Chinook Ridge Lodge and Golf Course Biophysical Impact Assessment

Prepared for:

Chinook Ridge Lodge and Golf Course

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Table of Contents

Table of Contents

APPENDICES

LIST OF TABLES **Page**

LIST OF FIGURES **Appended**

1.0 Introduction

Stantec Consulting Ltd. was retained by Chinook Ridge Lodge and Golf Course (Client) to conduct a Biophysical Impact Assessment on the Subject Property (Figure 1, Appendix A), located in the southeast quarter of Section 31, Township 28, Range 03, West of the Fifth Meridian (SE ¼-31-28-03W5M). This area is located thirty minutes northwest of Calgary, Alberta and falls within the Rocky View County (RVC) district, which has participating communities east, west and north of Calgary.

RVC has policies regarding new development within their district which protect and enable the County to meet their higher legal and statutory legislative requirements (Rocky View, N.D.).

1.1 SCOPE

The Biophysical Impact Assessment describes the existing environment of the Subject Property, and provides a detailed review of the Subject Property. The BIA will look at environmental impacts of the project and provide measures to mitigate or compensate for these impacts. The specific requirements for the BIA were determined through communication with the biologist from RCV and are as follows:

- Map out vegetation communities;
- Identify if any rare plants are present on site;
- Identify and map all wetlands;
- Identify bird species present in each vegetative community;
- Report any wildlife encounters on site;
- Identify and review the proposed development;
- Identify and analyze potential environmental impacts; and
- Develop a mitigation plan to help prevent environmental impacts on the site.

1.2 BACKGROUND

The Client requires a land re-designation from RVC, in order to change the land use from agricultural to recreational, before any development can proceed. The land re-designation permitting process requires the completion of a Biophysical Assessment prior to the change.

The County's Biophysical Assessment requirements began with an Initial Project Review, followed by a meeting with the municipal planner and municipal biologist to determine if valued ecosystem components (VEC's) were present. At this time, Stantec personnel had conducted a Biophysical Overview of the Subject Property, which consisted of a desktop review to assess valued ecosystem components. The information collected as part of the biophysical overview is presented and discussed in this report. The desktop review revealed that there were potential wetlands on the Subject Property and that several listed fauna had been recorded within a nine km radius of the Subject Property. Listed fauna and potential wetlands are both triggers for a full Biophysical Impact Assessment (BIA) under the county's Biophysical Assessment Terms of Reference.

Stantec Consulting was then retained by Chinook Ridge Lodge and Golf Course, in accordance with the Terms of Reference of RVC, to conduct a BIA on the Subject Property.

On June 13, 2011, Stantec met with a biologist from RVC to outline the requirements of the BIA. It was determined that a full BIA, with field component, would be required before development could proceed. Stantec completed the field component of the BIA on June 24 and 25, 2011.

1.2.1 Site Description

The Subject Property is approximately 59.83 hectares and has an elevation between 1207 to 1230 meters. The landowner's home is located on the east side of the Subject Property and is currently operating as a bed and breakfast. In addition to the landowner's home, there is a large hay barn located in the southeast corner of the property. The Subject Property is a mosaic of cultivated fields, horse pasture, wetlands, and windrows, all situated around a centrally located mature aspen (*Populus tremuloides*) stand with a well-developed understory. The rolling terrain slopes primarily to the west, with a small portion of the land sloping to the north (Chinook Ridge, N.D.). The Subject Property is located in the southeast quarter of Section 31, Township 28, Range 03, West of the Fifth Meridian (Figure 1, Appendix A) and is part of Alberta's Parkland Region, and Foothills Parkland Sub-region.

The Foothills Sub-region is a mosaic of native grasslands, agricultural areas, aspen woodlands, and willow shrub lands, situated on rolling topography. It is the highest Sub-region within Alberta's Parkland Region, with an average elevation of 1250m (AOE, N.D.), resulting in cooler temperatures and a shorter growing season. There is less cultivation in the Foothills Sub-region due to the shorter growing season, and as a result, there is a greater abundance of native vegetation than in other Parkland Sub-regions.

1.2.2 Chinook Ridge Proposed Development

The Chinook Ridge Lodge and Golf Course conceptual development includes a main lodge, a 6500 yard 18 hole golf course, sleeping cabins located in the forested area, and RV parking located in the southwest corner of the Subject Property. The proposed sleeping cabins and RV parking will be completely self-contained, with no utilities, and the RV area will not be considered a campground.

The conceptual development design includes proposed developments identified through communication with the Client and remains a simplified concept. The conceptual development design is subject to change based on the opinions of professionals working on all aspects of the development process (Figure 2, Appendix A).

The client aims to develop the golf course in the most environmentally sustainable way, and plans to utilize environmentally friendly and sustainable products/building materials in all aspects of the development (Chinook Ridge, N.D.). In addition to working with environmental professionals, the Client wants to certify Chinook Ridge Lodge and Golf Course through an Audubon International initiative program, such as The Audubon Cooperative Sanctuary Program (ACSP) for Golf Courses (Audubon International, N.D.). The ACSP is an award winning certification program that helps golf courses protect, preserve and minimize harmful impacts to the environment through stringent environmental regulations. By working with Audubon International and Environmental professionals, the Chinook Ridge Lodge and Golf Course can become a valuable conservation area.

The client proposes to enhance plant diversity and wildlife habitat by adding native trees, and enhancing or adding water features to the golf course design (Chinook Ridge, N.D.). In addition to adding conservation features, the use of pesticides will be highly regulated by *Alberta Environment's Pest Management Regulation Act* (PMRA), and the use of water will be reduced through the development of an integrated water management plan and subsurface irrigation system (Chinook Ridge, N.D.). Environmental mitigation techniques will be discussed further in the Impacts and Mitigation section of this report.

1.3 APPLICABLE LEGISLATION

The following section outlines the main federal, provincial, and municipal acts, regulations, or policies that may be relevant to certain facets of the Chinook Ridge Biophysical Impact Assessment. However, the following is not a comprehensive list of legislation or policies pertaining to the proposed Chinook Ridge Lodge and Golf Course, and depending on design and construction details/methods, additional acts/policies may apply.

1.3.1 Federal

Species at Risk Act,

The *Species at Risk Act* was created to protect wildlife and critical habitat for wildlife to prevent extinction and aid in the recovery of threatened populations on private and federal land. The Act lists wildlife species as extirpated, endangered or threatened and requires that a recovery program be prepared for species listed under the Act. Removal, harassing, destruction, collection, possession and trading of listed species is prohibited, along with disturbance to dens or nesting sites. These restrictions apply to all species listed in Schedule 1 located on Federal Lands, all birds listed in Schedule 1 and the *Migratory Birds Convention Act* on both private and Federal lands, and all aquatic species listed in Schedule 1 on both private and Federal land.

Stipulated within the Act is the protection of "critical habitat" which is key to the survival and/or recovery of listed species. This Act aims to protect "critical habitat" through voluntary programs and environmental stewardship but will apply prohibitions against destruction of habitat if required.

If the development is expected to destroy critical habitat for species listed in the Act, potential regulatory requirements may need to be met depending on jurisdiction and land ownership.

Migratory Birds Convention Act

The *Migratory Birds Convention Act* (MBCA) and *Migratory Birds Regulations* (MBR) are directed at the protection and preservation of migratory birds and migratory bird habitat. The MBCA and MBR apply to various:

- migratory game birds, including ducks, geese, swan, cranes, shorebirds, and pigeons;
- migratory insectivorous birds, including chickadees, cuckoos, hummingbirds, robins, swallows, and woodpeckers; and
- migratory non-game birds, including gulls, herons, loons, and puffins.

This legislation contains provisions designed to protect and preserve migratory birds. These include, but are not limited to:

- prohibition against disturbing, destroying, or taking a nest, egg, or nest shelter of a migratory bird; and
- prohibition against depositing or permitting to be deposited oil, oil wastes, or any other substances harmful to migratory birds in any waters or any area frequented by migratory birds.

The Minister can issue permits for certain activities related to migratory birds. However, there are no permits for disturbing, destroying, or taking a nest, egg, or nest shelter of a migratory bird, nor for depositing or permitting to be deposited oil, oil wastes or any other substances harmful to migratory birds in any waters or any area frequented by migratory birds. These activities are strictly prohibited by the legislation. If municipal development activities result in the destruction or disturbance of migratory birds, nests, or eggs, Environment Canada can take enforcement action.

Typically, if construction activities necessitate the cutting, transplanting, or disturbance of trees or other nesting areas of migratory birds, Environment Canada will stipulate the periods of the year that the construction may be undertaken (coinciding with times that the birds are not nesting and raising their young). These periods can vary depending on the particular migratory bird species, but will typically range between March/April through to September/October. Therefore, vegetation removal should be scheduled outside of these critical periods.

This Act will become important should vegetation removal activities occur during the breading season.

1.3.2 Provincial

Municipal Government Act

The *Municipal Government Act* aims to encourage responsible government within the municipalities of Alberta. The Act governs the powers of municipalities by defining rights to create and invoke bylaws, expropriate lands under certain conditions, etc. This Act also lists prohibitions which places limits on the powers of municipalities.

Public Lands Act

In 1930, Canada transferred control for the natural resources in Alberta to the province. Alberta passed the *Provincial Lands Act* on March 28, 1931, for the administration of lands, minerals, forests, fisheries, and to control drilling of gas wells. In 1949, this legislation was amended to become the *Public Lands Act*. It currently regulates various public land uses (i.e. forestry, grazing, land dispositions), sale and purchase of land, and declaration of water bodies as being owned by the Crown. The Crown may claim the bed and shore of permanent water bodies (wetlands, creeks, drainage channels, etc.) found on a given property.

Water Act

The *Water Act* supports and promotes the conservation and management of water in Alberta. In addition, the Act also addresses the following:

- Protects existing water licenses that are in good standing by bringing them forward and making them subject to the new Act;
- Protects existing traditional agricultural uses of water through a streamlined, voluntary registration process that "grandfathers" the relative priority of the right according to the date when the water was first used;
- Recognizes the importance of protecting Alberta's rivers, streams, lakes, and wetlands by requiring development of a strategy to protect the aquatic environment as part of the provincial water management planning framework;
- Prohibits the export of Alberta's water to the United States; and
- Prohibits any inter-basin transfers of water between Alberta's major river basins.

The Act prescribes that all water is the property of the Crown and an approval is required to conduct an activity in a water body (s.36). Activity is defined broadly to include placing constructing works within a water body, and removing or disturbing ground and/or vegetation that results in altering the flow, level, direction and/or location of a water body. This Act will

come into effect during any modification to the existing drainage channels or wetlands, as well as the installation of outfalls or crossing structures (i.e. culverts, bridges, etc.), if required.

Environmental Protection and Enhancement Act

The *Environmental Protection and Enhancement Act* (EPEA) (2002) was designed to ensure sustainable use of the environment through protection and enhancement of air, land and water. The Act strengthens and clarifies Alberta's environmental laws, and eliminates duplication among existing Acts. The act guarantees public participation in any decisions that may affect the environment by increasing public access to information, participation in the Environmental Assessment and Approval Processes, and the right to appeal certain decisions.

The approval process aids in the identification and prevention of potential problems before a project begins, and approval conditions detail operating requirements that the projects must follow. Regular inspections and monitoring will ensure projects comply with stringent environmental standards during, and after, their operation. Failure to comply with this Act may result in penalties.

The Act addresses emissions, release of substances, application and use of pesticides, storm water drainage, and incident reporting requirements, and will become applicable during the construction of storm water management facilities and related infrastructure associated with the Golf Course.

Occupation Health and Safety Act

This act protects workers and employers personal safety within the Province of Alberta and outlines the duties and responsibilities of employers and employees while conducting work. The act will apply to any construction and/or operation conducted during the development process.

Weed Control Act

This Act regulates the control of noxious, and prohibited noxious, weeds in Alberta, which may include Canada thistle, scentless chamomile, leafy spurge, nodding thistle, dodder, knapweed, toadflax, purple loosestrife, and Persian darnel among others. The Act requires landowners to control weed infestations throughout their property; failure to comply with the act may result in penalties.

The application of pesticides is controlled through the *Environmental Protection and Enhancement Act* and should be reviewed in the event that pesticide application is required.

Wildlife Act

Alberta's *Wildlife Act* is the main piece of provincial legislation that deals with wildlife and protects certain wildlife habitat from disturbance. The Act includes the protection of bird nests, animal dens, and upland game and migratory birds, defined under the *Migratory Bird Convention Act* in Alberta. If the proposed development is anticipated to disturb or destroy habitat of wildlife species listed under the Act, potential regulatory requirements may need to be met depending on jurisdiction and land ownership.

1.3.3 Municipal

Riparian Land Conservation and Management (Policy 419) March 30, 2010

This policy serves to conserve and manage riparian lands for the purposes of protecting biodiversity and wildlife habitat, maintaining water quality, reducing erosion and providing recreational, education and economic opportunities. This policy recognizes riparian lands as sensitive areas and requires development to demonstrate plans to maintain or restore riparian lands. It also requires a setback from riparian lands, may require dedication as Environmental Reserve, and the County can inform appropriate regulatory bodies of degradation, pollution or encroachment on riparian lands. According to this policy, plans to mitigate for potential riparian impacts are required and may include but are not limited to: site specific stormwater management plan, regional stormwater management plan, erosion and sediment control plan, construction plant, biophysical impact assessment and environmental protection plan.

This policy will be applied to: planning documents adopted by Council, Land Use Bylaw, subdivision applications, development and building permits, road construction, other bylaws and policies. This policy will apply during the construction phase of the Chinook Ridge Lodge and Golf Course.

Wetland Conservation and Management (Policy 420) March 30, 2010

This policy serves to conserve and manage wetlands for the purposes of protecting biodiversity and wildlife habitat, maintaining water quality, contributing to groundwater recharge, reducing erosion and providing recreational, education and economic opportunities. This policy was designed to help meet provincial objectives, such as those in Alberta's Water for Life Strategy. This policy recognizes wetlands as sensitive areas and aims to reduce the negative effects on wetlands from development. Scientifically determined setbacks will be required from wetlands.

In areas where development affects a wetland, the County requires the applicant to demonstrate mitigation of impacts to the wetland through avoidance, minimization of degradation, or compensation for the loss. Mitigation plans will be required for development applications and may include but are not limited to: site specific stormwater management plan, regional stormwater management plan, erosion and sediment control plan, construction plant, biophysical impact assessment and environmental protection plan. This policy will apply during any development or building phases of Chinook Ridge Lodge and Golf Course.

Rocky View County Land Use Bylaw (C-4841-1997) Adopted September 29, 1998

The Land Use Bylaw dictates the requirements and conditions outlined in development permits, identifies setbacks from waterbodies/roads/etc., and discusses appearance of outdoor spaces, signage restrictions, and restrictions related to hydrology.

Some specific items identified in this Bylaw include:

- development must be more than 6 m above the normal water level and more than 1,200 m away from the normal water line on a major watercourse (7.26)
- development must be more than 3 m above normal water level and more than 300 m away from the normal water line on a minor watercourse (7.26)
- Potable water should not be used for irrigation of landscaping plantings and vegetation (section 26.9)
- Existing landscaping or natural vegetation should be conserved, and may be relocated on site as shown on the Landscaping Plan (26.11.7)
- Any areas subject to excavation, stripping or grading during construction phases of development shall be protected from wind and water erosion (26.11.9)
- Water conservation measures should be done with consideration of the Stormwater Management Plan to achieve an effective solution which incorporates on-site use of stormwater for landscape irrigation (26.11.15)
- The use of water efficient landscaping and xeriscaping is strongly encouraged, which includes the use of drought-tolerant indigenous vegetation, in conjunction with permeable or pervious surfacing material (26.11.16)
- The use of Kentucky Bluegrass (*Poa pratensis*) for landscaping is strongly discouraged. The use of indigenous fescue grasses is strongly encouraged (26.11.17)
- Noxious or restricted weeds, or invasive plants, as outlined by the Alberta Weed Control Act, shall not be used for landscaping vegetation, and if established, should be controlled as outlined in the Act (26.11.18)
- The publication “A Guide to Using Native Plants on Disturbed Soil” by Alberta Government should be referenced for information on the use of native species (26.11.19)
- Outdoor lighting on any development shall use full cut-off (shielded) outdoor light fixtures that direct the light downward and reduce glare and light pollution (27.2.1)

Many of the specific items identified by this bylaw apply to the Chinook Ridge conceptual development plan, and these items should be followed where possible.

Municipal District of Rocky View No. 44 Bylaw C-5772 (Noise Bylaw) – 2003

This bylaw restricts excessive, unnecessary or unusual noise during daytime (7:00 AM – 10:00 PM weekdays and 9:00 AM to 10:00 PM weekends) and nighttime (10:01 PM – 6:59 AM weekdays and 10:01 PM – 8:59 AM weekends) hours unless lawfully permitted. If the creation of noise is necessary and lawfully permitted, the individuals involved must take all necessary steps to minimize the noise created. This bylaw includes restrictions for residential noise and vehicle noise. This bylaw may apply to any construction noise during the development of Chinook Ridge Lodge and Golf Course as well as increased traffic noise once the developments are complete.

Municipal District of Rocky View NO. 44 Regulation of the operation, maintenance, use and control of the sewage systems, stormwater drainage systems (Bylaw C5083-99)

The Surface Drainage Bylaw (Rocky View, N.D.) regulates wastewater collection systems and stormwater. This document discusses the required information for projects that are proposed to connect to existing wastewater collection systems (water quality, pre-treatment, volumes etc.) Releases into the wastewater collection system or storm drainage system are not permitted unless the release is: subsurface drainage or non-contaminated groundwater; potable water; a discharge that was approved by Council in writing; or water from repair to maintenance of utilities or roads. If an unsanctioned release occurs, this incident must be reported. If wastewater released into the systems does not comply with this bylaw, Council may require monitoring or installation of pre-treatment facilities. This bylaw will apply to any wastewater and/or stormwater management facilities that are part of the Chinook Ridge Lodge and Golf Course design.

Municipal District of Rocky View NO. 44 Litter Bylaw (C-5754-2003)

The Litter Bylaw prohibits the disposal of litter on public property and transportation of litter that is not contained or secured. This bylaw also lists restrictions for disposal of litter on private property including the waste must not leach and is not otherwise transferred onto adjacent lands. This bylaw will apply to all aspects of Chinook Ridge development as well as once the developments are complete and the golf course is open to the public.

2.0 Methodology

The Biophysical Impact Assessment was divided into two components: a desktop review and a field program. Standard and/or generally accepted methodology was used to complete the BIA and the methods for each component are listed below.

2.1 DESKTOP REVIEW

The desktop review was conducted prior to the field component of the BIA, and the background information from the desktop review helped develop the scope of the field program. The following section outlines the methodology of the desktop review components.

2.1.1 Agricultural Land Capability Assessment

The Alberta Soil Survey Report No 53 (Soil Survey of the Municipal district of Rocky View NO. 44 Alberta) was reviewed to determine the Land Capability Classification for Arable Agriculture in the RVC District. This classification system accounts for climate, soils and the landscape; however, the final classification is based only on the most limiting factor of a site.

2.1.2 Aerial Photograph Review

Selected aerial photographs dating from 1950 to 2010 were reviewed, and vegetative communities were pre-stratified using both current and historic air photographs.

2.1.3 Survey Sites

Survey Site Target locations were pre-determined based on air photo interpretation and were selected based on the following criteria:

- Survey sites should be located in a relatively homogeneous part of the vegetative community;
- Survey sites should represent the vegetation community as a whole, and
- Survey sites should be located far enough away from any boundary to decrease the chances of edge effect.

2.1.4 Online Databases

Online databases were searched to identify important background information about the Subject Property:

- Alberta Soil Information Viewer (GOA, 2009) was searched for soils information;

- Quaternary Geology of Southern Alberta Maps (Hamilton et al., 1999) was searched for geology and hydrogeology information;
- Alberta Conservation Information Management Systems (ACIMS) was searched for rare flora occurrences, and the
- Fish and Wildlife Management Information System (FWIMIS) was searched for wildlife occurrences.

The desktop review provides an overview of the Subject Property, and highlights areas of interest that require additional planning for the field component.

2.2 FIELD PROGRAM

The field program consisted of several components including, identification of rare flora, identification and classification of wetlands, mapping vegetative communities and conducting an avian survey within each mapped community.

Wildlife incidentals were recorded throughout the duration of the field program and any information obtained through personal communication with the client was noted.

2.2.1 Vegetation Mapping and Rare Flora Assessment

The Survey Sites were 20 meters x 20 meters (400 m^2); however, a meandering survey was also conducted to capture any incidentals that may have been missed at the Survey Site. An inventory of the dominant species within the forest, tree and shrub, and herbaceous layers were collected at each site, as well as a complete species list. Diameter at breast height (1.3 m) and tree height were collected for Survey Sites that contained trees.

Vegetative communities were delineated and mapped using information collected from the Survey Sites and the Government of Alberta's Central Parkland Range Plant Community Guide (Burkinshaw et al, 2009). The Subject Property is located south of the Central Parkland region and no plant community guide exists for this area; therefore the guide could not be applied for all vegetative communities. Where vegetative communities could not be diverged from the community guide, community identifiers were developed.

A Rare Flora Survey was planned for early spring and fall to account for variation in growth and flowering times (Stantec, 2010). The first Rare Flora Survey was conducted during the field program on June 24 and 25, 2011, and the areas surveyed were associated with the eight Vegetation Survey Sites. Therefore, the site identifiers associated with Spring Rare Flora Survey program are shared with the Vegetation Survey Site locations (Figure 1, Appendix A). The second Rare Flora Survey was conducted on August 17, 2011 and these sites are listed separately (Figure 1, Appendix A). A complete species inventory was collected for each Rare Flora Survey and the Alberta Conservation Information Management System (ACIMS) was then used as a reference to check for rare plants.

A representation of the bryophyte community was collected at each of the Vegetation Survey Sites, and bryophytes were sent to a professional bryologist for identification. ACIMS was used as a reference to check for rare bryophytes.

2.2.2 Wetland Assessment

The wetlands identified during the historical air photo review were verified by the presence of standing water and/or riparian vegetation during the field program. All wet areas identified in the aerial photo review, as well as those apparent at the time of the site visit were investigated. Wetlands were classified according to the Stewart and Kantrud Wetland Classification System (Stewart and Kantrud, 1971), which was developed for classifying wetlands in the glaciated prairie region. It is one of two classification systems approved by Alberta Environment (AENV) and Alberta Sustainable Resource Development (ASRD). Wetlands are grouped into the appropriate class based on the vegetation present in their deepest zone. There are seven classes of wetlands in the Steward and Kantrud classification system, that increase in number based on their permanence:

Class I – Ephemeral Ponds

Class II – Temporary Ponds

Class III – Seasonal Ponds and Lakes

Class IV – Semipermanent Ponds and Lakes

Class V – Permanent Ponds and Lakes

Class VI – Alkali Ponds and Lakes

Class VII – Fen (Alkaline Bog) Ponds

The vegetation in each zone, as well as a complete species list, was recorded for all wetlands present on the Subject Property. In addition, a Rare Flora Survey was conducted in wetland locations with unique habitat, at the discretion of Stantec personnel during the Field Program, and all wildlife observed in the wetland vicinity was recorded.

Field data was collected using the ASUS A636N Personal Digital Assistant (PDA) and built-in Global Positioning System receiver. The software incorporated into the PDA consists of Microsoft Windows Mobile 5® and ESRI's mobile Geographical Information Systems (GIS) mapping application ArcPad® version 7.1. The base map utilized for the wetland delineations consisted of a 2010 geo-referenced aerial photograph obtained from Alberta Sustainable Resource Development (ASRD). The area calculated for the observed wetlands was determined based on information gathered from the historical aerial photograph review and from observation and GIS delineation of the natural transition between riparian and upland vegetation observed at each wetland.

Data management was facilitated by ESRI's ArcGIS® version 9.3, which is necessary for input and storage of field data. ESRI's GIS tools are helpful for integrating and mapping various elements with other data sets such as property boundaries and natural areas. Field observations and integration of other data sets form the basis for final map interpretation.

2.2.3 Avian Survey

Avian (point-count) Surveys were conducted throughout the Subject Property to obtain a representative cross section of birds residing in each community type. Care was taken to locate points entirely within, and away from the edge of an identified community type. Avian Surveys were conducted in the early morning when birds are the most active. Before commencing the point count, surveyors remained quiet for one minute to assimilate into the area and encourage the birds to continue signing. Avian Surveys lasted three minutes, during which time the surveyor recorded the location of all birds heard within a 50 meter radius and noted any birds heard outside of the 50 meter radius. The 50 meter radius captures the birds present in the identified community type; birds outside of this radius typically represent birds present in adjacent habitats.

2.3 ECOLOGIAL VALUE AND CONNECTIVITY ASSESSMENT

Ecological Value and Connectivity were assessed and determined using information from both the desktop review and field program and are discussed below.

2.3.1 Connectivity Assessment

Ecological connectivity was assessed by examining the natural areas on the Study Area and in the surrounding properties (Figure 5, Appendix A). The connectivity of the natural features on the Study Areas were ranked according to habitat value of the natural feature (i.e. how likely it is that wildlife will want to use a natural feature) and adjacent land use. Distance to adjoining natural features outside the Study Areas boundary was also considered, as most wildlife species display gap avoidance behavior and will avoid crossing between habitat patches if the distance is too great (Barnum 2003). Movement between habitat patches is ideal when gap distances are less than 45 meters for birds (Tremblay and St. Clair 2009), 100 meters for mobile species like deer (Thomas et al. 1979), and approximately 50 meters for amphibians (Biolinx and E. Wind 2004). Areas with smaller distances between habitat patches were considered to have a higher degree of connectivity. Connectivity was assessed based on the following general distance criteria:

- Ecologically Valuable areas less than 100 meters were considered to have high Habitat Connectivity
- Ecologically Valuable areas between 100 and 200 meters apart were considered to have medium habitat connectivity

- Ecologically valuable areas greater than 200 meters apart were considered to have low habitat connectivity

2.3.2 Ecological Value Rankings

After completion of the field program, Stantec personnel ranked the various components of the Subject Property into areas of High, Medium and Low Ecological Value (Figure 5, Appendix A). Rankings were based on information from both the desktop review and field program, with a strong emphasis on species diversity (both flora and fauna), current and potential wildlife habitat, presence of water, percent of native species and habitat connectivity.

Table 2.1
Ecological Value Ranking System

Rank	Habitat Characteristics
High	▪ High connectivity to ecosystems across the landscape ▪ No ecosystem fragmentation ▪ High probability of rare species ▪ High biodiversity (richness and evenness) ▪ Significant habitat ▪ Sustainability potential high
Medium	▪ Some connectivity to ecosystems across the landscape ▪ Some ecosystem fragmentation ▪ Moderate probability of rare species ▪ Moderate biodiversity (richness and evenness) ▪ Moderate habitat ▪ Moderate sustainability potential
Low	▪ No connectivity to ecosystems across the landscape ▪ Complete ecosystem fragmentation ▪ Low probability of rare species ▪ Low biodiversity (richness and evenness) ▪ Provides marginal habitat ▪ Sustainability potential limited

3.0 Results

The following sections highlight the results of the BIA desktop review and field program.

3.1 DESKTOP REVIEW

The desktop review provided baseline information about the soils, geology/hydrogeology, rare flora, wildlife, and wetlands for the Subject Property. This section outlines the results of the desktop review and includes information on various VEC's.

3.1.1 Agricultural Land Capability

According to the Alberta Research Council's Environmental Research and Engineering department (Turchenek et al 1994), the Land Capability Classification for Arable Agriculture in the RVC district is Class 4, Subclass H, which means that agriculture is severely limited by temperature in this area. The Subclass indicates the most limiting factor of a site, and the Class indicates the degree of severity caused by that limiting factor. In this case, the Subclass H, indicates that crop growth on the Subject Property is limited by temperature, and Class 4 indicates that this is a severe limitation restricting the range of crops that can grow, and that special management practices may be necessary in order to practice agriculture in this area (Turchenek et al 1994).

3.1.2 Aerial Photograph Review

Selected aerial photographs dating from 1950 to 2010 (Appendix B) were reviewed, and are summarized in Table 3.1. In 1950, the Subject Property was primarily forested with only a small portion in the southwest corner used for agriculture. By 1953, much of the trees in the south portion of the Subject Property had been removed for agricultural use, and by the mid to late 70's most of the remaining trees on the Subject Property had been removed, only a small tree patch was left near the center of the property. In addition, a wetland and small tree patch were present in the southwest corner of the property, but the wetland appeared to have been partially filled in the early 80's and now contains woody vegetation. Several broken and/or continuous treed corridors were present throughout the aerial photo review which provide connectivity between the small treed patched within the Subject Property and treed areas on adjacent properties. Table 3.1 provides a more detailed summary of the changes that occurred on the Subject Property since 1950.

Table 3.1
Aerial Photograph Summary

Year	Month	Description
1950	**July**	The Subject Property is mainly forested with some agricultural development in the southwest corner. There also appears to be a non-forested area running north-south along the east boundary of the Subject Property. The forested area extends north and northwest into the surrounding areas.
1953	**September**	Most of the trees have been removed in the south half of the Subject Property; however, trees are still present on the south border and the agricultural boundary running north-south. A clump of trees in the southwest corner of the Subject Property appear to be in a depression connected with a wetland area, and another patch of trees off the southwest corner of the property. Several rows of trees exist along the south and east agricultural fields.
1962	**September**	The Subject Property and surrounding areas appear similar to the previous photograph, however the rows of trees in the south and east agricultural fields are now gone.
1966	**August**	Most of the forest to the north of the Subject Property has been removed, along with additional trees on the east side of the Subject Property. A small treed corridor (running north-south) connects the trees within the Subject Property to a treed area in the north. The wetland in the southwest corner of the Subject Property appears to contain water.
1970	**July**	The Subject Property and surrounding area appears similar to the previous photograph; however, the wetland in the southwest corner appears to be dry.
1974	**June**	The Subject Property and surrounding areas appear similar to the previous photograph.
1979	**June**	Most of the forest has been removed, and now only a small stand of trees remain present near the center of the property, and a second small stand remains present northwest of the property. A building appeared near the center of the Subject Property, south of the remaining tree patch, and the wetland boundary is easily distinguishable in this photo.
1982	**September**	The Subject Property looks similar to the previous air photo; however, the wetland appears less prominent. It appears to have been partially filled in or disturbed in some way.
1984	**August**	The Subject Property looks similar to the previous air photo; however, a broken line of vegetation now runs north-south on the east boundary. A wet area is starting to develop near the center of the Subject Property.
1987	**May**	The Subject Property looks similar to the previous air photo; however, the central wet area is more prominent and appears to head north out of the Subject Property.
1993	**July**	The Subject Property looks similar to the previous air photo; however this photo was taken during a drier month and water is no longer visible in the central wet area. The central wet area also appears to have been disturbed by agriculture.
1998	**May**	The Subject Property appears similar to the previous air photo; however, a new building is now located in the northeast corner and the wet area in the southwest is now fully treed. Agricultural is no longer running through the central wet area.

Year	Month	Description
2000	**August**	The Subject Property appears similar to the previous air photo; however the central wet area is less prominent.
2010	**June**	The Subject Property appears similar to the previous air photo; however, an additional building is now present in the southeast corner of the Subject Property and an additional square development just north of the new building. It appears that trees and/or shrubs are now growing in the central wet area.

3.1.3 Soils

The results from the Alberta Soil Information Viewer (GOA, 2009) show that the soil on the Subject Property and surrounding area is an Orthic Black Chernozem on medium textured till. The soils series is 100% Dunvargan and the medium textured tills are made up predominately of clay and loam.

3.1.4 Geology and Hydrogeology

The Quaternary Geology of Southern Alberta Maps (Hamilton et al., 1999) revealed that the Subject Property and surrounding area is made up of hummocky, low relief landforms, with a limiting slope of 6%.

3.1.5 Rare Flora

The ACIMS database was searched and no rare occurrences were identified on the Subject Property (ACIMS, 2011).

3.1.6 Wildlife

The ASRD Fisheries and Wildlife Management Information System (FWMIS, 2011) was searched to determine what wildlife species were present within a nine, five, and three kilometer radius of the Subject Property (Table 3.2). The results showed that several wildlife species listed as *Sensitive, At Risk, or May Be at Risk*, were noted within a nine kilometer radius of the Subject Property. However, only the northern pigmy owl (*Glaucidium gnoma*) and the pileated woodpecker (*Dryocopus pileatus*) were noted within a six kilometer radius of the Subject Property, and only the northern pigmy owl was noted within a three kilometer radius of the Subject Property. Refer to Table 3.2 for a summary of the common and listed species present within the various search radii examined.

Table 3.2
Listed species located near the Subject Property

Wildlife Species	9km	6km	3km	Status 2010
barn swallow	Present	-	-	Sensitive
barred owl	Present	-	-	Sensitive
bay-breasted warbler	Present	-	-	Sensitive
black tern	Present	-	-	Sensitive
brewer's sparrow	Present	-	-	Sensitive
cape may warbler	Present	-	-	Sensitive
eastern phoebe	Present	-	-	Sensitive
great blue heron	Present	-	-	Sensitive
great grey owl	Present	-	-	Sensitive
grizzly bear	Present	-	-	At Risk
least flycatcher	Present	-	-	Sensitive
northern harrier	Present	-	-	Sensitive
northern leopard frog	Present	-	--	At Risk
northern pigmy owl	Present	Present	Present	Sensitive
pileated woodpecker	Present	Present	-	Sensitive
sandhill crane	Present	-	-	Sensitive
short-eared owl	Present	-	-	May be at Risk
sora	Present	-	-	Sensitive
swainson's hawk	Present	-	-	Sensitive

3.2 FIELD RESULTS

The BIA field results played a large role in prioritizing ecologically valuable areas on the Subject Property. The following section outlines the results of the BIA field program.

3.2.1 Vegetative Communities

The Subject Property was delineated into seven Vegetative Community Classes (Figure 6, Appendix A), based on information from the Government of Alberta's Central Parkland Range Plant Community Guide, and the Steward and Kantrud Wetland Classification System. Where vegetation communities diverged from the community guide, community identifiers were developed.

CPD13. *Aw/Snowberry-Rose*

This Vegetation Class encompassed the central tree stand and the adjacent east windrow within the Subject Property (Figure 5, Appendix A). The tree, shrub and forb community was similar to the CPD13. Aw/Snowberry-Rose community in the Government of Alberta's Central Parkland Range Plant Community Guide; however, the site contained several species not listed, and none of the grasses listed for this community type were present. Trembling aspen was the dominant tree species, replacing balsam popular (*Populus balsamifera*) in the guide. The shrub layer contained prickly rose (*Rosa acicularis*) and snowberry (*Symphoricarpos albus*), but not at the percent cover levels listed in the guide. The forb layer was very similar to the guide,

however false solomon's seal (*Smilacina stellate)* was present at approximately 10% cover when compared with an average of 1% cover in the guide. Common dandelion (*Taraxacum officinale*), cream-colored vetchling (*Lathurus ochroleucus*), wild strawberry (Fragaria sp.), and northern bedstraw (*Galium boreale*) were all present at approximately the same average percent covers listed in the guide (1-2%). However, forbs not listed in the book were also present, such as sweet cicely (*Osmorhiza depauperata*), fairybells (*Disporum trachycarpum*), fireweed (*Epilobium angustifolium*), pink wintergreen (*Pyrola asarifolia*), snake root (*Sanicula marilandica)* and multiple *Ribes* species among others (Photo 1, Appendix C).

The CPD13. Aw/Snowberry-Rose community appeared to have been in place for a long time, with minimal disturbances. The mature aspen stand had an average height of 16.9 m, and a healthy sub-canopy and shrub layer of aspen were regenerating in the understory. The aspen trees within the sub-canopy were approximately 8.5 meters in height, while the aspen regeneration in the shrub layer were anywhere between 1.0 and 1.8 meters. This mature stand, with flourishing understory, made for a very healthy and diverse community.

Aspen/Rose Windrows

The Aspen/Rose community made up the majority of the windrows within the Subject Property (Figure 5, Appendix A), and was a simplified version of the CDP13. Aw/Snowberry-Rose community. Aspen trees dominated the tree layer and prickly rose dominated the understory. In addition to prickly rose, some strawberry, snowberry, false solomon's seal, and *Ribes* sp. were present.

Timothy/Dandelion Pasture

The Timothy/Dandelion Pasture community dominated the majority of the Subject Property (Figure 6, Appendix A) and was a simple vegetative community. Timothy (*Phleum pratense*), common dandelion and American vetch (*Vicia Americana*) characterized the community. Clover (*Trifolium* sp.), graceful cinquefoil and silverweed (*Potentilla* sp.), alfalfa (*Medicago sativa*), and smooth brome (*Bromis inermis*) were all present as well (Photo 2, Appendix C), but in smaller quantities.

Timothy/Alfalfa Pasture

The Timothy/Alfalfa pasture community was located in the southwest quarter of the Subject Property (Figure 5, Appendix A) and was being used as a horse pasture at the time of the site visit. This vegetation community was heavily dominated by timothy and alfalfa, but common dandelion, Canada thistle (*Cirsium arvense*), orchard grass *(Dactylis glomerata*), Kentucky bluegrass (*Poa pratense*), clover, and rough cinquefoil (*Potentilla norvegica*) were also present. The Timothy/Alfalfa vegetative community appeared quite healthy at the time of the site visit (Photo 3, Appendix C).

Salix/Carex Riparian Area

The *Salix/Carex* Riparian Area was located in the southwest quarter of the Subject Property, between wetlands W1 and W2 (Figure 5, Appendix A). The creation of a man made dugout in this location separated the wetlands and altered the vegetative community, creating a small community unlike anywhere else on the Subject Property. This Vegetation Class was dominated by an assortment of *Carex* and *Salix* species but also had a fairly high percent cover of creeping spike rush (*Eleocharis palustris*), Baltic rush (*Juncus balticus*), and reed canary grass (*Phalaris arundinacea*). Basket willow (*Salix petiolaris*) was the most dominant willow species and beaked willow (*Salix bebbiana*) was fairly prominent as well. Beaked sedge (*Carex utriculata*) was the most dominant *Carex* species, however water sedge (*Carex aquatilis*) and golden sedge (*Carex aurea*) were also observed. The *Salix/Carex* Riparian Vegetation Class was a unique assemblage of vegetation that was found only in a narrow ring around the manmade dugout (Photo 5, Appendix C).

COND10. Reed Canary Grass-Awned sedge-Narrow reed grass

The closest community type that resembled wetlands W1, W2, W3 and W4 found in the community guide was COND10. Reed Canary Grass-Awned sedge-Narrow reed grass. This community is dominated by awned sedge (Carex atherodes) and therefore is most similar to wetlands W1 and W2. Most of the species present in the community guide are present to some degree in wetlands W1 and W2; however, the only species from this community class that was present in wetlands W3 and W4 was narrow reed grass (*Calamagrostis stricta*). Please refer to Section 3.2.2 for more detailed information regarding the species composition of the wetlands present on the Subject Property.

3.2.2 Rare Flora

On June 24 and 25, 2011, Rare Flora Surveys were conducted at each of the eight Vegetation Survey Sites (Figure 1, Appendix A). A complete species inventory was collected at each site and bryophytes were collected for identification by a specialist. A second survey was undertaken on August 17, 2011 to identify late season vegetation species that may not have been present during the earlier survey, and to identify species that may not have been mature enough to positively identify in June. Four sites were surveyed during the late season assessment (Figure 1, Appendix A).

Following the field surveys, the species lists for each site were cross referenced with the Alberta Conservation Information Management System (ACIMS) to determine if any of the species were listed as rare. The results showed that no rare flora species were identified on the Subject Property. Results of the field surveys and corresponding ACIMS data can be found within Appendix D.

3.2.3 Wetlands

The aerial photo review revealed two wet areas within the Subject Property, however when these areas were investigated in the field, four separate wetlands were delineated.

Wetlands W1 (Photo 5, Appendix C) and W2 (Photo 6, Appendix C) were located in the southeast corner of the Subject Property (Figure 1, Appendix A) and were both classified as Class III, Seasonal Ponds and Lakes (Steward and Kantrud, 1971). They were similar in size (0.31 ha and 0.24 ha) and shape, and based on the historic aerial photograph review appeared to be part of a large overland drainage. It appeared that these wetlands were historically one larger wetland and were separated during the creation of the manmade dugout located in the *Salix/Carex Riparian* area. The material that was removed during the creation of the dugout appeared to have been placed beside the dugout creating a barrier between the two wetlands.

The most dominant species in the shallow marsh zone of W1 and W2 was awned sedge (*Carex atherodes*); however, W1 was also dominated with narrow reed grass (*Calamagrostis stricta*), while W2 was dominated with water sedge, reed canary grass, and slough grass (*Beckmannia syzigachne*). The wet meadow zones of W1 and W2 were dominated by marsh reed grass (*Calamagrostis Canadensis*), and northern reed grass (*Calamagrostis stricta*); however, the wet meadow zone of W1 also contained some smooth brome. There was a reasonably gradual change from characteristic wet meadow vegetation to upland vegetation in both wetlands. The dominant species in the upland transition zones of W1 and W2 were Kentucky bluegrass, marsh reed grass and several pockets of willow species. The upland transition zone in W1 also contained a large percentage of smooth brome.

Wetlands W3 (0.21 ha) and W4 (1.04 ha) were located in the northeast quarter of the Subject property (Figure 1, Appendix A) and appeared to be connected by an overland drainage (Photo 7, Appendix C).

The central wet meadow zones of W3 (Photo 8, Appendix C) and W4 (Photo 9, Appendix C) were heavily dominated by Baltic rush, however, W3 was also dominated with marsh and northern reed grass, common horsetail (*Equisetum arvense*), and water sedge, while W4 was dominated with common dandelion, timothy, and one large pocket of willow species. The upland transitional zone of W3 and W4 was dominated by timothy, Kentucky bluegrass, common dandelion and American vetch. The transition to upland interface was dominated by a mixture of species such as Baltic rush, timothy and willow pockets. W4 had a more abrupt transition to upland vegetation on the east size due to the effects of the channel.

3.2.4 Wildlife

Birds were the only wildlife species that were studied on the Subject Property; however, wildlife incidentals were noted and recorded. Five Avian (point-count) Surveys were conducted and the results of these surveys showed that a wide assortment of bird species utilize the Subject Property. Several other wildlife species were observed during the field program and personal

communication with the Client provided additional information about species that frequently utilize the property.

Birds

Avian Survey Site B1 was located in the southwest quarter of the Subject Property, in the general vicinity of wetlands W1 and W2 (Figure 1, Appendix A), and Avian Survey Site B2 was located in the agricultural field west of W3. Savannah sparrows (*Passerculus sandwichensis*) and tree swallows were the most common birds; however, magpies, clay colored sparrows, and house wrens, were also noted. House wrens were most commonly heard calling from the wind rows to the east of B1 and to the south of B2. A northern flicker (*Colaptes auratus*) was heard calling to the southwest of B1, and a Wilson's snipe was heard to the southwest of B2. In addition, a western wood-pewee (*Contopus sordidulus*) was heard calling from the windrow east of B2 and a red eyed vireo (*Vireo olicaceus*) was heard from the windrow south of B2.

Avian Survey Site B3 was located in the agricultural field south of the tree stand (Figure 1, Appendix A) and contained only one savannah's sparrow within the survey radius, however a second savannah sparrow was heard calling directly west of B3. A clay colored sparrow was heard calling northwest of the site, as well as a vesper sparrow (*Pooecetes gramineus*) to the southeast. Several bird species were heard calling from the tree stand to the north and windrow to the east such as the house wren, red eyed vireo, least flycatcher (*Empidonax minimus*), and American robin (*Turdus migratorius*).

Avian Survey Site B4 was located near the center of the tree stand (Figure 1, Appendix A) and had the greatest bird diversity of the Avian Survey Sites. Several bird species were heard within the survey radius including a warbling vireo (*Vireo gilvus*), yellow-rumped warbler (*Dendrocia coronate*), and American goldfinch, as well as multiple yellow warblers (Dendroica petechial), least flycatchers, house wrens, and Tennessee warblers (*Vermivora peregrine*). A tree swallow was heard outside the survey radius to the west and a brown-headed cowbird (*Molothrus ater*) was both heard and observed to the south.

Avian Survey Site B5 was located in the east half of wetland W3 (Figure 1, Appendix A) but had lower bird diversity than B1, which was located near wetlands W1 and W2. One clay colored sparrow and two savannah sparrows were heard within the survey radius, and in addition to more clay colored and savannah sparrows outside of the survey radius, only a black billed magpie, house wren, American goldfinch, and tree swallow were heard.

Wetland Wildlife

Several birds were heard and/or observed in the general vicinity of both W1 and W2, including a sora (*Porzana Carolina*), Lincoln's sparrow (*Melospiza lincolnii*), house wren (*Troglodytes aedon*), and red tailed hawk (*Buteo jamaicensis*). In addition, a Wilson's snipe (*Gallinago delicate*) was heard calling to the west in the adjacent property. Other than birds, there were no other wildlife encounters at W1 or W2, however deer scat and bedding areas were noted in W2.

Several bird species were noted in the general vicinity of wetlands W3 and W4, including a savannah's sparrow, clay colored sparrow (*Spizella pallida*), American goldfinch (*Spinus tristis*), black billed magpie (*Picia hudsonia*), and tree swallow (*Tachycineta bicolor*). In addition to the bird species, a white tailed deer (*Odocoileus virginianus*) was observed south of wetland W3.

Incidental Wildlife

A white tailed deer (*Odocoileus virginianus*) was observed south of wetland W3, and was then observed moving into the tree stand located near the center of the Subject Property. Stantec personnel noted that the vegetation in W3 had been heavily browsed, which could be the result of moose and/or deer.

A pack of coyotes was heard howling northwest of W2; however, whether or not the coyotes were on the Subject Property was unknown.

Communicated Wildlife

Personal communication with the Client revealed that a family of red foxes were living on the Subject Property and this was confirmed when Stantec personnel observed a fox behind the Client's home, south of the tree stand, at the time of the site investigation. Communication with the client also revealed that moose (*Alces alces*) often utilize wetland areas W3 and W4, and that several deer may be residents on the property. The Client has observed both mule deer (*Odocoileus hemionus*) and white tailed deer on the property as well as an elk (*Cervus elaphys*) on the north fence line in late spring.

The Client communicated that a neighbor witnessed a young bear on the fence line of the Subject Property in late June of 2011. However, the species of bear could not be identified at the time of the sighting. In addition to the various land mammals, personal communication with the Client revealed that a great horned owl (*Bubo virginianus*) nest was located near the dugout between wetlands W1 and W2. The owl pair associated with this nest has been seen utilizing both the hay barn and large tree stand on the Subject Property. In addition, the Client has frequently observed bald eagles (*Haliaeetus leucocephalus*) flying over the Subject Property.

3.3 ECOLOGICAL VALUE

The mature forested stand located in the center of the Subject Property, as well as wetlands W1, W2, W3 and W4 were all determined to be of high ecological value (Figure 3, Appendix A). The forested area contained a high level of species diversity in terms of vegetation and wildlife, and contained a large percent of native species. These attributes provide good wildlife habitat, and for these reasons the mature forested stand had the highest habitat potential on the Subject Property. In addition the forested stand is of critical value to habitat connectivity on the Subject Property. It is centrally located with wetlands W1 and W2 located to the east, wetlands W3 and W4 located to the north, and a large forested area (adjacent to the Subject Property) to the east. It is connected to several windrows that branch out in various directions and provide even greater habitat connectivity to the stand.

The wetlands (W1, W2, W3, and W4) were also classified as having high ecological value (Figure 3, Appendix A) due to the presence of water, species diversity, and high avian diversity on the Subject Property. Personal communication with the client indicated that moose and deer often utilize these areas as well. Because the wetlands were being utilized by several wildlife species they were considered to have high habitat potential and are therefore considered to be of high ecological value.

The windrows were determined to be of medium ecological value (Figure 3, Appendix A) due to the number of bird species observed, the presence of native species, as well as their important role in connecting habitat on, and off, the Subject Property.

The remaining agricultural areas and horse pasture (Figure 3, Appendix A) were considered to be of low ecological value (Figure 3, Appendix A) due to low levels of species diversity, non-native species. Areas with low species diversity tend to have low habitat potential because they can only be utilized by a narrow range of wildlife species. In addition, areas dominated by non-native vegetation may not provide the habitat requirements for native wildlife species.

3.4 CONNECTIVITY

Based on the general distance criteria, the connectivity results show that Subject Property has low connectivity with surrounding areas. Several ecologically valuable tree stands exist outside the Subject Property; however, the distances to them are all approximately 200 meters or greater. This gap is too large for most song birds and amphibians to cross. In fact, large ungulates start to display gap avoidance at distances of only 100 meters (Thomas et al. 1979), and therefore habitat connectivity with adjacent properties is considered low.

Habitat connectivity within the Subject Property is considered medium to high. Distances between windrows are anywhere between 59 and 132 meters and therefor may be providing a link between ecologically valuable habitats.

The highest habitat connectivity within the Subject Property is between the forested area and wetland W3. The distance between these two ecologically valuable areas is only 58 meters. Please refer to Figure 5, Appendix A for a detailed connectivity image that show the distances between ecologically valuable habitats.

4.0 Impacts and Mitigation

Various habitat types are represented within the Subject Property including a mature aspen stand with well-developed understory, several cultivated fields, a horse pasture and multiple windrows. Changing and/or developing the land will impact each of these areas differently; however, environmental impacts can be mitigated by conserving areas of high ecological value and/or enhancing the value of areas currently considered to have low ecological value. The following sections outline the specific short and long term impacts that the golf course development will have on ecologically valuable areas and specifies general impacts as well.

4.1 IMPACTS TO ECOLOGICALLY VALUABLE AREAS

4.1.1 Forested Areas

The mature aspen stand located in the center of the Subject Property is considered to be of High Ecological Value. The client has proposed several non-invasive sleeping cabins within this stand, and this will likely require the removal of several mature aspen trees.

Noise

During the construction of the sleeping cabins the forested stand may be impacted in a variety of ways. Noise pollution from machinery, as well as the direct loss of trees, may impact certain wildlife species that currently use this area. Hand falling trees would reduce noise pollution, and avoid the removal of valuable habitat trees (large mature standing dead trees or snags with plenty of holes) will reduce the effects of wildlife habitat loss.

Vegetation Removal

This removal of trees can cause long term habitat loss and/or fragmentation. The number of proposed sleeping cabins will have an effect on the overall impact to the forested site; therefore, reducing the number of proposed sleeping cabins should reduce the overall impact to the site. In addition to reducing the number of sleeping cabins, utilizing naturally open areas will help reduce the number of trees that need to be removed, or clumping development together may help reduce the effects of fragmentation by localizing the disturbance. Sleeping cabins in the trees will likely increase the amount of foot traffic meandering through the forest, thus trampling plants and reducing the overall species diversity. Placing the sleeping cabins close to the perimeter of the stand and having designated pathways that encourage people to walk outside of the stand may be beneficial in reducing foot traffic within the stand. In addition to designated pathways, educational signs can help deter people from meandering through the forest by identifying local species and the reasons for the conservation of the forested area.

Connectivity

Where the sleeping cabins are placed within the stand may have important long term implications to large wildlife that utilize wetlands W3 and W4, as well as the forested stand. Placing sleeping cabins on the north perimeter of the forest may create a barrier to ungulates wishing to move back and forth from the wetlands to the forest. Placing sleeping cabins on the south boundary of the forest should reduce the impacts on wildlife movement between the forest and wetlands W3 and W4.

Long term impacts to the forested stand can be mitigated using some of the suggestions listed in Section 6.0 (Recommendations); however, any manipulation of the stand will have long term impacts that cannot be completely avoided.

4.1.2 Wetlands

In addition to the forested area, the wetlands (W1, W2, W3 and W4) were also classified as having High Ecological Value. Conservation of these areas is highly suggested. The Client has proposed to both conserve and enhance wetlands features on the Subject Property. Conservation and enhancement plans may include, leaving a generous natural buffer around the wetlands (which will provide more habitat and reduce disturbance to wildlife), and/or restoring wetlands W1 and W2 back to one wetland, which would increase the permanence of the wetland leading to greater species diversity and habitat.

The client expressed interested in wanting to deepen wetland areas W3 and W4, creating a permanent body of open water. The historical air photos show that wetlands W3 and W4 have historically undergone some disturbances, so enhancing these wetland areas is a great way to restore wildlife habitat that may have been lost. Permanent water bodies tend to attract a greater number of wildlife species as they provide more stable habitats that some species require for their lifecycle. The client also expressed interest in planting larger treed vegetation in and around wetlands W3 and W4.

Planting large vegetation around golf course water bodies is a good idea to help combat the effects of eutrophication. Golf course water bodies are often highly eutrophic due to fertilizer run-off and increased light levels (Kunimatsu 1999). Excess nutrients and increased light levels promote the success of net primary producers such as algae and phytoplankton. Plant biomass often increases as a result of high levels of oxygen produced by algae and phytoplankton during photosynthesis. However, when these excessive levels of plants and net primary producers begin to die, oxygen is used up in the process of decomposition, depriving the system of usable oxygen and creating toxic conditions for many species. Adding large vegetation to the perimeter of a water body should decrease water temperatures and light levels creating a less favorable environment for the development of net primary producers. In addition, more of the fertilizer run-off will be utilized by large treed vegetation before ever reaching the water body. River alder (*Alnus incana*) and/or balsam poplar (*Populus balsamifera*) may be a good choice to plant around W3 and W3, as the Subject Property is located within their natural range and both species are known to inhabit moist areas such as river banks and lakeshores (Royer 2007). Not

using fertilizers or reducing the amount of applied fertilizer will also help reduce the effects of eutrophication of wetlands.

Adding additional water features can create new habitat and attract more wildlife to the site. Natural depressions and low-lying areas should be considered for the locations of new water features in order to decrease the level of disturbance to the land. Using native soils salvaged from pre-existing wetlands will establish a native seed bank in a new wetlands. There is a good opportunity to do this on the Subject Property; if the client wishes to deepen an existing wetland, the soil can be salvaged and utilized in the creation of a new wetland. A native seed bank should assist in quicker regeneration and establishment of the wetland, and therefore, increase the time in which the new wetland becomes valuable to wildlife species. In addition to salvaging wetland soil, rock and brush piles can be placed around new wetlands in order to supply small mammals with cover until larger shrubby vegetation persists on its own.

The wetlands may be negatively impacted by manipulation even if the end result of the manipulation is to increase the wetland function and habitat potential. No deleterious substances should enter the water during construction and special care should be taken to reduce the risks of sedimentation of wetland waters. Reducing bank slopes during wetland construction may help reduce the chance of sedimentation. Common wetland wildlife may be displaced during wetland construction so it is recommended that only one wetland be manipulated at a time, leaving plenty of available habitat to displaced wildlife.

Overall the long term effects to wetlands on the Subject Property are anticipated to be positive if the wetlands are both conserved and/or enhanced. Any destruction to wetlands however, will have long term impacts that cannot be completely mitigated.

4.2 GENERAL IMPACTS

4.2.1 Water

Water use and consumption is a large concern for the development of Chinook Ridge Lodge and Golf Course on the Subject Property. The client is currently working with Stantec personnel to develop a sustainable Water Management Plan, and it is highly recommended to continue to develop and strengthen this plan. As part of the Water Management Plan, the client has proposed three independent water sources that will be utilized for both the Chinook Ridge Lodge and for irrigation of the golf course.

Well water, sourced by an independent aquifer, is the first of the three independent water sources and has been identified and investigated by a professional hydrogeologist with Stantec Consulting Ltd. Because the well is sourced by an independent aquifer, it should have no impact on the wells in adjacent properties. Stantec hydrogeologists identified that the maximum volume of water that can be extracted from the well is 64.4 cubic meters a day and this should be strictly enforced (Chinook Ridge, N.D.).

The second proposed water source is storm water runoff from the roofs and parking areas at Chinook Ridge, and the water will be stored for later irrigation purposes. The final water source will come from the Chinook Ridge sanitation system, which proposes to recycle water at least once before treating it for irrigation purposes. The proposed system will recycle bathing water for flushing toilets before sanitizing it for use in the irrigation systems (Chinook Ridge, N.D.).

Loss of water to wind and evaporation during irrigation is another impact that the Chinook Ridge Golf Course will have on the environment; however, the client is proposing the use of a sub-surface irrigation system that should significantly reduce the loss of water. The sub surface irrigation system that is currently being considered can adapt to different soil types and is compatible with using treated effluent (Chinook Ridge, N.D.). In addition, the client would like the irrigation system to measure moisture levels and only apply water when it is actually necessary. This type of system would reduce water losses due to overwatering, help reduce runoff (and therefore reduce eutrophication of water bodies) and help prevent soil erosion. The Client plans to irrigate only the golf course greens (not the fairways or roughs) which will also significantly decrease the use of water associated with the proposed development.

In addition to using sophisticated irrigation systems that minimize water loss, using native grass mixes that require less water and having more natural areas that do not require irrigation, could also aid in the reduction of water use.

4.2.2 Fertilizers and Pesticides

The proposed golf course development will likely require the use of fertilizers and pesticides at times, both of which can have a negative effects on the environment. Fertilizer run-off can cause rapid eutrophication of water bodies as mentioned earlier, and pesticides can be harmful to certain organisms. Not using fertilizer or significantly reducing the use of fertilizers would reduce the effects of eutrophication of water bodies. Using native grass mixes should reduce the amount of weedy competition and thereby reduce the need for pesticides. In addition, avoiding the use of fertilizers and pesticides during periods of slower vegetation growth (i.e. late summer) will reduce the amount of chemicals leaching into the ground, surface water and surrounding water bodies.

4.2.3 Erosion and Sedimentation

The Chinook Ridge conceptual design aims to utilize the current topography; however in areas where the topography is manipulated soil instability can become a problem. In addition to sloped topography, very short grass (which is required for the short of golf) can also reduce slope stability. The length of grass roots is generally comparable to the length of grass blades, and therefore very short grass tends to have very short root systems. With virtually no roots to support the soil, grassy slopes are at risk of erosion. Erosion can cause sedimentation of nearby water bodies creating unfavorable conditions for several wildlife species, particularly amphibians. Maintaining longer grass where possible, (especially on slopes and near water bodies) may be a valuable way to reduce the chances of erosion and sedimentation at Chinook Ridge Lodge and Golf Course.

4.2.4 Connectivity

Although the Chinook Ridge conceptual development design aims to conserve ecologically valuable areas, some trees may need to be removed or wetlands manipulated in order to accommodate the proposed 18 hole golf course. Changing the landscape can reduce connectivity between important habitats both within the Subject Property and with adjacent properties. The golf course design may require the removal or partial removal of some of the windrows on the Subject Property, and some of the windrow are currently acting as corridors or stepping stones that connect ecologically valuable areas. However, the goal of the Client is to enhance connectivity, by adding water features, strategically planting trees and shortening the gaps between ecologically important areas. Therefore, any destruction or partial destruction of wetlands, or any removal of trees, should be mitigated by the addition and enhancement of these features somewhere else on the Subject Property.

The most important windrow on the Subject Property are currently those that attach the central forested area to the large forested system north of the Subject Property, and the most important area to be maintained for wildlife movement is the space between W3 and the forested area. This area will become even more important if the Client decides to deepen and enhance W3. Increasing the permanence of the W3 will increase wildlife potential, thereby increasing wildlife movements between W3 and the forested area. Leaving a completely naturalized space between W3 and the forested stand will decrease the effects of the golf course on wildlife habitat and movements within the Subject Property.

Although there are no windrows that lead directly from the wetlands W1 and W2 to the central forested area, the windrows that are present shorten the gap between valuable habitats.

Wildlife species will be affected by loss of connectivity between ecologically valuable areas; however, this can be mitigated by creating new forested stands between fairways that link ecologically valuable habitats. Forested areas should be strategically placed to accommodate wildlife traveling through the Subject Property.

5.0 Summary

Stantec Consulting Ltd. was retained by Chinook Ridge Lodge and Golf Course to conduct a Biophysical Impact Assessment for the proposed development located in the southeast quarter of Section 31, Township 28, Range 03, West of the Fifth Meridian (SE ¼-31-28-03W5M).

The objective of the Biophysical Impact Assessment was to describe the existing environment and provide a detailed review of the Subject Property. The BIA delineated vegetation communities, identified rare plants, wetlands, birds and wildlife present on the site and analyzed potential environmental impacts of the proposed development. The BIA presented mitigation strategies to help prevent harmful environmental impacts to the current Subject Property.

The following list summarizes the important findings of the BIA with respect to the Subject Property:

- The forested area and wetlands were designated a high priority natural area. These sites had high species diversity (in terms of both vegetation and wildlife), contained mostly native species, were large in size, and had high habitat potential.
- The windrows were determined to be of medium ecological value due to the number of bird species observed, the presence of native species, as well as their important role in connecting habitat on, and off, the Subject Property.
- The remaining agricultural areas and horse pasture were considered to be of low ecological value due to low levels of species diversity, non-native species, and low habitat potential.
- The Subject Property had low Habitat Connectivity with adjacent properties due to long distances between ecologically valuable areas. Habitat connectivity within the Subject Property was considered medium to high and the windrows play an important part in connecting ecologically valuable areas.
- The Subject Property is located in an area that contains severe agricultural temperature limitations and therefore may be better suited to a different type of land designation. If the Client continues to work with environmental professionals and moves forward with an Audubon International certification, Chinook Ridge Lodge and Golf Course may serve as a valuable conservation area in the future.

Overall, the Biophysical Impact Assessment determined the potential negative environmental impacts on the Subject Property to be:

- Loss of forested and wetlands areas;
- Sedimentation and erosion due to construction and manipulation of natural slopes;
- Changes in hydrology due to manipulation of the natural terrain; and

- Loss of original habitat connectivity within the Subject Property.

The Chinook Ridge Lodge and Golf Course proposed conceptual design is expected to have several positive environmental impacts as well, which may include:

- Increased wildlife habitat due to the addition of water features and planted trees;
- Enhanced wildlife habitat due to the increase in permanence of some wetland areas;
- Increased habitat connectivity due to the addition of water features and strategically placed trees; and
- Increased visual esthetics.

6.0 Recommendations

Based on the Biophysical Impact Assessment, the following recommendations are provided:

- Retain the forested area and wetlands W1, W2, W3, and W4 with an adequate buffer;
- Plant low maintenance native vegetation whenever possible that will reduce water consumption and provide habitat for local wildlife;
- Use a naturalized design, and native seed bank, for artificial water features;
- Maintain pre disturbance drainage patterns currently observed throughout the Subject Property;
- Continue to develop and enhance the proposed water management plan to reduce water consumption on the Subject Property;
- Maintain habitat connectivity by adding several treed areas throughout the golf course;
- Add larger woody vegetation to the perimeter of wetlands and water features to reduce the effects of eutrophication and provide additional wildlife habitat;
- Use minimal amounts of fertilizer and avoid fertilizing during periods of slow vegetation growth (ie. Late summer) because fertilizers are more likely to leach into the ground and surface water during these times;
- Use interpretive signs around ecologically valuable areas to educate the public and limit inadvertent human damage to the areas;
- Ensure all necessary approvals are obtained prior to development (i.e., *Water Act*, *Public Lands Act*, *Fisheries Act*, etc.);
- Destruction or partial destruction of wetlands W1, W2, W3, and W4 will require a water act approval and compensation, and
- A second rare flora survey should be conducted in August 2011 to account for the variation in growth and flowering times of plants.

7.0 Best Management Practices

In order to minimize impacts to existing vegetation and wildlife in any ecologically valuable areas on the Subject Property, a preliminary set of Best Management Practices (BMP's) are provided below:

1. Clearing of native vegetation should be avoided between April 15 and July 31 to prevent harm to nesting migratory birds and breeding wildlife;

2. Prior to construction activities, the boundaries of the natural areas to be conserved should be clearly identified with fencing or flagging, and reviewed with the construction contractor;

3. All works and undertakings should be adequately designed and mitigated to prevent erosion and sedimentation. Sediment and erosion control measures should be implemented prior to work and maintained throughout the course of construction, using a variety of techniques as per detailed design;

4. All disturbed areas should be re-vegetated with native vegetation as soon as possible;

5. Appropriate precautions should be taken to ensure that deleterious substances do not enter the natural areas; and

6. All debris generated from construction activities should be properly removed from the site.

8.0 Limitations and Qualifications

In conducting the investigation and rendering our conclusions, Stantec gives the benefit of its best judgment based on its experience and in accordance with generally accepted professional standards for this type of investigation. This report was submitted with the best information to date and on the information provided. The conclusions made within this report are a professional opinion, not a certification of the Subject Property's environmental condition, no other warranty, expressed or implied is made. This report has been prepared for the exclusive use of Chinook Ridge Golf and Country Club for the purposes of assessing the current state of the Subject Property. Any use which any third party makes of this report, or any reliance on or decisions to be made on it, are the responsibility of such third parties. Stantec accepts no responsibility for damages, if any, suffered by any other third party as a result of decisions made or actions based on this report. Our conclusions are limited by the following:

- All vegetation and wildlife inventories were completed during the dates and times specified and conditions may vary outside that time;
- The information contained within this report is based on the information provided to date by various agencies and the design drawings available at the time of report preparation. Should the drawings be amended in the future, revisions to the report may be required; and
- The investigation was limited to those parameters specifically outlined in this report.

9.0 Stantec Quality Management Program

This report, entitled "**Chinook Ridge Lodge and Golf Course Biophysical Impact Assessment**; Prepared for: **Chinook Ridge Lodge and Golf Course**; Prepared by; Stantec Consulting Ltd.; August 2011" was produced by the following individual(s):

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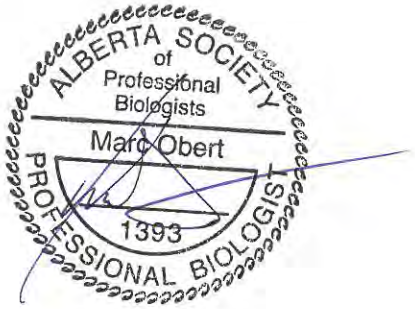
Environmental Scientist

This report has been reviewed by:

Angie Bates Dipl., BAEM
Senior Associate



Marc Obert, B.Sc., P.Ag., P.Biol.
Environmental Scientist

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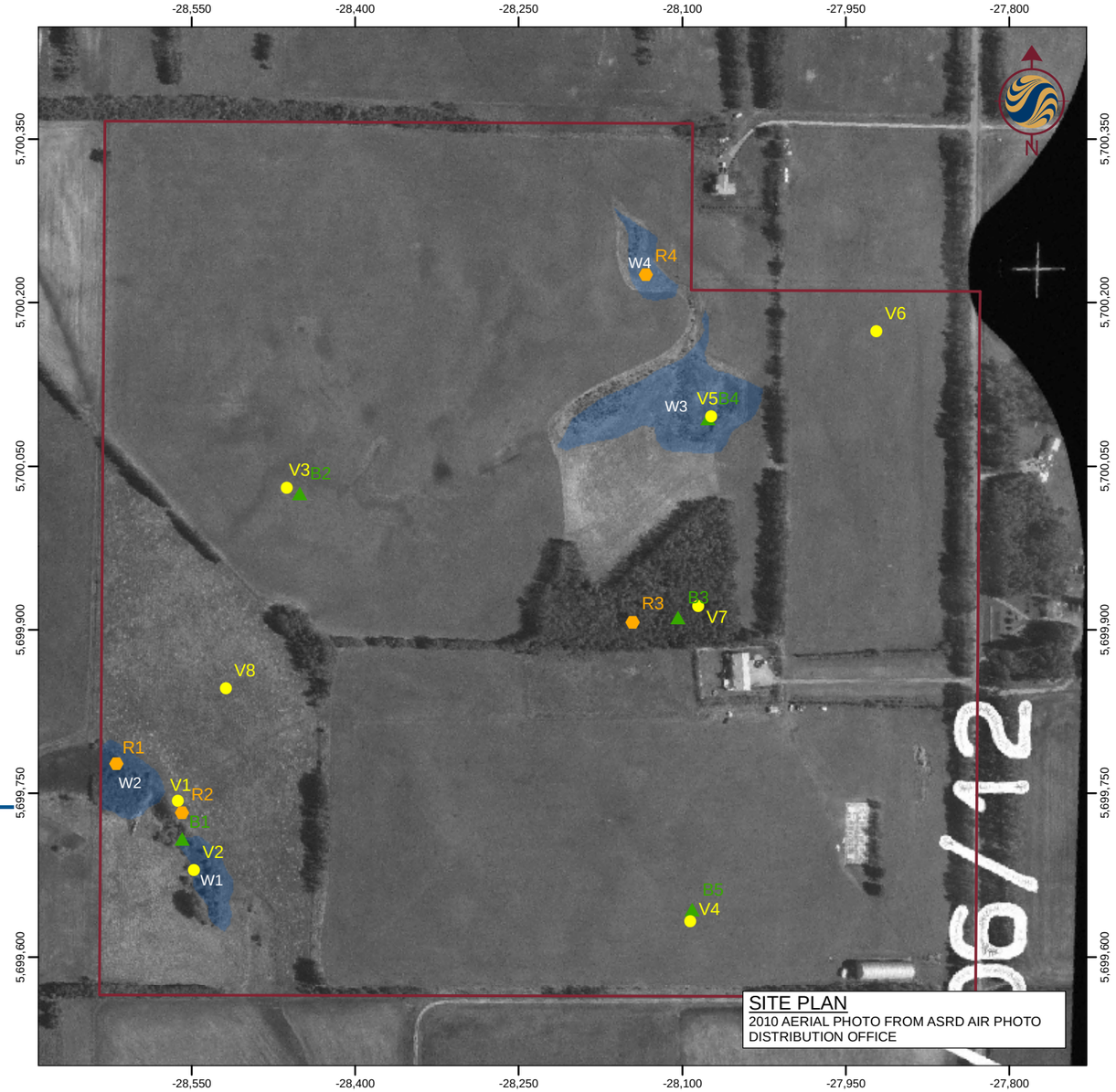
Appendix A
Figures

LOCATION PLAN
SCALE 1:7,005,101



SITE PLAN
2010 AERIAL PHOTO FROM ASRD AIR PHOTO DISTRIBUTION OFFICE

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Projection: 3TM CM:114° Projection: NAD83
Map of Alberta obtained from Natural Resources Canada, 2004.

Subject Property
Wetlands

Avian Survey Sites
B1
B2
B3
B4
B5

Vegetation and First Rare Flora Survey Sites
V1
V2
V3
V4
V5
V6
V7
V8

Second Rare Flora Survey Sites
R1
R2
R3
R4

Site Description
SE 1/4-31-28-03W5M

This map is for reference purposes only
0 30 60 90 120 150
1:5,000 Metres

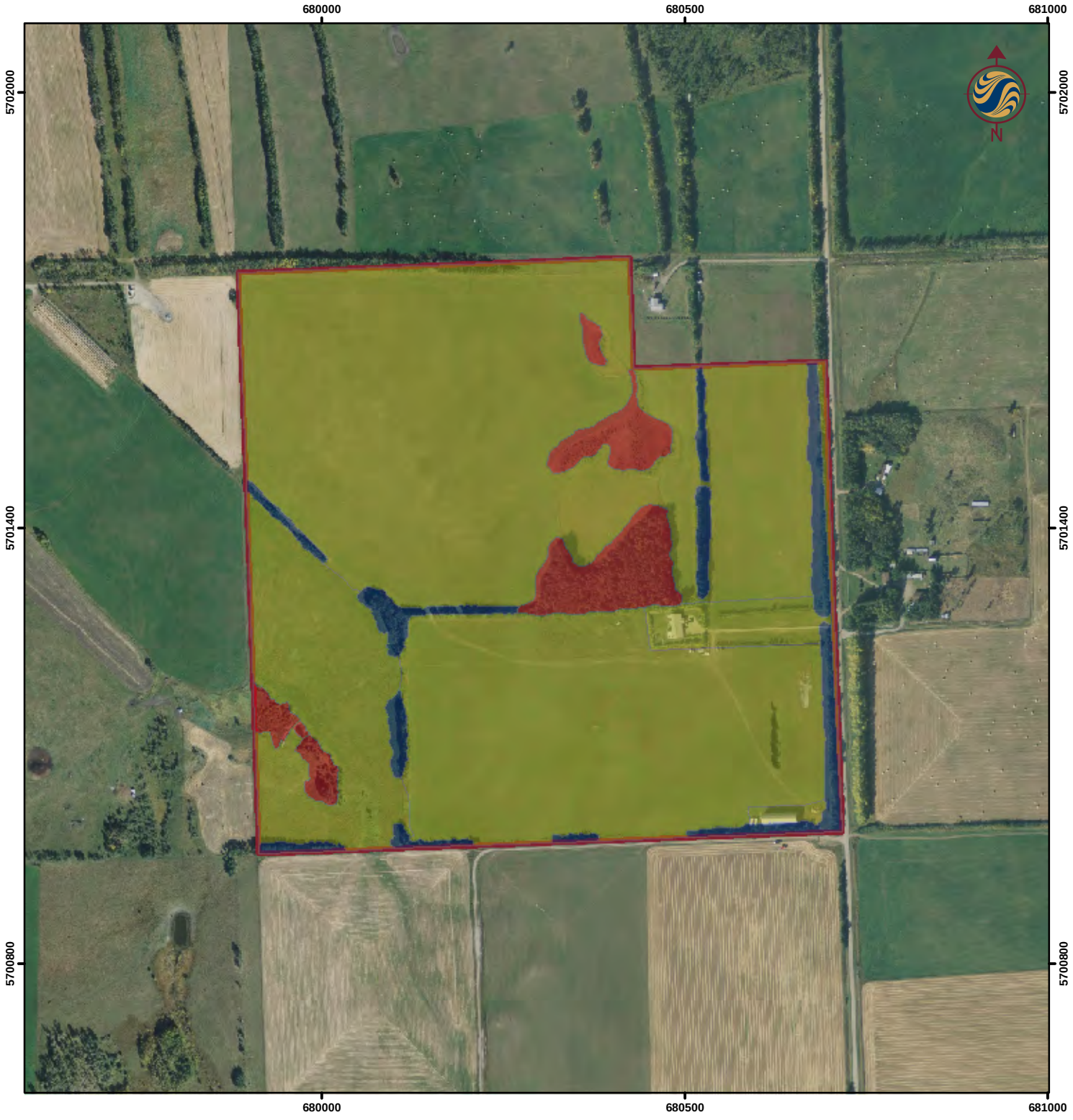
Client/Project
CHINOOK RIDGE LODGE AND GOLF COURSE

CHINOOK RIDGE BIOPHYSICAL IMPACT ASSESSMENT

Figure No.
1

Title
SITE LOCATION AND SURVEY POINTS

Figure 2. Golf Course Concept Design



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Ecological Rankings

High | Medium | Low | Subject Property

This map is for reference purposes only.

1:7,500 0 62.5 125 250 375 500 Metres

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Projection: NAD83 | UTM ZONE 11N

Client/Project
CHINOOK RIDGE LODGE & GOLF COURSE

CHINOOK RIDGE
BIOPHYSICAL IMPACT ASSESMENT

Figure No.
3

Title
ECOLOGICAL VALUES

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CONNECTIVITY

- HIGH < = 100m
- MED = 100 - 200m
- LOW = > 200m
- 1km Buffer
- Subject Property

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Projection: NAD83 | UTM ZONE 11N

This map is for reference purposes only.

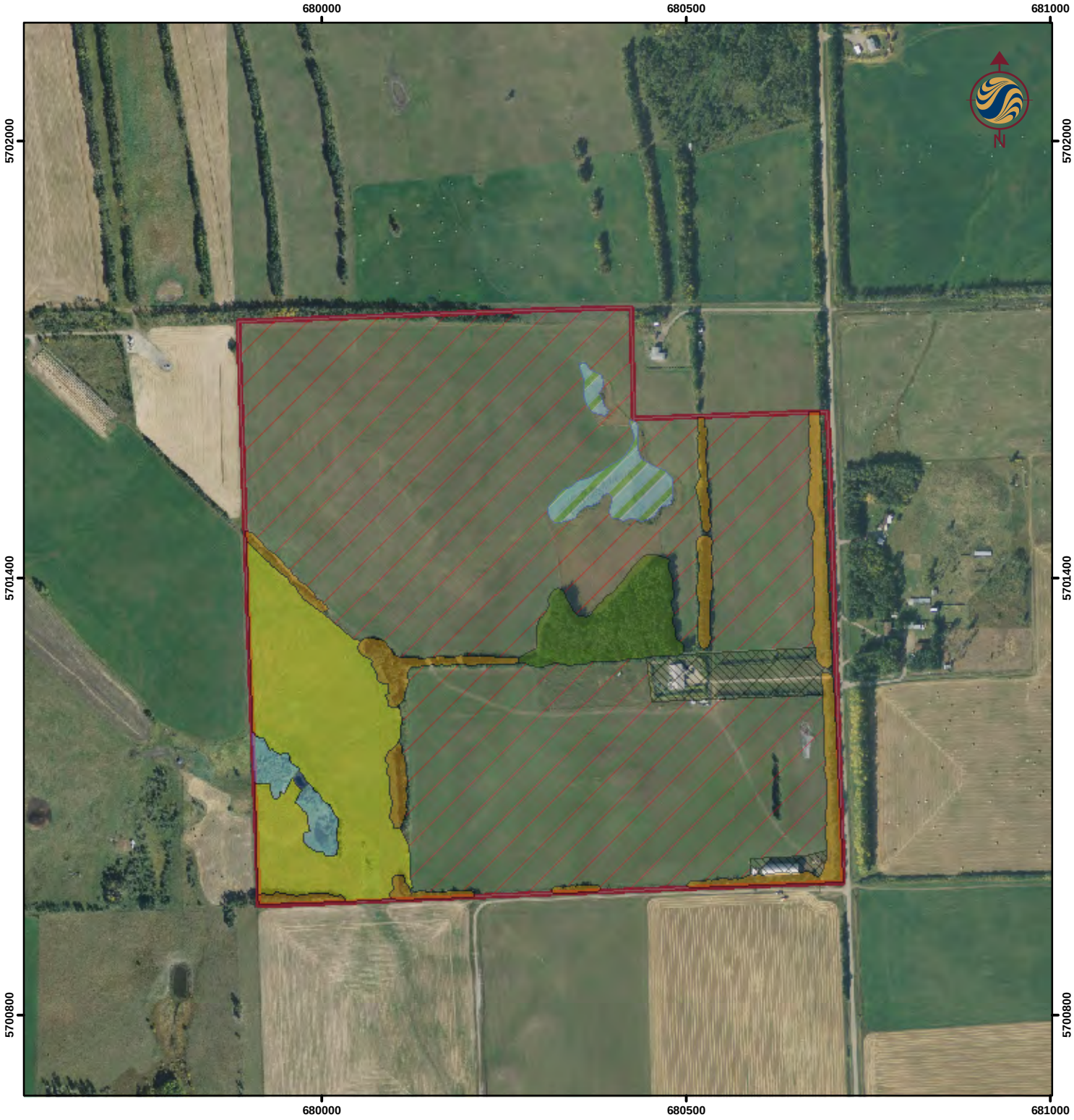
1:15,000 0 125 250 500 750 1,000 Metres

Client/Project
CHINOOK RIDGE LODGE & GOLF COURSE

CHINOOK RIDGE
BIOPHYSICAL IMPACT ASSESMENT

Figure No.
4

Title
HABITAT CONNECTIVITY RANKING



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By: rhills

August , 2011
1491-04750

Vegetation Classes

- Aspen Rose Windrows
- CPD13. Aw / Snowberry Rose
- Class II - Temporary Ponds
- Class III - Seasonal Ponds and Lakes
- Farmyard
- Salix / Carex Riparian Area
- Timothy / Alfalfa Pasture
- Timothy / Dandelion Pasture
- Subject Property

This map is for reference purposes only.

1:7,500 0 62.5 125 250 375 500 Metres

Stantec

Projection: NAD83 | UTM ZONE 11N

Client/Project
CHINOOK RIDGE LODGE & GOLF COURSE

CHINOOK RIDGE
BIOPHYSICAL IMPACT ASSESMENT

Figure No.
5

Title
VEGETATION COMMUNITY CLASSES