

**North/Northwest Natural Area  
Screening Study, City of Saskatoon**

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## **1.0 Introduction**

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The City of Saskatoon contracted Stantec Consulting Ltd. (Stantec) to conduct a Natural Area Screening of the North/Northwest sector. As required by the City of Saskatoon Official Community Plan Bylaw No. 8769 (Section 9.2), a screening must be 'undertaken for important natural areas, features, or archaeological sites' during the development design process.

The project is comprised of the following tasks as described below:

- Background literature review
- Review of relevant legislation
- Inventory of natural areas
- Functional assessment of the North Swale
- Heritage assessment
- Recommendations





## **2.0 The Study Area**

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### **2.1 LOCATION**

The study area lies within the north/northwest corner of the Corman Park – Planning District Boundary for the City of Saskatoon, which includes Township 37 of Range 6 W3M and Township 37 and 38 of Range 5 W3M (Figure 1). The study area is mostly agricultural land (cropland primarily) that includes the North Development Area and is adjacent to the John G. Diefenbaker Saskatoon Airport Management Area, Agriplace and Marquis Industrial neighbourhoods in the City of Saskatoon. The eastern portion of the study area contains the natural area known as the North Swale.

This section provides a brief overview of the biophysical character of the study area screened for the City of Saskatoon.

### **2.2 BIOPHYSICAL OVERVIEW – REGIONAL PERSPECTIVE**

Several environmental studies have been conducted on lands within the study area and were used in preparing this biophysical overview. These studies include:

- Environmental Screening Report, Marquis/Silverwood Industrial Area, Saskatoon, Saskatchewan (AMEC, 2002)
- North Industrial Sector Plan Natural Areas Screening Resource Overview Report (Stantec, 2006)
- Saskatoon Wetland Policy Study (Stantec, 2009)

#### **2.2.1 Landscape Areas**

The site is located within the eastern portion of the Saskatoon Plain landscape area of the Moist Mixed Grassland Ecoregion of Saskatchewan (Acton et al., 1998). The Saskatoon Plain landscape area is a level glacial till plain with limited surface drainage associated around the South Saskatchewan River (Acton et al., 1998). The landscape is comprised of gently undulating glaciolacustrine landscapes within the southern portion and thinner deposits of discontinuous cover on an eroded, stony, and gravely glacial till surface towards the north. At the northern margin of the area, the eroded till plain has a large amount of gravel and is covered with a very thin, sandy deposit (Acton et.al., 1998).

### **2.2.2 Soils**

The study area is comprised of Dark Brown soils with varying soil textures, including clay loam soils in the southwest portion of the study area, sandy loam and loam soils in the central and eastern portion of the study area, and gravelly loam soils in the northeastern corner of the study area (Acton and Ellis, 1978). The North Swale is located on carbonated and/or saline Rego Humic Gleysols, with the surrounding upland area having Orthic Dark Brown soils. Soil texture within the North Swale is clay loam, with a loam texture on the surrounding uplands.

The Land Capability for Agriculture within the study area is predominately Class 3 and 4 (Figure 2 and Appendix A), therefore the soils have moderately severe to severe limitations that restrict the range of crops or require special conservation practices. The main limitation to agriculture within the study area is excess moisture. The soils within the North Swale have a Class 5 Capability for Agriculture (Figure 2), which means that the soils have very severe limitations that restrict their use to the production of native or tame species of perennial forage crops. The main limitation to agriculture within the North Swale is excess moisture and salinity.

### **2.2.3 Wetlands**

The definition of a wetland in Canada is “*land that is saturated with water long enough to promote wetland or aquatic processes as is indicated by poorly defined soils, hydrophytic vegetation and various kinds of biological activity which are adapted to the wet environment*” (Mitsch and Gosselink 2007).

There are numerous wetlands within the study area, which have varying degrees of permanence on the landscape. In the eastern portion of the study area, there is a large complex of wetlands known as the North Swale (Stantec, 2006 and 2009). Disturbance over time has divided the water into multiple wetlands. The size and permanence, along with high diversity of the wildlife that utilize the area, make this area a candidate for preservation within the northern portion of the City of Saskatoon (Stantec, 2006).

### **2.2.4 Vegetation**

Within the Saskatoon Plain landscape area, native mixed-grass vegetation is limited to the sandy soils where a variety of grasses and shrubs are the most characteristic species on the uplands. Saline areas exist in depressional areas and are dominated by various salt-tolerant grasses such as alkali grass and red samphire. Aspen is present within non-saline areas and associated with high water tables (Acton et al. 1998).

The southern portion of the North Swale was surveyed by AMEC (2002). The dominant vegetation in the larger wetlands were cattail and sedge species, while smooth brome and dock species dominated the smaller wetlands. Typically the smaller wetlands were surrounded by a ring of willows. No rare species were observed during their survey as it was completed in the winter which did not allow for a rare vegetation survey. A subsequent survey by Stantec was completed in the summer of 2009 which found cattails, common bulrush, Baltic rush, Carex, and

wheatgrass species in wetlands 5060 and 5061 and great bulrush, cattails, creeping spike rush, Baltic rush, and beaked sedge in wetlands 5000 and 5001 (Stantec, 2009).

A screening of the Saskatchewan Conservation Data Centre (SKCDC) database indicated two records of rare species within the study area (SKCDC, 2012). Engelmann's spike-rush (*Eleocharis engelmannii*), provincially ranked S2, was observed in 1966 within SE 26-37-6-W3M (Figure 6) and in 1965 within SE 19-37-5-W3M. Chaffweed (*Centunculus minimus*), provincially ranked S2, was also found in 1965 within SE 19-37-5-W3M. Section 19-37-5-W3M has been developed in recent years, therefore the rare species occurrence at that location is no longer relevant.

### **2.2.5 Wildlife**

The North Swale was highlighted as ecologically significant in the *North Industrial Sector Plan Natural Areas Screening – Resource Overview Report* (Stantec 2006). The central portion of the North Swale had large populations of birds including: white pelicans (20-25), yellow-headed blackbirds, multiple species of grebes, geese, ducks, sandpipers and shorebirds. The white pelican is a provincially ranked species (S3B), which brings focus to the ecological significance of the North Swale (Saskatchewan Conservation Data Centre, 2010). The SKCDC database search revealed no records of rare wildlife species within the study area.

## **2.3 HERITAGE RESOURCES**

The study area contains some areas of unbroken native prairie, including areas on the riverbank where archaeological potential is considered to be high. Two historic homesteads are known (from previous studies, refer to Section 6.0) to exist within the study area, which include the Caswell and Valley Crest Homestead Sites. As such, a thorough heritage screening is warranted to determine which portions of the study area may have heritage concerns.



## **3.0 Regulatory Context**

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The following sections highlight the relevant federal, provincial, and municipal acts, regulations and policies potentially affecting development within the North/Northwest study area.

### **3.1 FEDERAL**

#### **3.1.1 Federal Policy on Wetland Conservation**

The *Federal Policy on Wetland Conservation* promotes the retention of wetlands and wetland function throughout Canada with specific focus on federal lands. A no net loss of wetland function is stated for federal land that has experienced severe wetland loss and degradation to wetland function. The strategies for best management of wetlands outlined in the policy include: developing public awareness, managing wetlands on federal lands, promoting wetlands conservation on federally protected lands, enhancing cooperation, conserving wetlands of significance, ensuring sound scientific basis for policies, and promoting international action.

#### **3.1.2 Species at Risk Act**

The *Species at Risk Act* (SARA), as administered by the Federal Minister of the Environment, Minister of Fisheries and Oceans, and/or the Minister of Parks Canada Agency, prevents the extirpation or extinction of species that are of special concern, endangered or threatened. The Act legislates the protection of these species and any existing critical habitats, including wetlands, through agreements and permits, enforcement measures, and a public registry.

#### **3.1.3 Migratory Birds Convention Act**

The *Migratory Birds Convention Act*, as administered by the Federal Minister of the Environment, has the authority of control over migratory birds within Canada, territorial waters of Canada adjacent to any province or territory, and all provinces and territories within Canada. The Act stipulates that no active nesting site or habitat of a migratory bird species, such as wetlands, shall be disturbed during active nesting and rearing stages, during the approximate times of April to August. Bird species of concern are also identified under the Act.

When site preparation occurs within the North/Northwest sector, vegetation clearing should be conducted outside of the avian breeding period (before May 1 or after July 31) as per the *Migratory Bird Convention Act*. If clearing must take place during the avian breeding season, a qualified bird expert should confirm that there are no active nests in the area within seven days of clearing commencing.

### **3.1.4 Fisheries Act**

The *Fisheries Act*, as administered by the Federal Minister of the Environment and the Minister of Fisheries and Oceans, has the authority of control over fish habitat protection and pollution prevention in all fish-bearing waterbodies in Canada, including wetlands. The Act regulates the release of deleterious substances and deposits into fish-bearing waterbodies. Under the Act, harmful alteration of fish habitat is forbidden.

### **3.1.5 Canadian Environmental Protection Act**

The primary focus of the *Canadian Environmental Protection Act*, as administered by the Federal Minister of the Environment, is on pollution prevention and the protection of the environment and human health in order to contribute to sustainable development. Discharges of pollution into the environment, including wetlands, are overseen by this Act.

## **3.2 PROVINCIAL**

### **3.2.1 Saskatchewan Wetland Policy**

The *Saskatchewan Wetland Policy* was developed in 1995 and outlines the provincial government's commitment to the sustainable management of wetlands. The policy states that the numbers, diversity and productive capacity of wetlands will be maintained to provide social, economic, and environmental benefits to the Saskatchewan public.

The specific objectives of the policy are:

- To encourage sustainable management of wetlands on public and private lands to maintain their functions and benefits;
- To conserve wetlands that are essential to maintain critical wetland species or wetland functions; and
- To restore or rehabilitate degraded wetland ecosystems where previous destruction or alteration has resulted in a significant loss of wetland functions or benefits.

### **3.2.2 Wildlife Habitat Protection Act**

The *Wildlife Habitat Protection Act* (WHPA) is designated to protect valued natural Crown land through designations, which restricts the selling or clearing and breaking up of the land without first acquiring permission. As stated within *The Wildlife Habitat Protection (Land Designation) Amendment Act, 2010* (Chapter 36):

- Section 6 (4); "Wildlife habitat and ecological lands may be granted by or transferred from a ministry that administers those lands on behalf of the Crown in right of Saskatchewan to a Crown corporation that may be prescribed in the regulations or any other agency of the Crown that may be prescribed in the regulations."

- Section 6 (5); “Wildlife habitat and ecological lands may be granted by or transferred from a Crown corporation or an agency of the Crown mentioned in subsection (4) to a ministry that is authorized by or pursuant to an Act to administer Crown lands on behalf of the Crown in right of Saskatchewan.”

Within the study area, there are no WHPA designated lands.

### **3.2.3 Wildlife Act**

The *Wildlife Act* came into force in 1998 and covers the protection of wild species (plant, animal, or organism) at risk within Saskatchewan. The Act prohibits people to kill, injure, possess, disturb, take, capture, harvest, genetically manipulate or interfere with any wild species at risk. In addition it allows for the designation of species as extirpated, endangered, threatened, or vulnerable and allows for the preparation and implementation of recovery plans for listed wild species at risk.

Saskatchewan Ministry of Environment (MOE) has developed industry activity restriction guidelines for vertebrate species at risk (Arsenault 2009). If a breeding site for a listed species is observed within the study area, then the recommended setback distances should be established around the species location at the time of development.

### **3.2.4 Provincial Lands Act**

Under the *Provincial Lands Act*, the Provincial Crown owns the bed and shore of any river, stream, watercourse, lake, creek, spring, ravine, canyon, lagoon, swamp, marsh or other body of water. The Act prescribes manners in which the Crown may grant or transfer public land, which includes the bed and shore of any water body.

### **3.2.5 Saskatchewan Watershed Authority Act**

The *Saskatchewan Watershed Authority Act* outlines the Authority’s mandate to manage, control and protect the water resources, watersheds and related lands by regulating water development and water use. The Act states that the property in and the rights to all surface water and groundwater is vested in the Crown. As such, landowners are required to obtain a water rights license for the use of surface water or groundwater or to obtain a drainage permit for any construction that results in the draining or filling of wetlands.

However, if drainage waters are contained within the City of Saskatoon boundary then approval from the Saskatchewan Watershed Authority (SWA) is not required; but approval from the City would be required.

### **3.2.6 The Planning and Development Act**

The *Planning and Development Act* outlines the conditions under which Environmental Reserves can be taken. The Act states that the owner of land that is subject of a proposed subdivision to provide part of that land as Environmental Reserve, if the land consists of:

- a. a ravine, coulee, swamp, natural drainage course or creek bed;
- b. wildlife habitat or areas that are environmentally sensitive, or contain historical features or significant natural features;
- c. land that is subject to flooding or is, in the opinion of the approving authority, unstable; or
- d. land that abuts the bed and shore of any lake, river, stream or other body of water and that is required for the purpose of the prevention of pollution, the preservation of the bank, or the protection of the land to be subdivided against flooding.

The Act also outlines the conditions where buffer strips or municipal reserve must be dedicated within a proposed subdivision.

### **3.2.7 Environmental Assessment Act**

The *Environmental Assessment Act* states that a proponent of a 'development' shall conduct an environmental impact assessment. A 'development' under the *Act* is defined as any project, operation or activity that is likely to:

- a. have an affect on any unique, rare or endangered feature of the environment;
- b. substantially utilize any provincial resource and in so doing preempt the use, or potential use, of that resource for any other purpose;
- c. cause the emission of any pollutants or create by-products, residual or waste products which require handling and disposal in a manner that is not regulated by any other Act or regulation;
- d. cause widespread public concern because of potential environmental changes;
- e. involve a new technology that is concerned with resource utilization and that may induce significant environmental change; or
- f. have a significant impact on the environment or necessitate a further development which is likely to have a significant impact on the environment.

With recent (2012) changes made to the Saskatchewan environmental assessment process, a proponent now has the ability to self-assess their project based upon the criteria above. Any proposed development within the North/Northwest study area should be referred to the Ministry



of Environment website and a self-assessment completed to ensure no provincial environmental assessment is required.

### **3.2.8 Environmental Management and Protection Act**

Under the *Environmental Management and Protection Act (EMPA)*, no person shall discharge or allow the discharge of a substance into the environment in an amount, concentration or level or at a rate of release that may cause an adverse effect. The Act also regulates shoreline alteration activities and states that a permit is required if any of the following are to occur:

- a. alter or cause to be altered the configuration of the bed, bank or boundary of any river, stream, lake, creek, marsh or other watercourse or water body;
- b. remove, displace or add any sand, gravel or other material from, in or to the bed, bank or boundary of any river, stream, lake, creek, marsh or other watercourse or water body; or
- c. remove vegetation from the bed, bank or boundary of any river, stream, lake, creek, marsh or other watercourse or water body.

EMPA has been revised (2010) but the new Act has not yet been proclaimed. No changes within the Act should significantly alter the above discussion.

## **3.3 MUNICIPAL**

### **3.3.1 The Corman Park – Saskatoon Planning District Official Community Plan Bylaw, 2010 (Bylaw No. 8844)**

The Corman Park – Saskatoon Planning District Official Community Plan Bylaw, 2010 (Bylaw No. 8844) outlines an Official Community Plan for the City of Saskatoon to work in conjunction with the Rural Municipality (RM) of Corman Park No. 344 in the future land use for the expansion of Saskatoon. Section 4, Agricultural Objectives and Policies, promotes the proactive environmental stewardship by agriculture operators within the Corman Park – Saskatoon Planning District to sustain productivity and minimize adverse environmental impacts. Section 10, Environmental and Heritage Resource Objectives and Policies, promotes the conservation and management of significant environmental and heritage resources within the Corman Park – Saskatoon Planning District. There is focus on integration and complementing natural features and landscapes along with re-utilization or restoration of designated Municipal Heritage properties during development.

### **3.3.2 Rural Municipality of Corman Park No. 344, Official Community Plan (Bylaw No. 8/94)**

While this is a separate document from the Corman Park – Saskatoon Planning District Official Community Plan identified in Section 3.3.1, the objectives of the bylaw and plan are similar.

### **3.4 OTHER – AIRPORT REGULATIONS**

#### **3.4.1 Land Use in the Vicinity of Airports TP-1247**

Within this publication, Transport Canada describes the characteristics of airports that may influence land uses outside of the airport boundaries. Recommendations and guidelines are also outlined for protections of obstacle limitation surfaces, telecommunications and electronic systems, bird hazards, aircraft noise, and restrictions to visibility. Within Part III, Bird Hazards, of this publication, land use practices not recommended for areas 8.0 km or less from the airport reference point include sanitary landfills, food waste landfill sites, and the planting of crops that may either attract birds or adversely affect their flight pattern. There is no specific wording in this document that restricts the construction of stormwater management ponds within the vicinity of the airport.

#### **3.4.2 Saskatoon Airport Zoning Regulations**

The *Saskatoon Airport Zoning Regulations* (1987) include information relating to building and land use restrictions in the vicinity of the airport, with particular focus on airport or aircraft safety. The *Regulations* are currently being revised to include more specific information relating to bird hazards. Clyde Stormberg, Environment/Compliance Manager with the Saskatoon Airport Authority, was contacted on September 11, 2012 to discuss the revisions to the *Regulations* and he provided the following information:

1. There will be a 4 km setback around the airport for:
  - a. Sewage lagoons
  - b. Open water storage. Exceptions will be made on open water storage if:
    - Measures are taken to detract geese and other large birds;
    - A file design is given to the City; and
    - Open water design must fit municipal specifications.
2. There will be an 8 km setback around the airport for waste/garbage dumps.

## **4.0 Inventory of Natural Areas**

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### **4.1 METHODS**

Natural areas within the study area were inventoried by Stantec in July 2012. This included both desktop and field studies. The wetlands of ecological and/or hydrological significance (generally Class 2 and above) were mapped using ArcGIS. The class and boundaries of each wetland was verified using aerial photographs from various years that included years of extreme high and low precipitation, and contour lines.

#### **4.1.1 Pre-Field Desktop Screening**

A desktop screening was completed to identify areas of potential environmental significance including wetlands, native prairie, tree stands, and areas that have not been disturbed by agricultural or industrial development. The following resources were used during the desktop screening:

- Environmental Screening Report, Marquis/Silverwood Industrial Area, Saskatoon, Saskatchewan (AMEC, 2002)
- North Industrial Sector Plan Natural Areas Screening Resource Overview Report (Stantec, 2006)
- Saskatoon Wetland Policy Study (Stantec, 2009)
- The Corman Park – Saskatoon Planning District Official Community Plan Bylaw, 2010 (Bylaw No. 8844) (City of Saskatoon, 2010)
- Rural Municipality of Corman Park No. 344, Official Community Plan (Bylaw No. 8/94) (RM of Corman Park, 1994)
- Saskatchewan Conservation Data Centre (SKCDC)
- Species at Risk Registry and COSEWIC databases
- Soils of the Saskatoon Map Area 73-B Saskatchewan (Acton and Ellis, 1978)
- Environment Canada Historical Precipitation Data (Environment Canada, 2012)

Natural areas were identified on aerial photographs using ArcGIS prior to the field investigation. A map book with aerial photos of the quarter sections, at a scale of 1:7500, was created for use in the field survey; land access was marked and wetlands surveyed in 2009 were labeled.

### **4.1.2 Field Investigations**

Field surveys within the study area were completed in July 2012 on areas where land access was granted and focused on lands that had not been surveyed by Stantec in previous years. Wetlands targeted for field investigation included seasonal (Class 3), semi-permanent (Class 4), and permanent (Class 5) wetlands, and other wetlands which provide valuable hydrological or ecological linkages. A significant portion of the field work was targeted towards the North Swale, which is discussed in more detail in Section 5.0. Ephemeral (Class 1) and temporary (Class 2) wetlands were not targeted during the field investigation as they provide relatively little function for stormwater management and incorporation into a development plan. Tree stands that were assessed to be ecologically significant were also visited during the field survey.

Information recorded for the natural areas included: dominant vegetation (primary (1<sup>o</sup>) and secondary (2<sup>o</sup>) species), including rare and noxious/nuisance species; observed wildlife species, including rare species; level and type of disturbance; surrounding land use; and linkage to other natural areas. Stewart and Kantrud (1971) classification of class and cover of each wetland was also recorded (refer to Appendix B). Photos and GPS points were taken for most natural areas during the field survey.

### **4.1.3 Post-Field Mapping**

Following the field survey, natural areas were mapped using ArcGIS. Classes and boundaries of wetlands field checked in 2009 and 2012 were confirmed using aerial photographs from various years (2001, 2005, 2006, 2008, 2009 and 2011), including those from below normal and above normal precipitation years. Using information provided by the Environment Canada's normal climate database, the high precipitation year between 1995 and 2010 was 2006 (488.8 mm) and the low precipitation year was 2001 (159.7 mm) (Environment Canada, 2012).

Wetlands that were not surveyed in the 2009 wetland survey (Stantec, 2009), and those on land in which there was no land access in 2012, were classified and mapped using historical air photos and contour levels. Although Class 3, 4, and 5 wetlands were the focus of the field survey, Class 2 wetlands were mapped based on aerial photos and contour levels.

The same wetland classification methods were used during the 2009 wetland inventory, conducted as part of the Saskatoon Wetland Policy Study (Stantec, 2009), which allowed the results from the 2009 wetland inventory to be directly incorporated into the findings of the North/Northwest Natural Area Screening.

## **4.2 FINDINGS**

### **4.2.1 Inventory of Natural Areas**

A total of 764 wetlands were classified within the study area (Figures 3 to 5), with 295 wetlands being classified during the field surveys (2009 and 2012) and 469 wetlands being classified using aerial photographs, due to restricted land access and/or time limitations (Table C.1 in

Appendix C). In addition, a total of 39 tree stands were identified within the study area (Figures 3 to 5). The number and area of the wetlands (separated into wetland classes) and tree stands identified within the study area are presented in Table 4.1.

**Table 4.1: Natural Areas within the Study Area**

Natural Area Type	# (Total)	# (Field Checked)	Total Area (ha)
Class 2 wetland	302	67	234
Class 3 wetland	398	193	406
Class 4 wetland	62	33	450
Class 5 wetland	2	2	58
Tree stands	39	12	75
<b>TOTAL (wetlands)</b>	<b>764</b>	<b>295</b>	<b>1147</b>
<b>TOTAL (wetlands + tree stands)</b>	<b>803</b>	<b>307</b>	<b>1222</b>

Detailed information regarding dominant vegetation, wildlife, surrounding landuse, level of disturbance and wetland linkages for each wetland were recorded into a Microsoft Access database. The entire database and photographs of the majority of natural areas can be found on a CD attached to this report.

#### 4.2.2 Vegetation

A complete list of vegetation observed within the study area during the field survey is presented in Table C.2 of Appendix C. Dominant vegetation observed within the wetlands included species common to the region, such as common cattail, sago pondweed, creeping spikerush, common plantain, and common chickweed. Dominant vegetation observed within the tree stands included trembling aspen, balsam poplar, western snowberry, wolf willow, willow species, prickly rose, and smooth brome. Due to the agricultural activities within the study area, noxious and nuisance species were common within or adjacent to the majority of natural areas, and included noxious species such as Canada thistle, absinthe, nodding thistle, narrow leaved hawksbeard, and cleavers and nuisance species such as dandelion, quack grass, and fox-tail barley.

Five provincially listed plant species were observed at seven locations within the study area during the field survey. The listed species included narrow-leaved water plantain (S3), meadow pussytoes (S1), Engelmann's spikerush (S2), northern blue-eyed grass (S3?), narrow-leaved cattail (S1?) (Table 4.2 and Figure 6). Three of the rare plant locations were within the North Swale and included two locations of narrow leaved cattails and one location of narrow leaved water plantain. The species with '?' associated with their listing indicates that there is some uncertainty with the ranking, either to do with the taxonomy of the species or the data that supports the ranking.

During development of the study area, effort should be made to protect the listed plant species. However, if this is not feasible within the development concept, then mitigation options such as transplantation and/or seed collection should be considered. It is only necessary to consider mitigation options for S1 and S2 species.

#### **4.2.3 Wildlife**

A complete list of wildlife observed within the study area during the field survey is presented in Table C.3 of Appendix C. The majority of wildlife species observed were birds, including Red-winged Blackbird, Savannah Sparrow, Vesper Sparrow, Brewer's Blackbird, American Crow, Le Conte's Sparrow, and Western Meadowlark. There were also a few observations of white-tail deer, white-tailed jackrabbit and boreal chorus frog.

Three federally listed wildlife species were observed within the study area (Table 4.2). Sprague's Pipit is listed as threatened under the Species at Risk Act (SARA) and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and Bobolink and Barn Swallow are listed as threatened under COSEWIC (Government of Canada, 2012).

To ensure compliance with the *Migratory Bird Convention Act*, it is recommended that vegetation clearing be conducted prior to May 1 or after August 1. If clearing must be conducted within the breeding bird season, then a wildlife specialist should conduct a survey to verify that no nests are present.

A review of *The Wildlife Habitat Protection (Land Designation) Amendment Act, 2010* (Chapter 36) was conducted to determine in any federal lands within the study area would meet the conditions for designation under WHPA. However, since there are no Crown lands located within the study area, none of the land would be eligible for designation under WHPA.

**NORTH/NORTHWEST NATURAL AREA SCREENING STUDY, CITY OF SASKATOON**

Inventory of Natural Areas

September 16, 2012

**Table 4.2: Provincially and Federally Tracked Species Observed within the Study Area**

Scientific Name	Common Name	SKCDC ranking <sup>1</sup>	COSEWIC designation <sup>2</sup>	Located within Natural Area	Land Location	UTM (NAD 83, Zone 13)	
						Easting	Northing
<b>Vegetation</b>							
<i>Alisma gramineum</i> Lej.	narrow-leaved water plantain	S3	n/a	5363	NW 35-37-5-W3M	389583	5787948
<i>Antennaria corymbosa</i> E.E. Nelson*	meadow pussytoes	S1	n/a	5311	NE 5-38-5-W3M	385170	5789186
				5308	NE 4-38-5-W3M	386820	5789659
<i>Eleocharis engelmannii</i> Steud.	Engelmann's spikerush	S2	n/a	5140	SW 24-37-6-W3M	381132	5784121
<i>Sisyrinchium septentrionale</i> E.P. Bicknell	northern blue-eyed grass	S3?	n/a	5307	SE 32-37-5-W3M	385245	5786553
<i>Typha angustifolia</i> L.	narrow-leaved cattail	S1?	n/a	5361	SE 2-38-5-W3M	390156	5787995
				5060	SE 28-37-5-W3M	387252	5785515
<b>Wildlife</b>							
<i>Anthus spragueii</i>	Sprague's pipit	S3B	Threatened	5033	SW-29-37-5-W3M	Heard within quarter section	
				5047	SW-34-37-5-W3M	Heard within quarter section	
<i>Dolichonyx oryzivorus</i>	Bobolink	S5B	Threatened	5161	NE-24-37-6-W3M	381930	5784369
<i>Hirundo rustica</i>	Barn swallow	S5B	Threatened	5075	NE-16-37-6-W3M	Heard within quarter section	

<sup>1</sup> **S1:** Extremely Rare, 5 or fewer occurrences in Saskatchewan, or very few remaining individuals

**S2:** Rare, 6 to 20 occurrences in Saskatchewan or few remaining individuals

**S3:** Rare to uncommon, 21 to 100 occurrences in Saskatchewan.

**S3B:** Rare to uncommon, 21 to 100 occurrences in Saskatchewan. Rank applies to the breeding population in the province.

**S5B:** Very common, more than 100 occurrences; widespread and abundant, but may be rare in parts of its range. Rank applies to the breeding population in the province.

?: means that there is some uncertainty with the ranking, either to do with the taxonomy of the species or the data that supports the ranking.

<sup>2</sup> **Threatened:** A species likely to become endangered if limiting factors are not reversed.

#### **4.2.4 Summary**

Overall, the habitat quality of the natural areas (wetlands and tree stands) within the study area is generally poor. The natural areas are highly disturbed from past and current agricultural activity (or adjacent agricultural activity), which has allowed exotic/invasive species to invade, thereby decreasing biodiversity. The disturbed nature of the natural areas limits the recreation and education potential at present. Additionally, with the exception of the North Swale, there are no natural linkages between the natural areas having significant value to wildlife. There are also no landforms of significance within the study area.

Despite the poor condition of the majority of the natural areas within the study area, there are a few areas which have been less impacted by disturbance and therefore provide relatively good quality habitat. Further discussion of these areas is provided in Section 7.0.



## **5.0 Functional Assessment of the North Swale**

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### **5.1 METHODS**

Due to the hydrological and ecological significance of the North Swale, a more detailed field assessment was completed for the wetlands within this area (which includes natural areas 5000, 5001, 5060, 5061, 5360, 5361, 5362, 5363, 5364, and 5365). The following tasks were completed during the field survey at the North Swale.

- Wetland classification based on the Stewart and Kantrud classification method (as described in Section 4.0 and Appendix B)
- Detailed vegetation inventory by wetland zone, including cover class of each vegetation species, measure of the quality of each vegetation zone, and disturbance level.
- Detailed wetland functional assessment (refer to Section 5.1.1)
- Measurement of water depth
- Collection of water quality data, including field measurement of water temperature, electrical conductivity (EC), pH, and dissolved oxygen levels
- Collection of sediment quality data, including sample collection and laboratory analysis for texture, metals, and BTEX / F1 to F4 hydrocarbons

#### **5.1.1 Wetland Functional Assessment**

A detailed wetland functional assessment, based on the Minnesota Routine Assessment Method (MnRAM) for Evaluating Wetland Functions (Minnesota Board of Water and Soil Resources, 2010a), was conducted on wetlands within the North Swale (10 wetlands in total). Due to no land access within NW 21-37-5-W3M, a functional assessment for natural area 5365 was conducted based on available data, rather than field measurements.

The MnRAM wetland functional assessment was developed in 1991 and has been updated several times. In a scientific review paper by Fennessy et al. (2007), the MnRAM method was concluded to be one of the top rated wetland assessment methods as it could be used to measure conditions, was rapid, included a site visit, and could be verified. The Wetland Management Classification system provides a scientifically based approach to ranking wetland functions, which can then be used to make landuse and wetland management decisions.

The MnRAM wetland functional assessment evaluates 12 function characteristics for each wetland, which include:

1. Maintenance of Characteristic Vegetation Diversity/Integrity
2. Maintenance of Hydrologic Regime
3. Flood/Stormwater Attenuation
4. Downstream Water Quality
5. Maintenance of Wetland Water Quality
6. Shoreline Protection
7. Maintenance of Characteristic Wildlife Habitat Structure
8. Maintenance of Characteristic Fish Habitat
9. Maintenance of Characteristic Amphibian Habitat
10. Aesthetics/Recreation/Education/Cultural
11. Commercial Uses
12. Ground Water Interaction

The functional capacity of each wetland was determined by answering a total of 72 questions (field and desktop based), which relate to the 12 functions listed above (refer to Appendix D for a copy of the datasheet). Information collected for the functional assessment included the wetland classification, size, vegetative community, soils, hydrology, ecological characteristics, and cultural uses.

Overall, the data collected during the functional assessment resulted in a qualitative value for each function of the assessed wetland. This is then combined to create a wetland Management Class, which include Preserve, Manage 1, and Manage 2 (refer to Table 5.1). Management Classes are based on the wetland's current and potential functions, with focus on the wetland's susceptibility to stormwater degradation (Minnesota Board of Water and Soil Resources 2012). For more information on the MnRAM wetland management classification system refer to Appendix F.

**Table 5.1: Wetland Management Class Determination**

The Management Classes are determined by having at least one of the characteristics listed below their respective classes:

Function / Value	Preserve	Manage 1	Manage 2
Vegetative Diversity/Integrity	<u>Exceptional</u>	<u>High</u>	<u>Moderate</u>
Shoreline Protection	<u>High</u>	<u>Moderate</u>	<u>Low</u>
Wildlife Habitat	<u>Exceptional</u>	<u>High</u>	<u>Moderate</u>
Fish Habitat	<u>Exceptional</u>	<u>High</u>	<u>Moderate</u>
Amphibian Habitat	<u>High</u>	<u>Moderate</u>	<u>Low</u>
Commercial Uses	-	<u>High</u>	-
Combination	<u>Exceptional</u> for aesthetics/recreation/ education/cultural <b>and</b> <u>High</u> for wildlife	<u>High</u> for aesthetics/recreation/ education/cultural <b>and</b> <u>Moderate</u> for wildlife habitat	<u>Medium</u> for aesthetics/recreation/ education/cultural <b>and</b> <u>Low</u> for wildlife habitat
	<u>High</u> for vegetative diversity/integrity <b>and</b> <u>High</u> for wetland water quality	<u>Moderate</u> for vegetative diversity/integrity <b>and</b> <u>High</u> for wetland water quality	-
	<u>High</u> for vegetative diversity/integrity <b>and</b> <u>High</u> for hydrologic regime	<u>Moderate</u> for vegetative diversity/integrity <b>and</b> <u>High</u> for hydrologic regime	-
	<u>Exceptional</u> for stormwater attenuation <b>and</b> <u>Moderate</u> or higher for vegetative diversity/integrity	<u>High</u> for stormwater attenuation <b>and</b> <u>Moderate</u> or higher for vegetative diversity/integrity	-

**5.1.2 Information Plan**

In conjunction with the field work conducted for the functional assessment, the ecological boundary of the main portion of the North Swale (5060, 5061, 5360, 5361, 5362, 5363, 5364, 5365) was walked on July 12/13 and GPS tracks were recorded on September 12, 2012. The ecological boundary of the North Swale included the wetland areas of the swale, plus any additional upland areas of ecological significance. The ecological boundary of wetlands 5000 and 5001 was not determined as these wetlands are no longer connected to the North Swale by surficial natural drainage. In addition, wetlands 5000 and 5001 are located within the 4 km airport buffer and therefore it is not recommended to conduct any wildlife habitat enhancement work in the vicinity of these wetlands.

Land access permission was not granted for the entire boundary of the North Swale, therefore the ecological boundary shown on Figure 7 would need to be field checked within N 34, NW 35, and W 21-35-37-5-W3M to verify its accuracy.

An ArcMap layer of the North Swale ecological boundary is saved to the CD that is attached to this report.

## 5.2 FINDINGS

### 5.2.1 Physical Characteristics

There are ten wetlands that comprise the North Swale, which consists of one Class 5 wetland, eight Class 4 wetlands, and one Class 3 wetland (Table 5.2). The North Swale is 288 ha in size. Historically, wetlands 5000 and 5001 would have been part of the North Swale, however industrial/commercial developments have isolated these wetlands from the swale.

The area surrounding the North Swale consists of gently sloping land (~2%) on the north side of the swale and level land adjacent to the south side of the swale with a moderate slope (~5%) separating the swale from the surrounding upland. Pasture land borders the northern side of the swale and cultivated agricultural land borders the southern side of the swale. A portion of the North Swale (wetlands 5060, 5361, and 5364) has little disturbance within the wetland, however there are other areas of the swale (within wetlands 5061, 5360, 5362, 5363, and 5365) that have been impacted by infilling, road developments, and drainage canals.

**Table 5.2: Wetlands within the North Swale**

Natural Area ID	Area (ha)	Location					Stewart and Kantrud Classification <sup>1</sup>		
		QRT	SEC	TWP	RGE	MER	Class	Cover	Phase
5000	21.54	NW	17	37	5	3	4	3	Open water
5001	4.08	SW	20	37	5	3	4	2	Open water
5060	57.12	E	28	37	5	3	5	3	Open water
5061	23.23	NW	27	37	5	3	4	3	Open water
5360	50.24	S	34	37	5	3	4	3	Open water
5361	33.84	S	2	38	5	3	4	2	Normal emergent and Open water
5362	26.48	NW	35	37	5	3	4	2	Open water
5363	4.67	NW	35	37	5	3	3	2	Open water
5364	20.75	E	34	37	5	3	4	2	Open water
5365	46.33	NW	21	37	5	3	4	2	Normal emergent

<sup>1</sup> refer to Appendix B for a description of the Stewart and Kantrud (1971) wetland classification system

### 5.2.2 Vegetation

A total of 70 vegetation species were identified in the 2012 North Swale field survey. Table E.1 (Appendix E) provides a detailed list of the vegetation species observed per wetland zone during the field survey. Two provincially listed species were observed: narrow leaved cattail (S1?) at 2 locations, and narrow leaved water plantain (S3) at one location (Table 4.2 and Figure 6).

The deep marsh zone and shallow marsh zone tended to have the highest quality of vegetation, whereas the wet meadow zone and low prairie zone tended to have lower vegetative community

quality because of the invasion of noxious and nuisance species. The two peripheral zones are particularly prone to weed invasion in areas that are adjacent to disturbed land (seed source of weedy species) because pioneering weedy species tend to outcompete native species in areas that have fluctuating water levels.

Table 5.3 provides the proportions of each wetland vegetation zone per wetland, its invasive / exotic species cover class, and the community quality of each zone.

**Table 5.3: Wetland Vegetation Zone, Proportions, and Quality**

Wetland Vegetation Zone	Proportion (%)	Invasive/exotic vegetation (Cover Class <sup>1</sup> )	Community Quality <sup>2</sup> (E, H, M, L)
<b>5000</b>			
Deep marsh zone 1 (open water)	70	1	M
Deep marsh zone 2	5	1	H
Shallow marsh zone 1	10	1	M
Shallow marsh zone 2	10	1	M
Wet meadow zone	5	4	L
<b>5001</b>			
Deep marsh zone 1 (open water)	40	1	M
Shallow marsh zone 1	50	1	H
Shallow marsh zone 2 (ditch on west side of berm)	10	1	H
<b>5060</b>			
<b>North</b>			
Deep marsh zone 1 (open water)	30	1	H
Shallow marsh zone 1	20	1	H
Wet meadow zone 1	10	5	M
Low Prairie zone 1	10	3	M
<b>South</b>			
Deep marsh zone 2	5	1	H
Shallow marsh zone 2	15	2	H
Shallow marsh zone 3	5	1	H
Wet meadow zone 2	5	5	L
<b>5061</b>			
Deep marsh zone 1 (open water)	60	1	M
Deep marsh zone 2	10	1	H
Shallow marsh zone 1	10	2	H
Shallow marsh zone 2	5	1	H
Wet Meadow Zone 1	10	5	L
Wet meadow zone 2	5	6	L
Berm	<5	6	L
<b>5360</b>			
Deep marsh zone 1 (open water)	20	1	H

Wetland Vegetation Zone	Proportion (%)	Invasive/exotic vegetation (Cover Class <sup>1</sup> )	Community Quality <sup>2</sup> (E, H, M, L)
Deep marsh zone 2	10	1	H
Shallow marsh zone 1	5	2	H
Shallow marsh zone 2	15	1	H
Shallow marsh zone 3	15	3	M
Wet meadow zone 1	15	3	M
Wet meadow zone 2/Low Prairie Zone	20	6	L
<b>5361</b>			
Deep marsh zone 1 (open water)	5	1	H
Shallow marsh zone	75	1	H
Wet meadow zone	10	2	H
Low prairie zone	10	4	M
<b>5362</b>			
<b>North</b>			
Deep marsh zone 1 (open water)	30	1	H
Deep marsh zone 2	15	1	H
Shallow marsh zone 1	10	1	H
Wet meadow zone	5	1	H
<b>South</b>			
Shallow marsh zone 2	10	3	M
Wet meadow zone 2	30	4	L to M
<b>5363</b>			
<b>East side of fence</b>			
Deep marsh zone 1 (open water)	15	1	H
Deep marsh zone 2	15	1	H
Shallow marsh zone 1	5	1	H
<b>West side of fence</b>			
Deep marsh zone 3	40	1	H
Shallow marsh zone 2	5	1	H
Wet meadow zone	20	4	H
<b>5364</b>			
Deep marsh zone	70	1	H
Shallow marsh zone	10	1	H
Wet meadow zone	10	4	M
Low Prairie Zone	10	6	L

<sup>1</sup> Vegetation Cover Classes: 1=0-3%; 2=>3 to 10%; 3=>10 to 25%; 4=>25 to 50%; 5=>50 to 75%; and 6=>75 to 100%

<sup>2</sup> Community Quality; E=excellent, H=high, M=moderate, L=low

### 5.2.3 Wildlife

A total of 24 bird species were observed during the field survey. In addition, minnow species and a white-tailed jackrabbit were seen during the survey. No federally or provincially listed wildlife species were observed within the North Swale during the field survey, however Sprague's pipit was heard in 2009 immediately to the north of wetland 5061 within SW 34-37-5-W3M (pasture land).

Table E.2 (Appendix E) provides a detailed list of wildlife species observed during the field survey.

### 5.2.4 Water Depth and Quality

Water depth and quality measurements were collected from the wetlands in the North Swale (Table 5.4). Water depth within the North Swale wetlands ranges from approximately 0.75 m to 1.4 m at the deepest point. The wetlands have slightly basic to basic pHs, are influenced by the groundwater (as evidenced by elevated EC values), and can support aquatic species (as evidenced by the oxygen saturation levels in the water).

**Table 5.4: Water Depth and Quality within the North Swale**

Wetland ID	Water Depth (m)	Temp(°C)	EC (µs)	pH	DO (%)
5000	1.4	18.9	1436	9.21	77.4
5001	0.9	17.1	1759	8.23	50.9
5060	1.3	28.9	1931	8.74	134.8
5061	0.8	27.6	2250	8.59	137.4
5360	1.0	26.3	1891	9.02	173.6
5361	0.6	26.5	3281	7.32	126.6
5362	1.0	25.1	2596	9.39	155.4
5363	0.75	no access			
5364	0.75	29.2	2440	8.29	186.4
5365	no access				

### 5.2.5 Sediment Quality

Sediment samples were collected from three wetlands (5060, 5360, and 5364) within the North Swale and submitted to ALS Group in Saskatoon for analysis of texture, metals and hydrocarbons. The samples were collected from the sides of the wetlands in water ~0.4 m deep. Due to restricted access to wetland 5364, the sediment sample was collected next to the road, whereas the samples collected from wetlands 5060 and 5360 were collected next to agricultural/pasture land.

The sediment texture was silt loam within wetlands 5060 and 5360 and sandy loam within wetland 5364, likely due to sand inputs from the road (Table E.3 in Appendix E). The metal parameters were below applicable guidelines for the sediment samples from the three wetlands. Hydrocarbon levels were slightly elevated within wetland 5360, relative to the other two wetlands however this could be due to the high organic content of the sediment.

### **5.2.6 Functional Assessment**

Based on the MnRAM wetland functional assessment, wetlands 5060, 5361, 5363, and 5364 were assigned a management class of Preserve (Figure 7) and wetlands 5000, 5001, 5061, 5360, 5362, and 5365 were assigned a management class of Manage 1. Results of the functional assessment are provided in Table 5.5, which details the score for each function that was assessed, and the resulting management class. A summary of the functional assessment of each wetland is described below.

#### 5060 - Preserve

Wetland 5060 has a large buffer on its north and west sides, an upland berm (approximately 2 m tall with a 15 to 20° slope) separating the wetland from a cultivated field (where New Holland tests its equipment) to the southwest, a gravel road (Millar Avenue) on its east side, and an industrial site at its southern end. The berm protects the wetland from runoff from the field that could potentially cause erosion or sedimentation. Overall, the wetland is relatively healthy and scored high in vegetative diversity and in functions of flood/stormwater attenuation and maintenance of water quality, resulting in it being assigned a Management Class of Preserve.

#### 5061 – Manage 1

Wetland 5061 has a cultivated field to the south, a gravel road (Millar Avenue) on the west, and a construction site to the north; consequently, it has no buffer. The lack of buffer results in a decreased function in maintenance of wetland water quality and wildlife habitat. Wetland 5061 has been subject to substantial amounts of filling at its north end and has been split from wetland 5360 by the construction of a causeway. As such, the wetland has undergone significant disturbance; however, a berm has been built around the portion of the wetland that is undergoing infilling and construction and the wetland portion on the other side of the berm is relatively healthy with high vegetative diversity. The berm at the time of the field survey in July 2012 was about 5 to 10 cm below the surface of the water and heavily vegetated with bulrush and other shallow marsh and deep marsh zone species. The berm aids in preventing sedimentation caused by the infilling and construction from polluting the other wetland areas and the thick vegetation has effectively created habitat for nesting birds; several nests were observed during the field survey. The wetland received a wetland Management Class of Manage 1, placing it below Preserve wetlands, because other than having high vegetative diversity it did not receive a score of high for any of the other functions assessed. The lack of buffer contributed to the diminished functions of maintenance of wetland water quality and wildlife habitat.



5360 – Manage 1

Wetland 5360, which is separated by a causeway from wetland 5061, has also been subject to substantial amounts of filling at its south end. A cultivated field borders it to the southeast and a railway to the north east. Unlike wetland 5061, wetland 5360 has a buffer of pastureland along its northern edge increasing its score for wildlife habitat. Similar to 5061, a berm separates the portion of the wetland that is undergoing infilling from the remaining wetland resulting in the wetland outside the berm being relatively healthy with high vegetative diversity. The wetland had high vegetative diversity in most of the zones, except for the low prairie and wet meadow vegetation zones on the north side; the northern most zone received a score of low because it was highly invaded by perennial sow thistle in the low prairie zone and by fox-tail barley in the wet meadow zone (refer to Table 5.3). Wetland 5360 received a wetland Management Class of Manage 1, placing it below Preserve wetlands.

5361 - Preserve

Wetland 5361 is located north of a gravel road (Penner Road) and bordered by a cultivated field to the east and north except for its northern boundary in SW 02 38 05 W3M, which is made up of pasture, including a small patch of native prairie. It attained a Management Class of Preserve because of the presence of a provincially tracked plant species, narrow-leaved cattail (S1?) and because of its exceptional score in maintenance of wetland water quality. It also scored high in the functions of flood and stormwater attenuation and wildlife habitat.

5362 – Manage 1

Wetland 5362 is located south of Penner Road, just east of its intersection with Wanuskewin Road. Property access was not granted and a roadside assessment was conducted. The wetland has no buffer because it is bordered by roads on the west and north, and by an agricultural field on the southeast side. Besides being bordered by Penner Road, the northeast half of the wetland showed little evidence of disturbance; however, the southwestern half of the wetland has been altered significantly to form a drainage canal that stretches from the northeastern half of the wetland to the culvert under Wanuskewin road, connecting it to wetland 5364. The wetland showed high vegetative diversity, but did not receive high scores in any of the other functions mostly due to the lack of buffer. It was assigned a wetland Management Class of Manage 1.

5363 - Preserve

Wetland 5363 is bordered on all three sides by gravel roads (Penner Road) and connected to the adjacent wetlands by culverts. Property access was not granted and a roadside assessment was conducted. Due to the smaller area of the wetland and the roads bordering the wetland, vegetation zones and dominant vegetation species was easily observed. Wetland 5363 attained a Management Class of Preserve because of the presence of a tracked species, narrow leaved water plantain (S3), which included a population of over 200 plants in the shallow marsh zone on the western half of the wetland. Although the shallow marsh zone was relatively

healthy and diverse, weeds dominated the wet meadow zone, which began at the edge of the road and formed a peripheral ring around the remainder of the wetland.

#### 5364 - Preserve

The wetland is bordered by Wanuskewin Road on its northeast side, railway on its west side, and an agricultural field on its southeast side. Wetland 5364 attained a Management Class of Preserve because it had high vegetative diversity, and scored high in functions of flood / stormwater attenuation, maintenance of wetland water quality, and wildlife habitat.

#### 5365 – Manage 1

Due to no land access and the lack of visibility from the adjacent road, vegetative zones and vegetative species could not be accurately recorded for the whole wetland, but a general idea of vegetation zone quality attained from the vantage point at the northend was used in the functional assessment. Wetland 5365 attained a management class of Manage 1 with a high score in wildlife habitat because of its large size, vegetative pattern, and buffer located on its east side.

#### 5000 – Manage 1

Wetland 5000 is located south of a gravel road (60<sup>th</sup> Street West). Other than the gravel road at the north end of the wetland that cuts across the shallow marsh zone, splitting it from wetland 5001, the wetland showed little disturbance. Wetland 5000 was assigned a Management Class of Manage 1 due to lower vegetative diversity on the northern edge of the wetland and the proximity to the gravel road.

#### 5001 – Manage 1

Wetland 5001 is located between Highway 16 to the east and 60<sup>th</sup> Street West to the south. In July 2012 it was observed that a gravel berm had been put in about 5 to 10 m north of the gravel road; the berm wrapped around both the south and eastern sides of the wetland. The berm was over 95% bare, with vegetation consisting of only invasive and exotic species. Functions diminished in this wetland mainly because there is no buffer, it is located beside a highway, and it does not have a low prairie or wet meadow vegetation zone. Wetland 5001 was assigned a Management Class of Manage 1.

**Table 5.5: Wetland Management Classes – Results**

Functions	Wetland ID									
	5000	5001	5060	5061	5360	5361	5362	5363	5364	5365
Vegetative Diversity	High	High	High	High	High	Exceptional*	High	Exceptional*	High	High
Maintenance of Characteristic Hydrological Regime	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Flood/Stormwater/ Attenuation	Moderate	High	High	Moderate	Moderate	High	Moderate	High	High	Moderate
Downstream Water Quality	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Maintenance of Wetland Water Quality	Moderate	Moderate	High	Moderate	Moderate	Exceptional	Moderate	Exceptional	High	Moderate
Shoreline Protection	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Maintenance of Characteristic Wildlife Habitat Structure	Moderate	Moderate	High	Moderate	High	High	Moderate	High	High	High
Maintenance of Characteristic Fish Habitat	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Moderate	Not Applicable	Moderate	Moderate	Not Applicable	Not Applicable
Maintenance of Characteristic Amphibian Habitat	Moderate	Low	Moderate	Low	Moderate	Low	Moderate	Low	Moderate	Low
Aesthetics/Recreation/ Education/Cultural	Moderate	Low	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Commercial Uses	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Groundwater Interaction	Combination Discharge, Recharge									

\*Exceptional given because of the presence of a provincially tracked species, which results in the wetland being classified as Preserve.

Highlighted boxes indicate the function(s) that determined the Wetland Management Class.



## **6.0 Heritage Assessment**

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### **6.1 METHODS**

As a part of the North / Northwest Natural Area Screening Study, a heritage and archaeological review was conducted to identify areas that may require a Heritage Resource Impact Assessment (HRIA) prior to development. Field and desktop studies were conducted to determine heritage sensitive areas.

The following sources were consulted:

- Heritage Sensitivity Screening Data, created by Heritage Conservation Branch (Ministry of Parks, Culture, and Sport) and accessed on the GeoSask Website
- Archaeological Inventory for the Province of Saskatchewan (Heritage Conservation Branch, Ministry of Parks, Culture, and Sport)
- Saskatchewan Homestead Records (Saskatchewan Archives Board)
- Dominion Land Survey Maps (Saskatchewan Archives Board)
- Historic Air Photos (Information Service Corporation – ISC)
- Recent Satellite Imagery (City of Saskatoon)
- Soil Survey of Saskatchewan Maps
- Previous Studies (see below)

Known archaeological site location data was received from Saskatchewan Ministry of Parks, Culture, and Sport (Heritage Conservation Branch). This information includes all recorded archaeological sites within the study area. This data was converted from an excel spreadsheet format to a shapefile to be used in ArcMap. Heritage sensitivity data was downloaded from the GeoSask website. This data shows which quarter sections are categorized as Sensitive and Not Sensitive for heritage resources within the study area. The Sensitivity rankings are determined by the Heritage Conservation Branch based on set criteria for determining archaeological potential.

Soil types, surficial geology, and glacial drift thickness were also examined. This data provides information pertaining to landscape formation and the likelihood of archaeological preservation. Historical imagery was examined for areas surrounding each of the two known homestead sites. Examining the oldest imagery available enabled the examination historic sites in their most intact form available, as well as observe the rate of deterioration of the site.

Satellite imagery was looked at in order to determine areas that have been disturbed (ie. cultivation) and areas that are still intact (ie. native prairie). Lands that are classified as native prairie are considered to have higher heritage sensitivity, because undisturbed archaeological sites are thought to have more potential to provide information about the past than those that have been disturbed by the plow.

Dominion Land Survey (DLS) maps from the Saskatchewan Archives Board were studied within the survey area. These maps provide information concerning each township recorded by surveyors in the late 1800's to early 1900's. They show the topography of this time period, as well as the location of trails and historic homesteads in the area.

The Saskatchewan Homestead Index Database records were also retrieved from the Saskatchewan Archives Board for the known homestead sites within the study area. The Homestead records provide information such as patent date, land ownership, family names and ages, the number and size of buildings on the property, as well as livestock information.

A Heritage Report Review was also conducted of all known relevant archaeological reports previously conducted in the area. The study boundaries of three of these reports fall within our current study area (Walker 1983, Stantec 1998, and AMEC 2002). These reports were examined to see if they contained any additional information on known sites in the study area, particularly for the Caswell and Valley Crest Homestead sites.

## **6.2 FINDINGS**

### **6.2.1 Areas of No Further Concern**

Areas of no further concern (green areas, refer to Figure 8) are located in regions of cultivated eroding glacial till. There are no known areas of blowing sand or river deposits in these areas, and therefore no potential for deeply buried sites. Any sites that do exist, therefore, will have been destroyed by the plow. There are no known sites in these areas, and no historic homesteads indicated on DLS maps. They have not been indicated as "sensitive" in the Heritage Sensitivity Screening Data. These are areas that are not in close proximity to major water bodies.

### **6.2.2 Areas Requiring Heritage Resources Impact Assessment (HRIA) Prior to Development**

Areas requiring an HRIA prior to development were determined using several factors. Areas were deemed sensitive if they had known sites or known historic homesteads. They were also considered sensitive if they contained unbroken native prairie, and met some of the following standard criteria outlined by Heritage Conservation Branch:

- Within the same quarter section as (or within 500 m of) a previously recorded site, unless it is shown to be of low heritage significance;
- Within 1 km of permanent rivers/streams;

- Within 1 km of well-formed valleys containing permanent and/or seasonal watercourses;
- Within 1 km of permanent/seasonal water bodies that are greater than 2 km in length/width;
- Within 1 km of smaller water bodies that are located in well-defined drainage basins;
- On hummocky terrain (defined by 3 or more contour intervals and 4 or more sloughs per quarter section).

Table 6.1 outlines the quarter sections that met the above criteria and were deemed to have heritage sensitivity (shown in pink on Figure 8).

**Table 6.1: Heritage Sensitive Quarter Sections**

16-37-06-W3M	SE 27-37-06-W3M	SW 28-37-05-W3M	SW 34-37-05-W3M	SW 35-37-05-W3M
NW 22-37-06-W3M	NE 18-37-05-W3M	NE 28-37-05-W3M	NE 34-37-05-W3M	NW-17-37-05-W3M
NE 22-37-06-W3M	NE 20-37-05-W3M	SE 28-37-05-W3M	SE 34-37-05-W3M	NW 26-37-05-W3M
SE 22-37-06-W3M	SW 20-37-05-W3M	NW 27-37-05-W3M	NW 35-37-05-W3M	SW 26-37-05-W3M
SW 2-38-5-W3M	SW 23-37-5-W3M	SE 20-37-5-W3M		

If a development within these areas was referred to the Heritage Conservation Branch (Ministry of Parks Culture and Sport), they would most likely return a requirement for an HRIA. This is because these lands meet the criteria, outlined above, under which Heritage Conservation Branch usually requires an HRIA. For these reasons, we recommend an HRIA on these areas but recognize that this recommendation must be vetted by the Heritage Conservation Branch. This can be done by submitting a referral form (or simply a permit application for the HRIA work) to the Heritage Conservation Branch prior to development.

### **6.2.3 Archaeological Sites within the Study Area**

A summary of the archaeological sites located within the study area is presented in Table 6.2. Specific discussion on the Caswell and Valley Crest Homestead Sites and the Battleford – Saskatoon Trail are included below.

#### ***Caswell Homestead Site***

The Caswell Homestead site is located within SW 28-37-5-W3M. Homestead records indicate that patent was granted to John J. Caswell in 1907. His house was built in 1903 and a stable is reported to have been built around the same time. The house has burned down but concrete foundations are still visible. There are 3 buildings that are still standing, which appear to be of a more modern construction due to evidence of electrical conduit, or may be older buildings

altered in more recent years. There is a well approximately 5 m to the northwest of the house foundation. A ditch is located on the north edge of the yard, and a mound is located in the center of the yard, possibly the location of an old outbuilding. There are many post-1920's era artifacts located within the site area. The farmyard is reported to have been occupied at least into the 1960's. A raised edge can be seen on the northern and eastern edges of the site, possibly the location of an old fence line. This site has been given the Borden Designation FbNq-8 and included in the Archaeological Inventory for the Province of Saskatchewan.

This site was subject to a field visit to confirm its existence, record it with the Heritage Conservation Branch, and do some basic mapping. This is typically the first, or "Reconnaissance" phase of archaeological evaluation. The next phase, should development be desired in the area, is to map the site in detail and conduct test excavations or (if desired) a geophysical survey to determine if there are significant intact archaeological remains associated with this homestead. If the results of this study determine that there are no significant archaeological remains that would warrant further study through excavation, then no more work will be required on the site and the detailed map will be considered an adequate mitigation of impact by development. Development would then be allowed to proceed in the area and there would be no setbacks required.

If significant archaeological materials were encountered, recommendations would be put forward to either complete a salvage excavation, provide interpretive data if desired, or establish buffers of avoidance for the site.

In the interim, development should avoid the main area of standing structures and junk piles, including the tree rows west of the concrete foundation.

### ***Valley Crest Homestead Site***

The quarter section of SW 23-37-5-W3M contains a homestead site (Valley Crest Homestead) and this area also has high potential for pre-contact archaeological sites due to its proximity to the river. There is also a possible child burial (word of mouth to City of Saskatoon Engineers 1983) at this location. In previous studies (Stantec 1998), manganese tinted glass was found scattered on the valley rim near Harris Rebar. It was noted that a stone foundation and refuse pit was known to exist on the Harris Rebar leases in close proximity to an apparent cellar depression. Field investigations found that there were two cellar depressions that were still visible at this homestead site. The previous owner of Section 23-37-05-W3M (prior to Harris Rebar), since 1892, was the Temperance Colonization Society (Certificate of title # 131.A.40).

Owing to time constraints, this site was confirmed as to location and existence only.

An HRIA should be conducted to map the site in detail. A Saskatchewan Archaeological Resource Record Form should be submitted to Heritage Conservation Branch to record the site in the Province's Inventory of Archaeological Sites and obtain a Borden Designation for the site. This affords the site some protection in that it would then be flagged with Heritage Conservation Branch and an HRIA would be required prior to impact by development.



The HRIA should include test excavations and a geophysical survey to determine if there are significant intact archaeological remains associated with this homestead. In this instance, a geophysical survey is recommended owing to the possibility of a small unmarked grave in the area. A geophysical survey is a non-intrusive way of determining if there are disturbed soils (such as a grave shaft) in the area. It should be noted, however, that an unmarked infant burial may be very difficult to pinpoint exactly within the total area of the site. For that reason, oral tradition may become the best evidence that can be obtained regarding the burial and the city may wish to consider establishing a general setback around the area. The area is very attractive and overlooks the river and would be well suited for a natural walking trail area.

If the results of this study determine that there are no significant archaeological homestead remains that would warrant further study through excavation, then no more work will be required from an archaeological perspective; with the exception of setbacks for the grave as discussed above. If significant archaeological materials were encountered, recommendations would be put forward to either complete a salvage excavation, provide interpretive data if desired, and establish buffers of avoidance for the site.

In the interim, development should avoid the area from the east fence of the Harris Rebar property to the edge of the river. Based on our observations in the field, Harris Rebar is not impacting the site at this time.

It should be noted that the site exists right on the east-west quarter section line of Section 23 and in fact the majority of the site extends north into the NW of 23-37-5-W3M, which is not part of the study area for this screening. If this is in fact land owned by Harris Rebar, permission from Harris Rebar would be required to go on to the site and do a detailed investigation of the site. During the field work for this study, the field crew stopped in at the Harris Rebar office prior to looking for the site and so had permission to do investigations conducted under this study.

### ***Battleford - Saskatoon Trail***

Examination of the Dominion Land Survey Maps from 1901 quarter sections indicates that NW 16-37-06-W3M, NE 16-37-06-W3M, SE 16-37-06-W3M, and SW 15-37-06-W3M contain a portion of the Battleford – Saskatoon Trail.

Section 16 and SW 15-37-06-W3M are cultivated, with the exception of some wetlands that exist in the area. Any remnants of the trail that were in cultivation will have been destroyed; however, an HRIA is recommended prior to development for the uncultivated wetland margins in case any intact remnants of the trail exist there.

Due to no land access permission, the wetland margins along the trail route were not examined as part of the current study.

**Table 6.2: Known Archaeological Sites within the Study Area**

Site Name	Borden	Land Location	UTM (NAD 83, Zone 13)		Description	Recommendation
			Easting	Northing		
Caswell Homestead Site	FbNq-8	SW 26-37-5-W3M	386085	5784985	Historic remains of the homestead John J. Caswell.	HRIA prior to disturbance by development.
Valley Crest Homestead Site	TBA	NE 23-37-5-W3M	389273	5784034	Historic homestead; oral tradition indicates an infant burial at this location.	HRIA prior to disturbance by development, remote sensing to locate the burial is recommended as well.
Battleford - Saskatoon Trail	n/a	16-37-6-W3M			Historic maps indicate a possibility for historic trail remnants in uncultivated wetland margins within this section	HRIA of uncultivated wetland margins prior to disturbance by development.
None	FbNq-1	27-37-6-W3M (provenienced to section only)			A single Scotsbluff (8800 years BP) was found by a landowner somewhere within the section. The point itself is still with the collector; but its existence creates a high archaeological potential for the whole section because of the possibility that the site it came from is somewhere in the section.	HRIA prior to disturbance by development.
Blue Lettuce Site	FbNq-2	NE 20-37-05-W3M	385349	5784321	Small scatter of stone tools indicative of potential for intact archaeological sites in the area.	HRIA prior to disturbance by development.
Agriplace Site	FbNq-3	SE 20-37-5-W3M	385549	5783320	Small scatter of stone tools indicative of potential for intact archaeological sites in the area.	HRIA prior to disturbance by development.
Site #1	FbNq-5	SE 22-37-06-W3M	378749	5783621	Scatter of McKean/Pelican Lake (about 4100-1850 years BP) artifacts including a precontact copper tool, also a historic gunflint.	HRIA prior to disturbance by development.
Site #2	FbNq-6	NE 22-37-06-W3M	378949	5784921	Scatter of Pelican Lake (3300 -1850 years BP) stone tools.	HRIA prior to disturbance by development.
Site #3	FbNq-7	NW 22-37-06-W3M	377949	5784721	Scatter of stone tools.	HRIA prior to disturbance by development.

## 7.0 Recommendations

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This section provides recommendations for the important natural areas, known and potential heritage resources, the North Swale, and for future studies. Figure 9 provides a general overview of natural and historic areas of interest.

As noted previously, much of the North/Northwest study area has been disturbed by agriculture, industrial and commercial developments, transportation corridors, and other human disturbances. The North Swale, discussed separately in Section 7.2, is the only large natural area having high potential for protection and possible recreation and interpretive use. There are natural areas outside of the North Swale boundaries that have conservation value, however these are small, isolated or located in close proximity to the airport relative to the North Swale.

Section 7.1 provides recommendations for the natural areas outside of the North Swale boundaries. Additionally, all recommendations related to heritage resources are discussed in Section 7.3.

### 7.1 NATURAL AREAS OUTSIDE OF NORTH SWALE BOUNDARIES

#### 7.1.1 Natural Areas – West Portion

Natural areas within the western portion of the study area are primarily related to Class 2 and 3 wetland locations (refer to Figure 4). Of the many areas, only wetland 5096 (Section 14-37-6-W3M), and wetlands 5160, 5161, 5162, and 5163 (all located within NE 24-37-6-W3M), are considered having low disturbance (refer to Figure 9). The many other wetlands, however, do provide the region with important hydrologic functions and the potential exists for developing a stormwater management plan that incorporates some of the wetlands within the development area.

- It is recommended that wetlands 5096, 5160, 5161, 5162, and 5163 be considered within any stormwater management plan as locations suitable for retention in as natural a state as possible. For example, they could form the basis for the development of a naturalized wetland stormwater management plan. This is particularly the case with wetlands 5160, 5161, 5162, and 5163, as their proximity to each other provides opportunities for planners to integrate them as a larger naturalized stormwater area.
- However, all these wetlands are located within the 4 km buffer of the airport. Considering the restrictions set forth in the *Saskatoon Airport Zoning Regulations*, it is not recommended that they be used for open water storage unless measures are taken to detract large birds, and a design, that fits all municipal specifications, is approved by the City.

### **7.1.2 Natural Areas – East Portion**

The North Swale dominates the eastern portion of the study area and specific recommendations for the swale are discussed in Section 7.2. Other natural areas in the eastern portion of the study area that were considered 'of interest' are discussed below and displayed on Figure 9.

Natural Areas 5052, 5053, and 5055 (all located within SW 26-37-5-W3M) are wetlands with relatively low disturbance. However, given their small size and proximity to highways and developing roadways, these wetlands have little opportunity for protection.

Natural Area 5065 (NW 32-37-5 W3M) is a Class 3 seasonal wetland area having relatively low disturbance.

- It is recommended that Natural Area 5065 be considered in a stormwater management plan as a site having good natural qualities and the potential to be integrated into a naturalized wetland plan.

Natural Area 8307, located within Section 5-38-5 W3M, is a low disturbance area having a combination of aspen stands, Class 2 wetlands, and an S1 rare plant species (meadow pussytoes). In addition, Natural Areas 5050 and 5944 (located within SE 33-37-5-W3M) are Class 4 and 2 wetlands, respectively, with a thick peripheral band of willows and trees (trembling aspen and cottonwoods) that provide valuable wildlife habitat.

- It is recommended that an ecological survey be conducted at these locations to better delineate the natural area boundaries and to determine a potential setback, if warranted. This survey should include an early spring site visit, in addition to the summer season visit.

## **7.2 NORTH SWALE**

### **7.2.1 Information Plan**

Transportation corridors and land developments have separated the Swale into several interconnected wetlands (wetlands 5000, 5001, 5060, 5061, 5360, 5361, 5362, 5363, 5364, and 5365). Wetland boundaries of the North Swale are identified in Figure 7, in addition to the ecological boundary of the North Swale. Due to considerable development in the area surrounding the North Swale, the ecological boundary closely follows the wetland boundary for the majority of the North Swale. However, the ecological boundary of the swale within SW 2-38-5-W3M extends northward slightly to encompass an area of intact native prairie. In addition, the ecological boundary of the North Swale within Section 34-37-5-W3M extends northward to include a large area of relatively undisturbed prairie, which contains several Class 2 wetlands (5047, 5048, 5049, 5062, 5825, and 5826) (Figures 7 and 9). However, this area lies within, or adjacent to, the proposed corridor of the perimeter highway proposed by the Saskatchewan Ministry of Highways and Infrastructure (MHI), therefore it is recommended that the City of Saskatoon consult with MHI on their plans for the perimeter road, and that the natural areas

within and adjacent to that road corridor be identified to MHI as areas having ecological significance.

As shown on Figure 7, land access permission was not granted for the entire boundary of the North Swale, therefore the ecological boundary shown on Figure 7 would need to be field checked within N 34, NW, and W-21-35-37-5-W3M to verify its accuracy.

According to *The Planning and Development Act*, the swale and land within the ecological boundary (as shown in Figure 7) meets the requirements of an Environmental Reserve in that the land consists of all of the following:

- a. a ravine, coulee, swamp, natural drainage course or creek bed;
- b. wildlife habitat or areas that are environmentally sensitive, or contain historical features or significant natural features;
- c. land that is subject to flooding or is, in the opinion of the approving authority, unstable; or
- d. land that abuts the bed and shore of any lake, river, stream or other body of water and that is required for the purpose of the prevention of pollution, the preservation of the bank, or the protection of the land to be subdivided against flooding.

## 7.2.2 Wetland Management Class Strategies

A 2012 wetland functional assessment identified that wetlands 5060, 5361, 5363, and 5364 have high ecological value and represent wetlands to be managed to preserve these values (Preserve) (Figure 7). The other wetlands are identified as wetlands that should be maintained without degrading their existing functions and values (Manage 1) (Figure 7).

Table 7.1 provides generic management strategies and stormwater treatment recommendations for each Management Class; it is recommended that the City review these strategies and incorporate them as possible. Specific recommendations for the North Swale include<sup>1</sup>:

- Given the ecological and hydrological significance of the North Swale, it is recommended that wetlands located outside the 4 km airport buffer zone with a Management Class of Manage 1 (5061, 5360, and 5362) be rehabilitated. Wetlands 5000, 5001, and 5365 fall within the 4 km buffer of the airport and thus it is not encouraged that they be rehabilitated, so as to not encourage use by geese and other large birds.
- Establish a minimum 20 m buffer around the ecological boundary of the North Swale wetlands. One exception to this is where the ecological boundary within Section 24-37-5-W3M borders the highway/road; it is not necessary to buffer the ecological boundary at these locations.

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<sup>1</sup> Where applicable, the Northeast Swale Development Guidelines (Stantec 2012) were adapted to apply to the North Swale.

- A 20 m buffer is recommended, rather than a 15 m buffer, as the majority of the ecological boundary of the swale is located at the wetland boundary and therefore the additional upland buffer is recommended for the protection of water quality. However, an extra buffer for the maintenance of wildlife habitat is not required.
- Seed any disturbed lands within the 20 m buffer using species native to the area.
- Establish a fence between the outer edge of the buffer and any adjacent land use, producing an “ecological buffer zone”. This zone is required to reduce encroachment into the buffer by non-compatible activities (e.g., storage of materials, parking of vehicles, etc.). Encroachment by commercial and industrial land uses will have a serious detrimental impact upon the natural vegetation bordering the Swale, thereby also affecting wildlife habitat, water quality, and the natural functions of the wetlands.
- Enforce land use within the ecological buffer zone. Activities associated with adjacent industrial and commercial land uses should not be allowed to spill into the zone.
- Maintain the “Preserve” wetlands in a natural state. To accomplish this it is recommended that the “Manage 1” wetlands be used for a more direct linkage to any stormwater management plan created for the area. For example, lands adjacent to the “Manage 1” wetland could be used for the development of forebays, or as connections to forebays or retention ponds located beyond the North Swale boundary (this could occur within the ecological boundary).
- With the exception of stormwater management activities and developments discussed in Section 7.2.2, no other land uses should be allowed within the ecological buffer zone.

In order to prevent the degradation of wetland functions and values during the construction and post construction of a stormwater management system, it is important that best management practices (BMPs) be implemented. Appendix G provides a list of BMPs and outlines the benefits for each, the pollutants that are controlled, and some general construction requirements. The BMPs are based on the following two documents, which are recommended to be used as guides during construction and maintenance of any potential stormwater management system:

- *Minnesota Urban Small Sites BMP Manual – Stormwater Best Management Practices for Cold Climates* (Barr Engineering Company, 2001).
- *Protecting Water Quality in Urban Areas – Best Management Practices for Dealing with Storm Water Runoff from Urban, Suburban, and Developing Areas of Minnesota* (Minnesota Pollution Control Agency, 2000).

**Table 7.1: Management Class Strategies and Recommendations**

Management Class	Management Strategy	Stormwater Treatment	Buffer	Hydrologic Guidelines <sup>1</sup>
Preserve	Maintain wetland and existing functions, values and wildlife habitat. Active management may be required to protect unique features. Strict avoidance standards should be applied and conservation easements may be appropriate.	Avoid conveyed flows where prudent and feasible. Upstream sediment and nutrient pretreatment is required to maintain background loading rates. Maintain existing hydrology and divert increased flows. Avoid concentrating flows.	≥15 m for water quality and ≥30 m for wildlife habitat. <sup>2</sup>	<i>Bounce (10 yr):</i> Existing <i>Inundation (1 &amp; 2 yr):</i> Existing <i>(10 yr):</i> Existing <i>Runout Control:</i> <sup>3</sup> No Change Maintain existing hydrology. Encourage infiltration and reduced impervious BMPs. Conduct water budget analysis.
Manage 1	Maintain wetland without degrading existing functions, values and wildlife habitat.	Pretreat conveyed flows to maintain background loading rates.	10-15 m	<i>Bounce (10 yr):</i> Existing + 0.15 m <i>Inundation (1 &amp; 2 yr):</i> Existing plus 1 day <i>(10 yr):</i> Existing + 7 days <i>Runout Control:</i> <sup>2</sup> No Change Maintain existing hydrology. Encourage infiltration and reduced impervious BMPs.
Manage 2	Maintain wetland footprint. Improve wetland biological and plant community diversity/integrity or enhance other functions if possible.	Pretreat all conveyed discharges to remove all heavy particles and maximize removal of fine grained sediment prior to discharging to the wetland.	7.5-10 m	<i>Bounce (10 yr):</i> Existing + 0.3 m <i>Inundation (1 &amp; 2 yr):</i> Existing plus 2 days <i>(10 yr):</i> Existing + 14 days <i>Runout Control:</i> <sup>2</sup> 0 to 0.3 m above existing runoff

(Minnesota Board of Water and Soil Resources 2012)

<sup>1</sup> Bounce: difference between the peak flood elevation and the normal wetland elevation.

Inundation Period: time that flood waters are temporarily stored in the wetland that exceed the normal wetland elevation

Runout control: elevation of the outlet

Water budget: a water balance calculation, which accounts for the inflow and outflow of water to and from the habitat area over a certain period, while at the same time, considering the habitat's water demand.

$$\text{Water Balance} = P + Si - Go - ET \quad (\text{Where: } P = \text{precipitation, } Si = \text{surface inflow, } Go = \text{loss/outflow, and } ET = \text{evapotranspiration})$$

### **7.2.3 Linkage Opportunities**

The natural qualities of the North Swale also have potential to be used as a recreation and education amenity for the North/Northwest region. As the swale extends for a considerable distance through the area, it provides an opportunity to develop a commuter pedestrian and bicycle path system along both sides. This could allow connection to the Trans Canada trail system being developed along Wanuskewin Road. Additionally, the City of Martensville is considering connecting to the Trans Canada trail system near Wanuskewin, providing future opportunities to link both cities with a commuter trail system along a natural wetland complex.

- It is recommended that a pedestrian/bicycle pathway system be considered for at least one side of the North Swale. This 3m wide pathway would be developed between the ecological buffer and the outer fence.
- It is recommended that the pathway system connect to the surrounding development areas at regular intervals, but preferably near the “Manage 1” wetlands, rather than the “Preserve” wetlands.
- Interpretive signage is recommended, illustrating the ecological importance of wetlands (wildlife habitat, surface hydrology, etc.). These sign locations could also be at locations providing bird viewing opportunities.

## **7.3 AIRPORT ZONING RESTRICTIONS**

As noted previously, the southern extent of the North Swale (natural areas 5000, 5001, and 5365) and a large portion of the southern extent of the study area are located within the 4 km buffer of the Saskatoon airport. Considering the restrictions set forth in the *Saskatoon Airport Zoning Regulations*, it is not recommended that wetlands within 4 km of the airport be used for open water storage, unless measures are taken to detract large birds, and a design, that fits all municipal specifications, is approved by the City.

## **7.4 HERITAGE RESOURCES**

### **7.4.1 Potential Heritage Resource Sensitive Lands**

As discussed in Section 6.2, it is recommended that an HRIA be conducted within the 23 quarter sections identified in Table 6.1 prior to impact by development. These quarters are also represented in pink on Figures 8 and 9.

### **7.4.2 Caswell Homestead Site**

At this screening stage, archaeologists were only able to confirm the presence of the site and do some basic site mapping, but not perform any detailed examination to determine the site’s content and archaeological significance. In the event that development encroaches on this site,



it is recommended that an HRIA be conducted, including detailed mapping and testing for significant buried archaeological deposits. A detailed mapping and testing program would establish the nature and content of archaeological deposits on the site and assess their significance. This would then establish heritage boundaries that future development should avoid, if any.

### **7.4.3 Valley Crest Homestead Site**

At this screening stage, archaeologists were only able to confirm the presence of the site, but not perform any detailed examination to determine site extents. For this reason, boundaries for avoidance by development could not be determined. This site should be examined in detail with an HRIA prior to any impact by development. The HRIA should include test excavations and a geophysical survey to determine if there are significant intact archaeological remains associated with this homestead. In this instance, a geophysical survey is recommended owing to the possibility of a small unmarked grave in the area, however it may be difficult to pinpoint the exact location of the burial given the total area of the site. Therefore, oral tradition may become the best evidence that can be obtained regarding the burial and the City may wish to consider establishing a general setback around the area.

It should be noted that the site exists right on the east-west quarter section line of Section 23 and in fact the majority of the site extends north into the NW of 23-37-5-W3M, which is not part of the study area for this screening.

### **7.4.4 Battleford - Saskatoon Trail**

At this screening stage, archaeologists were not able to confirm the presence of the trail due to no land access permission. However, much of the area has been cultivated, with the exception of some wetlands. Any remnants of the trail that were in cultivation will have been destroyed; however, an HRIA is recommended prior to development for the uncultivated wetland margins in case any intact remnants of the trail exist there.

## **7.5 FURTHER INVESTIGATIONS**

As noted above, there are some recommended future investigations. These are:

- Completion of HRIAs prior to development at the locations identified in Section 7.2.
- An ecological study having a broader time span in which to collect information on the natural area within Section 5-38-5 W3M (vicinity of Natural Area 8307) and SE 33-37-5-W3M (vicinity of Natural Areas 5050 and 5944).
- Confirm the ecological boundary of the North Swale within N 34, NW, and W-21-35-37-5-W3M (could not be surveyed in the field due to no land access permission).

- Develop a restoration plan for the Manage 1 wetlands within the North Swale that are located >4 km from the airport (5061, 5360, and 5362).
- Consult with the Saskatoon Airport Authority on acceptable designs for naturalized stormwater management ponds located within the 4 km airport buffer. Due to the large number of wetlands located within the 4 km airport buffer, there is an opportunity to retain some of the natural wetlands within the future development plans.

Additionally, the City of Saskatoon is developing a Wetland Policy. The implications of this are unknown at this time, but there may be a need to complete functional assessments for wetlands outside the North Swale boundary and to incorporate those findings into future stormwater management plans.

## 8.0 References

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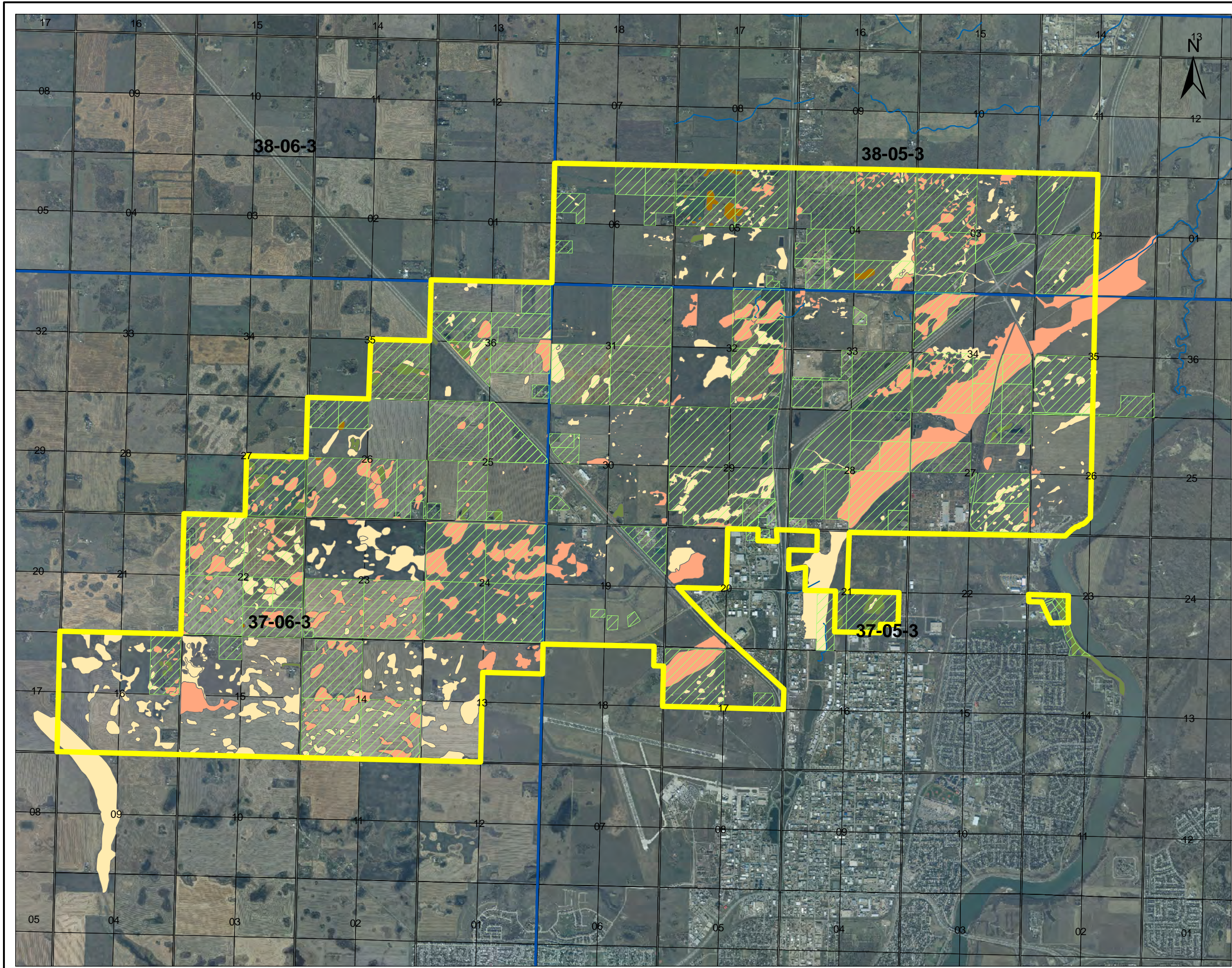
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# FIGURES



### Study Area, Property Access, and Natural Areas

Acknowledgements: Original Drawing by Stantec.  
Imagery: 2009 60cm SGIC Imagery

- Study\_Area
- Property access granted
- Wetland field-checked
- Wetland not field-checked
- Treestand field-checked
- Treestand not field-checked
- Watercourse

113253776 Scale: 1:50,000



	<p>PREPARED BY</p>	<p>FIGURE NO.</p> <p style="font-size: 24px; font-weight: bold;">1</p>
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## Soil Capability for Agriculture

Acknowledgements: Original Drawing by Stantec.  
Imagery: 2009 60cm SGIC Imagery

### Soil Capability Class

- Class 3
- Class 4
- Class 5
- Class 6
- Study\_Area
- Watercourse
- Waterbody

Example: 3(9)M 4(1)E

This means that 90% of this soil polygon is Class 3 due to a slight moisture limitation and 10% of the soil area is Class 4 due to an erosion limitation.

\* Refer to Appendix A for a description of capability classes and subclasses.

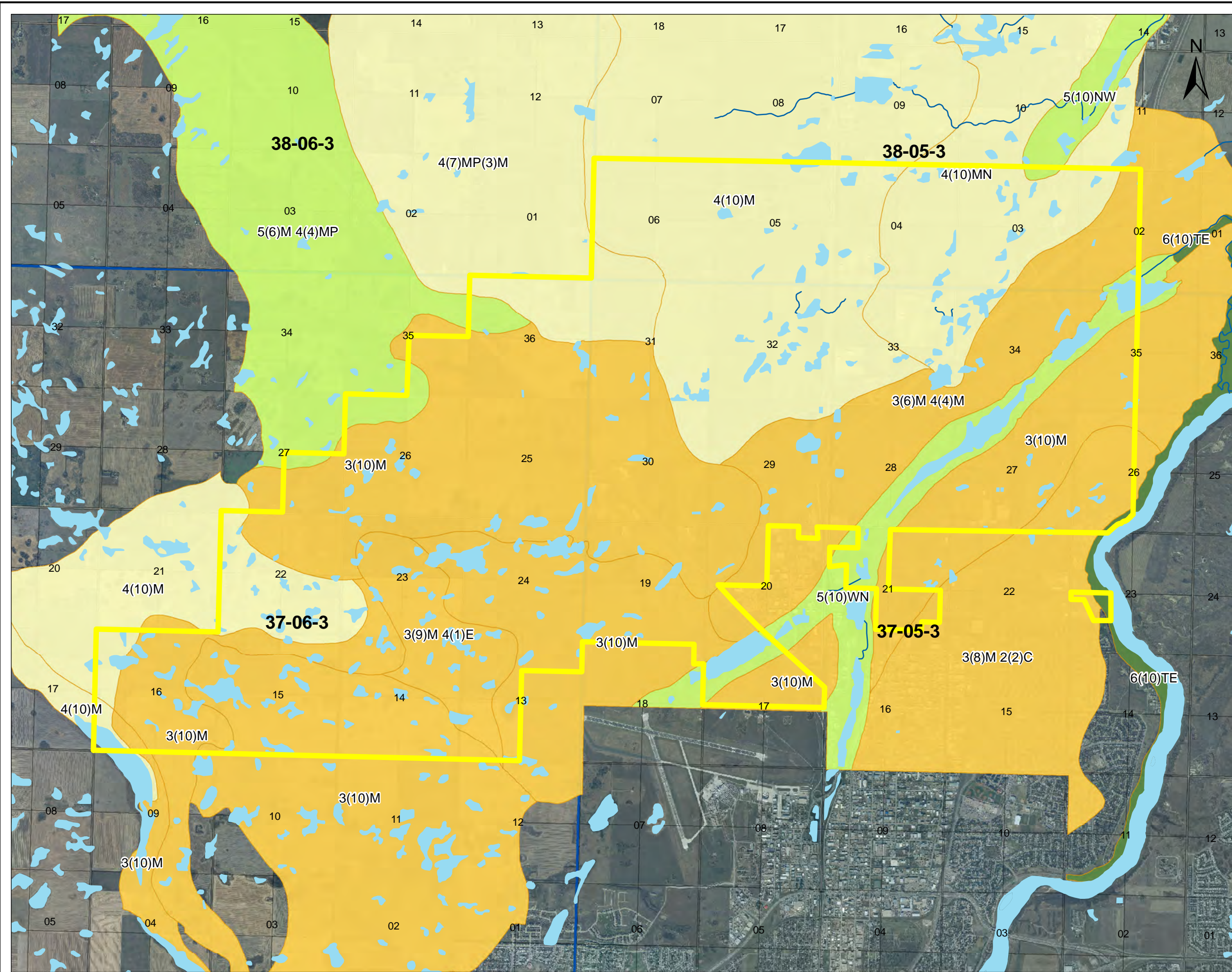
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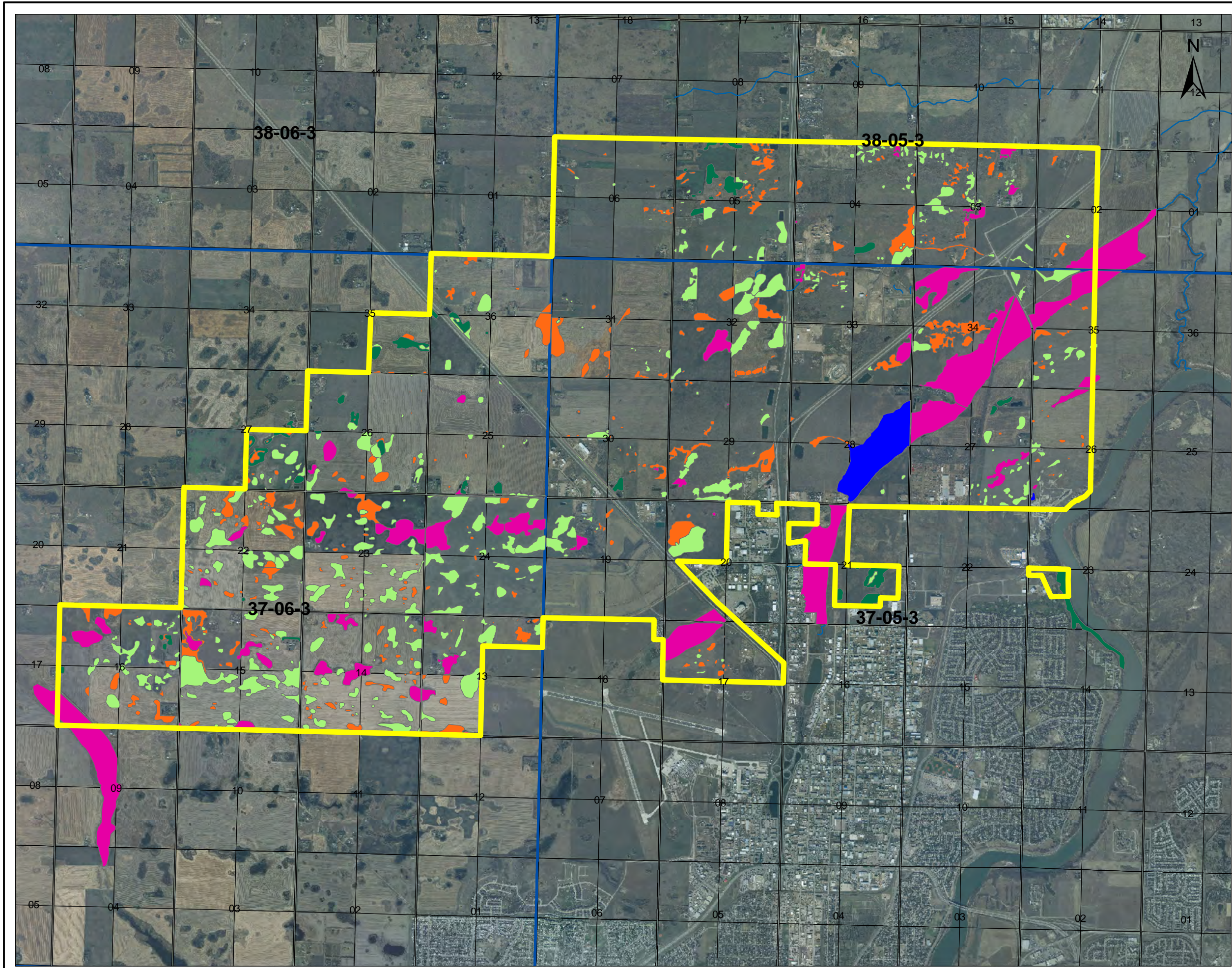
PREPARED FOR:



FIGURE NO. 2



Last Modified: Sep 11, 2013 BY: Hagenmar



**Natural Areas**

- Class 2- Temporary
- Class 3- Seasonal
- Class 4- Semi-permanent
- Class 5- Permanent
- Tree stand
- Study\_Area
- Watercourse

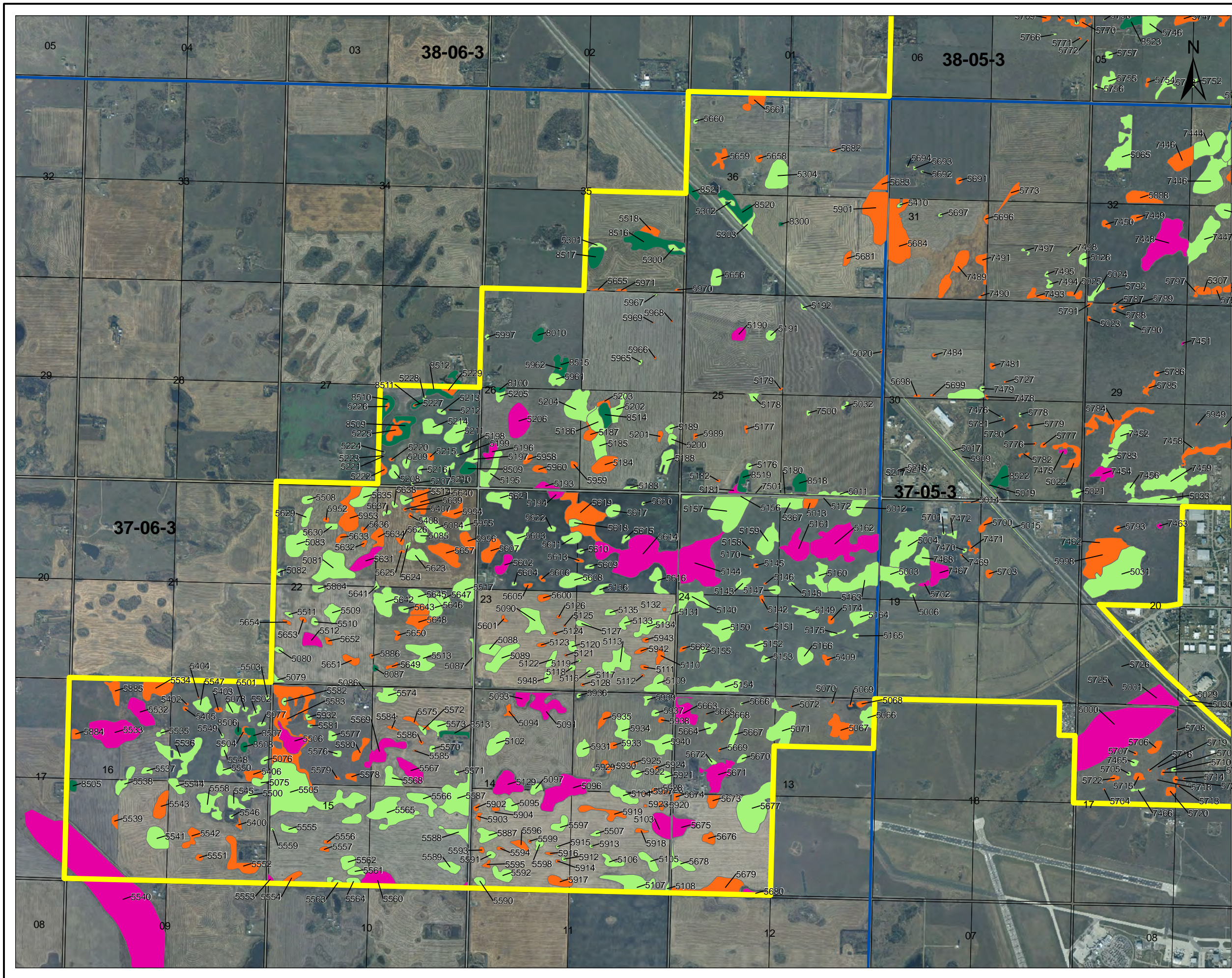
See Figure 4 and Figure 5  
for Natural Area ID numbers.

Scale: 1:50,000

113253776



NWT	NU	
AB	SK MB	
		PREPARED BY <b>Stantec</b>
USA		FIGURE NO. <b>3</b>



### Natural Area Inventory West Portion

Acknowledgements: Original Drawing by Stantec.  
Imagery: 2009 60cm SGIC Imagery

**Natural Areas**

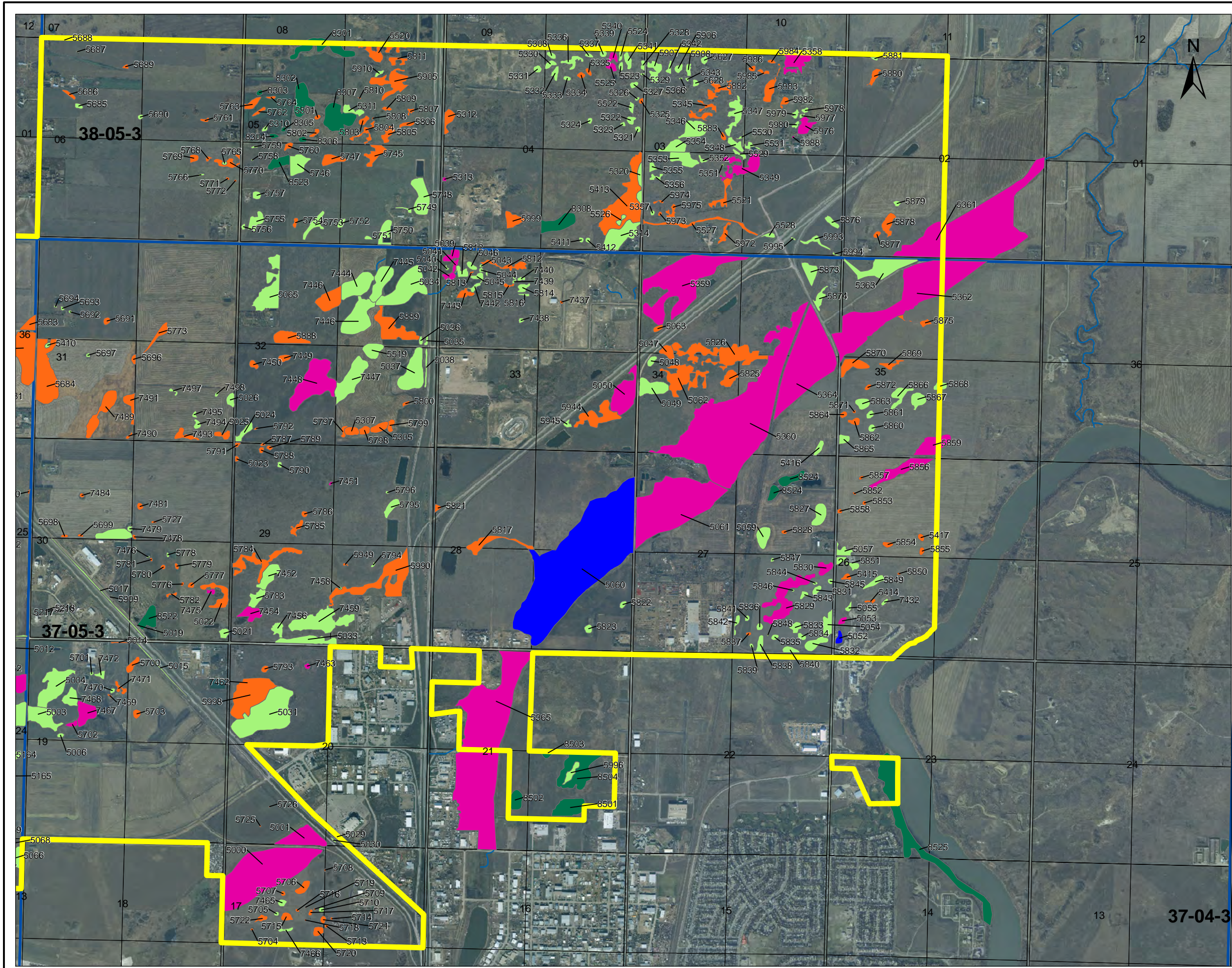
- Class 2- Temporary
- Class 3- Seasonal
- Class 4- Semi-permanent
- Class 5- Permanent
- Tree stand
- Study\_Area
- Watercourse

Scale: 1:30,000



FIGURE NO. 4

Last Modified: Sep 11, 2012 BY: Hagenmair



### Natural Area Inventory East Portion

Acknowledgements: Original Drawing by Stantec.  
Imagery: 2009 60cm SGIC Imagery

- Natural Areas**
- Class 2- Temporary
  - Class 3- Seasonal
  - Class 4- Semi-permanent
  - Class 5- Permanent
  - Tree stand
  - Study\_Area
  - Watercourse

113253776 Scale: 1:30,000



PREPARED FOR:

PREPARED BY:

FIGURE NO. 5

Last Modified: Sep 11, 2013 BY: Hgremm

### Provincially and/or Federally Tracked Species

Acknowledgements: Original Drawing by Stantec.  
Imagery: 2009 60cm SGIC Imagery

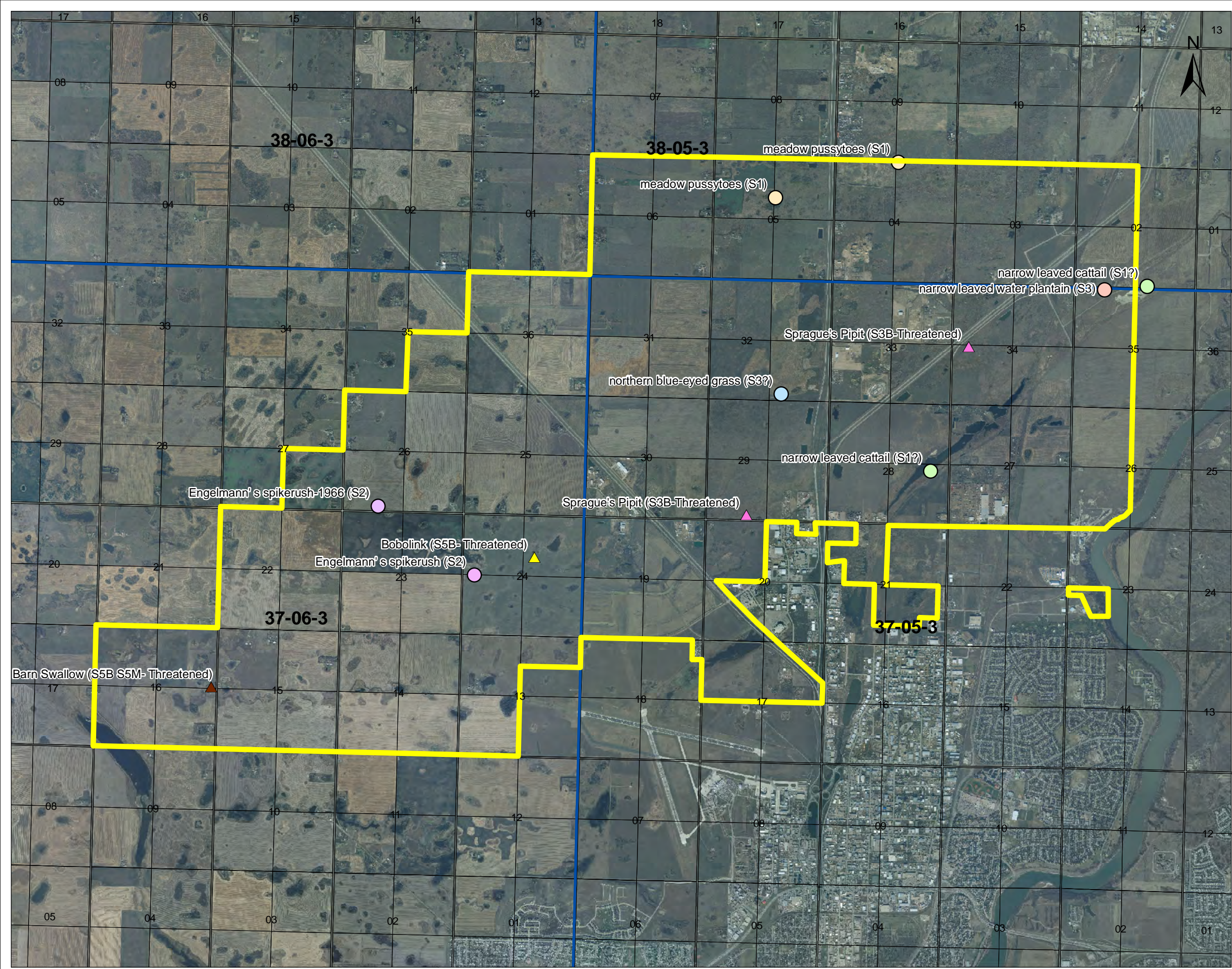
**Tracked Wildlife**

- ▲ Barn Swallow (S5B S5M- Threatened)
- ▲ Bobolink (S5B- Threatened)
- ▲ Sprague's Pipit (S3B-Threatened)

**Tracked Plants**

- Englemann's spikerush (S2)
- Englemann's spikerush-1966 (S2)
- meadow pussytoes (S1)
- narrow leaved cattail (S1?)
- narrow leaved water plantain (S3)
- northern blue-eyed grass (S3?)

**Study\_Area**



Scale: 1:50,000



FIGURE NO. 6

Last Modified: Sep 11, 2013 BY: Hagenmair

# North Swale Wetland Management Classes and Information Plan

Acknowledgements: Original Drawing by Stantec.  
Imagery: 2009 60cm SGIC Imagery

### Wetland Management Classes

-  Preserve
-  Manage 1
-  Ecological boundary
-  Property access granted
-  Study Area
-  Watercourse

\*Management Classes are based on the Minnesota Routine Assessment Method (MnRAM) for evaluating wetland functions (Minnesota Board of Water and Soil Resources, 2010a)

Scale: 1:30,000

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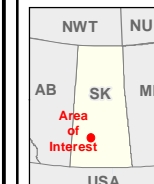
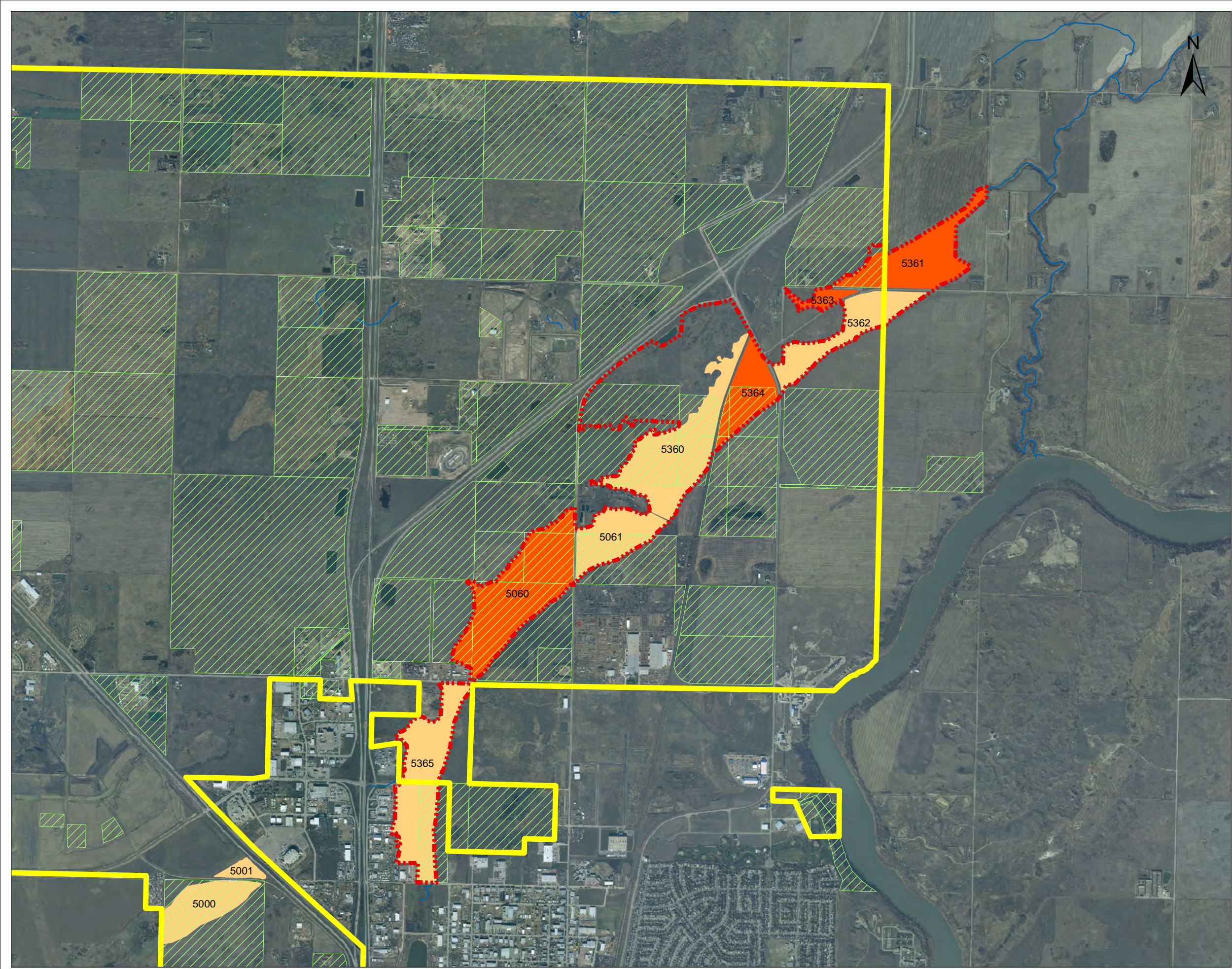


FIGURE NO. 7

Last Modified: Sep 11, 2012 BY: Hagenmair

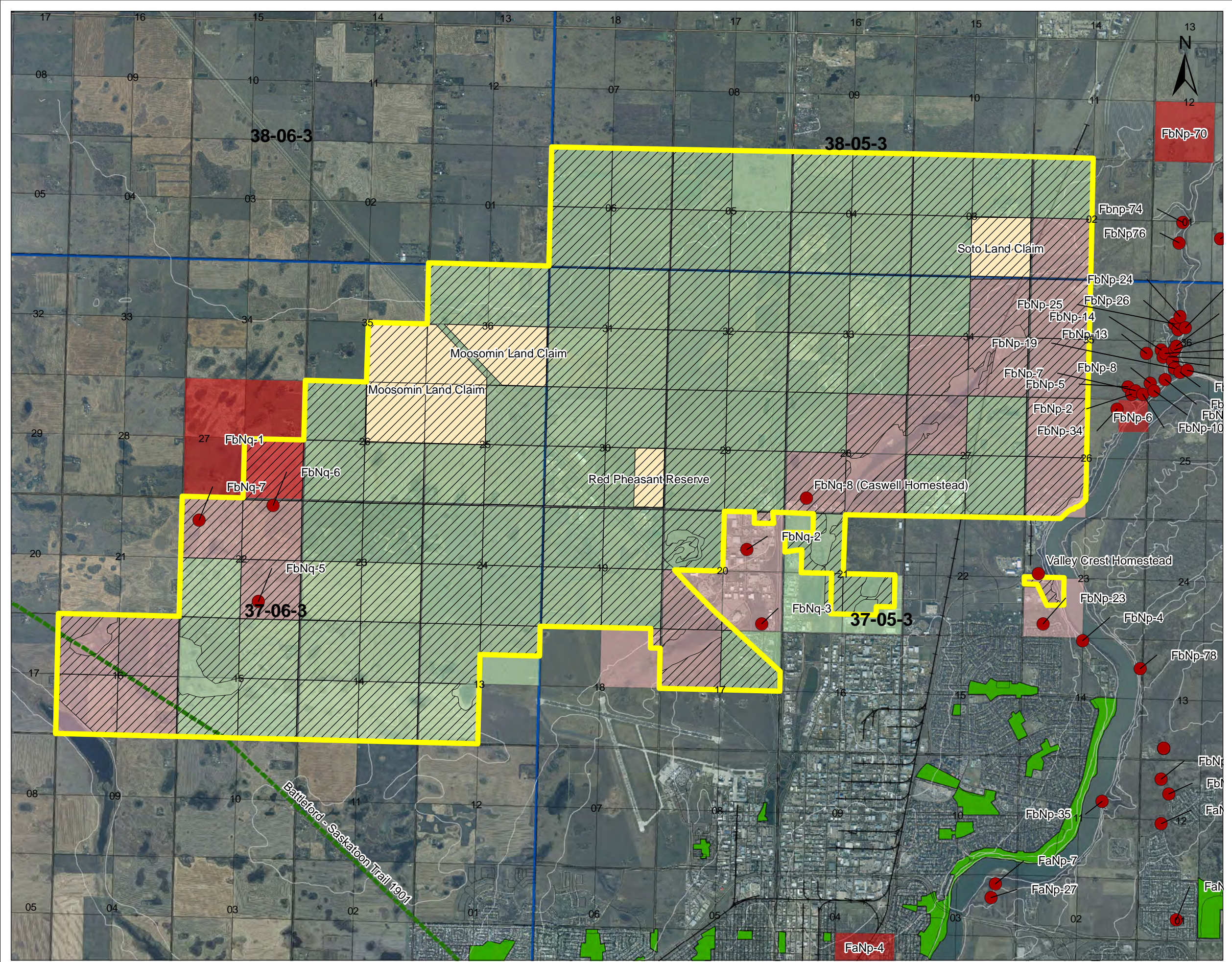


# Heritage Screening

Acknowledgements: Original Drawing by Stantec.  
Imagery: 2009 60cm SGIC Imagery

### Heritage Sensitivity

- No
- Yes
- Disturbed
- Archeological Site
- Archeological Site- Section
- Land Claims and Reserves
- Battleford- Saskatoon Trail
- Study Area
- Railway
- Contours
- Roads
- Parks



Scale: 1:50,000



<p>Area of Interest</p>	<p>PREPARED BY</p>
<p>FIGURE NO.</p> <p style="font-size: 24px; font-weight: bold;">8</p>	

Last Modified: Sep 11, 2013 BY: Hagenmair

# Natural and Historical Areas of Interest

Acknowledgements: Original Drawing by Stantec.  
Imagery: 2009 60cm SGIC Imagery

- 4 km Airport Buffer
- Wetlands
- Tree stands
- Natural Areas of Interest**
- Wetland
- Tree stand
- Ecological boundary
- Tracked Wildlife**
- Barn Swallow (S5B S5M- Threatened)
- Bobolink (S5B- Threatened)
- Sprague's Pipit (S3B-Threatened)
- Tracked Plants**
- Engelmann's spikerush (S2)
- meadow pussytoes (S1)
- narrow leaved cattail (S1?)
- narrow leaved water plantain (S3)
- northern blue-eyed grass (S3?)
- Heritage Sensitivity**
- No
- Yes
- Archeological Site
- Archeological Site- Section
- Land Claims and Reserves
- Battleford- Saskatoon Trail
- Study\_Area
- Watercourse

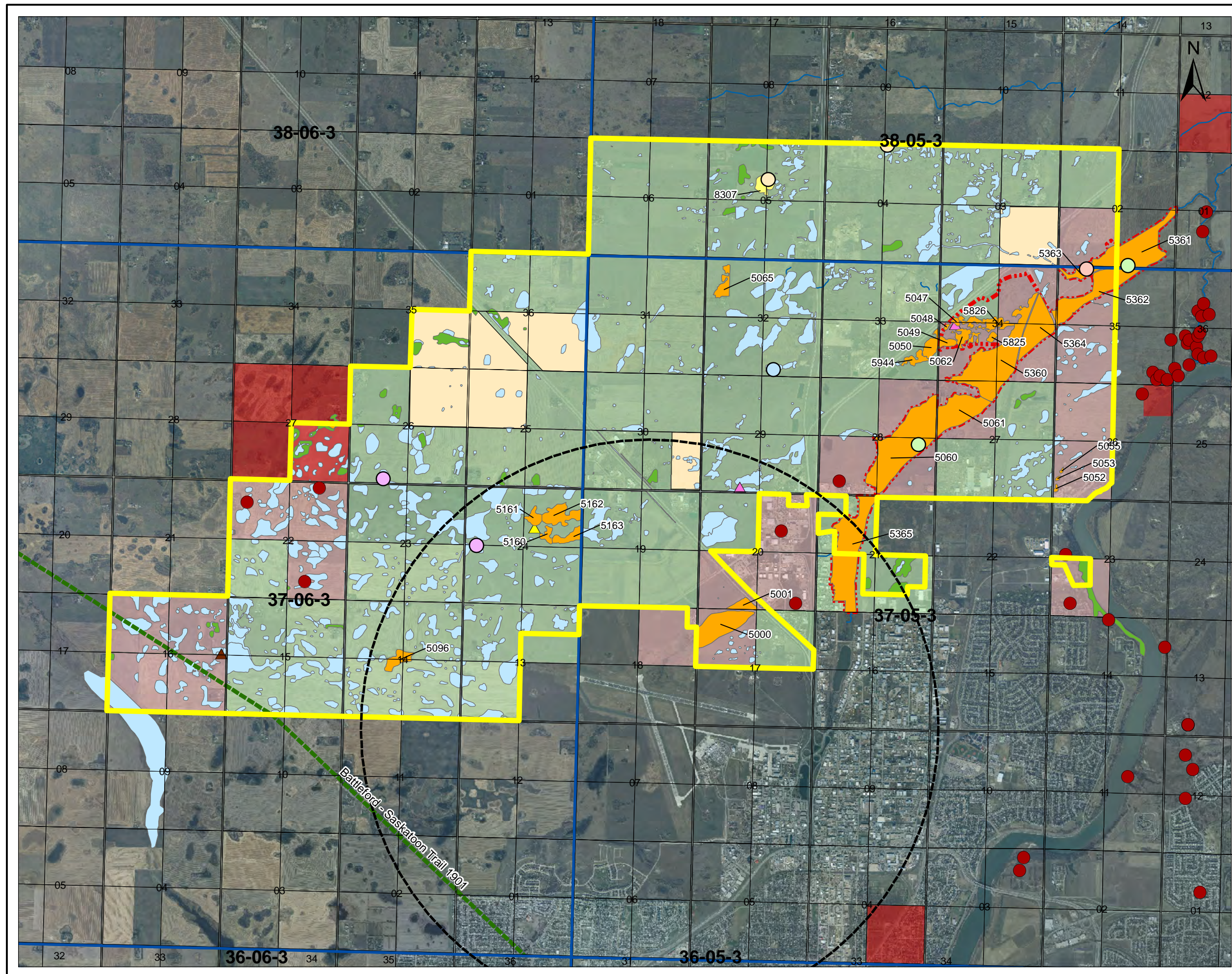
113253776 Scale: 1:51,307



PREPARED FOR:

PREPARED BY:

FIGURE NO. 9



Last Modified: Sep 11, 2013 BY: Hagenmair





# **APPENDIX A**

Land Capability for Agriculture - Classes and Subclasses

## Soil Capability for Agriculture

The Canada Land Inventory (CLI) classification system is divided into 8 classes, which rate agricultural land capability and identify specific limiting factors to agricultural production. Class 1 lands have the highest capability to support agricultural land use activities and Class 7 lands have the lowest capability. The CLI Soil Capability for Agriculture classes and subclasses are described below (Environment Canada 1972).

---

<b>Description</b>	
<b>Class</b>	
1	Soils in this class have no significant limitations in use for crops.
2	Soils in this class have moderate limitations that restrict the range of crops or require moderate conservation practices.
3	Soils in this class have moderately severe limitations that restrict the range of crops or require special conservation practices.
4	Soils in this class have severe limitations that restrict the range of crops or require special conservation practices, or both.
5	Soils in this class have very severe limitations that restrict their capability to producing perennial forage crops, and improvement practices are feasible.
6	Soils in this class are capable only of producing perennial forage crops, and improvement practices are not feasible.
7	Soils in this class have no capability for arable culture or permanent pasture.
O	Organic soils
<b>Subclasses</b>	
C	Adverse Climate - this subclass denotes a significant adverse climate for crop production as 'median' climate which is defined as one with sufficiently high growing-season temperatures to bring crops to maturity.
E	Erosion - this subclass includes soils where damage from erosion is a limitation to agricultural use.
M	Moisture Limitations - this subclass consists of soils where crops are affected by drought owing to inherent soil characteristics. These soils usually have low water-holding capacity.
N	Salinity – this subclass includes soils that possess excessive soluble salts which adversely affect crop growth or restrict the range of crops that may be grown.
P	Stoniness – this subclass consists of soils that are sufficiently stony to hinder tillage, planting and harvesting operations.
T	Topography - this subclass is made up of soils where topography is a limitation. Both the percent of slope and the pattern or frequency of slopes in different directions affect the cost of farming and the uniformity of growth and maturity of crops as well as the hazard of erosion.
W	Excess Water - this subclass includes soils where excess water other than brought about by inundation is a limitation to agricultural use. Excess water may result from inadequate soil drainage, a high water table, seepage or from runoff from surrounding areas.

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# **APPENDIX B**

Stewart and Kantrud (1971) Wetland Classification System

## **Stewart and Kantrud (1971) Wetland Classification System**

The Stewart and Kantrud (1971) wetland classification system is divided into three hierarchical levels (classes, subclasses, and cover types). Numerous wetland characteristics, such as water permanence, water chemistry, vegetation life form, cover interspersion, species composition and dominance, are evaluated in order to classify a wetland. Below is a description of the Stewart and Kantrud (1971) wetland classes, subclasses, and cover types.

### **Classes**

Each major class of natural ponds and lakes is distinguished by the vegetational zone that occurs in the central (or deepest) part and occupies 5% or more of the total wetland area. There are seven major classes of natural ponds and lakes, which include:

- Class 1 – Ephemeral ponds
- Class 2 – Temporary ponds
- Class 3 – Seasonal ponds and lakes
- Class 4 – Semi-permanent ponds and lakes
- Class 5 – Permanent ponds and lakes
- Class 6 – Alkali ponds and lakes
- Class 7 – Fen (alkaline bog) ponds.

### **Subclasses**

The subclasses of natural ponds and lakes are based on differences in species composition of plant communities within the wet meadow, shallow marsh, or deep marsh zones, which are correlated with variations in average salinity of surface waters. Not all subclasses occur within each class of wetland. For example, no subclasses occur within Class I ephemeral ponds, Class VI alkali ponds and lakes, and Class VII fen ponds. Overall, there are five subclasses of natural ponds and lakes, which include:

- Subclass A - Fresh (occurs in Class II, III, IV)
- Subclass B - Slightly Brackish (occurs in Class II, III, IV, V)
- Subclass C - Moderately Brackish (occurs in Class III, IV, V)
- Subclass D - Brackish (occurs in Class IV, V)
- Subclass E - Subsaline (occurs in Class IV, V).

### **Cover Types**

Cover types represent differences in the spatial relation between emergent vegetation cover and open water or exposed bottom soil. There are four cover types within natural ponds and lakes, which include:

Cover type 1 – closed stands of emergent vegetation with open water or bare soil covering less than 5 percent of wetland area.

Cover type 2 – open water or bare soil covering 5 to 95 percent of the wetland area.

Cover type 3 – open water surrounded by peripheral band of emergent vegetation cover, with an average width of 6 feet or more in width.

Cover type 4 - open water surrounded by peripheral band of emergent vegetation cover, with an average width of less than 6 feet in width.



# **APPENDIX C**

Natural Area Inventory of the North/Northwest Screening Area

**Table C.1. Natural Area Inventory of the North/Northwest Screening Area**

Natural Area ID	Natural Area Type	Area (ha)	Wetland Class	Cover Type	Legal Land Location					Field Checked
					QRT	SEC	TWP	RGE	MER	
5000	Wetland	21.54	4	3	NW	17	37	05	3	Y
5001	Wetland	4.08	4	2	SW	20	37	05	3	Y
5003	Wetland	5.31	3	1	N	30	37	05	3	Y
5004	Wetland	4.83	3	1	NW	19	37	05	3	Y
5006	Wetland	0.17	3	1	NW	19	37	05	3	Y
5011	Wetland	1.18	3	1	SE	25	37	06	3	Y
5012	Wetland	1.65	3	1	NE	24	37	06	3	Y
5013	Wetland	0.89	2	1	NE	24	37	06	3	Y
5014	Wetland	0.13	2	2	NW	19	37	05	3	Y
5015	Wetland	0.55	3	2	NE	19	37	05	3	Y
5017	Wetland	1.17	3	2	SW	30	37	05	3	Y
5019	Wetland	0.10	3	2	SE	30	37	05	3	Y
5020	Wetland	0.05	2	1	NE	25	37	06	3	Y
5021	Wetland	0.52	3	3	SE	30	37	05	3	Y
5022	Wetland	1.92	2	1	SE	30	37	05	3	Y
5023	Wetland	0.13	2	1	NW	29	37	05	3	Y
5024	Wetland	0.83	3	1	SW	32	37	05	3	Y
5025	Wetland	0.62	2	1	SE	31	37	05	3	Y
5026	Wetland	0.60	3	1	SE	31	37	05	3	Y
5029	Wetland	0.24	3	3	E	20	37	05	3	Y
5030	Wetland	0.08	3	3	SE	20	37	05	3	Y
5031	Wetland	11.45	3	3	NW	20	37	05	3	Y
5032	Wetland	0.22	3	-	SE	25	37	06	3	Y
5033	Wetland	2.41	3	2	S	29	37	05	3	Y
5034	Wetland	6.41	3	1	NE	32	37	05	3	Y
5035	Wetland	0.17	3	2	NE	32	37	05	3	Y
5036	Wetland	0.19	3	1	NE	32	37	05	3	Y
5037	Wetland	4.65	3	1	SE	32	37	05	3	Y
5038	Wetland	0.50	3	1	SE	32	37	05	3	Y
5039	Wetland	0.86	4	1	NW	33	37	05	3	Y
5040	Wetland	0.08	3	1	NW	33	37	05	3	Y
5041	Wetland	0.35	4	1	NW	33	37	05	3	Y
5042	Wetland	0.48	4	2	NW	33	37	05	3	Y
5043	Wetland	0.07	3	1	NW	33	37	05	3	Y
5044	Wetland	0.11	3	1	NW	33	37	05	3	Y
5045	Wetland	0.52	3	1	NW	33	37	05	3	Y
5046	Wetland	0.38	3	1	NW	33	37	05	3	Y
5047	Wetland	1.04	2	1	W	34	37	05	3	Y
5048	Wetland	0.44	3	1	SW	34	37	05	3	Y
5049	Wetland	2.50	3	2	SW	34	37	05	3	Y
5050	Wetland	4.84	4	3	SE	33	37	05	3	Y
5052	Wetland	0.46	5	-	SW	26	37	05	3	Y
5053	Wetland	0.30	4	-	SW	26	37	05	3	Y
5054	Wetland	1.31	3	-	SE	27	37	05	3	Y
5055	Wetland	0.26	3	-	SW	26	37	05	3	Y
5057	Wetland	0.78	3	-	NW	26	37	05	3	Y
5059	Wetland	1.53	3	1	NE	27	37	05	3	Y
5060	Wetland	57.12	5	3	S	28	37	05	3	Y
5061	Wetland	23.23	4	-	NW	27	37	05	3	Y
5062	Wetland	4.95	2	-	SW	34	37	05	3	Y
5063	Wetland	0.32	2	-	NW	34	37	05	3	Y

Natural Area ID	Natural Area Type	Area (ha)	Wetland Class	Cover Type	Legal Land Location					Field Checked
					QRT	SEC	TWP	RGE	MER	
5065	Wetland	5.18	3	2	NW	32	37	05	3	Y
5066	Wetland	1.73	3	1	NE	13	37	06	3	Y
5067	Wetland	2.86	2	1	NE	13	37	06	3	Y
5068	Wetland	0.40	2	1	NE	13	37	06	3	Y
5069	Wetland	0.11	2	1	NE	13	37	06	3	Y
5070	Wetland	0.06	2	1	NE	13	37	06	3	Y
5071	Wetland	4.86	3	1	N	13	37	06	3	Y
5072	Wetland	0.03	2	2	NE	13	37	06	3	Y
5075	Wetland	1.00	3	2	E	16	37	06	3	Y
5076	Wetland	0.35	3	2	NE	16	37	06	3	Y
5077	Wetland	0.24	3	2	NE	16	37	06	3	Y
5078	Wetland	0.95	3	2	NE	16	37	06	3	Y
5079	Wetland	0.33	3	1	SW	22	37	06	3	Y
5080	Wetland	0.32	3	3	SW	22	37	06	3	Y
5081	Wetland	5.26	3	3	NW	22	37	06	3	Y
5082	Wetland	0.27	3	3	NW	22	37	06	3	Y
5083	Wetland	3.22	3	3	NW	22	37	06	3	Y
5084	Wetland	1.73	3	3	NE	22	37	06	3	Y
5085	Wetland	1.08	3	2	NE	22	37	06	3	Y
5086	Wetland	0.05	3	2	NW	15	37	06	3	Y
5087	Wetland	0.45	3	2	SE	22	37	06	3	Y
5088	Wetland	1.32	3	2	SW	23	37	06	3	Y
5089	Wetland	2.82	3	3	SW	23	37	06	3	Y
5090	Wetland	2.56	3	2	SW	23	37	06	3	Y
5091	Wetland	3.30	4	2	NW	14	37	06	3	Y
5093	Wetland	1.22	4	2	NW	14	37	06	3	Y
5094	Wetland	0.49	2	2	NW	14	37	06	3	Y
5095	Wetland	0.95	3	2	SW	14	37	06	3	Y
5096	Wetland	5.93	4	3	SE	14	37	06	3	Y
5097	Wetland	0.70	3	-	SW	14	37	06	3	Y
5102	Wetland	2.33	3	-	NW	14	37	06	3	Y
5103	Wetland	2.70	4	3	SE	14	37	06	3	Y
5104	Wetland	1.79	3	3	SE	14	37	06	3	Y
5105	Wetland	1.25	3	2	SE	14	37	06	3	Y
5106	Wetland	1.02	3	2	SE	14	37	06	3	Y
5107	Wetland	4.30	3	3	SE	14	37	06	3	Y
5108	Wetland	0.22	3	2	SE	14	37	06	3	Y
5109	Wetland	1.82	3	2	SE	23	37	06	3	Y
5110	Wetland	0.72	2	-	SE	23	37	06	3	Y
5111	Wetland	0.25	2	-	SE	23	37	06	3	Y
5112	Wetland	0.06	2	-	SE	23	37	06	3	Y
5113	Wetland	3.04	3	2	SE	23	37	06	3	Y
5116	Wetland	0.34	3	-	SE	23	37	06	3	Y
5117	Wetland	0.05	3	-	SE	23	37	06	3	Y
5118	Wetland	0.24	3	-	S	23	37	06	3	Y
5119	Wetland	0.09	3	2	SE	23	37	06	3	Y
5120	Wetland	0.55	3	2	S	23	37	06	3	Y
5121	Wetland	0.05	2	2	SW	23	37	06	3	Y
5122	Wetland	0.68	3	-	SW	23	37	06	3	Y
5123	Wetland	0.24	2	-	SW	23	37	06	3	Y
5124	Wetland	0.11	2	-	SW	23	37	06	3	Y
5125	Wetland	0.04	2	-	SW	23	37	06	3	Y
5126	Wetland	0.10	2	-	SW	23	37	06	3	Y



Natural Area ID	Natural Area Type	Area (ha)	Wetland Class	Cover Type	Legal Land Location					Field Checked
					QRT	SEC	TWP	RGE	MER	
5127	Wetland	0.43	3	3	S	23	37	06	3	Y
5128	Wetland	0.08	2	2	SE	23	37	06	3	Y
5129	Wetland	3.23	4	-	W	14	37	06	3	Y
5131	Wetland	0.35	3	2	SE	23	37	06	3	Y
5132	Wetland	0.06	2	-	SE	23	37	06	3	Y
5133	Wetland	0.69	3	2	SE	23	37	06	3	Y
5134	Wetland	1.82	3	2	SE	23	37	06	3	Y
5135	Wetland	0.41	3	-	SE	23	37	06	3	Y
5136	Wetland	0.73	3	-	SE	23	37	06	3	Y
5140	Wetland	2.78	3	2	W	24	37	06	3	Y
5142	Wetland	0.22	2	3	NW	24	37	06	3	Y
5143	Wetland	0.89	3	3	NW	24	37	06	3	Y
5144	Wetland	9.88	4	3	NW	24	37	06	3	Y
5145	Wetland	0.15	2	-	NW	24	37	06	3	Y
5146	Wetland	0.06	2	-	NW	24	37	06	3	Y
5147	Wetland	0.61	3	2	NW	24	37	06	3	Y
5148	Wetland	0.15	3	2	NE	24	37	06	3	Y
5149	Wetland	1.35	3	-	SE	24	37	06	3	Y
5150	Wetland	2.77	3	3	SW	24	37	06	3	Y
5151	Wetland	0.10	2	3	SW	24	37	06	3	Y
5152	Wetland	0.81	3	3	SW	24	37	06	3	Y
5153	Wetland	0.33	3	2	SW	24	37	06	3	Y
5154	Wetland	2.77	3	2	SW	24	37	06	3	Y
5155	Wetland	0.57	3	3	SW	24	37	06	3	Y
5156	Wetland	0.79	3	3	NW	24	37	06	3	Y
5157	Wetland	6.67	3	3	NW	24	37	06	3	Y
5158	Wetland	0.07	2	2	NW	24	37	06	3	Y
5159	Wetland	2.84	3	3	NW	24	37	06	3	Y
5160	Wetland	2.38	3	3	NE	24	37	06	3	Y
5161	Wetland	3.51	4	3	NE	24	37	06	3	Y
5162	Wetland	10.42	4	3	NE	24	37	06	3	Y
5163	Wetland	5.03	3	3	NE	24	37	06	3	Y
5164	Wetland	1.63	3	3	SE	24	37	06	3	Y
5165	Wetland	0.20	3	3	SE	24	37	06	3	Y
5166	Wetland	1.56	3	-	SE	24	37	06	3	Y
5170	Wetland	0.12	3	3	NW	24	37	06	3	Y
5172	Wetland	0.71	3	1	N	24	37	06	3	Y
5174	Wetland	0.34	2	-	SE	24	37	06	3	Y
5175	Wetland	0.33	3	2	SE	24	37	06	3	Y
5176	Wetland	0.27	3	-	SW	25	37	06	3	Y
5177	Wetland	0.19	2	-	SW	25	37	06	3	Y
5178	Wetland	0.49	3	-	W	25	37	06	3	Y
5179	Wetland	0.07	2	-	N	25	37	06	3	Y
5180	Wetland	0.22	3	-	S	25	37	06	3	Y
5181	Wetland	0.40	4	-	SW	25	37	06	3	Y
5182	Wetland	0.09	2	2	SW	25	37	06	3	Y
5183	Wetland	0.30	3	3	SE	26	37	06	3	Y
5184	Wetland	2.26	2	2	SE	26	37	06	3	Y
5185	Wetland	2.00	3	2	SE	26	37	06	3	Y
5186	Wetland	2.23	3	3	SE	26	37	06	3	Y
5187	Wetland	0.95	2	2	SE	26	37	06	3	Y
5188	Wetland	1.46	3	-	SE	26	37	06	3	Y
5189	Wetland	0.46	3	-	SE	26	37	06	3	Y

Natural Area ID	Natural Area Type	Area (ha)	Wetland Class	Cover Type	Legal Land Location					Field Checked
					QRT	SEC	TWP	RGE	MER	
5190	Wetland	1.10	4	-	NW	25	37	06	3	Y
5191	Wetland	0.61	3	-	NW	25	37	06	3	Y
5192	Wetland	0.18	3	-	NE	25	37	06	3	Y
5193	Wetland	0.73	4	3	SW	26	37	06	3	Y
5194	Wetland	0.69	4	3	NW	23	37	06	3	Y
5195	Wetland	2.27	3	2	SW	26	37	06	3	Y
5196	Wetland	0.91	4	3	SW	26	37	06	3	Y
5197	Wetland	0.66	3	3	SE	27	37	06	3	Y
5198	Wetland	0.46	3	2	SE	27	37	06	3	Y
5199	Wetland	0.08	3	3	SE	27	37	06	3	Y
5200	Wetland	0.54	3	-	SE	26	37	06	3	Y
5201	Wetland	0.34	2	-	SE	26	37	06	3	Y
5202	Wetland	1.50	3	-	SE	26	37	06	3	Y
5203	Wetland	0.40	2	2	SE	26	37	06	3	Y
5204	Wetland	4.24	3	2	S	26	37	06	3	Y
5205	Wetland	0.58	3	2	SW	26	37	06	3	Y
5206	Wetland	4.03	4	2	SW	26	37	06	3	Y
5207	Wetland	0.05	3	2	SE	27	37	06	3	Y
5208	Wetland	0.81	3	3	SE	27	37	06	3	Y
5209	Wetland	0.45	3	4	SE	27	37	06	3	Y
5210	Wetland	0.44	3	4	SE	27	37	06	3	Y
5211	Wetland	2.37	3	3	SE	27	37	06	3	Y
5212	Wetland	0.02	2	2	SE	27	37	06	3	Y
5213	Wetland	0.30	3	3	SE	27	37	06	3	Y
5214	Wetland	1.68	3	3	SE	27	37	06	3	Y
5215	Wetland	0.32	2	2	SE	27	37	06	3	Y
5216	Wetland	0.29	3	2	SE	27	37	06	3	Y
5217	Wetland	0.00	3	2	SW	30	37	05	3	Y
5218	Wetland	0.00	3	2	SW	30	37	05	3	Y
5219	Wetland	0.01	3	2	SW	30	37	05	3	Y
5220	Wetland	0.11	2	2	SE	27	37	06	3	Y
5221	Wetland	0.01	2	-	SE	27	37	06	3	Y
5222	Wetland	0.48	2	3	SE	27	37	06	3	Y
5223	Wetland	0.01	2	2	SE	27	37	06	3	Y
5224	Wetland	0.03	3	2	SE	27	37	06	3	Y
5225	Wetland	1.36	2	3	SE	27	37	06	3	Y
5226	Wetland	0.19	2	2	SE	27	37	06	3	Y
5227	Wetland	0.07	2	2	SE	27	37	06	3	Y
5228	Wetland	0.08	3	-	SE	27	37	06	3	Y
5229	Wetland	0.65	2	-	E	27	37	06	3	Y
5300	Wetland	0.54	3	3	SE	35	37	06	3	Y
5301	Wetland	0.51	3	2	SE	35	37	06	3	Y
5302	Wetland	0.97	3	2	SW	36	37	06	3	Y
5303	Wetland	0.81	3	2	SW	36	37	06	3	Y
5304	Wetland	3.56	3	2	NW	36	37	06	3	Y
5305	Wetland	0.88	2	2	SE	32	37	05	3	Y
5307	Wetland	0.73	2	1	SE	32	37	05	3	Y
5308	Wetland	0.32	3	2	NE	04	38	05	3	Y
5310	Wetland	0.17	3	1	NW	05	38	05	3	Y
5311	Wetland	0.83	3	-	N	05	38	05	3	Y
5312	Wetland	1.03	2	1	NW	04	38	05	3	Y
5313	Wetland	0.10	4	3	SW	04	38	05	3	Y
5314	Wetland	4.02	3	-	SE	04	38	05	3	Y

Natural Area ID	Natural Area Type	Area (ha)	Wetland Class	Cover Type	Legal Land Location					Field Checked
					QRT	SEC	TWP	RGE	MER	
5320	Wetland	0.97	3	-	SE	04	38	05	3	Y
5321	Wetland	0.20	3	-	NE	04	38	05	3	Y
5322	Wetland	0.39	3	2	NE	04	38	05	3	Y
5323	Wetland	0.13	3	2	NE	04	38	05	3	Y
5324	Wetland	0.17	3	-	NE	04	38	05	3	Y
5325	Wetland	0.15	2	2	NE	04	38	05	3	Y
5326	Wetland	0.09	3	-	NE	04	38	05	3	Y
5327	Wetland	0.29	3	-	NE	04	38	05	3	Y
5328	Wetland	0.25	3	-	NE	04	38	05	3	Y
5329	Wetland	0.07	3	-	NE	04	38	05	3	Y
5330	Wetland	0.41	3	2	N	04	38	05	3	Y
5331	Wetland	0.33	3	-	NW	04	38	05	3	Y
5332	Wetland	0.48	3	-	NE	04	38	05	3	Y
5333	Wetland	0.19	3	-	NE	04	38	05	3	Y
5334	Wetland	0.26	2	-	NE	04	38	05	3	Y
5335	Wetland	0.21	2	-	NE	04	38	05	3	Y
5336	Wetland	0.86	3	-	NE	04	38	05	3	Y
5337	Wetland	0.20	3	-	NE	04	38	05	3	Y
5339	Wetland	0.26	3	-	E	09	38	05	3	Y
5340	Wetland	0.52	4	-	NE	04	38	05	3	Y
5341	Wetland	0.62	3	-	NE	04	38	05	3	Y
5342	Wetland	0.31	3	2	NW	03	38	05	3	Y
5343	Wetland	0.08	3	-	NW	03	38	05	3	Y
5345	Wetland	1.36	2	-	NW	03	38	05	3	Y
5346	Wetland	2.34	3	-	NW	03	38	05	3	Y
5347	Wetland	2.15	3	-	NW	03	38	05	3	Y
5348	Wetland	0.77	3	-	NW	03	38	05	3	Y
5349	Wetland	3.28	4	3	S	03	38	05	3	Y
5351	Wetland	0.03	3	1	SW	03	38	05	3	Y
5352	Wetland	0.25	3	-	SW	03	38	05	3	Y
5353	Wetland	1.93	3	-	SW	03	38	05	3	Y
5354	Wetland	1.56	3	2	NW	03	38	05	3	Y
5355	Wetland	0.36	3	-	SW	03	38	05	3	Y
5356	Wetland	0.37	3	-	SW	03	38	05	3	Y
5357	Wetland	0.13	3	-	SW	03	38	05	3	Y
5358	Wetland	2.48	4	-	SE	10	38	05	3	Y
5359	Wetland	18.43	4	3	N	34	37	05	3	Y
5360	Wetland	50.24	4	3	S	34	37	5	3	Y
5361	Wetland	33.84	4	2	S	02	38	05	3	Y
5362	Wetland	26.48	4	2	NE	34	37	05	3	Y
5363	Wetland	4.67	3	2	NW	35	37	05	3	Y
5364	Wetland	20.75	4	2	E	34	37	05	3	Y
5365	Wetland	46.33	4	-	W	21	37	05	3	N
5366	Wetland	0.04	3	-	NW	03	38	05	3	Y
5367	Wetland	1.83	3	-	SE	29	37	05	3	Y
5400	Wetland	0.29	2	-	SE	16	37	06	3	N
5402	Wetland	0.08	2	-	NE	16	37	06	3	N
5403	Wetland	0.27	2	-	NE	16	37	06	3	N
5404	Wetland	0.03	2	-	NE	16	37	06	3	N
5405	Wetland	0.15	2	-	NE	16	37	06	3	N
5406	Wetland	1.08	2	-	NE	16	37	06	3	Y
5407	Wetland	0.07	2	-	NE	22	37	06	3	N
5408	Wetland	0.15	2	-	NE	22	37	06	3	N

Natural Area ID	Natural Area Type	Area (ha)	Wetland Class	Cover Type	Legal Land Location					Field Checked
					QRT	SEC	TWP	RGE	MER	
5409	Wetland	0.48	2	-	SE	24	37	06	3	N
5410	Wetland	0.14	3	-	SW	31	37	05	3	N
5411	Wetland	0.14	3	-	SE	04	38	05	3	N
5412	Wetland	0.15	3	-	SE	04	38	05	3	N
5413	Wetland	9.42	2	-	SE	04	38	05	3	N
5414	Wetland	0.20	2	-	SW	26	37	05	3	N
5415	Wetland	0.31	2	-	SW	26	37	05	3	N
5416	Wetland	0.56	3	-	SE	34	37	05	3	N
5417	Wetland	0.25	2	-	NW	26	37	05	3	N
5500	Wetland	0.61	3	-	SE	16	37	06	3	N
5501	Wetland	0.19	3	2	NE	16	37	06	3	N
5502	Wetland	0.55	3	2	NE	16	37	06	3	Y
5503	Wetland	0.14	3	2	NE	16	37	06	3	Y
5504	Wetland	0.34	2	2	NE	16	37	06	3	Y
5505	Wetland	15.40	3	2	W	15	37	06	3	Y
5506	Wetland	2.71	4	2	NW	15	37	06	3	N
5507	Wetland	0.33	3	2	SE	14	37	06	3	N
5508	Wetland	0.61	3	2	NW	22	37	06	3	Y
5509	Wetland	1.49	3	2	SW	22	37	06	3	Y
5510	Wetland	0.34	3	2	SW	22	37	06	3	Y
5511	Wetland	0.25	3	2	SW	22	37	06	3	Y
5512	Wetland	1.42	4	2	SW	22	37	06	3	Y
5513	Wetland	4.12	3	-	SE	22	37	06	3	Y
5514	Wetland	0.58	3	-	NE	22	37	06	3	Y
5517	Wetland	2.71	3	-	E	22	37	06	3	Y
5518	Wetland	0.95	2	-	SE	35	37	06	3	N
5519	Wetland	1.59	3	-	NE	32	37	05	3	N
5520	Wetland	2.15	2	-	E	05	38	05	3	N
5521	Wetland	1.31	2	-	SW	03	38	05	3	N
5522	Wetland	0.32	3	-	NE	04	38	05	3	N
5523	Wetland	0.24	3	-	NE	04	38	05	3	N
5524	Wetland	0.22	3	-	E	04	38	05	3	N
5525	Wetland	0.40	4	-	NE	04	38	05	3	N
5526	Wetland	0.29	3	-	SE	04	38	05	3	N
5527	Wetland	2.14	2	-	S	03	38	05	3	N
5528	Wetland	0.32	3	-	SE	03	38	05	3	N
5529	Wetland	0.34	3	-	W	03	38	05	3	N
5530	Wetland	0.19	3	-	NW	03	38	05	3	N
5531	Wetland	0.36	3	-	NE	03	38	05	3	N
5532	Wetland	2.91	4	-	NW	16	37	06	3	N
5533	Wetland	6.88	4	-	NW	16	37	06	3	N
5534	Wetland	2.79	2	-	N	16	37	06	3	N
5535	Wetland	0.34	3	-	NW	16	37	06	3	N
5536	Wetland	3.97	3	-	N	16	37	06	3	N
5537	Wetland	0.45	3	-	NW	16	37	06	3	N
5538	Wetland	1.49	3	-	W	16	37	06	3	N
5539	Wetland	0.52	2	-	SW	16	37	06	3	N
5540	Wetland	66.61	4	-	E	09	37	06	3	N
5541	Wetland	2.68	3	-	SE	16	37	06	3	N
5542	Wetland	1.29	2	-	SE	16	37	06	3	N
5543	Wetland	1.95	2	-	SW	16	37	06	3	N
5544	Wetland	1.05	3	-	NE	16	37	06	3	N
5545	Wetland	1.12	3	-	SE	16	37	06	3	N

Natural Area ID	Natural Area Type	Area (ha)	Wetland Class	Cover Type	Legal Land Location					Field Checked
					QRT	SEC	TWP	RGE	MER	
5546	Wetland	0.13	3	-	SE	16	37	06	3	N
5547	Wetland	1.34	3	-	NE	16	37	06	3	N
5548	Wetland	0.51	3	-	NE	16	37	06	3	N
5549	Wetland	0.12	3	-	NE	16	37	06	3	N
5550	Wetland	1.00	3	-	NE	16	37	06	3	N
5551	Wetland	0.30	2	-	SE	16	37	06	3	N
5552	Wetland	3.21	2	-	SE	16	37	06	3	N
5553	Wetland	0.26	4	-	SW	15	37	06	3	N
5554	Wetland	0.86	2	-	SW	15	37	06	3	N
5555	Wetland	0.73	3	-	SW	15	37	06	3	N
5556	Wetland	0.18	2	-	SW	15	37	06	3	N
5557	Wetland	0.29	2	-	SW	15	37	06	3	N
5558	Wetland	2.77	3	-	SE	16	37	06	3	N
5559	Wetland	0.09	3	-	SW	15	37	06	3	N
5560	Wetland	3.58	4	-	SE	15	37	06	3	N
5561	Wetland	0.80	3	-	SW	15	37	06	3	N
5562	Wetland	1.23	3	-	SW	15	37	06	3	N
5563	Wetland	0.33	3	-	SW	15	37	06	3	N
5564	Wetland	0.66	3	-	SW	15	37	06	3	N
5565	Wetland	6.70	3	-	SW	15	37	06	3	N
5566	Wetland	2.12	3	-	SE	15	37	06	3	N
5567	Wetland	2.33	4	-	NE	15	37	06	3	N
5568	Wetland	1.66	3	-	NE	15	37	06	3	N
5569	Wetland	3.19	4	-	NE	15	37	06	3	N
5570	Wetland	0.26	3	-	NE	15	37	06	3	N
5571	Wetland	0.17	3	-	NE	15	37	06	3	N
5572	Wetland	0.33	3	-	NE	15	37	06	3	N
5573	Wetland	1.31	3	-	NE	15	37	06	3	N
5574	Wetland	1.81	3	-	NE	15	37	06	3	N
5575	Wetland	0.65	2	-	NE	15	37	06	3	N
5576	Wetland	0.35	3	-	NW	15	37	06	3	N
5577	Wetland	0.52	3	-	NW	15	37	06	3	N
5578	Wetland	0.52	2	-	NW	15	37	06	3	N
5579	Wetland	0.14	2	-	NW	15	37	06	3	N
5580	Wetland	1.13	2	-	NW	15	37	06	3	N
5581	Wetland	0.13	3	-	NW	15	37	06	3	N
5582	Wetland	0.24	3	-	NW	15	37	06	3	N
5583	Wetland	10.35	2	-	SW	15	37	06	3	N
5584	Wetland	0.24	2	-	NE	15	37	06	3	N
5585	Wetland	0.06	2	-	NE	15	37	06	3	N
5586	Wetland	0.11	2	-	NE	15	37	06	3	N
5587	Wetland	5.19	3	-	SE	15	37	06	3	N
5588	Wetland	1.38	3	-	SE	15	37	06	3	N
5589	Wetland	1.24	3	-	SE	15	37	06	3	N
5590	Wetland	0.56	3	-	SW	14	37	06	3	N
5591	Wetland	0.40	3	-	SW	14	37	06	3	N
5592	Wetland	1.49	3	-	SW	14	37	06	3	N
5593	Wetland	0.20	2	-	SW	14	37	06	3	N
5594	Wetland	0.17	2	-	SW	14	37	06	3	N
5595	Wetland	0.27	2	-	SW	14	37	06	3	N
5596	Wetland	0.77	2	-	SW	14	37	06	3	N
5597	Wetland	1.10	3	-	SW	14	37	06	3	N
5598	Wetland	0.41	3	-	SW	14	37	06	3	N

Natural Area ID	Natural Area Type	Area (ha)	Wetland Class	Cover Type	Legal Land Location					Field Checked
					QRT	SEC	TWP	RGE	MER	
5599	Wetland	0.08	2	-	SW	14	37	06	3	N
5600	Wetland	0.54	2	-	SW	23	37	06	3	N
5601	Wetland	0.19	2	-	SW	23	37	06	3	N
5602	Wetland	1.25	4	-	NW	23	37	06	3	N
5603	Wetland	1.64	3	-	NW	23	37	06	3	N
5604	Wetland	0.12	3	-	NW	23	37	06	3	N
5605	Wetland	0.27	2	-	NW	23	37	06	3	N
5606	Wetland	0.19	2	-	NW	23	37	06	3	N
5607	Wetland	1.97	2	-	NW	23	37	06	3	N
5608	Wetland	2.38	3	-	NW	23	37	06	3	N
5609	Wetland	0.27	3	-	NE	23	37	06	3	N
5610	Wetland	0.23	3	-	NE	23	37	06	3	N
5611	Wetland	1.28	3	-	NE	23	37	06	3	N
5613	Wetland	0.22	2	-	NE	23	37	06	3	N
5614	Wetland	13.31	4	-	NE	23	37	06	3	N
5615	Wetland	0.33	3	-	NE	23	37	06	3	N
5616	Wetland	1.63	3	-	SE	23	37	06	3	N
5617	Wetland	1.03	3	-	NE	23	37	06	3	N
5618	Wetland	0.57	3	-	NW	23	37	06	3	N
5619	Wetland	6.86	2	-	NE	23	37	06	3	N
5620	Wetland	0.09	3	-	NE	23	37	06	3	N
5621	Wetland	2.04	3	-	NW	23	37	06	3	N
5622	Wetland	0.29	3	-	NW	23	37	06	3	N
5623	Wetland	1.54	3	-	NE	22	37	06	3	Y
5624	Wetland	0.19	3	-	NE	22	37	06	3	N
5625	Wetland	0.13	2	-	NE	22	37	06	3	N
5626	Wetland	0.30	2	-	NE	22	37	06	3	N
5627	Wetland	0.33	3	-	NW	03	38	05	3	N
5628	Wetland	0.25	3	-	NW	03	38	05	3	N
5629	Wetland	0.98	3	-	NW	22	37	06	3	Y
5630	Wetland	0.51	3	-	NW	22	37	06	3	N
5631	Wetland	2.28	4	-	NW	22	37	06	3	N
5632	Wetland	0.23	2	-	NW	22	37	06	3	N
5633	Wetland	0.42	2	-	NW	22	37	06	3	N
5634	Wetland	1.28	2	-	NW	22	37	06	3	N
5635	Wetland	1.96	3	-	NW	22	37	06	3	N
5636	Wetland	0.24	2	-	NW	22	37	06	3	N
5637	Wetland	0.25	3	-	NE	22	37	06	3	N
5638	Wetland	0.22	3	-	NE	22	37	06	3	N
5639	Wetland	0.09	2	-	NE	22	37	06	3	N
5640	Wetland	3.33	2	-	NE	22	37	06	3	Y
5641	Wetland	0.22	3	-	SE	22	37	06	3	N
5642	Wetland	3.42	3	-	NE	22	37	06	3	N
5643	Wetland	0.42	3	-	SE	22	37	06	3	N
5645	Wetland	1.70	3	-	SE	22	37	06	3	N
5646	Wetland	1.51	3	-	SE	22	37	06	3	N
5647	Wetland	1.00	3	-	SE	22	37	06	3	N
5648	Wetland	2.13	2	-	SE	22	37	06	3	N
5649	Wetland	0.34	2	-	SE	22	37	06	3	N
5650	Wetland	0.37	2	-	SE	22	37	06	3	N
5651	Wetland	0.82	2	-	SW	22	37	06	3	Y
5652	Wetland	0.29	2	-	SW	22	37	06	3	Y
5653	Wetland	0.20	2	-	SW	22	37	06	3	N

Natural Area ID	Natural Area Type	Area (ha)	Wetland Class	Cover Type	Legal Land Location					Field Checked
					QRT	SEC	TWP	RGE	MER	
5654	Wetland	0.19	2	-	SW	22	37	06	3	N
5655	Wetland	0.20	2	-	SE	35	37	06	3	N
5656	Wetland	1.14	3	-	SW	36	37	06	3	N
5657	Wetland	3.10	2	-	NE	22	37	06	3	N
5658	Wetland	0.34	2	-	NW	36	37	06	3	N
5659	Wetland	1.18	2	-	NW	36	37	06	3	N
5660	Wetland	0.16	3	-	NW	36	37	06	3	N
5661	Wetland	1.43	2	-	NW	36	37	06	3	N
5662	Wetland	0.25	2	-	SW	24	37	06	3	N
5663	Wetland	2.67	4	-	NW	13	37	06	3	N
5664	Wetland	0.79	3	-	NW	13	37	06	3	N
5665	Wetland	0.03	2	-	NW	13	37	06	3	N
5666	Wetland	0.07	3	-	NW	13	37	06	3	N
5667	Wetland	1.21	3	-	NW	13	37	06	3	N
5668	Wetland	0.07	2	-	NW	13	37	06	3	N
5669	Wetland	0.08	2	-	NW	13	37	06	3	N
5670	Wetland	0.43	3	-	NW	13	37	06	3	N
5671	Wetland	3.78	4	-	NW	13	37	06	3	N
5672	Wetland	0.29	3	-	NW	13	37	06	3	N
5673	Wetland	0.89	2	-	SW	13	37	06	3	N
5674	Wetland	0.30	2	-	SW	13	37	06	3	N
5675	Wetland	2.08	4	-	SW	13	37	06	3	N
5676	Wetland	0.79	2	-	SW	13	37	06	3	N
5677	Wetland	7.47	3	-	NW	13	37	06	3	N
5678	Wetland	1.35	3	-	SW	13	37	06	3	N
5679	Wetland	4.61	2	-	SW	13	37	06	3	N
5680	Wetland	0.81	4	-	SW	13	37	06	3	N
5681	Wetland	0.61	2	-	SE	36	37	06	3	N
5682	Wetland	0.14	2	-	NE	36	37	06	3	N
5683	Wetland	0.96	2	-	NE	36	37	06	3	N
5684	Wetland	7.34	2	-	SW	31	37	05	3	N
5685	Wetland	0.22	3	-	NW	06	38	05	3	N
5686	Wetland	0.31	2	-	NW	06	38	05	3	N
5687	Wetland	0.02	3	-	NW	06	38	05	3	N
5688	Wetland	0.03	3	-	NW	06	38	05	3	N
5689	Wetland	0.14	2	-	NW	06	38	05	3	N
5690	Wetland	0.15	3	-	NE	06	38	05	3	N
5691	Wetland	0.27	2	-	NW	31	37	05	3	N
5692	Wetland	0.06	3	-	NW	31	37	05	3	N
5693	Wetland	0.08	3	-	NW	31	37	05	3	N
5694	Wetland	0.04	3	-	NW	31	37	05	3	N
5696	Wetland	0.24	2	-	SW	31	37	05	3	N
5697	Wetland	0.10	3	-	SW	31	37	05	3	N
5698	Wetland	0.13	2	-	NW	30	37	05	3	N
5699	Wetland	0.09	2	-	NW	30	37	05	3	N
5700	Wetland	0.65	2	-	NW	19	37	05	3	N
5701	Wetland	0.08	3	-	NW	19	37	05	3	N
5702	Wetland	0.32	4	-	NW	19	37	05	3	N
5703	Wetland	0.39	2	-	NE	19	37	05	3	N
5704	Wetland	0.04	2	-	NW	17	37	05	3	N
5705	Wetland	0.12	3	-	NW	17	37	05	3	N
5706	Wetland	0.78	2	-	NW	17	37	05	3	N
5707	Wetland	0.13	2	-	NW	17	37	05	3	N

Natural Area ID	Natural Area Type	Area (ha)	Wetland Class	Cover Type	Legal Land Location					Field Checked
					QRT	SEC	TWP	RGE	MER	
5708	Wetland	0.03	2	-	NW	17	37	05	3	N
5709	Wetland	0.02	2	-	NW	17	37	05	3	N
5710	Wetland	0.17	3	-	NW	17	37	05	3	N
5713	Wetland	0.07	2	-	NE	17	37	05	3	N
5714	Wetland	0.04	2	-	NE	17	37	05	3	N
5715	Wetland	0.51	2	-	NW	17	37	05	3	N
5716	Wetland	0.07	2	-	NW	17	37	05	3	N
5717	Wetland	0.14	2	-	NW	17	37	05	3	N
5718	Wetland	0.02	2	-	NW	17	37	05	3	N
5719	Wetland	0.01	2	-	NW	17	37	05	3	N
5720	Wetland	0.54	2	-	NW	17	37	05	3	N
5721	Wetland	0.22	2	-	NE	17	37	05	3	N
5722	Wetland	0.37	2	-	NW	17	37	05	3	N
5725	Wetland	0.02	2	-	SW	20	37	05	3	N
5726	Wetland	0.01	2	-	SW	20	37	05	3	N
5727	Wetland	0.07	2	-	NE	30	37	05	3	N
5745	Wetland	1.52	2	-	SE	05	38	05	3	N
5746	Wetland	2.03	3	-	SW	05	38	05	3	N
5747	Wetland	1.18	2	-	SE	05	38	05	3	N
5748	Wetland	3.17	3	-	SE	05	38	05	3	N
5749	Wetland	0.24	3	-	SE	05	38	05	3	N
5750	Wetland	1.55	3	-	SE	05	38	05	3	N
5751	Wetland	0.16	3	-	SE	05	38	05	3	N
5752	Wetland	0.34	3	-	SE	05	38	05	3	N
5753	Wetland	1.25	3	-	SW	05	38	05	3	N
5754	Wetland	0.23	2	-	SW	05	38	05	3	N
5755	Wetland	1.22	3	-	SW	05	38	05	3	N
5756	Wetland	0.13	3	-	SW	05	38	05	3	N
5757	Wetland	0.39	3	-	SW	05	38	05	3	N
5758	Wetland	0.03	3	-	SW	05	38	05	3	N
5759	Wetland	0.09	3	-	SW	05	38	05	3	N
5760	Wetland	0.32	2	-	SW	05	38	05	3	N
5761	Wetland	0.18	2	-	NE	06	38	05	3	N
5762	Wetland	0.29	2	-	NW	05	38	05	3	N
5763	Wetland	0.71	2	-	NW	05	38	05	3	N
5764	Wetland	0.14	2	-	NW	05	38	05	3	N
5765	Wetland	0.10	3	-	SE	06	38	05	3	N
5766	Wetland	0.08	3	-	SE	06	38	05	3	N
5768	Wetland	0.14	2	-	SE	06	38	05	3	N
5769	Wetland	0.39	2	-	SE	06	38	05	3	N
5770	Wetland	0.98	2	-	SE	06	38	05	3	N
5771	Wetland	0.06	2	-	SE	06	38	05	3	N
5772	Wetland	0.04	2	-	SE	06	38	05	3	N
5773	Wetland	1.02	2	-	NE	31	37	05	3	N
5776	Wetland	0.07	2	-	SE	30	37	05	3	N
5777	Wetland	0.21	2	-	SE	30	37	05	3	N
5778	Wetland	0.08	3	-	SE	30	37	05	3	N
5779	Wetland	0.13	2	-	SE	30	37	05	3	N
5780	Wetland	0.13	2	-	SE	30	37	05	3	N
5781	Wetland	0.05	2	-	SE	30	37	05	3	N
5782	Wetland	0.18	2	-	SE	30	37	05	3	N
5783	Wetland	1.20	3	-	SW	29	37	05	3	N
5784	Wetland	3.73	2	-	SW	29	37	05	3	N



Natural Area ID	Natural Area Type	Area (ha)	Wetland Class	Cover Type	Legal Land Location					Field Checked
					QRT	SEC	TWP	RGE	MER	
5785	Wetland	0.62	2	-	NW	29	37	05	3	N
5786	Wetland	0.22	2	-	NW	29	37	05	3	N
5787	Wetland	0.08	2	-	SW	32	37	05	3	N
5788	Wetland	0.17	2	-	NW	29	37	05	3	N
5789	Wetland	0.14	2	-	NW	29	37	05	3	N
5790	Wetland	0.16	3	-	NW	29	37	05	3	N
5791	Wetland	0.14	2	-	NW	29	37	05	3	N
5792	Wetland	0.06	2	-	SW	32	37	05	3	N
5793	Wetland	0.27	2	-	NW	20	37	05	3	N
5794	Wetland	0.09	3	-	SE	29	37	05	3	N
5795	Wetland	0.97	3	-	NE	29	37	05	3	N
5796	Wetland	0.06	3	-	NE	29	37	05	3	N
5797	Wetland	0.29	2	-	SE	32	37	05	3	N
5798	Wetland	0.52	2	-	SE	32	37	05	3	N
5799	Wetland	0.42	2	-	SE	32	37	05	3	N
5800	Wetland	0.16	2	-	SE	32	37	05	3	N
5801	Wetland	0.16	2	-	NW	05	38	05	3	N
5802	Wetland	0.28	2	-	NW	05	38	05	3	N
5803	Wetland	0.41	2	-	NE	05	38	05	3	N
5804	Wetland	0.86	2	-	NE	05	38	05	3	N
5804	Wetland	0.58	3	-	SW	22	37	06	3	Y
5805	Wetland	0.83	2	-	NE	05	38	05	3	N
5806	Wetland	0.40	2	-	NE	05	38	05	3	N
5807	Wetland	0.21	2	-	NE	05	38	05	3	N
5808	Wetland	0.03	2	-	NE	05	38	05	3	N
5809	Wetland	0.21	2	-	NE	05	38	05	3	N
5810	Wetland	0.03	2	-	NE	05	38	05	3	N
5811	Wetland	0.67	2	-	NE	05	38	05	3	N
5812	Wetland	1.25	2	-	NW	33	37	05	3	N
5812	Wetland	0.65	3	1	NW	33	37	05	3	N
5813	Wetland	0.08	2	-	NW	33	37	05	3	N
5814	Wetland	0.52	3	-	NW	33	37	05	3	N
5815	Wetland	0.20	2	-	NW	33	37	05	3	N
5816	Wetland	0.16	3	-	NW	33	37	05	3	N
5817	Wetland	2.32	2	-	SW	28	37	05	3	N
5821	Wetland	0.22	2	-	NW	28	37	05	3	N
5822	Wetland	0.25	3	-	SE	28	37	05	3	N
5823	Wetland	0.36	3	-	SE	28	37	05	3	N
5825	Wetland	1.30	2	-	SW	34	37	05	3	N
5826	Wetland	7.90	2	-	NE	34	37	05	3	N
5827	Wetland	1.55	3	-	NE	27	37	05	3	N
5828	Wetland	0.14	2	-	NE	27	37	05	3	N
5829	Wetland	5.81	4	-	SE	27	37	05	3	N
5830	Wetland	0.96	4	-	SE	27	37	05	3	N
5831	Wetland	0.38	3	-	SE	27	37	05	3	N
5832	Wetland	1.23	3	-	SE	27	37	05	3	N
5833	Wetland	0.62	3	-	SE	27	37	05	3	N
5834	Wetland	0.29	3	-	SE	27	37	05	3	N
5835	Wetland	0.22	3	-	SE	27	37	05	3	N
5836	Wetland	0.27	3	-	SE	27	37	05	3	N
5837	Wetland	0.10	2	-	SE	27	37	05	3	N
5838	Wetland	0.65	3	-	SE	27	37	05	3	N
5839	Wetland	0.09	3	-	SE	27	37	05	3	N

Natural Area ID	Natural Area Type	Area (ha)	Wetland Class	Cover Type	Legal Land Location					Field Checked
					QRT	SEC	TWP	RGE	MER	
5840	Wetland	0.55	3	-	SE	27	37	05	3	N
5841	Wetland	0.15	3	-	SE	27	37	05	3	N
5842	Wetland	0.37	3	-	SE	27	37	05	3	N
5843	Wetland	0.29	3	-	SE	27	37	05	3	N
5844	Wetland	0.09	3	-	SE	27	37	05	3	N
5845	Wetland	0.16	3	-	SE	27	37	05	3	N
5846	Wetland	0.04	3	-	SE	27	37	05	3	N
5847	Wetland	0.09	3	-	SE	27	37	05	3	N
5848	Wetland	0.03	3	-	SE	27	37	05	3	N
5849	Wetland	0.75	3	-	SW	26	37	05	3	N
5850	Wetland	0.05	2	-	SW	26	37	05	3	N
5851	Wetland	0.86	3	-	SW	26	37	05	3	N
5852	Wetland	0.04	2	-	NW	26	37	05	3	N
5853	Wetland	0.09	2	-	NW	26	37	05	3	N
5854	Wetland	0.32	2	-	NW	26	37	05	3	N
5855	Wetland	0.22	2	-	NW	26	37	05	3	N
5856	Wetland	3.44	4	-	NW	26	37	05	3	N
5857	Wetland	0.09	2	-	NW	26	37	05	3	N
5858	Wetland	0.13	2	-	NW	26	37	05	3	N
5859	Wetland	3.08	4	-	SW	35	37	05	3	N
5860	Wetland	0.30	3	-	SW	35	37	05	3	N
5861	Wetland	0.32	3	-	SW	35	37	05	3	N
5862	Wetland	0.44	2	-	SW	35	37	05	3	N
5863	Wetland	0.85	3	-	SW	35	37	05	3	N
5864	Wetland	0.26	2	-	SW	35	37	05	3	N
5865	Wetland	0.56	3	-	SW	35	37	05	3	N
5866	Wetland	1.43	3	-	SW	35	37	05	3	N
5867	Wetland	1.21	3	-	SW	35	37	05	3	N
5868	Wetland	0.61	3	-	SW	35	37	05	3	N
5869	Wetland	0.65	2	-	SW	35	37	05	3	N
5870	Wetland	1.78	2	-	SW	35	37	05	3	N
5871	Wetland	0.06	2	-	SW	35	37	05	3	N
5872	Wetland	0.19	2	-	SW	35	37	05	3	N
5873	Wetland	1.43	3	-	NE	34	37	05	3	N
5874	Wetland	0.93	3	-	NE	34	37	05	3	N
5875	Wetland	0.59	2	-	NW	35	37	05	3	N
5876	Wetland	0.57	3	-	SE	03	38	05	3	N
5877	Wetland	0.25	2	-	SW	02	38	05	3	N
5878	Wetland	1.23	2	-	SW	02	38	05	3	N
5879	Wetland	0.22	3	-	SW	02	38	05	3	N
5880	Wetland	0.66	2	-	NW	02	38	05	3	N
5881	Wetland	0.14	3	-	SW	11	38	05	3	N
5882	Wetland	1.45	2	-	NW	03	38	05	3	N
5883	Wetland	0.23	2	-	NW	03	38	05	3	N
5884	Wetland	0.56	2	-	NW	16	37	06	3	N
5885	Wetland	1.47	2	-	NW	16	37	06	3	N
5886	Wetland	0.13	2	-	SE	22	37	06	3	N
5887	Wetland	1.34	3	-	SW	14	37	06	3	Y
5888	Wetland	2.27	2	-	NW	32	37	05	3	N
5889	Wetland	4.30	2	-	NE	32	37	05	3	N
5901	Wetland	6.30	2	-	NE	36	37	06	3	Y
5902	Wetland	0.21	2	-	SW	14	37	06	3	Y
5903	Wetland	0.26	2	-	SW	14	37	06	3	Y

Natural Area ID	Natural Area Type	Area (ha)	Wetland Class	Cover Type	Legal Land Location					Field Checked
					QRT	SEC	TWP	RGE	MER	
5904	Wetland	0.20	2	-	SW	14	37	06	3	Y
5905	Wetland	3.39	2	-	NE	05	38	05	3	Y
5906	Wetland	0.38	3	2	NW	03	38	05	3	Y
5907	Wetland	1.35	3	2	NW	03	38	05	3	Y
5908	Wetland	0.38	3	2	NW	03	38	05	3	Y
5909	Wetland	0.26	3	2	SW	30	37	05	3	Y
5910	Wetland	0.22	3	-	NE	05	38	05	3	Y
5912	Wetland	0.12	3	-	SW	14	37	06	3	N
5913	Wetland	0.09	3	-	SE	14	37	06	3	N
5914	Wetland	0.09	2	-	SW	14	37	06	3	N
5915	Wetland	0.09	3	-	SW	14	37	06	3	N
5916	Wetland	0.18	2	-	SW	14	37	06	3	N
5917	Wetland	1.41	2	-	SW	14	37	06	3	N
5918	Wetland	0.31	2	-	SE	14	37	06	3	N
5919	Wetland	1.69	2	-	SE	14	37	06	3	N
5920	Wetland	0.27	2	-	SE	14	37	06	3	N
5921	Wetland	0.97	3	-	NE	14	37	06	3	N
5922	Wetland	0.49	3	-	NE	14	37	06	3	N
5923	Wetland	0.06	2	-	SE	14	37	06	3	N
5924	Wetland	0.16	2	-	NE	14	37	06	3	N
5925	Wetland	0.25	2	-	NE	14	37	06	3	N
5926	Wetland	0.22	2	-	SE	14	37	06	3	N
5927	Wetland	0.05	2	-	NE	14	37	06	3	N
5928	Wetland	0.19	2	-	SE	14	37	06	3	N
5929	Wetland	0.08	3	-	NE	14	37	06	3	N
5930	Wetland	0.54	2	-	NE	14	37	06	3	N
5931	Wetland	1.28	3	-	NE	14	37	06	3	N
5932	Wetland	0.23	3	-	NW	15	37	06	3	N
5933	Wetland	0.32	2	-	NE	14	37	06	3	N
5934	Wetland	2.57	3	-	NE	14	37	06	3	N
5935	Wetland	0.78	2	-	NE	14	37	06	3	N
5936	Wetland	0.14	3	-	NE	14	37	06	3	N
5937	Wetland	0.34	3	-	NE	14	37	06	3	N
5938	Wetland	0.23	2	-	NE	14	37	06	3	N
5939	Wetland	0.42	3	-	NE	14	37	06	3	N
5940	Wetland	2.16	3	-	NE	14	37	06	3	N
5942	Wetland	0.38	2	-	SE	23	37	06	3	N
5943	Wetland	0.20	2	-	SE	23	37	06	3	N
5944	Wetland	3.57	2	-	SE	33	37	5	3	Y
5945	Wetland	0.28	3	-	SE	33	37	5	3	Y
5948	Wetland	0.57	3	-	SW	23	37	06	3	N
5949	Wetland	0.08	2	-	SE	29	37	5	3	N
5952	Wetland	0.21	2	-	NW	22	37	06	3	N
5953	Wetland	3.80	2	-	NW	22	37	06	3	N
5954	Wetland	1.19	2	-	NE	22	37	06	3	N
5955	Wetland	0.71	3	-	NE	22	37	06	3	N
5956	Wetland	1.41	2	-	NE	22	37	06	3	N
5958	Wetland	0.45	2	-	SW	26	37	06	3	N
5959	Wetland	0.32	2	-	SW	26	37	06	3	N
5960	Wetland	0.61	2	-	SW	26	37	06	3	N
5961	Wetland	1.11	3	-	NW	26	37	06	3	N
5962	Wetland	0.04	2	-	NW	26	37	06	3	N
5965	Wetland	0.12	3	-	NE	26	37	06	3	N

Natural Area ID	Natural Area Type	Area (ha)	Wetland Class	Cover Type	Legal Land Location					Field Checked
					QRT	SEC	TWP	RGE	MER	
5966	Wetland	0.04	2	-	NE	26	37	06	3	N
5967	Wetland	0.05	3	-	NE	26	37	06	3	N
5968	Wetland	0.05	2	-	NE	26	37	06	3	N
5969	Wetland	0.03	2	-	NE	26	37	06	3	N
5970	Wetland	0.09	2	-	SE	35	37	06	3	N
5971	Wetland	0.18	2	-	SE	35	37	06	3	N
5972	Wetland	0.69	2	-	SW	03	38	05	3	N
5973	Wetland	0.09	2	-	SW	03	38	05	3	N
5974	Wetland	0.15	2	-	SW	03	38	05	3	N
5975	Wetland	0.50	2	-	SW	03	38	05	3	N
5976	Wetland	1.25	4	-	NE	03	38	05	3	N
5977	Wetland	0.12	3	-	NE	03	38	05	3	N
5978	Wetland	0.20	3	-	NE	03	38	05	3	N
5979	Wetland	0.30	3	-	NE	03	38	05	3	N
5980	Wetland	0.21	3	-	NE	03	38	05	3	N
5982	Wetland	0.43	2	-	NE	03	38	05	3	N
5983	Wetland	1.42	2	-	NE	03	38	05	3	N
5984	Wetland	0.17	2	-	NE	03	38	05	3	N
5985	Wetland	0.25	2	-	NE	03	38	05	3	N
5986	Wetland	0.21	2	-	NE	03	38	05	3	N
5988	Wetland	0.03	4	-	NE	03	38	05	3	N
5989	Wetland	0.17	2	-	SW	25	37	06	3	N
5990	Wetland	7.79	2	-	SW	29	37	05	3	N
5993	Wetland	0.71	3	2	SE	03	38	05	3	Y
5994	Wetland	0.08	3	-	SE	03	38	05	3	Y
5995	Wetland	0.07	3	-	SE	03	38	05	3	Y
5996	Wetland	0.85	3	-	SE	21	37	05	3	N
5997	Wetland	0.15	3	-	NW	26	37	06	3	N
5998	Wetland	7.24	2	-	NW	20	37	05	3	N
5999	Wetland	1.35	2	-	SW	04	38	05	3	N
7432	Wetland	0.19	3	-	SW	26	37	05	3	N
7437	Wetland	0.06	2	-	NE	33	37	05	3	N
7438	Wetland	0.15	3	-	NW	33	37	05	3	N
7439	Wetland	0.12	3	-	NW	33	37	05	3	N
7440	Wetland	0.17	3	-	NW	33	37	05	3	N
7442	Wetland	0.37	3	-	NW	33	37	05	3	N
7443	Wetland	0.69	2	-	NW	33	37	05	3	N
7444	Wetland	3.65	3	-	NE	32	37	05	3	Y
7445	Wetland	3.00	3	-	NE	32	37	05	3	Y
7446	Wetland	2.76	2	-	NW	32	37	05	3	Y
7446	Wetland	4.98	3	-	NE	32	37	05	3	Y
7447	Wetland	4.60	3	-	SW	32	37	05	3	N
7448	Wetland	8.13	4	-	SE	32	37	05	3	N
7449	Wetland	0.48	2	-	SW	32	37	05	3	N
7450	Wetland	0.38	2	-	SW	32	37	05	3	N
7451	Wetland	0.07	4	-	NW	29	37	05	3	N
7452	Wetland	2.05	3	-	SW	29	37	05	3	N
7454	Wetland	1.46	4	-	SW	29	37	05	3	N
7456	Wetland	0.85	3	-	SW	29	37	05	3	N
7458	Wetland	0.06	3	-	SE	29	37	05	3	N
7459	Wetland	6.00	3	-	SW	29	37	05	3	N
7462	Wetland	0.04	3	-	NW	20	37	05	3	N
7463	Wetland	0.18	4	-	NW	20	37	05	3	N

Natural Area ID	Natural Area Type	Area (ha)	Wetland Class	Cover Type	Legal Land Location					Field Checked
					QRT	SEC	TWP	RGE	MER	
7465	Wetland	0.33	3	-	NW	17	37	05	3	N
7466	Wetland	0.29	3	-	NW	17	37	05	3	N
7467	Wetland	2.25	4	-	NW	19	37	05	3	Y
7468	Wetland	1.35	3	-	NW	19	37	05	3	Y
7469	Wetland	0.07	2	-	NW	19	37	05	3	N
7470	Wetland	0.13	3	-	NW	19	37	05	3	N
7471	Wetland	0.46	2	-	NW	19	37	05	3	N
7472	Wetland	0.35	3	-	NW	19	37	05	3	N
7475	Wetland	0.24	4	-	SE	30	37	05	3	N
7476	Wetland	0.04	3	-	SE	30	37	05	3	N
7478	Wetland	0.10	2	-	NE	30	37	05	3	N
7479	Wetland	0.17	3	-	NW	30	37	05	3	N
7481	Wetland	0.23	2	-	NE	30	37	05	3	N
7484	Wetland	0.11	2	-	NW	30	37	05	3	N
7489	Wetland	3.16	2	-	SW	31	37	05	3	N
7490	Wetland	0.14	2	-	SW	31	37	05	3	N
7491	Wetland	1.15	2	-	SW	31	37	05	3	N
7493	Wetland	0.87	2	-	SE	31	37	05	3	N
7494	Wetland	0.34	3	-	SE	31	37	05	3	N
7495	Wetland	0.16	3	-	SE	31	37	05	3	N
7497	Wetland	0.18	3	-	SE	31	37	05	3	N
7498	Wetland	0.13	3	-	SE	31	37	05	3	N
7500	Wetland	0.14	3	-	SE	25	37	06	3	N
7501	Wetland	0.09	3	-	SW	25	37	06	3	N
8010	Tree stand	0.94	Trees	-	NW	26	37	06	3	Y
8087	Tree stand	0.20	Trees	-	SW	22	37	06	3	Y
8100	Tree stand	0.37	Trees	-	SW	26	37	06	3	Y
8300	Tree stand	0.13	Trees	-	SW	36	37	06	3	Y
8301	Tree stand	3.76	Trees	-	NE	05	38	05	3	Y
8302	Tree stand	2.90	Trees	-	NW	05	38	05	3	Y
8303	Tree stand	0.18	Trees	-	NW	05	38	05	3	Y
8304	Tree stand	0.22	Trees	-	NW	05	38	05	3	Y
8305	Tree stand	0.13	Trees	-	NW	05	38	05	3	Y
8306	Tree stand	0.24	Trees	-	NW	05	38	05	3	Y
8307	Tree stand	4.25	Trees	-	NE	05	38	05	3	Y
8308	Tree stand	2.80	Trees	-	SE	04	38	05	3	Y
8501	Tree stand	3.03	Trees	-	SE	21	37	05	3	N
8502	Tree stand	1.55	Trees	-	SW	21	37	05	3	N
8503	Tree stand	0.60	Trees	-	NE	21	37	05	3	N
8504	Tree stand	6.41	Trees	-	SE	21	37	05	3	N
8505	Tree stand	0.53	Trees	-	SW	16	37	06	3	N
8506	Tree stand	0.35	Trees	-	NE	16	37	06	3	N
8507	Tree stand	0.97	Trees	-	NE	16	37	06	3	N
8508	Tree stand	0.43	Trees	-	NE	16	37	06	3	N
8509	Tree stand	1.08	Trees	-	SE	27	37	06	3	N
8509	Tree stand	3.31	Trees	-	SE	27	37	06	3	N
8510	Tree stand	1.75	Trees	-	SW	27	37	06	3	N
8511	Tree stand	0.47	Trees	-	SE	27	37	06	3	N
8512	Tree stand	2.63	Trees	-	SE	27	37	06	3	N
8513	Tree stand	0.91	Trees	-	NE	15	37	06	3	N
8514	Tree stand	1.43	Trees	-	SE	26	37	06	3	N
8515	Tree stand	1.65	Trees	-	NW	26	37	06	3	N
8516	Tree stand	4.82	Trees	-	SE	35	37	06	3	N

Natural Area ID	Natural Area Type	Area (ha)	Wetland Class	Cover Type	Legal Land Location					Field Checked
					QRT	SEC	TWP	RGE	MER	
8517	Tree stand	1.84	Trees	-	SE	35	37	06	3	N
8518	Tree stand	1.54	Trees	-	SE	25	37	06	3	N
8519	Tree stand	1.13	Trees	-	SW	25	37	06	3	N
8520	Tree stand	2.81	Trees	-	NW	36	37	06	3	N
8521	Tree stand	0.80	Trees	-	NE	35	37	06	3	N
8522	Tree stand	1.81	Trees	-	SE	30	37	05	3	N
8523	Tree stand	1.34	Trees	-	SW	05	38	05	3	N
8524	Tree stand	0.79	Trees	-	NE	27	37	05	3	N
8524	Tree stand	1.33	Trees	-	NE	27	37	05	3	N
8525	Tree stand	13.30	Trees	-	SE	23	37	05	3	N

**Table C.2. Vegetation Species Observed within the Study Area**

Scientific name	Common name	Provincial Designations <sup>1</sup>
<i>Acer negundo</i> L.	Manitoba Maple	
<i>Achillea millefolium</i> L.	common yarrow	
<i>Agropyron cristatum</i> (L.) Gaertn.	crested wheatgrass	
<i>Alisma gramineum</i> Lej.	narrow-leaved water plantain	S3
<i>Alisma subcordatum</i> Raf.	broad-leaved water plantain / water plantain	
<i>Alopecurus aequalis</i> var. <i>aequalis</i> Sobol.	short-awned foxtail	
<i>Amaranthus blitoides</i> S. Watson	prostrate pigweed	
<i>Anemone canadensis</i> L.	Canada anemone	
<i>Antennaria corymbosa</i> E.E. Nelson*	meadow pussytoes	S1
<i>Antennaria microphylla</i> Rydb.	small-leaved pussytoes	
<i>Artemisia absinthium</i> L.	absinthe	Noxious
<i>Artemisia biennis</i> Willd.	biennial wormwood	
<i>Artemisia ludoviciana</i> Nutt.	prairie sage	
<i>Aster</i> sp	aster sp	
<i>Beckmannia syzigachne</i> (Steud.) Fernald	slough grass	
<i>Bolboschoenus maritimus</i> ssp. <i>paludosus</i> (A. Nelson) Å. Löve & D. Löve	prairie bulrush	
<i>Brachythecium</i> sp	aquatic moss	
<i>Brassica</i> sp	mustard sp	
<i>Bromus inermis</i> Leyss.	smooth brome	
<i>Calamagrostis stricta</i> ssp. <i>inexpansa</i> (A. Gray) C.W. Greene	northern reed grass	
<i>Callitriche palustris</i> L.	water starwort	
<i>Campanula rotundifolia</i> L.	harebell	
<i>Capsella bursa-pastoris</i> (L.) Medik.	shepherd's purse	
<i>Carduus nutans</i> L.	nodding thistle	Noxious
<i>Carex aquatilis</i> Wahlenb.	water sedge	
<i>Carex atherodes</i> Spreng.	awned sedge	
<i>Carex athrostachya</i> Olney	long-bracted sedge	
<i>Carex bebbii</i> Olney ex Fernald	bebb's sedge	
<i>Carex rossii</i> Boott	ross' sedge	
<i>Carex rostrata</i> Stokes	beaked sedge	
<i>Carex pellita</i> Muhl. ex Willd.	wooly sedge	
<i>Carex praticola</i> Rydb.	meadow sedge	
<i>Carex</i> sp	sedge sp	
<i>Cerastium fontanum</i> ssp. <i>vulgare</i> (Hartm.) Greuter & Burdet	common chickweed / common mouse-ear chickweed	
<i>Ceratophyllum demersum</i> L.	hornwort	
<i>Chenopodium</i> L.	goosefoot	
<i>Cirsium arvense</i> (L.) Scop.	Canada thistle	Noxious
<i>Cirsium</i> sp	thistle sp	
<i>Collomia linearis</i> Nutt.	narrow-leaved collomia	
<i>Comandra umbellata</i> (L.) Nutt.	pale comandra	
<i>Conyza canadensis</i> (L.) Cronquist	Canada fleabane	
<i>Cornus stolonifera</i> Michx.	red-osier dogwood	
<i>Crepis tectorum</i> L.	narrow leaved hawk's-beard	Noxious
<i>Descurainia sophia</i> (L.) Webb ex Prantl	flixweed	
<i>Distichlis spicata</i> (L.) Greene	alkali grass / salt grass	
<i>Echinochloa crus-galli</i> var. <i>crus-galli</i> (L.) P. Beauv.	barnyard grass	
<i>Elaeagnus commutata</i> Bernh. ex Rydb.	wolfwillow	
<i>Eleocharis acicularis</i> (L.) Roem. & Schult.	needle spikerush	
<i>Eleocharis engelmannii</i>	Engelmann's spikerush	S2
<i>Eleocharis palustris</i> (L.) Roem. & Schult.	creeping spikerush	
<i>Eleocharis</i> sp	spikerush sp	
<i>Elymus repens</i> (L.) Gould	quack grass	Nuisance
<i>Epilobium palustre</i> L.	marsh willowherb	
<i>Equisetum arvense</i> L.	common horsetail	
<i>Equisetum</i> sp	horsetail sp	
<i>Erigeron</i> sp	fleabane sp	
<i>Eriophorum</i> sp	cottongrass sp	
<i>Fragaria virginiana</i> ssp. <i>glauca</i> (S. Watson) Staudt	wild strawberry	

Scientific name	Common name	Provincial Designations <sup>1</sup>
<i>Gaillardia aristata</i> Pursh	gaillardia	
<i>Galium aparine</i> L.	cleavers	Noxious
<i>Galium boreale</i> L.	northern bedstraw	
<i>Glyceria grandis</i> var. <i>grandis</i> S. Watson	tall manna grass / american manna grass	
<i>Glyceria striata</i> (Lam.) Hitchc.	fowl manna grass	
<i>Glycyrrhiza lepidota</i> Pursh.	wild licorice	
<i>Grindelia squarrosa</i> var. <i>quasiperennis</i> Lunell	gumweed	
<i>Helianthus annuus</i> L. ssp. <i>lenticularis</i> (Lindl.) Cockerell	common annual sunflower	
<i>Hieracium umbellatum</i> L.	hawkweed	
<i>Hordeum jubatum</i> ssp. <i>jubatum</i> L.	foxtail barley	Nuisance
<i>Juncus filiformis</i> L.	thread rush	
<i>Juncus</i> sp	rush sp	
<i>Juncus subtilis</i> E. Mey.	slender rush	
<i>Lactuca serriola</i> L.	prickly lettuce	Noxious
<i>Lappula occidentalis</i> (S. Watson) Greene	western bluebur / flat-spine sheepbur / stickseed	
<i>Lemna minor</i> L.	lesser duckweed	
<i>Lemna</i> sp	duckweed sp	
<i>Lemna trisulca</i> L.	ivy-leaved duckweed	
<i>Leucanthemum vulgare</i> Lam.	oxeye daisy	Noxious
<i>Limosella aquatica</i> L.	mudwort	
<i>Lycopus uniflorus</i> Michx.	northern horehound	
<i>Lysimachia maritima</i> (L.) Galasso, Banfi & Soldano	sea milkwort	
<i>Medicago lupulina</i> L.	black medic	
<i>Medicago sativa</i> L.	alfalfa	
<i>Melilotus albus</i> Medik.	white sweet clover	
<i>Melilotus officinalis</i> (L.) Lam.	yellow sweet clover	
<i>Melilotus</i> sp	sweet clover	
<i>Mentha arvensis</i> L.	wild mint	
<i>Monolepis nuttalliana</i> (Schult.) Greene	spear-leaved goosefoot	
<i>Myriophyllum sibiricum</i> Kom.	northern milfoil, siberian water-milfoil	
<i>Oenothera biennis</i> L.	yellow evening primrose	
<i>Orthocarpus luteus</i> Nutt.	owl's clover	
<i>Persicaria amphibia</i> (L.) Delarbre	water smartweed	
<i>Persicaria lapathifolia</i> (L.) Gray	nodding smartweed	
<i>Phalaris arundinacea</i> L.	reed canarygrass	
<i>Plantago major</i> L.	common/prairie plantain	
<i>Poa compressa</i> L.	Canada bluegrass	
<i>Poa palustris</i> L.	fowl blue grass	
<i>Poa pratensis</i> L.	kentucky bluegrass	
<i>Poa secunda</i> ssp. <i>secunda</i> J. Presl	canby blue	
<i>Poa</i> sp	bluegrass sp	
<i>Polygonum aviculare</i> L.	prostrate knotweed	
<i>Polygonum convolvulus</i> L.	wild buckwheat	
<i>Polygonum lapathifolium</i> L.	pale persicaria	
<i>Populus balsamifera</i> L.	balsam poplar	
<i>Populus tremuloides</i> Michx.	trembling aspen	
<i>Potamogeton natans</i>	floating pondweed	
<i>Potamogeton pusillus</i> L.	slender pondweed	
<i>Potamogeton richardsonii</i> (A. Benn.) Rydb.	Richardson's pondweed	
<i>Potamogeton</i> sp	pondweed sp	
<i>Potentilla anserina</i> L.	silverweed	
<i>Potentilla bipinnatifida</i> Douglas ex Hook.	plains cinquefoil	
<i>Potentilla gracilis</i> Douglas ex Hook.	graceful cinquefoil	
<i>Potentilla norvegica</i> L.	Norwegian Cinquefoil	
<i>Potentilla rivalis</i> Nutt.	brook Cinquefoil	
<i>Prunus pensylvanica</i> L. f.	pin cherry	
<i>Prunus virginiana</i> L.	chokecherry	
<i>Puccinellia nuttalliana</i> (Schult.) Hitchc.	nuttal's salt-meadow grass / nuttal's alkali grass	
<i>Ranunculus aquatilis</i> var. <i>diffusus</i> With.	white water crowfoot	
<i>Ranunculus cymbalaria</i> Pursh	seaside buttercup	
<i>Ranunculus gmelinii</i> DC.	Gmelin's Crowfoot	
<i>Ranunculus macounii</i> Britton	macoun's buttercup	



Scientific name	Common name	Provincial Designations <sup>1</sup>
<i>Ranunculus sceleratus</i> L.	celery-leaved buttercup / cursed buttercup	
<i>Rhynchospora capillacea</i> Torr.	slender beak rush	
<i>Ribes oxycanthoides</i> L.	northern gooseberry	
<i>Rorippa palustris</i> (L.) Besser	marsh yellow cress	
<i>Rosa acicularis</i> Lindl.	prickly rose	
<i>Rosa woodsii</i> Lindl.	common wild rose	
<i>Rumex occidentalis</i> S. Watson	western dock	
<i>Rumex pseudonatronatus</i> Borbás	field dock	
<i>Rumex crispus</i> L.	curly dock	
<i>Rumex salicifolius</i> Weinm.	narrow leaved dock	
<i>Rumex</i> sp	dock sp	
<i>Sagittaria cuneata</i> E. Sheld.	arum-leaved arrow head	
<i>salix exigua</i> Nutt.	narrowleaf willow	
<i>Scolochloa festucacea</i> (Willd.) Link	spangletop	
<i>Schoenoplectus pungens</i> var. <i>pungens</i> (Vahl) Palla	three-square bulrush	
<i>Schoenoplectus tabernaemontani</i> (C.C. Gmel.) Palla	common great bulrush / softstem bulrush	
<i>Setaria viridis</i> (L.) P. Beauv.	green foxtail	
<i>Silene noctiflora</i>	night-flowering catchfly	
<i>Sium suave</i> Walter	water parsnip	
<i>Sisyrinchium septentrionale</i>	northern blue-eyed grass	S3?
<i>Solidago</i> spp.	goldenrod	
<i>Solidago canadensis</i> L.	Canada goldenrod	
<i>Solidago missouriensis</i> Nutt.	low goldenrod	
<i>Solidago mollis</i> Bartlett	velvety goldenrod	
<i>Solidago rigida</i> ssp. <i>humilis</i> (Porter) S.B. Heard & Semple	stiff goldenrod	
<i>Sonchus</i> sp.	sow thistle sp	
<i>Spiraea alba</i> Du Roi	narrow-leaved meadowsweet / narrow-leaved spirea	
<i>Stachys palustris</i> L.	marsh hedge-nettle	
<i>Stipa</i> spp.	needle and thread grass	
<i>Stuckenia pectinata</i> (L.) Börner	sago pondweed	
<i>Symphoricarpos occidentalis</i> Hook.	western snowberry	
<i>Symphyotrichum ciliatum</i> (Ledeb.) G.L. Nesom	rayless aster	
<i>Symphyotrichum ericoides</i> (L.) G.L. Nesom	tufted white prairie aster	
<i>Symphyotrichum lanceolatum</i> var. <i>hesperium</i> (A. Gray) G.L. Nesom	willow aster	
<i>Tanacetum vulgare</i> L.	common tansy	Noxious
<i>Taraxacum officinale</i> ssp. <i>officinale</i> F.H. Wigg.	dandelion	Nuisance
<i>Tephrosia palustris</i> (L.) Reichenbach	marsh ragwort	
<i>Thalictrum venulosum</i> Trel.	veiny meadowrue	
<i>Thlaspi arvense</i> L.	stinkweed	
<i>Tragopogon dubius</i> Scop.	goat's-beard	
<i>Trifolium hybridum</i> L.	alsike clover	
<i>Trifolium</i> sp	clover sp	
<i>Triglochin maritima</i>	seaside arrow-grass	
<i>Triticum durum</i> Desf.	durum	
<i>Typha angustifolia</i> L.	narrow-leaved cattail	S1?
<i>Typha latifolia</i> L.	common cattail	
<i>Urtica dioica</i> L.	stinging nettle	
<i>Utricularia vulgaris</i> L.	common bladderwort	
<i>Veronica peregrina</i> L.	hairy speedwell	

<sup>1</sup> S1: Extremely Rare, 5 or fewer occurrences in Saskatchewan, or very few remaining individuals

S2: Rare, 6 to 20 occurrences in Saskatchewan or few remaining individuals

S3: Rare to uncommon, 21 to 100 occurrences in Saskatchewan

?: means that there is some uncertainty with the ranking, either to do with the taxonomy of the species or the data that supports the ranking.

Noxious and nuisance species, listed under The Weed Control Act (2010)

**Table C.3. Wildlife Species Observed within the Study Area**

Species Code	Scientific Name	Common Name	Provincial Rank <sup>1</sup>	COSEWIC Designation <sup>2</sup>
<b>Birds</b>				
SPSA	<i>Actitis macularius</i>	Spotted Sandpiper		
RWBL	<i>Agelaius phoeniceus</i>	Red-winged Blackbird		
LCSP	<i>Ammodramus leconteii</i>	LeConte's Sparrow		
GRSP	<i>Ammodramus savannarum</i>	Grasshopper Sparrow		
NSHO	<i>Anas clypeata</i>	Northern Shoveler		
BWTE	<i>Anas discors</i>	Blue-winged Teal		
MALL	<i>Anas platyrhynchos</i>	Mallard		
GADW	<i>Anas strepera</i>	Gadwall		
SPPI	<i>Anthus spragueii</i>	Sprague's Pipit	S3B	Threatened
AMBI	<i>Botaurus lentiginosus</i>	American Bittern		
CANG	<i>Branta canadensis</i>	Canada Goose		
RTHA	<i>Buteo jamaicensis</i>	Red-tailed Hawk		
KILL	<i>Charadrius vociferus</i>	Killdeer		
BLTE	<i>Chlidonias niger</i>	Black Tern		
NOFL	<i>Colaptes auratus</i>	Northern Flicker		
AMCR	<i>Corvus brachyrhynchos</i>	American Crow		
CORA	<i>Corvus corax</i>	Common Raven		
BOBO	<i>Dolichonyx oryzivorus</i>	Bobolink	S5B	Threatened
HOLA	<i>Eremophila alpestris</i>	Horned Lark		
BRBL	<i>Euphagus cyanocephalus</i>	Brewer's Blackbird		
AMCO	<i>Fulica americana</i>	American Coot		
WISN	<i>Gallinago delicata</i>	Wilson's Snipe		
COYE	<i>Geothlypis trichas</i>	Common Yellowthroat		
BARS	<i>Hirundo rustica</i>	Barn Swallow	S5B	Threatened
FRGU	<i>Larus pipixcan</i>	Franklin's Gull		
MAGO	<i>Limosa fedoa</i>	Marbled Godwit		
RUDU	<i>Oxyura jamaicensis</i>	Ruddy Duck		
SAVS	<i>Passerculus sandwichensis</i>	Savannah Sparrow		
WIPH	<i>Phalaropus tricolor</i>	Wilson's Phalarope		
EAGR	<i>Podiceps nigricollis</i>	Eared Grebe		
VESP	<i>Poocetes gramineus</i>	Vesper Sparrow		
SORA	<i>Porzana carolina</i>	Sora		
AMAV	<i>Recurvirostra americana</i>	American Avocet		
CCSP	<i>Spizella pallida</i>	Clay-coloured Sparrow		
TRSW	<i>Tachycineta bicolor</i>	Tree Swallow		
GRYE	<i>Tringa melanoleuca</i>	Greater Yellowlegs		
WILL	<i>Tringa semipalmata</i>	Willet		
EAKI	<i>Tyrannus tyrannus</i>	Eastern Kingbird		
YHBL	<i>Xanthocephalus xanthocephalus</i>	Yellow-headed Blackbird		
UNDU		Unknown duck species		
<b>Fish</b>				
UNMI		Unknown minnow species		
<b>Amphibians</b>				
BCFR	<i>Pseudacris maculata</i>	Boreal chorus frog		
WOFR	<i>Rana sylvatica</i>	Wood Frog		
<b>Mammals</b>				
WTDE	<i>Odocoileus virginianus</i>	White-tailed deer		
WTJA	<i>Lepus townsendii</i>	White-tailed jackrabbit		

<sup>1</sup> S3B, Rare to uncommon, 21 to 100 occurrences in Saskatchewan. Rank applies to the breeding population in the province.

S5B; Very common, more than 100 occurrences; widespread and abundant. Rank applies to the breeding population in the province.

<sup>2</sup> Threatened; A species likely to become endangered if limiting factors are not reversed.



# **APPENDIX D**

Wetland Functional Assessment Datasheet

<b>Date:</b>		<b>Wetland name / ID:</b>			<b>Legal Land Location:</b>																
<b>Stewart &amp; Kanrud Class, Cover</b>		<b>Class:</b>	<b>Sub:</b>	<b>Cover:</b>	<b>Water temp:</b>	<b>EC (µS):</b>	<b>pH:</b>														
<b>Phase:</b>		Normal Emergent	Open-water	Drawdown bare-soil	Natural Drawdown Emergent	Cropland Drawdown	Cropland Tillage														
Special Features (from list, p.2--enter letter/s)																					
#1	Community Number (circle each community which represents at least 10% of the wetland)	13A, 13B, 12B, 15A, 15B, 16A, 16B																			
#2 & #3		~ Describe each community type individually below ~			~ Describe each community type individually below ~																
PC 1	Zone (LPZ, WMZ, SMZ, DMZ, POZ)																				
	Community Proportion (% of total)																				
	Dominant Vegetation / Cover Class																				
	Invasive/exotic Vegetation / Cover Class																				
	Community Quality (E, H, M, L)																				
PC 2	Zone (LPZ, WMZ, SMZ, DMZ, POZ)																				
	Community Proportion (% of total)																				
	Dominant Vegetation / Cover Class																				
	Invasive/exotic Vegetation / Cover Class																				
	Community Quality (E, H, M, L)																				
PC 3	Zone (LPZ, WMZ, SMZ, DMZ, POZ)																				
	Community Proportion (% of total)																				
	Dominant Vegetation / Cover Class																				
	Invasive/exotic Vegetation / Cover Class																				
	Community Quality (E, H, M, L)																				
PC 4*	Zone (LPZ, WMZ, SMZ, DMZ, POZ)																				
	Community Proportion (% of total)																				
	Dominant Vegetation / Cover Class																				
	Invasive/exotic Vegetation / Cover Class																				
	Community Quality (E, H, M, L)																				
#45	Zone (LPZ, WMZ, SMZ, DMZ, POZ)	Zone:	Zone:	Zone:	Zone:																
	% vascular																				
	% non vascular																				
	% litter																				
	% bare ground																				
	% water																				
	Photo ID																				
Wildlife																					
Comments:																					
#4	Listed, rare, special plant species?	Y	N																		
#5	Rare community or habitat?	Y	N																		
#6	Pre-European-settlement conditions?	Y	N																		
Floodplain Forest [1A, 2A, 3A] * Hardwood Swamp [3B] * Coniferous Bog [2A, 4B] * Coniferous Swamp [4B] * Open Bog [1B, 5A, 5B, 6A, 7A, 9A, 10A] * Calcareous Fen [7B, 11B, 14A] * Shrub Swamp [6B] * Alder Thicket [8A] * Shrub-carr [8B] * Sedge Meadow [10B, 11A, 12A, 13A] * Shallow Marsh [13B] * Deep Marsh [12B] * Wet to Wet-Mesic Prairie [14B, 15A] * Fresh (Wet) Meadow [15B] * Shallow, Open Water [9B, 16A] * Seasonally Flooded Basin [16B]						<table border="1"> <thead> <tr> <th>Cover Class</th> <th>Class Range</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>0 - 3%</td> </tr> <tr> <td>2</td> <td>3 - 10%</td> </tr> <tr> <td>3</td> <td>10 - 25%</td> </tr> <tr> <td>4</td> <td>25 - 50%</td> </tr> <tr> <td>5</td> <td>50 - 75%</td> </tr> <tr> <td>6</td> <td>75 - 100%</td> </tr> </tbody> </table>		Cover Class	Class Range	1	0 - 3%	2	3 - 10%	3	10 - 25%	4	25 - 50%	5	50 - 75%	6	75 - 100%
Cover Class	Class Range																				
1	0 - 3%																				
2	3 - 10%																				
3	10 - 25%																				
4	25 - 50%																				
5	50 - 75%																				
6	75 - 100%																				

\*If there are more than four plant community types, use the next column over to enter the rest and do not rely on the automatic average calculations.

*Italic questions are answered via GIS analyses or other methods in-office*

#	Date: Question Description	Wetland ID:							
		Depressional/Isolated Riverine Lacustrine		Rating Depress'l/Flow-through Peatland Floodplain		Depress'l/Tributary Slope Other			
7	Hydrogeomorphology and Topography (circle one)								
8	<b>Maximum Water Depth</b> (inches) : % inundation								
9	<i>Local Watershed Area--immediate drainage (acres)</i>								
10	<b>Estimated size of existing wetland (acres)</b>								
11	SOILS: Upland/Wetland (survey classification + site)								
12	<b>Outlet characteristics for flood retention</b>	A		B		C			N/A
13	Outlet characteristics for hydrologic regime	A		B		C			N/A
14	<b>Dominant upland land use (within 500 ft)</b>	A		B		C			
15	Soil condition (wetland)	A		B		C			
16	<b>Vegetation (% cover)</b>					___ %			
17	Emerg. veg. flood resistance	A		B		C			N/A
18	<b>Sediment delivery</b>	A		B		C			
19	<i>Upland soils (based on soil group)</i>	A		B		C			
20	<b>Stormwater runoff pretreatment &amp; detention</b>	A		B		C			
21	<i>Subwatershed wetland density</i>	A		B		C			
22	<b>Channels/sheet flow</b>	A		B		C			
23	Adjacent naturalized buffer, average width (feet)					___ feet			
24	<b>Adjacent area management</b> (to 50 ft.) (% of each, minimum 20%)	Full	___ %	Manicured	___ %	Bare	___ %		
25	Adjacent area diversity and structure (to 50 ft.) (% percent of each)	Native	___ %	Mixed	___ %	Sparse	___ %		
26	<b>Upland area slope</b> (to 50 ft.) (% in each category)	Gentle	___ %	Moderate	___ %	Steep	___ %		
27	<i>Downstream sensitivity/WQ protection</i>	A		B		C			
28	<b>Nutrient loading</b>	A		B		C			
29	Shoreline wetland	Y		N					
30	<b>Shoreline - rooted vegetation (% cover )</b>					___ %			
31	Shoreline - wetland in-water width (in feet, average)					___ ft			
32	<b>Shoreline - emergent veg. erosion resistance</b>	A		B		C			
33	Shoreline - erosion potential	A		B		C			
34	<b>Shoreline - bank protection/upslope veg.</b>	A		B		C			
35	<i>Rare Wildlife</i>	Y		N					
36	<b>Scare/Rare/S1/S2 local community</b>	Y		N					
37	Vegetation interspersed cover (see diagram 1)	1	2	3	4	5	6	7	8
38	<b>Veg. community interspersed (see diagram 2)</b>	1			2		3		N/A
39	Wetland detritus	A		B		C			N/A
40	<b>Wetland interspersed on landscape</b>	A		B		C			
41	Wildlife barriers	A		B		C			
42	<b>Amph. breeding potential - hydroperiod</b>	Adequate		Inadequate					
43	Amphibian breeding potential - fish presence	A		B		C			
44	<b>Amphibian &amp; reptile overwintering habitat</b>	A		B		C			N/A
46	<b>Fish habitat quality</b>	E		A		B		C	N/A
47	Fish species (list)								
48	<b>Unique/rare educ./cultural/rec. opportunity</b>	Y		N					
49	Wetland visibility	A		B		C			
50	<b>Proximity to population</b>	Y		N					
51	<i>Public ownership</i>	A		B		C			
52	<b>Public access</b>	A		B		C			
53	Human influence on wetland	A		B		C			
54	<b>Human influence on viewshed</b>	A		B		C			
55	Spatial buffer	A		B		C			
56	<b>Recreational activity potential</b>	A		B		C			
57	Commercial crop--hydrologic impact	A		B		C			N/A
58	<b>GW - Wetland soils</b>	R		D					
59	<i>GW - Subwatershed land use</i>	R		D					
60	<b>GW - Wetland size and soil group</b>	R		D					
61	<i>GW - Wetland hydroperiod</i>	R		D					
62	<b>GW - Inlet/Outlet configuration</b>	R		D					
63	<i>GW - Surrounding upland topographic relief</i>	R		D					
64	<b>Restoration potential w/o flooding</b>	Y		N					
65	<i>Landowners affected by restoration</i>	all public		1		2		3+	
66 A	<b>Existing wetland size (acres) [same as #10]</b>					___ acres			
66 B	Total wetland restoration size (acres)					___ acres			
66 C	<b>Potential new wetland area (acres)=B-A</b>					___ acres			
67	Average width of naturalized upland buffer (potential)					___ feet			
68	<b>Ease of potential restoration</b>	A		B		C			
69	Hydrologic alteration type	Outlet	Tile	Ditch	GW pump	Watershed div.	Filling		
70	<b>Potential wetland type (Circ. 39)</b>	1	2	3	4	5	6	7	8
71	Wetland sensitivity to stormwater	E		A		B		C	
72	<b>Additional stormwater treatment needs</b>	A		B		C			
<b>Comments:</b>									



# **APPENDIX E**

Natural Area Inventory of the North Swale







**Table E.2. Wildlife Species Observed within the North Swale**

<b>Species Code</b>	<b>Scientific Name</b>	<b>Common Name</b>
<b>Birds</b>		
SPSA	<i>Actitis macularius</i>	Spotted Sandpiper
RWBL	<i>Agelaius phoeniceus</i>	Red-winged Blackbird
LCSP	<i>Ammodramus leconteii</i>	LeConte's Sparrow
NSHO	<i>Anas clypeata</i>	Northern Shoveler
BWTE	<i>Anas discors</i>	Blue-winged Teal
MALL	<i>Anas platyrhynchos</i>	Mallard
AMBI	<i>Botaurus lentiginosus</i>	American Bittern
CANG	<i>Branta canadensis</i>	Canada Goose
KILL	<i>Charadrius vociferus</i>	Killdeer
BLTE	<i>Chlidonias niger</i>	Black Tern
HOLA	<i>Eremophila alpestris</i>	Horned Lark
AMCO	<i>Fulica americana</i>	American Coot
WISN	<i>Gallinago delicata</i>	Wilson's Snipe
COYE	<i>Geothlypis trichas</i>	Common Yellowthroat
MAGO	<i>Limosa fedoa</i>	Marbled Godwit
RUDU	<i>Oxyura jamaicensis</i>	Ruddy Duck
SAVS	<i>Passerculus sandwichensis</i>	Savannah Sparrow
WIPH	<i>Phalaropus tricolor</i>	Wilson's Phalarope
EAGR	<i>Podiceps nigricollis</i>	Eared Grebe
SORA	<i>Porzana carolina</i>	Sora
AMAV	<i>Recurvirostra americana</i>	American Avocet
GRYE	<i>Tringa melanoleuca</i>	Greater Yellowlegs
WILL	<i>Tringa semipalmata</i>	Willet
YHBL	<i>Xanthocephalus xanthocephalus</i>	Yellow-headed Blackbird
<b>Fish</b>		
UNMI		Unknown minnow species
<b>Mammals</b>		
WTJA	<i>Lepus townsendii</i>	White-tailed jackrabbit

**Table E.3. Sediment Quality within the North Swale**

			Natural Area ID	5060	5360	5364
			ALS ID	L1178713-1	L1178713-3	L1178713-2
			Date Sampled	7/13/2012 12:00:00 PM	7/13/2012 2:50:00 PM	7/13/2012 3:45:00 PM
Analyte	Units	D.L.	Guideline	Sediment	Sediment	Sediment
% Moisture	%	1	n/v	78.1	86.2	73.5
% Sand (2.0mm - 0.05mm)	%	0.1	n/v	35	31.7	56.7
% Silt (0.05mm - 2um)	%	0.1	n/v	51.4	65.3	31.9
% Clay (<2um)	%	0.1	n/v	13.6	3.03	11.4
Texture	n/a	n/a	n/v	Silt loam	Silt loam	Sandy loam
Aluminum (Al)	mg/kg	50	n/v	4450	5720	6540
Antimony (Sb)	mg/kg	0.1	n/v	0.19	0.33	0.28
Arsenic (As)	mg/kg	0.1	5.9 <sup>a</sup>	1.86	3.56	2.33
Barium (Ba)	mg/kg	1	n/v	90.9	71.7	81.9
Beryllium (Be)	mg/kg	0.5	n/v	<0.50	<0.50	<0.50
Bismuth (Bi)	mg/kg	1	n/v	<1.0	<1.0	<1.0
Cadmium (Cd)	mg/kg	0.1	0.6 <sup>a</sup>	0.26	0.32	0.21
Calcium (Ca)	mg/kg	100	n/v	81600	59000	30000
Chromium (Cr)	mg/kg	0.5	37.3 <sup>a</sup>	7.95	9.53	11
Cobalt (Co)	mg/kg	1	n/v	3	3.5	4
Copper (Cu)	mg/kg	1	n/v	31.1	58.9	11.8
Iron (Fe)	mg/kg	50	n/v	6270	8100	9420
Lead (Pb)	mg/kg	1	35 <sup>a</sup>	5.2	7.7	11.8
Lithium (Li)	mg/kg	2	n/v	11.6	10.9	10.2
Magnesium (Mg)	mg/kg	100	n/v	15400	12300	6920
Manganese (Mn)	mg/kg	1	n/v	393	229	225
Mercury (Hg)	mg/kg	0.01	0.17 <sup>a</sup>	0.031	0.077	0.028
Molybdenum (Mo)	mg/kg	1	n/v	<1.0	3.3	1
Nickel (Ni)	mg/kg	1	n/v	8.5	12.4	10.6
Phosphorus (P)	mg/kg	50	n/v	715	1050	595
Potassium (K)	mg/kg	100	n/v	2220	2640	2340
Selenium (Se)	mg/kg	0.2	n/v	0.58	0.83	0.39
Silver (Ag)	mg/kg	0.2	n/v	<0.20	<0.20	<0.20
Sodium (Na)	mg/kg	100	n/v	1020	1700	800
Strontium (Sr)	mg/kg	1	n/v	305	204	110
Thallium (Tl)	mg/kg	0.1	n/v	<0.10	0.11	0.11
Tin (Sn)	mg/kg	2	n/v	<2.0	<2.0	<2.0
Titanium (Ti)	mg/kg	5	n/v	97.5	94.6	119
Uranium (U)	mg/kg	0.1	n/v	1.24	3.27	1.48
Vanadium (V)	mg/kg	1	n/v	14	18.1	17.1
Zinc (Zn)	mg/kg	5	123 <sup>a</sup>	50	77.3	50.4

			Natural Area ID	5060	5360	5364
			ALS ID	L1178713-1	L1178713-3	L1178713-2
			Date Sampled	7/13/2012 12:00:00 PM	7/13/2012 2:50:00 PM	7/13/2012 3:45:00 PM
Analyte	Units	D.L.	Guideline	Sediment	Sediment	Sediment
Benzene	mg/kg	0.015	n/v	<0.025	<0.030	<0.015
Ethylbenzene	mg/kg	0.03	n/v	<0.050	<0.060	<0.030
Toluene	mg/kg	0.15	n/v	<0.25	<0.30	<0.15
Xylenes	mg/kg	0.3	n/v	<0.50	<0.60	<0.30
F1 (C6-C10)	mg/kg	30	n/v	<50	<60	<30
F1-BTEX	mg/kg	30	n/v	<50	<60	<30
F2 (C10-C16)	mg/kg	180	n/v	<180	300	<180
TEH (C11-C22)	mg/kg	300	n/v	<300	1030	<300
F3 (C16-C34)	mg/kg	300	n/v	980	7350	1480
TEH (C23-C60)	mg/kg	600	n/v	1350	13100	2660
F4 (C34-C50)	mg/kg	300	n/v	380	4380	890
Total Hydrocarbons (C6-C50)	mg/kg	300	n/v	1360	12000	2370
Chrom. to baseline at nC50	n/a	0	n/v	Yes	Yes	Yes

**Notes:**

- <sup>a</sup> Canadian Sediment Quality Guidelines for the Protection of Aquatic Life - ISQG
- n/a Not applicable
- n/v No standard/guideline value
- < 0.03 The analyte was not detected above the laboratory estimated quantitation limit.
- D.L. Detection Limit



# **APPENDIX F**

## Recommended Wetland Management Classification System

# Recommended Wetland Management Classification System

To accompany the Minnesota Routine Assessment Method for Evaluating Wetland Functions, Version 3.0

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# 1.0 Wetland Management Recommendations

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This document is a companion to the *Minnesota Routine Assessment Method for Evaluating Wetland Functions* (MnRAM) [version 3.0 or later]. It is meant to provide a basis for developing wetland management recommendations from data gathered in the field. The objective of a wetland management classification system and management standards is to achieve no net loss of wetland functions and values within the management area while providing flexibility for economic development that may require wetland impacts. Impacts to wetlands include not only direct impacts such as filling, draining, and excavating, but also indirect impacts from stormwater inputs, changes to local surface and ground water hydrology, and pollutant loading.

The wetland protection process begins with an inventory and field assessment of all wetlands within the management area. The wetland inventory should identify wetlands by type (Circ. 39 or Cowardin), size, location and landscape setting, and wetland functions. Wetland assessment evaluates functional capacity, both existing and potential, based on inventory information as well as: vegetative community, soils, hydrology, ecologic characteristics, and cultural uses. Following completion of this assessment, each wetland can be assigned to a recommended management class based on the wetland's current and potential functions as well as the evaluation of local critical wetland resources and the wetland's susceptibility to stormwater degradation (Table 1.1). Each wetland can be classified according to a recommended level of wetland protection and acceptable hydrologic changes (Table 1.2).<sup>1</sup>

## 1.1 Wetland Management Classification

With data for each wetland in the assessment area complete, the functional indices can then be used to classify the wetlands. This guidance document presents two classification standards based on expert wetland recommendations and concepts<sup>2</sup> and in compliance with the state Wetland Conservation Act<sup>3</sup>, state water quality standards<sup>4</sup>, and various wetland management plans from both metropolitan and rural Minnesota areas.

Suggested classification schemes offered are for Basic Protection and Increased Protection standards; local authorities can choose a management classification level based on local resource needs and preferences. The Basic Protection Standard (Figure 1.1) is the minimum recommended level that will satisfy no-net-loss goals, protect critical resources, and allow for use of some wetlands in development zones. The Increased Protection Standard will include more wetlands in the Preserve category that might otherwise fall into Manage 1, thereby protecting less-than-pristine wetlands in areas that are at an increased risk for wetland impact, whether direct; outright loss by development pressures or indirect; ecological impact from increased use or hydrologic changes.

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<sup>1</sup> Based largely on the state guidance document *Storm-Water and Wetlands: Planning and Evaluation Guidelines for Addressing Potential Impacts of Urban Storm-Water and Snow-Melt Runoff on Wetlands*, State of Minnesota Storm Water Advisory Group, 1997.

<sup>2</sup> Some of which are presented in *Storm-Water and Wetlands: Planning and Evaluation Guidelines for Addressing Potential Impacts of Urban Storm-Water and Snow-Melt Runoff on Wetlands*, State of Minnesota Storm Water Advisory Group, 1997.

<sup>3</sup> Minn. Rules Chap. 8420.

<sup>4</sup> Minn. Rules Chap. 7050.

These two options are offered as a starting point for regional decision-making. Any final policy will need to take into account how current and predicted pressures affect the landscape. An initial evaluation of the effect of both standards will give an indication how the local wetland manager can adapt an individual strategy to maximize resource protection while retaining development benefits to their community. Using GIS-mapping tools will be invaluable for this evaluation.

Using this system will classify a wetland into one of four categories: Preserve, Manage 1, Manage 2, or Manage 3. The Preserve category is for exceptional and highest-functioning wetlands or those sensitive wetlands receiving conveyed storm water runoff that have yet retained a medium level of vegetative diversity/integrity. These wetlands are those that should be preserved in (or improved to) their most pristine or highest functional capacity with wide, natural buffers, in perpetuity. In the Manage 1 category are high-quality wetlands that should be protected from development and other pressures of increased use, including indirect effects. Maintaining natural buffers will help to retain the significant function these wetlands provide. In the event that impacts to these wetlands cannot be avoided, replacement ratios for mitigation should exceed the state-required minimums. Manage 2 wetlands provide medium functional levels and the wetland extent should be maintained. These wetlands often provide optimal restoration opportunity. Manage 3 wetlands have been substantially disturbed; replacement considerations can be minimized<sup>5</sup> after proper sequencing.

### **Using the Flowchart**

The process can be followed in Figures 1.1 [Basic Standard] and 1.2 [Increase Protection Standard]. Begin at the top and follow the arrows and numbered boxes through the diagram until all of the wetlands have been placed in a management category. Find all wetlands that are classified as Critical Resources, as described in Section 2.0; those wetlands are classified in the Preserve category. Wetlands determined to not fit any of the Critical Resources categories are then classified into one of the four management class groups. The suggested wetland management criteria that could be applied to wetlands within each management class are provided in Table 1.1.

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<sup>5</sup> Replacement minimized down to a 1:1 ratio (in the counties with less than 50 percent of their historic wetlands) or lower (in counties with more than 50 percent of their historic wetlands).

**Table 1.1**  
**Recommended Wetland Management Standards**  
**Minnesota Routine Assessment Method for Evaluating Wetland Functions, Version 3.0**

Management Class	Management Strategy	Stormwater Treatment	Buffer <sup>1</sup>	Mitigation Standard	Hydrologic Guidelines
<b>A—Preserve</b>	Maintain wetland and existing functions, values and wildlife habitat. Possible need for active management of wetland to protect unique features. Apply strict avoidance standards. May be appropriate to develop a conservation easement.	Avoid conveyed flows where prudent and feasible. Upstream sediment and nutrient pretreatment required to maintain background loading rates. Maintain existing hydrology—divert increased flows. Avoid concentrating flows.	≥50 feet for water quality ≥100 feet for wildlife habitat. <sup>2</sup> Require monuments to mark buffer edge.	WCA minimum or greater replacement ratio with documented replacement of functions/values. Consider requiring buffer replacement.	<u>Bounce (10 yr):</u> Existing <u>Inundation (1 &amp; 2 yr):</u> Existing <u>(10 yr):</u> Existing <u>Runout Control:</u> <sup>3</sup> No Change Maintain existing hydrology. Encourage infiltration and reduced impervious BMPs. Conduct water budget analysis.
<b>B—Manage 1</b>	Maintain wetland without degrading existing functions, values and wildlife habitat. Apply WCA sequencing process.	Pretreat conveyed flows to maintain background loading rates.	35-50 feet  Require monuments to mark buffer edge.	WCA minimum or greater replacement ratio. Replacement of functions and values on site or in location specified in plan for drain/fill/excavation impacts.  In compliance with Ch. 7050 the entire area affected by storm water or other wastewater flows must be avoided, minimized and replaced at a replacement ratio of 1:1 for all changes in wetland type.	<u>Bounce (10 yr):</u> Existing + 0.5 ft <u>Inundation (1 &amp; 2 yr):</u> Existing plus 1 day <u>(10 yr):</u> Existing + 7 days <u>Runout Control:</u> <sup>2</sup> No Change Maintain existing hydrology. Encourage infiltration and reduced impervious BMPs.
<b>C—Manage 2</b>	Maintain wetland footprint. Improve wetland biological and plant community diversity/integrity or enhance other functions if possible. Apply WCA sequencing process. Consider for restoration.	Pretreat all conveyed discharges to remove all heavy particles and maximize removal of fine grained sediment prior to discharging to the wetland	25-35 feet Require monuments to mark buffer edge.	WCA minimum replacement of acreage and functions/values on site or in location specified in plan for drain/fill/excavation impacts  In compliance with Ch. 7050 the entire area affected by storm water or other wastewater flows must be avoided, minimized and replaced at a replacement ratio of 1:1 for all changes in wetland type.	<u>Bounce (10 yr):</u> Existing + 1.0 ft <u>Inundation (1 &amp; 2 yr):</u> Existing plus 2 days <u>(10 yr):</u> Existing + 14 days <u>Runout Control:</u> <sup>2</sup> 0 to 1.0 ft above existing runoff
<b>D—Manage 3</b>	Allow for relaxed sequencing and replacement plan flexibility. Consider for restoration/enhancement.	Pretreat all conveyed flows to remove all medium grained and larger sediments.	25 feet	WCA allows mitigation flexibility with minimum standards required in the plan area, see M.R. 8420.0650.  In compliance with Ch. 7050 the entire area affected by storm water or other wastewater flows must be avoided, minimized and replaced at a replacement ratio of 1:1 for all changes in wetland type.	<u>Bounce (10 yr):</u> No Limit <u>Inundation (1 &amp; 2 yr):</u> Existing plus 7 days <u>(10 yr):</u> Existing + 21 days <u>Runout Control:</u> <sup>2</sup> 0 to 4.0 ft above existing runoff

<sup>1</sup> Buffers are unmowed, naturalized strips of vegetation around the wetland perimeter. Buffers would be provided during development or redevelopment

<sup>2</sup> Where possible, use 300-foot buffers as per MnRAM (Question #23).

<sup>3</sup> If currently landlocked, new outlet should be above delineated wetland elevation.



### 1.1.1 Preserve

Wetlands classified as **Preserve** have at least one of the following characteristics:

- Wetlands rated with exceptional vegetative diversity/integrity, which may include wetlands with natural communities not significantly impacted by invasive species or other human-induced alterations, wetlands harboring endangered or threatened plant species, or rare wetland habitats classified as imperiled (S1) or critically imperiled (S2) by the state rankings.
- Wetlands rated as exceptional for wildlife habitat. These include wetlands known to harbor endangered or threatened animal species, rare communities, or wildlife refuges and fish and wildlife management areas whose purpose is maintaining suitable habitats for wildlife.
- Wetlands rated as high for amphibian habitat.
- Wetlands rated as exceptional for fish habitat. These wetlands include those specifically managed for fish management; designated trout streams, lakes or adjacent wetlands; and known spawning habitat for game fish.
- Wetlands rated high for shoreline protection. Wide wetlands bordering lakes and feeder streams that have persistent, emergent, submergent, or floating-leaved vegetation are critical to protecting the water quality of the lakes from bank erosion and sedimentation from upstream.
- Wetlands rated exceptional for aesthetics/education/recreation/cultural and rated high for wildlife habitat, include those located on public lands that provide a unique or rare recreational, educational, or cultural opportunity, and have high functional level for wildlife since that is typically a primary focus for users.
- Wetlands that are exceptionally sensitive to stormwater impacts and have a vegetative diversity/integrity rating of medium or higher were also placed in this category. These wetlands may have suffered some degradation from human influences due to their heightened sensitivity. The vegetative quality of the wetland is such that improved management may allow for restoration of the community.
- Wetlands with a high vegetative diversity/integrity rating *and* a high rating for wetland water quality. The vegetative community in these wetlands typically has been only slightly affected by humans and still maintains high functioning to maintain water quality, which is critical to wetland sustainability.
- Wetlands with a high vegetative diversity/integrity rating *and* a high rating for hydrologic regime. The vegetative community in these wetlands typically has been only slightly affected by humans and still maintains high functioning levels for hydrologic regime, which is critical to wetland sustainability.

### 1.1.2 Manage 1

Wetlands classified as **Manage 1** have at least one of the following characteristics:

- Wetlands rated with high vegetative diversity/integrity, which typically include diverse wetland plant communities with less than 20 percent cover of non-native or invasive species.

- Wetlands rated as high for wildlife habitat. These generally include wetlands located within large tracts of undeveloped land or in parks, which allow for wide high quality upland buffers. In addition, this includes seasonal wetlands that are well buffered.
- Wetlands rated as medium for amphibian habitat. This includes seasonal wetlands that are well buffered.
- Wetlands rated as high for fish habitat. These wetlands are lacustrine/riverine or are contiguous with a permanent waterbody or watercourse and provide spawning/nursery habitat, or refuge for native fish species in adjacent lakes, rivers or streams.
- Wetlands rated medium for shoreline protection. These wetlands include those that are moderately wide and support persistent emergent, submergent, or floating-leaved vegetative cover bordering lakes and feeder streams.
- Wetlands rated high for aesthetics/education/recreation/cultural *and* medium for wildlife habitat, include those that provide a number of benefits that may include: spatial buffering, accessibility, public ownership, multiple recreational opportunities, and medium-quality wildlife habitat.
- Wetlands that are highly sensitive to stormwater impacts *and* have a vegetative diversity/integrity rating of medium or high were also placed in this category. The vegetative quality of the wetland is such that improved management may allow for restoration of the community.
- Wetlands with a medium vegetative diversity/integrity rating *and* a high rating for wetland water quality. The vegetative community in these wetlands has only been moderately affected by humans and still maintains high functioning levels for water quality, which is critical to wetland sustainability. These wetlands would likely benefit from active management.
- Wetlands with a medium vegetative diversity/integrity rating *and* a high rating for hydrologic regime were placed in the **Manage 1** category. The vegetative community in these wetlands has only been moderately affected by humans and still maintains high functioning levels for hydrologic regime, which is critical to wetland sustainability. These wetlands would likely benefit from active management.
- Wetlands rated high for commercial use. These wetlands provide important social value without having an altered hydrology.

### 1.1.3 Manage 2

Wetlands classified as **Manage 2** have at least one of the following characteristics:

- Wetlands rated with medium vegetative diversity/integrity, which typically include wetlands with less diversity and up to 50 percent cover of non-native or invasive species.
- Wetlands rated as medium for wildlife habitat. These often include wetlands that are increasingly separated from natural communities and wildlife corridors; they often lack significant upland buffers and are increasingly altered.
- Wetlands rated as low for amphibian habitat. These wetlands are increasingly altered, but they still have some opportunity to provide either breeding, over wintering, or resting habitat for amphibians.
- Wetlands rated as medium for fish habitat. These wetlands include those which are intermittently connected to waterbodies supporting native fish populations

- Wetlands rated low for shoreline protection. While these wetlands are not providing the highest level of protection to the lake or river systems, their mere presence provides some level of protection that should not be dismissed. These wetlands are typically narrow, with little emergent, submergent, or floating-leaved vegetation.
- Wetlands rated Medium for aesthetics/education/recreation/cultural and Low for wildlife habitat.

### 1.1.4 Manage 3

Wetlands classified as **Manage 3** include all of the remaining wetlands that did not fit into any of the above-described conditions. **All** of these wetlands would rate low for vegetative diversity/integrity. Many of these wetlands rate medium or high for downstream water quality protection and for flood storage/attenuation. This correlation is expected since wetlands that provide higher levels of water quality treatment and runoff/rate control often suffer from ecological degradation.

## 1.2 Wetland Restoration Potential

Evaluate restoration potential of drained and partially drained wetlands in the field. The potential for wetland restoration is determined based on the ease with which the wetland could be restored considering factors including: the number of landowners within the historic wetland area, the size of the potential restoration area, the potential for establishing buffer areas or water quality ponding, the extent and type of hydrologic alteration, and the potential for flooding adjacent properties. Using those parameters, a functional rating of High, Medium, or Low is computed where High means that there will be fewer obstacles to completing a successful restoration.

## 1.3 Wetland Susceptibility to Stormwater Input

Stormwater runoff carries soil particles, nutrients, and contaminants that can change the ecological balance of the receiving water body. Changes in the volume, rate, frequency, or duration of stormwater entering or discharging from the water body can also change the ecological integrity. Alterations to the ecological integrity of a wetland often result in changes in the functional capacity, fish and wildlife habitat, replacement of native vegetation with invasive and disturbance-tolerant plant species, and/or other impacts to the wetland's functions and values.

A methodology<sup>6</sup> for determining the susceptibility of wetlands to degradation by stormwater input relates wetland type to a susceptibility level as shown in Table 1.2. Wetlands such as bogs and fens can easily be degraded by changes in the stormwater inflows and are designated as exceptionally susceptible. On the other hand, floodplain forests are more tolerant of changes in the frequency, magnitude and duration of flooding without degradation and are therefore classified as moderately susceptible. Shallow marshes and wet meadows dominated by hybrid cattail, reed canary grass, or other invasive/non-native species (see Table 1.2 and MNRAM 3.0) have a moderate susceptibility to stormwater fluctuations and inputs.

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<sup>6</sup> *Storm-Water and Wetlands: Planning and Evaluation Guidelines for Addressing Potential Impacts of Urban Storm-Water and Snow-Melt Runoff on Wetlands* (State of Minnesota Storm Water Advisory Group, 1997).

## 1.4 Wetland Management Standards

Wetland management standards are proposed to maintain tolerable hydrologic and water quality changes in wetlands based on the goals stated for the management classifications. The recommended wetland management system (Table 1.1) presents a framework for management of storm water in and around wetlands as well as considering the regulation of impacts to wetlands and wetland mitigation; it is not meant to be used for specific wetland area designs. Replacement plans must also consider other laws that may apply, including local regulations, state Wetland Conservation Act rules, and U.S. Army Corps of Engineers 404 or other permit requirements. Additional investigations or evaluations, including detailed hydrologic modeling and modeling of nutrient loadings and removals, will need to be performed to determine final pipe sizes, pipe configuration, pipe elevations, pipe location, and site grading.

### 1.4.1 Wetland Hydrology Standards

Wetland hydrology management standards were developed<sup>7</sup> to protect wetlands from hydrologic impacts. These standards present tolerable hydrologic changes in terms of bounce (difference between the peak flood elevation and the normal wetland elevation), inundation period (time that flood waters temporarily stored in the wetland exceed the normal wetland elevation), and runout control (elevation of the outlet). It is assumed that wetland impacts will be minimized and existing wetland functions and values will be maintained if these standards are implemented.

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<sup>7</sup> Standards shown in Table 1.1.

**Table 1.2**  
**Susceptibility of Wetlands to Degradation by Stormwater Impacts<sup>8</sup>**  
**Minnesota Routine Assessment Method for Evaluating Wetland Functions, Version 3.0**

Exceptionally Susceptible Wetland Types: <sup>1</sup>	Highly Susceptible Wetland Types: <sup>2</sup>	Moderately Susceptible Wetland Types: <sup>3</sup>	Least Susceptible Wetland Types: <sup>4</sup>
Sedge Meadows	Shrub-carrs <sup>a</sup>	Floodplain Forests <sup>a</sup>	Gravel Pits
Open Bogs	Alder Thickets <sup>b</sup>	Fresh (Wet) Meadows <sup>b</sup>	Cultivated Hydric Soils
Coniferous Bogs	Fresh (Wet) Meadows <sup>c, e</sup>	Shallow Marshes <sup>c</sup>	Dredged Material/Fill Material Disposal Sites
Calcareous Fens	Shallow Marshes <sup>d, c</sup>	Deep Marshes <sup>c</sup>	
Low Prairies	Deep Marshes <sup>d, c</sup>		
Lowland Hardwood Swamps			
Seasonally Flooded Wetlands			

<sup>1</sup> Special consideration must be given to avoid altering these wetland types. Inundation must be avoided. Water chemistry changes due to alteration by stormwater impacts can also cause adverse impacts. Note: All scientific and natural areas and pristine wetland should be considered in this category regardless of wetland type.

<sup>2</sup> a., b., c. Can tolerate inundation from 6 inches to 12 inches for short periods of time. May be completely dry in drought or late summer conditions. d. Can tolerate +12 inches inundation, but adversely impacted by sediment and/or nutrient loading and prolonged high water levels. e. Some exceptions.

<sup>3</sup> a. Can tolerate annual inundation of 1 to 6 feet or more, possibly more than once/year. b. Fresh meadows that are dominated by reed canary grass. c. Shallow marshes dominated by reed canary grass, cattail, giant reed, or purple loosestrife.

<sup>4</sup> These wetlands are usually so degraded that input of urban storm water may not have adverse impacts.

Notes: There will always be exceptions to the general categories listed above. Use best professional judgment. A more complete description of wetland characteristics under each category is contained in Appendix A of the source (see footnote). Pristine wetlands are those that show little disturbance from human activity.

<sup>8</sup> **Adapted from:** *Storm-Water and Wetlands: Planning and Evaluation Guidelines for Addressing Potential Impacts of Urban Storm-Water and Snow-Melt Runoff on Wetlands*, State of Minnesota Storm-Water Advisory Group, June 1997.

### **1.4.2 Wetland Buffer Standards**

Wetland buffer standards were developed with the focus on the buffer widths necessary for protecting water quality and for providing wildlife habitat. Suggested wetland buffer standards in Table 1.1 were developed based on a review of the scientific literature. The literature shows that the effectiveness of wetland buffers in removing sediments and nutrients from surface runoff varies widely due to many factors which include but are not limited to: slope, vegetative cover density, vegetation types, and width. Typically, buffers are established for their water quality improvement potential. High quality wildlife habitat requires significantly wider buffers and higher vegetative diversity/integrity.

Results from numerous studies on the effectiveness of buffers for improving water quality were compiled in a report prepared for the Minnehaha Creek Watershed District<sup>9</sup>. This data suggests that buffer widths of 50 feet generally will provide adequate protection from suspended solids for maintaining high water quality.

The data for phosphorus removal shows a slightly stronger, although not statistically significant, trend. Buffers wider than 60 feet showed considerably greater total phosphorus reductions than narrower buffers (69 percent of those buffers reduced total phosphorus by more than 70 percent).

Another major function of wetland buffers is providing wildlife habitat. Recommendations in the literature for wetland buffer maintenance for optimal wildlife functions range from an absolute minimum of 50 feet up to 600 feet. In general, wider buffers are suggested as providing greater wildlife benefits. Reasonable wildlife benefits can be realized with the retention of 100-foot wide buffers. Several communities in the Twin Cities Metropolitan area have enacted wetland buffer ordinances with required buffer widths up to 100 feet.

### **1.4.3 Wetland Sequencing and Mitigation Standards**

The wetland sequencing and mitigation standards presented are suggestions based on interagency discussions and experiences with Comprehensive Wetland Management Plans. The goal of the recommended standards is to provide incentives to protect high quality wetland resources while realizing that low quality wetlands would not receive as stringent protection.

There are specific standards that must be met according to state and federal rules (WCA, 404, etc.). They can be varied by local plan and these management standards could serve as a basis, but not a substitute, for a local plan. Some management prescriptions suggested here could be implemented without a formalized local plan but all local, state, and federal rules would still apply. The COE could use these standards to vary replacement ratios on a case-by-case basis.

### **1.4.4 Stormwater Treatment Standards**

Stormwater treatment management standards were developed to protect wetlands from water quality impacts. Various levels of pre-treatment of conveyed stormwater are recommended based on wetland management classification.

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<sup>9</sup> EOR, 2001

## 1.5 Best Management Practices

A table of common best management practices (BMPs) is provided in the Comprehensive Guidance. It includes a description of the benefits of each, pollutants controlled, and some general construction requirements. A comprehensive selection and design manual<sup>10</sup> for BMP usage in cold climates covers a total of 40 BMPs including:

- Definition and description of the BMP
- Discussion of the BMP's means of operation
- Diagrams and information to guide design and installation
- Listing of inspection and maintenance considerations
- References for more detailed information

A comprehensive guide<sup>11</sup> to BMPs for protection and improvement of water quality in Minnesota includes the major principles and notable points relating to BMP practices. This is not a design manual. The BMP approaches are split into several categories including:

- BMPs for Storm Water Systems
- Detention Ponds
- Erosion Protection and Sediment Control
- Pollution Prevention

In addition, the manual includes a section summarizing the attributes of various hydrologic models. Best management practices should be implemented to the extent feasible in all construction projects to maintain and prevent degradation of wetland functions and values.

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<sup>10</sup> *The Minnesota Urban Small Sites BMP Manual – Stormwater Best Management Practices for Cold Climates*, Metropolitan Council and Barr Engineering Co., 2001.

<sup>11</sup> *Protecting Water Quality in urban Areas – Best Management Practices for Dealing with Storm Water Runoff from Urban, Suburban, and Developing Areas of Minnesota*, Minnesota Pollution Control Agency, 2000.

## 2.0 Critical Wetland Resources

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Wetlands in the assessment area should be evaluated for designation as critical resources based on several features defined in Minnesota Statutes. These critical wetland resources should be classified into the Preserve management class due to their special functions. Criteria for designating wetlands as critical resources are as follows:

- Outstanding Resource Value Waters (Minn. Rules 7050.0180)
- Designated Scientific and Natural Areas (Minn. Rules 86A.05)
- Wetlands with known occurrences of Threatened or Endangered Species (Minn. Stat. 84.0895)
- State Wildlife Management Areas (Minn. Stat. 86A.05, subpart 8)
- State Aquatic Management Areas (Minn. Stat. 86A.05, subpart 14).
- Wellhead Protection Areas (Minn. Stat. 103I.101, MN Rules Chapter 4720).
- Sensitive Ground Water Areas (MN Rules 8420.0548, Subp. 6).
- Designated trout streams or trout lakes (MN Rules 6264.0050).
- Calcareous fens (MN Rules 8420.1010 through 8420.1060).
- High priority areas for wetland preservation, enhancement, restoration and establishment (MN Rules 8420.0350, subpart 2).
- Designated Historic or Archaeological Sites
- State or federal designated wild and scenic rivers (MN Rule Chapter 7050)

### 2.1 Outstanding Resource Value Waters

"Outstanding resource value waters" are defined in MN Rules 7050.0180 as waters within the Boundary Waters Canoe Area Wilderness; Voyageur's National Park; and Department of Natural Resources designated scientific and natural areas; wild, scenic, and recreational river segments; Lake Superior; those portions of the Mississippi River from Lake Itasca to the southerly boundary of Morrison County that are included in the Mississippi Headwaters Board comprehensive plan dated February 12, 1981; and other waters of the state with high water quality, wilderness characteristics, unique scientific or ecological significance, exceptional recreational value, or other special qualities which warrant stringent protection from pollution.

#### 2.1.1 Calcareous Fens

Calcareous fens are defined in MN Rules 8420.1020 as peat-accumulating wetlands dominated by distinct groundwater inflows having specific chemical characteristics. The water is characterized as circumneutral to alkaline, with high concentrations of calcium and low dissolved oxygen content. The chemistry provides an environment for specific and often rare hydrophytic plants<sup>12</sup>. Minnesota Rules 8420.1010-1070 sets out minimum standards and criteria for the identification, protection, and management of calcareous fens as authorized by Minnesota Statutes, section 103G.223. The MnDNR is charged with identifying and maintaining a list of calcareous fens in the state and maintains a database of them. Calcareous fens are also listed in the Classifications for Waters in

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<sup>12</sup> MN Rules 8420.1020



Major Surface Water Drainage Basins<sup>13</sup>. Finally, the rules for Nondegradation of Outstanding Resource Value Waters<sup>14</sup> also lists identified calcareous fens in the state.

### 2.1.2 Scientific and Natural Areas

State scientific and natural areas (SNA) are established to protect and perpetuate, in an undisturbed natural state, those natural features which possess exceptional scientific or educational value (MN Statutes 86A.05). This may include but is not limited to any of the following features: geological processes; significant fossil evidence, an undisturbed plant community, an ecological community significantly illustrating the process of succession and restoration to natural condition following disruptive change; a habitat supporting a vanishing, rare, endangered, or restricted species of plant or animal; a relict flora or fauna persisting from an earlier period; or a seasonal haven for concentrations of birds and animals, or a vantage point for observing concentrated populations, such as a constricted migration route. The area should embrace an area large enough to permit effective research or educational functions and to preserve the inherent natural values of the area.

### 2.1.3 Habitat for Designated Endangered, Threatened, or Special Concern Species

Endangered and threatened plant and animal species are protected in Minnesota as specified in MN Statutes 84.0895. In MN Statutes, Subp. 3, species of wild animal or plant are designated as:

1. **Endangered**, if the species is threatened with extinction throughout all or a significant portion of its range; or
2. **Threatened**, if the species is likely to become endangered within the foreseeable future throughout all or a significant portion of its range; or
3. **Species of special concern**, if although the species is not endangered or threatened, it is extremely uncommon in this state, or has unique or highly specific habitat requirements and deserves careful monitoring of its status.

In 1987, the Minnesota County Biological Survey (MCBS) began a systematic survey of rare biological features. The goal of the MCBS is to identify significant natural areas and to collect and interpret data on the distribution and ecology of rare plants, rare animals, and native plant communities. The MCBS data for the assessment area (if available) should be examined for sites with medium, high and outstanding biologic diversity significance.

The MnDNR Natural Heritage and Nongame Research Program (Natural Heritage Program) collects, manages, and interprets information about nongame animals, native plants, and plant communities to promote the wise stewardship of these resources. The Natural Heritage Program has developed a ranking system that is intended to reflect the extent and condition of natural communities and species in Minnesota.<sup>15</sup> These 'state ranks' have no legal ramifications, they are used by the Natural Heritage Program to set priorities for research and for conservation planning. They are grouped as follows:

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<sup>13</sup> MN Rules 7050.0470

<sup>14</sup> MN Rules 7050.0180, Subp. 6

<sup>15</sup> Aaseng, N.E., J.C. Almendinger, R.P. Dana, B.C. Delaney, H.L. Dunevitz, K.A. Rusterholz, N.P. Sather, and D.S. Wovcha. 1993. Minnesota's Native Vegetation: A Key to Natural Communities, Version 1.5. Minnesota Department of Natural Resources Biological Report No. 20. Natural Heritage Program.

### **State Element Rank:**

**S1:** Critically imperiled in the state because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extirpation from the state.

**S2:** Imperiled in state because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extirpation from the state.

**S3:** Rare or uncommon in state (on the order of 21 to 100 occurrences).

**S4:** Apparently secure in state with many occurrences.

**S5:** Demonstrably secure in state and essentially ineradicable under present conditions.

**SH:** Of historical occurrence in the state, perhaps having not been verified in the past 20 years, and suspected to be still extant.

**SN:** Regularly occurring, usually migratory and typically nonbreeding species for which no significant or effective habitat conservation measures can be taken in the state.

**SR:** Reported from the state, but without persuasive documentation which would provide a basis for either accepting or rejecting the report.

**SRF:** Reported falsely.

**SU:** Undetermined. Possibly in peril in the state but status uncertain; need more information.

**SX:** Extirpated within the state.

The Natural Heritage Program information database should be searched to determine if any endangered, threatened, or special concern species have been sighted within 500 feet of the assessment area. The list of species, the subwatershed location, legal protection status, state element rank and county should be compiled.

#### **2.1.4 State Wildlife Management Areas**

State wildlife management areas are established to protect those lands and waters which have a high potential for wildlife production and to develop and manage these lands and waters for the production of wildlife, for public hunting, fishing, and trapping, and for other compatible outdoor recreational uses<sup>16</sup>. State wildlife management areas satisfy the following criteria:

1. Includes appropriate wildlife lands and habitat, including but not limited to marsh or wetlands and the margins thereof, ponds, lakes, stream bottomlands, and uplands, which permit the propagation and management of a substantial population of the desired wildlife species; and
2. Includes an area large enough to ensure adequate wildlife management and regulation of the permitted recreational uses.

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<sup>16</sup> MN Statute 86A.05, subpart 8. A map of all MnDNR Wildlife Management Areas can be found at: [www.dnr.state.mn.us/maps/compass.html](http://www.dnr.state.mn.us/maps/compass.html).

### **2.1.5 Designated Trout Streams and Lakes**

Designated trout streams and lakes in the state of Minnesota are inhabited by trout other than lake trout. Fishing and other restrictions have been placed on these waterbodies to protect and foster the propagation of trout. Wetlands associated with these lakes are an integral part of the whole ecosystem that functions to maintain the characteristics necessary to support the fishery.

A list of all state trout streams and lakes can be found at: [www.revisor.leg.state.mn.us/arule/6264/](http://www.revisor.leg.state.mn.us/arule/6264/).

### **2.1.6 Aquatic Management Areas**

Minnesota Statutes 86A.05, Subpart 14, allows for the establishment of aquatic management areas to protect, develop, and manage lakes, rivers, streams, and adjacent wetlands and lands that are critical for fish and other aquatic life, for water quality, and for their intrinsic biological value, public fishing, or other compatible outdoor recreational uses. Aquatic management areas may be established to protect wetland areas under ten acres that are donated to the department of natural resources. Aquatic management areas must meet one or more of the following criteria:

1. Provides angler or management access;
2. Protects fish spawning, rearing, or other unique habitat;
3. Protects aquatic wildlife feeding and nesting areas;
4. Protects critical shoreline habitat; or
5. Provides a site for research on natural history.

### **2.1.7 Wellhead Protection Areas**

Wellhead protection is defined as a method of preventing well contamination by effectively managing potential contaminant sources in all or a portion of the well's recharge area. The statutory authority for wellhead protection comes from Minnesota Statutes 103I.101. The rules for establishment of Wellhead Protection Plans are found in Minnesota Rules Chapter 4720, which are administered by the Minnesota Department of Health. Wetlands present within wellhead protection areas are likely to be predominantly recharge wetlands. Since wetlands typically collect surface water runoff from a larger upland area, recharge wetlands within wellhead protection areas have a greater probability of transmitting pollutants to a public groundwater supply than other wetlands. Wellhead protection plans are developed and implemented by the public water supplier, which is typically a city or the Minnesota Department of Health.

### **2.1.8 Sensitive Groundwater Areas**

The Wetland Conservation Act requires that projects proposing to impact wetlands must evaluate whether the impacts would have an adverse impact on groundwater quality<sup>17</sup>. If it is determined that a proposed replacement plan would have a significant adverse impact on groundwater quality, the replacement plan must be denied. Wetlands determined to be primarily recharge wetlands as a result

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<sup>17</sup> Minnesota Rules 8420.0548, Subpart 6. The state rules governing wellhead protection can be accessed on the web at: [www.revisor.leg.state.mn.us/arule/4720/](http://www.revisor.leg.state.mn.us/arule/4720/).

of a functional assessment using *MNRAM Version 3.0* should be evaluated for the potential to affect groundwater resources<sup>18</sup>.

### **2.1.9 High-Priority Areas for Wetland Preservation, Enhancement, & Restoration**

Water management plans prepared by water management organizations in the metropolitan areas under Minnesota Statutes, section 103B.231 must identify those areas that qualify as high priority areas for wetland preservation, enhancement, restoration, and establishment<sup>19</sup>. These priority areas shall be included in the next scheduled water management plan update. Plans should give strong consideration to identifying as high priority areas, minor watersheds having less than 50 percent of their original wetland acreages, and intact wetlands, diminished wetlands, and the areas once occupied by wetlands that have been diminished or eliminated and could feasibly be restored taking into account the present hydrology and use of the area. Plans should give strong consideration to identifying as high priority areas all type 1 or 2 wetlands, and other wetlands at risk of being lost by permanent conversion to other uses. When individual wetlands are identified as high priority for preservation and restoration, the high priority area shall include the wetland and an adjacent buffer strip not less than 16.5 feet wide around the perimeter of the wetland and may include up to four acres of upland for each wetland acre.

Plans may identify additional high priority areas where preservation, enhancement, restoration, and establishment of wetlands would have high public value by providing benefits for water quality, flood water retention, public recreation, commercial use, and other public uses. High priority areas should be delineated by minor or major watershed.

### **2.1.10 State and Federal Designated Scenic and Wild Rivers**

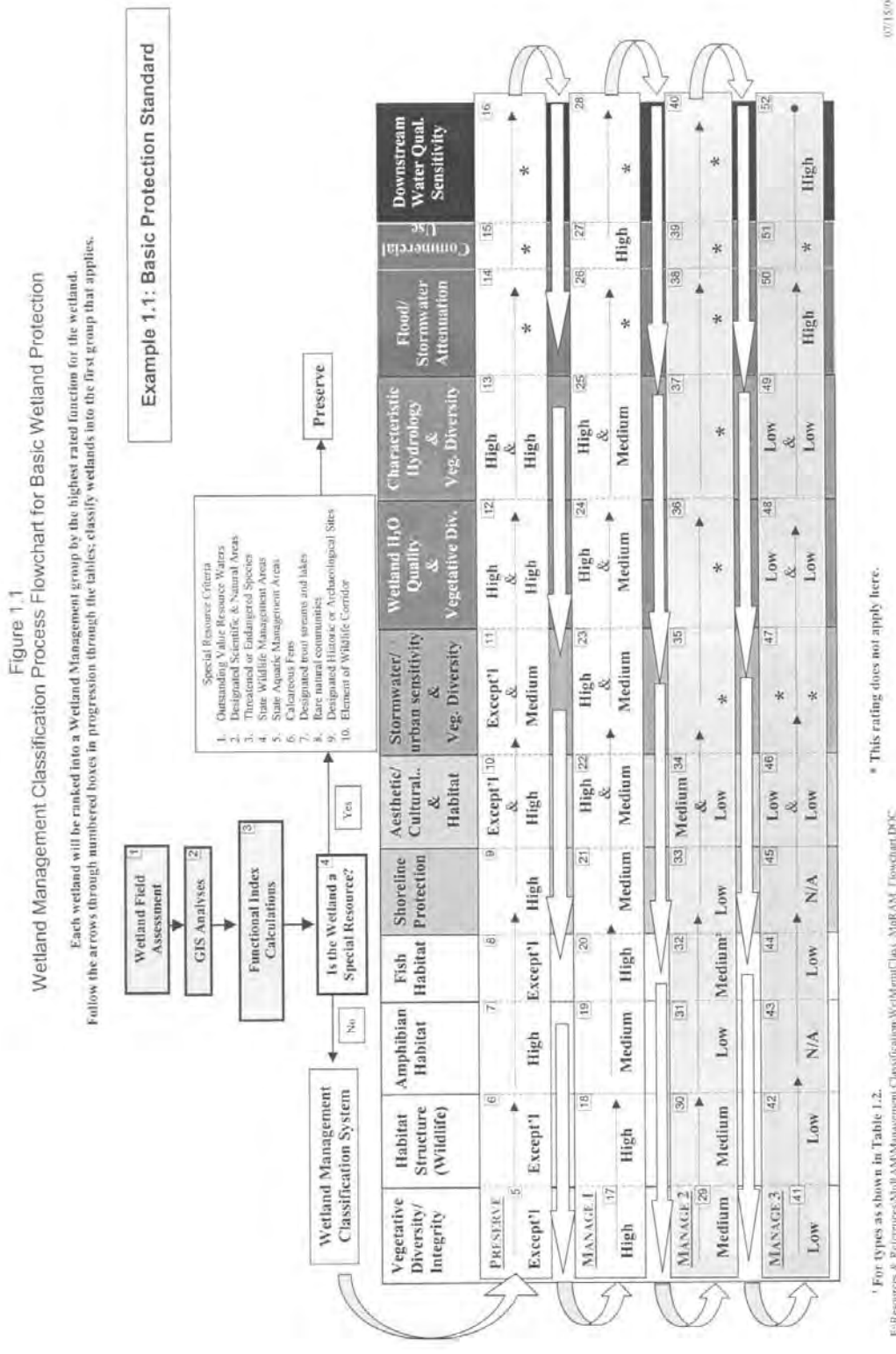
The rules for the protection of state designated scenic and wild rivers is set forth in Minnesota Rules Chapter 6105 as administered by the MnDNR<sup>20</sup>. Wild rivers are defined as those that exist in a free-flowing state with excellent water quality and with adjacent lands that are essentially primitive and scenic rivers are defined as those that exist in a free-flowing state with adjacent lands that are essentially primitive. Management plans must be developed before a river can be included in the wild and scenic river system. The plans must give emphasis to the preservation and protection of the area's scenic, recreational, natural, historic, and similar values while placing no unreasonable restrictions upon compatible, preexisting, economic uses of particular tracts of land.

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<sup>18</sup> Evaluate according to the guidelines in: *Criteria and Guidelines for Assessing Geologic Sensitivity of Ground Water Resources in Minnesota* (MnDNR, 1991).

<sup>19</sup> Minnesota Rules 8420.0350, Subp. 2

<sup>20</sup> The state rules can be accessed at: [www.revisor.leg.state.mn.us/arule/6105/](http://www.revisor.leg.state.mn.us/arule/6105/).

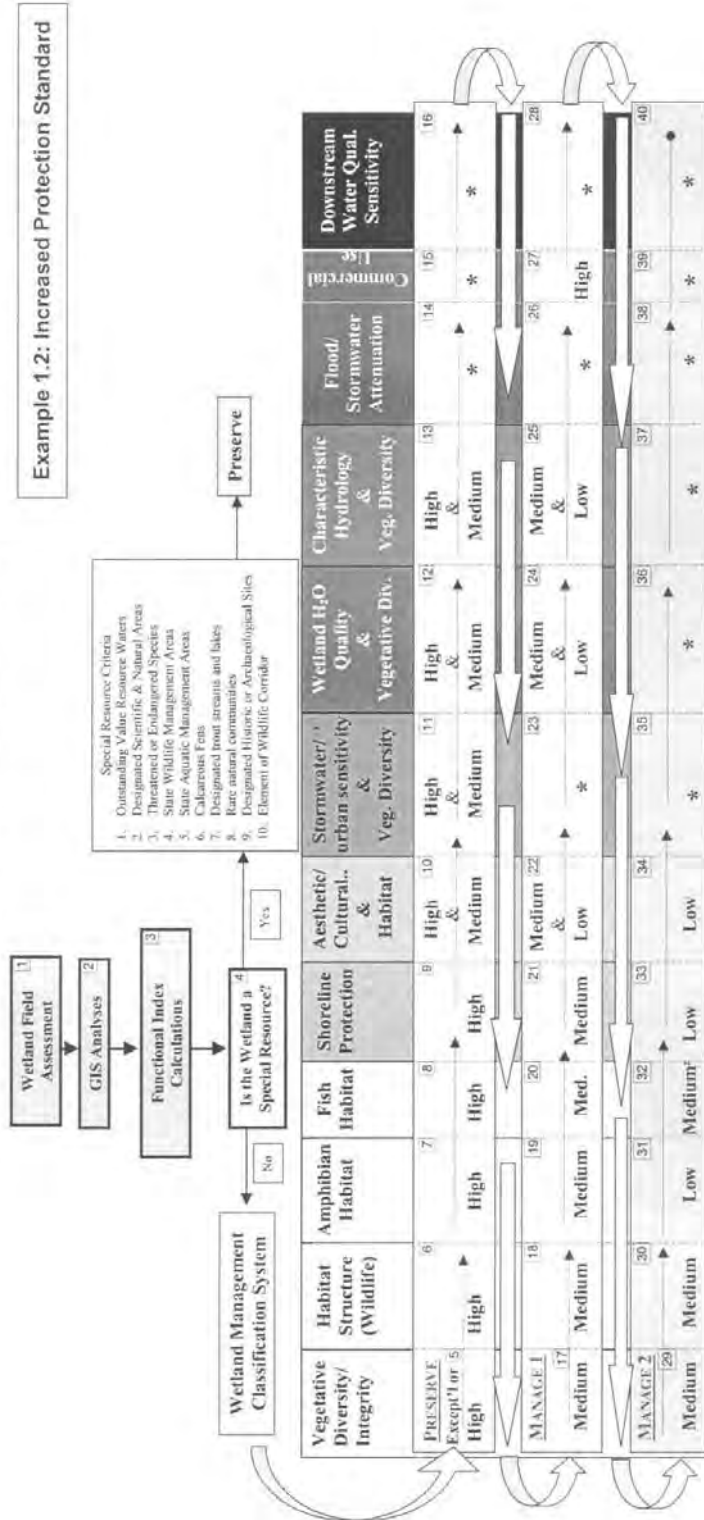


<sup>1</sup> For types as shown in Table 1.2.  
F:\Resources\SubRAM\Management Classification\WetMgmtClass\_MoRAM\_Flowchart.DOC

\* This rating does not apply here.

Figure 1.2 Wetland Management Classification Process Flowchart for Increased Wetland Protection

Each wetland will be ranked into a Wetland Management group by the highest rated function for the wetland. Follow the arrows through numbered boxes in progression through the tables; classify wetlands into the first group that applies.



<sup>1</sup> For types as shown in Table 1.2.

\* This rating does not apply here.



# **APPENDIX G**

## Best Management Practices

**Table G.1. Best Management Practices**

Type of Practice	Area of Benefit	Storm Protection Benefit	Pollutants Controlled	Construction Requirements
<b>Nonstructural Source Controls</b>				
Street Sweeping	Street right-of-way.	Reduction in potential for clogging storm drains with debris. Some oil and grease control possible.	Paper and plastics, leaves and twigs, dust, and oil and grease.	Acquire street sweeping equipment.
Sidewalk Cleaning	Sidewalk right-of-way in areas of heavy foot traffic.	Reduction in pollutants entering storm drain.	Oil and dirt.	None.
Clean and Maintain Storm Drain Channels Annually	Channel capacity and receiving water. Upstream flood control benefits. Includes benefits to channel wildlife habitat and vegetation.	Prevent erosion in channel. Improve capacity by removing silt and sedimentation. Remove debris that is habitat destroying or toxic to wildlife.	Silt and sediment and the contaminants contained therein. Plastic, glass, paper, and metal thrown or washed in channel.	None.
Clean and Inspect Storm Inlets and Catch Basins Annually	Site dependent flood control benefits.	Allows proper drainage to prevent flooding and continued proper operation of facilities.	Silt and sediment and the contaminants contained therein. Plastic, glass, paper, and metal thrown or washed into facilities.	None.
Clean and Inspect Debris Basins Annually	Site dependent flood control benefits.	Allows proper drainage to prevent flooding and continued proper operation of facilities.	Silt and sediment and the contaminants contained therein. Plastic, glass, paper, and metal thrown or washed into facilities.	None.
Storm Drains Cleaned and Maintained Every 3 to 6 Years	Flood control and water quality benefits.	Allows proper drainage to prevent flooding and continued proper operation of facilities.	Silt and sediment and the contaminants contained therein. Plastic, glass, paper, and metal thrown or washed into facilities.	None.
Storm System Pump Stations Cleaned and Maintained Annually	Site dependent flood control and water quality benefits.	Prevents flooding and allows continued proper operation of facilities.	Silt and sediment and the contaminants contained therein. Plastic, glass, paper, and metal thrown or washed into facilities.	None.
Inspect and Maintain Sewer System	Storm drain system and receiving water.	Prevents and eliminates sewer system surcharges.	Contaminants, toxics, and coliform bacteria.	None.
<b>Minor Structural Source Controls</b>				
Storm Drain Inlet Protection	Storm drain drainage area.	Prevent debris from entering storm drain.	Dirt, leaves, twigs, paper, plastic, and other incidentals.	Not available.
Outlet Protection	Storm drain receiving water.	Prevent erosion at the outlet of pipes or paved channels and protect downstream water quality.	Turbidity and sediment.	Structural apron lining at the outlet location. Made of riprap, grouted riprap, concrete, or other structural materials.
Slope Stabilization and Erosion Control Measures	Site and topography dependent.	Reduce silt and sediment load to storm drains.	Silt and sediment and the contaminants therein.	None.
Interceptor Swale	Dependent on flow velocity. Max. velocity for earth channel is 6 fps. Max. velocity for vegetated or riprap channel is 8 fps.	Shorten length of exposed slopes and intercept and divert storm runoff from erodible areas.	Sediment and silt and the contaminants contained therein.	Excavation drainageway across disturbed areas or rights-of-way.



Type of Practice	Area of Benefit	Storm Protection Benefit	Pollutants Controlled	Construction Requirements
Improve and Maintain Natural Channels	Channel capacity and receiving water. Upstream flood control benefits. Includes benefits to channel wildlife habitat and vegetation.	Prevent erosion in channel. Improve capacity by removing silt and sedimentation. Remove debris that is habitat destroying or toxic to wildlife.	Silt and sediment and the contaminants contained therein. Plastic, glass, paper, and metal thrown or washed in channel.	None.
Diversion Channel	Dependent of flow velocity. Maximum velocities: 5 fps for vegetated channel and 8 fps for riprap channel. Not for use on slopes greater than 15%. Drainage area should be 5 acres or less.	Intercept and convey runoff to outlets at nonerosive velocity.	Sediment and erosion controls.	Lined drainageway of trapezoidal cross section.
Grass-Lined Channel	Site dependent but of larger capacity than interceptor or perimeter swales.	Intercept runoff and convey runoff from site.	Sediment and silt and the contaminants contained therein.	Excavation of channel or improvements to natural channel. Stabilization with vegetation.
Storm Drain Drop Inlet Protection	Areas less than 1 to 2 acres.	Filters sediment from runoff before it enters inlet. Provides relatively good protection.	Sediment and the contaminants contained therein.	Barrier around storm drain inlet. Useful for areas where storm drain is operational before area runoff area is stabilized.
Riprap	Site dependent	Provides stabilization and erosion control for stream banks and channels, outlet, and slopes.	Erosion and sediment.	Placement of rock on area to be stabilized. May also require use of filter fabric liner.
Gabions	Site dependent	Provides stabilization and erosion control for stream banks, outlet, and slopes.	Erosion and sediment.	Placement of wire cage with rocks over area to be stabilized. May also require use of filter fabric liner.
Vegetative Control	Applicable and effective for most sites.	Provides stabilization and erosion control for streambanks, swales, channels, outlets, slopes, open disturbed areas. Can be up to 99% effective with established cover. Temporary seeding can be up to 90% effective.	Erosion and sediment.	Site preparation (can include land leveling and installation of irrigation system), seeding or planting, and netting or mulching to establish seed. Can also include other sodding, ground cover, shrubs, trees, and native plants.
Filter Strips	Site dependent.	Receives overland flow slowing runoff and trapping particulates. Can be 30 to 50% effective for sediment control.	Silt, sediment, trash, organic matter, and to an extent, soluble pollutants through infiltration.	Grading and vegetative establishment. Should have a minimum width of 15 to 20 feet. Good performance is achieved with a 50 to 75 foot width.
Fence Open Channels	Site dependent.	Prevent windblown trash from entering channel. Prevents illegal dumping in channel.	Trash and pollutants.	Construction of fences.
<b>Discharge Elimination Methods</b>				
French Drains and Subsurface Drains	Dependent on site topography and soil permeability.	Provides drainage of "wet" soils to allow establishment of vegetation. Can reduce runoff.	Sediment.	Underground perforated pipe leading to a surface water outlet. Pipe size, bedding and depth is dependent on site conditions.

Type of Practice	Area of Benefit	Storm Protection Benefit	Pollutants Controlled	Construction Requirements
Infiltration Trench and Dry Well	Small drainage areas. Runoff from rooftops, parking lots, residential, etc.	Provides temporary storage of runoff and infiltration to soil. Not for use in areas where groundwater could become contaminated.	Prevents 100% of pollutants from entering surface water. Oil, grease, floating organic matter, and settleable solids should be removed before water enters trench.	Excavation of a shallow trench 2' to 10' deep. Backfilled with coarse stone aggregate.
Exfiltration Trench	Site dependent.	Prevent silting on underlying filter gravel or rock bed. Retain first flush, reduce runoff volume and peak discharge rate and promote water quality improvement.	Prevents pollutants from entering surface water. Oil, grease, floating organic matter, and settleable solids should be removed before water enters trench.	Uses perforated pipe with suitable membrane filter material. Installed before receiving water outlet or in groundwater recharge area.
Porous Pavement	Site dependent. Requires relatively flat surface.	Allow infiltration of surface runoff. Reduce runoff volume and pollutant loadings from low volume traffic areas.	Oil and grease.	Install porous pavement. May require twice as much paving material as standard asphalt to achieve same strength.
Retention Basin	Best for sites of 5 to 50 acres.	Promotes infiltration to groundwater and reduces runoff volume and velocity. Filters pollutants.	Sediment, trace metals, nutrients, and oxygen-demanding substances.	Excavation of a basin over permeable soils. Size is site dependent. Depth is 3 to 12 feet.
<b>Floatables and Oil Removal</b>				
Clarifiers and Oil and Water Separators on Parking Structures	Parking lot structure and receiving water.	Collect debris before it can enter storm drain.	Oil, grease, and antifreeze from vehicles and foods and food wrappers.	Install grit and separators.
Oil and Grit Separators	Site dependent. For heavy traffic areas or areas with high potential for oil spills.	Remove pollutants.	Sediments and hydrocarbons.	Install oil and grit separators on storm drains.
Sediment/Grease Trap	Installed on storm drain inlets.	Intercept and trap sediment and grease from runoff.	Sediment, oil, and grease.	Install sediment and grease traps.
<b>Solids Removal</b>				
Detention Basin	Four acres of drainage area for each acre/foot of storage provided to retain a permanent pool of water.	Temporary storage of storm runoff until release. Can also improve water quality.	Sediment, trace metals, hydrocarbons, nutrients, and pesticides.	Excavation of a basin over soils which will cause excessive seepage. May require a liner. Can be used aesthetically as a small pond in landscaping.
Extended Detention Basin	Size for a minimum detention time of 24 hours.	Temporary storage of runoff for an extended period of time. Can improve water quality.	Sediment, trace metals, hydrocarbons, nutrients, and pesticides.	Excavation of a basin over soils which will cause excessive seepage. May require a liner. Can be used aesthetically as a small pond in landscaping.
Bar Screens	Site dependent.	Restrict passage of objects which may obstruct pump station suction bays.	Large debris.	Install bar screens before pump station suction bays.