

**Northeast Swale Development
Guidelines (2012)**

Prepared for:
City of Saskatoon
Planning and Development Branch
Community Service Department



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Steering Committee

Chris Schulz, City of Saskatoon
Alan Wallace, City of Saskatoon
Laura Hartney, City of Saskatoon
Don Cook, City of Saskatoon
Cal Sexsmith, City of Saskatoon
Mike Velonas, Meewasin Valley Authority
Amber Jones, Meewasin Valley Authority

Technical Advisory Committee

Anna Leighton, Vegetation specialist
Luc Delanoy, Meewasin Valley Authority
Chet Neufeld, Native Plant Society of Saskatchewan
Barb Hanbidge, Ducks Unlimited Canada
Stan Shadick, Saskatoon Nature Society
Candace Neufeld, Environment Canada
Bob Roger, Wildlife Federation
Mel Stauffer, Geology, Professor Emeritus, U of S
Les Henry, Soil Science, Professor Emeritus, U of S
Graham White, RM of Aberdeen
Rebecca Row, RM of Corman Park
Chris Schulz, COS, (Planning and Development Branch
Galen Heinrichs, COS, Strategic Services Branch
Brenda Wallace, COS, Environmental Services Branch
Gary Pedersen, COS, Parks Branch
David LeBoutillier, COS, Transportation Branch
Tyson McShane, COS, Lands Branch

1.0 Introduction

The Northeast Swale (the Swale) is located in the northeastern area of the city of Saskatoon and has long been regarded as a unique environment, having unique ecological, hydrological, and hydrogeological characteristics. It contains remnants of native prairie, has numerous ecologically important wetlands, and also provides constraints to development as it sits over the Forestry Farm Aquifer. For the purposes of this report, the study area is defined as the Swale boundary within the current city limits. A discussion of the Swale boundary is presented in more detail in Sections 2.2 and 3.3.

Development guidelines for the protection of the Swale were prepared in 2002 (Stantec 2002). However, since that time more studies have been completed on the ecological character of the region, including a more detailed assessment of the wetland characteristic of much of the Swale and a better understanding of the important upland environments including the vegetation and bird populations. As the city expands rapidly in the north east sector (University Heights in particular), the City of Saskatoon and the Meewasin Valley Authority determined a need to update the development guidelines to reflect this new knowledge and to better prepare the City for development of neighbourhoods adjacent to the unique region. Additionally, as the City implements the University Heights Sector Plan, and plans for a new commuter bridge crossing of the South Saskatchewan River, public interest in the Swale has highlighted the need to update the guidelines. This interest is further stimulated by the Saskatchewan Ministry of Highways and Infrastructure's plans to construct a Perimeter Highway that will cross the Swale within the city limits.

This document presents revised guidelines for the Northeast Swale and replaces the 2002 guidelines. More details are provided on the Swale boundary, the road crossings, and issues related to stormwater management. A new discussion on the creation of a Greenway around the Swale is an important addition to the new Northeast Swale Development Guidelines. All figures referred to in this report are presented in Appendix A.

The overall goal of this document is to provide direction for the minimization of disturbance to the Swale, while also meeting transportation, utility, stormwater management and other community needs.

This study was guided by a Steering Committee and a Technical Advisory Committee. Members are identified in the Acknowledgements in the Table of Contents.

2.0 The Northeast Swale

2.1 THE SWALE

The Northeast Swale is located within the Moist Mixed Grassland Ecoregion of the Prairie Ecozone and is adjacent to landscape areas of the Aspen Parkland Ecoregion. Transitional zones such as this provide a diverse habitat for both plants and animals, and much of this diversity is represented within the swale region. Therefore, examples of native moist mixed grassland species are common, as are those plant and animal species associated with the aspen parkland. The grasslands and the several small aspen bluffs within the Swale provide habitat for white-tailed deer and a variety of small mammals and birds.

The *Northeast Background Study* (The UMA Group, 1985) described the Swale as a channel scar with sloughs. They state:

The surficial landform in this area is an eroded till plain. The sheet-type erosion has left behind a lag of gravel and boulders on the ground surface. The area is underlain by an extensive inter-till sand deposit known as the Forestry Farm Aquifer. This aquifer is of a relatively large regional extent and is recharged by surficial infiltration in the uplands to the east of the area.

The current scar and sloughs of this area are remnants of glacial times. The channel formerly carried meltwater and once flowed as a broad sheet of water to the north. The area is considerably above the present river. The scar has been incised within the former glacial lake bottom that we know today as the prairie tableland. As the scar has been scoured below the general level of the prairie, it has remained an integral part of the prairie surface drainage system since being abandoned by the river. Over time it has accumulated some rich soils but the continued erosion by surface drainage has carried most of them off. None the less, this area supports rich plant and animal life communities. Two examples are the fescue grassland and natural prairie that serve as a habitat for grassland birds. The scar is a wildlife corridor for mammals and a habitat for numerous bird varieties.

Due to the undulating topography and boulder cover, the agricultural capability is low and the area has never been farmed. Examples of natural prairie still exist. As few examples are left in North America they are worthy of preservation...

The sloughs within the channel scar are maintained as wet areas throughout the year by the Forestry Farm Aquifer. This groundwater affects not only this area but also affects

the riverbank and a number of piping failures (Peturrson's Ravine, Regional Psychiatric Centre, Riddell).

The Forestry Farm, although not part of the channel scar, is linked to it by a fescue grassland.

2.1.1 Geotechnical Importance

The Forestry Farm Aquifer and the general region around the Swale were investigated in 1985 and 1986, by BBT Geotechnical Consultants Ltd. Their geotechnical study was completed as part of an investigation into the potential constraints the aquifer provides to sewer installation and subdivision development. The character of the aquifer, piping failures near the riverbank, and the general geotechnical details provided by these investigations have helped define for the City of Saskatoon a zone of what was referred to as "unserviceable land" (Figure 1, Appendix A). This zone defines lands within the northeast area that have less than 6 m of cover overlying the Forestry Farm Aquifer. The six metre depth they chose represents the probable maximum cover required for the installation of a water and sewer system.

2.1.2 Ecological Importance

Weichel's 1992 investigation identified the Swale as being a priority area for protection. His study was focused on ecological values rather than geotechnical constraints. Other studies (Delanoy 2001 and Bizecki-Robson and Dynes 1998) also have described the need to protect habitats like the Northeast Swale. Recent studies (e.g., Jensen 2009, MVA 2009, Shadick 2009, Jensen 2012, and Stantec 2012) have examined the vegetation, wetlands and wildlife character of the Swale in detail. These studies, completed since the 2002 guideline document, provide a more complete understanding of the ecological significance of the Swale with respect to wetlands and ecological characteristics (e.g., flora and fauna populations). Important findings are summarized below and important ecological units are identified on Figure 3, Appendix A:

- The Swale provides a good variety of upland and wetland habitats that are important to a wide variety of bird species (186+ bird species have been identified, with 61 species known to nest in the Swale).
- The Swale provides habitat for common nighthawk, loggerhead shrike and horned grebe (all federally listed species at risk). These species have all been observed within the Swale, although no nests are known to currently exist.
- The wetlands are important for a wide variety of waterfowl and shoreland birds.

- The uplands, while disturbed in some areas by over grazing in the past, contain significant amounts of native prairie, including some provincially ranked (S3) rare species (*Lilium philadelphicum*, *Viola pedatifida*, and *Alisma gramineum*). The assemblage of native species is one of the Swale's most important attributes, and provides habitat for the wide range of birds. The plant communities in the swale are dominated by western porcupine grass and northern wheatgrass. This association of mixed grass prairie tends to transition into the fescue prairie¹. Fescue prairie once extended over a large portion of Canada but less than 5% of its original expanse now remains in Saskatchewan².
- The wetlands (Figure 2, Appendix A) have been classified using the Stewart and Kantrud system and it was determined that the majority are Class 4³, or semi-permanent (Stantec 2012). A functional assessment has noted that the Class 4 wetlands are important ecologically as they provide important water storage, waterfowl habitat, amphibian habitat, and native plant habitat. Note that this study did not include a study of amphibian species and abundance.
- Peturrson's Ravine is located where the river and the swale connect and is an area of high ecological integrity (Figure 3, Appendix A). The marl bog ecosystem within the ravine supports several nationally rare plant species. The ravine is the result of unique hydrological conditions and changes to the surrounding hydrology may have a detrimental effect on the ecology.⁴ The Peturrson's Ravine Resource Management Plan (Golder 1995) provides recommendations for developments adjacent to the ravine. These are further discussed in Section 3.5.3 in a discussion of road development along Central Avenue.

The Technical Advisory Committee discussed the potential importance of reptiles and amphibians in the Swale, particularly as northern leopard frogs have been observed in wetlands within the Swale⁵. Northern leopard frogs are protected by the federal Species at Risk Act

¹ Managing Saskatchewan Rangeland. 2008. J. Bruynooghe and R. McDonald eds. <http://www.saskforage.ca/publications/ManagingRangeland.pdf>

² Grilz, P.L. and J.T. Romo. 1995. Management considerations for controlling smooth brome in fescue prairie. *Natural Areas Journal* 15:148-156.

³ The Wetland Policy Study (Stantec 2009) initially identified some of these wetlands as Class 5. More detailed field work in 2012 noted that they have characteristics more similar to a Class 4. This conclusion is based upon the emergent vegetation discovered in 2012.

⁴ Golder Associates. 1995. Peturrson's Ravine Resource Management Plan. Prepared for Meewasin Valley Authority.

⁵ Personal communication, MVA staff, August 2012.

(SARA). However, no studies have examined reptile and amphibian populations within the Swale.

2.1.3 Heritage Importance

Several heritage resource studies have also been completed on lands within and adjacent to the Swale (Walker 1983; Stantec 1999 and 2001). Walker's Saskatoon Perimeter Archaeological Resource Assessment included lands within 13-37-5 W3M and 18 & 7-37-4 W3M. Stantec's investigations focused on all the lands in the northern half of 12-37-5 W3M. The only lands not examined in detail are located in a portion of Section 13. However, Stantec's heritage overview of the site, including a site visit, suggests it has low heritage potential. This is based upon its disturbed condition (cultivated field) and the results of the studies on adjacent sections.

The studies identified two locations having historic interest (Stantec 1999); both of which are in the NW 12-37-5 W3M. This quarter has remnants of the Batoche Trail and evidence of the limestone quarrying activities conducted during Saskatoon's early history in the late 1800s. These historic remnants provide for interesting interpretive opportunities. However, from a provincial regulatory perspective, neither site requires specific protection. The investigations completed here by Stantec are sufficient for regulatory needs and no further action is required.

The heritage locations are highlighted on Figure 3, Appendix A.

2.2 THE SWALE BOUNDARY

Based upon a review of these reports a Swale boundary has been delineated that forms the fundamental unit requiring protection and/or special consideration. The Swale boundary is based upon:

- Geotechnical boundaries (the 6 m cover over the Forestry Farm Aquifer);
- The distribution of wetlands within the region;
- The distribution of native and altered (grazed, exotic, cropland) vegetation units;
- Maintenance of a connection between the Swale and the South Saskatchewan River Valley; and
- The heritage resource character of small portions of the western portion of the Swale.

The Northeast Swale boundary is further discussed in Section 3.3.

The Steering Committee and Technical Advisory Committee are in agreement that the Swale has hydrological and ecological importance and requires protection. The next section provides further discussion and guidelines on how to achieve that protection.

3.0 Development Guidelines

3.1 INTRODUCTION

This section provides discussions and guidelines for the four major requirements of this guideline update:

1. What is the boundary of the Swale?
2. How should the Swale be separated from surrounding land uses?
3. Where are appropriate locations for transportation and utility corridors to cross the Swale?
4. How should stormwater be managed so as to not adversely affect the Swale?

In addressing these questions in the following discussion some reference is also made to the Meewasin Valley Authority's Northeast Swale Resource Management Plan. This management plan is being prepared concurrently with the development guidelines.

It is important to note that while the development guidelines provide direction for the four requirements identified above, they are also intended to guide future neighbourhood development on lands adjacent to the Swale. It is intended that future planning consider the protection of the Swale.

3.2 FUNDAMENTAL CONSIDERATIONS FROM THE 2002 GUIDELINES

There are several fundamental guiding principles recognized as being important to the complementary development of urban lands and natural areas. These consider the biophysical characteristics of the natural area and the desire to reduce or avoid adverse environmental effects upon the flora, fauna, hydrology, soils and terrain that could result from urban development adjacent to or within the Swale. They include:

- Maintain existing terrain. Natural drainage patterns and topography are important components of the natural system and should be restored or rehabilitated should they be modified during development activities.
- Preserve streams, floodplains and wetlands.
- Minimize the creation of hard/impervious surfaces.

- Build in the least sensitive areas.
- Provide buffers or setbacks between the natural area and the adjacent proposed development
- Direct runoff onto vegetated areas.
- Use appropriate vegetation for reseeding, erosion control, etc.
- Reduce vehicle traffic and speeds through the swale.
- Incorporate stormwater management controls: e.g., retention ponds and infiltration basins prior to release into natural streams, wetlands or lakes.
- Control litter (during and after development)

These principles are considered in the determination of the Swale boundaries, and the guidelines for setbacks and buffers, road and infrastructure crossings, and stormwater management. These topics are discussed in the following sections and guidelines are presented.

3.3 THE SWALE BOUNDARY

3.3.1 Objective

- To delineate the boundary of the Northeast Swale.
- To guide land use and development planning within and adjacent to the Swale boundary.

3.3.2 Discussion

The Swale boundary (Figure 4, Appendix A) was determined based upon the ecological character of the Swale and its surrounding environment, and encompasses all of the areas (wetland and upland ecosystems) identified as being important in previous studies (Refer to Section 2.2). The boundary is delineated based upon the level of disturbance between the Swale and the surrounding landscape and/or the boundary of the “unserviceable land”.

- The “southern” boundary follows existing roads (Central Avenue, Fedoruk Drive) and a distinct line between cultivated and uncultivated lands (2011 aerial photographs). The most easterly portion of this boundary is associated with the unserviceable land designation, as no detailed field studies were completed on this private, cultivated land.
- The proposed “northern” boundary follows a portion of Agra Road and then follows a line trending northeast. This boundary was determined based upon a site visit in 2012 and

generally follows a line between more highly disturbed cultivated lands and the more native and less disturbed Swale lands. The most easterly portion (i.e., east of Range Road 3045) of this boundary is associated with the unserviceable land designation. Some disturbed lands along the north boundary fall within the Swale boundary and some relatively good native prairie areas fall outside the boundary. Prior to residential development, there may be some opportunity to further refine this boundary to include the small portions of native prairie and exclude the more disturbed sites. However, it is suggested that the modifications result in no net loss of native prairie within the Swale Boundary presented in this document. The Swale boundary presented here represents a compromise that protects the ecological character of the Swale and provides lands available for development adjacent to the Swale.

The Northeast Swale Resource Management Plan will present a vision for this important natural area. It will look at the specific management practices needed to protect the ecological and heritage resources as well as developing a strategy for recreation that ensures conservation of the swale while utilizing the recreational, educational, and interpretive opportunities that exist.

Further details should be obtained from the Resource Management Plan.

3.3.3 Guidelines

- Develop a Resource Management Plan for the lands lying within the Swale boundaries. This will be the responsibility of the Meewasin Valley Authority.
- Delineate the important ecological area boundaries within the Swale using fencing (e.g., page wire fence) and/or signage.
- Create a Greenway (setback zone) beyond the Swale boundary (refer to discussion in Section 3.4).
- Develop roads and other infrastructure crossings only at location(s) within the Swale that are identified in Section 3.5 of this guideline document.
- The Northeast Swale Resource Management plan should identify acceptable recreational uses of the swale and greenway.

3.4 THE GREENWAY

A Greenway is recommended as a setback or buffer between the Swale and the adjacent neighbourhoods.

3.4.1 Objectives

- To provide a zone between the Swale boundary and adjacent land uses (residential, commercial, institutional, roads, etc.) that acts as a buffer protecting the landscape within the Swale.
- To provide a zone where trails (pedestrian and bicycling) can be developed for recreation and commuting and which does not adversely affect the Swale.
- To provide a naturalized transition zone that restricts the encroachment of exotic plant species from residential areas into the Swale.

3.4.2 Discussion

A setback is the distance from a rear lot line or edge of a developed area to an identifiable natural area (the Swale).⁶ Within the setback may be found ecological buffers, geotechnical allowances, and additional space for trails and/or roads. The setback may be used to control access to the natural area and to reduce or prevent encroachment to the ecological buffer and adjacent Swale. The setback for the Swale will be referred to as the Greenway.

The Greenway also provides opportunities to develop trails, roadways, and stormwater management practices. It can be managed as a naturalized corridor protecting both the Northeast Swale and providing an amenity for adjacent neighbourhoods.

Three zones within the Greenway are recommended (Figure 5, Appendix A):

- An Ecological Buffer zone having a 15m width outward from the Swale should be developed to act as a filter to minimize impacts from adjacent land use and to protect the ecological functions within the Swale. All vegetation within this buffer should be species native to the Swale. Currently, there are many areas lying within this proposed buffer that are mixture of native and exotic species, and efforts will be required to control invasive species and reintroduce native species. These efforts can include weed management, seeding and/or allowing natural regeneration to proceed. Slopes at more than 5% toward the Swale should have an additional 5m of Ecological Buffer.
- A Trail Zone adjacent to the Ecological Buffer. This trail should be 3m wide (approximate) and developed as a pedestrian/cycling pathway suitable for commuting

⁶ Carolinian Canada Draft Guide for Determination of Setbacks and Buffers. www.carolinian.org

use. Meandering from the Trail Zone into the Ecological Buffer is acceptable on flat slopes (<5%) and where natural vegetation is well established.

- A Transition Zone adjacent to the Trail Zone. Meandering of the trail into the Transition Zone is acceptable. This zone should be seeded to low growing native species and will act as the outer edge of the Greenway, adjacent to other land uses (residential, roads, commercial, etc.) The Transition Zone has the potential to be used as a tool in local stormwater management and be integrated with low impact stormwater management efforts on adjacent lands. It can include a grassy swale, or other low impact stormwater management tools such as rain gardens and bioswales. Refer to Section 3.6 for further discussion of stormwater management.

There are opportunities to vary the width of the Ecological Buffer and the Transition Zone within the Greenway to allow for Trail Zone meandering. This could help to better integrate with future neighbourhood, roadway and commercial developments.

3.4.3 Greenway Guidelines

- Three zones comprise the Greenway: Ecological Buffer, Trail Zone, and Transition Zone. The Greenway extends from Swale boundary to the lot line or road associated with the adjacent land use.
- It is recommended that the Ecological Buffer and the Trail Zone be included within the Northeast Swale Resource Management Plan.
- It is recommended that the Transition Zone be included within the City's stormwater management system.
- The boundary between the Swale and the Ecological Buffer should be delineated using a page wire fence and/or signage.
- Species native to the Swale should be used within the Ecological Buffer and can include grasses, forbs, shrubs, and aspen. A recommended grass seed mix is provided in Appendix B.
- The Ecological Buffer should have a minimum width of 15 m. The width should be expanded to 20 m if the slope toward the Swale is greater than 5%. Also, additional widths could be added to potentially allow a more meandering Trail development if desired. Some meandering into the 15 m minimum width of the Ecological Buffer is acceptable at locations that are flat (<5% slope toward the Swale) and well vegetated.

- Trail development should occur within the Trail Zone but meanders into adjacent zones are acceptable. However meanders into the Ecological Buffer should be restricted to land having slopes less than 5% and which are well vegetated, or at points of access to the Swale (e.g., access to a nature trail or observation areas developed within the Swale). The access points should be determined in consultation with the MVA and be in accordance with the Northeast Swale Resource Management Plan.
- Trails should have a width of approximately 3-4 m and be a shared pedestrian and bicycle use design using crusher dust or asphalt. An additional 1 m strip along the Ecological Buffer side of the Trail Zone can be designated for mowing should the vegetation become too high and impede trail use.
- Trails can meander into the Transition Zone as long as there is no interference with any stormwater management development.
- Vegetation within the Transition Zone should use species native to the area. These will be predominantly grass species, although other native plantings (e.g., shrubs and trees) can be dispersed through the zone (refer to Appendix B, Recommended Seed Mix).
- The Transition Zone should be used as a component of the stormwater management system and should be seeded to species that can be mowed or grazed. Mowing should only be implemented if the vegetation impedes trail use or presents a fire hazard.
- The Transition Zone should be variable in width (minimum of 3 m), depending upon what role it will have in stormwater management. If it will be used for stormwater management the width should be a minimum of 5 m.
- A fence is highly recommended between the outer edge of the Transition Zone and adjacent land uses, particularly the back lots of residential developments.
- Non-motorized access to the Greenway should be distributed along the outer edge of the Transition Zone, providing access to the trail system. Access to the Swale should be at locations determined in a future recreation plan informed by the Northeast Swale Resource Management Plan.

3.5 ROAD AND INFRASTRUCTURE CROSSINGS

3.5.1 Objectives

- To identify the location(s) of transportation corridor(s) across the Swale.

- To identify the location(s) of utility corridor(s) across the Swale.
- To provide guidelines related to ecological protection during design, construction and operation phases of the transportation and utility crossings.

3.5.2 Discussion

The purpose of these guidelines is to minimize disturbance to the Swale, while still meeting transportation, utility, stormwater management, and other community needs. To accomplish this, three transportation and utility crossing locations (Figure 6, Appendix A) have been identified that, if designed, constructed and managed according to the guidelines presented below, should effectively minimize adverse environmental effects on the Swale. It is also recommended that the transportation corridors be shared with utility crossings, therefore limiting the road and infrastructure disturbances to a shared corridor.

The crossings are:

- Crossing #1: The recommended east transportation (arterial road) and utility crossing (#1 on Figure 6) is very near an existing north-south grid road (Range Road 3045). It is the intent that once a new transportation corridor is constructed near this location, Range Road 3045 will be removed and the disturbed portion of the Swale rehabilitated.
- Crossing #2: Central Avenue is the current western most Swale crossing (#2 on Figure 6) and it is recommended that this crossing remain to provide an arterial road into the developing neighbourhoods north of the Swale. The design of the crossing must take into account the environmental significance of Peturrson's Ravine to the west, and the ongoing environmental monitoring occurring around the University of Saskatchewan Chemical Landfill Remediation Site to the east.
- Crossing #3: This potential crossing (#3 on Figure 6) should be located at Lowe Road (Range Road 3050) and lie along the existing centreline. This crossing can be a collector road/utility crossing (27 m wide right-of-way) connecting the Evergreen neighbourhood to future neighbourhoods north of the Swale.

Members of the Technical Advisory Committee and the Swale Watchers⁷ noted the potential for disturbance of nesting birds during construction, and the possible movement of amphibians and

⁷ The Swale Watchers is a group of concerned citizens representing a variety of local and provincial environmental groups, all with interest in protecting natural areas. They requested and held a meeting with Stantec to discuss their concerns and ideas.

reptiles across the transportation corridor during operation. The guidelines address these two concerns.

3.5.3 Guidelines

Planning and Design:

- Crossing #1 should be constructed as a Class C, 4-lane undivided arterial road. (Figure 7, Appendix A) with a maximum right-of-way width of 32 m.
- Crossing #2 should be constructed as a Class B arterial road with a maximum right-of-way width of 32 m. Slope stability is a concern at Peturrson's Ravine due to both the steepness of the ravine slopes (>20%) and the groundwater discharge and piping failure along the banks. Due to the proximity of this crossing to Peturrson's Ravine, the following recommendations from the *Peturrson's Ravine Resource Management Plan*⁸ and from Hardy BBT Limited (1987, 1988) should be considered when designing and constructing the road, or any other development adjacent to the ravine:
 - Avoid building on key habitat protection areas, especially areas where rare plants are found;
 - Avoid slump areas along eastern bank of south Saskatchewan River;
 - Maximize use of presently disturbed areas;
 - Avoid clearing native woody vegetation (tall shrubs and trees) where possible;
 - Avoid floodplain and sideslopes (>5%) which are a natural travel corridor for several wildlife species;
 - Hydrologically isolate the ravine from potentially contaminated surface run-off from nearby subdivisions;
 - Monitor changes to groundwater flows and quality pertaining to unique and/or endangered species of the ravine;
 - Minimize facilities and activities below the top of bank line and, when necessary to design, build, and manage, to minimize exposure of soil to erosive forces;
 - Keep significant improvements beyond the probable extent of potential slope movement damage (20 metres from top of bank);
 - Ensure surface flow into the main ravine is not increased or hydrologically focused by surrounding improvements;
 - Ensure that surface flow over the top of bank in other areas does not adversely affect the stability or key ecological areas identified in the resource management plan.

⁸ Golder Associates 1995.

- Crossing #3 should be constructed as either a Class A, 2 lane undivided collector road having parking lanes on each side, or a Class B, 2 lane undivided collector road having parking on one side and a maximum right-of-way width of 27 m.
- Posted maximum speed should be 50 kph to reduce wildlife interactions.
- Design should be in accordance with the City of Saskatoon's "New Neighbourhood Design and Development Standards Manual".
- The transportation crossings should be shared with utility crossings. Construction of the water main and arterial road at Crossing #1 will be adjacent to wetlands and the construction/installation must be coordinated to reduce the construction disturbance duration within the crossing corridor.
- The road design at Crossing #1 should include a minimum of two pedestrian crossings within the Swale.
- Multi-purpose pedestrian and bicycle lanes should be included on at least one side of the road.
- Wildlife crossing, pedestrian crossing, and no stopping signs are recommended.
- Street lighting at all crossings should be Dark Sky compliant.

Ecologically Related Design Needs:

- Conduct an amphibian and reptile species composition and abundance survey and have an experienced herpetologist determine if the populations warrant special road design mitigation. If required, it is recommended that the road include amphibian and reptile crossing structures using the guidelines in "Wildlife Crossing Structure Handbook: Design and Evaluation in North America" (FHWA 2011).
- Culverts on Crossing #1 should be designed to allow natural flow from the west to the east, and also provide opportunities use by small mammals, fish, reptiles and amphibians. The culvert entry and exits should include rocks, small shrubs and/or taller vegetation that provide cover for animals using the culverts.

- Road design should consider that deer and other mammals will be crossing the road. A level crossing is recommended, where possible⁹. Therefore, it is recommended that culvert crossings be designed to minimize grade changes along the roadway.
- Right-of-way vegetation should strive to include species native to the Swale or should be non-invasive if not native. The species should also be salt-tolerant. Trees along the ROW may be considered; however, the design must ensure spacing and species selection mitigate any potential impact to safety of wildlife crossing the road. Low growing, mowable species are preferred between the curb and the multi-purpose trail within the right-of-way (Figure 7, Appendix A). The planting of buffalo berry and similar shrubs can be considered near the culverts and in the right-of-way between the trail and the Swale.

During Construction:

- The City should contract an independent environmental monitor during the construction within the Swale. That monitor will provide advice on location of storage and laydown areas, topsoil stockpiles, activities near watercourses and wetlands, and site reclamation activities. The monitor does not need to be onsite for 100% of the construction period, but will be required at project kick-off, and for certain environmentally sensitive activities (e.g., work near wetlands or watercourse crossings). Regular inspections should be required for the remainder of the activities (e.g., every second day).
- Clearing activities should not be scheduled between May 1 and July 31, to avoid disturbance of nesting birds.
- Topsoil should be stripped and stockpiled for later use in site reclamation.
- Stockpiled topsoil should be covered with tarps to reduce the potential for weed growth. The need for this can be determined in consultation with the environmental monitor, as this requirement is influenced by the length of time the stockpiled soil will remain.
- All construction activities should be confined to the right-of-way and designated equipment storage and laydown areas. Previously disturbed areas adjacent to the ROW could be used for equipment storage and laydown, with the agreement of the environmental monitor.

⁹ This recommendation is based upon a review of the literature, including: Barnes and Adams 1999, Clevenger & Wells 1997, Clevenger & Waltho 2000, Jacob Herrero et al 2000, FHWA 2011, and others (see bibliography)

- Equipment should be cleaned prior to entry in the right-of-way to avoid the spread of noxious weeds.
- No equipment storage or laydown area should be allowed within 50 m of any wetland or watercourse.
- No equipment should be serviced or fueled within 50 m of any wetland or watercourse.
- Silt fences and similar erosion control measures should be implemented to ensure overland flow is not allowed to deposit sediment laden water into any watercourse or wetland.
- All construction debris should be removed from the site as quickly as feasible and be disposed of at a City of Saskatoon approved location.
- Site reclamation activities should begin as soon as feasible following construction. This includes spreading of stockpiled topsoil onto the disturbed lands; seeding with species native to the Swale, and installation of temporary erosion control measures where applicable (e.g., erosion blankets, water diversion structures, etc.).
- The preferred seed mix should be determined in consultation with the MVA and include grasses (refer to Appendix B) and low growing shrubs (e.g., buffalo berry)

Range Road 3045 Decommissioning

- Decommissioning should be scheduled for the late summer to late fall period.
- Backhoes removing road material should avoid entering into the wetland (with exception of the bucket).
- All road material should be removed from the Swale by truck as quickly as feasible. No stockpiles of material should be allowed on undisturbed lands.
- Wetland slopes should be contoured similar to the slopes adjacent to the old road.
- Wetland disturbance should be confined to the old right-of-way.
- Equipment should be cleaned prior to entry in the right-of-way to avoid the spread of noxious weeds.
- No equipment storage or laydown area should be allowed within 50 m of any wetland or watercourse.

- No equipment should be serviced or fueled within 50 m of any wetland or watercourse.
- Silt fences and similar erosion control measures should be implemented to ensure overland flow is not allowed to deposit sediment laden water into any watercourse or wetland.
- The disturbed wetland should be left to naturally revegetate.
- The old road bed should be reclaimed to native species using techniques approved by the MVA. NOTE: Some old road bed may be suitable to provide limited access to interpretive sites and wetlands. The Northeast Swale Resource Management Plan should be consulted prior to removal of the road bed.

Post Construction:

- The right-of-way between the curb and the multi-use trail within the ROW should be regularly mowed so that vegetation growth does not encourage animal grazing within the right-of-way.
- Culvert crossings should have rocks, small shrubs and taller vegetation that will not be mowed. However, these vegetated areas will need to be inspected on a regular basis to remove debris and garbage that may collect.
- Culverts should be regularly inspected and debris removed when required ensuring an unimpeded flow of water. This will be important in early spring and following heavy rainfall events.
- Monitoring of reclamation success should continue until the right-of-way and disturbed lands are revegetated. Erosion control devices (e.g., silt fences) will need to remain in place until the disturbed areas are stable.

3.6 STORMWATER MANAGEMENT**3.6.1 Objectives**

- To protect the water quality within the Swale
- To keep the wetland water level fluctuations within the Swale as natural as possible.
- To manage stormwater in the adjacent neighbourhoods using a variety of techniques, including low impact designs.

- To minimize or avoid the construction of stormwater structures within the Swale.
- To recognize and consider the unique hydrological conditions that have established the marl bog in Peturrson's Ravine.

3.6.2 Discussion

Maintenance of water quality and the natural fluctuations of water within the wetlands are vital aspects to the protection of the Swale. Stormwater management plans are required for all neighbourhoods adjacent to the Swale and the integration of these plans with the overall management of the Swale is required.

Complicating this process is the potential development of the Perimeter Highway by Saskatchewan Highways and Infrastructure (SHI). This road is proposed to cross the Swale within the SW 20-37-4 W3M and, depending upon its design, could interfere with the flow of water east of Range Road 3045. There is potential that the highway could influence water levels on wetlands within the Swale. However, at this time, the roadway has not been surveyed, nor the means of crossing the wetland identified.

The mineral composition of the marl bog in Peturrson's Ravine is a result of highly mineralized groundwater seeps. This results in a unique wetland community that includes nationally rare plant species. There is also the addition of fresh surface water from the culvert under Central Avenue that creates a freshwater wetland supporting a different plant community. The maintenance of these two communities is only possible under current hydrological conditions. Consideration should be given to how altering the drainage patterns in the area will alter the presence of these two co-existing environments.

3.6.3 Guidelines

- Complete a stormwater model for adjacent lands that includes the potential impacts on water levels within the receiving wetland within the Swale.
- Determine from SHI plans for the Perimeter Highway and include that knowledge into the stormwater models for the neighbourhoods in the northeast sector.
- Utilize the Transition Zone within the Greenway to help manage stormwater from adjacent residential areas (e.g., flow from backyards) and incorporate low impact stormwater management techniques within the adjacent neighbourhoods. These will provide filtration, peak flow attenuation, and water infiltration benefits. Techniques can include bioswales, rain gardens, vegetated filter strips, and grassy swales, among others.

- Use the existing water course (Figure 2, Appendix A) as part of the neighbourhood stormwater management plan for lands south of the Swale. This water course could be developed as an engineered wetland or stream channel and integrated with a stormwater retention pond.
- Generally, all stormwater retention ponds should be located outside of the Swale, except as noted below:
 - It is recommended that a stormwater retention pond(s) be integrated within the existing water course shown in Figure 2, and that the water course (engineered) be used to direct water into the large wetland in the Swale currently crossed by Range Road 3045 (NW 17-37-4 W3M). This stormwater retention pond can be built, along with its associated infrastructure, within the Swale in the area shown on Figure 6, Appendix A.
 - Stormwater may also need to enter the Swale from the north. This water should be directed into the existing retention ponds in NE 12-37-5 W3M. A utility corridor necessary for this purpose can be located within the area shown on Figure 6, Appendix A.
 - Consideration should be given to integrating previously undisturbed areas, such as old gravel and borrow pits, into the stormwater management system. These disturbed areas could function as engineered wetlands. Detailed studies on the potential for this use are required, including topographic surveys, rare and endangered species surveys, and an assessment of whether or not there will be adverse effects upon the Swale.
- Wetlands within the Swale have experienced significant water level fluctuation as part of their normal cycle. The stormwater management plans should consider the need to allow this fluctuation to continue, although also recognizing that the duration of peak flow occasionally may have a longer duration than currently experienced.
- Hydrologically isolate Peturrson's Ravine from potentially contaminated surface run-off from nearby subdivisions.

4.0 Conclusion

As stated in the introduction, the overall goal of this document is to provide direction for the minimization of disturbance to the Swale, while also meeting transportation, utility, stormwater management and other community needs. For the guidelines to be effective, the importance of the Swale to the community is a message that should be relayed to the residents and businesses who will reside in adjacent neighbourhoods.

To be effective, it is recommended that the City and MVA provide to the residents:

- Information on the Swale ecology
- Information on the importance of respecting the boundaries and resource management objectives of the MVA,
- Information on methods that residents can implement in their own backyards that will help to protect this valuable ecosystem.

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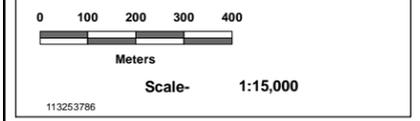
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Appendix A: Figures

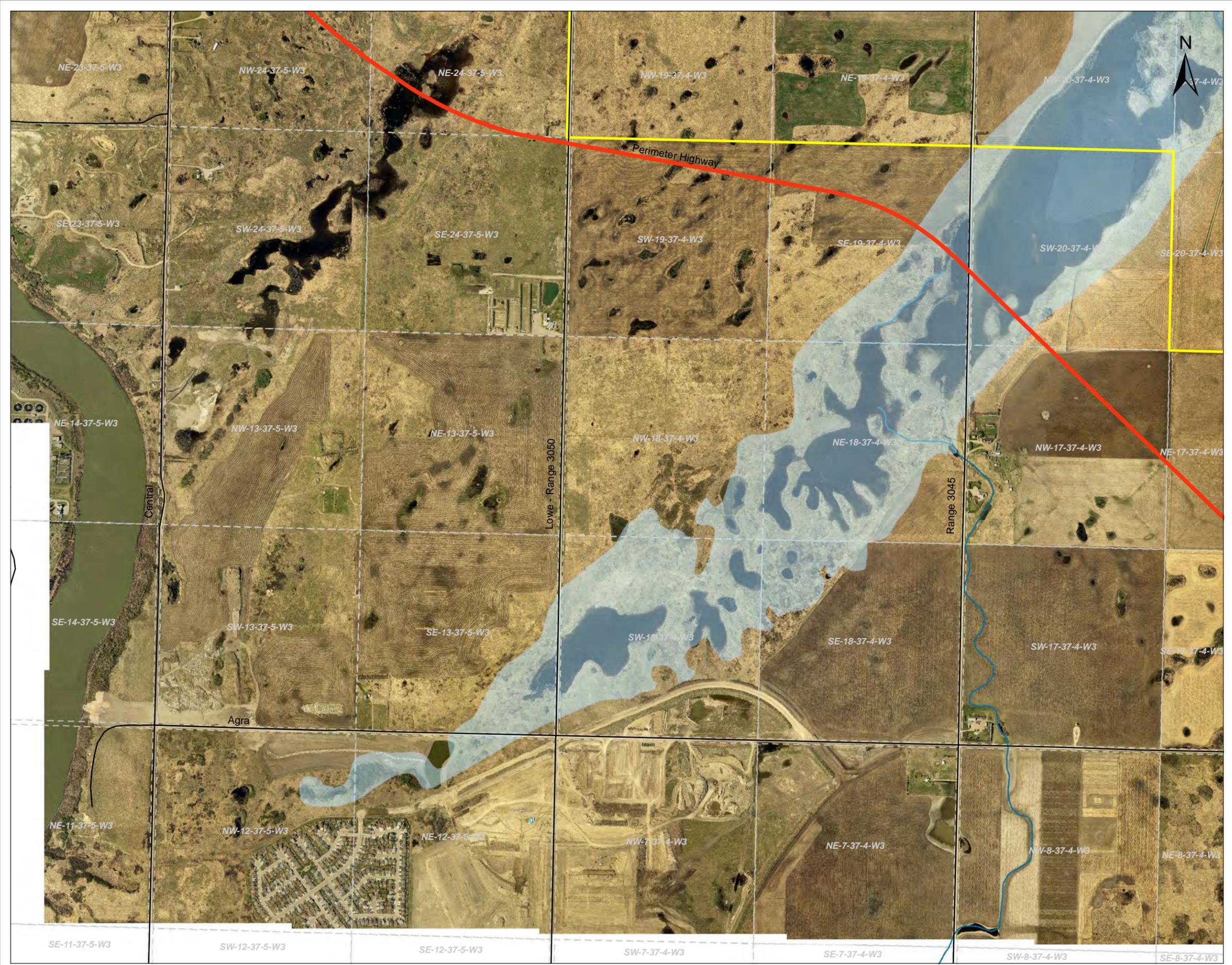
Northeast Swale Unserviceable Land

Projection: UTM Zone 13 NAD 83
Acknowledgements: Original Drawing by Stantec.
Imagery: 2011 (20cm)

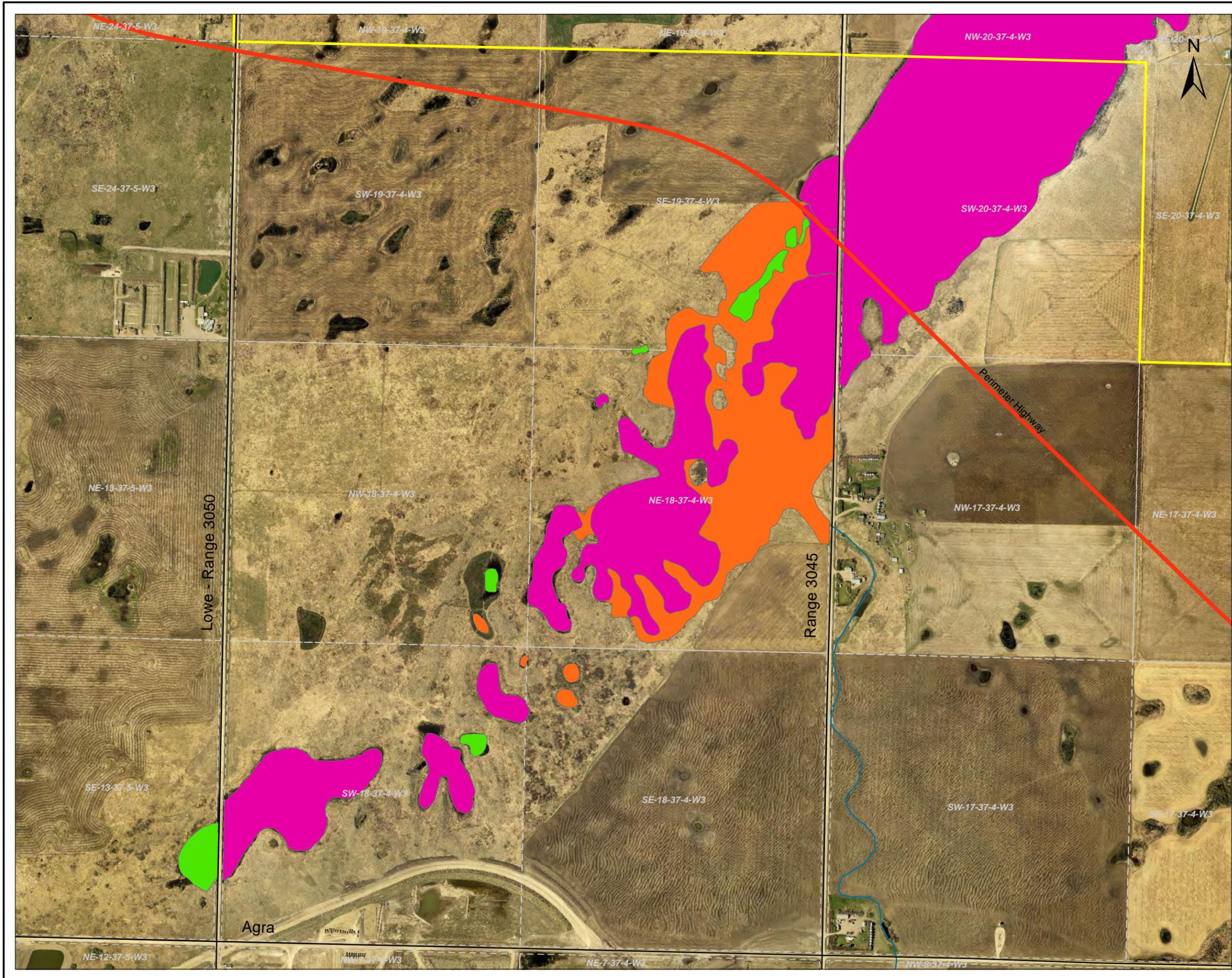
- Legend
- Unserviceable land
 - City limits
 - Perimeter Highway
 - Existing roads
 - Existing water course



NWT	NU	 PREPARED BY Stantec
AB	SK	
 Area of Interest		FIGURE NO. <div style="text-align: center; font-size: 24px; font-weight: bold;">1</div>
USA		



Last Modified: SEP 08, 2012 By: hysentme

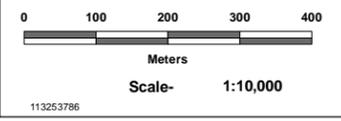


North East Swale Development Guidelines

Wetland Classes (Stewart and Kantrud)

Projection: UTM Zone 13 NAD 83
 Acknowledgements: Original Drawing by Stantec.
 Imagery: 2011 (20cm)

- Legend
- Class 1- Ephemeral
 - Class 2- Temporary
 - Class 3- Seasonal
 - Class 4- Semi-permanent
 - Class 5- Permanent
 - City limits
 - Perimeter Highway
 - Existing roads
 - Existing water course



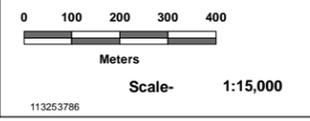
	<p>PREPARED BY</p>
<p>FIGURE NO.</p> <p>2</p>	

Last Modified: SEP 08, 2012 By: hysentme

Important Ecological and Heritage Areas

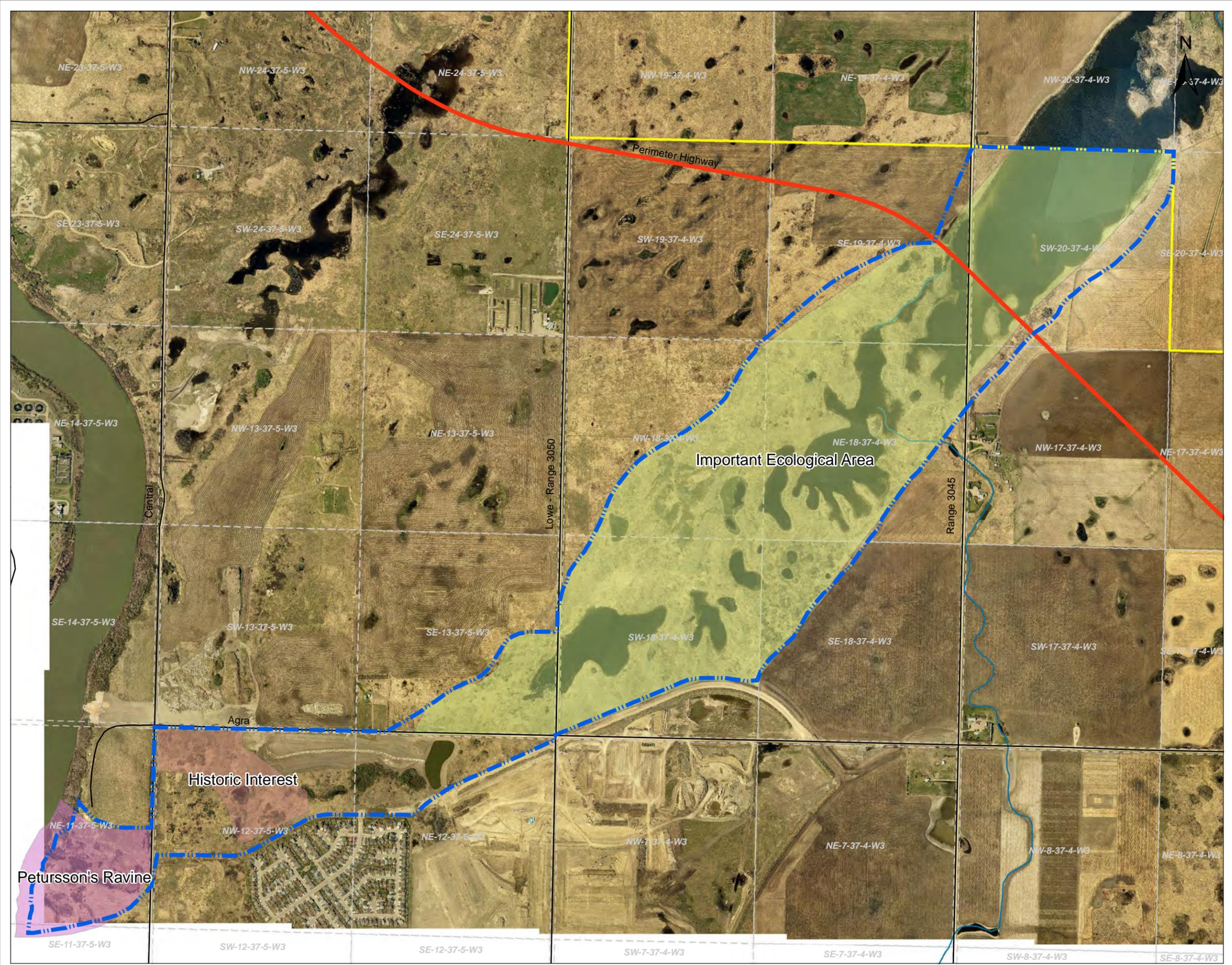
Projection: UTM Zone 13 NAD 83
Acknowledgements: Original Drawing by Stantec
Imagery: 2011 (20cm)

- Legend**
-  Historic Interest
 -  Important Ecological Area
 -  Petursson's Ravine
 -  Swale Boundary
 -  City limits
 -  Perimeter Highway
 -  Existing roads
 -  Existing water course



PREPARED BY

FIGURE NO. **3**



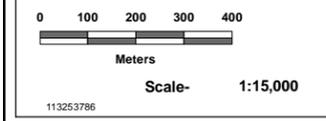
last modified: SEP 09, 2012 By: hysentme

Northeast Swale Boundary

Projection: UTM Zone 13 NAD 83
Acknowledgements: Original Drawing by Stantec.
Imagery: 2011 (20cm)

Legend

-  Swale Boundary
-  City limits
-  Perimeter Highway
-  Existing roads
-  Existing water course



PREPARED FOR

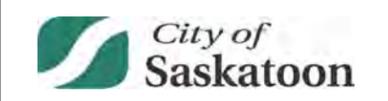
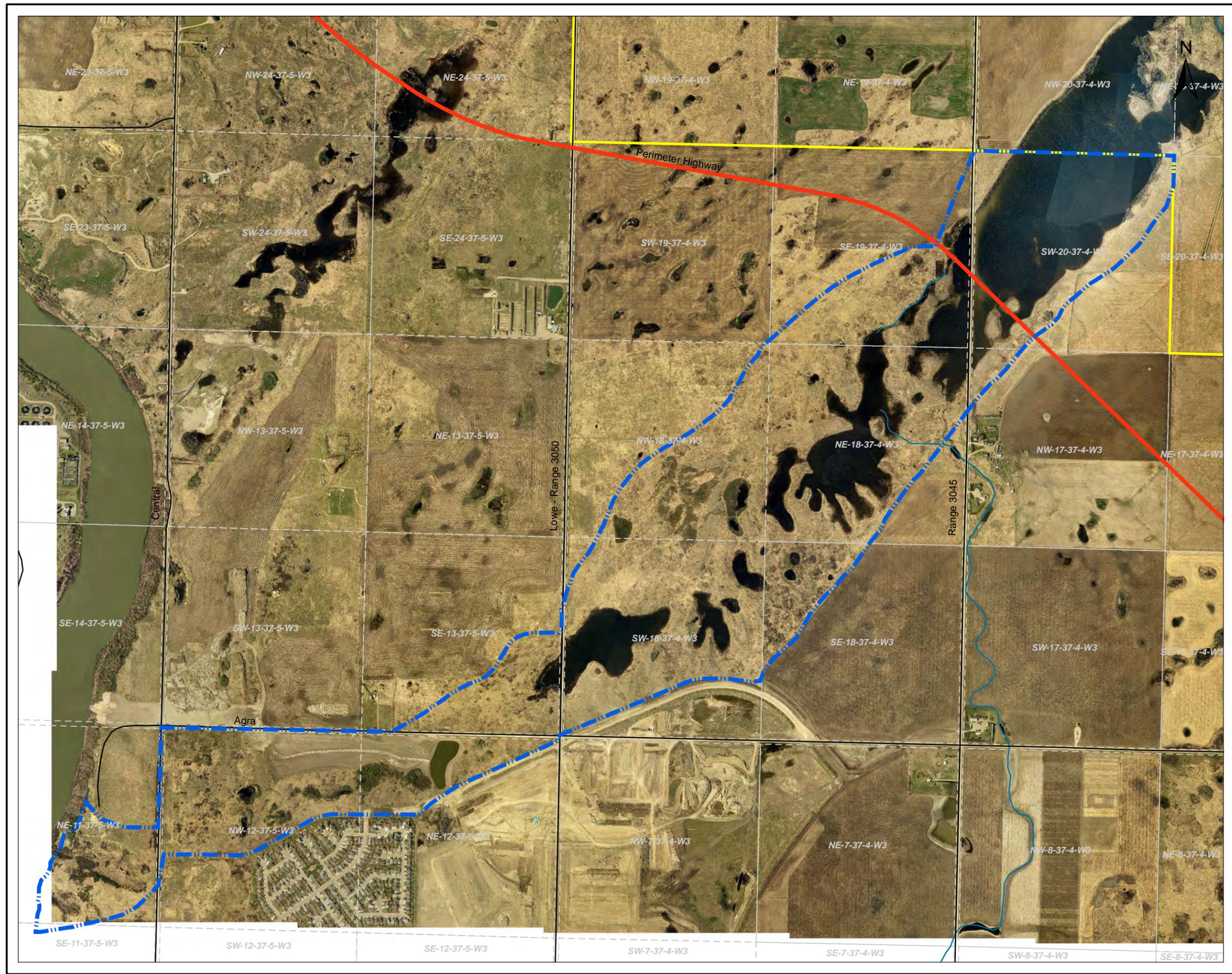
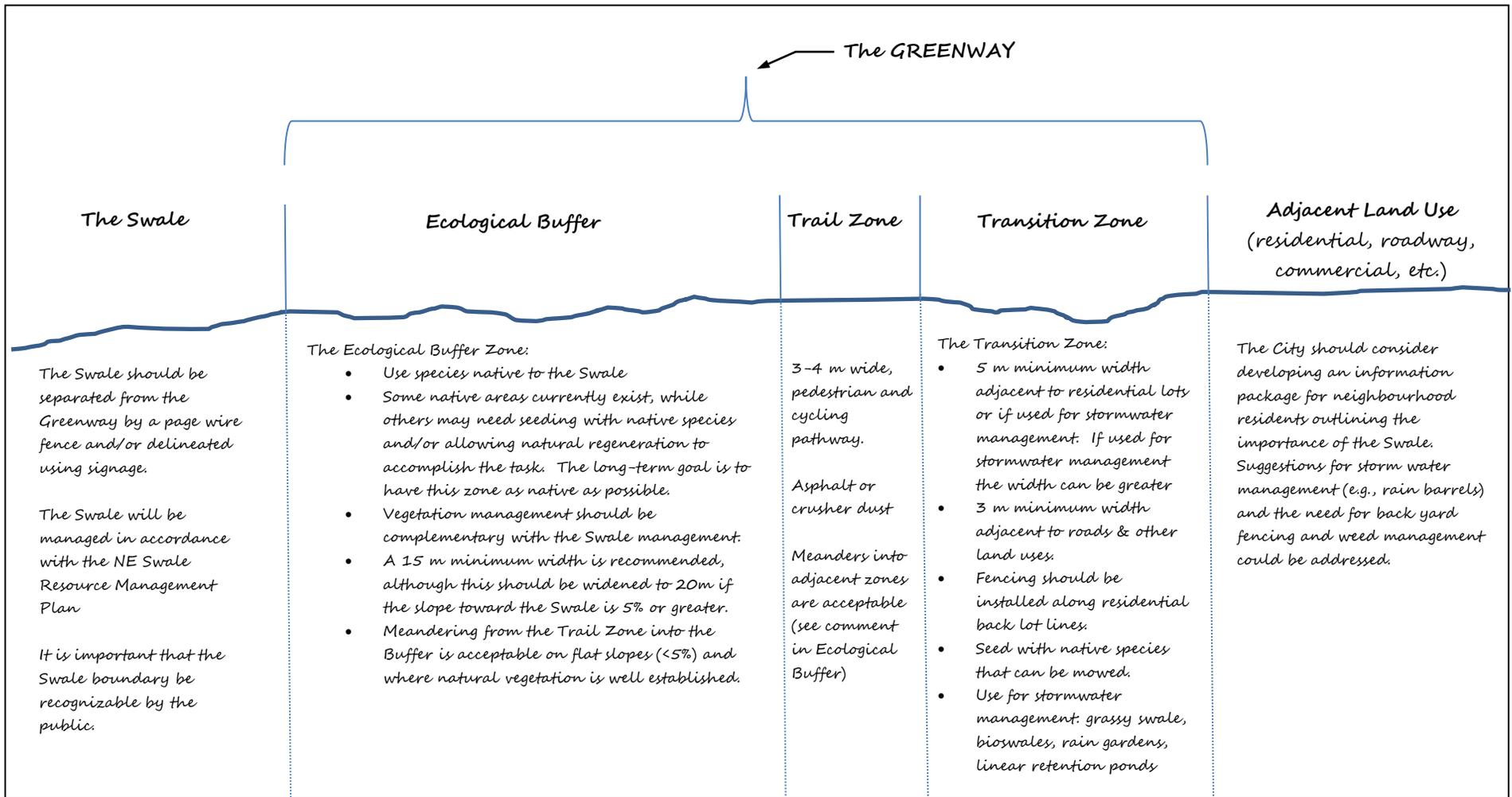


FIGURE NO. **4**



Last Modified: SEP 09, 2012 By: hysentm

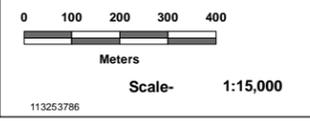


Transportation and Utility Crossings

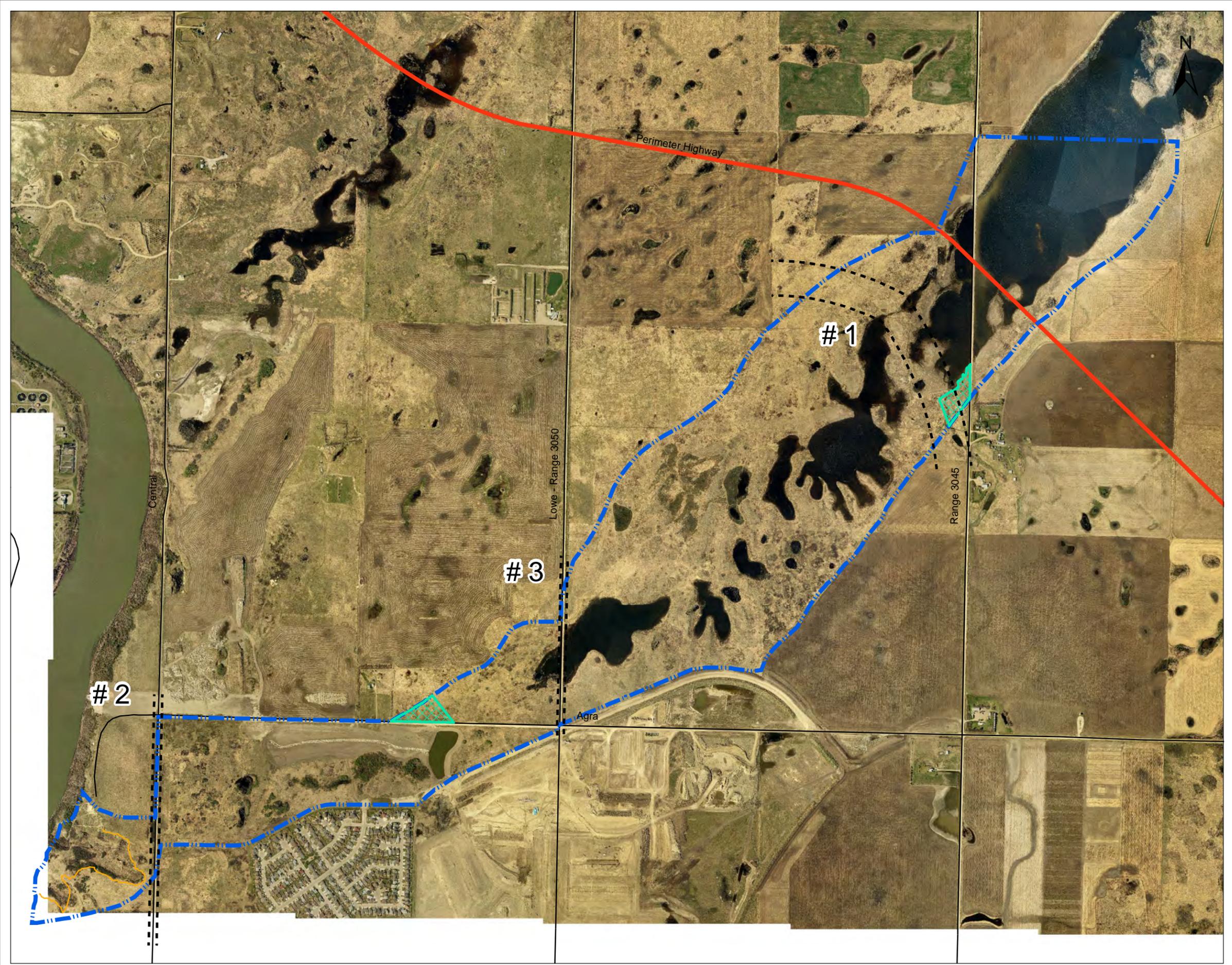
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Acknowledgements: Original Drawing by Stantec.
Imagery: 2011 (20cm)

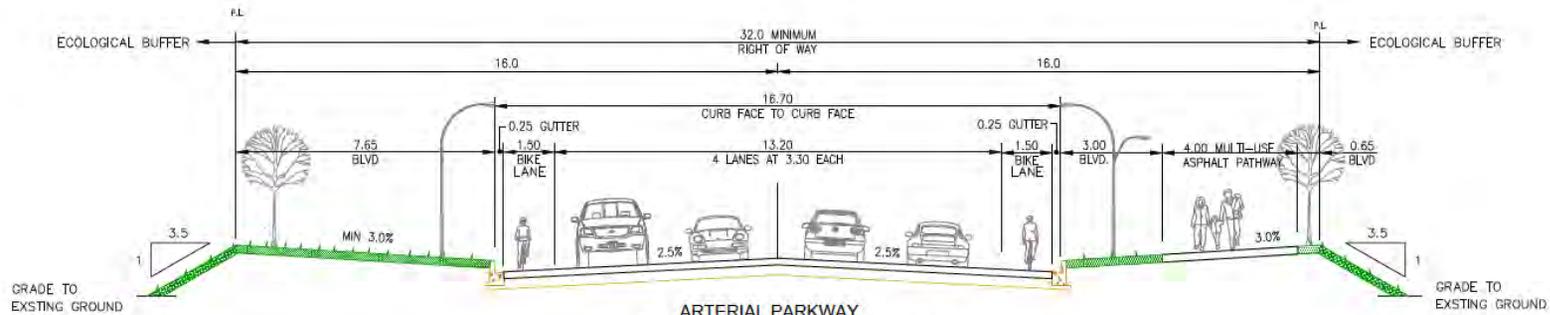
Legend

- - - Crossing #
-  Potential Stormwater Works
-  Swale Boundary
-  Perimeter Highway
-  Existing Roads
-  Peturrson's Ravine bank top



	PREPARED BY
FIGURE NO.	6





ARTERIAL PARKWAY

SCALE 1:150 / 1:75

ARTERIAL PARKWAY DESIGN

- 1. POSTED SPEED = 50 km/h
- 2. NO SUPERELEVATION ON CURVES
- 3. SIGNS: WILDLIFE CROSSING
PEDESTRIAN CROSSING
NO STOPPING

TRANSPORTATION BRANCH – FUNCTIONAL		
DESIGNED	DESIGNED FOR	DATE
DESIGNED	DATE	
DESIGNED	DATE	
DESIGNED	DATE	
DRAWN BY	UT	DATE 2012-11-27



UNIVERSITY HEIGHTS SECTOR
MARQUIS DR TO McORMOND DR
PROPOSED ARTERIAL ALIGNMENT
NORTH EAST SWALE PARKWAY
2011 AERIAL IMAGE SHOWN

GENERAL MANAGER	
SCALE: 1	DATE
REV. AS SHOWN	
DEPT. AS SHOWN	
SHEET NO.	PLAN NO.
	249-0061-103R001

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9.5.12



Stantec

Client/Project
CITY OF SASKATOON
NORTHEAST SWALE DEVELOPMENT
GUIDELINES

Figure No.

7

Title

Crossing Concept
(McOrmand Dr.)

Appendix B: Recommended Seed Mix

Native Species Mix Recommendations for the NE Swale Greenway and Road Rights-of-way
Prepared by: Meewasin Valley Authority, 2012

NE Swale Greenway

The recommended seed mix and rates for the NE Swale Greenway are given in Table 1. The proportion of species was determined based on the composition of native grass species found in the swale (Table 2), as well as looking at species mixes recommended for similar areas (City of Saskatoon recommendations at Hyde Park, *Native Species Mixtures for Restoration in the Prairie and Parkland Ecoregions of Saskatchewan*, and *Rebuilding your Land with Native Species*). A rate of 40 PLS seeds/sq foot is recommended for reestablishment of native grasses in the Moist Mixed Grasslands (Wark, Gabruch, Penner, Hamilton, & Coblun). Table 1 represents an ideal mix for the northeast swale. However, the realities of native grass seed source availability, as well as the price of native seeds, may result in alteration, and it is not expected that all species will be included. If a species can not be found, than the other species should be redistributed to ensure a similar distribution.

Canada wild rye is found in very limited numbers in the swale, but because it is an early successional species, it is recommended at a higher rate than indicated by the species composition at the swale. Both western and northern wheatgrass are rhizomatous species and are recommended at no more than 3.5 PLS seeds/square foot, as this is the suggested rate to ensure they do not dominate the planted area (Wark et al). Purple Prairie Clover is not found in the swale but is given as an additional or alternative legume to include. However, both are common in nearby native areas, and are the only native legumes commercially available. The presence of a legume can have a positive effect on the long term health of the native grasses (Mike Schellenbourg, personal communication).

Table 1. Recommended native seed mix for the NE swale Greenway.

Common Name	Scientific Name	Percentage in Mix	PLS seeds/sq foot	Seeding Rate (kg/ha)*
Western Porcupine Grass	<i>Stipa spartea v. curtisetata</i>	15%	6	5.4
Blue grama	<i>Bouteloua gracilis</i>	10%	4	0.3
Plains Rough fescue	<i>Festuca altaica ssp. Hallii</i>	10%	4	1.0
Canada wildrye	<i>Elymus Canadensis</i>	10%	4	1.7
Purple Prairie Clover	<i>Astragalus canadensis</i>	10%	4	0.8
Canadian Milkvetch	<i>Dalea purpurea</i>	10%	4	0.7
Western wheatgrass	<i>Agropyron smithii</i>	5%	2	0.9
June grass	<i>Koeleria cristata</i>	5%	2	0.1
Northern wheatgrass	<i>Elymus lanceolatus (syn. Agropyron dasystachyum)</i>	5%	2	0.7

Common Name	Scientific Name	Percentage in Mix	PLS seeds/sq foot	Seeding Rate (kg/ha)*
Awne d wheatgrass	<i>Agropyron subsecundum</i>	5%	2	0.7
Green needlegrass	<i>Stipa viridula</i>	2.5%	1	0.3
Mat muhly	<i>Muhlenbergia cuspidata</i>	2.5%	1	0.3
Needle and Thread	<i>Stipa comata</i>	2.5%	1	0.4
Slender wheatgrass	<i>Agropyron trachycaulum</i>	2.5%	1	0.4

*Based on seeds/lb given in Wark, Gabbruch, Penner, Hamilton, & Coblun

Table 2. Percentage cover of select species (native grasses) found in quadrats at the Northeast swale (Delanoy, 2002)

Common Name	Scientific Name	Weighted average cover
Western Porcupine Grass	<i>Stipa spartea v. curtiseta</i>	12.3%
Blue grama	<i>Bouteloua gracilis</i>	4.3%
Plains Rough fescue	<i>Festuca altaica ssp. Hallii</i>	3.9%
Canada wildrye	<i>Elymus Canadensis</i>	0.03%
Purple prairie clover	<i>Dalea purpurea</i>	No
Western wheatgrass	<i>Agropyron smithii</i>	4.7%
June grass	<i>Koeleria cristata</i>	1.6%
Northern wheatgrass	<i>Elymus lanceolatus (syn. Agropyron dasystachyum)</i>	1.5%
Awne d wheatgrass	<i>Agropyron subsecundum</i>	1.4%
Green needlegrass	<i>Stipa viridula</i>	0.8%
Mat muhly	<i>Muhlenbergia cuspidata</i>	1%
Needle and thread	<i>Stipa comata</i>	0.5%
Slender wheatgrass	<i>Agropyron trachycaulum</i>	0.2%
Prairie sandreed	<i>Calamovilfa longifolia</i>	0.1%
Little bluestem	<i>Schizachyrium scoparium</i>	Yes*

*found elsewhere in swale but not in quadrats.

Road Right-of-way Recommendations

Most of the species recommended in table 1 will not survive along the road ROW because of the presence of road salt. A typical salt tolerant mix (recommended by Ducks Unlimited Canada) for this ecoregion is comprised of Western wheat grass, slender wheat grass, alkali grass, and tufted hair grass in equal proportions. As all these species are found within the swale, this mix is recommended for the ROW. Additional species that could also be included or substituted are Nuttali salt meadowgrass, blue grama, and salt grass.

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