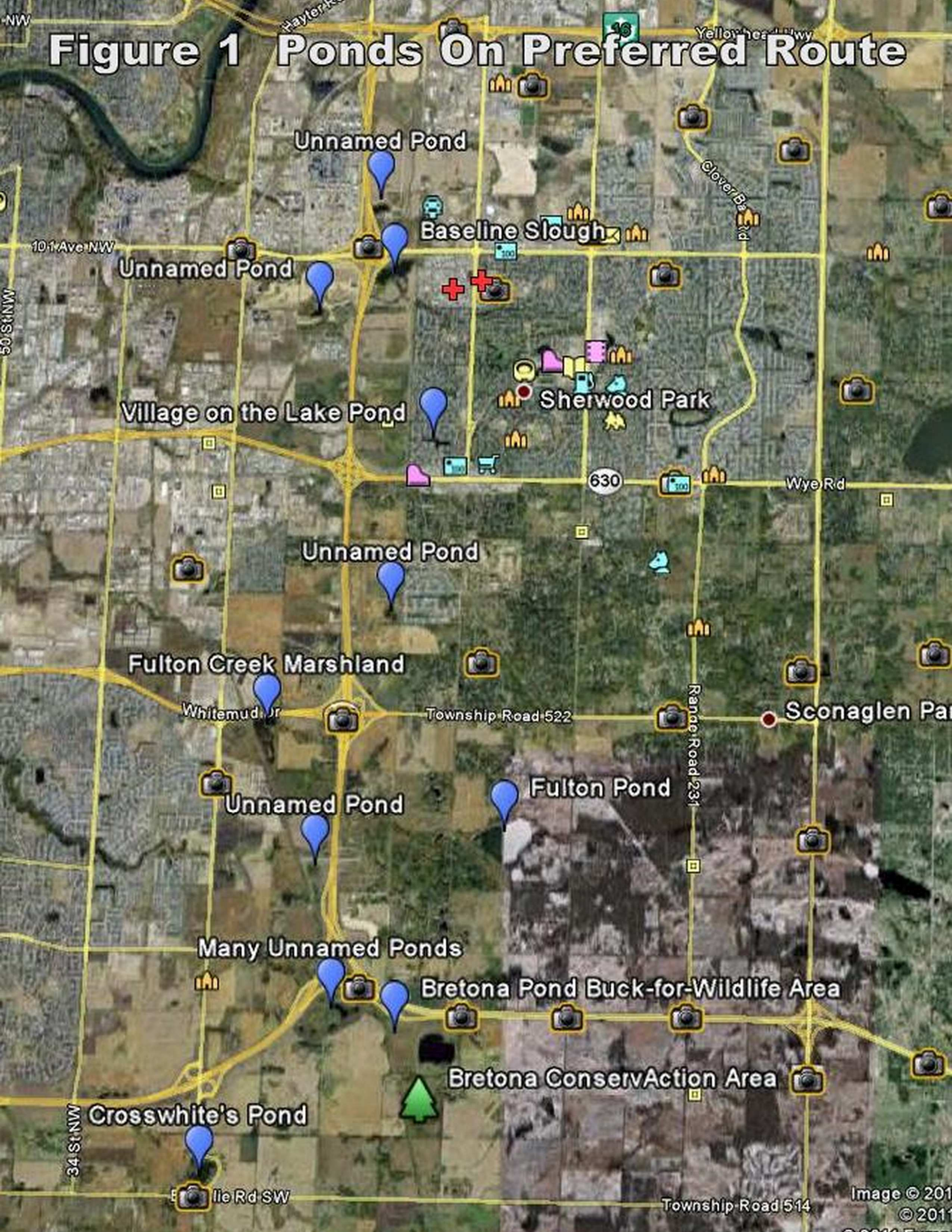

Figure 1 Ponds On Preferred Route

Table 1

<u>Birds Observed by the Author in the Bretona Pond Wetland Complex</u>

(*Sensitive** AB Gov't; *At Risk*[1] AB Gov't; *May Be At Risk*[2] AB Gov't; *Special Concern*[3] Committee on the Status of Endangered Wildlife in Canada (COSEWIC); *Threatened*[a] COSEWIC; *Threatened*[o] Species at Risk Act (SARA); Special Concern[n] SARA)

Common loon
Western grebe*
Red-necked grebe
Horned grebe*[3]
Eared grebe
Pied-billed grebe*
American white pelican*
Double-crested cormorant
Tundra swan
Trumpeter swan[1]
Canada goose
Greater white-fronted goose
Snow goose
Mallard
Northern pintail*
Gadwall
American wigeon
Northern shoveler
Blue-winged teal
Cinnamon teal
Green-winged teal*
Redhead
Canvasback
Ring-necked duck
Greater scaup
Lesser scaup*
Common goldeneye
Barrow's goldeneye
Bufflehead
White-winged scoter*
Surf scoter
Common merganser
Hooded merganser
Ruddy Duck
Northern goshawk*
Cooper's hawk
Sharp-shinned hawk
Northern harrier*
Rough-legged hawk
Red-tailed hawk
Swainson's hawk*
Bald eagle*
Osprey*
Gyrfalcon
Peregrine falcon[1,3,o]
Merlin
American kestrel
Ruffed grouse
Sharp-tailed grouse*
Ring-necked pheasant
Gray partridge
Great blue heron*
Black-crowned night heron*
American bittern*
Sandhill crane*
Sora*
American coot
American avocet
Black-bellied plover
Semi-palmated plover
Killdeer
Greater yellowlegs
Lesser yellowlegs
Solitary sandpiper
Spotted sandpiper
Long-billed dowitcher
Short-billed dowitcher
Wilson's phalarope
Common snipe
Pectoral sandpiper
Baird's sandpiper
Least sandpiper
Semi-palmated sandpiper
Western sandpiper
Herring gull
California gull
Ring-billed gull
Franklin's gull
Bonaparte's gull
Common tern
Black tern*
Rock dove
Mourning dove
Great horned owl
Long-eared owl
Short-eared owl[2,3,n]

Snowy owl
Common nighthawk*[a]
Ruby-throated hummingbird
Northern flicker
Pileated woodpecker*
Yellow-bellied sapsucker
Hairy woodpecker
Downy woodpecker
Eastern kingbird
Eastern phoebe*
Yellow-bellied flycatcher
Alder flycatcher
Least flycatcher*
Western wood-pewee
Olive-sided flycatcher[a]
Horned lark
Barn swallow*
Cliff swallow
Tree swallow
Bank swallow
Northern rough-winged swallow
Purple martin*
Blue jay
Gray jay
Black-billed magpie
American crow
Common raven
Black-capped chickadee
White-breasted nuthatch
Red-breasted nuthatch
House wren
Marsh wren
Gray catbird
American robin
Varied thrush
Hermit thrush
Swainson's thrush
Mountain bluebird
Golden-crowned kinglet
Ruby-crowned kinglet
Bohemian waxwing
Cedar waxwing
Northern shrike
European starling
Blue-headed vireo
Red-eyed vireo
Philadelphia vireo
Warbling vireo
Black-and-white warbler
Tennessee warbler
Yellow warbler
Magnolia warbler
Yellow-rumped warbler
Blackpoll warbler
Palm warbler
Common yellowthroat*
Wilson's warbler
American redstart
House sparrow
Western meadowlark
Yellow-headed blackbird
Red-winged blackbird
Rusty blackbird*[3]
Brewer's blackbird
Common grackle
Brown-headed cowbird
Baltimore oriole*
Western tanager*
Rose-breasted grosbeak
Evening grosbeak
Pine grosbeak
Purple finch
House finch
Common redpoll
Hoary redpoll
Pine siskin
American goldfinch
White-winged crossbill
Red crossbill
Savannah sparrow
Le Conte's sparrow
Nelson's sharp-tailed sparrow
Vesper sparrow
Dark-eyed junco
American tree sparrow
Chipping sparrow
Clay-colored sparrow
Harris' sparrow
White-crowned sparrow
White-throated sparrow
Fox sparrow
Lincoln's sparrow
Swamp sparrow
Song sparrow
Lapland longspur
Snow bunting

Table 2

Mammals Observed by the Author in the Bretona Pond Wetland Complex

(*Sensitive** AB Gov't; *May Be At Risk*[2] AB Gov't)

Arctic shrew
Pygmy shrew
Little brown bat
Snowshoe hare
White-tailed jackrabbit
Richardson's ground squirrel
Red Squirrel
Northern pocket gopher
Beaver
Deer mouse
Southern red-backed vole
Meadow vole
Muskrat
Meadow jumping mouse
Porcupine
Coyote
Red fox
Black bear
Ermine weasel
Least weasel
Long-tailed weasel[2]
Striped skunk
American badger*
White-tailed deer
Mule deer
Moose

Table 3

Flora* Recorded in the Bretona Pond Wetland Complex by the Author and Not Recorded in the Preferred Route by Applicants' Consultants

Common Name	Scientific Name
Yellow lady's-slipper	*Cypripedium calceolus*
Pale coral-root orchid	*Corallorhiza trifida*
Spotted coral-root orchid	*Corallorhiza maculata*
Hooded ladies'-tresses	*Spiranthes romanzoffiana*
Green smartweed	*Polygonum scabrum*
Wind flower (cut-leaved anemone)	*Anemone multifida*
White water crowfoot	*Ranunculus circinatus*
Golden corydalis	*Corydalis aurea*
White cinquefoil	*Potentilla arguta*
Hedysarum	*Hedysarum alpinum*
Common red clover	*Trifolium pratense*
Wild white geranium	*Geranium richardsonii*
White wintergreen	*Pyrola elliptica*
Indian pipe	*Monotropa uniflora*
Rosy everlasting	*Antennaria rosea*
Orange hawkweed	*Hieracium aurantiacum*
Philadelphia fleabane	*Erigeron philadelphicus*
Marsh ragwort	*Senecio congestus*
Thin-leaved ragwort	*Senecio pseudaureus*
Common groundsel	*Senecio vulgaris*
Goat's-beard	*Tragopogon dubius*

* Nomenclature from Moss (1971)