Biophysical Assessment for the Elan Neighbourhood

2017 Update

Prepared for:
Dream Development
c/o Invistec Consulting Ltd.
10235–101 Street, 4th Floor
Edmonton, AB T5J 3G1

Updated: April 12, 2017

Report #1722

Prepared by Fiera Biological Consulting
200, 10318–82 Avenue | Edmonton, AB T6E 1Z8 | Tel: (780) 466.6554 | Fax: (780) 466.9134 | W: fieraconsulting.ca
LETTER OF TRANSMITTAL

April 12, 2017

Mr. Ryan Eidick
Operations Manager, Manager of Planning
Invistec Consulting Ltd.
4th Floor, 10235-101 Street
Edmonton, AB T5J 3G1

Dear Mr. Eidick:

Re: Biophysical Assessment for the Elan Neighbourhood

On behalf of Dream Development, Invistec Consulting Ltd. has requested that Fiera Biological Consulting Ltd. complete this Biophysical Assessment to accompany the submission of an Area Structure Plan (ASP) for the development of the Elan neighbourhood in the Town of Beaumont. This assessment includes an evaluation of all wetlands located on lands owned by Dream Development as well as a desktop inventory of wetlands and all areas with environmental significance situated throughout the study area. Wetlands were classified using the Steward and Kantrud Classification System and were evaluated for size and permanence. Information collected in the field was supplemented by biophysical information gathered from other government and non-government sources (as available and applicable). As well, recommendations for the protection and enhancement of natural features for integration into the neighbourhood design are included based on a concept plan provided on February 15, 2017.

We are pleased to provide you with a updated version of this report. If you have any questions or comments regarding the assessment or its conclusions, please contact our office at your convenience.

Sincerely,

FIERA BIOLOGICAL CONSULTING LTD.

Shari Clare, PhD, P Biol
sclare@fieraconsulting.ca
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1. Introduction

The Elan Neighbourhood is an area of approximately 518 ha located along the western boundary of the Town of Beaumont, within Sections 28 and 33 of 50-24-4. A portion of the lands within this neighbourhood are owned by Dream Development (Dream), and in 2014, Dream initiated the development of an Area Structure Plan to outline a general framework for land use change and development within the ASP lands. At the time that the neighbourhood planning process was initiated by Dream, the lands within the Elan Neighbourhood were under the jurisdiction of Leduc County; however, in December 2016, the lands with the Elan Neighbourhood were annexed by Town of Beaumont. Given that most of the planning for the Elan Neighbourhood took place prior to the annexation, this biophysical report was developed to address the requirements of both Leduc County and the Town of Beaumont to ensure compliance with the planning policies and regulations of both municipalities.

The purpose of this biophysical assessment is to inform and support the development of the Elan Neighbourhood Area Structure Plan by identifying ecologically important and significant areas, as well as to provide recommendations on protecting the natural amenities that may be conserved within the neighbourhood. Specifically, this Biophysical Assessment includes the following:

1. A desktop-level inventory of all wetlands that occur within the neighborhood. This includes a detailed assessment and classification of the wetlands located on lands owned by Dream, and provides a description of the value and function of each of the wetlands that were assessed in the field.
2. An inventory of the existing vegetation, watercourses, and riparian areas within the neighbourhood.
3. Recommendations for the conservation, protection, and enhancement of natural features to be integrated into the neighbourhood design to reduce ecological impacts and maintain ecological connectivity.

As well, this report provides general planning recommendations and considerations that can be used to help guide decision making as it relates to maintaining or enhancing natural features and/or the ecological network within the neighbourhood and surrounding lands.

2. Study Area

The Elan neighbourhood is located within the Town of Beaumont, in 28-50-24-4 and 33-50-24-4 (Figure 1). All field work completed as part of this biophysical assessment were limited to lands owned by participating landowners (i.e., Dream), including NW and SE-33-50-24-W4, and the west half of SW-33-50-24-W4. Any natural features located on non-participating lands were evaluated using remote sensing or desktop analysis only.
Figure 1. Study area boundary for the Elan ASP, including the extent of lands owned by Dream Development where field assessments were conducted.
3. Regulatory Review

The proposed neighbourhood development is subject to a variety of municipal, provincial, and federal legislation, guidelines, and policies that have bearing on ecological planning for the neighbourhood. This biophysical assessment was developed with consideration of the following policies, guidelines, and regulations as they relate to the protection of wildlife, vegetation, and aquatic resources within the study area.

3.1. Municipal

Town of Beaumont Municipal Development Plans

Municipal Development Plans (MDPs) are high-level land use policy documents that all municipalities with a population greater than 3500 must prepare as directed by the Municipal Government Act (MGA). The Town of Beaumont MDP was created in 1998, and was most recently amended in 2009. The MDP identifies the following Parks, Recreation, and Open Spaces objectives:

- Develop a continuous pedestrian system connecting major activity areas;
- Ensure availability and accessibility of park and recreation facilities, and open spaces for residents and visitors, and;
- Integrate significant natural landforms, native tree stands, natural watercourses, and stormwater drainage features into the Park and Open Space system, where practical.

The MDP has environmental planning policies that directly relate to the Elan study area including:

- The Town will ensure that lands are available for parks, recreation, and open spaces within the community by requiring 10% of subdivided land be taken as municipal reserve, less the land required for environmental reserves;
- The Town, in conjunction with Leduc County, will protect the LeBlanc drainage canal for its regional stormwater drainage function, to buffer different land uses, to permit continued development of major open space corridors, and to provide an open space amenity area for the proposed Business Park.

It should be noted that a new MDP is in progress, and it is expected that the document will be approved by Town Council in 2017.

3.2. Provincial

Public Lands Act

The bed and shores of all permanent watercourses and water bodies are considered public lands and are owned by the Crown, unless ownership is otherwise stated. As such, approvals under the Public Lands Act [R.S.A. 2000, c. P-40] are required for any activity on the bed or shore of Crown owned rivers, streams, or lakes. A request for determination of Crown ownership under the Public Lands Act was submitted for the study area in March 2014. Two wetlands, Wetland 16 and Wetland 17, have been claimed by the Province under Section 3 of the Public Lands Act and must be retained post-development.
Water Act

The Water Act [R.S.A. 2000, c. W-3] stipulates that all water in the province is vested in the Crown. As such, an approval and/or attainment of a license are required before undertaking any works that might impact a surface water body or the aquatic environment (Province of Alberta 2013). Specific activities that require an approval include:

- Partial or complete filling of a water body for recreational, agricultural, and industrial uses, road construction, residential development, or any other purpose;
- Activities impacting or having the potential to impact (cumulative effects) the aquatic environment and involving the disturbance, alteration, or modification of a water body;
- Removal or destruction of vegetation, aquatic plants and trees within the confines of the bed and shores of a water body;
- Draining of a water body; or,
- Re-alignment of a water body.

Wetland Management in the Settled Area of Alberta (An Interim Policy)

Developed in 1993, this interim policy provides direction on the management of wetlands in the settled areas (white zone) of Alberta (Alberta Water Resources Commission 1993). The primary goal of the policy is to “sustain the social, economic, and environmental benefits that functioning wetlands provide, now and in the future” by conserving wetlands in a natural state, mitigating the degradation and loss of wetlands, and enhancing, restoring, or creating wetlands in areas where they have been depleted or degraded.

In September 2013, Alberta's new wetland policy was released. The policy implementation plan, including directives outlining standardized wetland assessment, classification and reporting methods came into effect on June 1, 2015. Water Act applications completed using wetland field assessments undertaken after June 1, 2015, must be prepared in accordance with guidelines for wetland assessment, reporting requirements, and compensation procedures outlined in the new Alberta Wetland Policy. However, as the wetland assessments conducted within the Elan neighbourhood were completed prior to the June 1, 2015 policy implementation, the interim policy, along with its wetland assessment and compensation requirements will apply to the wetlands assessed in Elan (see Section 8.1 and Appendix C for further clarification) if the Water Act application is submitted by July 5, 2017. If the application is submitted after this date, new wetland assessments must be conducted following the new provincial wetland policy requirements.

Species at Risk Program and Wildlife Act

Alberta has a Species at Risk Program, which was initiated as a response to the Province’s commitment to the Accord for the Protection of Species at Risk in Canada. The intent of the Accord is to prevent species in Canada from becoming extinct as a consequence of human activity. Any species that is designated as Endangered or Threatened becomes legally protected under Alberta’s Wildlife Act [R.S.A 2000, c.W-10]. This legal designation prohibits the disturbance, killing or trafficking of these species, and provides immediate protection of birds of prey nests and den sites. Any species that is designated as “Sensitive” after a general assessment, or as “Special Concern” after a detailed assessment becomes eligible for special management actions designed to prevent the species from becoming “At Risk”. 
The Weed Control Act

The *Weed Control Act* provides legal authority to manage native and introduced weed species that impact agricultural production. Specifically, Section 31 states: “An occupant of land, or if the land is unoccupied, the owner of the land shall, as often as is necessary:

(a) destroy all restricted weeds located on the land to prevent the spread, growth, ripening, or scattering of the restricted weeds,

(b) control in accordance with this Act and the regulation all noxious weeds located on the land to prevent the spread, growth, ripening, or scattering of the noxious weeds.

Municipal Government Act

The *Municipal Government Act* (MGA) forms the legal basis for the way local municipal governments operate in Alberta. The MGA gives municipalities responsibility for land use planning within their boundaries, and requires that each municipality create a Municipal Development Plan, which outlines policies for land use. The MGA also grants municipalities the power to designate lands as Municipal and Environmental Reserve. Upon subdivision, 10% of the total developable land area must be designated as Municipal Reserve. Environmental Reserve can also be dedicated for conservation of swamps, ravines, other natural drainage courses, and/or buffers on these areas.

### 3.3. Federal

Species at Risk Act

The Federal *Species at Risk Act* protects listed wildlife species and their critical habitats on federal lands, but does not apply to lands held by the Province of Alberta or its private citizens unless “the laws of Alberta do not effectively protect the species or the residences of its individuals”. In this case, the Minister may issue an order in council to protect federally listed species that occur on provincial or private lands.

Migratory Bird Convention Act

The *Migratory Birds Convention Act* [1994, c.22] (MBCA) is a federal legislation based on an international treaty signed by Canada and the United States of America that aims to protect migratory birds from indiscriminate harvesting and destruction on all lands within Canada. Under the MBCA, efforts should be made to provide for and protect habitat necessary for the conservation of migratory birds, and to conserve habitats that are essential to migratory bird populations, such as nesting, wintering grounds, and migratory corridors.

Fisheries Act

The *Fisheries Act* [R.S.C., 1985, C. F-14] is a federal legislation established to manage and protect Canada’s fisheries resources. This Act protects fish and fish habitat, regulates pollution prevention, the harvesting of fish, and the safe use of fish.
4. Methods

4.1. Wetland Inventory and Assessment

Under the provincial *Water Act*, the definition of a water body includes: "any location where water flows or is present, whether or not the flow or presence of water is continuous, intermittent or occurs only during a flood, and includes but is not limited to wetlands". Water bodies that meet the criteria of surface water bodies under the Act include: marshes, sloughs, prairie potholes, shallow open water, ephemeral wetlands, bogs, fens, lakes, peatlands, oxbows, swamps, muskeg, and water courses. In combination, these definitions formed the basis for the identification of wetlands for this assessment.

**Wetland Desktop Inventory**

A preliminary wetland inventory was created using a combination of terrain analysis, aerial photograph review, and a probability of open water analysis. Potential wetlands were identified using a depression finding algorithm (probability of depression) with a 15m LiDAR digital elevation model (DEM).

In addition, an open water probability map was derived to help determine the class of each wetland by combining 10 different open water maps. These open water maps were derived using historical air photos that were selected to represent a range of climate conditions. In addition, photos from years that approximated the long-term mean of P-PET (approximately -78 mm) were selected. Open water in each air photo was manually digitized and each pixel was assigned a value of zero (no water) or one (water) in each photo. The probability of open water was then calculated for each pixel by summing the value from each year, and calculating an average value. The value represents a range of probabilities from 0 to 100%, with pixels characterized as 100% representing areas covered by open water in 10 out of 10 air photos. Lower scores (e.g., 10%) indicate locations where water is more ephemeral.

A wetland boundary was digitized if the following Boolean statement was met: the probability of depression was greater than 0.3, and if one of two of the following occurred:

1. There was visual indication of wetland vegetation or saturation on the 2013 high spatial resolution aerial photo, or
2. The probability of open water was greater than 0.3.

This preliminary technique was not able to identify all wetlands due to the coarse nature of the LiDAR available. Thus, historical air photos from several years (1950, 1966, 1977, 1982, 1993, 1998, and 2013) were examined to visually identify ephemeral and temporary wetlands situated in the study area that may have been missed by depressional analysis. All wetlands identified in this inventory were given a unique identification number and the inventory was used to direct field assessment.

**Wetland Field Assessment**

Wetland field assessments were conducted on June 5 and 6, 2014. All wetlands identified through the remote sensing and desktop inventory were visited in the field to verify wetland presence. All confirmed wetlands were delineated, classified, and assessed for condition. Wetland class was confirmed using a combination of criteria, including the presence or absence of open water, the type and abundance of vegetation present in the wetland basin at the time of the field assessment, historical aerial photographs, and the wetland permanence mapping.

Wetlands situated outside the boundaries owned by Dream Development were not visited in the field. These wetlands were remotely sensed and wetland delineations were determined based on a probability of open water analysis and air photo interpretation.
Wetland Delineation

Wetland boundaries were delineated using a combination of criteria, including wetland vegetation, hydric soil assessments, and indicators of wetland hydrology are commonly used to delineate wetland boundaries (US Army Corps of Engineers, 2010). As the majority of the wetlands within the study area had been previously impacted by agricultural disturbances, the hydrologic properties of the wetlands had been altered, and were thus mostly unreliable in determining the wetland boundaries. Instead, boundaries were determined primarily through changes in vegetation. Wetland boundary were delineated where there was a marked change in abundance from facultative wetland species (i.e. species that have a 34-100% estimated probability of occurring in wetlands) to facultative upland species (i.e. species that have a 67-100% estimated probability of occurring in upland areas). In instances where vegetation couldn’t reliably provide wetland boundaries, a soil pit was dug to assess hydric soil properties. Hydric soils are characterized by several indicators, including redox concentrations present in the soil, thick layers of organic material, and/or a depleted or gleyed matrix.

Wetland Classification

Given that wetland surveys were completed prior to the implementation of the new Alberta Wetland Classification System (AWCS; ESRD 2015), wetlands were classified using the Stewart and Kantrud wetland classification system (Stewart & Kantrud 1971), which primarily classifies wetlands on the basis of the dominant vegetation community present in the central or deepest part of the wetland basin (Table 1).

<table>
<thead>
<tr>
<th>Wetland Class</th>
<th>Description</th>
<th>Defining Vegetation</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Ephemeral</td>
<td>Wetland low-prairie</td>
</tr>
<tr>
<td>II</td>
<td>Temporary</td>
<td>Wet meadow</td>
</tr>
<tr>
<td>III</td>
<td>Seasonal</td>
<td>Shallow marsh</td>
</tr>
<tr>
<td>IV</td>
<td>Semi-permanent</td>
<td>Deep marsh</td>
</tr>
<tr>
<td>V</td>
<td>Permanent</td>
<td>Open water</td>
</tr>
<tr>
<td>VI</td>
<td>Alkaline</td>
<td>Salt-tolerant</td>
</tr>
</tbody>
</table>

Wetland Assessment

Wetland condition was assessed for condition using an adapted rapid assessment method (RAM) that was developed specifically for wetlands in the central Parkland region of Alberta (Bayley 2009). The RAM uses four metrics, comprised of a total of 19 different indicators, to assess wetland condition. The metrics, and the weightings that were used to score the wetlands, included:

- Size (5%)
- Upland buffer and surrounding land use (40%)
- Hydrology (15%)
- Vegetation and vegetation communities (40%)

All wetlands that had water present at the time of assessment were assessed for water quality using 5 additional indicators. The water quality score is presented separately from the RAM score, as several of the wetlands assessed did not contain water at the time of assessment, and therefore could not be applied consistently to all wetlands in the study area.

For each wetland assessment, the vegetation and vegetation community metric was focused on the riparian, emergent, wet meadow, and open water vegetation zones. The boundary of each wetland was navigated using a meander search pattern in an effort to maximize the number of new vegetation species encountered. A portion of the assessment was focused on detecting and documenting the occurrence of avifauna, amphibians, mammals, and species at risk. All
shorelines and riparian areas adjacent to water bodies were visually scanned for amphibians, and any detection by sight or sound was noted. The duration of each wetland assessment varied depending on the size and complexity of the wetland, but generally ranged from 15 minutes for small or simple sites (e.g. wetlands that had been very heavily impacted), to 120 minutes for large and complex sites.

Each wetland was assigned a score out of a possible maximum of 100, with higher quality (condition) wetlands receiving higher scores. All Class III to V wetlands, as well as Class I or II wetlands that had not been severely impacted by anthropogenic activities (e.g. agricultural land use), that were located on participating lands were assessed using this RAM. These RAM scores provide a relative value for each wetland assessed, allowing for direct comparisons between wetlands. Wetlands located on non-participating land could not be assessed or scored using the RAM. These wetlands were delineated and classified using the remotely sensed wetland inventory as well as air photo interpretation. Wetland classification and delineation of remotely sensed wetlands should be confirmed in the field during future planning stages and prior to any development or construction activities.

In many cases, wetlands encountered in the field had been severely impacted by agricultural or other anthropogenic land use, i.e., the wetland basin had been cultivated such that little or no evidence of wetland vegetation remained. In these cases, a modified RAM method was used to assess heavily impacted wetlands. The modified RAM included the same metrics as listed above; however, the indicators were not individually scored. Given that many of the Class I and II wetlands assessed did not contain water, the water quality metric was discarded from the final modified RAM score calculation. As a result, scores derived using the modified RAM are not directly comparable to the scores derived using the full RAM. However, the modified RAM scores do provide a relative condition score for Class I and II wetlands that were assessed using the modified RAM, allowing for direct comparisons between the wetlands assessed using this method.

4.2. Tree Stand Assessment
No natural tree stands occur within the study area. Small pockets of treed areas associated with wetlands were noted and assessed with the associated wetland.

4.3. Watercourse Assessment
The Elan study area had been heavily disturbed by the agricultural surroundings and historical air photo review identified the creation of several drainage ditches within the study area. Most of these anthropogenic features conduct water only during the spring and during heavy rainfall events. Field assessment of these features was limited to lands owned by Dream Development. Field assessments were focused on the LeBlanc Canal, which was identified as an important feature to be integrated into the future urban development within the Elan ASP Terms of Reference (Leduc County 2014)
5. Results

5.1. Historical Conditions

The study area is located in the Central Parkland Natural Subregion of Alberta, which is a transition zone between grasslands to the south and closed aspen forests to the north. This entire subregion has been intensely cultivated due to the fertile nature of the soils. Reports vary, but recent information suggests that approximately 5% of the Central Parkland Natural Subregion remains covered by native vegetation (Natural Regions Committee 2006). The patches of remaining native parkland vegetation are generally restricted to areas unsuitable for agriculture due to topography or soil constraints. Wetlands make up approximately 10% of the Central Parkland Natural Subregion (Natural Regions Committee 2006).

Native grassland communities in this sub-region are dominated by plains rough fescue, or co-dominated by western porcupine grass, northern wheat grass, and a variety of perennial herbs. Shrub communities of western snowberry, silverberry, prickly rose, chokecherry, and Saskatoon berry dominate moderately well drained sites. Treed areas in the subregion are dominated by stands of aspen with diverse understories that vary with soil type and moisture. Understory species typical of aspen stands include: Saskatoon berry, prickly rose, beaked hazelnut, and a variety of forbs and grasses. Balsam poplar and white spruce are common on moist, rich sites. Low wet areas are typically dominated by common cattail, sedges or bulrushes, and willow shrub lands.

The project area is located in the North Saskatchewan River Basin, which is comprised of 12 tertiary watersheds. The Elan ASP study area is located in the northeastern portion of the Strawberry subwatershed. As of 2005, land use in the Strawberry subwatershed was dominated by agricultural land uses. In addition to agriculture, approximately 19% of the watershed was classified as developed (urban, peri-urban, and industrial), and 2% of the watershed area was comprised of constructed or natural water bodies (NSWA 2005).

Wildlife

A review of sensitive wildlife occurrences reported for the study area included a search of the provincial Fisheries and Wildlife Management Information System (FWMIS). Four sensitive species have been reported to occur within a 5-km radius of the study area (Table 2). These species have the potential to use the study area, given the current combination of upland agriculture and wetland habitat. The American kestrel (Falco sparverius), Swainson’s hawk (Buteo swainsoni), and short-eared owl (Asio flammeus) are birds of prey that can potentially use the open agricultural fields found in the study area to hunt prey. The wetlands located in the study area provide suitable habitat for the northern leopard frog (Lithobates pipiens). The provincial (Government of Alberta 2017) and federal (Government of Canada 2017) status of each species is reported in Table 2. A copy of the FWMIS search report is included in Appendix A.

Table 2. Wildlife species reported to have occurred within a 5 km radius of the study area by the provincial Fisheries and Wildlife Management Information System database.

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Provincial Status</th>
<th>SARA status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birds</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>American Kestrel</td>
<td>Falco sparverius</td>
<td>Sensitive</td>
<td>Not Assessed</td>
</tr>
<tr>
<td>Swainson’s Hawk</td>
<td>Buteo swainsoni</td>
<td>Sensitive</td>
<td>Not Assessed</td>
</tr>
<tr>
<td>Short-eared Owl</td>
<td>Asio flammeus</td>
<td>May be At Risk</td>
<td>Special concern</td>
</tr>
<tr>
<td>Amphibians</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northern Leopard Frog</td>
<td>Lithobates pipiens</td>
<td>At Risk</td>
<td>Endangered</td>
</tr>
</tbody>
</table>
Rare Plants

The Alberta Conservation Information Management System (ACIMS) was queried to provide information regarding any known occurrence of rare plant species within the project area and vicinity. No rare plant occurrence records were reported for this location; however, it should be noted that an absence of records does not necessarily indicate that rare plants do not exist in the area. Rather, a lack of records may be a result of having very few or no inventories completed in the area. Additionally, rare plants are often found at different times during the growing season; therefore, the timing or length of surveys can be a factor in whether rare plants are detected. A comprehensive rare plant survey was not conducted as part of this assessment. The copy of the ACIMS search report is included in Appendix B.

5.2. Existing Conditions

Land Use

Current land use within the study area is dominated by agriculture. Several commercial developments also exist within the study area including Cheyenne Tree Farms Ltd (NE-33-50-24-4), Journey’s End RV Storage Ltd. (NE-28-50-24-4), as well as a small elk farm located within SW-28-50-24-4. The east side of quarter section SW-33-50-24-4 is home to the Beaumont and District Agricultural Society. This 70-acre facility hosts horse jumping events and other equine competitions as well as many community events. Several private residences exist within the study area.

The study area includes many ephemeral, seasonal, and permanent wetlands though many have been impacted by surrounding agriculture and by the creation of drainage ditches. One such drainage ditch, located in the NE corner of section 33-50-24-4, locally known as LeBlanc Canal, is connected to Irvine Creek, a tributary to the Blackmud Creek and, eventually, the North Saskatchewan River. LeBlanc Canal passes through the Town of Beaumont and is fed by several stormwater management facilities, and is vital to the overall stormwater management system of the town (Stantec 2011).

5.3. Wetland Inventory

A field assessment to identify wetlands within the study area was conducted on June 5 and 6, 2014. Average rainfall recorded at the Edmonton International Airport in May was 37.4 mm; the May historical average is 42.9 mm (Government of Canada, accessed July 10, 2014). As a result, many of the wetlands in the study area contained water at the time of assessment, and likely represented conditions related to normal or near normal hydroperiod.

In total, the wetland inventory identified 46 water bodies within the Elan ASP study area. Seventeen of the semi-permanent and permanent water bodies identified in the study area were determined from historical air photos to be anthropogenically created (i.e. dugouts), with the remaining 29 water bodies classified as wetlands (Table 3 and Table 4). Of the 29 wetlands, nine were assessed in the field using the Rapid Assessment Method, where wetland boundaries and class were verified in the field. In addition, three of the anthropogenic water bodies were assessed in the field. The remaining 34 water bodies (including 14 anthropogenic water bodies) were located on non-participating lands; as a result, the location, class, and boundaries of these wetlands could not be field verified (Table 4).

The majority of the field verified wetlands were Class I or II. Three wetlands were Class I, which are characterized as having surface water for only short periods in the spring, and are typically dominated by bluegrass, goldenrod, and other wetland low-prairie species (Stewart & Kantrud 1971). Four wetlands were classified as Class II, which are dominated by wet meadow vegetation such as fine-stemmed grasses, sedges and associated wet forbs (Stewart & Kantrud 1971). These wetlands are low-lying areas covered by standing or slow-moving water for several weeks after snowmelt, or after a heavy rainfall event. One wetland was classified as Class III, which
typically contain persistent water until July or August, and are characterized by shallow marsh vegetation in the center of the wetland that is dominated by emergent wetland grasses, sedges, and rushes. The remaining wetland was a Class IV. Class IV wetlands maintain water throughout the growing season (May to September), and are dominated by deep marsh vegetation in the center of the wetland, with the emergent zone characterized by cattails, bulrushes, and pondweeds (Stewart & Kantrud 1971).

Table 3. Stewart and Kantrud classification and number of wetland and water bodies that were field verified in the ASP study area.

<table>
<thead>
<tr>
<th>Class</th>
<th>Number</th>
<th>Description</th>
<th>Hydroperiod</th>
<th>Defining Vegetation</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>3</td>
<td>Ephemeral</td>
<td>Weeks</td>
<td>Wetland low prairie</td>
</tr>
<tr>
<td>II</td>
<td>4</td>
<td>Temporary</td>
<td>Weeks</td>
<td>Wet meadow</td>
</tr>
<tr>
<td>III</td>
<td>1</td>
<td>Seasonal</td>
<td>May-July</td>
<td>Shallow marsh</td>
</tr>
<tr>
<td>IV</td>
<td>1</td>
<td>Semi-Permanent</td>
<td>May-Sept</td>
<td>Deep marsh</td>
</tr>
<tr>
<td>V</td>
<td>0</td>
<td>Permanent</td>
<td>Year round</td>
<td>Open marsh</td>
</tr>
<tr>
<td>Anthropogenic</td>
<td>3</td>
<td>Human Created (e.g. dug out)</td>
<td>Year round</td>
<td>Open water</td>
</tr>
</tbody>
</table>

Table 4. Stewart and Kantrud classification and number of wetland and water bodies that were remotely sensed in the Elan ASP study area.

<table>
<thead>
<tr>
<th>Class</th>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I/I/III</td>
<td>19</td>
<td>Ephemeral/Temporary/Seasonal</td>
</tr>
<tr>
<td>IV/V</td>
<td>1</td>
<td>Semi-permanent/Permanent</td>
</tr>
<tr>
<td>Anthropogenic</td>
<td>14</td>
<td>Human Created (e.g. dug-out)</td>
</tr>
</tbody>
</table>
Figure 2. Location and class of all water bodies identified pre-development in the Elan ASP study area in June 2014.
Figure 3. Location of all wetlands and water bodies that were field verified in the Elan ASP study area pre-development.
Figure 4. Location of all water bodies that were identified by remote sensing and were not verified in the field within the Elan ASP study area.
5.4. Wetland Condition Assessments

A total of six wetlands were assessed in the field using the Full RAM method (Table 5). Scores for wetlands assessed using the full RAM ranged between 21 and 41, and water quality scores ranged between 37 and 42 for the two wetlands with standing or open water. A detailed description of each wetland visited in the field is provided below.

Table 5. Wetlands assessed using the full Rapid Assessment Method (RAM)

<table>
<thead>
<tr>
<th>Wetland Class</th>
<th>Wetland ID</th>
<th>Area (ha)</th>
<th>RAM Score</th>
<th>Water Quality Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class I</td>
<td>133</td>
<td>3.61</td>
<td>21</td>
<td>N/A</td>
</tr>
<tr>
<td>Class II</td>
<td>119</td>
<td>0.11</td>
<td>32</td>
<td>N/A</td>
</tr>
<tr>
<td>Class II</td>
<td>127</td>
<td>0.07</td>
<td>31</td>
<td>N/A</td>
</tr>
<tr>
<td>Class II</td>
<td>121</td>
<td>0.02</td>
<td>30</td>
<td>N/A</td>
</tr>
<tr>
<td>Class III</td>
<td>120</td>
<td>0.64</td>
<td>40</td>
<td>37</td>
</tr>
<tr>
<td>Class IV</td>
<td>9</td>
<td>2.18</td>
<td>41</td>
<td>42</td>
</tr>
</tbody>
</table>

Class I and II wetlands that had been heavily impacted by agricultural activities (i.e. the wetland basin has been entirely cultivated) were assessed using a modified RAM protocol. RAM scores ranged from 17.5 to 26. A summary of the Class I and II wetlands, including a description, size, and score is presented in Table 6. These wetlands are not described further in this report.

Table 6. Heavily impacted wetlands within the Elan ASP area, assessed using the modified RAM protocol.

<table>
<thead>
<tr>
<th>Wetland Class</th>
<th>Wetland ID</th>
<th>Description</th>
<th>Area (ha)</th>
<th>RAM Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class I</td>
<td>136</td>
<td>Situated between two small tree stands, no standing water, partial riparian zone.</td>
<td>0.053</td>
<td>26</td>
</tr>
<tr>
<td>Class I</td>
<td>122</td>
<td>Surrounded by cultivation, no standing water, basin has been cultivated.</td>
<td>0.129</td>
<td>20.5</td>
</tr>
<tr>
<td>Class II</td>
<td>4</td>
<td>Surrounded by cultivated field, some standing water, little new vegetation growth.</td>
<td>0.253</td>
<td>17.5</td>
</tr>
</tbody>
</table>
A. Class I Wetlands

Wetland 133

Stewart and Kantrud Class:  I
Location (3TM):  5914843N 36393E
Size (ha):  3.61
RAM Score:  21
Water Quality Score:  N/A
Claimed by province:  No

This large wetland was dominated by grasses and sedges (Carex spp.). Little standing water existed within the wetland, with the exception of standing water found within anthropogenically modified channels. The largest such channel, the LeBlanc Canal, passed through the northern portion of Wetland 133 providing hydrological connectivity throughout the general area. The wetland acted as a floodplain to the LeBlanc Canal during annual spring runoff events, thereby supporting the Class I designation of this wetland. In addition, this area is hayed at least once per year by the local farmer (pers. comm K. Klapstein). Several treed areas, composed primarily of aspen (Populus tremuloides) and willows (Salix spp.) exist on the periphery of the wetland. Wetland delineation was based on subtle differences in vegetation and the extent of hydric soils.

Photo 1. Wetland 133 photographed in June 2014.
B. Class II Wetlands

Wetland 119

<table>
<thead>
<tr>
<th>Stewart and Kantrud Class:</th>
<th>II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location (3TM):</td>
<td>5914007N 36749W</td>
</tr>
<tr>
<td>Size (ha):</td>
<td>0.11</td>
</tr>
<tr>
<td>RAM Score:</td>
<td>32</td>
</tr>
<tr>
<td>Water Quality Score:</td>
<td>N/A</td>
</tr>
<tr>
<td>Claimed by province:</td>
<td>No</td>
</tr>
</tbody>
</table>

Wetland 119 was located in a small depression and was dominated by cattail (*Typha latifolia*), rushes (*Eleocharis palustris*), and grasses. Though no standing water was present at the time of the assessment, the soils were saturated with water. Cultivated field surrounded this wetland and little riparian zone existed. An anthropogenically modified channel, conveying water through quarter section SE-33-50-24-4, was located in close proximity and likely provides hydrologic connectivity to Wetland 119.

Photo 2. Wetland 119 photographed in June 2014.
Wetland 127

Stewart and Kantrud Class: II
Location (3TM): 5913757N 36017E
Size (ha): 0.07
RAM Score: 31
Water Quality Score: N/A
Claimed by province: No

Wetland 127 was a Class II wetland surrounded by row cropping and dominated by cattails (*Typha latifolia*) and bulrush (*Scirpus lacustris*). No standing water was visible within the wetland during the field survey, though saturated soils were present. This wetland had been heavily impacted by the surrounding row crop and by farming equipment, with tire tracks having been observed running through the wetland. Boreal chorus frogs (*Pseudacris maculata*) were observed within the wetland.

Photo 3. Wetland 127 photographed in June 2014.
Wetland 121

Stewart and Kantrud Class: II
Location (3TM): 5913593N 37021
Size (ha): 0.02
RAM Score: 30
Water Quality Score: N/A
Claimed by province: No

This Class II wetland was located within a small depression surrounded by row cropping. The wetland was dominated by cattails (*Typha latifolia*) and bulrush (*Scirpus lacustris*) and had saturated soils but no standing water. The wetland had previously been cultivated.

Photo 4. Wetland 121 photographed in June 2014.
C. Class III Wetlands

Wetland 120

Stewart and Kantrud Class: III
Location (3TM): 5913601N 36874E
Size (ha): 0.64
RAM Score: 40
Water Quality Score: 37
Claimed by province: No

Wetland 120 was a Class III wetland located within quarter section SE-33-50-24-4. The wetland was dominated by cattails (*Typha latifolia*) and bulrush (*Scirpus lacustris*), and some standing water was detected during the field survey. Canada geese (*Branta canadensis*) and boreal chorus frogs (*Pseudacris maculata*) were observed at this wetland.

A channelized drainage ditch crossing the quarter section connects this wetland to nearby Wetland 119. The channel was vegetated with young poplars (*Populus* spp.), willows (*Salix* spp.), and aquatic vegetation, including water parsnip (*Sium suave*) and duckweed (*Lemna minor*). The channel likely connects to the LeBlanc Canal in quarter section NE-28-50-24-4, though the prominence of the ditching decreased in the northern portion of the channel.

Photo 5. Wetland 120 photographed in June 2014.
D. Class IV Wetlands

Wetland 9

Stewart and Kantrud Class: IV
Location (3TM): 5913672N 35749W
Size (ha): 2.18
RAM Score: 41
Water Quality Score: 42
Claimed by province: No

Wetland 9 was an extensive wetland located within SW-33-50-24-4. This class IV wetland was dominated by rushes (*Eleocharis palustris*), bulrushes (*Scirpus lacustris*), cattails (*Typha latifolia*), and other graminoid species (grasses, sedges). Patches of shrubs provided a sparse riparian area surrounding the wetland. A small, isolated patch of upland habitat was centrally located within the wetland, and was wholly surrounded by wetland habitat as indicated by saturated soils, standing water, and hydrophytic vegetation. Several species of noxious weeds were present within this wetland including scentless chamomile (*Matricaria maritime*) and Canada thistle (*Cirsium arvense*). Notable wildlife observations included moose (*Alces alces*), deer (*Odocoileus* sp.), coyote (*Canis latrans*), wood frog (*Rana sylvatica*), boreal chorus frog (*Pseudacris maculata*), red-winged blackbird (*Agelaius phoeniceus*), mallards (*Anas platyrhynchos*), and sora rail (*Porzana carolina*).

![Wetland 9 photographed in June 2014.](image-url)
E. Anthropogenic Water Bodies

In total, 17 wetlands within the study area were determined to be anthropogenically created water bodies. Of these, three were assessed in the field, and historic air photos were used to confirm that these features were human-created and not naturally occurring wetlands that had been modified (Table 7). Generally, these features were characterized as having regular, linear shorelines, with steep slopes and little to no emergent or wet meadow vegetation. While these features are not naturally occurring, many of them have been on the landscape for an extended period of time, and as such, do offer habitat for aquatic species, particularly waterfowl. A description of all anthropogenic features assessed in the field is provided below.

Table 7. Scores for anthropogenic water bodies field assessed in the Elan ASP study area.

<table>
<thead>
<tr>
<th>Water Body ID</th>
<th>Area (ha)</th>
<th>RAM Score</th>
<th>Water Quality Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>123</td>
<td>0.04</td>
<td>48</td>
<td>42</td>
</tr>
<tr>
<td>130</td>
<td>0.051</td>
<td>36</td>
<td>39</td>
</tr>
<tr>
<td>2</td>
<td>0.358</td>
<td>24</td>
<td>68</td>
</tr>
</tbody>
</table>
Water Body 123

Location (3TM): 5914138N 35916E
Size (ha): 0.04
RAM Score: 48
Water Quality Score: 42
Claimed by province: No

This dugout was situated within a farmyard and was characterized by a large open water zone and a partially intact riparian buffer consisting of poplars (Populus tremuloides) and willows (Salix spp.). Dominant species within the wetland included sedges (Carex spp.), northern water-plantain (Alisma triviale), creeping spike rush (Eleocharis palustris), bluejoint reed grass (Calamagrostis canadensis), and pondweed (Potamogeton gramineus). Air photo review suggests this dugout was constructed prior to 1993.

Water Body 130

Location (3TM): 5914524N 35782E
Size (ha): 0.05
RAM Score: 36
Water Quality Score: 39
Claimed by province: No

Water Body 130 was an open-water dugout located within a farmyard, in close proximity to a quonset hut and several silos. The steep sloped sides of this dugout supported a riparian zone dominated by cattails (*Typha latifolia*) and some willow shrubs (*Salix* spp.). This water body had high non-native species cover, which included scentless chamomile (*Matricaria perforata*), hempnettle (*Galeopsis tetrahit*), and stinkweed (*Thlapsi arvense*). 

Photo 8. Water Body 130 photographed in June 2014.
Water Body 2

Location (3TM): 5914954N 35989E
Size (ha): 0.36
RAM Score: 24
Water Quality Score: 68
Claimed by province: No

Water Body 2 was located adjacent to Township Road 510, in the north portion of NE-33-50-24-4. The riparian zone was limited due to the steep slopes surrounding the dugout, but included patches of rushes (Eleocharis palustris), cattails (Typha latifolia), and sparse shrubs (Salix spp. and Populus spp.). Signs of erosion were evident. This water body was mostly surrounded by agriculture, though a farmyard was located directly west of the dugout. Notable wildlife observations included muskrat and waterfowl.

5.5. Watercourse Assessment

Several permanent and semi-permanent anthropogenic watercourses are found within the Elan ASP area (Figure 5), the most significant of which is the LeBlanc Canal. The LeBlanc Canal passes through the Elan study area in the northeast corner and travels through Beaumont, with several drainage ditches trailing off the main canal and through most of study area. This canal is a major component to the overall stormwater management system of the Town of Beaumont, as several stormwater management facilities within Beaumont feed into and provide overflow relief to the LeBlanc Canal.

At the time of assessment, high water levels were observed within the canal in NW-33-50-24-4. No riparian zone was present within this section. Signs of erosion on the banks and sedimentation within the canal were evident. The canal had been periodically channelized and the vegetation removed to ensure continuous water flow through the area (pers. comm. K. Klapstein). Dominant vegetation included sedges (Carex spp.) consistent with the wetland surrounding the Canal (Wetland 133). Field assessment and air photo interpretation indicated that this wetland acts as a floodplain for spring runoff and storm events.

![LeBlanc Canal](image)

Photo 10. LeBlanc Canal photographed in June 2014 from quarter section NE-33-50-24-4.
Figure 5. Watercourses within and surrounding the Elan study area.
6. Overview of Proposed Development

Planning of the Elan neighbourhood was a collaborative process that included engineers, urban planners, biologists, as well as Town of Beaumont and Leduc County representatives. Underlying the goal of the planning process was the desire to retain high quality permanent wetlands and create pedestrian connectivity to all green spaces, including linkages to the west with East Vistas and east with other neighbourhoods within Town of Beaumont. As such, the overall design of the post-development ecological network was informed by principles of conservation planning and ecological design.

The retained wetlands were targeted for retention because they provide important habitat elements and were considered important for overall connectivity. Semi-natural habitats were then strategically located to enhance or buffer natural habitats within the network, with consideration given to maintaining core habitat patches as well as maintaining connectivity and wildlife movement corridors.

6.1. Post-Development Ecological Network

Semi-Natural Habitat

Semi-natural habitat, such as parks, school sites, and naturalized stormwater management facilities (SWMFs) offer habitat to a variety of species that are adapted to urban environments. These areas also increase permeability of the urban matrix and help to facilitate wildlife movement across the landscape by creating movement corridors or stepping stone habitats between core areas. The Elan neighbourhood is proposed to include 88.59 ha of semi-natural habitat, including public utility lots and right-of-ways, parks, greenways, stormwater management facilities (SWMFs), and a constructed super wetland complex (see Table 8 and Figure 6). The super wetland complex is proposed to include a series of interconnected semi-natural constructed wetlands that will function to regulate stormwater for the Town of Beaumont as well as in the region surrounding the study area (see Section 6.1.3 for more information). Semi-natural habitat represents ~18% of the gross developable area of the proposed Elan neighbourhood.

Semi-natural habitat in Elan is distributed fairly evenly across the neighbourhood, and consists of large areas of green space for schools and parks, as well as many greenway corridors connecting parks, SWMFs, and neighbourhoods (Figure 6). In addition, SWMF placement was chosen to create additional ecological and pedestrian linkages of semi-natural habitat that further connect the neighbourhood. By creating connected habitat, the neighbourhood as a whole can serve as an important movement corridor for wildlife. Large patches of semi-natural habitat will improve permeability for wildlife within the neighbourhood and act as foraging, breeding, and resting habitat for small mammals and birds.

Several public utility lots (PUL), including two pipelines and a sewer/waterline situated in the south, exist within the neighbourhood and act as wildlife movement corridors. These PULs bisect the neighbourhood in three different places and provide connectivity laterally through the neighbourhood for both small- and medium-sized animals. Some of these corridors provide linkages to SWMFs, their buffers, and other open spaces, thereby improving the potential accessibility of wildlife to these areas.

Table 8. Summary of the type and area of semi-natural land uses proposed for the Elan neighbourhood post-development.

<table>
<thead>
<tr>
<th>Semi-Natural Land Use</th>
<th>Area (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LeBlanc Canal ROW</td>
<td>5.85</td>
</tr>
<tr>
<td>Public Utility Lot</td>
<td>9.76</td>
</tr>
<tr>
<td>Parks and greenways (MR)</td>
<td>37.37</td>
</tr>
<tr>
<td>Super Wetland Complex</td>
<td>10.78</td>
</tr>
<tr>
<td>Stormwater Management Facilities</td>
<td>24.83</td>
</tr>
<tr>
<td>Total</td>
<td>88.59</td>
</tr>
</tbody>
</table>
Figure 6. Location of semi-natural habitat that contributes to the ecological network of the Elan neighbourhood ASP.
Wetlands

Of the 46 wetlands identified in the Elan study area, two will be retained (Table 9). Both retained wetlands will be completely avoided, with no direct impacts to the wetland basin (Figure 7). As per the requirements of the Municipal Government Act, a minimum buffer of 6 m will be placed around each retained wetland. Proposed arterial and collector roadways have been aligned so as to not impact any retained wetlands.

In total, 44 wetlands, of which 27 are naturally occurring, will be completely lost as a result of development within the Elan neighbourhood (Table 10). The wetlands lost consist of field-verified Class I, II, III and IV wetlands, remotely-sensed Class I/II/III wetlands, and anthropogenic water bodies.

Table 9. All natural features that are proposed for retention in the Elan neighbourhood, including the retention tool that is proposed for each wetland.

<table>
<thead>
<tr>
<th>Wetland</th>
<th>Class*</th>
<th>Area Retained</th>
<th>Retention Strategy</th>
<th>Retention Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>I/II/III</td>
<td>0.6</td>
<td>Retain</td>
<td>ER</td>
</tr>
<tr>
<td>17</td>
<td>IV/V</td>
<td>1.6</td>
<td>Retain</td>
<td>ER</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>2.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Wetland class estimated using remote sensing methods; final classification and area should be confirmed through a field assessment.

Table 10. Summary of wetlands in the Elan Neighbourhood, including percent of wetland area that may be retained post-development, presented by class. Retained area calculations include wetlands that are proposed to be completely retained. Lost area calculations include both complete and partial losses.

<table>
<thead>
<tr>
<th>Class</th>
<th>Total Number</th>
<th>Total Area (ha)</th>
<th>Number of Retained Wetlands</th>
<th>Retained Area (ha)</th>
<th>Lost Area (ha)</th>
<th>% Area retained</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>3</td>
<td>3.8</td>
<td>0</td>
<td>0.0</td>
<td>3.8</td>
<td>0</td>
</tr>
<tr>
<td>II</td>
<td>4</td>
<td>0.5</td>
<td>0</td>
<td>0.0</td>
<td>0.5</td>
<td>0</td>
</tr>
<tr>
<td>III</td>
<td>1</td>
<td>0.6</td>
<td>0</td>
<td>0.0</td>
<td>0.6</td>
<td>0</td>
</tr>
<tr>
<td>IV</td>
<td>1</td>
<td>2.2</td>
<td>0</td>
<td>0.0</td>
<td>2.2</td>
<td>0</td>
</tr>
<tr>
<td>V</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0.0</td>
<td>0.0</td>
<td>0</td>
</tr>
<tr>
<td>I/II/III</td>
<td>19</td>
<td>11.7</td>
<td>1</td>
<td>0.6</td>
<td>11.1</td>
<td>5</td>
</tr>
<tr>
<td>IV/V</td>
<td>1</td>
<td>1.6</td>
<td>1</td>
<td>1.6</td>
<td>0.0</td>
<td>100</td>
</tr>
<tr>
<td>Anthropogenic</td>
<td>17</td>
<td>3.6</td>
<td>0</td>
<td>0.0</td>
<td>3.6</td>
<td>0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>46</td>
<td>24.0</td>
<td>2</td>
<td>2.2</td>
<td>21.8</td>
<td>9.2</td>
</tr>
</tbody>
</table>
Figure 7. Wetlands that will be retained in the Elan neighbourhood.
LeBlanc Canal and Super Wetland Complex

The LeBlanc Canal and its right-of-way (5.85 ha) will be retained within the Elan neighbourhood. This drainage feature will be incorporated into a “super wetland complex”, situated centrally in the north of the neighbourhood (see Figure 6). The super wetland complex is expected to include lands north of the Elan neighbourhood boundaries to manage annual flooding issues in this area and the Town of Beaumont.

The super wetland complex will be situated in the approximate location of Wetland 133, a 3.6 ha ephemeral (Class I) wetland. This area currently floods during annual spring runoff and heavy storm events. The proposed 10.78 ha wetland complex will consist of a series of constructed, naturalized wetlands interconnected through channels and overflow weirs. The wetlands will vary in elevation, be created to include benching where deeper water pools will be located throughout the complex, and be vegetated with wetland species. The expected result will be a wetland complex with zones that experience seasonal drawdowns, zones that maintain water throughout the growing season, and areas in between the high and low water marks that will be seasonally wet. The complex will be designed to treat runoff discharging from the neighbourhood as well as manage stormwater up to and including the 1:100 year storm design event.

As the wetlands will vary in elevation, and will maintain different high water levels, a diversity of wetland vegetation will be supported within the complex. The complex may support marsh, emergent, submersed, and riparian vegetation, creating high quality, diverse wildlife habitat and offering water purification for the area. The completed super wetland complex is expected to offer interpretive opportunities through low-impact trails (mulch and/or gravel), boardwalks, and signage educating residents about the ecological functions and benefits of wetlands. Further details surrounding the construction and design of the super wetland complex will be provided at the subdivision stage.

Post-Development Ecological Network

When the area of semi-natural and natural habitat is combined, the total area of the post-development ecological network in the Elan neighbourhood is expected to be 91.34 ha (Figure 8, Table 11).

Table 11. Summary of the type and area of semi-natural lands that are proposed for retention in the Elan neighbourhood.

<table>
<thead>
<tr>
<th>Ecological Network Component</th>
<th>Area (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semi-natural habitat</td>
<td>88.59</td>
</tr>
<tr>
<td>Retained naturally occurring wetlands (including 6m buffer)</td>
<td>2.75</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>91.34</strong></td>
</tr>
</tbody>
</table>
Figure 8. Proposed post-development ecological network in the Elan neighbourhood, including both natural and semi-natural habitat.
7. Ecological Impact Assessment

The Elan ASP covers an area of approximately 518 ha, with the neighbourhood expected to house over 17,350 residents (Invistec Consulting Ltd. 2014) once fully built out. The neighbourhood has been annexed by the Town of Beaumont, and is located at the far west end of the town. Due to the proximity of the neighbourhood to land identified as Environmentally Significant Areas (ESAs) in Leduc County, planning and management of natural features and connectivity within the neighbourhood has important implications for wildlife habitat and movement in the area.

As development of the neighbourhood progresses, the number of wetlands within Elan will decline, and the ecological impacts that will result from this loss are expected to have both immediate and long-term impacts on wildlife and wildlife habitat. The anticipated impacts of urban development on these habitats includes a disruption of existing hydrological conditions, impacts to the quality and quantity of surface water, reduced habitat diversity and connectivity, introduction of invasive species, and increased human use. These impacts are discussed in more detail below.

7.1. Disruption of Existing Hydrological Conditions

Hydrology is one of the most important factors in the establishment and maintenance of wetland processes (Charman 2002; Rydin and Jeglum 2006). Hydrologic conditions affect salinity, oxygen levels, and nutrient availability, which, in turn, influence the flora and fauna assemblages found within a wetland (USEPA 1996). The hydrologic conditions of a wetland also influence the hydroperiod, which is the periodic or regular occurrence of flooding and/or saturated soil conditions (Marble 1992). As a function of the water budget, the hydroperiod fluctuates seasonally and is influenced by the capacity of the wetland to store and release water.

In general, the natural hydrology of an area is the primary determinant of wetland habitat. It is what defines the size, shape, permanence, number, and spatial configuration of wetlands over the landscape; combined, these characteristics create habitat diversity. As many species have different life histories, wetlands varying in size, shape, and permanence are required to maximize the number and species that are able to meet their life requisites in a given area. Changes to local and regional hydrological regimes through urban development, road building, or direct loss or alteration of wetlands by draining or infilling, threaten aquatic-dependent species by reducing the abundance and variety (i.e., size, shape, permanence) of wetlands (Gibbs 2000). Moreover, the abundance and spatial configuration of wetlands are important to maintain connectivity among wetlands, creating wetland ‘communities’ rather than individual isolated wetlands amidst a matrix of unsuitable habitat in urban and agricultural landscapes.

Efforts should be made to match pre- and post-development surface flow to the wetlands that are to be retained, though the timing, volume, and quality of water flows will change. In addition, neighbourhood development will change groundwater hydrology, and the impacts of this disruption are, at present, not well understood. As a result, the development of Elan will likely have long-term effects on any retained wetlands that rely on groundwater inputs. By matching pre- and post-development surface runoff volumes, some effects can be minimized, though the overall hydrological health of the wetlands retained within Elan is likely to decline.
7.2. Water Quality and Quantity

Water quality can be impacted by urban development through changes to water chemistry and temperature, introduction of pollutants, sedimentation, and water table disruptions. Surface water in the neighbourhood is expected to discharge into the LeBlanc Canal, which discharges into the Blackmud Canal. Ultimately, water from the Elan neighbourhood will outfall into the North Saskatchewan River. It is important to minimize negative impacts to water quality as a result of this development due to the local and regional significance of the North Saskatchewan River and River Valley for wildlife and fish habitat as well as recreational, educational, and cultural opportunities. Changes to current water quality and quantity of water bodies within the Elan study area should be minimized through careful design of the major and minor stormwater system.

Changes to Water Chemistry and Temperature

Wetlands that are retained within an urban development can be impacted by changes in nutrient levels and increasing temperatures. Increased nutrients can decrease the number and diversity of aquatic invertebrates, which limits food sources for amphibians, waterfowl, and fish. These conditions can also result in algal blooms, which shade out floating and submergent vegetative species, thereby eliminating forage for some waterfowl.

Higher water temperatures could result from urban runoff, compared to natural surface and groundwater flow patterns, due to a reduction in the amount of vegetative cover and an increase in water conveyance and drainage time (USEPA 1996). Higher temperatures are associated with decreased dissolved oxygen levels, which can negatively impact wetland flora and fauna. Some of these impacts can be minimized by coupling storm water management facilities and wetlands. Designing storm water facilities to include separate storm basins to treat water before discharging into natural wetlands may help mitigate changes to water chemistry and temperature.

Introduction of Point and Non-Point Pollution

Natural wetlands that are retained within a neighbourhood development or integrated into stormwater management facilities are often impacted by an increase in the loading of pollutants in runoff. The most typical types of pollutants found in urban runoff include sediments, oxygen-demanding substances, nutrients such as phosphorus and nitrogen, heavy metals, pesticides, hydrocarbons, and debris (USEPA 1996). Contaminants enter aquatic systems as run-off from fertilizers, pesticides, and herbicides placed on croplands, golf courses, and/or residential lawns. Additionally, contaminants are often contained in stormwater (Bishop et al. 2000) and run-off from roads (Boxall and Maltby 1997). Amphibians, reptiles, fish, birds, mammals, and aquatic vegetation all have the potential to be exposed to these pollutants, either by direct contact or through bioaccumulation.

Changes to Sediment and Soil Characteristics

The textural characteristics of wetland soils can be altered as a result of changes in the amount, type, and/or particle size of sediments that enters a wetland, which may ultimately change the character of the wetland (USEPA 1996). Other soil characteristics including (but not limited to) pH, porosity, and conductivity can also be impacted by changes to wetland hydrology or vegetation (USEPA 1996). In addition, suspended particles tend to absorb pollutants such as heavy metals, nutrients, hydrocarbons, and bacteria (Stockdale 1991); therefore an increase in the amount of suspended particles introduced into a wetland can increase the amount of pollutants that become incorporated into the soils and sediments. These pollutants can then appear throughout the wetland environment via re-suspension, vegetative uptake, or the accumulation in the tissues of animals living in the water or sediments, as well as the predators that consume these animals.
7.3. Reduced Wetland Habitat Diversity and Connectivity

Wetland Habitat

Large, permanent wetlands are often more valued by society because of their aesthetic value and a misconception that more permanent wetlands offer higher quality habitat for wildlife, compared to small, temporary wetlands. These preconceptions, however, are incorrect, as a variety of wetland sizes and degrees of water permanence are critical to supporting a broader range of biodiversity. In fact, small, temporary wetlands generally support a greater diversity of species in higher abundance that larger wetlands (Semlitsch 2000). In particular, the loss of small, temporary wetlands (<4.0 ha) may be particularly damaging to amphibian populations. Amphibians do well, or are generally reliant on, wetlands with intermediate hydroperiods, and often, the most valuable wetlands for amphibians are semi-permanent and seasonal wetlands that are less than 1 ha in size (Petranka et al. 2007).

Temporary wetlands can also provide important habitat for waterfowl, offering pairing habitat for early nesting duck species (Drewien 1968; Dzubin 1969; Krapu 1974; Naugle et al. 2001) and important foraging habitats for migrating waterfowl and shorebirds (Naugle et al., 2001). Distances between suitable foraging sites have direct implications for waterfowl bioenergetics. Waterfowl move daily between wetlands to forage, and in the process, expend energy when travelling. As a result, waterfowl incur higher energetic costs moving between wetlands that are spaced further apart. These higher energetic costs can potentially impact reproductive and migration success of individuals and populations.

In the Elan study area, there are many ephemeral, seasonal, and temporary wetlands. The loss of these types of wetlands will have immediate and long-term impacts on wetland-dependent species, and will likely reduce the richness and diversity of wetland-dependent species in the area post-development. Wetland species generally exist in small, disjunct populations (Møller and Rørdam 1985; Dodd 1990; Sjörgren 1991 in Gibbs 2000), and these local populations combine to form larger meta-populations, that are sustained by the movement of individuals between wetlands (Ricklef 1993). Thus, natural or human induced disturbance events that result in the alteration or loss of wetlands on the landscape can not only eliminate local populations, but can also increase the risk of extirpation of entire meta-populations (Semlitsch 2000). The loss of wetlands in Elan will increase the distance between habitats, which will have effects on habitat connectivity.

In addition to considering the number and configuration of wetlands during planning, the composition and quality of the intervening terrestrial habitat is also an important consideration, particularly for amphibians. While amphibians require aquatic habitat to breed, they spend the vast majority of their time in terrestrial habitat. As a result, wetlands need to be connected by suitable upland habitat, which for amphibians includes cool, moist, microclimatic conditions. Buffering wetlands, placing ‘naturalized’ areas in urban matrices (e.g. greenways, naturalized stormwater management facilities), and maintaining natural areas in close proximity to wetlands are all strategies for maintaining terrestrial habitat quality and connectivity between wetlands.

Terrestrial Habitat

A major consequence of agricultural and urban development is fragmentation of natural habitats. In extreme cases, this fragmentation can lead to isolation of floral and faunal populations, which can result in population inbreeding, exhaustion of food sources, and ultimately, population extinction (Lienert 1994). In landscapes where fragmentation has resulted in isolated habitat patches, wildlife corridors provide linkages between habitat patches; these linkages reduce the vulnerability of populations to local extinctions and provide a mechanism for habitat recolonization should a local extinction occur (Bennett 1990; Sykes et al. 1996; Gibbs 2000).
Wildlife corridors are defined as strips of land or vegetation that differ from the matrix through which it runs (Barrett and Bohlen 1991). Corridors have several functions, including (but not limited to): providing core habitat for species with small home ranges, facilitating movement across the landscape for mammals, and providing movement, foraging, and nesting habitat for a variety of bird species (Forman and Godron 1986). A number of greenways planned within the Elan neighbourhood, which, if naturalized to contain a diversity of trees, shrubs, forbs, and grasses, can function as wildlife corridors and provide habitat within an urban matrix. The design and maintenance of greenways is an important consideration as greenways that are narrow or heavily managed (e.g. paved or sparsely vegetated) support a lower abundance and richness of development-sensitive bird and mammals species (Mason et al. 2007).

While there are no significant upland tree stands providing extensive forested habitat within the Elan study area, the LeBlanc Canal is a connector waterway from the Town of Beaumont to the Blackmud Ravine and, therefore, makes it a potentially important local corridor for terrestrial wildlife movement. This feature, as well as the proposed greenways, park spaces, and SWMFs, will provide habitat and movement corridors for wildlife if properly naturalized and maintained to support wildlife populations. Thoughtful consideration must be given to maintaining and/or enhancing wildlife movement throughout the property, and to managing the matrix (in this case, residential development) to make it less hostile to the dispersion of animals (Franklin 1993).

Development of the road network and the transition from an agriculturally dominated matrix to a landscape dominated by residential development will have long term impacts on wildlife movement. While efforts will be made to facilitate movement of wildlife through the neighbourhood (see Section 8.2), habitat fragmentation and the loss of connectivity will have negative impacts on many species. This will result in both direct and indirect impacts, and the decline or elimination of species that are sensitive to habitat fragmentation and human disturbance.

7.4. Invasive Species
After habitat loss, invasive species represent one of the largest threats to biodiversity. Invasive species, and in particular, non-native plants, impact native ecosystems by altering wildlife habitat and out-competing native species, including sensitive or at-risk species. Other impacts of invasive species include: lower aesthetic and property values, greater incidences of disease and insect outbreaks, reduced forage for wildlife, and declines in soil stability and water quality (Cranston et al. 2002).

Some wetlands within the Elan study area have been impacted by invasive species, and construction activities associated with the development of the neighbourhood will increase the potential for the spread and establishment of invasive species to previously unaffected areas. Increased human activity within and near wetlands will also increase the potential for invasive species establishment. Thus, the development of Elan is likely to have immediate and long-term impacts on wetlands through the spread of invasive species. However, these impacts can be minimized through targeted and active management of invasive species.

7.5. Increased Human Presence and Use
An important concern as development proceeds in the Elan study area is the increase in the number of people who have access to wetlands that may be retained in the neighbourhood. In particular, an increase in human presence and direct use of natural features is likely to have negative impacts on secretive species, such as Yellow rail. In addition, species that are sensitive to the presence of people, vehicles, or other disturbances that are typically associated with residential development (e.g. dogs, cats, lights, etc.) are likely to decline in numbers, and will be replaced by species that are more tolerant of human disturbances and urban environments.
While an increase in human activity and disturbance is inevitable with the proposed development activities, these impacts can be reduced by placing buffers around retained natural features (see Section 8.5) and by restricting or limiting access with boardwalks, interpretative opportunities, and prohibitive signage within the super wetland complex.

8. Construction and Operational Mitigation Measures

While the potential impacts of urban development on wetlands are numerous, there are opportunities to minimize impacts through careful design and management. The following sections provide general suggestions for the management of natural features in the post-development landscape, such that potential impacts can be minimized, and ecological function in the area can be maintained or improved over time. These mitigation measures include considerations for maintaining the functional capacity of existing natural features, as well as enhancing natural and semi-natural habitat. These measures were designed with the objective of creating and maintaining a vibrant and functional ecological network over the long-term that will support urban biodiversity, as well as provide passive and active recreational opportunities for community residents.

8.1. Habitat Restoration, Naturalization, and Wetland Compensation

Habitat Restoration and Naturalization
The overall goal of habitat restoration and naturalization of Elan is to create and maintain functional habitat for utilization by wildlife toward core habitat areas, while also providing appropriate active or passive recreational opportunities for area residents. This section provides a general overview of potential areas for restoration and naturalization; more specific and detailed information related to these efforts should be provided at subdivision stage.

Restoration efforts should be focused on wetlands that will be retained in the neighbourhood as well as the LeBlanc Canal. In particular, restoration activities should be concentrated on eliminating or reducing the occurrence of non-native and invasive plants. Many of the wetlands, as well as the LeBlanc Canal, contain at least one noxious weed species, including Canada thistle and scentless chamomile. Efforts to control the occurrence and spread of these species should be a high priority. In addition, restoration efforts should include establishing native forbs, grasses, and shrubs to create high quality and more structurally complex habitat in areas that may be considered important linkages in the neighbourhood.

Most wetlands within this study area and the Canal have been heavily impacted by the surrounding agricultural land use as evidenced by the absence of riparian buffers, tire tracks through wetlands, and low vegetative diversity. By controlling non-native and invasive species through restoration using native plant communities and enhancing riparian buffers around retained wetlands, the chances of maintaining natural function of the retained wetlands will be greatly increased.

Wetland Compensation
As of June 1, 2015, the Alberta Wetland Policy was implemented. All wetland assessments conducted post-implementation are required to follow guidelines for wetland assessment, reporting requirements, and compensation procedures outlined by the new policy. It is the Province’s position that wetlands assessments conducted prior to June 1, 2015, are valid for a period of three years, and during this time, will be evaluated under the 1993 Interim Wetland Policy. Field surveys for the Elan study area were completed in June of 2014, and, therefore, assessment methods, applications for disturbance or removal of wetlands, and compensation procedures will be evaluated under the 1993 Interim Wetland Policy, so long as a Water Act
application is submitted for these wetlands prior to July 5, 2017. If a Water Act approval is not secured for Elan prior to July 6, 2017, the Province will require these wetlands to be re-assessed using the new wetland assessment procedures and guidelines.

The total area of naturally occurring wetland habitat that may be completely lost as a result of the development of the Elan neighbourhood is 18.2 ha. Habitat Connectivity and Wildlife Passage While no significant upland natural areas occur within the Elan ASP area, the LeBlanc Canal and other drainage ditches within the study area provide hydrologic connectivity to Blackmud Creek, to the stormwater management facilities located south of the study area, as well as to the broader landscape. These channels also provide passage for wildlife moving through the study area and into surrounding core habitats. Core habitats located close to the Elan study area include Cawes Lake (within 3 km) and Gwynne Channel/Saunders Lake (within 5km), both previously identified as Environmentally Significant Areas important for wildlife habitat and waterfowl production areas (Westworth & Associates Ltd. 1990).

Development of the Elan neighbourhood will result in habitat fragmentation and will decrease connectivity between any remaining habitat patches. Thus, special efforts need to be directed towards improving connectivity between remnant patches to reduce mortality and facilitate wildlife passage through the neighbourhood. Retained wetlands within the study area and their associated riparian areas and buffers will likely serve as important habitat for wildlife (especially songbirds) travelling through the area, on their way to better, core habitat. Though the retained wetlands and parks planned within the Elan neighbourhood may provide many resources for species, these areas will likely not be of sufficient size or quality to provide all habitat requirements or ecological functions of the wildlife travelling through.

While wildlife passage and use within this study area will likely be limited, ensuring connectivity between natural habitats is key to the functionality of the ecological network of the region. This section provides some suggestions for improving wildlife passage within the neighbourhood.

1. **Traffic Calmed Areas**: Traffic calming should be considered in areas where a roadway intersects natural or semi-natural feature. In particular, traffic calming is needed in areas where the movement of small- and medium-sized terrestrial mammals is most likely, such as along semi-natural and natural upland habitat corridors. Strategies for traffic calming include boulevard extensions, lower speed limits, and/or a reduction in the number of lanes of traffic.

2. **Wildlife Crossing Structures**: Wildlife crossing structures provide safe passage for wildlife either under or above human-made movement barriers, such as roads. These structures serve to reconnect fragmented habitat, and help to minimize mortality and conflicts between wildlife and humans. Some examples of these structures include:

   - **Amphibian Tunnel**: Amphibians are semi-aquatic animals that frequently move between wetland and upland habitat. Thus, any road that bisects wetland-upland habitat, or wetland-wetland habitat should consider amphibian passage and movement between these adjacent habitats. Amphibian tunnels placed under a roadway have been shown to be effective for facilitating safe crossing of not only amphibians, but also snakes and small animals (Glista et al. 2009). Generally constructed from concrete or PVC with large diameter openings to allow for air flow, amphibian tunnels are often used in combination with plastic fencing along roads to direct amphibians toward the tunnel.

   - **Bridge or Open Bottom/Box Culvert**: Any proposed crossings of LeBlanc Canal should consider a bridge or culvert structure in order to maintain habitat connectivity of the Canal. A bridge in such location would maintain amphibian, fish, and waterfowl movement as well as some land passage for terrestrial wildlife within the Elan neighbourhood, through the Town of Beaumont, as well as across the local landscape. An open-bottom culvert would be a suitable alternative given a sufficient diameter or opening and naturalization within the culvert.
8.2. Post-Development Drainage

In order to ensure the persistence of any retained wetlands within Elan, careful consideration must be given to surface drainage and water quality post-development. In order to sustain surface water flows in the post-development landscape, the major and minor storm system should be adjusted in an attempt to match contributory areas from the pre-development condition. Quality of water entering retained wetlands is an important consideration and where low quality sources of water (e.g. roads, commercial land) are expected to drain into retained wetlands, the stormwater design should have runoff being treated through a fore bay, bioswale, stormwater management facility, or a Stormceptor™ manhole (or equivalent) prior to discharge.

It is important to note that while higher class (Class IV and V) wetlands rely on consistent water inputs, wetlands do require occasional drawdown. Over stabilization of water levels may negatively impact the condition of the vegetation communities within the wetlands. Consideration should be taken to match pre-disturbance water flows to the retained wetlands.

8.3. Stormwater Facility Design and Operation Considerations

The stormwater management design proposed for the Elan neighbourhood is expected to utilize a variety of approaches to creating an innovative and ecologically functional system. Five stormwater management facilities (SWMF) and one super wetland complex incorporating four interconnected ponds are being created throughout the neighbourhood. Specific targets and goals related to construction of the SWMF should be considered to improve wildlife habitat, wildlife movement, and permeability of the neighbourhood. As well, constructing SWMFs that resemble natural wetland habitats help to create long-term aesthetic benefits for residents. Naturalized facilities have also been shown to improve water quality over conventional storm pond design, and have lower overall maintenance costs (Ross and Martz 2013).

Given the benefits associated with naturalized SWMFs, all facilities in Elan should be designed with the following principals in mind:

- The shoreline and slopes should vary in consistency, size, and configuration to create distinct habitat zones that reflect the potential frequency of flooding. Habitat zones within the SWMFs should include the following:
  - Deep marsh: these areas should have standing water depths that range between 15 and 90 cm (Shaw and Fredine 1971). Common vegetation in this zone includes herbaceous emergent, floating, floating-leaved, and submergent vegetation, generally dominated by cattails and bulrushes.
  - Shallow marsh: this habitat zone should have soils that are saturated or inundated by standing water, with water depths ranging between 5 and 15 cm (Shaw and Fredine 1971). Herbaceous emergent vegetation, such as bulrushes and sedges, and floating vegetation are common in this vegetation zone.
  - Wet meadow: this zone is permanently saturated and seasonally flooded, with water depths ranging between 0 and 5 cm. Common vegetation in this zone includes sedges and water-loving grasses and forbs.
- Vegetation should be interspersed throughout the facility to improve water quality, create habitat for insects and amphibians, and discourage use by species such as Canada goose. This can be achieved through placement of floating islands, or through the creation of vegetation benches that are placed at the appropriate height to encourage establishment of deep marsh emergent vegetation.

The super wetland complex is expected to be an innovative, educational, and functional stormwater management facility that will contribute to the management of stormwater in the Elan neighbourhood. As discussed in Section 6.1.3, naturalization will be a key objective of the facility.
Preliminary design of the complex includes multiple wetland zones created throughout the complex to ensure seasonal drawdown, maintain diverse wetland vegetation, supply habitat for wildlife species, and to offer natural water purification. It is recommended that once detailed design and engineering commences on the super wetland complex, a multi-disciplinary approach that includes biologists and ecologists, landscape architects, and stormwater engineers, be utilized to ensure the functionality of the system for the purposes of water treatment, water storage, and provision of wildlife habitat.

8.4. Development Setbacks (Buffers)
Placing development setbacks on wetlands and other retained natural features is important for maintaining the condition and health of retained natural features. Buffers are transition zones between urban development and natural features, and these areas can help to improve the quality of surface waters entering natural feature. Buffers also offer additional wildlife habitat. From the perspective of human use, buffers can improve the aesthetic appeal of a natural feature, and create both passive and active recreational opportunities for local residents.

The *Municipal Government Act* (MGA) states that a buffer no less than 6 m must be placed on all lands retained as Environmental Reserve, for the purpose of preventing pollution or providing public access to and beside the bed and shore. Therefore all wetlands and channels being retained within the Elan neighbourhood will be buffered by a minimum of 6 m. For the both wetlands being retained, this buffer is further surrounded by parks and greenways (Municipal Reserve, MR). It is recommended that semi-natural MR spaces surrounding the retained wetland be naturalized through native plantings and/or be designed for low impact recreation such as walking and biking.

8.5. General Construction Recommendations
In addition to the specific considerations and recommendations provided above, the following general construction recommendations should be considered as the development of Elan progresses:

**Timing Restrictions**
- Under Section 6(a) of the *Migratory Bird Convention Act*, it is an offence to “disturb, destroy or take a nest, egg, or nest shelter” of a migratory bird. As such, any land clearing activities should be scheduled to occur outside the breeding season for migratory songbirds (approximately May 1 to July 31).
- All construction activities within 100 m of a wetland should be conducted outside of the critical breeding period for waterfowl and amphibian species to avoid disturbance. If land-clearing activities must occur during this time, qualified personnel should systematically search all affected areas for active nests. If active nests are located, all land clearing activities should be rescheduled to occur outside critical breeding and nesting period.
- Under the provincial Wildlife Act, it is an offence to damage the nest of any resident breeding birds. Any tree clearing activities scheduled for February or March should be preceded by a breeding owl survey to ensure that clearing activities do not disturb nesting owls.

**Sedimentation and Erosion Control**
- Minimize the amount of natural vegetation removed near wetland and other water bodies, particularly within the riparian zone. Riparian areas can effectively slow runoff, reduce runoff volume by allowing infiltration, and remove suspended solids, nutrients, and other contaminants from overland stormwater runoff. Riparian zones also provide critical habitat for many bird and amphibian species.
• Hand-clear vegetation from unstable or erodible banks to avoid the use of heavy machinery.

• Develop and implement a sediment control plan, install control measures, and inspect sediment control measures regularly.

• Stockpile soil in designated areas away from any watercourse or water body to ensure runoff from the stockpile does not enter the water body.

• Minimize the amount of time erodible soils are exposed and stabilize soils as soon as possible after construction by seeding, spreading mulch, or installing erosion control blankets.

9. Conclusion

The Elan study area has recently been annexed by the Town of Beaumont, and includes an area of approximately 518 ha. While much of the area has been heavily impacted by agricultural activities, significant ecological features within the study area include the LeBlanc Canal and associated floodplain as well as several semi-permanent and permanent wetlands. Wetlands 16 and 17 in SW-28-50-24-4 have both been claimed as Crown Land under the Public Lands Act, and will be retained post-development. These wetlands should be protected and maintained by ensuring comparable pre- and post-development flows, by focusing on naturalization and restoration of the riparian areas, and by maintaining buffers from adjacent development.

The super wetland complex, to be constructed to mitigate the flooding effects of the LeBlanc Canal, provides the opportunity for the Elan Neighbourhood to be an example of neighbourhood planning informed by ecological design principals. By focusing on creating high quality habitat and by maintaining connectivity to open spaces and significant natural features surrounding the neighbourhood, the neighbourhood of Elan can simultaneously sustain functional wildlife habitat and a vibrant, livable neighbourhood for future residents.
10. References


Invistec Consulting Ltd. 2014. Elan Local Area Structure Plan. Leduc County: Invistec Consulting Ltd.


Leduc County. 2006. Parks and Open Spaces Master Plan. Leduc County.


Ross, L.C.M., and Martz, D. 2013. Integrating natural wetland and improving design of naturalized stormwater management facilities in the City of Edmonton; Workshop guidebook. December 4th and 5th, Edmonton, AB.


Shaw SP and CG Fredine. 1971. Wetlands of the United States, their extents and their value to waterfowl and other wildlife. US Fish and wildlife Service Circular 39, 67 Pages


Stantec Consulting Ltd., 2011, Town of Beaumont – Leduc County Joint Growth Study


Appendix A: FWMIS Search Results

**Fish and Wildlife Internet Mapping Tool (FWIMT)**

(source database: Fish and Wildlife Management Information System (FWMIS))

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**Species Summary Report**

Report Created: 4-Jun-2014 09:12

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**Species present within the current extent:**

**Fish Inventory**
- BROOK STICKLEBACK
- FATHEAD MINNOW

**Wildlife Inventory**
- AMERICAN KESTREL
- NORTHERN LEOPARD FROG
- SHORT-EARED OWL
- SWAINSON’S HAWK

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**Buffer Extent**

- **Centroid (X,Y):** 602941, 5911087
- **Projection:** 10-TM AEP Forest
- **Centroid:** NW 33 50 24 4
- **Buffer Radius:** 5 kilometers

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**Wildlife Contact Information**

- **Primary Contact**
  - Name: Delaney Anderson
  - Phone: 780-415-1328
  - Email: Delaney.Anderson@gov.ab.ca
  - Town:

- **Alternative**
  - Name:
  - Phone:
  - Email:
  - Town:

**Fisheries Contact Information**

- **Primary Contact**
  - Name: FRLs:Denyse Gullion
  - Phone: 780-675-8205
  - Email: Denyse.Gullion@gov.ab.ca
  - Town: Athabasca

- **Alternative**
  - Name:
  - Phone:
  - Email:
  - Town: Athabasca
Appendix B: ACIMS Search Results

Search ACIMS Data

1. Select Requester: * Consultant
2. Select Reason for Request: * Element Occurrence Search
3. SEC: 24 TWP: 050 RGE: 24 MER: 0
   (option) Convert Lat/Long to Township

Layers
- Element Occurrences (part one, non-sensitive)
- Element Occurrence (part two, sensitive)
- Protected Areas
- Crown Reservation/Notation
- 100 m Proximity - Protected Areas
- 100 m Proximity - Crown Reservation/Notation

* Required

Table of Results

Date: 4/6/2014
Requestor: Consultant
Reason for Request: Element Occurrence Search
SEC: 28 TWP: 050 RGE: 24 MER: 4

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No Non-sensitive EOs Found: Next Steps - See FAQ

**Sensitive EOs: 0** *(Data Updated: June 2013)*

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No Sensitive EOs Found: Next Steps - See FAQ

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**Crown Reservations/Notations: 0** *(Data Updated: April 2013)*

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No Crown Reservations/Notations Found