



NORTHEAST AREA STRUCTURE PLAN

BYLAW 16—2022
24 OCT 2022



TABLE OF CONTENTS

	Executive Summary	1
01	Purpose, Background & Context	2
	PART 1.1 Purpose	2
	PART 1.2 Background	3
	PART 1.3 Context	4
02	Policy Framework Context	8
	PART 2.1 Compliance	8
	PART 2.2 Policy Compliance	9
	PART 2.3 Plan Interpretation	11
03	Analysis of Existing Conditions	12
	PART 3.1 Natural	12
	PART 3.2 Built Form	15
04	Opportunities & Constraints	22
05	Generalized Future Land Use Concept	24
	PART 5.1 Overall Vision	24
	PART 5.2 Shadow Plan Area	27
	PART 5.3 Density	28
	PART 5.4 Industrial	28
	PART 5.5 Commercial & Industrial Service	29
	PART 5.6 Buffer Area & Reserve Land	30
	PART 5.7 Recreation	31
	PART 5.8 Development Sequence	32
06	Utility Services	34
	PART 6.1 Water	36
	PART 6.2 Wastewater/Sanitary	36
	PART 6.3 Stormwater	38
07	Transportation Network	40
	PART 7.1 Rail	40
	PART 7.2 Roads	42
08	Policies	43
	PART 8.1 Land Use Policies	43
	PART 8.2 Utility Services Policies	47
	PART 8.3 Transportation Network Policies	48
	PART 8.4 Neighbourhood Structure Plans	49
09	Implementation, Monitoring & Amendment	50
	PART 9.1 Implementation	50
	PART 9.2 Monitoring	51
	PART 9.3 Amendment	51

APPENDICES

The following reports are provided for reference purposes and do not form part of this bylaw.

A	Market Study	52
B	Environmental Review	102
C	Servicing Review	182
D	Transportation Impact Assessment	246
E	Phase 1 Environmental Site Assessment	278

LIST OF FIGURES

FIGURE 1	Plan Location	5
FIGURE 2	Plan Area	7
FIGURE 3	Plan Area Topography	13
FIGURE 4	Existing Land Use	17
FIGURE 5	Plan Area Context	19
FIGURE 6	Land Ownership	21
FIGURE 7	Future Land Use Concept	25
FIGURE 8	Sequence of Development	33
FIGURE 9	Water Distribution	35
FIGURE 10	Sanitary Servicing	37
FIGURE 11	Stormwater Management	39
FIGURE 12	Transportation Network	41

LIST OF TABLES

TABLE 1	Current Land Use District Allocation by Area*	16
TABLE 2	Unique Well Identifier Summary	18
TABLE 3	Land Ownership Distribution	20
TABLE 4	Land Use Concept Statistics	26
TABLE 5	Shadow Plan Future Land Use Concept Statistics	27

EXECUTIVE SUMMARY

The **Northeast Area Structure Plan** (“Northeast ASP” or “the ASP”) provides a policy framework to guide more detailed planning, subdivision and development of an industrial neighbourhood in the northeast quadrant of the City of Lloydminster. Additionally, it provides rudimentary development analysis of Shadow Plan Areas within the Rural Municipality of Britannia, which abut the ASP boundary to the east and north.

The ASP provides a high-level land use and engineering analyses of the suitability of the plan area for industrial development and assesses the natural and built environments to identify opportunities and constraints to future development. Furthermore, the ASP provides preliminary analyses of the existing water, sanitary, stormwater and transportation systems to identify what improvements may be required to support full build out.

Buffer Areas throughout the plan area provide setbacks to natural and constructed wetlands and watercourses and act to separate less compatible uses. Buffer areas may be designated as environmental reserve or municipal reserve where appropriate, and as determined by a Neighbourhood Structure Plan in collaboration with the City of Lloydminster.

Lastly, based on the preliminary analyses, the ASP offers policy direction to guide the development of Neighbourhood Structure Plans and future land uses and installation of municipal infrastructure. The ASP also provides direction for the implementation and monitoring of the document over time.

01

PURPOSE, BACKGROUND & CONTEXT

This section introduces readers to the Northeast ASP, where it is located and current landownership within the plan area.

PART 1.1

PURPOSE

The Northeast Area Structure Plan (“Northeast ASP” or “the ASP”) provides a high-level land use and engineering analyses for the plan area, which is the area of study defined by the boundary of the Area Structure Plan. It sets the stage for Neighbourhood Structure Plans to provide detailed analyses in the future to support specific subdivision and development applications consistent with this ASP.

It also offers rudimentary land use analysis for adjacent ‘shadow plan’ areas within the Rural Municipality of Britannia (‘RM of Britannia’ or ‘the RM’), which are for discussion purposes only and not statutory.

BACKGROUND

The Northeast ASP was initiated by the City's Land Division Department with the intention of providing clarity on the future use of the subject lands as well as provide clarity to the RM of Britannia on how lands adjacent to its boundary may develop over time.

The original Northeast ASP was adopted in 2020 as Bylaw 32-2020. The boundary included approximately **120 ha** (296 ac) future residential lands, and the boundary did not include the Lloydminster Agricultural Exhibition Association Grounds, the Lloydminster Golf & Curling Centre lands, or the CP Railway and yards ("the existing developed lands"). Accordingly, the technical studies found in Appendices A through E do not provide analyses of these already developed lands yet are still valid for the remainder of the undeveloped lands within the ASP. Under the current Area Structure Plan policy, a market analysis is not required. However, since the original ASP was supported by the Market Study found in **Appendix A**, it is provided strictly for information purposes as aspects of its analysis no longer apply to the plan area.

In 2022, the City updated its Area Structure Plan Policy to allow for greater market responsiveness in the development industry. The new policy reduced the level of detail required in ASPs, restricted their use for parcels of land greater than a quarter section in area, and introduced non-statutory Neighbourhood Structure Plans (NSPs) to guide smaller, neighbourhood-scale development. The NSPs support specific subdivision and development proposals within the ASP boundary through detailed environmental, land use and engineering analyses without requiring the same rigorous approval process as ASPs.

Also in 2022, the City annexed approximately **23.5** quarter sections of land from the County of Vermilion River. With the addition of this land, a review of the original Northeast ASP was undertaken with an eye to land use allocation across the City. It was concluded that including residential land in the middle of an otherwise industrial neighbourhood was not in keeping with best planning practices, nor was it consistent with the City's Municipal Development Plan, which requires industrial land to be separated from non-compatible uses, such as residential. Further, post-annexation, residential demand could be accommodated in other areas with less potential for land use conflict. Therefore, the decision was made to remove the residential land use from the Northeast ASP.

This new Northeast ASP provides a framework for future growth in Lloydminster's northeast lands with policies that have been established to ensure growth occurs in a logical and integrated pattern, support efficient use of existing infrastructure and expansion thereof, and reduces potential land use conflicts with incompatible land uses.

CONTEXT

LOCATION

As shown in **Figure 1 Plan Location**, the plan area is located east of Highway 17, between 52nd Street and 67th Street, and bounded on the east by the RM of Britannia. The plan area for the Northeast ASP is approximately **595.60 ha** (1,471.75 ac) as shown in **Figure 2 Plan Area**. Of this, approximately **114 ha** (281.6 ac) represents the existing developed lands.

SHADOW PLAN AREA

The Northeast ASP is adjacent to lands in the RM of Britannia. As such, development inside the Northeast ASP boundary may affect future land uses in the RM of Britannia and vice versa. The purpose of the Shadow Plan Area is to provide consistency and continuity to future land uses and primary transportation routes across the municipal boundaries.

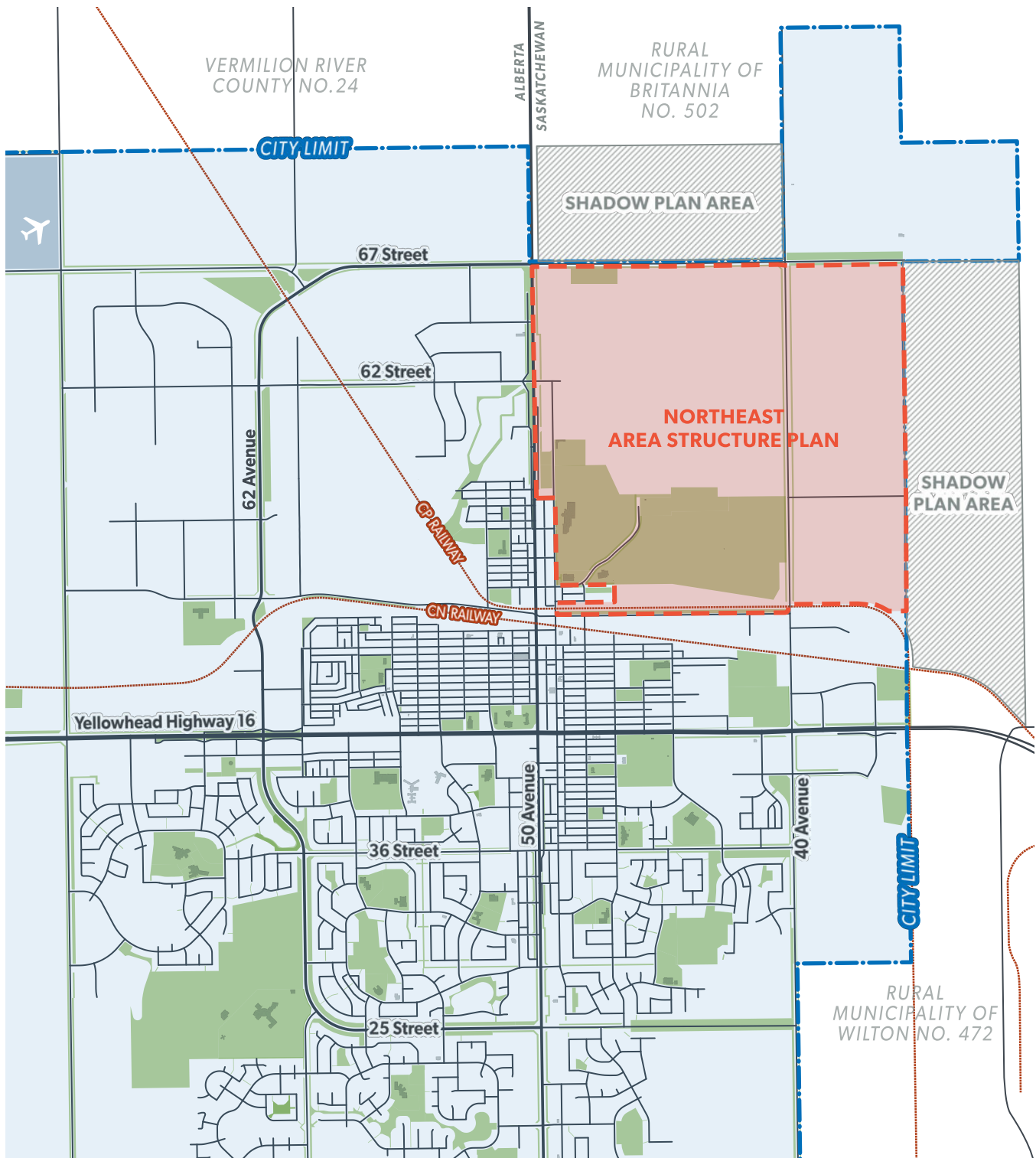
The Shadow Plan Area represents approximately **368.2 ha** (909.8 ac) but has no statutory effect; and the RM of Britannia is not required to adhere to the land use designations or road locations shown in the Shadow Plan Area. Any suggested land use designations and road locations proposed in this ASP are for discussion purposes only and are not statutory requirements. Accordingly, the Shadow Plan Area may be revised at the discretion of the RM of Britannia prior to development to reflect circumstances at the time, and any future changes to the Shadow Plan Area would not trigger an amendment to this ASP.

MARKET DEMAND

A detailed Market Study was prepared by Urbanics Consultants Ltd. for the original ASP boundary to determine the demand for residential, retail, office, industrial, and institutional land in Lloydminster. With the removal of residential land uses from the Northeast ASP, this aspect of the Urbanics report is no longer applicable.

However, the Market Study notes that in a medium market share scenario over the study period to 2046, market demand for industrial and retail space at the Northeast ASP lands is estimated to be **329 ha** (812 acres).

A copy of the Market Study is provided in **Appendix A**.



LEGEND

- - - - - City Boundary
- - - - - ASP Boundary
- Shadow Plan Area

- Roads
- - - - - Railroads

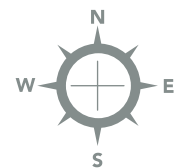


FIGURE 1

Plan Location

PUBLIC ENGAGEMENT

A virtual public open house was hosted by the City on June 16, 2022. A full account of the event is found in the What We Heard report dated July 22, 2022, found on the City's Your Voice Lloyd website (www.yourvoicelloyd.ca/NEASP). The following summarizes and paraphrases from the *What We Heard Report*.

The engagement event was promoted through the following channels:

- Mailed letters to northeast area landowners/stakeholders
- Email invites to relevant contacts
- City of Lloydminster social media posts/stories
- City of Lloydminster news release
- Meridian Source Newspaper
- Digital Billboards
- Economic Development email newsletter
- Community Engagement email newsletter

Questions raised focused on the following topic areas:

01/ Effect of the ASP on existing residential property and land uses in the plan area,

02/ Future planning requirements and approvals process, and

03/ The adequacy of the transportation network to support the proposed uses.

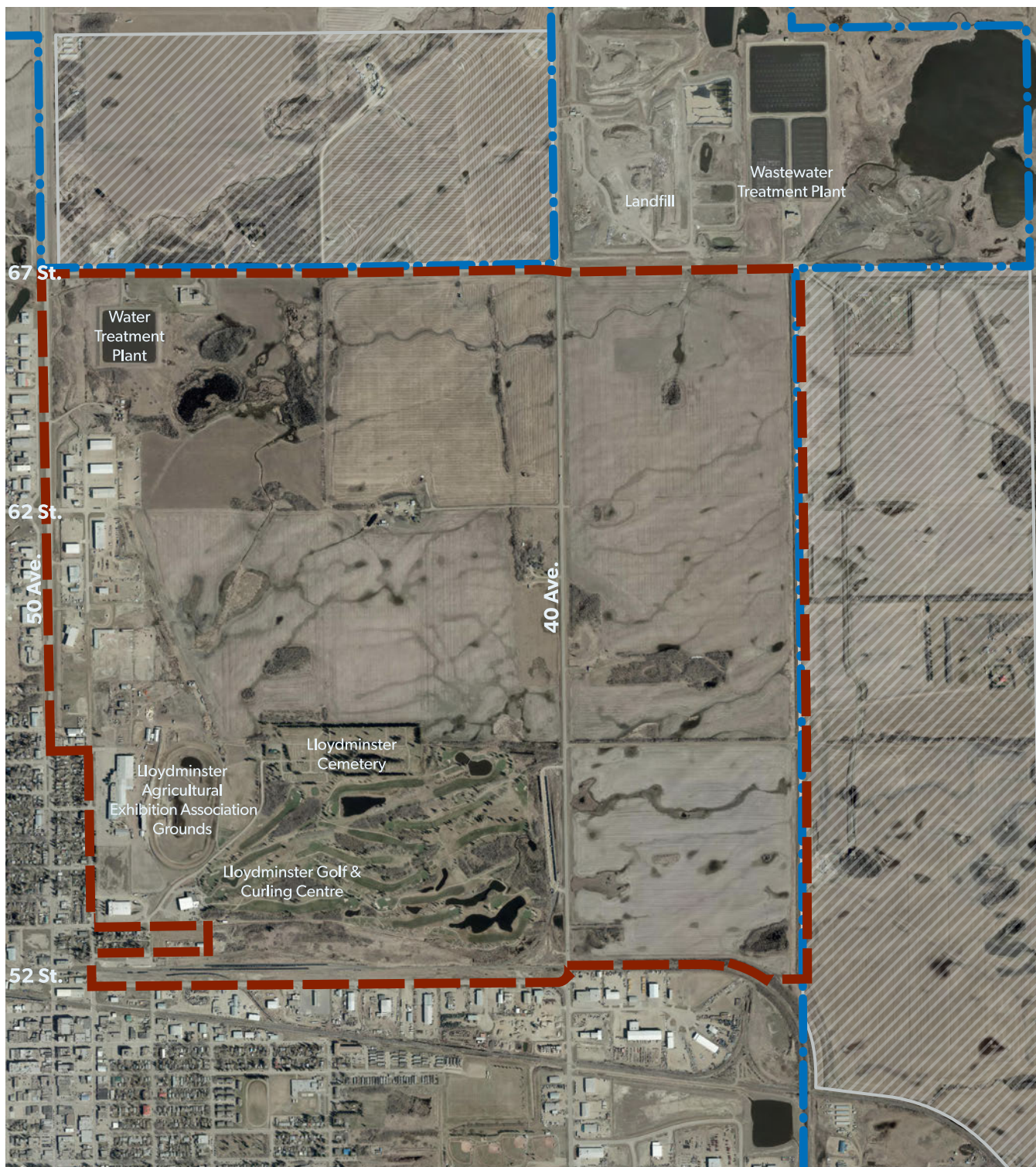
City responses to the questions:

01/ The land use bylaw that affects residential properties is not being changed. All your current rights to development will remain. This plan only touches on the area surrounding you and the future development of the area.

At this time, there are no plans to change the existing land use. As per the Land Use Bylaw, which dictates development rights, it will not be amended in accordance with this Northeast Area Structure Plan amendment. Land Use bylaws will be amended closer to the time of development, through the review and approval of a Neighbourhood Structure Plan.

02/ Once the Area Structure Plan (ASP) is adopted, future subdivision, redistricting and development must be supported by a Neighbourhood Structure Plan (NSP), which are approved by Administration rather than Council if the NSP complies in all respects with the Northeast ASP. Neighbourhood Structure Plans must follow existing Council policy available on the City's website.

03/ A Traffic Impact Assessment has been completed for the Northeast ASP and identifies required transportation network improvements to support the proposed land uses. The removal of residential development from the Northeast Area Structure Plan decreases the number of daily trips local roadways in the area will experience, reducing demand. Also of note is that because the residential land uses have been removed, the extensive trails network previously proposed was also removed. However, sidewalk requirements for roadways remain in place to support non-vehicular modes of transportation for commuters.



LEGEND

- • — City Boundary
- - - ASP Boundary
- Shadow Plan Area

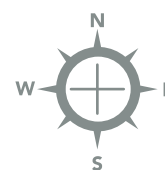


FIGURE 2
Plan Area

02

POLICY FRAMEWORK CONTEXT

This section outlines the policy framework that enables and directs the Northeast ASP and its relationship to other plans and bylaws within Lloydminster.

PART 2.1

COMPLIANCE

Per the Lloydminster Charter, ASPs are governed under the Alberta Municipal Government Act which provides direction for the contents of an ASP, ensuring they describe:

- The sequence of development proposed for the area;
- The land uses proposed for the area, either generally or with respect to specific parts of the area;
- The density of population proposed for the area either generally or with respect to specific parts of the area; and
- The general location of major transportation routes and public utilities.

POLICY COMPLIANCE

MUNICIPAL GOVERNMENT ACT (MGA)

The MGA empowers municipalities to shape their communities. It regulates how municipalities are funded and how, as local governments, they should govern and plan for growth.

With respect to Area Structure Plans, the MGA sets forth the criteria for what they must address. As noted above, this includes the sequence of development, the proposed land uses, the density of population and the general location of major transportation routes and public utilities.

LLOYDMINSTER PLANNING DISTRICT OFFICIAL COMMUNITY PLAN (OCP)

The OCP provides policy direction and guidelines for the RM of Wilton, the RM of Britannia and the City of Lloydminster related to the region's physical, social and economic development. The City and RMs have mutual and long-term interests in how the area is developed.

The Northeast ASP was developed to be consistent with the OCP.

LLOYDMINSTER MUNICIPAL DEVELOPMENT PLAN (MDP)

This Northeast ASP was created at the same time the Municipal Development Plan was undergoing a major review in 2022. The Northeast ASP complies with the policies of MDP in effect at the time of production but not with the Map 2 Future Land Use Concept given the changes proposed herein. The changes in land use contained in this Northeast ASP will be represented in the new MDP.

The Lloydminster Municipal Development Plan (MDP) was amended previously to reflect the 2020 Northeast ASP. The 2022 MDP rewrite will correct the land use designations to reflect this Northeast ASP.

This ASP upholds the sound planning principles encouraged through policy in the MDP by:

- Facilitating orderly and contiguous development in the northeast area of the City;
- Providing significant lands for industrial uses;
- Locating industrial lands in appropriate locations to reduce land use conflict with incompatible uses;
- Clustering industrial uses to support partnerships and increase productivity; and
- Restricting non-industrial uses in areas designated for industrial development.

AREA STRUCTURE PLAN POLICY 610-03

The purpose of ASP Policy 610-03 is to create a framework and provide clarity for the preparation of a long-range planning document for undeveloped parcels larger than one quarter section, which applies to the Northeast ASP.

The Policy requires an ASP provide a network level analysis of transportation and utility services, and generalized land use designations, leaving details to the Neighbourhood Structure Plan stage. The ASP must describe the following in a generalized manner:

- Proposed use of land;
- Density of the population;
- Sequence of development; and
- General location of all major transportation routes and public utilities.

LAND USE BYLAW

The Future Land Use Concept prepared for the Northeast ASP can be accommodated within the Lloydminster Land Use Bylaw (LUB). Land use designations shown on the Future Land Use Concept (Figure 7) do not signify land use districts specified in the LUB. Future development proposals within the areas currently districted Urban Transition (UT) District will require an amendment to the LUB to redistrict the lands prior to development. Redistricting applications will need to be supported by an approved Neighbourhood Structure Plan.

PLAN INTERPRETATION

MAP INTERPRETATION

Unless otherwise specified within this plan, the boundaries or locations of any symbols or areas shown on a map are approximate only, not absolute, and shall be interpreted as such. They are not intended to define exact locations except where they coincide with clearly recognizable physical features or fixed boundaries such as property lines or utility/road rights-of-way. No measurements or area calculations should be taken from the ASP maps.

POLICY INTERPRETATION

Where “*shall*”, “*will*”, “*must*” or “*require*” are used in a policy, the policy is considered mandatory to achieve a desired result.

Where “*should*” is used in a policy it is anticipated that the policies will be applied in all situations unless it can be clearly demonstrated to the satisfaction of the Development Authority, that the policy is not reasonable, practical, or feasible in a given situation.

03

ANALYSIS OF EXISTING CONDITIONS

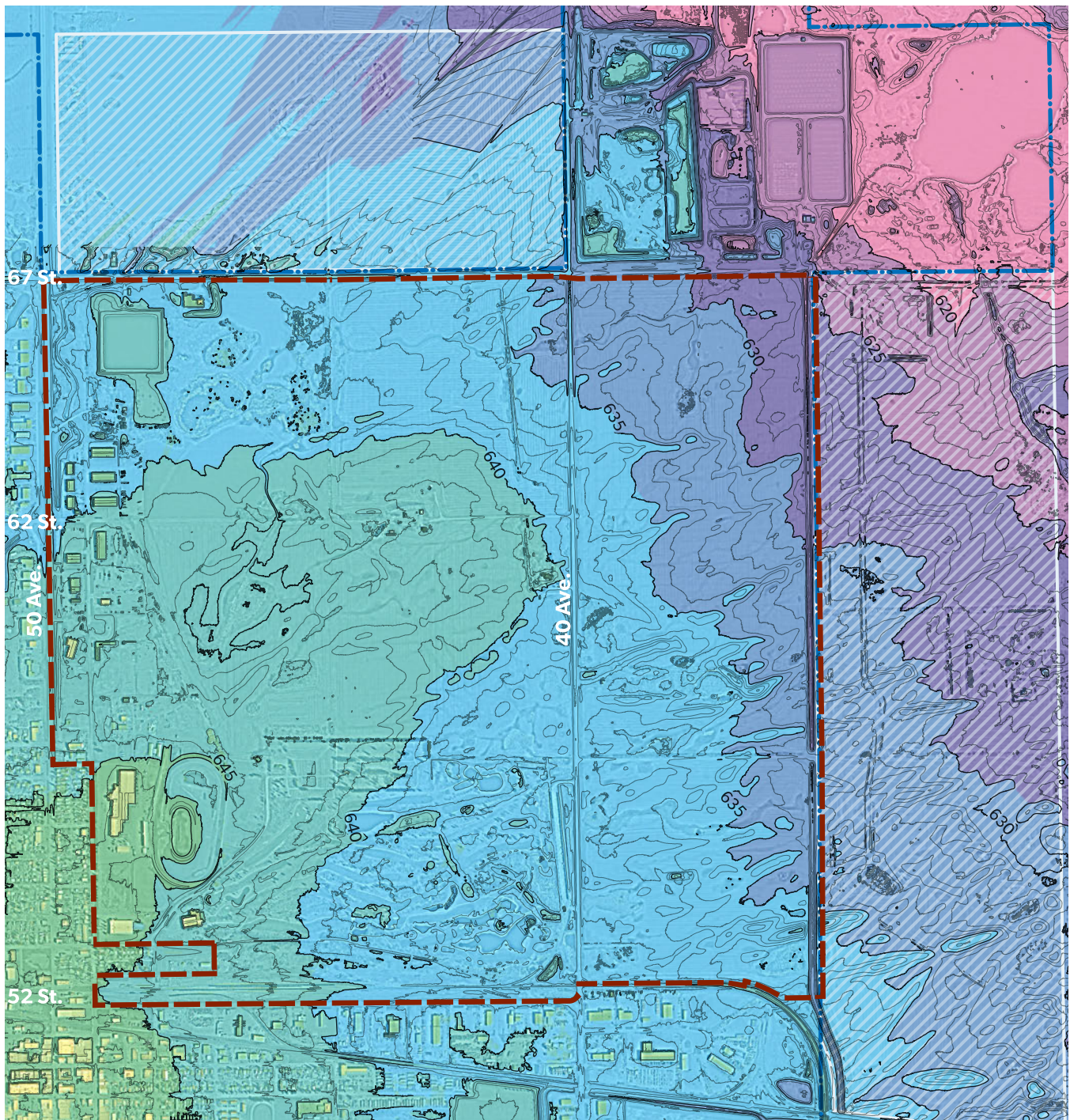
This section provides context and analysis of the existing conditions within the plan area.

PART 3.1

NATURAL

SOILS

Soils in the area within and surrounding the ASP are predominantly black loam with dark gray and gray Luvisolic soils. These soils have moderate limitations that reduce the choice of crops and require moderate conservation practices. Future development will require earthworks that will likely result in admixing of soils, erosion, and sedimentation. Additionally, soils from outside the ASP lands may be used as fill during development. At the development stage, the Development Authority may request that an erosion and sediment control plan be implemented to address potential issues.



LEGEND

--- City Boundary

--- ASP Boundary

▨ Shadow Plan Area

— 5 m Contour Interval

— 1 m Contour Interval

Ground Elevation

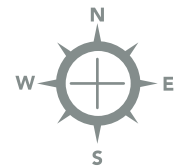
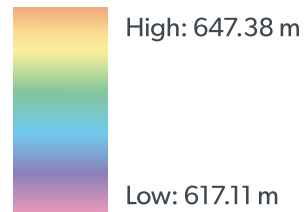


FIGURE 3

Plan Area Topography

WATER

Wetlands identified within the plan area include marshes, swamps, and a watercourse. One artificial wetland feature (City of Lloydminster Water Treatment Plant) was also identified in the plan area. Of the wetland features, 10 have been identified as being likely permanent which may require preservation, or equivalent naturalised reconstruction where preservation is not feasible. An Environmental Review is provided in **Appendix B**.

TOPOGRAPHY

The topography within the ASP is relatively flat as most of these lands have been actively cultivated or developed. Some depressional wetland areas are present. The lands generally slope from the west to east, and from south to north, representing an overall grade change of approximately 20 m (from 645m to 625m) as shown on **Figure 3 Plan Area Topography**.

VEGETATION

Vegetation within the plan area is mainly cultivated, interspersed with numerous wetlands and treed areas including treed wetlands and windrows. The treed areas are dominated by Aspen species. A modified watercourse is located in the northwest corner of the plan area and no rare vegetative species are present. There are no known occurrences of rare animal species or animal assemblages located within the plan area.

BUILT FORM

The lands adjacent to the Northeast ASP have the following land use designations per the LUB, described counterclockwise from the southwest corner of the ASP boundary:

- Medium Density Residential District (R4), Service Commercial District (C5), Light Industrial District (I1), Row House Residential District (R3), Urban Park District (UP) and Central Commercial District (C1) at southwest corner.
- Light Industrial District (I1) along south boundary to the southeast corner.
- Lands within the RM of Britannia along the eastern boundary, which include rural commercial, industrial and agricultural uses.
- Public Utility District (PU) at the northeast corner including the City of Lloydminster Landfill and Waste Water Treatment plant.
- Lands within the RM of Britannia including rural commercial, rural residential and agricultural uses along the northwestern boundary.
- Light Industrial District (I1), Medium Industrial District (I2), Urban Transition District (UT), Urban Park District (UP), Public Utility District (PU), Single Family Residential District (R1), and Service Commercial District (C5) along the west boundary, on the west on the west side of 50th Avenue.
- Service Commercial District (C5), Medium Density Residential District (R4), Row House Residential District (R3), Urban Park District (UP), Light Industrial District (I1) and Central Commercial District (C1) along west boundary east of 50th Avenue.





The ASP borders the RM of Britannia along a portion of the north boundary and the entirety of the east boundary. RM land uses adjacent to the ASP to the north are Agriculture District (A), Rural Commercial (C1), to the east, Agriculture District (A), Industrial District (M1) and Rural Commercial District (C1).

EXISTING LAND USE DISTRICTS

The plan area is predominantly districted as Urban Transition (UT) District to allow for a limited range of agricultural and rural land use activities in a relatively undeveloped state, awaiting urban development and utility servicing. Portions of Light Industrial District (I1) and Service Commercial District (C5) also fall within the plan area as shown on **Figure 4 Existing Land Use**. Existing development in the plan area consists of light industrial and service commercial uses along Highway 17 along the west boundary of the plan area, as detailed below.

TABLE 1

Current Land Use District Allocation by Area*

Land Use District	Area**	
	Hectares	Acres
 Urban Transition District (UT)	369.8	913.8
 Light Industrial District (I1)	105.0	259.4
 Service Commercial District (C5)	1.8	4.4
 Urban Park District (UP)	95.7	236.5
	572.3	1414.1

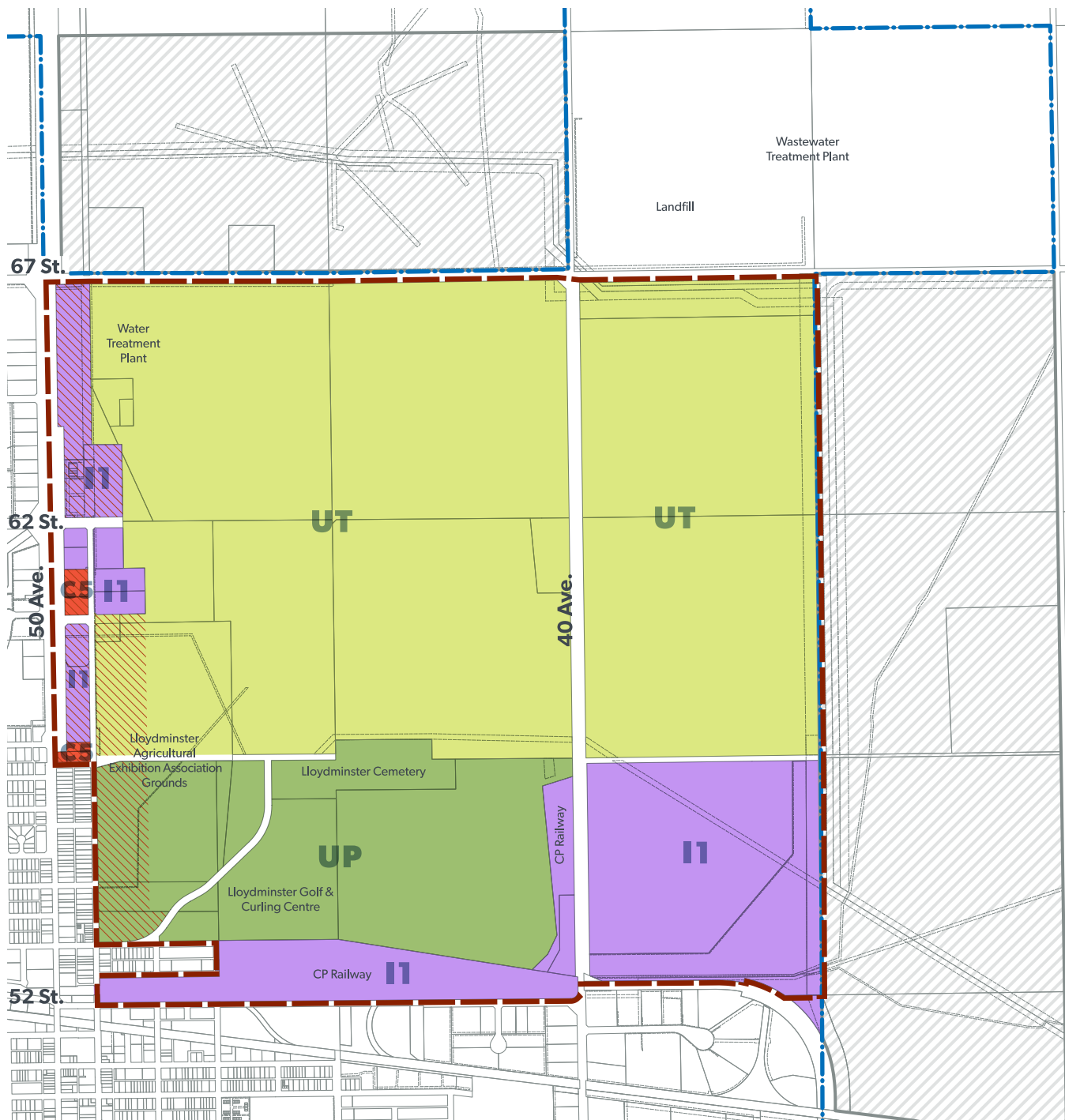
Colours correspond to those depicted in Figure 4.

HISTORICAL RESOURCES

The lands within the plan area have previously been disturbed through extensive farming and currently portions of the west and south support industrial uses. A review utilizing the Government of Saskatchewan’s Land Sensitivity Screening Tool did not identify any of the subject lands as historically significant at this time.

* Land Use Districts are subject to change through future Land Use Amendment applications and/or changes to the LUB.

** Areas are approximate only and any discrepancies are a result of rounding.



LEGEND

--- City Boundary

Highway Corridor Overlay

--- ASP Boundary

Shadow Plan Area

UT – Urban Transition

UP – Urban Park

I1 – Light Industrial

C5 – Service Commercial

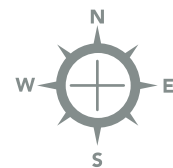


FIGURE 4

Existing Land Use








OIL & GAS INFRASTRUCTURE

There are seven active, suspended, completed or abandoned well locations in the statutory plan area (see **Figure 5 Plan Area Context**). Each well is identified below in **Table 2** and ownership details will need to be confirmed at the Neighbourhood Structure Plan stage. Additionally, there are 14 active and two abandoned well locations in the Shadow Plan Area. These wells are not discussed here as they are outside the statutory limits of the ASP.

Active and suspended wells are primarily concentrated in the central north and northeast plan area. There are four operating and one abandoned liquid petroleum pipelines within or adjacent to the plan area. Future development will conform to legislation with respect to setbacks and development regulations.

TABLE 2

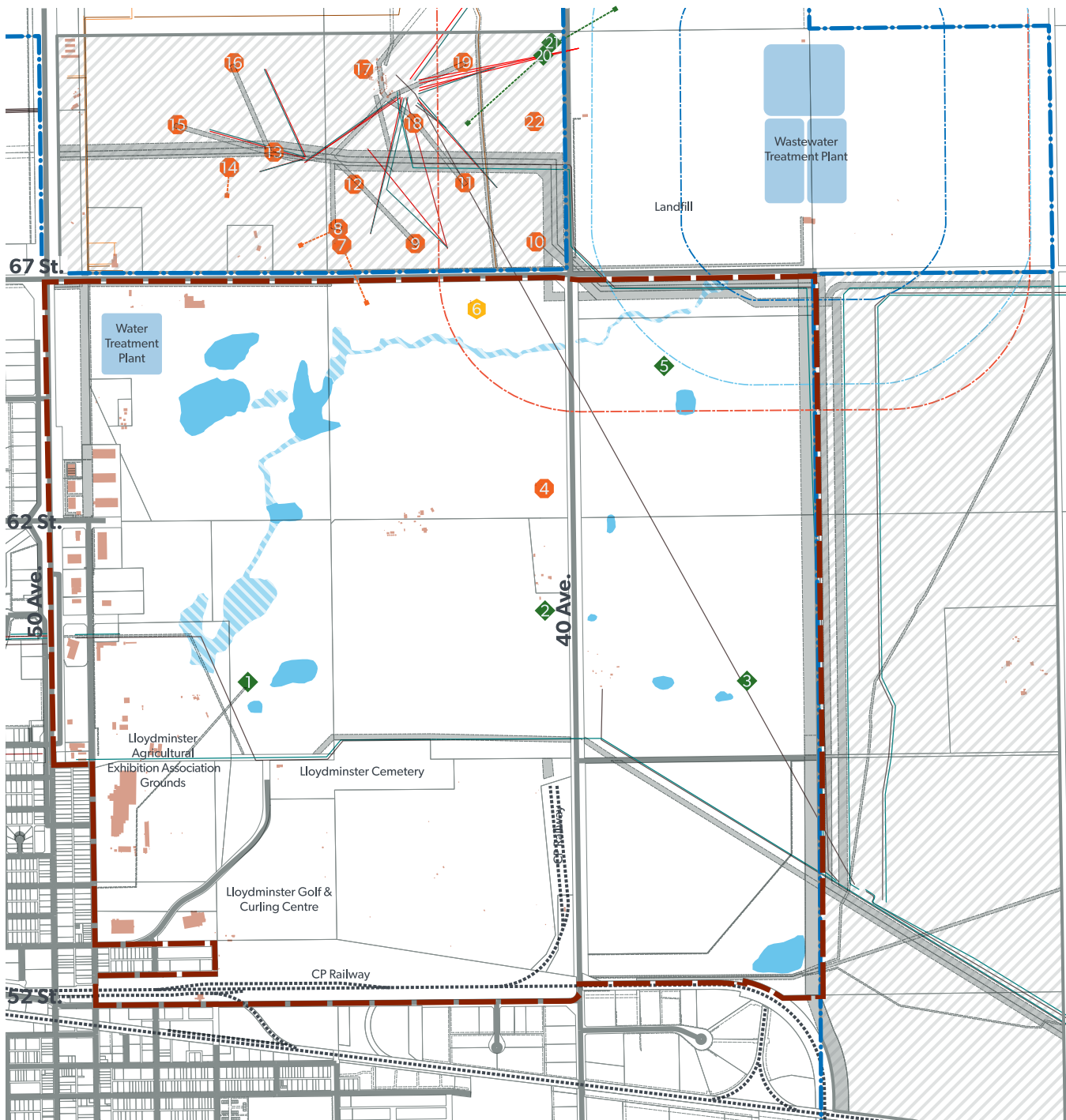
Unique Well Identifier Summary

ID	Unique Well Identifier (UWI)	Owner/Licensee	Spud Date
 1	131/03-11-050-28W3/00	The Lloydminster Gas Company	11/20/1933
 2	111/08-11-050-28W3/00	Cona Resources Ltd.	08/13/1979
 3	101/03-12-050-28W3/00	Abandoned - Owner Obsolete	03/08/1935
 4	111/09-11-050-28W3/00	Original Oil Inc.	08/07/1979
 5	111/13-12-050-28W3/00	Cona Resources Ltd.	03/16/1981
 6	131/16-11-050-28W3/00	West Lake Energy Corp.	07/27/1979
 7	191/15-11-050-28W3/00	West Lake Energy Corp.	12/04/1985

Colours and icons correspond to those depicted in **Figure 5**.

MUNICIPAL INFRASTRUCTURE

Existing water, sanitary, and stormwater infrastructure within the ASP is predominantly located along the west side of the plan area along or near 50th Avenue. The Water Treatment Plant is in the northwest corner of the ASP and an existing watermain runs along 40th Avenue. The existing East Sanitary Trunk and East Drainage Channel both run along the east boundary of the ASP. A Servicing Review is provided in **Appendix C**.



LEGEND

- | | |
|---|---|
| -.-.- City Boundary | # Suspended Oil Well |
| --- ASP Boundary | ◆ Dry/Abandoned Well (w/ downhole) |
| Shadow Plan Area | ● Potentially Permanent Wetland |
| --- Road Network | ▨ Non-Permanent Wetland/Connection |
| -.-.- Rail Line | --- 457 m Landfill Setback |
| Utility Rights of Way | -.-.- 300 m / 600 m Lagoon Setback |
| # Active Oil Well (w/ downhole) | ■ Existing Building |

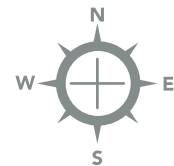


FIGURE 5

Plan Area Context

TRANSPORTATION INFRASTRUCTURE

The ASP is bound by Highway 17 to the west and arterial roadways 52nd Street to the south and 67th Street to the north. The future extension of 62nd Street as an arterial roadway from 50th Avenue to 40th Avenue is identified in the Transportation Master Plan. Fourtieth Avenue bisects the ASP and is designated as an arterial roadway.



A limited street network in the southwest of the ASP, including the termination of 62nd Street, the 50th Avenue service road and a portion of 49th Avenue, provides access to existing light industrial and service commercial development.

Highway 17, 52nd Street, 67th Street and 40th Avenue are designated truck routes and the future extension of 62nd Street will likely be a truck route as an extension of the existing truck route, west of Highway 17. Highway 17, north of 62nd Street, 67th Street and 40th Avenue are designated dangerous goods routes. Access to arterial roads (as identified) from the ASP is limited and subject to access management requirements. A Traffic Impact Assessment is provided in **Appendix D**.

LAND OWNERSHIP

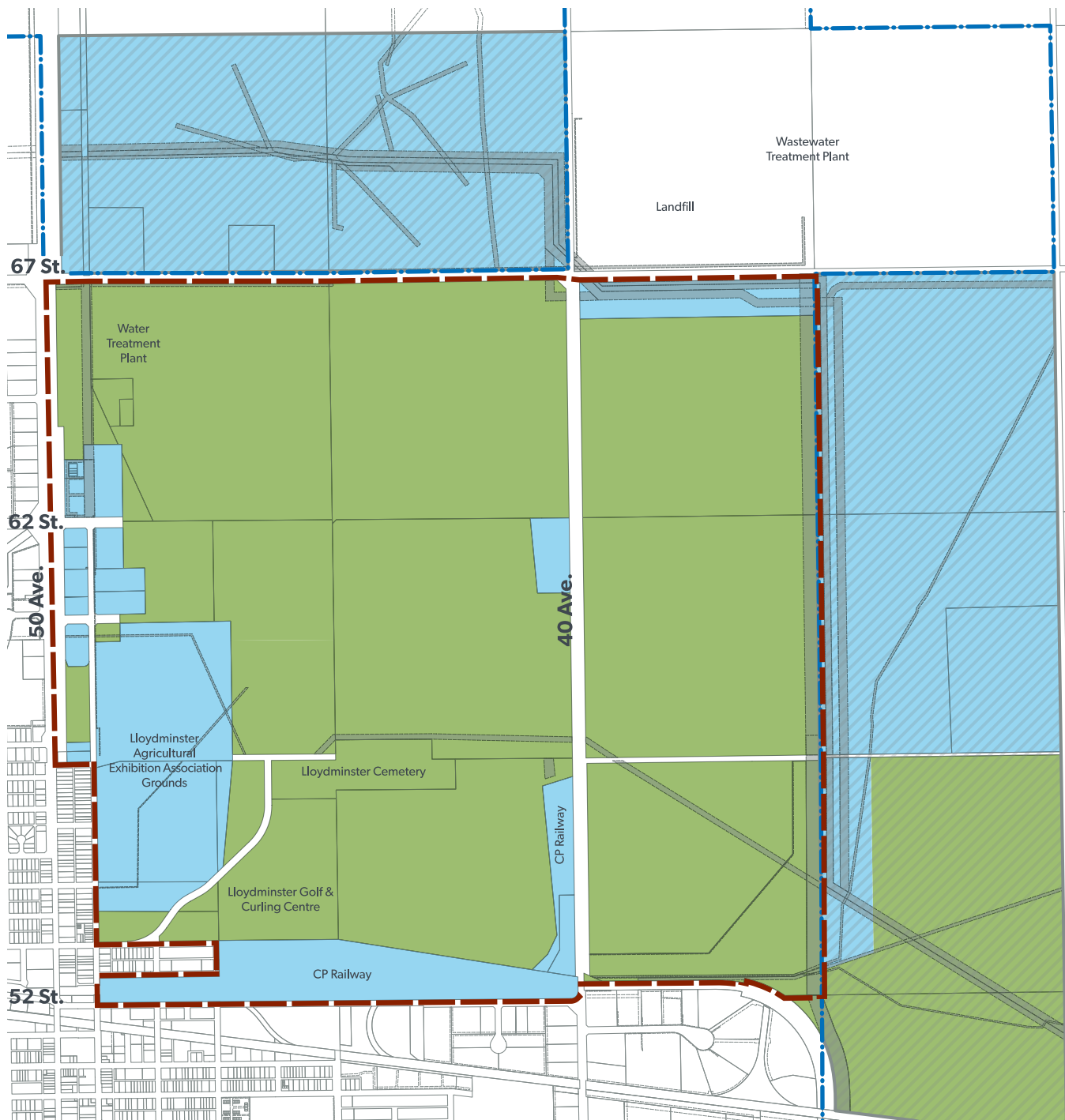
Of the **595.6 ha** plan area, approximately **94.4 ha** or almost **16%** of land is privately owned, while **476.4 ha** or **80%** is publicly owned land, with the City of Lloydminster being the majority public landowner (see **Figure 6 Land Ownership**). A distribution of land ownership within the plan area is summarized in **Table 3** below.

TABLE 3
Land Ownership Distribution

Ownership	Approximate Area*	
	Hectares	Acres
 Publicly Owned Lands	476.4	1177.2
 Privately Owned Lands	94.4	233.3
Roads	24.8	61.3
TOTAL	595.6	1471.8

Colours correspond to those depicted in *Figure 6*.

* Areas are approximate only and any discrepancies are a result of rounding.



LEGEND

- City Boundary
- ASP Boundary
- Shadow Plan Area
- Private Ownership
- Public Ownership
- Right-of-Way

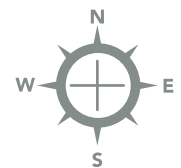


FIGURE 6

Land Ownership

04

OPPORTUNITIES & CONSTRAINTS

This section highlights the opportunities and constraints for future development.

TRANSPORTATION NETWORK

The transportation network as described above provide ample opportunities to service an industrial development area as conceived by the Northeast ASP. The truck and dangerous goods routes along with the proposed extensions of existing roads into the Shadow Plan Area will offer good circulation post development.

Lloydminster has the advantage of being serviced by both CP and CN Rail. Adjacent to the plan area to the south is existing rail infrastructure that could support future spur lines for added service within the Northeast ASP.

CONTAMINATION

A Phase I Environmental Site Assessment (ESA) was commissioned separately by the City on June 24, 2020. Several spills were identified in the plan area that should be remediated prior to future development. A Phase II ESA was also recommended to further understand the scope of contamination on the western portion of the plan area. A copy of the Phase I ESA is provided in **Appendix E**.

In areas identified as requiring a Phase II analysis, the study would be a requirement of the Neighbourhood Structure Plan.

LIMITING DISTANCES

The City's Wastewater Treatment Plant and Sanitary Landfill area are located north of the ASP. Setbacks associated with the wastewater treatment lagoon and landfill limit the proposed uses in the Future Land Use Concept. Neighbourhood Structure Plans will need to identify how to mitigate this constraint.

WETLANDS

A number of existing wetlands were identified by the Environmental Assessment. If compensation is to be avoided, then these wetlands could pose some constraints on development. However, with Provincial approval, some of the wetlands could be incorporated into overall stormwater management plans. More detailed analysis of this opportunity would be required at the Neighbourhood Structure Plan stage.

OIL & GAS INFRASTRUCTURE

There are four abandoned wells, one suspended well and one active well in the plan area, along with pipeline rights-of-way (see **Figure 5 Plan Area Context**). Oil and gas infrastructure may pose a constraint to future development, and subsequent planning work will need to identify mitigation approaches and setback requirements.

05

GENERALIZED FUTURE LAND USE CONCEPT

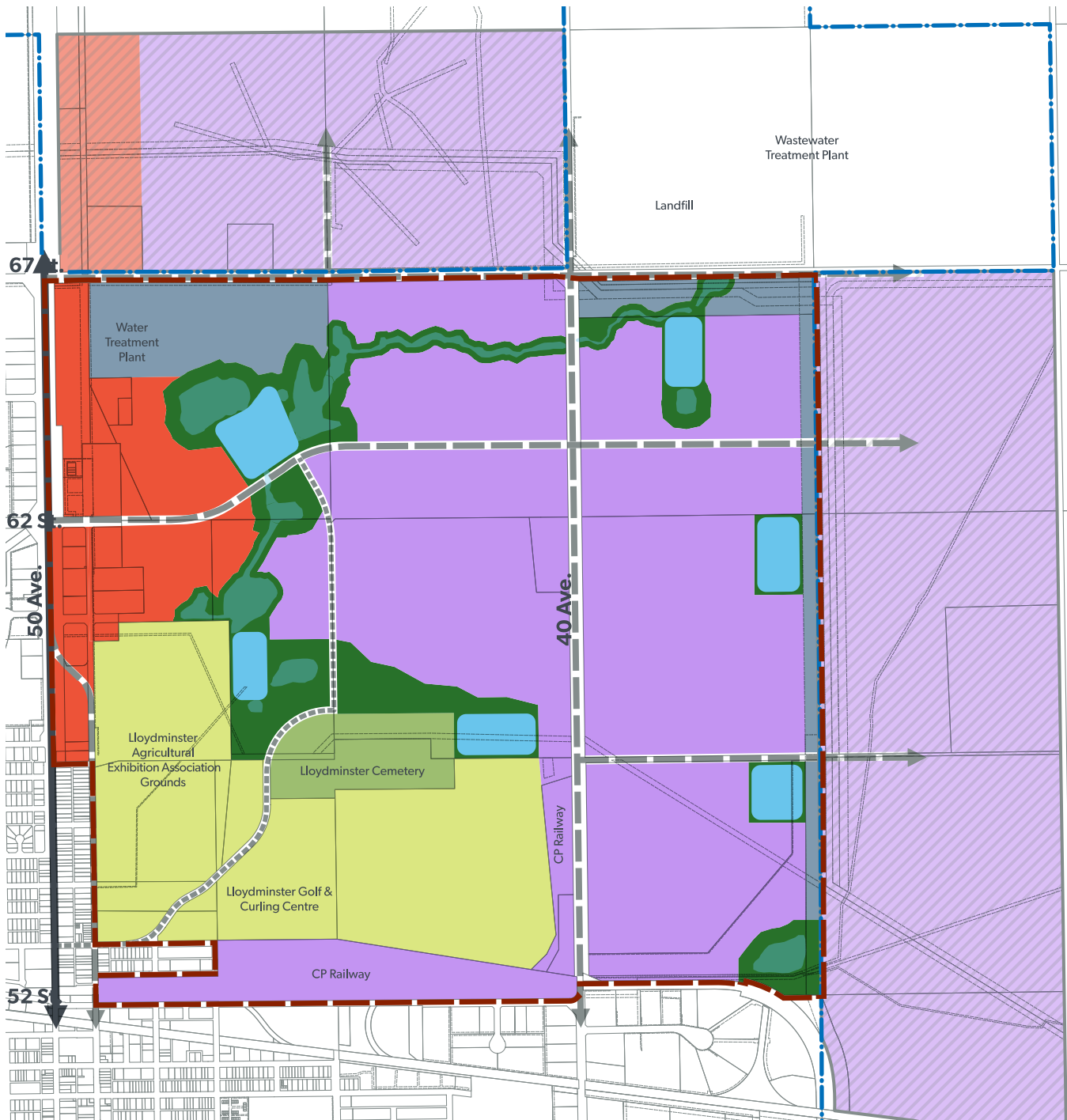
This section provides the overall Development Concept for the Northeast Area Structure Plan.

PART 5.1

OVERALL VISION

The Northeast ASP supports the development of an industrial neighbourhood in the City's northeast quadrant that will respond to current and future market needs for non-residential development (see **Figure 7 Future Land Use Concept**).

The neighbourhood is well situated to support industrial uses as it is separated from incompatible uses by major roadways, serviced by the CP Railway, and includes the limiting distances around the Wastewater Treatment Plant and Landfill within which certain types of non-residential uses can be considered for development.



LEGEND

- | | |
|---|---|
| - - - - - City Boundary | Commercial & Industrial Service |
| - - - - - ASP Boundary | Industrial |
| Shadow Plan Area | Utilities |
| Highways | Cemetery |
| Arterial Roads | Recreation |
| Collector Roads | Storm Water Pond |
| Buffer Area | Wetland |

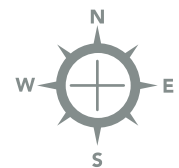














FIGURE 7
Future Land Use Concept

Table 4 below summarizes the proposed distribution of land uses within the plan area.

TABLE 4

Land Use Concept Statistics

Land Use Type	Area (ha.)	Area (ac.)	% of GDA
PLAN AREA	595.6	1,471.8	
 Potential Environmental Reserve (ER)	59.4	146.8	
 Water Treatment Plant	22.8	56.3	
 Cemetery (Existing)	9.0	22.2	
 Cemetery (Expansion)	6.3	15.6	
GROSS DEVELOPABLE AREA	511.2	1263.2	100%
 Commercial & Industrial Service	50.0	123.6	10.04%
 Industrial	246.2	608.4	49.43%
 Industrial (Railway)	28.1	69.4	5.64%
 Recreational (Golf Course)	60.4	149.3	12.13%
 Recreational (Ag Ex)	25.7	63.5	5.16%
 Recreational (Ag Ex Expansion)	20.7	51.2	4.16%
 Utilities	17.5	43.2	3.51%
 Storm Pond	20.4	50.4	4.10%
Roads	29.1	71.9	5.84%
TOTALS	511.2	1263.2	100%

Colours correspond to those depicted in *Figure 7*.



SHADOW PLAN AREA

The Shadow Plan Area considers what types of land uses may be appropriate for adjacent lands in the Rural Municipality of Britannia, Saskatchewan. It also shows how the existing transportation network within the statutory plan area of the Northeast ASP may be extended in the future to service the Shadow Plan Area.

As shown in **Figure 5**, the northern Shadow Plan Area is highly constrained by existing oil and gas infrastructure and by the limiting distances of the Wastewater Treatment Plant and the Sanitary Landfill. The constrained lands are likely to develop after the lands adjacent to Highway 17 and the less constrained eastern Shadow Plan Area.

Table 5 below summarizes the land uses as depicted on **Figure 7**; however, these areas do not take into consideration land for reserves, roadways, utility corridors or stormwater management ponds as may be required to support development in the future.

TABLE 5
Shadow Plan Future Land Use Concept Statistics

Land Use Type	Area (ha.)	Area (ac.)	% of GDA
SHADOW PLAN AREA	368.2	909.8	
 Commercial	22.0	54.4	5.98%
 Industrial	346.2	855.5	94.02%
TOTALS	368.2	909.8	100%

Colours correspond to those depicted in **Figure 7**.

Shadow Plan Area Objectives

- 01/ Consider future land use suited to the areas in collaboration with the RM of Britannia.
- 02/ Avoid potential land use conflicts with uses located within the NE ASP.
- 03/ Consider future transportation network continuity.
- 04/ Support regional growth and development.

PART 5.3

DENSITY

There is no residential development proposed for the area and therefore no residential density calculations are proposed.

The Market Study (**Appendix A**) assumes a commercial floor area ratio (FAR) of 0.35 and an industrial FAR of 0.15 for Lloydminster. Floor area ratio is used to calculate non-residential development density. These figures can be used in Neighbourhood Structure Plans to calculate land requirements for non-residential development.

PART 5.4

INDUSTRIAL

The majority of the plan area provides industrial uses, allowing for industrial uses from the south to merge northwards, and providing opportunity for the extension of rail services northwards to provide access to industrial users in the Northeast ASP. The industrial areas provide additional employment opportunities for Lloydminster. Further planning efforts will need to identify areas of transition between light, medium and heavy industrial uses.

Industrial Objectives

01/ Provide for a range of light, medium and heavy industrial uses to support and accommodate economic growth opportunities for the City and Region.

COMMERCIAL & INDUSTRIAL SERVICE

With the western boundary of the plan being located along Highway 17, it remains an important gateway to the City and future planning efforts will need to take this into consideration, especially on undeveloped sites. The Future Land Use Concept provides for the provision of additional light industrial and commercial development, similar to the existing uses within the plan area. The intersection of Highway 17 and 67th Street is recognized as an important gateway to the City and development should respond to and enhance the importance of this area as an economic driver.

Immediately adjacent to the existing built-out area along the Highway, there is opportunity for additional retail commercial to serve Lloydminster's greater regional area. This area benefits not only from its proximity to Highway 17, but also direct access onto 62nd Avenue, an arterial roadway linking to the remainder of the development area.

The Commercial & Industrial Service areas are flexible in that compatible industrial uses may be located within commercially-dominate areas, and commercial uses may extend into more light industrial areas. The intent is to offer flexibility to developers to respond to changing market demand over time. Delineation of land use will take place at the Neighbourhood Structure Plan stage. The buffer areas and wetland complexes within them that run along the eastern edge of the Commercial & Industrial Service areas serve to separate lighter/commercial-type industrial and commercial uses from the more intensive medium and heavy industry that would be found within the Industrial designation shown as purple on **Figure 7**.

Commercial & Industrial Service Objectives

- 01/** Provide for employment and commercial amenities near where people live, contributing to a livable community,
- 02/** Accommodate larger scale commercial developments securing Lloydminster as a regional hub for shopping, service and commerce, and
- 03/** Provide a non-intrusive buffer between residential and industrial land uses.

BUFFER AREA & RESERVE LAND

The plan boundary contains a number of wetlands, low lying areas and associated trees. In accordance with the Environmental Review (**Appendix B**), a **50 m** setback area has been applied to all permanent wetlands and a **20 m** setback area has been applied to all ephemeral drainage features. Additionally, some land is provided between incompatible uses, such as between the cemetery and surrounding industrial. These areas are shown on **Figure 7** as dark green and labelled “Buffer Area.” The wetlands within the Buffer Area may be integrated into the stormwater management system as stormwater retention ponds, pending Provincial approval. Such ponds will be naturalized to reduce the municipal burden for maintenance, dissuade access, and to help maintain existing habitat.

Lands above stormwater retention pond freeboard lines may be designated as Municipal Reserve at the discretion of the City of Lloydminster in consideration of such factors as, but not limited to, Municipal Development Plan policy, suitability, ongoing maintenance costs, and desirability of public access. Cash in lieu of reserves may be preferred by the City of Lloydminster. Setbacks to existing wetlands may be designated as Environmental Reserve or Environmental Reserve Easement. As a non-residential development area, there is no expectation for the provision of School Reserve in the Northeast ASP.

Buffer Area Objectives

- 01/** Protect and enhance natural areas and environmentally sensitive areas such as wetlands and treed areas,
- 02/** Utilize natural topography and drainage courses to management stormwater runoff while accommodating stormwater management facilities (SWMF), and
- 03/** Offer buffering between incompatible uses.

Reserve Land Objectives

- 01/** Protect natural wetland areas;
- 02/** Provide options for natural area protection; and,
- 03/** Be pragmatic when assessing need for new open spaces in non-residential areas.

RECREATION

The Recreation areas comprise primarily existing developed lands including the Lloydminster Agricultural Exhibition and the Lloydminster Golf and Curling Centre. Additional undeveloped lands directly north of the existing Lloydminster Agricultural Exhibition have been identified as Recreation to accommodate future expansion of the Exhibition grounds.

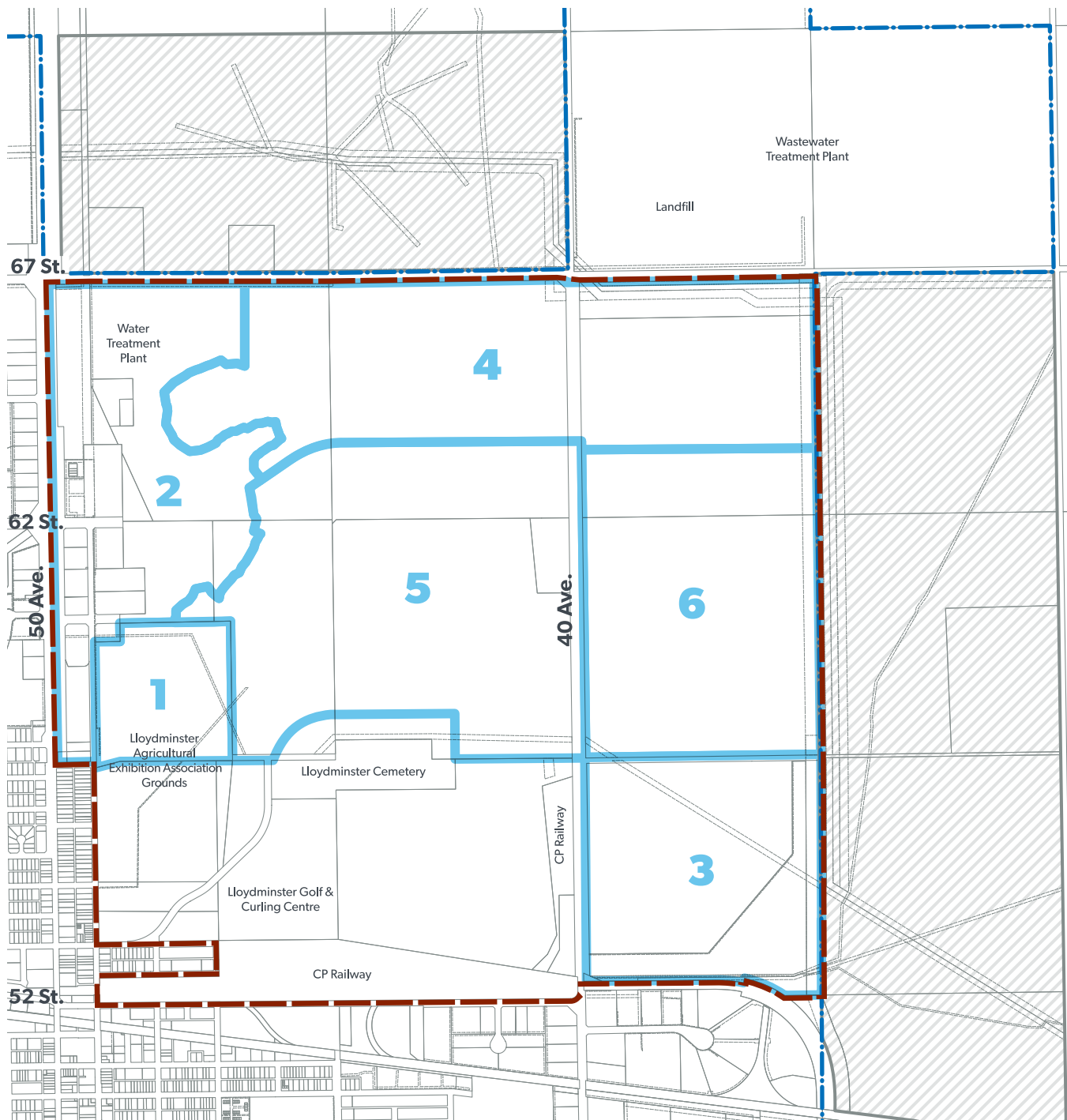
Recreation Objectives

- 01/** Support existing recreational facilities in the Northeast ASP; and,
- 02/** Enhance opportunities for recreational activities in the City and Region.

DEVELOPMENT SEQUENCE

The proposed sequence of development is shown in **Figure 8 Sequence of Development**. The existing developed areas are excluded from the sequencing because they are already developed. It is anticipated the land owned by the Lloydminster Agricultural Exhibition will start developing first, followed by the area directly behind the Highway 17 commercial frontage. After this, development is expected to commence at the southeast corner, followed by the northern plan area, and then the middle of the plan area. The last area to be developed in the plan area is expected to be the eastern side of the plan area. The sequence of development will be influenced by access to services, market forces and other considerations beyond the scope of this document. Deviations from the proposed sequence of development in this ASP will not require an amendment.

The development sequencing for the Shadow Plan Area is outside the scope of this ASP. However, given the constraints of the northern Shadow Plan Area, it is expected to develop after the eastern Shadow Plan Area. In any case, changes in staging that reflect actual market demand and landowner preference will not require an amendment to this ASP.



LEGEND

- .-.-.- City Boundary
- - - - ASP Boundary
- Shadow Plan Area
- 1—6 Phase Boundary

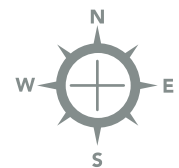


FIGURE 8
Sequence of Development

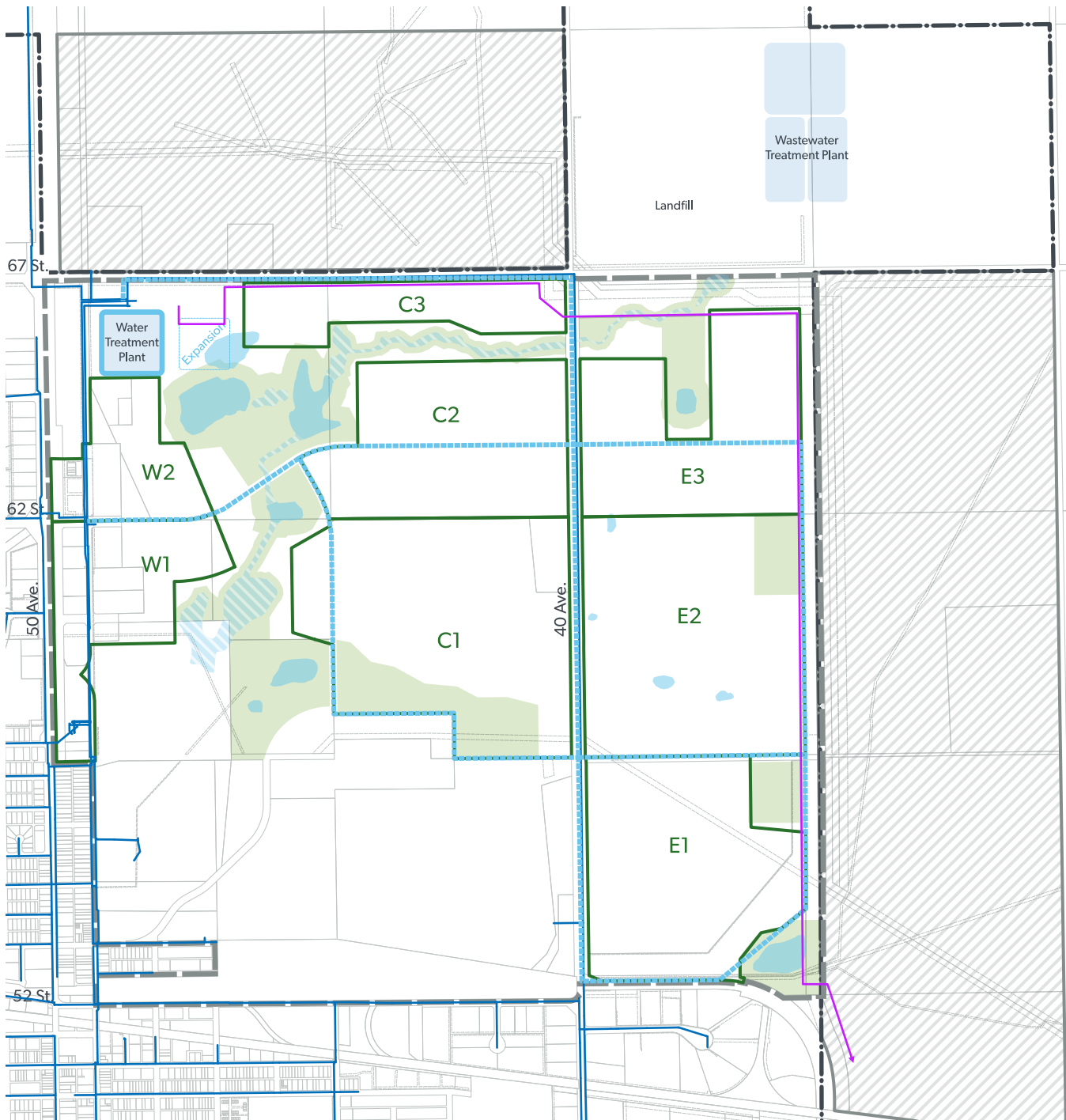
06 UTILITY SERVICES

This section outlines how water, sanitary and stormwater services are provided for within the plan area.

ISL Engineering and Land Services Inc. (ISL) prepared all the servicing studies for this ASP based on the City's Municipal Development Standards and the proposed Future Land Use Concept (**Figure 7**). The level of analysis is higher order for this ASP, and more detailed engineering will be required at the Neighbourhood Structure Plan stage. Therefore, these sections should be considered as guidelines for future detailed studies supporting proposed neighbourhood development concepts.

Overall recommendations include the review and update, as required, of the 2016 Water Master Plan, the 2016 Sanitary Sewer Master Plan and the 2015 Stormwater Master Plan.

The sections that follow contain summary excerpts and recommendations from the technical studies, which can be found in the Appendices should more detail be desired.



LEGEND

--- City Boundary

— ASP Boundary

▨ Shadow Plan Area

— Existing Watermain

C1—W2 Service Area

--- Proposed 300 mm Watermain

— SaskWater Pipeline
(approximate alignment)

▨ Buffer Area

▨ Potentially Permanent Wetland

▨ Non-Permanent Wetland/Connection

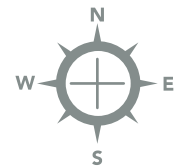


FIGURE 9

Water Distribution

PART 6.1

WATER

Water for consumptive uses and fire protection is proposed to be provided primarily by a **300 mm** watermain along 67th Street and 40th Avenue. The proposed water system comprises a grid main network of **300 mm** watermain tied into the existing network at 40th Avenue and at 49th Avenue to provide adequate looping for the area (see **Figure 9 Water Distribution**).

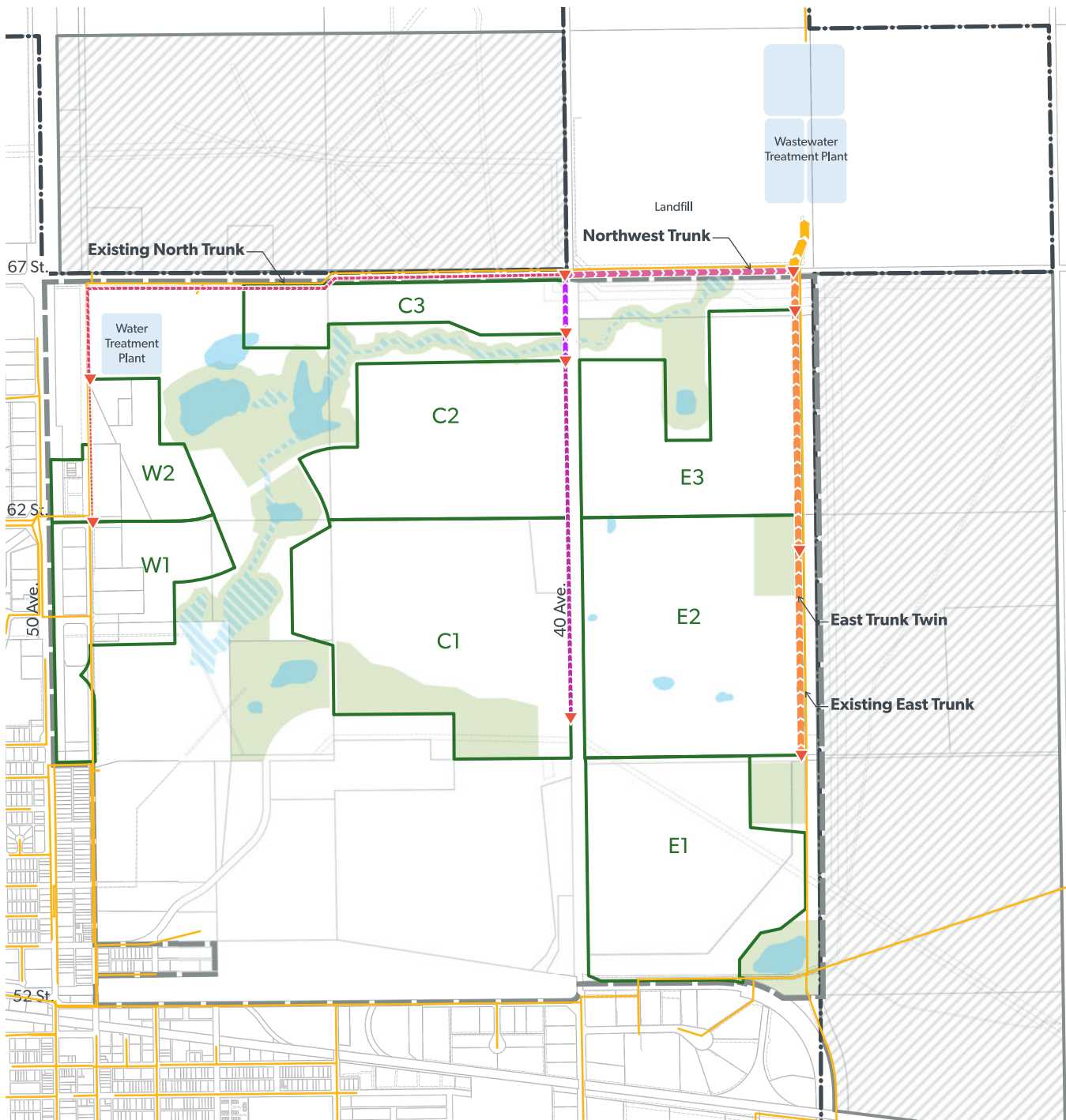
It is recommended that a detailed network analysis be completed to assess the adequacy of the water system as well as impacts to the City's existing system once more detailed employment densities are available.

Existing facilities may need to be upgraded as development proceeds in other areas of the City to ensure adequate water supply and pressure within the plan area. The currently available capacity of both the reservoir storage and the water treatment plant needs to be evaluated to confirm if additional upgrades will be required to facilitate the future proposed development, again once more detailed employment densities are known.

PART 6.2

WASTEWATER/ SANITARY

The proposed wastewater collection system is comprised of a gravity sewer network that connects to the waste water treatment plan northeast of the ASP boundary (see **Figure 10 Sanitary Servicing**). In order to provide wastewater servicing to the plan area, connections are proposed to the East Trunk Twin along the east boundary of the plan, and to the Northwest Trunk as proposed in the 2016 Sanitary Master Plan.



LEGEND

--- City Boundary

— ASP Boundary

▨ Shadow Plan Area

— Existing Sanitary Sewer

□ C1–W2 Service Area Boundary

▼ Service Area Lowest Elevation

Proposed Gravity Sewer

--- 250 mm

--- 375 mm

--- 450 mm

--- 525 mm

--- 1050 mm

--- 1200 mm

--- 1650 mm

■ Buffer Area

■ Potentially Permanent Wetland

■ Non-Permanent Wetland/Connection

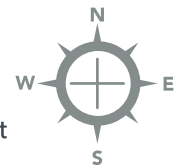


FIGURE 10

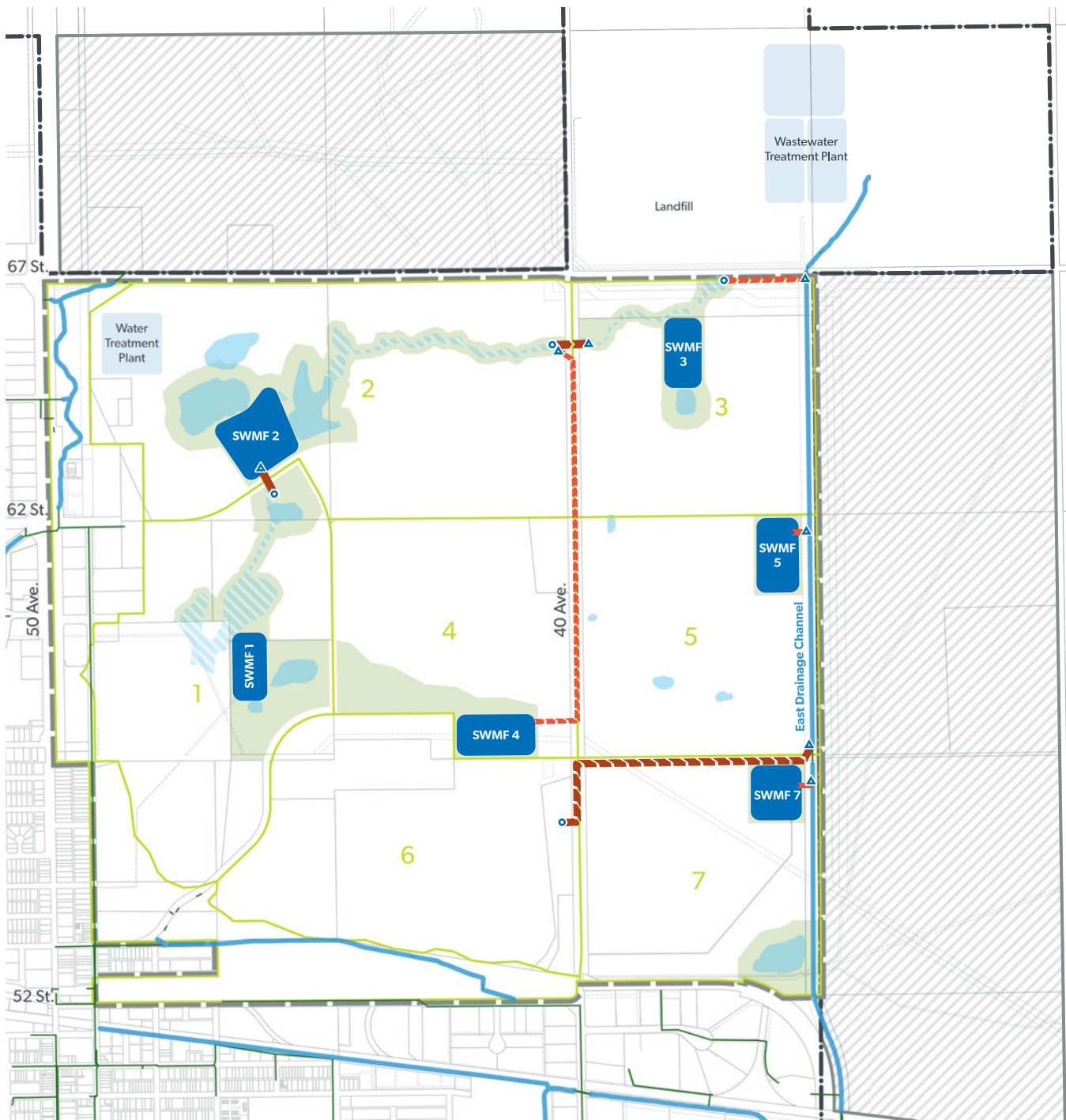
Sanitary Servicing

STORMWATER

Appropriate facilities for stormwater management are proposed throughout the plan area to control stormwater and alleviate the impact of post-development flows on overland conveyance routes.

The proposed system was sized based on a 1:5-year storm event, with stormwater management facilities (SWMFs) sized to withstand the 1:100-year storm event. The stormwater system as proposed consists of pipe and culvert connections to and from the SWMFs, with runoff from the ASP lands being conveyed to the East Drainage Channel, which ultimately discharged into Neale Lake (see **Figure 11 Stormwater Management**).

Implementation of stormwater management facilities is required as development progresses to ensure adequate quantity and quality of control of stormwater runoff is achieved throughout all phases of the plan area.



LEGEND

- | | |
|------------------------------|----------------------------------|
| --- City Boundary | Potentially Permanent Wetland |
| — ASP Boundary | Non-Permanent Wetland/Connection |
| Shadow Plan Area | Proposed SWMF |
| Existing Storm Pond/Channel | Proposed Inlet |
| Existing Storm Pipe | Proposed Outfall |
| 1—7 Storm Catchment Boundary | Proposed 300 mm Pipe |
| Buffer Area | Proposed 600 mm Pipe |

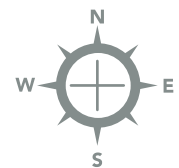


FIGURE 11

Stormwater Management

07

TRANSPORTATION NETWORK

This section addresses how transportation modes are accommodated within and beyond the plan area.

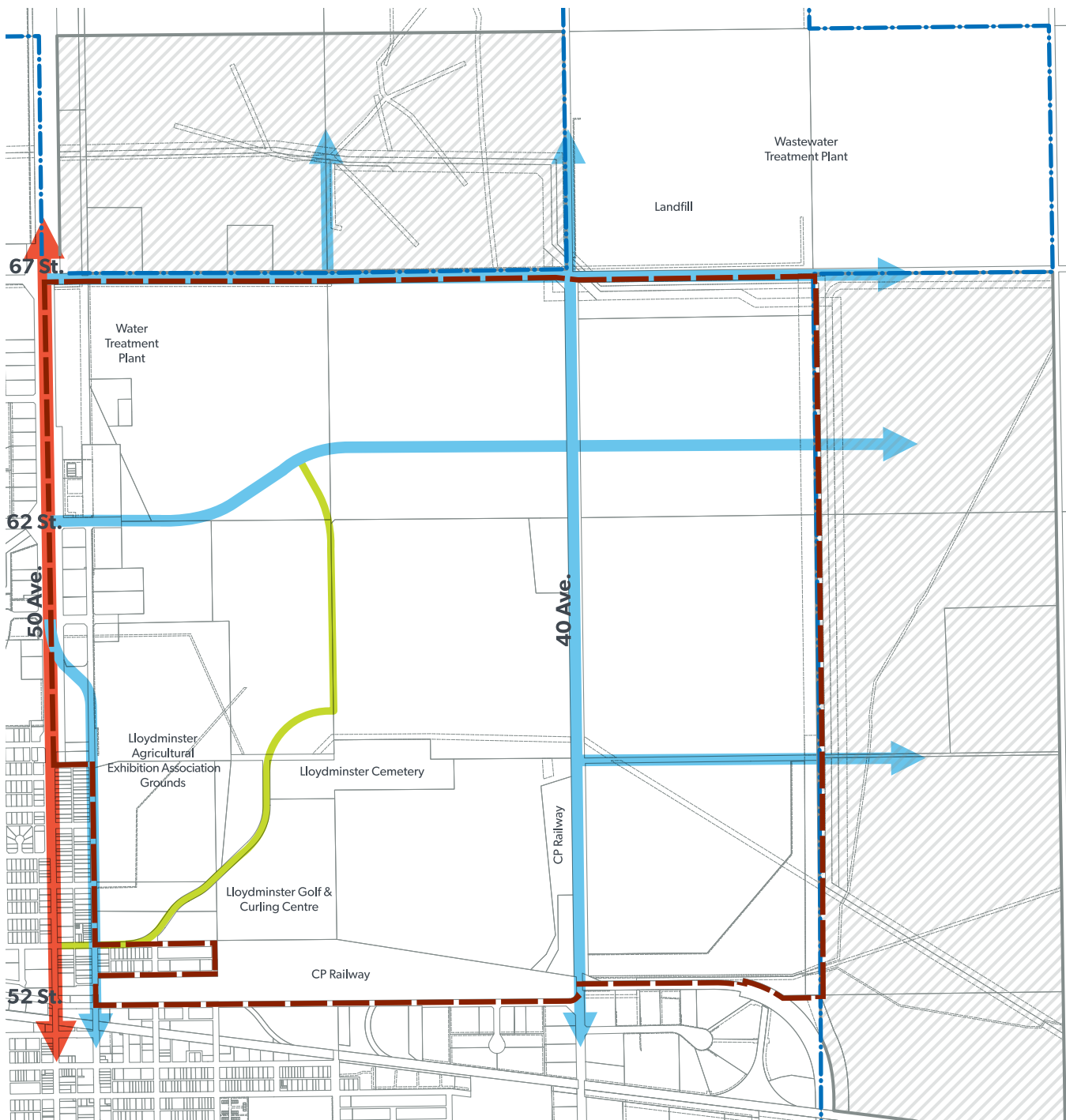
ISL Engineering provided an updated Traffic Impact Assessment (TIA) based on the revised Future Land Use Concept shown in Figure 7. The proposed transportation network is shown in **Figure 12 Transportation Network**.

Below summarizes the findings and recommendations that inform the transportation-related policies contained herein.

PART 7.1

RAIL

The CP Railway has a line running through the southern extent of the Northeast ASP. There is potential for development of a spur line and supporting industrial uses within the plan area. Such development would be considered suitable for this neighbourhood.



LEGEND

- .-.- City Boundary
- .-.- ASP Boundary
- Shadow Plan Area
- Highways
- Arterial Roads
- Collector Roads

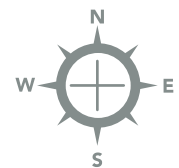


FIGURE 12

Transportation Network

ROADS

The TIA's analysis concluded that there will be high traffic volumes along 40th Avenue from employee trips to and from the industrial area. Peak volumes will occur northbound 40th Avenue during the morning, and southbound 40th Avenue during the afternoon.

Also, it is anticipated that some travellers may choose to short cut through the neighbourhood to avoid signalized intersections along Ray Nelson Drive and 50th Avenue, contributing to the traffic volumes in this area.

To address the above future conditions, the TIA recommends that 67th Street and 40th Avenue be classified as arterial roadways and that Cemetery Road be classified as a collector. Moreover, network improvements are recommended as follow:

- Modify intersection geometry as shown in TIA Exhibit 3.1 (see **Appendix D**);
- Provide traffic signals at the following intersections, signal timing as per the TIA
 - 60th Street and 50th Avenue, ▪ 52nd Street and 40th Avenue,
 - 67th Street and 50th Avenue, ▪ 62nd Street and 50th Avenue,
 - 62nd Street and 40th Avenue, ▪ 65th Street and 50th Avenue;
- Construct the future potential extension of Cemetery Road to align with the City's Urban Industrial/Commercial Roadway cross section drawing 1-102; and
- Require the construction of sidewalks along arterial roadways and consider providing a multi-use trail along one side of the collector roads to better support the City's commitment to active transportation.

The TIA also considered access management, which must align with Transportation Association of Canada's (TAC) Geometric Design Guide. Fiftieth Avenue is recommended to have access restrictions to the intersections at 60th Street, 62nd Street and 65th Street.

08

POLICIES

This section addresses how transportation modes are accommodated within and beyond the plan area.

PART 8.1

LAND USE POLICIES

SHADOW PLAN AREA

Since the Shadow Plan Area is outside the statutory boundary of the Northeast ASP, there are no policies applied to this area. However, should any of the policies below be useful to the RM of Britannia, they could be adopted into the RM's own statutory planning approach, in whole or in part, as desired.

COMMERCIAL & INDUSTRIAL SERVICE

General

Policy 8.1.1	All existing, legally permitted commercial development shall be considered in compliance to this plan.
Policy 8.1.2	The Developer shall allocate area for commercial and light industrial land uses within the Commercial & Industrial Service areas at the Neighbourhood Structure Plan stage.
Policy 8.1.3	The Developer shall ensure that all mechanical equipment associated with development shall be concealed by screen or otherwise incorporated within an associated building.
Policy 8.1.4	The Developer shall provide sidewalks and pedestrian accesses to the satisfaction of the Development Authority.
Policy 8.1.5	The Developer shall ensure parking and loading areas are clearly delineated from driveway accesses and pedestrian areas through landscaping.

Highway Commercial

Policy 8.1.6	The Development Authority shall require that development consists of uses that complement existing uses.
Policy 8.1.7	Developers shall design and orient all buildings to face the road or be located at a 90-degree angle to the road, with entrances clearly visible.
Policy 8.1.8	The Development Authority should require that neighbourhood layouts reflect generally accepted urban design principles that suit the climate, respond to pedestrian needs and enhance overall community cohesion.
Policy 8.1.9	The Developer shall provide landscaped screening measures to separate less compatible uses from each other or from public roadways and spaces to the satisfaction of the Development Authority.

Retail Commercial Policies

Policy 8.1.10	The Development Authority should direct primarily larger scale, auto-oriented commercial uses to locate in this area.
Policy 8.1.11	The Developer shall employ high quality architecture and landscaping design in new development and redevelopment.

Policy 8.1.12 The Developer should locate loading areas at the rear of buildings and screen them from view of 62 Avenue.

INDUSTRIAL

Policy 8.1.13 The Developer shall ensure Industrial development is designed in compliance with City standards and specifications for industrial uses.

Policy 8.1.14 The Development Authority may approve limited service industrial as an interim use where:

- It does not compromise the transition of the site to a fully serviced industrial area,
- It is compatible with the standard of development for general industrial uses in terms of landscaping, building design and screening of storage,
- Transportation capacity is available to support the development, and
- A deferred servicing agreement is in place.

Policy 8.1.15 The Development Authority, at its discretion, shall establish appropriate setbacks for industrial operations to mitigate negative impact including, but not limited to, excessive noise, toxic off-put or noxious odours on adjacent non-compatible land use parcels.

Policy 8.1.16 The Development Authority, in consideration of new rail access proposals and prior to recommending a decision, shall be satisfied with all information provided as required necessary to assess the merits of the proposed access.

Policy 8.1.17 Developers shall adhere to development setbacks from the existing wastewater treatment and landfill facilities and may not seek variances to these setbacks.

Policy 8.1.18 The Developer should provide landscaping treatment at each point of access into large scale industrial sites, including signage and lighting to assist with wayfinding, as may be appropriate.

Policy 8.1.19 Landscaping of individual industrial and commercial sites shall visually enhance the immediate area and, where applicable, provide a visual screen from arterial roads or other sensitive adjacencies.

Policy 8.1.20 All existing, legally permitted industrial development shall be considered in compliance to this plan.

BUFFER AREA & RESERVE LAND

Policy 8.1.21 The Development Authority shall not permit development within Provincial setbacks from a wetland as determined by a Wetland Impact Assessment or Biophysical Impact Assessment prepared by a Qualified Professional at the time of Neighbourhood Structure Plan or subdivision, as is appropriate as determined by the Development Authority. Setback distances to wetlands and waterbodies may be reduced from what is proposed in this ASP at the Neighbourhood Structure Plan stage only when supported by a detailed biophysical/wetland assessment that includes in-field investigations and setback recommendations.

Policy 8.1.22 Natural wetlands shall be preserved, or reconstructed when impacted by development, to an equivalent standard using plant species natural to the Region.

Policy 8.1.23 Natural and/or reconstructed wetlands and other natural drainage systems may be utilized for stormwater management where feasible and approved by the Province.

Policy 8.1.24 The Developer shall provide a 50m setback to all permanent wetlands and a 20m setback to all ephemeral drainage systems as identified by the Environmental Review in **Appendix B**.

Policy 8.1.25 The setbacks identified in **Policy 8.1.23** above shall be identified as either Environmental Reserve or Environmental Reserve Easement per the Municipal Government Act.

Policy 8.1.26 The application of Municipal Reserve to land above stormwater management pond freeboard lines is at the discretion of the City of Lloydminster.

Policy 8.1.27 School Reserves are not required to be provided within the Northeast ASP.

RECREATIONAL

Policy 8.1.28 Recreational lands may be used for camping or other recreation initiatives at the discretion of the Development Authority.

Policy 8.1.29 Intensification of use of existing Recreational facilities may be supported by the Development Authority within the context of an overall conceptual scheme.

UTILITY SERVICES POLICIES

GENERAL

Policy 8.2.1 A developer shall provide, or enter into an agreement to provide when required, the utility rights-of-way or easements necessary to accommodate the extension of infrastructure through or adjacent to a site to allow for servicing.

Policy 8.2.2 The Developer shall align services to avoid environmentally sensitive areas. Temporary disturbances shall be reclaimed to the satisfaction of the Development Authority.

Policy 8.2.3 The Developer shall provide servicing in alignment with the corresponding current Water, Wastewater, and Stormwater Master Plans, as amended.

WATER

Policy 8.2.4 The Developer shall provide the water distribution system as generally shown on **Figure 9**.

Policy 8.2.5 The design of the water distribution system shall ensure that as development progresses, sufficient looping and connections are provided for adequate domestic and fire flows.

Policy 8.2.6 The Developer shall, at the Neighbourhood Structure Plan stage, design the water distribution system to facilitate development to the satisfaction of the Development Authority.

SANITARY

Policy 8.2.7 The Developer shall provide the sanitary servicing as generally shown on **Figure 10**.

Policy 8.2.8 The Developer shall, at the Neighbourhood Structure Plan stage, design the sanitary system to facilitate development to the satisfaction of the Development Authority.

STORMWATER

- | | |
|----------------------|--|
| Policy 8.2.9 | The Developer shall provide stormwater management generally consistent with the catchment areas and ponds as shown on Figure 11 . |
| Policy 8.2.10 | The Developer shall provide a Stormwater Management Plan at the Neighbourhood Structure Plan stage. |
| Policy 8.2.11 | The Developer may integrate engineered natural stormwater wetlands within environmentally sensitive areas to ensure long-term sustainability in a manner that continues to provide viable habitat. |

PART 8.3

TRANSPORTATION NETWORK POLICIES

- | | |
|---------------------|---|
| Policy 8.3.1 | Roadways servicing the Northeast ASP area shall be built or upgraded to align with the City's Municipal Development Standards. This includes aligning with the City's Urban Industrial / Commercial Roadway cross section drawing 1-102. Commercial and industrial lanes must be paved. |
| Policy 8.3.2 | Collector roadways shall be generally located as shown on Figure 12 . |
| Policy 8.3.3 | A 1.5 m sidewalk must be placed along both sides of collector roads. A minimum 3.0 m wide multi-use trail or sidewalk must be placed on one side of arterial roads and may be placed on one side of a collector roadway. |
| Policy 8.3.4 | Access placement within the Northeast ASP area shall adhere to the City's Municipal Development Standards. The City currently requires designs to be in accordance with Transportation Association of Canada's (TAC) Geometric Design Guide. |
| Policy 8.3.5 | Intersection improvement should be considered at the development stages proposed within this TIA. |
| Policy 8.3.6 | A local Traffic Impact Assessment (TIA) may be required as a supporting study at the Neighbourhood Structure Plan stage. The scope of the TIA will depend on the size and intensity of the proposed development. |

NEIGHBOURHOOD STRUCTURE PLANS

Policy 8.4.1 The Developer shall ensure that a Neighbourhood Structure Plan in support of development within the Northeast ASP identifies the allocation of Buffer Areas as Environmental Reserve, Municipal Reserve, or Conservation Easement as appropriate to the satisfaction of the City of Lloydminster.

Policy 8.4.2 The Developer shall ensure a Phase II ESA is a component of a Neighbourhood Structure Plan in support of development within the Northeast ASP for areas identified in Appendix E as requiring a Phase II analysis.

Policy 8.4.3 The Developer shall ensure that a Neighbourhood Structure Plan in support of development within the Northeast ASP identifies the impacts on future development posed by the limiting distances associated with the Wastewater Treatment Plant and Sanitary Landfill will be mitigated.

Policy 8.4.4 The Developer shall ensure that a Neighbourhood Structure Plan in support of development within the Northeast ASP identifies the impacts on future development posed by existing wetlands by way of avoidance or by way of compensation.

09

IMPLEMENTATION, MONITORING & AMENDMENT

This section addresses how the Northeast Area Structure Plan will be Implemented, Monitored and Amended.

PART 9.1

IMPLEMENTATION

It is anticipated that development will generally proceed as shown on Figure 8. However, development is depending on landowner will, market forces and economic factors outside the scope of this ASP. Departures from the proposed sequencing may occur and would not be considered inconsistent with the intent of this ASP so long as the proposed development is consistent with the ASP's policies, informed by engineering analysis and represents a logical extension of existing services and development patterns.

PART 9.2

MONITORING

The Northeast ASP is a long-term policy document that supports cohesive development within the plan area and provides guiding principles and policies that work towards achieving cohesion over time. The policies within the Northeast ASP will be monitored and should be reviewed annually for minor housekeeping edits, and fully reviewed and updated every 5-10 years, or as deemed necessary by the City, until such time as build-out of the plan area is achieved.

PART 9.3

AMENDMENT

If substantive changes with regards to land use, road networks or any other significant aspect of the plan are contemplated, an amendment to the Northeast ASP, that includes a public hearing, shall be held in accordance with Alberta's Municipal Government Act (MGA).

Minor changes in allocation of the Buffer Areas will not require an amendment if, in the opinion of the Development Authority, the intent of the ASP is still achieved. Minor changes include those which would not erode the minimum setback areas around wetlands as described in this ASP and the accompanying Environmental Review found in **Appendix B**. Additionally, buffer areas should be maintained around constructed wetlands (stormwater management facilities).

Where an amendment to this ASP is requested by an applicant, the applicant shall be required to submit the justification and information necessary to support the amendment.

The Northeast ASP may also be amended by the City in response to changes in the overall policy direction within Lloydminster or to maintain consistency with higher-order statutory plans.

APPENDIX

A

MARKET STUDY

**The following report is provided for reference purposes
and does not form part of this bylaw.**

Lloydminster NE ASP Market Study

Lloydminster, Alberta/Saskatchewan

URBANICS CONSULTANTS LTD.

City of Lloydminster

Northeast Area Structure Plan Market Study

Lloydminster, Alberta/Saskatchewan

Prepared for:
ISL Engineering and Land Services Ltd.

May 2019

Prepared by:
Urbanics Consultants Ltd.
Suite 1207 – 409 Granville Street,
Vancouver BC, V6C 1T2

Table of Contents

List of Figures	iv
List of Tables	iv
1. Introduction	1
1.1. Main Objectives	1
1.2. Limitations:	2
2. Site Analysis.....	3
3. Economic Base Analysis.....	6
4. Population Forecast.....	8
4.1. The Willows ASP	8
4.2. Draft Lakeside Area Structure Plan.....	10
4.3. Population Projections	11
5. Employment Forecast.....	18
5.1. Current Employment Mix	18
5.2. Adjusted Employment Mix and Projection.....	19
6. Supply and Market Analyses.....	22
6.1. Land Supply	23
6.2. Commercial Market and Land Supply	25
6.3. Industrial Market and Land Supply.....	28
6.4. Institutional Land Supply.....	29
6.5. Development Permit Activity	29
6.6. Residential Supply	31
7. Demand Analyses	35
7.1. Residential Demand	35
7.2. Industrial Demand	37
7.3. Retail Demand.....	39
7.4. Institutional Demand.....	40
8. Findings and Recommendations	42

List of Figures

<i>Figure 1: Lloydminster context map</i>	<i>3</i>
<i>Figure 2: Northeast ASP Site and Context Map</i>	<i>4</i>
<i>Figure 3: Northeast ASP Parcel Ownership</i>	<i>5</i>
<i>Figure 4: West Texas Intermediate and Western Canadian Select Prices.....</i>	<i>6</i>
<i>Figure 5: CAPP Western Canadian Oil Production Forecast.....</i>	<i>7</i>
<i>Figure 6: Length of time residents have lived in Lloydminster</i>	<i>8</i>
<i>Figure 7: Land use map for The Willows</i>	<i>10</i>
<i>Figure 8: Municipal Development Plan Growth Projections (2013).....</i>	<i>12</i>
<i>Figure 9: Lloydminster population projection, by sex.....</i>	<i>13</i>
<i>Figure 10: Lloydminster 2016 Population Pyramid</i>	<i>16</i>
<i>Figure 11: Lloydminster 2046 Population Pyramid</i>	<i>16</i>
<i>Figure 12: Total zoned land supply by land use type.....</i>	<i>24</i>
<i>Figure 13: Land supply by commercial zoning</i>	<i>25</i>
<i>Figure 14: Commercial Supply by land use type</i>	<i>26</i>
<i>Figure 15: Land supply by mixed-use commercial zoning</i>	<i>26</i>
<i>Figure 16: Land supply by industrial zoning</i>	<i>28</i>
<i>Figure 17: Dwelling types as a proportion of total dwellings, Lloydminster</i>	<i>32</i>
<i>Figure 18: Median rents, Lloydminster (October 1999 - October 2018).....</i>	<i>34</i>

List of Tables

<i>Table 1: Land Use Statistics for The Willows</i>	<i>9</i>
<i>Table 2: Land Use Statistics for Lakeside</i>	<i>11</i>
<i>Table 3: Lloydminster population projection, by age.....</i>	<i>13</i>
<i>Table 4: Lloydminster E population forecast.....</i>	<i>14</i>
<i>Table 5: Lloydminster W population forecast.....</i>	<i>15</i>
<i>Table 6: Lloydminster employment mix 2016</i>	<i>18</i>
<i>Table 7: Alberta COPS employment projections</i>	<i>19</i>
<i>Table 8: Employment share projections Lloydminster 2016, 2021 (COPS), 2046 (Stabilized) ...</i>	<i>20</i>
<i>Table 9: Job growth by NAICS Industry segments 2016-2046</i>	<i>21</i>
<i>Table 10: Total zoned land supply by land use type.....</i>	<i>24</i>
<i>Table 11: Commercial supply by zoning and land use type.....</i>	<i>25</i>
<i>Table 12: Lloydminster shopping centre retail space, inventory and vacancy.....</i>	<i>27</i>
<i>Table 13: Industrial land area (acres) and assessed value, by zoning type.....</i>	<i>28</i>
<i>Table 14: New commercial development permits issued, by value and quantity.....</i>	<i>30</i>
<i>Table 15: New industrial development permits issued, by value and quantity</i>	<i>30</i>
<i>Table 16: Dwellings by type, Lloydminster in 2016.....</i>	<i>31</i>
<i>Table 17: Tenure by household type.....</i>	<i>32</i>
<i>Table 18: Tenure type as a proportion of households.....</i>	<i>33</i>
<i>Table 19: MLS residential sales statistics.....</i>	<i>33</i>

<i>Table 20: Median rents by number of bedrooms, October 2010 – October 2018.....</i>	<i>34</i>
<i>Table 21: Lloydminster housing stock by typology</i>	<i>35</i>
<i>Table 22: Household forecast to 2046, by dwelling type.....</i>	<i>36</i>
<i>Table 23: Northeast ASP lands housing forecast</i>	<i>37</i>
<i>Table 24: Lloydminster industrial jobs forecast.....</i>	<i>38</i>
<i>Table 25: Lloydminster industrial statistics</i>	<i>38</i>
<i>Table 26: Industrial land requirement forecast</i>	<i>39</i>
<i>Table 27: Retail land requirement forecast.....</i>	<i>40</i>
<i>Table 28: Northeast ASP retail land use forecast.....</i>	<i>40</i>

1. Introduction

Urbanics Consultants Ltd. has been retained by ISL Engineering and Land Services Ltd. to carry out land use market study which will aid in the development of the City of Lloydminster's Northeast Area Structure Plan (ASP).

Section 633 of the Alberta Municipal Governments Act (MGA) authorizes a council to adopt an Area Structure Plan (ASP) and states the minimum requirements for an ASP:

1. *For the purpose of providing a framework for subsequent subdivision and development of an area of land, a council may by bylaw adopt an area structure plan.*
2. *An area structure plan*
 - a) *must describe*
 - (i) *the sequence of development proposed for the area,*
 - (ii) *the land uses proposed for the area, either generally or with respect to specific parts of the area*
 - (iii) *the density of population proposed for the area either generally or with respect to specific parts of the area, and*
 - (iv) *the general location of major transportation routes and public utilities, and*
 - b) *may contain any other matters the council considers necessary.*

1.1. Main Objectives

The main objective of the study is to determine the demand for residential, retail, office, industrial, and institutional land in Lloydminster that will inform the planning of the Northeast ASP. Other objectives of the study are:

- Conduct population projections for Lloydminster over a 30-year period (2016-2046)
- Conduct employment projections for Lloydminster over a 30-year period (2016-2046)
- Create a profile of Commercial and Industrial Lands, identifying current supply, market characteristics, and growth potential/challenges.
- Create a profile of Residential supply, disaggregated by dwelling types and including current market information.
- Project demand for retail, office, and industrial land over the short-term, mid-term, and long-term.
- Identify the number of housing units by type and tenure that could be supported in the Northeast ASP area.
- Provide market-based recommendations to guide the development of an attractive, mixed-use community supporting Lloydminster's continued economic development.

1.2. Limitations:

Background data for this study was obtained from a variety of public (federal, provincial, regional, and municipal) and private sector sources during the period of March and April 2019.

Similar to other studies of this nature, a number of forecasts and assumptions regarding the state of the economy, the state of future competitive influences, and population projections have been made. These assumptions are made with great care and are based on the most recent and reliable information available. Should any assumptions noted in this study be undermined by the course of future events, we recommend that the study's findings be re-examined.

While specific assumptions may be noted throughout the report, the following general assumptions also apply:

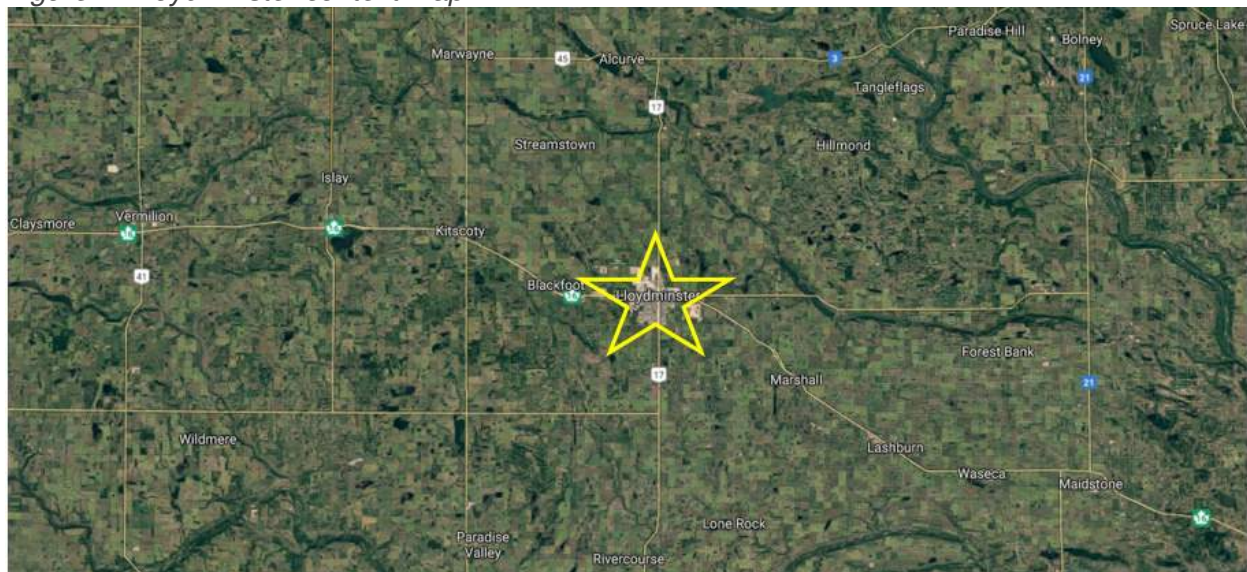
- No unforeseen economic or political events will occur within the study period on a national, provincial, or local level, which would significantly alter the outcomes of the study's analyses. Short-term fluctuations are likely to occur, but long-term gradual growth rates should prevail.
- The demand and market analyses are based on estimates, assumptions and other information developed from research of the market and knowledge of the industry.

2. Site Analysis

Lloydminster is a growing community centrally located in the Alberta – Saskatchewan heavy oil patch, and bisected by the provincial border. It is 250 km to the east of Edmonton, and 275 km to the west of Saskatoon. The community is a regional service centre noted for its complete range of recreation facilities, shopping, and events such as the Colonial Days Fair, Winterfest, and Heritage Day. Lloydminster is a centre for the oil-field servicing sector, oil refining, and agri-foods processing.

Lloydminster has strong transportation connectivity including the Yellowhead Highway and Hwy 17, as well as both CP and CN Rail service – a rarity in Alberta.

Figure 1: Lloydminster context map



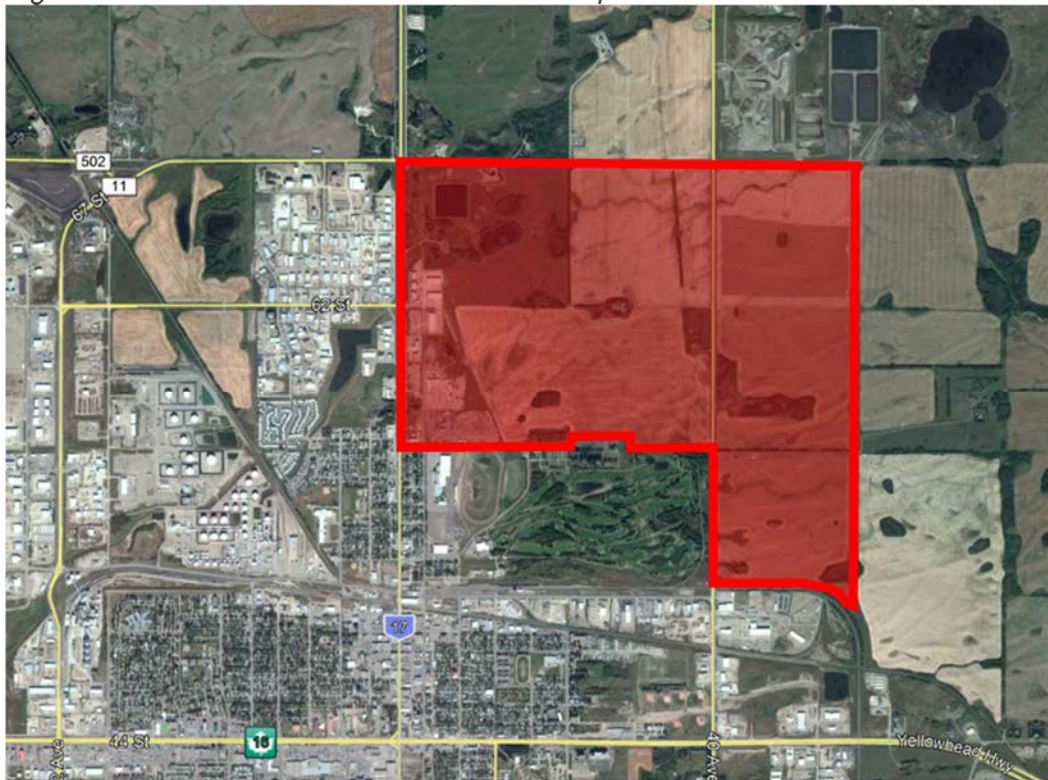
Source: Urbanics Consultants Ltd., Google Earth Pro

The site in question is in the north-east corner of the City, bounded by 67 St. to the north, Hwy 17 to the west, the Exhibition centre + Lloydminster Cemetery + Golf Centre + CP Rail Line to the south, and Rural Municipality of Britannia to the east. Lloydminster's landfill is located adjacent to the north-eastern parcel of the site, likely limiting suitability for residential development in that portion. However, the site is large enough that residential development can be comfortably buffered from the landfill by light industrial uses.

The site area totals approximately 1260 acres, the majority of which is comprised of city-owned lots with agricultural uses. The City's water treatment plant occupies the northwest parcel of the site. Centred on 49 Ave., 8 parcels totalling approximately 42 acres of private light industrial are present.

Figures 2 and 3 following provide a visual understanding of the area.

Figure 2: Northeast ASP Site and Context Map

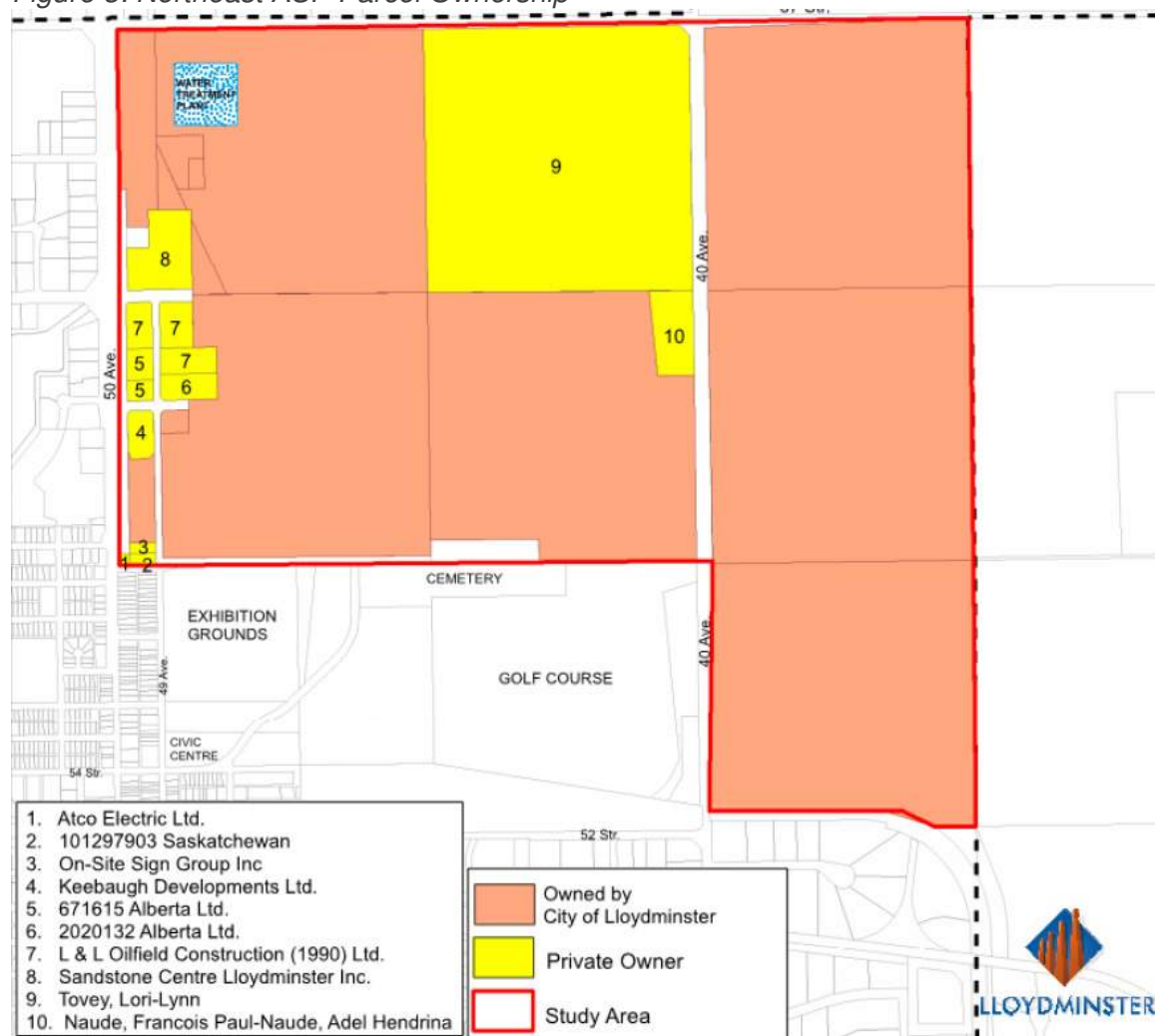


Source: Urbanics Consultants Ltd.; Google Earth Pro

Situated on Hwy 17 immediately across from the substantial Glenn E. Nielson Industrial Park, the Northeast ASP lands enjoy excellent transport access and proximity to Lloydminster's established areas of commerce.

Overall, the City serves as an economic and service hub for the surrounding rural area. This area includes extensive agricultural tracts, hamlets, and villages (including Kitscoty, Marshall, and Lashburn) which bring the Lloydminster trade area to over 130,000 people. This has allowed Lloydminster residents and businesses to establish wide-ranging commercial relationships which contribute to economic strength and stability. Part of this can be seen in Lloydminster's ability to support a comprehensive and growing retail sector which acts as a service centre to the area. Lloydminster's retail sector ranges from independent boutiques, to big box retail, to a wide variety of different restaurants that are unavailable elsewhere in the region until Edmonton and Saskatoon.

Figure 3: Northeast ASP Parcel Ownership



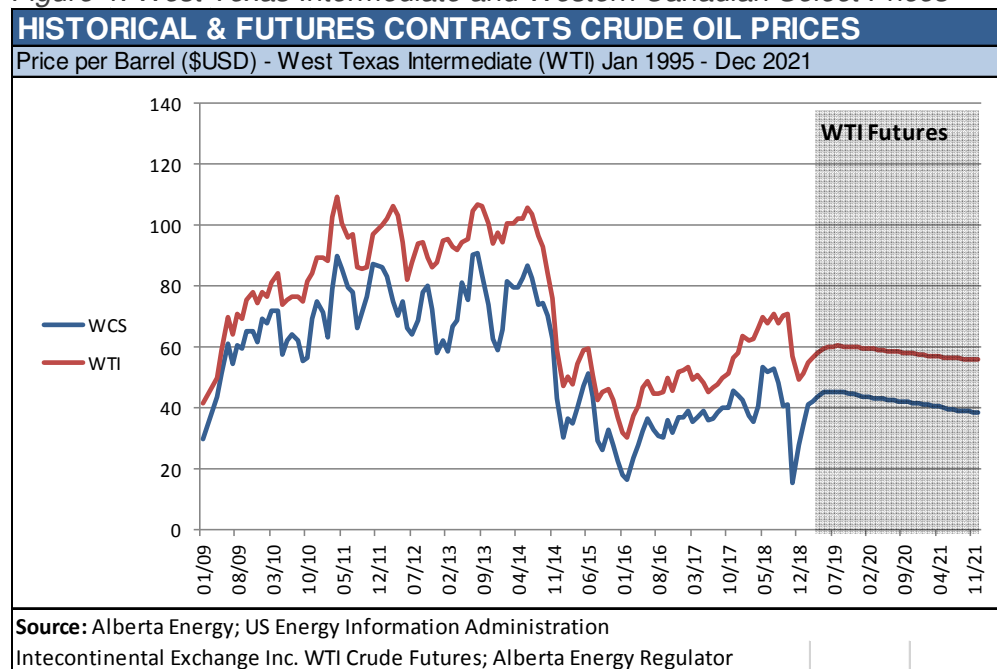
Source: City of Lloydminster

3. Economic Base Analysis

The economy of Lloydminster includes heavy oil production and agriculture, both of which provide a geographically-rooted base of commercial activity. Rich agricultural land encircles Lloydminster in both provinces, providing the City access to some of the best farmland in the western half of the country. The machinery that enables oil production is often complementary to the agricultural sector, and over 2,500 square miles of oil fields make Lloydminster the centre one of the most important regions for heavy crude production in both Canada and the United States. Oil production is core to the economy, and pipelining, refining, and upgrading continue to be the largest component of Lloydminster's economic base.

The trends in oil prices affects Lloydminster's economy considerably, with the City entering a tough 2-year recession upon the collapse of Western Canadian Select prices in October 2014. Partially in response to the price drop, the accelerated adoption of thermal oil extraction (shifting away from the longstanding cold heavy oil production with sand) techniques in the heavy oil regions surrounding Lloydminster have resulted in a substantial reduction of the amount of workers needed per unit of oil produced – meaning the local oil well servicing sector, comprising dozens of local businesses has been grappling with a double-headed challenge.

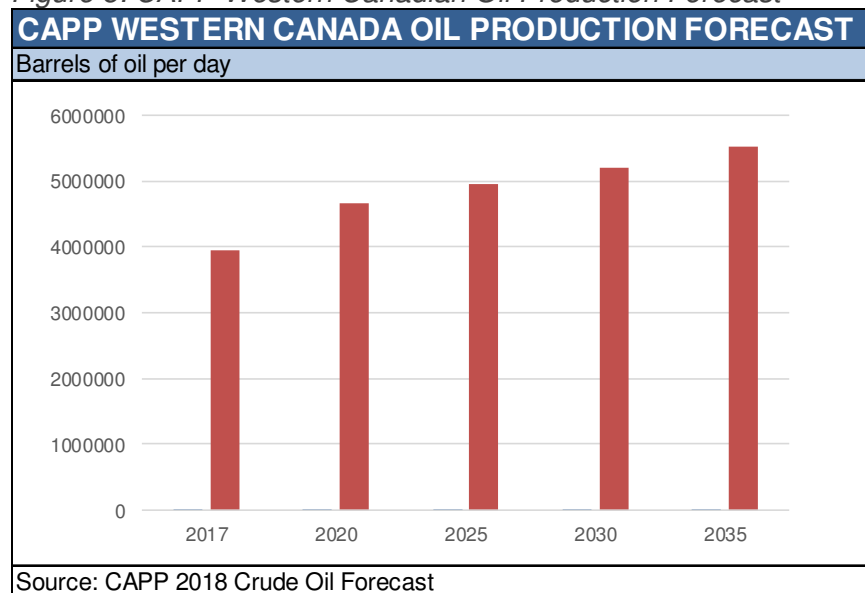
Figure 4: West Texas Intermediate and Western Canadian Select Prices



The price outlook for Western Canadian oil, as shown above, indicates that a return to the boom conditions of 2011 – 2013 is likely not on the cards in the medium term. However, the upside to production efficiencies is that they have at least ensured that oil production should continue to be an economically sustainable proposition despite lower baseline prices. Further, the Canadian

Association of Petroleum Producers still expects a nearly 40% increase in western Canadian oil production to take place by 2035, with positive implications for growth prospects in Lloydminster.

Figure 5: CAPP Western Canadian Oil Production Forecast



Despite several challenging years economically, Lloydminster’s retail market has not changed significantly. Vacancies have increased by roughly 2 percent in the last three and a half years, coming in at about 5.5 percent for the City¹, indicative of a healthy and balanced retail sector.

However, the slowdown in growth noticeably affected the residential real estate market in the City. The number of units sold for detached single-family homes in Lloydminster has declined roughly 5 percent since late 2017. There is a difference in how the two sides of the City have been affected; the Saskatchewan side of the City have only decreased by about 2.4 percent, while the Albertan side has decreased by a significantly higher percentage of 8 percent. Even with these trends following the decline in oil prices, a new stable housing market has appeared in the City and most real estate markets across the region appear to have stabilized.

Notably, Husky Energy is one of the largest companies in the City – operating the Husky Lloydminster Refinery as well as the Husky Energy Upgrader (adjacent to the City). In the 1990s, Husky constructed the largest ethanol plant in western Canada. Growth prospects appear to be strong with the firm having developed and deployed a successful template for a 10,000 barrel-per-day production site, numerous examples of which are being constructed in the Lloydminster area together with expanded local pipeline capacity. Further, a final decision for a substantial refinery expansion is due in 2020.

¹ Source: M.I.T. Appraisals and Brusdon Lawrek & Associates, Retail Mall Vacancy Survey (January 2019), Written by Trudy Larry & Rick Brunsdan

4. Population Forecast

Lloydminster has been able to retain much of its population for extended periods of time, with residents of 10+ years forming the largest residency cohort. According to the 2015 Municipal Census, 65% of the population has lived in Lloydminster for at least 5 years.

Figure 6: Length of time residents have lived in Lloydminster

Length of Residency	Total	Percent
Less than 2 years	4,519	16.41%
2 - 4 years	5,184	18.83%
5 - 9 years	5,313	19.29%
10+ years	12,514	45.46%
TOTAL		27,530

*Note: 3,847 residents chose not to provide their length of residency.

Source: City of Lloydminster 2015 Census Report

Since 2011, Lloydminster has also seen a large increase in the number of new residents according to the municipal census process, with the population having increased by 3,573 residents from 2011 to 2015. However, due to several years of challenging economic conditions, the population declined by 106 between 2013 and 2015. Interestingly, this is entirely due to a decline on the Alberta side of the City, with the Saskatchewan portion still posting a small increase. The Saskatchewan portion also posted similar absolute growth figures to Alberta between 2011 and 2013, despite a smaller population base (1,662 new residents, compared with 2,020 for the Alberta side).

4.1. The Willows ASP

Additional residential capacity has been allocated for the southern portion of Lloydminster, Saskatchewan. The Area Structure Plan for the 340-acre area known as The Willows area was finalized in June 2016.

The estimated population at full build-out based on the Land Use Concept is 5,228 at a gross density of 30.0 units per hectare. This estimate may change depending on actual development densities achieved as the area develops. The population could be lower or higher than estimated depending on a number of socio-economic factors and actual development densities that are achieved by homebuilders. An average person per unit (PPU) calculation of 2.47 PPU was used to derive the population estimate, across a mixture of detached homes, townhomes, and low-rise apartments. This is similar to the 2016 federal census findings of 2.65 residents per unit. 12.44 hectares of commercial development is planned, mainly along Hwy 17.

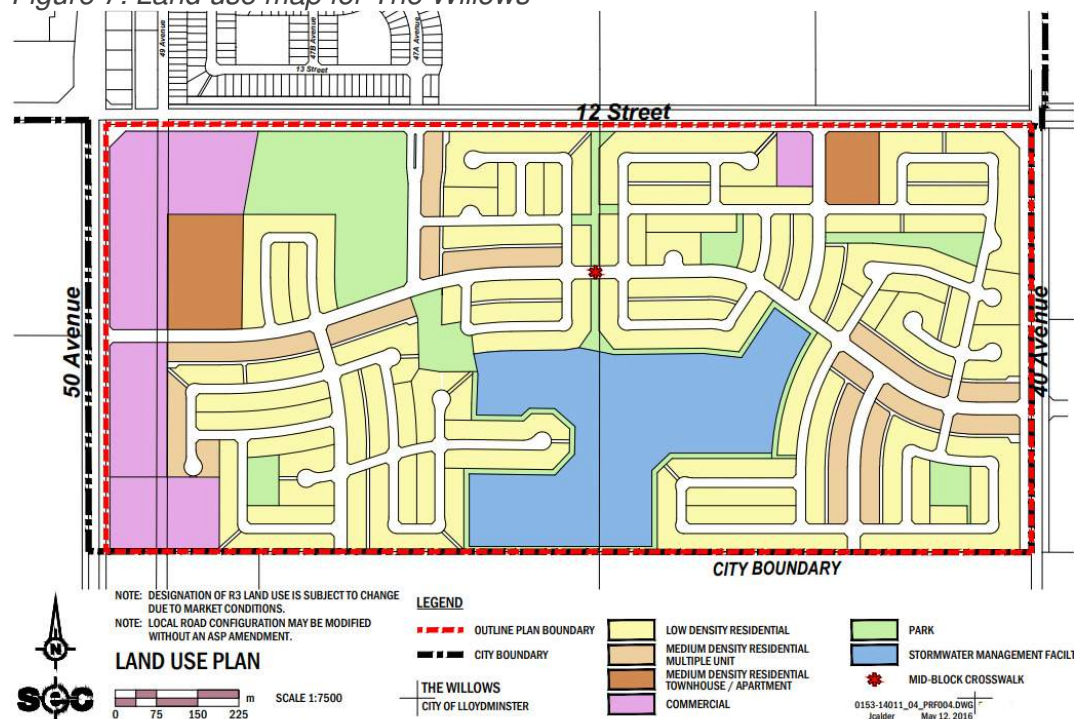
It is important to note that the The Willows ASP does not provide sufficient land to accommodate the population projection utilized in the Municipal Development Plan, which anticipates 14,664 new residents between 2020 and 2030. Even if the growth rate is half of the forecast, additional land would still be required to accommodate growth. The below table and figure illustrate the specifications and land use map for The Willows.

Table 1: Land Use Statistics for The Willows

Land Uses	Hectares	%GDA	Units	%Units	Pop.	%Pop.
GROSS AREA	137.63					
12 Street Road Widening	2.32					
50 Street Road Widening	0.61					
40 Street Road Widening	1.57					
GROSS DEVELOPABLE AREA	133.13	100%				
Other Land Uses						
School / Park / Municipal Reserve	13.31	10.0%				
Stormwater Management Facility/ PUL	15.19	11.4%				
Circulation	23.96	18.0%				
Commercial	12.44	9.3%				
Total Other Land Uses	64.9	48.7%				
Residential Land Uses						
Low Density Residential	57.04	42.9%	1,426	67.5%	3,992	76.3%
Medium Density Residential Multiple Unit	6.82	5.1%	255	12.1%	459	8.8%
Medium Density Residential Townhouse / Apartment	4.37	3.3%	432	20.4%	777	14.9%
Total Residential Land Uses	68.23	51.3%	2,113	100.0%	5,228	100.0%

Source: The Willows Area Structure Plan, Selected Engineering Consultants

Figure 7: Land use map for The Willows



Source: The Willows ASP, Selected Engineering Consultants

4.2. Draft Lakeside Area Structure Plan

It is likely that additional residential capacity will shortly be designated upon confirmation of the Lakeside ASP, the draft version of which is presently undergoing public consultation. The 145.0-acre site is located at the southwest corner of Lloydminster, Alberta.

The estimated population at full build-out based on the Land Use Concept is 1,728 at a gross density of 21.0 units per hectare. This estimate may change depending on actual development densities achieved as the area develops. The population could be lower or higher than estimated depending on a number of socio-economic factors and actual development densities that are achieved by homebuilders. An average person per unit (PPU) calculation of 2.72 PPU was used to derive the population estimate, across a mixture of detached homes, townhomes, and low-rise apartments. The usage of a larger PPU estimate compared to The Willows is justified by the lower density. 15.33 hectares of commercial development is planned, some of it in a mixed-use typology.

The Municipal Development Plan anticipates 14,664 new residents between 2020 and 2030. Adding the total projected population of Lakeside to the Willows still yields a substantial shortfall. Even if growth to 2030 is slow, there will most certainly be a requirement to open new land for development to accommodate the growth to 2046.

Table 2: Land Use Statistics for Lakeside

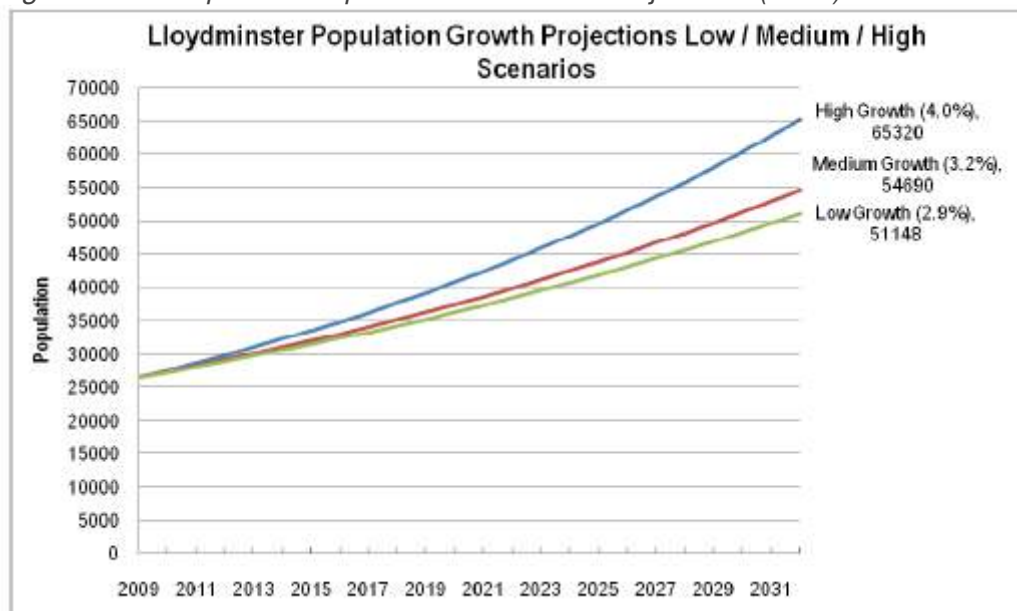
Use	Hectares	% GDA	Units	% Units	Pop.	% Pop.
Gross Area	58.72					
Road Widening	1.08					
Gross Developable Area	57.64	100%				
Other Uses						
MR	5.20	9.0%				
Public Utility Lots	2.71	4.7%				
Commercial	15.33	26.6%				
Circulation (Collector Roads)	4.07	7.1%				
Total - Other Uses	27.31	47.4%				
Residential Uses						
Low Density (12 units / ha)	21.80	37.9%	262	41.1%	863	50.0%
Medium Density (42 units / ha)	6.63	11.5%	278	43.8%	682	39.5%
Urban Village (51 units / ha)	1.88	3.3%	96	15.1%	182	10.5%
Total - Residential Uses	30.31	52.6%	636	100%	1,728	100%

Source: Lakeside Area Structure Plan, Musgrave Agencies

4.3. Population Projections

The municipal growth strategy outlines 3 different scenarios for Lloydminster's population growth to 2032. The low scenario is at 2.9% per annum, the medium at 3.2% with the high scenario at 4.0%. However given the amount of time passed since 2013 and the softer set of economic circumstances, the consultant deemed it necessary to conduct a fresh population forecast based on the cohort-component method.

Figure 8: Municipal Development Plan Growth Projections (2013)



Source: Municipal Development Plan 2013, Armin A. Preiksaitis & Associates Ltd. (ParioPlan)

Using the Cohort Component Model, the City of Lloydminster's population is forecasted in five-year increments to 2046. In forecasting population, the Cohort Component Model takes into account aging, expected births, deaths, in migration, out migration, immigration and emigration. Table 6 shows the historical (2011, 2016) and forecasted (2021-2046) populations for the City, by age. Figure 7 graphically demonstrates the historical and forecasted population growth in Lloydminster, by sex.

The City of Lloydminster is forecasted to grow from 31,390 residents in 2016 to 66,848 in 2046. From 2016 to 2046, the population is expected to grow annually by 2.7% among females, 2.4% among males and 2.6% overall. Figures shows the expected demographic changes (age and sex) from 2011 to 2046. The population of Lloydminster is generally expected to grow older during the projection period. The age group that is expected to see the largest growth in this timeframe is the 40 - 64 years range.

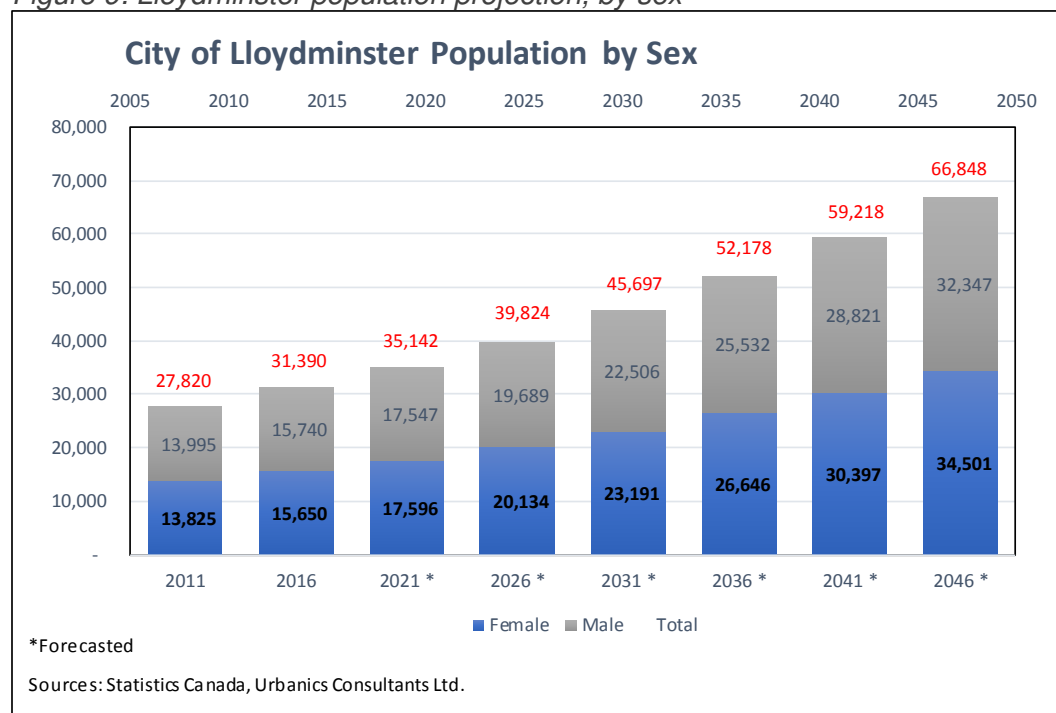
Table 3: Lloydminster population projection, by age

Lloydminster: Population by Age									
	2011	2016	2021 *	2026 *	2031 *	2036 *	2041 *	2046 *	2016 - 2046
Female	13,825	15,650	17,596	20,134	23,191	26,646	30,397	34,501	2.7%
Male	13,995	15,740	17,547	19,689	22,506	25,532	28,821	32,347	2.4%
Total	27,820	31,390	35,142	39,824	45,697	52,178	59,218	66,848	2.6%
Age Groups	2011	2016	2021 *	2026 *	2031 *	2036 *	2041 *	2046 *	2016 - 2046
0 - 19 years	7,875	9,030	10,425	11,816	12,926	14,085	15,440	17,140	8,110
20 - 39 years	9,640	10,650	11,265	11,586	12,472	14,099	16,329	18,778	8,128
40 - 64 years	7,865	9,030	10,557	12,526	14,992	17,323	19,287	20,917	11,887
65+ years	2,440	2,680	2,895	3,895	5,308	6,671	8,163	10,014	7,334
Total	27,820	31,390	35,142	39,824	45,697	52,178	59,218	66,848	35,458
Age Groups	2011	2016	2021 *	2026 *	2031 *	2036 *	2041 *	2046 *	2016 - 2046
0 - 19 years	28%	29%	30%	30%	28%	27%	26%	26%	23%
20 - 39 years	35%	34%	32%	29%	27%	27%	28%	28%	23%
40 - 64 years	28%	29%	30%	31%	33%	33%	33%	31%	34%
65+ years	9%	9%	8%	10%	12%	13%	14%	15%	21%

*Forecasted

Sources: Urbanics Consultants Ltd., Statistics Canada

Figure 9: Lloydminster population projection, by sex



The consultant notes that utilizing the cohort-component method, with conservative estimates for migration, results in an average annual growth rate between 2016 and 2046 of 2.6%. This is smaller than even the low scenario growth rate (2.9%) from the 2013 Municipal Development Plan. It is unlikely that the oil boom of 2011 – 2013 will be replicated, and in any case, technological shifts within the oil industry have reduced the amount of jobs required to directly service a well for a given amount of oil production – by up to 75%, according to some estimates. A substantial downward reduction in population estimates therefore seems prudent.

There are several limitations to the Cohort Component Model. Namely, the model presumes a constant migration rate beyond the year 2011. While this may be an accurate assumption, migration could change drastically as a result of economic or political changes to the City of Lloydminster. If the number of jobs increases at a greater than expected rate, immigration or in migration would also likely increase above its expected rate, and vice versa.

While noting that the distribution of population growth between the Alberta and Saskatchewan portions of the City is highly variable and subject to the decisions of homebuilders, City planners, and tax competitiveness of each province's regime, the consultant further estimates that Lloydminster E will grow at a faster rate than Lloydminster W. The populations of each component may be nearly equal by 2046, with the forecast estimating 32,227 residents in Lloydminster E and 34,471 in Lloydminster W. This is consistent with federal and municipal census findings, which indicate that population growth in Lloydminster E has been substantially stronger since 2009.

Table 4: Lloydminster E population forecast

Lloydminster E: Population by Age									
	2011	2016	2021 *	2026 *	2031 *	2036 *	2041 *	2046 *	2016 - 2046
Female	4,760	5,760	6,879	8,206	9,871	11,844	14,170	16,807	3.6%
Male	5,020	5,980	6,955	8,081	9,566	11,297	13,303	15,571	3.2%
Total	9,780	11,740	13,834	16,287	19,437	23,141	27,474	32,377	3.4%
Age Groups	2011	2016	2021 *	2026 *	2031 *	2036 *	2041 *	2046 *	2016 - 2046
0 - 19 years	2,870	3,500	4,238	4,966	5,578	6,229	7,040	8,118	4,618
20 - 39 years	4,120	4,740	5,105	5,265	5,846	6,914	8,362	9,947	5,207
40 - 64 years	2,235	2,840	3,704	4,898	6,228	7,529	8,780	9,920	7,080
65+ years	555	660	787	1,158	1,785	2,469	3,291	4,393	3,733
Total	9,780	11,740	13,834	16,287	19,437	23,141	27,474	32,377	20,637
Age Groups	2011	2016	2021 *	2026 *	2031 *	2036 *	2041 *	2046 *	2016 - 2046
0 - 19 years	29%	30%	31%	30%	29%	27%	26%	25%	22%
20 - 39 years	42%	40%	37%	32%	30%	30%	30%	31%	25%
40 - 64 years	23%	24%	27%	30%	32%	33%	32%	31%	34%
65+ years	6%	6%	6%	7%	9%	11%	12%	14%	18%

*Forecasted

Sources: Urbanics Consultants Ltd., Statistics Canada.

Table 5: Lloydminster W population forecast

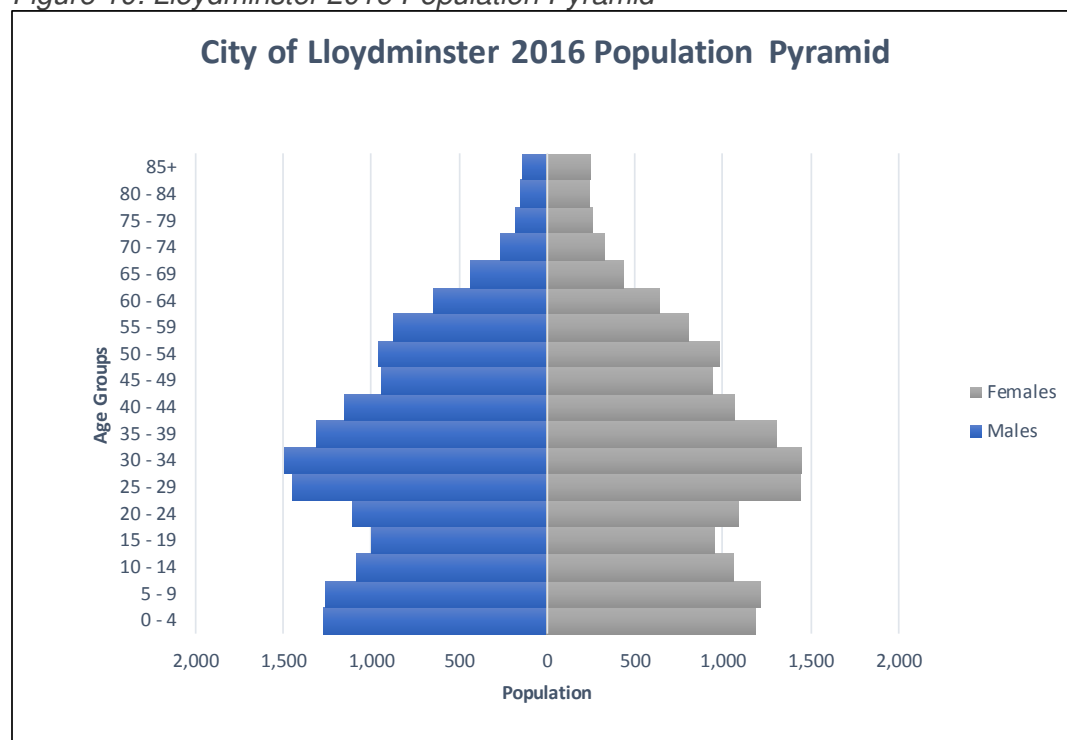
Lloydminster W: Population by Age									
	2011	2016	2021 *	2026 *	2031 *	2036 *	2041 *	2046 *	2016 - 2046
Female	9,065	9,890	10,717	11,929	13,319	14,802	16,227	17,695	2.0%
Male	8,975	9,760	10,591	11,608	12,941	14,235	15,518	16,776	1.8%
Total	18,040	19,650	21,308	23,537	26,260	29,037	31,744	34,471	1.9%
Age Groups	2011	2016	2021 *	2026 *	2031 *	2036 *	2041 *	2046 *	2016 - 2046
0 - 19 years	5,005	5,530	6,187	6,850	7,347	7,856	8,400	9,022	3,492
20 - 39 years	5,520	5,910	6,160	6,321	6,627	7,185	7,966	8,831	2,921
40 - 64 years	5,630	6,190	6,853	7,628	8,764	9,793	10,507	10,997	4,807
65+ years	1,885	2,020	2,108	2,738	3,523	4,202	4,871	5,621	3,601
Total	18,040	19,650	21,308	23,537	26,260	29,037	31,744	34,471	14,821
Age Groups	2011	2016	2021 *	2026 *	2031 *	2036 *	2041 *	2046 *	2016 - 2046
0 - 19 years	28%	28%	29%	29%	28%	27%	26%	26%	24%
20 - 39 years	31%	30%	29%	27%	25%	25%	25%	26%	20%
40 - 64 years	31%	32%	32%	32%	33%	34%	33%	32%	32%
65+ years	10%	10%	10%	12%	13%	14%	15%	16%	24%

*Forecasted

Sources: Urbanics Consultants Ltd., Statistics Canada

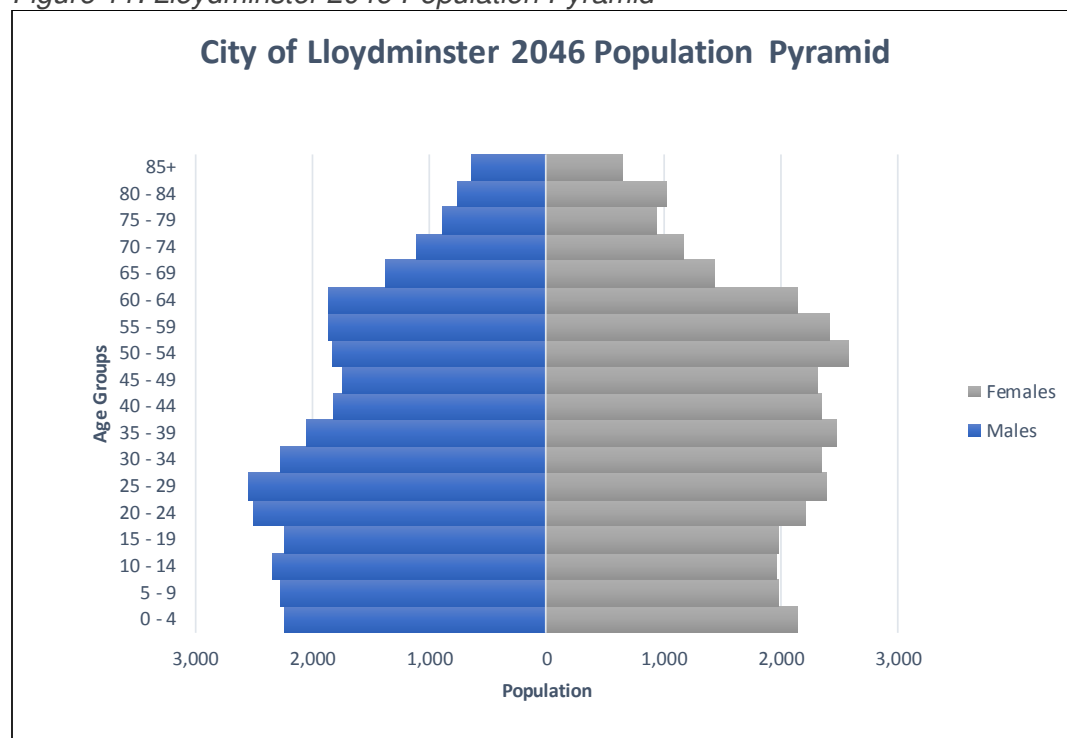
The share of people aged 0 - 19 years and 20 - 39 years is expected to decline during 2016 - 2046. The 40 - 64 and the 65+ age group is expected to increase in share. These shifts have important implications for the City. For instance, services for the aged population will likely need to be increased. Further, the immigration (or in-migration) of young to middle aged adults will continue to be important to maintaining a well stocked workforce and tax base. Figure 9 and 10 provide a graphical illustration of the shift towards an older demographic distribution.

Figure 10: Lloydminster 2016 Population Pyramid



Source: Statistics Canada

Figure 11: Lloydminster 2046 Population Pyramid



Source: Urbanics Consultants, Statistics Canada

The water supply in Lloydminster is sourced from the North Saskatchewan River, which is not expected to face capacity problems over the study period in supporting an expanded population. However, the City's existing water distribution infrastructure will likely have to undergo upgrading and expansion throughout the study period in order to not act as a constraint on population growth. The City's landfill has ample capacity, with the ability to accommodate 3.0% annual growth until 2060.

5. Employment Forecast

5.1. Current Employment Mix

For the purpose of projecting future employment trends in Lloydminster, the North American Industry Classification System (NAICS) Canada 2017 codes will be used to breakdown the workforce by industry segments. Various adjustments need to be made to convert current employment mix into future employment mix based on population factors.

The current workforce in Lloydminster is distributed among the following NAICS categories:

Table 6: Lloydminster employment mix 2016

Lloydminster: Employment by Sector		
Industry	Workers	% of labour force
Agriculture; forestry; fishing and hunting	245	1.4%
Mining; quarrying; oil and gas extraction	2795	15.6%
Utilities	85	0.5%
Construction	1540	8.6%
Manufacturing	750	4.2%
Wholesale Trade	590	3.3%
Retail Trade	2775	15.5%
Transportation and warehousing	765	4.3%
Information and cultural industries	150	0.8%
Finance and insurance	510	2.8%
Real estate and rental and leasing	355	2.0%
Professional; scientific and technical services	975	5.4%
Management of companies and enterprises	20	0.1%
Administrative and support; waste management and remediation services	485	2.7%
Educational services	1135	6.3%
Health care and social assistance	1770	9.9%
Arts; entertainment and recreation	165	0.9%
Accommodation and food services	1310	7.3%
Other services (except public administration)	1030	5.8%
Public Administration	445	2.5%
TOTAL	17895	100%

Source: Statistics Canada, Urbanics Consultants Ltd.

Unsurprisingly, oil & gas and retail are the two largest industries. Healthcare and construction are also strong concentrations of employment. This dovetails well with the economic base analysis chapter in that the 4 core strengths of the Lloydminster economy are:

- Abundant oil and gas resources nearby
- Well-developed range of small and large oil and gas employers located within Lloydminster itself

- Ample land for industrial growth and development
- Retail centre for a large rural trade area of at least 130,000

5.2. Adjusted Employment Mix and Projection

The province of Alberta has an industry and employment projection program called COPS. Canadian Occupational Projection System (COPS) Alberta Industry Employment Outlook: 2017 – 2021, which illustrates the varying strength of each sector in the Alberta economy from 2017-2021. The below table reflects the findings from COPS.

Table 7: Alberta COPS employment projections

ALBERTA COPS DYNAMIC EMPLOYMENT SHARE CHANGE						
	2017	% change	2018	% change	2021	ratio of share of labour force in 2021/2016
11 Agriculture; forestry; fishing and hunting	2.4%	0.0%	2.4%	-0.1%	2.3%	0.96
21 Mining; quarrying; and oil and gas extraction	5.9%	0.1%	6.0%	0.2%	6.2%	1.04
22 Utilities	0.9%	0.0%	0.9%	0.0%	0.9%	1.00
23 Construction	10.6%	0.1%	10.7%	0.5%	11.2%	1.05
31-33 Manufacturing	5.2%	0.0%	5.2%	-0.2%	5.0%	0.97
41 Wholesale trade	3.8%	0.0%	3.8%	-0.1%	3.7%	0.98
44-45 Retail trade	10.6%	-0.1%	10.5%	-0.1%	10.4%	0.98
48-49 Transportation and warehousing	5.9%	0.0%	5.9%	0.0%	5.9%	1.00
51 Information and cultural industries	1.2%	0.0%	1.2%	0.0%	1.2%	1.00
52 Finance and insurance	3.0%	-0.1%	2.9%	-0.2%	2.7%	0.91
53 Real estate and rental and leasing	1.7%	0.0%	1.7%	-0.1%	1.6%	0.92
54 Professional; scientific and technical services	8.0%	0.1%	8.0%	0.1%	8.1%	1.02
55 Management of companies and enterprises	0.2%	0.0%	0.2%	0.0%	0.2%	0.94
56 Administrative and support; waste management and remediation services	3.3%	0.0%	3.4%	0.0%	3.4%	1.02
61 Educational services	6.7%	0.0%	6.7%	-0.1%	6.6%	0.98
62 Health care and social assistance	12.2%	0.2%	12.3%	0.4%	12.7%	1.04
71 Arts; entertainment and recreation	2.2%	0.0%	2.2%	0.0%	2.2%	1.01
72 Accommodation and food services	6.4%	0.0%	6.4%	-0.1%	6.3%	0.99
81 Other services (except public administration)	5.4%	0.0%	5.4%	-0.1%	5.3%	0.98
91 Public administration	4.3%	-0.1%	4.3%	-0.2%	4.1%	0.94

Source: Canadian Occupational Projection System (COPS) Alberta Industry Employment Outlook: 2017 – 2021, Statistics Canada, Urbanics Consultants

The conclusions from the COPS 2017 projection is as follows:

Declining industries (with respect to share of workforce employed)

- Agriculture's share of employment will decline by 4%
- Finance and insurance by 9%
- Real estate and rental and leasing by 8%
- Management of companies and enterprises by 6%
- Public administration's by 6%

Growing Industries (with respect to share of workforce employed)

- Mining, quarrying, and oil & gas will increase by 4%
- Construction by 5%
- Healthcare and social assistance by 4%
- Modest share increases in most other sectors

Given that these are Alberta-wide projections, the employment profile of Lloydminster will be adjusted to match the relative growth and or decline in specific industries to 2021. Following that, the projection will forecast employment shares by industry from 2021 to 2046 based on a stabilized level.

The following table displays the share of workforce employed in the 20 NAICS industry categories in 2016, in 2021 adjusted by COPS projections, and in 2046 stabilized assuming a population in Lloydminster of 66,848.

Table 8: Employment share projections Lloydminster 2016, 2021 (COPS), 2046 (Stabilized)

EMPLOYMENT SHARE PROJECTIONS			
Industries (NAIC)	Lloydminster 2016	Lloydminster 2021 (given COPS projection)	Lloydminster stabilized to 2046
11 Agriculture; forestry; fishing and hunting	1.4%	1.3%	1.3%
21 Mining; quarrying; and oil and gas extraction	15.6%	16.1%	16.1%
22 Utilities	0.5%	0.5%	0.5%
23 Construction	8.6%	8.6%	8.6%
31-33 Manufacturing	4.2%	4.1%	4.1%
41 Wholesale trade	3.3%	3.3%	3.3%
44-45 Retail trade	15.5%	14.8%	14.8%
48-49 Transportation and warehousing	4.3%	4.3%	4.3%
51 Information and cultural industries	0.8%	0.8%	0.8%
52 Finance and insurance	2.8%	2.7%	2.7%
53 Real estate and rental and leasing	2.0%	1.9%	1.9%
54 Professional; scientific and technical services	5.4%	5.6%	5.6%
55 Management of companies and enterprises	0.1%	0.1%	0.1%
56 Administrative and support; waste management and remediation services	2.7%	2.8%	2.8%
61 Educational services	6.3%	6.4%	6.4%
62 Health care and social assistance	9.9%	10.5%	10.5%
71 Arts; entertainment and recreation	0.9%	0.9%	0.9%
72 Accommodation and food services	7.3%	7.2%	7.2%
81 Other services (except public administration)	5.8%	5.6%	5.6%
91 Public administration	2.5%	2.4%	2.4%

Source: Urbanics Consultants Ltd., Statics Canada, 2016 COPS. Canadian Occupational Projection System (COPS) Alberta Industry Employment Outlook: 2017 – 2021

Given the employment shares by industry identified in table 10, and the population projections in table 6, a model can be made that forecasts the total number of jobs by industry in each year. Table 11 below displays the number of jobs by industry in key years 2016-2021, then in each 5-year period from 2021- 2046. The model assumes that the overall employment rate will grow to 62% of the population, slightly more than the 59% in 2016 (which was an unusually soft year for employment).

Table 9: Job growth by NAICS Industry segments 2016-2046

Lloydminster: Employment by Sector								
	2016	2021 *	2026 *	2031 *	2036 *	2041 *	2046 *	2016 - 2046
Agriculture; forestry; fishing and hunting	245	259	297	347	401	459	519	274
Mining; quarrying; oil and gas extraction	2,795	3,197	3,664	4,274	4,947	5,652	6,391	3,596
Utilities	85	98	112	131	151	173	195	110
Construction	1,540	1,715	1,965	2,292	2,653	3,031	3,428	1,888
Manufacturing	750	820	940	1,096	1,269	1,449	1,639	889
Wholesale Trade	590	663	760	886	1,026	1,172	1,325	735
Retail Trade	2,775	2,934	3,362	3,922	4,539	5,186	5,864	3,089
Transportation and warehousing	765	861	986	1,151	1,332	1,521	1,720	955
Information and cultural industries	150	164	188	220	254	290	328	178
Finance and insurance	510	536	614	716	829	947	1,071	561
Real estate and rental and leasing	355	373	428	499	577	659	746	391
Professional; scientific and technical services	975	1,108	1,270	1,481	1,714	1,959	2,215	1,240
Management of companies and enterprises	20	23	26	30	35	40	45	25
Administrative and support; waste management and remediation services	485	547	627	732	847	968	1,094	609
Educational services	1,135	1,263	1,448	1,689	1,954	2,233	2,525	1,390
Health care and social assistance	1,770	2,094	2,400	2,799	3,240	3,701	4,185	2,415
Arts; entertainment and recreation	165	182	209	244	282	322	365	200
Accommodation and food services	1,310	1,427	1,636	1,908	2,209	2,523	2,853	1,543
Other services (except public administration)	1,030	1,116	1,279	1,492	1,727	1,973	2,231	1,201
Public Administration	445	475	544	635	734	839	949	504
TOTAL	17,895	19,854	22,756	26,544	30,720	35,099	39,688	21,793
*Forecasted								
Sources: Statistics Canada, Urbanics Consultants Ltd.								

The net job gains by industry can be seen on the far-right column in the above table. In total the consultant expects almost 22,000 jobs to be created in the City to 2046. Many of those jobs in industrial land use-requiring sectors:

- Agriculture: +274 jobs
- Mining and oil and gas: +3,596 jobs
- Utilities: +110 jobs
- Construction: +1,888 jobs
- Manufacturing: +889 jobs
- Wholesale Trade: +735 jobs
- Transportation and warehousing: +955 jobs

6. Supply and Market Analyses

According to the Municipal Development Plan (MDP), commercial development in the City is focused on downtown and vehicle-oriented commercial on the Yellowhead corridor. Downtown is unique to other retail areas in the City as it is conducive to small-scale retail, entertainment and cultural/social experiences. Vehicle-oriented commercial is the primary type of commercial development for the City, and, as the name suggests, it is designed to be highly accessible by vehicle and allow for large volumes of vehicular traffic in its vicinity. Urban villages are designed for a live-work-play model, where nearby residents work close enough to their primary residence which is intended to reduce overall automobile usage and automobile dependency. Lastly, neighbourhood commercial is mainly located within low-density suburban developments and aims to reduce the miles driven and dependency on the automobile by local residents.

The Lloydminster Planning Department proposes an eventual need for annexation to meet the City's 50-year growth needs, particularly for commercial and industrial properties. Due to a growing economy, new and increasing demand for commercial and industrial lands will be met with eventual annexation of surrounding land. As a result of annexation, a broader tax base could help finance the City's infrastructure and community services.

The City's 2008 Intermunicipal Development Plan (IDP) (revised 2017) proposes for more commercial growth south of 12th Street, along with development to the west and north of the City. The IDP also identified about 10-quarter sections for the development of future industrial and secondary commercial lands, which could prepare the City for 60 years of industrial land supply. As with any municipality, the growth projection for industrial and secondary commercial is problematic to ascertain; considering the standard limitations, the City found that a 30-year projection would equate to 312 hectares of land.

The Downtown Area Redevelopment Plan (DARP) was last adopted in 1988, and has since been considered to be largely obsolete given the time that has lapsed since its adoption. A new DARP is proposed to be developed by the City to provide a catalyst for downtown development. Given the relative proximity of downtown to the Northeast ASP lands, the consultant recommends ensuring that results of the upcoming new DARP are taken into account during more advanced stages of planning for Northeast ASP development.

Lloydminster has a limited supply of future non-residential lands within its municipal boundaries according to the City's 2009 Growth Study; the study found industrial and commercial land consumption in the City was 312 hectares over the 30 preceding years, and assuming this consumption rate hold stable for the future, the City would need five more sections of land for these kinds of land uses over the subsequent 30 years. Despite the City's lack of commercial land reserves, there remain sufficient land reserves that both industrial and commercial uses can access. In fact, the 2009 Growth Study identified that within the City there is sufficient non-residential land to address the demand for the next 74 years. Much of the non-residential land reserves are located in the northwest and northeast portions of the City.

Several Area Structure Plans are active in Lloydminster. Wigfield Industrial is located in the Saskatchewan side of the City in the eastern portion. According to the ASP for Wigfield Industrial, the light industrial gross developable area (GDA) is 78.06 hectares, heavy industrial GDA is 7 hectares, and commercial GDA is 7.3 hectares.

Parkview Estates is located in the Albertan side of the City, in the western portion. According to the Area Structure Plan for Parkview Estates, commercial GDA is 28.93 hectares which is mostly located in the northern portion of the area.

Colonial Park is located in the Saskatchewan side of Lloydminster, within the boundaries of 50 Avenue to the west, 25 Street to the south, 40 Avenue to the east and 36 Street to the north. The ASP proposes there are opportunities for commercial zoning in the parcels that are located at the two entrances off 40 Avenue; these parcels are located along what are considered to be major collector roads, close to multi-family developments. Commercial GDA comprises 7.42 hectares.

Hill Industrial is located in the northwestern portion of the City on the Albertan side. This ASP is primarily intended for industrial uses. The GDA for industrial is 364.3 hectares and commercial GDA is 36.74 hectares.

The Willows is located in the southeast portion of the City in Saskatchewan. This area is adjacent to new lands that may be annexed by the City. The ASP considers the Willows to contain both neighborhood commercial and vehicle-oriented commercial sites. The commercial GDA is 12.44 hectares, which is a total of 9.3 percent of the total GDA within the Willows.

6.1. Land Supply

The land supply for the City of Lloydminster will likely be strained by a growing demand for various land uses in the next decade. The specific constraints that the land supply will experience depend on which land use types are most in-demand, and how the City responds to developing a portfolio of land use types sufficient to meet the demand. The table below shows the number of acres for each land use in the City. The Urban Transition designation leads the City in the highest number of acres dedicated for one land use. Urban Transition is followed by Industrial, Public, and Residential land use.

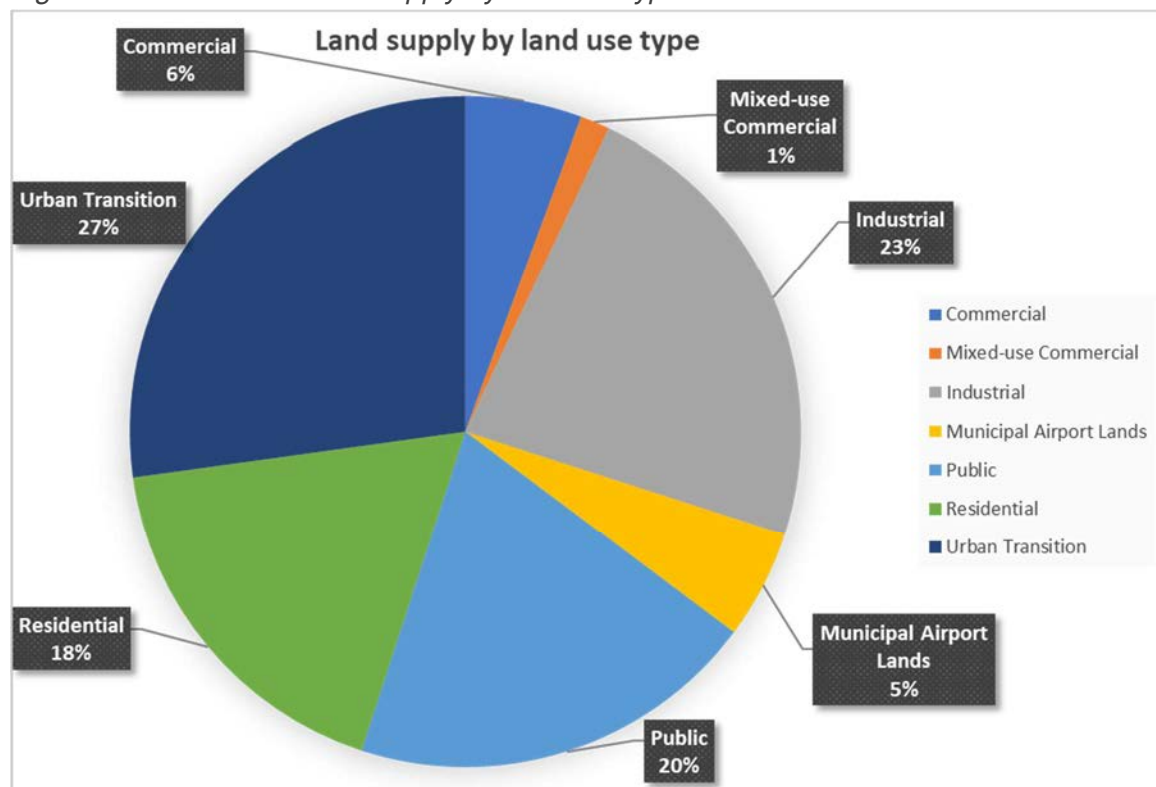
Table 10: Total zoned land supply by land use type

Land Use Type	Acre
Commercial	495
Mixed-use Commercial	125
Industrial	2,024
Municipal Airport Lands	464
Public	1,745
Residential	1,571
Urban Transition	2,398
Grand Total	8,823

Source: City of Lloydminster and Urbanics Consultants Ltd.

The figure below displays the share of land use types in Lloydminster. The share of Commercial is significantly lower to the top four land use types, denoting the emphasis of the local economy on industrial land uses over consumption-oriented land uses. It appears there is a small share of Mixed-Use Commercial in the City, which may make it difficult for the City to capitalize on the economic benefits that mixed-use commercial areas produce. For instance, mixed-developments that enable a walkable built environment help revitalize downtowns, raise property values, increase private investments, and support a stable business culture. The Northeast ASP presents an opportunity to combine multi-family demand and retail demand into new mixed-use communities.

Figure 12: Total zoned land supply by land use type



Source: City of Lloydminster and Urbanics Consultants Ltd.

6.2. Commercial Market and Land Supply

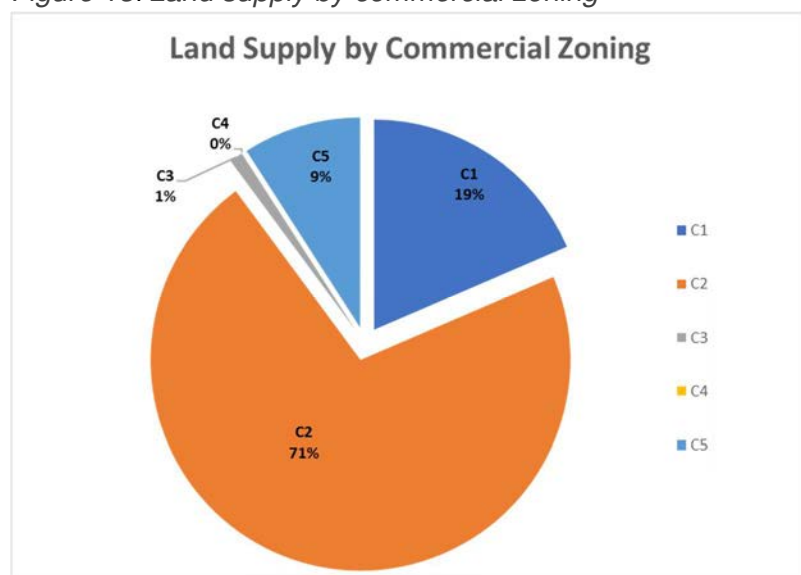
The commercial land supply in Lloydminster is divided into 12 zoning types. The majority of the commercial land supply by acreage is zoned for C3, followed by C1, C5, C3, and DC1. C4 and DC4 do not appear in the data available to have any acreage. Highway Corridor Commercial zoning is over half of the total acreage share, demonstrating the dominance of auto-oriented retail development. The second figure below shows the percentage of commercial land use types, clearly delineating C1 as 72 percent of the total share. The next figure breaks down the share of mixed-use and all other commercial types, showing the mixed-use category as only 20 percent of the total share of commercial land supply.

Table 11: Commercial supply by zoning and land use type

Zoning	Acre	Assessment Value	Zoning Type	Land Use Type	Additional Comments
C1	92	169,179,130	Central Commercial	Commercial	-
C2	353	312,953,400	Highway Corridor Commercial	Commercial	-
C3	5	5,860,100	Neighbourhood Commercial	Commercial	-
C4	-	-	Commercial Shopping Centre	Commercial	-
C5	45	52,104,300	Service Commercial	Commercial	-
Subtotal	495	540,096,930			
DC1	42	109,445,900	High Density Mixed-use	Commercial	High density residential, office and multi-purpose commercial uses
DC2	17	25,155,000	Multi-purpose commercial use	Commercial	Redevelopment of existing multi-purpose commercial uses
DC3	35	44,258,200	Large multi-purpose commercial uses	Commercial	Power Centres
DC4	0	9,270	Light Industrial Business Parks	Commercial	Light industrial business parks containing clean industrial and office uses with limited outdoor storage
DC5	9	11,865,500	Highway Corridor Commercial	Commercial	Vehicular oriented commercial Uses on Sites Abutting Highway 17
DC6	3	11,166,200	Multi-purpose commercial use	Commercial	Redevelopment of a Site for new multi-purpose commercial uses.
DC7	18	13,111,400	Regional Commercial	Commercial	Regional destination and mixed use Site that will consist of an Entertainment Center, Hotel and Retail
Subtotal	125	215,011,470			
Grand total	620				

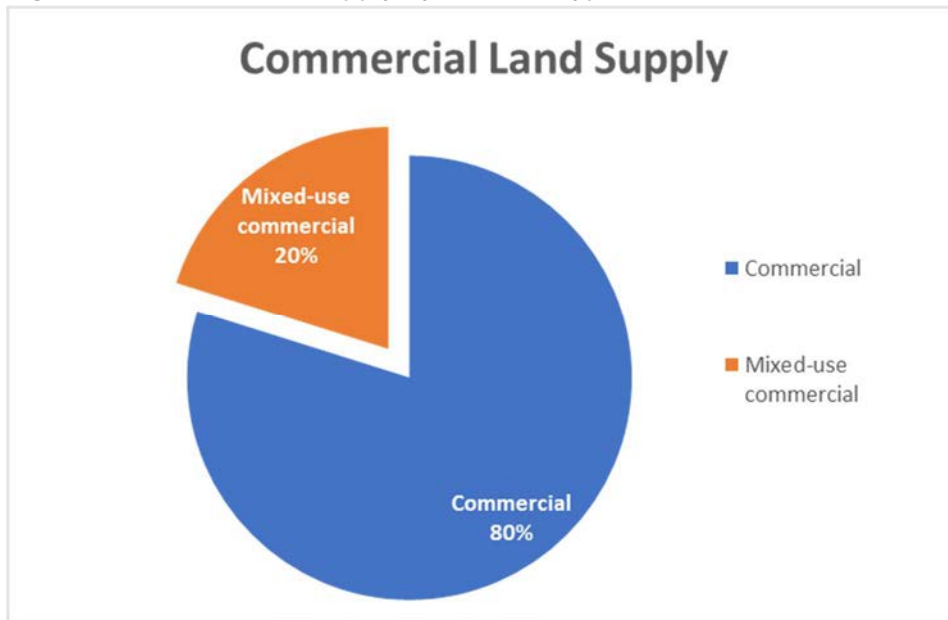
Source: City of Lloydminster and Urbanics Consultants Ltd.

Figure 13: Land supply by commercial zoning



Source: City of Lloydminster and Urbanics Consultants Ltd.

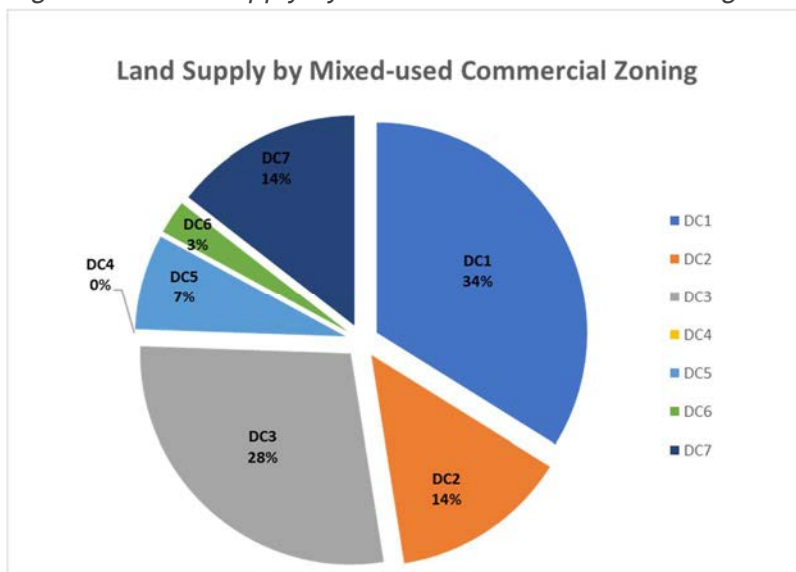
Figure 14: Commercial Supply by land use type



Source: City of Lloydminster and Urbanics Consultants Ltd.

The figure below shows that within the Mixed-Used Commercial zoning types, DC1 leads with 34 percent of the total share. DC1 is regarded as High Density Mixed-Use and is comprised of residential, office and multi-purpose commercial uses. Closely following DC1, DC3 (i.e., Large Multi-Purpose Commercial) is 28 percent of the total share, following a tie between DC7 and DC2 each with 14 percent of the total share. DC5 and DC6 are not popular commercial land use types, while the data available lists DC4 as containing no acreage within the City.

Figure 15: Land supply by mixed-use commercial zoning



Source: City of Lloydminster and Urbanics Consultants Ltd.

Retail Focus

The City's retail is concentrated along 44 Street and 50 Avenue, and the City's total amount of inventory is approximately 2.3 million square feet. According to an inventory conducted in January 2019 by M.I.T Appraisals and Brunsdon Lawrek & Associates, around 2,300,000 square feet of retail exists, with 1.937 million square feet in the Alberta portion and only 170,656 square feet in the Saskatchewan side. Additionally, there is one enclosed mall that is almost 200,000 square feet. The extent of this analysis excludes the retail component of the downtown core and one-storey free-standing building on pads (unless otherwise a part of a major development).

The following table is provided by M.I.T Appraisals and Brunsdon Lawrek & Associates, detailing inventory and vacancy in Lloydminster's shopping centre retail space.

Table 12: Lloydminster shopping centre retail space, inventory and vacancy

RETAIL MALL SURVEY									
EXECUTIVE SUMMARY - Effective December 31, 2018, Conducted January 3, 2019									
Type	Total Area (Sq.Ft.)	Anchor (Sq.Ft.)	CRU's (Sq.Ft.)	Total Vacant (Sq.Ft.)	Vac. 2018	Vac. 2017	Vac. 2016	Vac. 2015	Vac. 2014
Enclosed	199,982	109,433	90,549	47,672	23.84%	24.13%	4.40%	3.71%	11.37%
Strip	1,937,497	914,904	1,022,593	58,683	3.03%	2.02%	3.35%	2.79%	1.25%
Total Alberta	2,137,479	1,024,337	1,113,142	106,355	4.98%	4.12%	3.46%	2.89%	2.39%
Total Sask.	170,656	0	170,656	21,028	12.32%	8.40%	7.23%	11.66%	0%
Total City	2,308,135	1,024,337	1,283,798	127,383	5.52%	4.44%	3.76%	3.64%	2.20%

Source: M.I.T. Appraisals, Brunsdon Lawrek & Associates, Retail Mall Vacancy Survey (January 2019)

The overall vacancy rate in December 2018 was found to be 5.5 percent, with the Alberta side roughly 5 percent and the Saskatchewan side 12.3 percent. Furthermore, the Albertan side dominates mall retail space of the city and has roughly 93 percent of all the mall retail space, while the Saskatchewan side has only 7.4 percent of mall retail space. The Alberta side vacancy rate increased from 2017 (4.12 percent) to 2018 (5 percent). On the other side, vacancy in Saskatchewan also increased from 8.40 percent in 2017 to 12.32 percent in 2018. Strip retail slightly increased on the Alberta side from 2.02 percent in 2017 to 3.03 percent in 2018. In December 2018, the enclosed mall vacancy decreased from 4.13 percent to 23.84 percent from 2017 to 2018. As mentioned in a previous section, the overall city vacancy rate has increased slightly in 2017 from 4.44 percent to 5.52 percent in 2018. A vacancy rate such as this is considered to be balanced and still indicative of a vibrant retail sector, which has historically been strong in Lloydminster.

Rental rates between the Alberta and Saskatchewan sides vary considerably. Rental rates for the strip malls and mini-power centers on the Albertan side are roughly between \$8 per square foot

triple net to \$32 per square triple net. These rates seem to be consistent with retail rates in other major urban centers in Alberta. On the Saskatchewan side, rental rates are between \$8 per square feet triple net to \$25 per square feet triple net, according to the findings of M.I.T.

Since 2008, the majority of retail construction has taken place on the Alberta side of the City. This may be due in part because the commercial parcels along 50 Avenue are mostly developed. Most recently, no new construction has happened for either side of the City for 2018.

6.3. Industrial Market and Land Supply

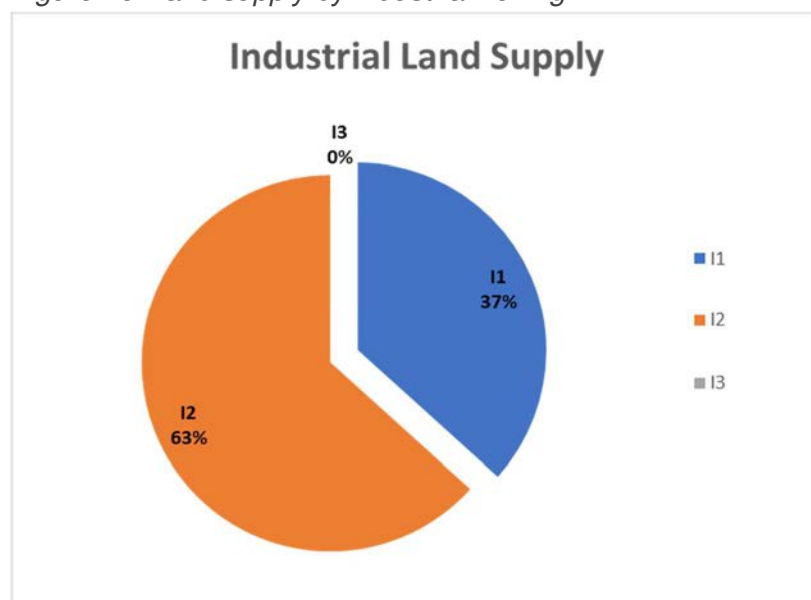
The table below displays the number of acres dedicated to industrial land supply based on the land use type. As the figure below also shows, the majority of industrial land use type is I2, where I1 is only 37 percent and data available for I3 shows no acreage (Heavy Industrial is also outside of the scope for the analysis of the Northwest ASP lands).

Table 13: Industrial land area (acres) and assessed value, by zoning type

I1	743	152,744,480	Light Industrial	Industrial
I2	1,282	361,001,080	Medium Industrial	Industrial
I3	-	-	Heavy Industrial	Industrial

Source: City of Lloydminster and Urbanics Consultants Ltd.

Figure 16: Land supply by industrial zoning



Source: City of Lloydminster and Urbanics Consultants Ltd.

Industrial market data for a community of Lloydminster's size is difficult to obtain, as data and brokerage firms do not include the City specifically in its research. However, a leading commercial

broker active in industrial sales and leasing agreed to be interviewed. Over the course of the discussion, it was found that:

- Pre-recession, industrial vacancies numbered only 200,000 – 300,000 sq. ft. By the beginning of 2018, vacancy had increased to 1.6 million.
- Finally in 2019, progress has been made in reducing the stock of vacant industrial properties, thanks to modest positive absorption.
- There is an increasing appetite among businesses to buy their own property, taking advantage of the price stability and availability seen in the industrial land market.
- The general feeling among Lloydminster businesses is one of cautious optimism. A downward shock in oil prices is unlikely to return, and the recent Alberta provincial election outcome has helped business confidence.
- The broker confirmed the observation of the Consultant that, as there is very little purpose-built office space in Lloydminster, most office-type activities take place within industrial premises. There are ongoing difficulties leasing the already small stock of purpose-built office space.

The consultant views the modest positive industrial absorption as likely to continue – at minimum. It is encouraging that absorption has recently become positive again despite recent reductions in the amount of jobs supported per oil well, and the lack of a solution to western Canadian pipeline capacity shortage. Should one or more new pipelines move forward, as is expected, then industrial demand in Lloydminster can be expected to further accelerate.

6.4. Institutional Land Supply

There are 298 acres zoned for institutional use (public services) under the public land use type with a total assessment value of 308,728,970. The majority of acreage represented is consumed by public educational properties.

6.5. Development Permit Activity

Development permits are issued for a variety of purposes related to the development of land and include construction, change of occupancy or owners in businesses, portable/permanent signs and home occupation businesses. Subdivision applications are processed most commonly to allow for denser land uses but also for consolidating land in some cases.

Building permits are a Planning Department function and in almost all cases are linked to a Development Permit. Building permit values represent investment in the construction of new buildings and is a key indicator that provides insights into the state of the local economy.

The two tables below summarize new commercial and industrial permit value and numbers from 2014 to 2018. For new commercial development permits, there was a surge in the number of new permits from 2014 to 2015, from 17 to 27 permits per year. However, in 2016 there was a sharp decline in permits to only 7 for the year, and since 2017 there have only been 5 permits a year.

Table 14: New commercial development permits issued, by value and quantity

Year	Value of new permits	Number of new permits
2014	36,105,414	17
2015	36,380,121	27
2016	4,858,293	7
2017	10,848,000	5
2018	2,523,795	5

Source: City of Lloydminster and Urbanics Consultants Ltd.

Following a decline similar to commercial development permits, new industrial development permits have decreased since 2014, however more steadily when compared to commercial development permits.

Table 15: New industrial development permits issued, by value and quantity

Year	Value of new permits	Number of new permits
2014	19,218,291	11
2015	9,579,783	7
2016	2,400,000	5
2017	1,650,000	2
2018	-	0

Source: City of Lloydminster and Urbanics Consultants Ltd.

2015 represented a peak for both the quantity of commercial development permits issued, and by total dollar value of applications. As for new industrial permits, 2014 represented the peak for both development permits issued, and total dollar value of applications approved. Both new commercial and industrial permits have been significantly decreased both by value and numbers since 2016. It is apparent that numbers of new permits have been decreasing year by year since 2014. There were no new industrial development permits issued in 2018.

For the purposes of this study, the consultant focused on new development permits because “new commercial and industrial” provides a useful indicator of demand for new commercial and industrial floorspace and, therefore, land.

With regards to commercial land, the 5-year average for new development permits is \$18,143,125, which is somewhere between 74,054 to 173,792 square feet of commercial space (with a per square foot building cost of \$105 to \$245 per square foot according to Altus 2019 Canadian Cost Guide). Given a Floor Area Ratio density of (FAR) of 0.35, this amounts to 5 to 11 acres of commercial land consumption per year.

With regards to industrial land, the 5-year average for new development permits is \$6,569,615 which is somewhere between 59,724 to 82,120 square feet of industrial space (with a per square foot building cost of \$80 to \$110 per square foot according to Altus 2019 Canadian Cost Guide).

Given a Floor Space Ratio density of (FSR) of 0.15, this amounts to 9 to 12.5 acres of industrial land consumption per year.

6.6. Residential Supply

6.6.1 Residential supply by dwelling types

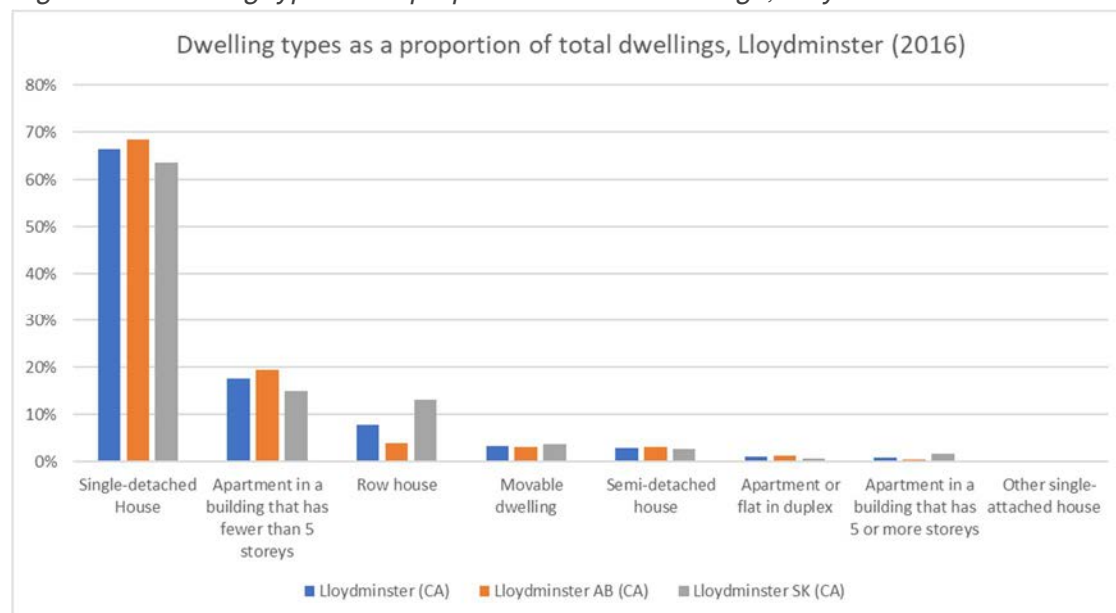
In 2016, in absolute terms, the table below shows 8,630 of 12,995 private dwellings in Lloydminster are single-detached houses, 2,275 are low-rise apartments (apartment in a building that has fewer than 5 storeys), 1,015 in row houses (725 of which are in Lloydminster, SK), and 1,080 in other types.

Table 16: Dwellings by type, Lloydminster in 2016

	Lloydminster (CA)	Lloydminster AB (CA)	Lloydminster SK (CA)
Total Private Dwellings	12,995	7,445	5,550
Single-detached House	8,630	5,100	3,530
Apartment in a building that has fewer than 5 storeys	2,275	1,450	825
Row house	1,015	290	725
Other	1,080	605	475
Movable dwelling	435	235	200
Semi-detached house	385	235	150
Apartment or flat in duplex	130	95	35
Apartment in a building that has 5 or more storeys	120	30	90
Other single-attached house	10	10	-

Source: Statistics Canada, Census 2016 and Urbanics Consultants Ltd.

In terms of percentage, the figure below displays approximately 66 percent of dwellings in Lloydminster are single-detached dwellings, which are the most common housing type. Lloydminster, AB and Lloydminster, SK have 69 percent and 64 percent of dwellings are single-detached dwellings respectively. Low-rise apartments (apartment in a building that have fewer than 5 storeys) were the next most common dwelling form at 18 percent. The third most popular dwelling form is row house in Lloydminster. 13 percent of dwellings in Lloydminster, SK are row houses, compared to only 3 percent of dwellings in Lloydminster, AB being row houses.

Figure 17: Dwelling types as a proportion of total dwellings, Lloydminster

Source: Statistics Canada, Census 2016 and Urbanics Consultants Ltd.

6.6.2 Residential supply by tenures

The table below examines the tenure by household type, displaying the majority of census family households to be one-couple-census family households of which most families had children. Among both owners and renters, this will influence the demand for housing and the market will likely respond with larger units with more bedrooms to accommodate a three-or-more family household.

Table 17: Tenure by household type

	Total	Owner	Renter
Total	12995	9010	3810
Census Family Households	9230	7240	2000
One-couple-census family housrholds	7595	6320	1270
Without children	3265	2695	570
With children	4330	3630	705
Lone-parent census family household	1400	730	665
Multiple-census family households	240	185	60
Non-census family households	3765	1955	1810
One person households	3115	1660	1455
Two-or-more person non-census-family household	645	290	355

Source: Lloydminster Housing Needs Assessment 2018

The table below displays that since 2006 ownership on the Saskatchewan side has been decreasing while ownership on the Albertan side has been increasing. The difference in ownership between the two sides of the City is significant, as 74 percent of residents in Alberta

are homeowners while 66 percent of residents in Saskatchewan are owners. The demand for rental units may be higher in the Saskatchewan side than Albertan side of the city.

Table 18: Tenure type as a proportion of households

	2016	2011	2006
Lloydminster (CA)			
Owner	71%	68%	68%
Change from prior census	3%	-1%	
Renter	29%	33%	32%
Change from prior census	-3%	1%	
Lloydminster AB (CA)			
Owner	74%	68%	69%
Change from prior census	6%	-1%	
Renter	26%	32%	31%
Change from prior census	-6%	1%	
Lloydminster SK (CA)			
Owner	66%	67%	68%
Change from prior census	-1%	0%	
Renter	34%	33%	32%
Change from prior census	1%	1%	

Source: Lloydminster Housing Needs Assessment 2018

6.6.3 Sales

The figure below demonstrates that the number of home sales have decreased in Lloydminster. The Alberta side initially had more home homes and continues to have more than their Saskatchewan counterpart, and the decline in home sales is also more dramatic for Saskatchewan (-3 percent versus -17 percent). Additionally, gross sales and average home prices are higher on the Alberta side, although the trend of decline since 2014 has been felt more sharply on the Alberta side as well.

Table 19: MLS residential sales statistics

Year	Lloydminster			Lloydminster AB			Lloydminster SK		
	Number of Sales	Gross sales (millions)	Average price/home	Number of Sales	Gross sales (millions)	Average price/home	Number of Sales	Gross sales (millions)	Average price/home
2014	762	272	356,352	505	189	374,398	257	82	320,882
2015	439	160	363,713	280	110	394,301	159	49	309,875
2016	290	100	343,448	185	69	373,468	105	31	287,137
2017	378	122	321,534	252	89	354,342	126	32	257,034
2018	358	108	302,933	249	81	325,585	109	27	251,181
Change from 2017 to 2018	-20	-13	-6%	-3	-8	-8.1%	-17	-5	-2.3%

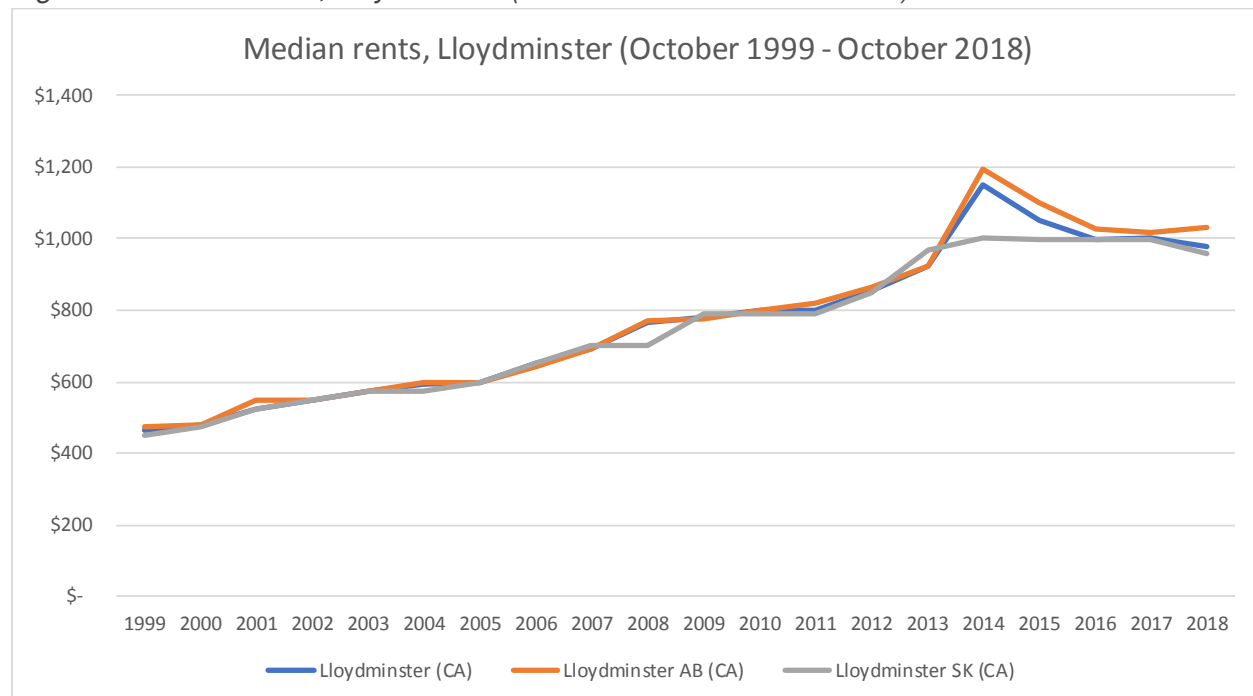
Source: MLS Statistics

6.6.4 Rent

The rental market has changed significantly between 1999 and 2018, as indicated in the figure below. The trend line shows a steady increase in rents, followed by a sharp increase between

2013 to 2014, followed by a sharp decline between 2015 to 2016. Since 2016, rents have been on the rise but have not returned to pre-2015 levels.

Figure 18: Median rents, Lloydminster (October 1999 - October 2018)



Source: CMHC Information Portal, Lloydminster (Assessed 2019)

The table below shows the progression of rents by number of bedrooms. According to the data, rental rates have oscillated since 2015, particularly for the Saskatchewan side. Most years show that the Alberta side has consistently had higher rents than the Saskatchewan side. Depending on several factors and personal preferences, renters that have lower incomes may gravitate to the Saskatchewan side, particularly larger families that desire more value per bedroom.

Table 20: Median rents by number of bedrooms, October 2010 – October 2018

	2018	2017	2016	2015	2014	2013	2012	2011	2010
Lloydminster (CA)									
Total	\$ 980	\$ 1,000	\$ 998	\$ 1,050	\$ 1,150	\$ 925	\$ 855	\$ 800	\$ 800
Bachelor	\$ 650	\$ 550	\$ 600	\$ 650	\$ 700	\$ 700	\$ 650	\$ 580	\$ 580
1 bedroom	\$ 880	\$ 900	\$ 895	\$ 900	\$ 925	\$ 775	\$ 750	\$ 700	\$ 695
2 bedroom	\$ 957	\$ 998	\$ 995	\$ 1,055	\$ 1,200	\$ 1,000	\$ 890	\$ 855	\$ 845
3+ bedroom	\$ 1,165	\$ 1,198	\$ 1,150	\$ 1,320	\$ 1,375	\$ 1,100	\$ 958	\$ 935	\$ 920
Lloydminster AB (CA)	\$ 1,030	\$ 1,017	\$ 1,025	\$ 1,100	\$ 1,195	\$ 925	\$ 865	\$ 820	\$ 800
Lloydminster SK (CA)	\$ 957	\$ 998	\$ 995	\$ 995	\$ 1,000	\$ 970	\$ 850	\$ 790	\$ 790

Source: CMHC information portal, Lloydminster (Accessed 2019) and Urbanics Consultants Ltd.

7. Demand Analyses

The following section estimates demand for residential, industrial, retail, and institutional land uses on the Northeast ASP lands.

As noted in the Supply Analysis, purpose-built office space is very rare in Lloydminster, as the overwhelming majority of business activity takes place within industrial or retail premises. Further, there is no evidence of an elevated level of demand for office space; the consultant has therefore not included office space as a distinct analysis.

7.1. Residential Demand

Residential demand largely determines how the housing market develops its housing inventory. The table below delineates the type of dwellings in the Lloydminster housing market at present; single-detached houses constitute the majority of dwelling types (64 percent), followed by lowrise apartments (19 percent) and row housing (9 percent). The predominance of single-detached is likely indicative of a market preference for such dwelling types, as residential zoning is relatively relaxed with regards to land use controls.

Table 21: Lloydminster housing stock by typology

	2016	
Occupied Private Dwellings by Structure Type	11,835	
Single-detached house	7,625	64.43%
Apartment in a building that has five or more storeys	115	0.97%
Other attached dwelling	3,760	31.77%
Semi-detached house	345	2.92%
Row house	1,045	8.83%
Apartment or flat in a duplex	150	1.27%
Apartment in a building that has fewer than five storeys	2,255	19.05%
Other single-attached house	5	0.04%
Movable dwelling	330	2.79%

Source: Sitewise Pro, Statistics Canada

Derived from the population forecast, the table below displays the projected number of dwelling types for the 2016 to 2046 period, stemming from the population forecast. Throughout Lloydminster there is expected to be demand for an additional 15,152 new homes, with a distribution of 8,716 new single-detached houses, 3,699 new apartments, 1,497 new row houses, 592 new semi-detached dwellings, and 416 new movable dwellings.

There is not a reason to expect Lloydminster to shift substantially to a proportionality different housing typology mix. However, as cities grow, detached dwellings decline as a share of the housing stock; in Lloydminster's case, the effect is expected to be fairly muted given the lack of physical growth constraints and family-oriented demographics. The model therefore assumes that detached dwellings will decline from 64% of the housing stock in 2016, to 60% in 2046.

Table 22: Household forecast to 2046, by dwelling type

Lloydminster: Households by Dwelling Type								
	2016	2021 *	2026 *	2031 *	2036 *	2041 *	2046 *	2016-2046
Single-detached house	7,590	8,432	9,544	11,055	12,737	14,494	16,306	8,716
Apartment in a building that has five or more storeys	115	129	147	172	200	229	260	145
Other attached dwelling	3,760	4,306	5,021	5,991	7,106	8,323	9,634	5,874
Semi-detached house	345	400	471	567	679	803	937	592
Row house	1,045	1,186	1,370	1,620	1,906	2,214	2,542	1,497
Apartment or flat in a duplex	150	168	192	224	260	299	339	189
Apartment in a building that has fewer than five storeys	2,255	2,569	2,981	3,540	4,181	4,876	5,620	3,365
Other single-attached house	5	6	6	7	9	10	11	6
Movable dwelling	330	370	422	493	573	658	746	416
Total	11,835	13,259	15,134	17,679	20,544	23,582	26,762	15,152

Source: Urbanics Consultants Ltd.

The below table illustrates the housing demand forecast for the Northeast ASP land for the period 2016 to 2046. In all market share scenarios, it is assumed that the Northeast ASP lands will not begin to absorb new housing until after 2021 due to the time required for development planning and construction. Further, as with industrial land use, the market shares in all scenarios increase after 2031, at which point available development opportunities adjacent to established subdivisions are likely to be exhausted.

In the medium scenario, market share is estimated at 30% of Lloydminster housing demand until 2031, and 50% thereafter. The result is a total of 5,960 homes warranted on-site – 3,413 detached homes, and 2,548 multi-family homes. The low scenario forecast estimates 3,900 total warranted homes during the study period, while the high scenario estimates 8,220. In the medium scenario, average annual housing absorption is estimated to be 115 – 150 homes per year until 2031, and 290 – 325 thereafter.

Table 23: Northeast ASP lands housing forecast

NORTHEAST ASP LANDS HOUSING DEMAND FORECAST							
Lloydminster Incremental Housing Demand	2016-2021	2026	2031	2036	2041	2046	TOTAL
Incremental Detached Home Demand	842	1112	1511	1682	1758	1812	8716
Incremental Multi-Family Home Demand ⁽¹⁾	599	786	1065	1223	1331	1431	6436
Total	1,441	1,898	2,576	2,905	3,089	3,243	15,152
ON-SITE DEMAND (UNITS)	2016-2021	2026	2031	2036	2041	2046	TOTAL
Low Market Share Scenario ⁽²⁾	-	285	386	1,017	1,081	1,135	3,904
Medium Market Share Scenario ⁽³⁾	-	569	773	1,453	1,544	1,621	5,960
High Market Share Scenario ⁽⁴⁾	-	1,139	1,545	1,743	1,853	1,946	8,226
AVG. ANNUAL ON-SITE DEMAND (UNITS)⁽⁵⁾	2016-2021	2026	2031	2036	2041	2046	TOTAL
Medium Market Share Scenario - Detached	-	67	91	168	176	181	3,413
Medium Market Share Scenario - Multi-Family	-	47	64	122	133	143	2,548
TOTAL		114	155	291	309	324	5,960
LAND ABSORPTION (ACRES)	2016-2021	2026	2031	2036	2041	2046	TOTAL
45 units per hectare scenario	-	31	42	80	85	89	327
35 units per hectare scenario	-	40	55	103	109	114	421
Notes: (1) Includes movable dwellings (2) 15% market share 2021 - 2031, 35% thereafter (3) 30% market share 2021 - 2031, 50% thereafter (4) 45% market share 2021 - 2031, 60% thereafter (5) Beginning in 2022							

Source: Urbanics Consultants Ltd.

In terms of required land area, 45 homes per hectare is the estimated density if development on the Northeast ASP lands proceeds with mixture of housing typologies indicated in the table. In this scenario, 327 acres of land is expected to be required for residential development over the course of the study period. In the event that the housing typology mix skews more towards detached homes than anticipated, a density of 35 units per hectare is likely. In the lower density scenario, 421 acres of land would be required for residential uses.

7.2. Industrial Demand

From the employment analysis, the below table illustrates job growth expected to take place within industrial premises in Lloydminster. Overall, 8,446 jobs are expected to be added in the fields which drive industrial land demand. Oil and gas is the most significant category, at 3,596 anticipated new jobs during the study period. Construction is second at 1,888 jobs, with manufacturing third at 890.

Table 24: Lloydminster industrial jobs forecast

Lloydminster: Industrial-Based Jobs								
	2016	2021	2026	2031	2036	2041	2046	2016 - 2046
Agriculture; forestry; fishing and hunting	245	259	297	347	401	459	519	274
Mining; quarrying; oil and gas extraction	2,795	3,197	3,664	4,274	4,947	5,652	6,391	3,596
Utilities	85	98	112	131	151	173	195	110
Construction	1,540	1,715	1,965	2,292	2,653	3,031	3,428	1,888
Manufacturing	750	820	940	1,096	1,269	1,449	1,639	889
Wholesale Trade	590	663	760	886	1,026	1,172	1,325	735
Transportation and warehousing	765	861	986	1,151	1,332	1,521	1,720	955
TOTAL	6,770	7,612	8,725	10,177	11,778	13,457	15,216	8,446

Source: Urbanics Consultants Ltd.

An analysis of improved industrial properties using 2018 assessment data finds that Lloydminster presently has 997 acres of improved I1 and I2 industrial lands.

Our model estimates that 6,919 Lloydminster residents were employed in industrial land consuming sectors in 2017, yielding a ratio of 0.14 acres of land required for each industrial job.

Table 25: Lloydminster industrial statistics

Improved I1 and I2 Land, 2017:	
997 acres	
Industrial jobs, 2017:	
6919	
Jobs per acre	Acres per job
6.94	0.1441

Source: Urbanics Consultants Ltd., Statistics Canada, Lloydminster assessment data

As the ratio only counts improved properties, and Lloydminster does not face physical land constraints, we expect the ratio to remain stable over time – there is not a need to switch to substantially denser forms of industrial development. Under these conditions, the City of Lloydminster is expected to absorb 1,189 acres of industrial land over the study period.

Three market share scenarios have been presented for the share of growth expected to be absorbed by the Northeast ASP lands. In all scenarios, absorption is expected to accelerate after 2031, at which point available lots in existing industrial zones will have been absorbed. The medium scenario predicts a market share of 30% to 2031, with 50% absorption for the remainder of the study period.

Table 26: Industrial land requirement forecast

Lloydminster: Industrial Land Forecast								
	2016	2021 *	2026 *	2031 *	2036 *	2041 *	2046 *	2016 - 2046
Industrial Sector Jobs	6,770	7,612	8,725	10,177	11,778	13,457	15,216	8,446
Total Required Industrial Land (Acres)	976	1,097	1,257	1,466	1,697	1,939	2,193	1,217
Incremental Industrial Absorption (Acres)		121	160	209	231	242	253	1,189
ON-SITE DEMAND (Acres)								
Low Market Share Scenario			16	21	69	73	76	255
Medium Market Share Scenario			48	63	115	121	127	474
High Market Share Scenario			64	84	150	157	165	620
Notes:								
(1) 15% market share 2021 - 2031, 35% thereafter								
(2) 30% market share 2021 - 2031, 50% thereafter								
(3) 45% market share 2021 - 2031, 60% thereafter								

Source: Urbanics Consultants Ltd.

In the medium scenario, the Northeast ASP lands will likely experience demand for 475 acres of industrial land by 2046, though the overall expected range is between 255 and 620 acres. Given that the study area is 1260 acres, there is considerable scope to accommodate a variety of land uses beyond industrial – even in a high market share scenario.

It is important to note that this analysis takes into account the fact that the surrounding rural counties, particularly Vermillion River, offer competing land for industrial development. By utilizing an employment profile of Lloydminster's total population (ie. including residents who commute outside the City), the "outflow" factor of City residents working in rural industrial properties is already accounted for in the ratio of industrial employment to industrial land required in the City of Lloydminster. A major change in land use policy by one of the rural counties may change this assumption, either by facilitating more development or by being more restrictive than the status quo, but the consultant is not aware of any such plans.

7.3. Retail Demand

The consultant estimates that Lloydminster's retail floorspace is approximately 2,500,000 sq. ft – a combination of the 2,300,000 sq. ft. of shopping centre space estimated by M.I.T. Appraisals, and an estimate of a further 200,000 sq. ft. of retail space in downtown and freestanding pads. At the time of the estimate, Lloydminster likely has a population of 34,000. While the vacancy rate of 5.5% was found to be higher than during the times of strong economic expansion that the City became accustomed to, it is still indicative of a balanced and robust retail space market. As such, the ratio of 73 sq. ft. of retail space per resident can be used as a guide to future space requirements.

Lloydminster is expected to require an additional 2,319,256 sq. ft. of retail space by 2046, consuming 183 acres of land at a floor area ratio of 0.3. While certain nodes may develop in a mixed-use fashion resulting in slightly higher densities, the utilization of underground parking is unlikely to significantly take hold in most development cases. We have therefore maintained the 0.3 FAR assumption over the course of the study period.

Table 27: Retail land requirement forecast

Lloydminster: Retail Land Requirement Forecast								
	#	2021 *	2026 *	2031 *	2036 *	2041 *	2046 *	2021 - 2046 Growth
Lloydminster Population		35,142	39,824	45,697	52,178	59,218	66,848	25,850
Total Retail Inventory (Sq. Ft.)		2,570,593	2,913,045	3,342,691	3,816,752	4,331,708	4,889,849	2,319,256
Additional Required Land Area (Acres) - 0.3 FAR		5	26	33	36	39	43	183

Source: Urbanics Consultants Ltd.

A key component of retail planning is the delineation of market share capture rates according to geography. The Highway 17 corridor and downtown Lloydminster are likely to remain as the destination retail locations in the City, as such, the on-site retail demand estimate was conducted on the assumption that demand would be derived primarily from population growth, as opposed to capturing the customer base of existing shopping centres.

For a non-destination retail development, it is likely that 10% of retail demand generated by the new on-site population will be captured by retail development in the Northeast ASP. For growth occurring in the rest of the city, an estimated 3% of retail market share may be captured. In total, the market is expected to warrant 140,000 sq. ft. of new retail space on the Northeast ASP lands throughout the study period. Approximately 100,000 sq. ft. stems from demand generated by the market-warranted amount of new residents, with the remainder stemming from demand elsewhere in the region.

Table 28: Northeast ASP retail land use forecast

Northeast ASP: Retail Land Use Forecast							
	2021 *	2026 *	2031 *	2036 *	2041 *	2046 *	2021 - 2046
On-site population growth (med. Scenario)	-	1,404	1,762	3,240	3,520	3,815	13,742
Warranted on-site retail (Sq. Ft.) - 10% market share		10,274	12,889	23,703	25,748	27,907	100,521
Off-site population growth	3,752	3,277	4,112	3,240	3,520	3,815	21,716
Warranted on-site retail (Sq. Ft.) - 3% market share	-	7,191	9,023	7,111	7,724	8,372	39,421
Total incremental on-site retail (Sq. Ft.)		17,465	21,912	30,814	33,472	36,279	139,942
Incremental Required Land Area (Acres) - 0.3 FAR	-	1	2	2	3	3	11

Source: Urbanics Consultants Ltd.

As with the industrial demand analysis, conducting the on-site demand via ratio of population to floorspace takes into account demand generated by populations outside the City of Lloydminster, provided that population growth outside the city maintains a similar relationship to urban population growth as before. While Census Division population projections are not available in Saskatchewan, the Government of Alberta population projection for Census Division 10 (a large component of Lloydminster's rural trade area) anticipates population growth proceeding at a similar rate to 1996 – 2018, a finding broadly consistent with population trends in Lloydminster as well.

7.4. Institutional Demand

Lloydminster's two largest institutional land users are Lakeland College and the Lloydminster Hospital, operated by the Prairie North Health Region. Both facilities are surrounded by ample

amounts of land, with more than sufficient space to accommodate expansions foreseeable over the study period. Further, there are not seen to be compelling locational or facility reasons for either institution to relocate to the Northeast ASP lands, nor need to open branch locations.

However, if residential development proceeds on the lands as envisioned in the demand analysis, then several schools will be required on the lands. As the Northeast ASP lands are envisioned to be heavy on industrial development (unlike typical new subdivisions), the standard guideline ratios of 3 elementary students, 1.5 junior high students, and 1.5 high school students per gross developable hectare should only be applied to the gross developable residential + retail land area. Doing so yields the result of:

- 1,014 elementary students
- 507 junior high students
- 507 high school students

While a survey of the capacity at existing schools is beyond the scope of this report, at minimum, provisions should be made for at least 2 – 3 elementary schools on site.

It is also noteworthy that, in a medium scenario, approximately 812 acres of the 1260-acre Northeast ASP area will be warranted for market development. Should there be a desire or need to expand the land area occupied by the Exhibition grounds, then the Northeast ASP lands would be able to accommodate such an expansion without forgoing land required for market needs.

8. Findings and Recommendations

On the basis of the above analyses, we find the following market-warranted levels of land consumption:

Industrial

Current job density for industrial land is:

- 6919 jobs in industrial-primary sectors
- Consuming 997 acres of improved land

The result is 6.94 jobs per acre.

By 2046, there will likely be 8,446 new industrial-oriented jobs in Lloydminster. This will mean additional demand for between 1,000 – 1,200 acres of new industrial land by 2046, given a similar level of job density per acre of industrial land.

The absorption (supply) analysis found that Lloydminster has an industrial land absorption rate of approximately 10 – 12 acres per year over the past 5 years, a considerably lower rate than the 40 acres per year of industrial land absorption estimated by the demand analysis. The discrepancy is explainable by building activity over the last 5 years (particularly 2016 – 2018) having been impacted by one of the worst economic downturns in recent regional history; conversely, the demand analysis is based on expected future growth performance.

The consultant believes that the demand projection is the more accurate of gauging industrial land needs over the 30-year study timeline. A medium market share scenario for the Northeast ASP lands would therefore result in 474 acres of industrial absorption during the study period, with a low scenario of 255 acres and a high scenario of 620 acres.

Residential

By 2046, there will likely be an additional 15,000 households in Lloydminster, bringing the City's population to 67,000. The consultant estimates that the unit type breakdown will be as follows:

- 8,700 detached homes
- 2,100 townhouse and duplex units
- 3,700 apartments
- 420 other units (mainly mobile homes)

In a medium market share scenario - with market share substantially increasing in the second half of the study period – the Northeast ASP lands can be expected to absorb 5,960 new homes to 2046. If approximately 3,400 are detached homes and 2,550 are multi-family (as estimated), 327

acres of land would be required to accommodate residential development. In a lower-density scenario, 421 acres would be required.

While northeast Lloydminster has not experienced strong residential growth in the recent past, the Northeast ASP lands are of a sufficient scale to create a residential community of critical mass so as to take-on a distinct identity (ie. positive marketing implications). Careful consideration must be given to the siting of any residential development, given the presence of the Landfill above the northeast corner of the site. It is recommended that industrial lands serve as a buffer between the Landfill and residential-designated land, with the industrial uses shifting from heavier to lighter uses in proportion to their proximity to residential land.

Retail

Although Lloydminster serves as a retail destination for a wider region of 130,000 people, the Northeast ASP lands are not considered ideal as a destination retail site. Compared to other land uses, retail is challenging to finance and lease, and is the most dependent on road exposure. Highway 17 cannot compete with the Yellowhead Highway in terms of exposure, traffic volumes, and critical mass.

The development of destination-grade retail space on site is further complicated by the presence of existing light industrial development along much of the site's Highway 17 frontage, which would require a costly assembly process to facilitate.

However, the Northeast ASP lands are expected to host a substantial new population, and therefore can capture a moderate amount of neighbourhood retail expenditures. The consultant estimates a market share capture comprising 10% of the expenditures of on-site residents, and 3% of the expenditures of new residents elsewhere in Lloydminster.

Under balanced market conditions, Lloydminster supports 73 sq. ft. of retail space per resident. In total, the City is expected to add 2,300,000 sq. ft. of retail space over the study period (current total retail inventory is estimated at 2,500,000 sq. ft.). A total of 183 acres of retail land throughout the city would therefore be required, at a FAR of 0.3.

Applying the estimated market shares to the above results in a finding that 140,000 sq. ft. of retail space would be supported on the Northeast ASP lands by the end of the study period. At an FAR of 0.3, 11 acres of land would be required.

It is recommended that planning for retail (or any exposure-dependent land uses, such as hospitality) use Highway 17 as the focus. However, zoning should be flexible so as to allow for the potential of a smaller retail node within the Northeast ASP site, should market demand materialize.

SUMMARY

In a medium market share scenario over the study period to 2046, market demand for industrial, residential, and retail space at the Northeast ASP lands is estimated to be 812 acres, out of a total of 1,260 available.

In a high market share scenario, nearly 1,100 acres of land would be consumed.

As the medium scenario is considerably more likely to be realized, the consultant notes that the Northeast ASP lands would have the capacity to accommodate a variety of recreational/civic land uses, should the City wish to capitalize on its adjacency to the existing exhibition and recreational facility cluster.

B

ENVIRONMENTAL REVIEW

**The following report is provided for reference purposes
and does not form part of this bylaw.**



Environmental Impact Assessment

Lloydminster Northeast Area Structure Plan

City of Lloydminster

November 2019



Table of Contents

1.0	Introduction	1
1.1	Environmental Impact Assessment Contents	2
1.2	Project Description	2
2.0	Biophysical Elements	4
2.1	Desktop Methodology	5
2.2	Results of the Desktop Review	8
3.0	Effects on Biophysical Elements	16
3.1	Study Limitations	17
3.2	Prediction of Effects on Biophysical Elements	17
4.0	Recommendations	20
4.1	Regulatory Framework	21
4.2	Wetland Conservation and Protection	23
4.3	Future Recommended Studies	23
5.0	Decision Making Framework	24
6.0	References	26

APPENDICES

Appendix A	HABISask Soil Output
Appendix B	Photo Plates
Appendix C	HABISask Rare Species Public Output
Appendix D	iMapInvasives Output
Appendix E	HABISask Important Habitat Public Output
Appendix F	HABISask Fisheries Output
Appendix G	FWMIS Output
Appendix H	Historical Photography
Appendix I	July 2019 Field Visit Memorandum

TABLES

Table 2.1:	Wetland Classification	7
Table 2.2:	Rare Vascular Vegetation Species in the H1 Landscape Area	8
Table 2.3:	Non-Native Weeds in Saskatchewan	10
Table 2.4:	Invasive Wildlife Species in Saskatchewan	11
Table 2.5:	Desktop Wetland Assessment Results ¹	12
Table 3.1:	Potential Biophysical Effects	17
Table 5.1:	Decision Framework	25



FIGURES

Figure 1.1:	Project Overview	3
Figure 2.1:	Wetlands, Watercourses and Waterbodies (Potential Current Extents)	13
Figure 2.2:	Wetlands, Watercourses and Waterbodies (Potential Current and Historical Extents)	14
Figure 2.3:	Permanent (Class IV or Swamp) Wetlands	15



1.0 Introduction



1.1 Environmental Impact Assessment Contents

As described in the Municipal Development Plan (MDP) 2013-2032 (Parioplan 2013), an Environmental Impact Assessment (EIA) is required for any proposed development that may have an environmental impact. As this Area Structure Plan (ASP) includes turning native undisturbed lands into a developed area containing infrastructure, an EIA is required.

EIA's may include, but not be limited to:

- A project description including its purpose, alternatives and staging requirements.
- A description of the biophysical development affected e.g., site conditions and topography including natural and man-made constraints to development).
- A prediction of effects that the project may have on the biophysical environment
- Limitations of the study, criteria used in any predictions, and interests consulted
- Recommendations and mitigation measures
- A framework for decision makers to determine the final course of action.

Lloydminster's unique position as a cross border city has resulted in this EIA including Alberta information where applicable, despite the land it pertains to being located just on the Saskatchewan side of the border.

The EIA of the Project (Figure 1.1) uses desktop level analysis to identify potentially sensitive biological and physical features on or adjacent to the Study Area that have potential to be impacted by the project; the study area is defined as within 2.0 km of the Project footprint (Figure 1.2). Included in this report is baseline environmental conditions pertaining to current land use, existing site conditions, vegetation communities, potential wildlife habitat, as well as species and areas of management concern. The schedule of the EIA resulted in the production of this report in the winter of 2019, as such historical photography and google streetview taken in summer conditions are used.

1.2 Project Description

ISL Engineering and Land Services Ltd. (ISL) has been retained by The City of Lloydminster (The City) to conduct an EIA (Parioplan 2013), as part of the NE ASP (the Project), depicted on Figure 1.1. The Project is located in 11-50-28 W3M, 2-50-28 W3M, E 12-50-28 W3M and E 1-50-28 W3M. The ASP area is bounded by 40 Avenue, 67 Street, 50 Avenue and built up areas to the south.

The Northeast ASP lands are currently a mixture of industrial land, a water treatment plant, a former airport, a former public works yard and undeveloped cultivated fields. The purpose of this ASP is to develop a plan for public and private investment in the area with the intent for it to become a mixed-use community that includes residential, commercial, industrial and institutional uses.

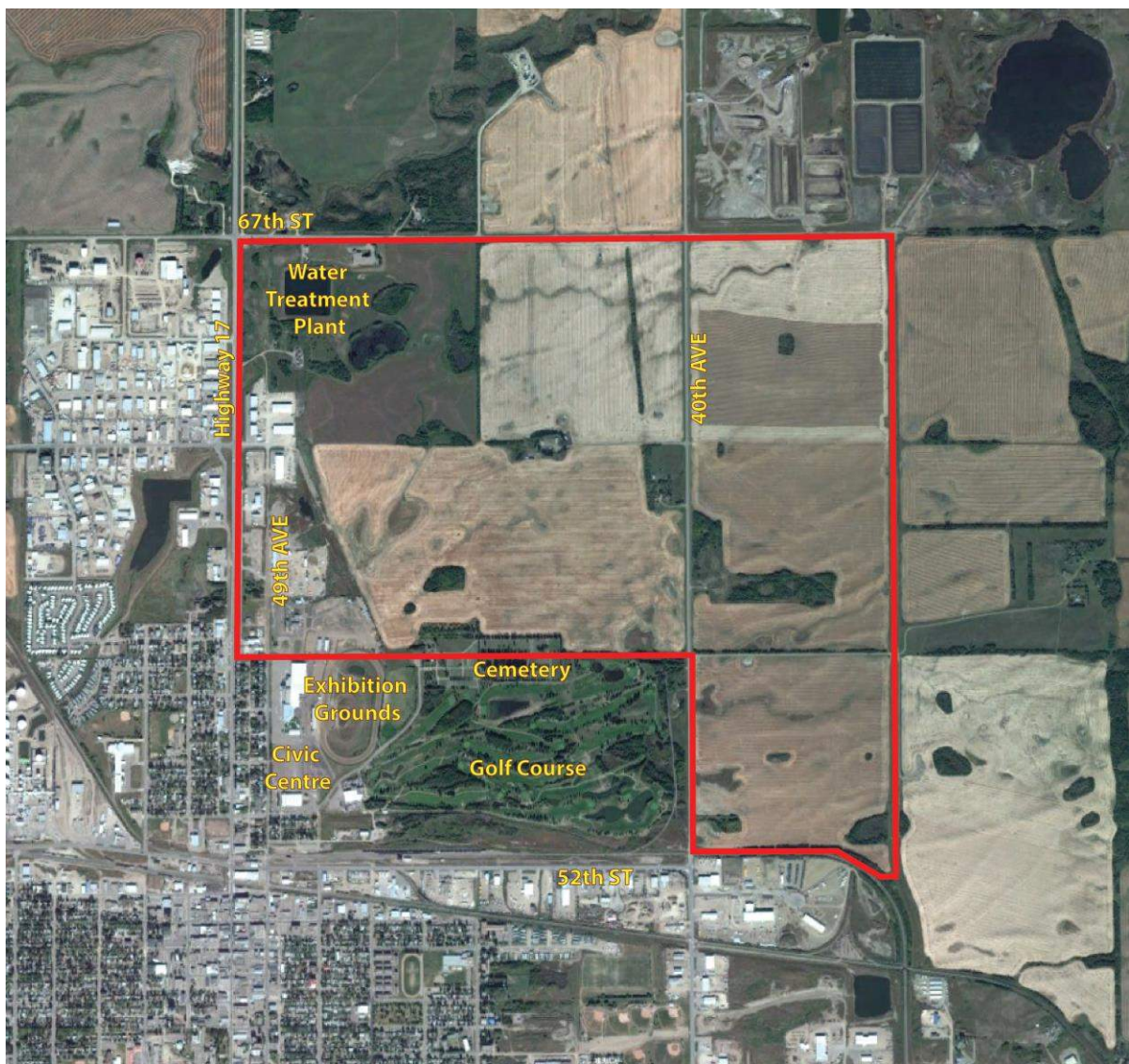


Figure 1.1: Project Overview



2.0 Biophysical Elements

2.1 Desktop Methodology

Wildlife species and vegetation elements of management concern are any that meet the following criteria:

- Species for which provincial and/or federal restricted activity periods or setback distances exist (Environment and Climate Change Canada 2017a);
- Species listed to be of Special Concern, Threatened or Endangered under the *Species at Risk Act (SARA)* (Government of Canada, 2002), Committee on the Status of Endangered Wildlife (COSEWIC) (Government of Canada 2015) or in the Wildlife Act (Government of Saskatchewan 1998)
- Previously identified fish and wildlife species provided by HABISask and listed in the Wildlife Act (SK CDC 2019, Government of Saskatchewan 1983); and
- Rare vegetation species listed on HABISask (SK CDC 2019).

Additional biophysical elements have been included if thought to be of potential concern given the biophysical elements present or potentially present in the ASP area.

2.1.1 Vegetation

Alberta Conservation Information Management System (ACIMS) and HABISask (Hunting Angling and Biodiversity Information) element occurrence data was reviewed to identify known rare plant and rare ecological community occurrences in the vicinity of the proposed Project. For invasive species, iMapInvasives was used to identify any potential concerns with invasive species in the Project area.

2.1.2 Wildlife

ISL conducted a review of AEP's (Alberta Environment and Parks) FWMIS (Fish and Wildlife Information Management System) database and the HABISask database for Saskatchewan to determine known species and wildlife protection area occurrences within a 2 km radius from the center of the ASP area.

2.1.3 Fish

To determine the presence of fish, and potential for fish habitat in the Project area, a review of FWMIS and the HABISask database for Saskatchewan was conducted.

2.1.4 Soil

Saskatchewan Soil Capability classification is interpretive, often based on existing information and not field studies. The Soil Index describes the limitations of soils affecting agricultural use. Classes 1-3 are considered suitable for crops, 4 are considered marginal and 5-7 are suitable as pasture (Shields et al. 1968). The HabiSask Database was queried to determine the soil Index value (Appendix A).

2.1.5 Wetlands

The HABISask database was assessed for potential water features by examining contour lines to gain an understanding of the number, size, and location of potential wetlands. To further identify wetlands, an assessment of historical photographs and satellite imagery was completed.

Wetland Classification

Wetlands are areas where the soil is inundated with water at an ephemeral to permanent time scale, such that the soils become reduced (i.e., hydric) and hydrophytic vegetation is dominant. Based on hydrologic, ecological, and soil (e.g., biogeochemical) properties, wetlands can be further grouped and classified. The methodology used to classify wetlands for the Project was based on the Stewart and Kantrud (1971) Wetland Classification System with the Alberta Wetland Classification System (AWCS) (Alberta Environment and Sustainable Resource



Development [ESRD] 2015) provided for informational purposes, given the proximity to Alberta and the uniqueness of the cross-border position of Lloydminster.

Within the AWCS there are five wetland classes divided into forms based on vegetation. Wetland forms are further subdivided into types based on biological, hydrologic, or biogeochemical attributes. Stewart and Kantrud (1971) Classes are comparable to the Water Permanency Type. It should be noted that to determine the full wetland Class, Form, and Type according to the AWCS, field assessment at the appropriate time of year (i.e., the growing season) is required. Consequently, this report only reports on wetland Class.

The following provides definitions of each wetland Class (from ESRD 2015). For more information on wetland Classification see the AWCS (ESRD 2015).

Marshes are mineral wetlands with water levels near, at or above the ground surface for variable periods during the year, and which supports graminoid vegetation in the deepest portion of the wetland in the majority of years.

Shallow open water wetlands are mineral wetlands with water levels near, at or above the ground surface of variable periods of the year, which is less than two metres deep at mid-summer and that contains an open water zone in the deepest wetland zone covering greater than 25% of the total area in the majority of years. The open water zone is an expanse of open, mostly unshaded water in marshes and shallow open waters that typically supports submersed, or floating vegetation and is less than two metres deep at mid-summer.

Swamps are mineral wetlands with water levels near, at or above the ground surface for variable periods during the year; and contains either more than 25% tree and/or shrub cover of a variety of species.

Bogs are peatlands fed by ombrogenous waters originating from precipitation with low concentrations of dissolved minerals. Bogs are not expected within the Project area.

Fens are minerogenous peatlands with surface or subsurface water flow that range from moderately-acidic or basic. Fens are not expected within the Project area.

Table 2.1 provides details on S&K and AWCS. The Study Area is expected to contain marshes, swamps and shallow open water wetlands of S&K classes I to IV.

Table 2.1: Wetland Classification

System	Class	Form	Type		
			Salinity	Water Permanence ¹	Plant Community Zone
S&K	Class I - Ephemeral ponds	-	-	Surface water present after snowmelt in most years for only a brief period of time	Low Prairie Zone
S&K	Class II - Temporary ponds	-	-	Surface water present after snowmelt or heavy rainfall	Wet Meadow
S&K	Class III - Seasonal Ponds	-	-	Surface water present in growing season, gone by end of the summer	Shallow Wetland
S&K	Class IV - Semi-permanent ponds	-	-	Surface water present year round in the majority of years unless in drought conditions	Deep Wetland
S&K	Class V - Permanent Ponds	-	-	Surface water present in all years including drought conditions	Open water
S&K	Class VI - Alkali ponds	-	High concentration of salts and dominated by salt tolerant plants	Intermittent	Alkaline
AWCS	Marsh [M]	Graminoid [G]	Freshwater [f] to slightly brackish [sb]	Temporary [II]	Wet Meadow
			Freshwater [f] to moderately brackish [mb]	Seasonal [III]	Shallow Wetland
			Freshwater [f] to brackish [b]	Semi-permanent [IV]	Deep Wetland
AWCS	Shallow Open Water [SOW]	Submersed and/or floating aquatic vegetation [A], bare [B]	Freshwater [f] to moderately brackish [mb]	Seasonal [III]	Shallow Wetland
			Freshwater [f] to sub-saline [ss]	Semi-permanent [IV]	Deep Wetland
			Slightly brackish [sb] to sub-saline [ss]	Permanent [V]	Open Water
			Saline [s]	Intermittent [VI]	Alkaline
AWCS	Swamp [S]	Wooded coniferous [Wc] ² , Wooded mixedwood [Wm] ² , Wooded deciduous [Wd] ² , Shrubby [S]	Freshwater [f] to slightly brackish [sb]	Temporary [II]	Wet Meadow
			Freshwater [f] to slightly brackish [sb]	Seasonal [III]	Shallow Wetland
			Moderately brackish [mb] to sub-saline [ss]	Seasonal [III]	Shallow Wetland

1. Roman numerals in AWCS are equivalent to wetland Classes by Stewart and Kantrud (1971).
2. Swamp types are not applicable to wooded swamps due to lack of available information.



2.2 Results of the Desktop Review

2.2.1 Land use and Habitat

Ecoregion and Landscape Area

The Aspen Parkland Ecoregion is a mosaic of aspen stands and fescue prairies. Aspen concentration becomes more pronounced as one moves northward in the ecoregion. Typically, the aspen stands will occur in moister areas such as valley bottoms and north facing slopes and hillsides. Fescue dominated grasslands will occur in drier and southward facing slopes (SK CDC 2014). The Project occurs in the Lloydminster Plain Landscape Area (H1). The plain is nearly level, although morainal uplands such as Eagle Hills and valleys such as the Big Gully Coulee occur within the Landscape Area. Most of the Lloydminster Plain is cropland for cereals (Padbury et al. 1998).

Local Habitat

Vegetation within the ASP area is mainly cultivated. Interspersed within is numerous wetlands, and treed areas including treed wetlands and windrows. The treed areas are dominated by Aspen. A modified watercourse is located in the NW corner of the ASP area. Photoplates of habitats taken by Google Streetview in summer are provided in Appendix B.

2.2.2 Vegetation

Rare Species

No rare vascular or non-vascular species occurrences are present in the ASP area (SK CDC 2019). The output from the publicly available database is provided in Appendix C. The nearest historical occurrence (with the 2km Study area) is located within city limits of Lloydminster in a developed area and is highly unlikely to be currently present given the development.

None of the plant species known to occur within 2 km of the proposed Project are listed by SARA, COSEWIC or the Alberta *Wildlife Act* (COSEWIC 2015, Government of Canada 2015).

Table 2.2: Rare Vascular Vegetation Species in the H1 Landscape Area

Common Name	Scientific Name	Provincial Rank ¹	Global Rank ²
Vascular Plants			
Short-stemmed Thistle	<i>Cirsium drummondii</i>	S3	G5
Western Hawk's-beard	<i>Crepis occidentalis</i>	S3	G5
Tall Blue Lettuce	<i>Lactuca biennis</i>	S3	G5
Prairie False-dandelion	<i>Nothocalais cuspidata</i>	S3	G5
Menzies' Catchfly	<i>Silene menziesii</i>	S3	G5
Hairy Bugseed	<i>Corispermum villosum</i>	S2	G4?
Bristle-leaved Sedge	<i>Carex eburnea</i>	S3	G5
Slender Spike-rush	<i>Eleocharis elliptica</i>	S3	G5
Moss Gentian	<i>Gentiana fremontii</i>	S3	G3G4
Marsh Felwort	<i>Lomatogonium rotatum</i>	S3	G5
Carolina Wild Geranium	<i>Geranium carolinianum</i>	S3	G5
Sticky Purple Geranium	<i>Geranium viscosissimum</i>	S2	G5
Soft Wild Bergamot	<i>Monarda fistulosa var. mollis</i>	S3	G5T5?

Common Name	Scientific Name	Provincial Rank ¹	Global Rank ²
Lesser Duckweed	<i>Lemna minor</i>	S1	G5
Lesser Bladderwort	<i>Utricularia minor</i>	S2	G5
Immaculate Lily	<i>Lilium philadelphicum</i> var. <i>andinum</i> f. <i>immaculata</i>	S1	G5TUQ
Pale Moonwort	<i>Botrychium pallidum</i>	S1	G3
Leathery Grape-fern	<i>Sceptridium multifidum</i>	S3	G5
Striped Coral-root	<i>Corallorhiza striata</i> var. <i>striata</i>	S3	G5T5
Small Yellow Lady's-slipper	<i>Cypripedium parviflorum</i>	S3	G5
Small Yellow Lady's Slipper	<i>Cypripedium parviflorum</i> var. <i>makasin</i>	S3	G5T4T5
Columbia Needlegrass	<i>Achnatherum nelsonii</i> ssp. <i>dorei</i>	S3	G5T5?
California Wild Oat Grass	<i>Danthonia californica</i> var. <i>americana</i>	S3	G5TNRQ
Plains Rough Fescue	<i>Festuca hallii</i>	S3	G5
Mutton Grass	<i>Poa fendleriana</i> ssp. <i>fendleriana</i>	S3	G5T5
Tumble Grass	<i>Schedonnardus paniculatus</i>	S3	G5
Northern Buttercup	<i>Ranunculus pedatifidus</i> var. <i>affinis</i>	S3	G5T5
Sandhills Cinquefoil	<i>Potentilla lasiodonta</i>	S2	G3
Crowfoot Violet	<i>Viola pedatifida</i>	S3	G5

Source: Saskatchewan Conservation Data Centre (2019)

- S1 (Critically Imperiled): Five or fewer occurrences, or especially vulnerable to extirpation due to other factor(s).

S2 (Imperiled): Twenty or fewer occurrences, or vulnerable to extirpation due to other factor(s).

S3 (Vulnerable): One hundred or fewer occurrences, or somewhat vulnerable due to other factors, such as restricted range, relatively small population sizes, or other factor(s).

S4 (Apparently Secure): Uncommon but not rare; potentially some cause for long term concern due to declines or other factors.

S5 (Secure): Common, widespread, abundant.

B: Breeding.

S_ S_ : Denotes the range of uncertainty about the status rank of the element.

SNA: Not Applicable because the species or ecosystems is not a suitable target for conservation activities (e.g., introduced species).

T (Tracked): Current information suggest species is rare or of conservation concern.
- Global (G) ranks are based on species status world-wide and follow a system parallel to Provincial Ranks (Note 1).

Weeds

Plants designated as Prohibited, Noxious or Nuisance in Saskatchewan are listed in Schedule I, II and III of the Ministerial Order for designation of Prohibited, Noxious and Nuisance weed in Accordance with the Weed Control Act (Government of Saskatchewan 2010). A search of the iMAPInvasives Database produced no results (Appendix D) Species known to be present are provided listed by the Saskatchewan Conservation Data Centre (2014) and are provided in the table below.

Table 2.3: Non-Native Weeds in Saskatchewan

Common Name	Scientific Name
Common burdock	<i>Arctium minus</i>
Absinthe	<i>Artemisia absinthium</i>
Japanese Brome	<i>Bromus japonicus</i>
Downy Brome	<i>Bromus tectorum</i>
Flowering Rush	<i>Butomus umbellatus</i>
Heart-pod Hoarycress	<i>Cardaria draba</i>
Nodding Thistle	<i>Carduus nutans</i>
Spotted knapweed	<i>Centaurea stoebe ssp. micranthos</i>
Canada Thistle	<i>Cirsium arvense</i>
Field Bindweed	<i>Convolvulus arvensis</i>
Common Hound's-tongue	<i>Cynoglossum officinale</i>
Leafy Spurge	<i>Euphorbia esula</i>
Baby's-breath	<i>Gypsophila paniculata</i>
Dame's Rocket	<i>Hesperis matronalis</i>
Common Frogbit	<i>Hydrocharis morsus-ranae</i>
Himalayan Balsam	<i>Impatiens glandulifera</i>
Field Scabious	<i>Knautia arvensis</i>
Kochia	<i>Kochia scoparia</i>
Long-stalk Hoarycress	<i>Lepidium appelianum</i>
Oxeye Daisy	<i>Leucanthemum vulgare</i>
Yellow Toadflax	<i>Linaria vulgaris</i>
Purple Loosestrife	<i>Lythrum salicaria</i>
Scentless Chamomile	<i>Matricaria perforata</i>
Wild Parsnip	<i>Pastinaca sativa</i>
European Buckthorn	<i>Rhamnus cathartica</i>
Russian Thistle	<i>Salsola kali</i>
White Cockle	<i>Silene latifolia</i>
Bladder Campion	<i>Silene vulgaris</i>
Perennial Sowthistle	<i>Sonchus arvensis</i>
Salt Cedar, Tamarisk	<i>Tamarix spp.</i>
Common Tansy	<i>Tanacetum vulgare</i>
Common Dandelion	<i>Taraxacum officinale</i>

Source: Saskatchewan Conservation Data Centre (2014)

2.2.3 Wildlife

2.2.4 Important Wildlife Habitats

The ASP is not located within or adjacent to any Ramsar wetlands (Bureau of the Convention on Wetlands 2014), World Biosphere Reserves (UNESCO 2015), Western Hemisphere Shorebird Reserves (WHSRN 2012), IBAs (Bird Studies Canada and Nature Canada 2015), Ducks Unlimited Canada Projects (DUC 2019), Migratory Bird Sanctuaries or National Wildlife Areas (Environment and Climate Change Canada 2017b).

The ASP area is not located within or adjacent to any provincially-identified parks, ecological reserves, Saskatchewan Wildlife Habitat Protection Act (WHPA) lands, Fish and Wildlife Development Fund lands or Agriculture and Agri-Food Canada (AAFC) Community Pasture Program (CPP) lands (AAFC-CPP lands) (SK CDC 2019; Appendix E).

The ASP area is within a North American Waterfowl Management Plan (NAWMP) Target Landscape (Government of Saskatchewan 2015). The Saskatchewan Water Security agency encourages land owners to participate in a voluntary stewardship agreement where conservation is recognized through a certificate of appreciation.

2.2.5 Rare Wildlife Species

No occurrences of rare vertebrate animals, invertebrate animals or animal assemblages are located within the ASP area. One animal assemblage occurs outside of the area, approximately 1 km from the ASP (SK CDC 2019) (Appendix C).

2.2.6 Invasive Wildlife Species

Invasive wildlife species as listed by the Saskatchewan CDC are provided in Table 2.4 below.

Table 2.4: Invasive Wildlife Species in Saskatchewan

Common Name	Scientific Name
Rock Pigeon	<i>Columba livia</i>
Common Carp	<i>Cyprinus carpio</i>
House Sparrow	<i>Passer domesticus</i>
Gray Partridge	<i>Perdix perdix</i>
Ring-necked Pheasant	<i>Phasianus colchicus</i>
Wild Boar	<i>Sus scrofa</i>

Source: Saskatchewan Conservation Data Centre (2014)

2.2.7 Fish and Fish Habitat

The ASP area is located in the Southern Fishing Zone (SK CDC 2019) (Appendix F). Potential fish habitat in the ASP area is limited to waterbodies which contain water on a year-round basis and do not freeze to the bed, of which the ASP area contains potential. The HABISask Database for Saskatchewan does not contain fisheries data in the ASP area, however the absence of data does not equate to an absence of fish (SKCDC 2019). The FWMS database in nearby Alberta contained an occurrence of Brook Stickleback, presumably this species could occur on the Saskatchewan side of the border (AEP 2015) (Appendix G).

2.2.8 Soil

Soils in the H1 Landscape Area are dominantly Black Loam with Dark Gray and Gray Luvisolic soils in heavily treed north facing slopes (Padbury et al. 1998). The soil is classified Index 2 in the Saskatchewan Soil Capability Index (SK CDC 2018). Soils in this class have moderate limitations that reduce the choice of crops or require moderate conservation practices (Shields et al. 1968).

2.2.9 Wetlands

In the ASP area, 58 wetland features were identified, delineated, and Classed using current and historical aerial imagery (Appendix H). Wetlands include Marshes, Swamps, and a watercourse. One Artificial feature was also identified in the ASP area (A Water Treatment Plant, Figure 1.1). Of the wetland features, 10 are likely to be reasonably permanent (Class IV or a Swamp). Table 2.5 summarizes the results of the desktop aerial interpretation within the Area. Some wetlands are connected to each other via ephemeral drainages however the majority appear to be isolate potholes.

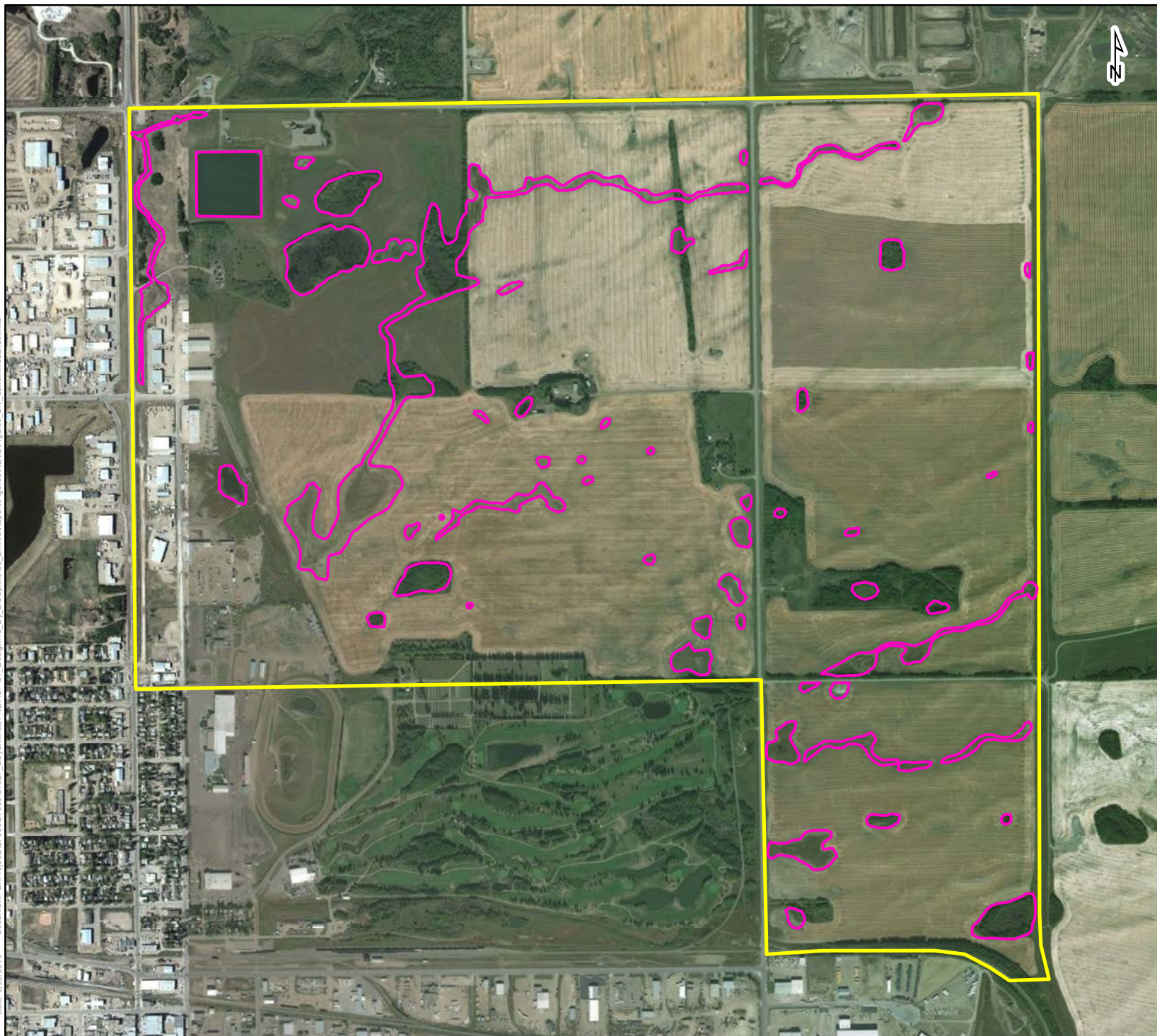
Figure 2.1 below illustrates the probable extents and locations of wetlands existing in the ASP currently, based on current ESRI Imagery. Figure 2.2 below illustrates the greatest probable extent and number of wetlands as all visible wetlands over all historical photographs area combined and superimposed on current ESRI Imagery. Figure 2.3 below illustrates the probable most permanent and still existing wetlands.

Table 2.5: Desktop Wetland Assessment Results¹

Wetland Class ¹	S&K Class	Number of Features	Area (ha)
Artificial	-	3	4.0
Watercourse	-	1	1.5
Wetland Complex	-	1	10.8
Marsh [M]	I	13	2.6
	II	10	0.8
	III	15	6.4
	IV	1	3.1
	V	0	0
	VI (Alkaline)	1	0.2
Swamp [S]	-	9	3.9
Total:		58	36.1

Notes:

1. This table is an estimate of wetland numbers and types based on the most current imagery available (Figure 2.1) and does not take potential wetlands that exist in other historical imagery. Fieldwork by a QP during the growing season is recommended.
2. Wetlands that contain more than one Class are considered complexes. If a portion of a complex is potentially permanent it is separately mapped and shown on Figure 2.3



Legend

- Approximate ASP Area
- Potential Currently Existing Wetlands, Watercourses and Waterbodies

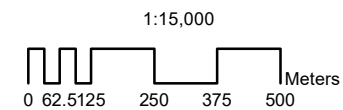
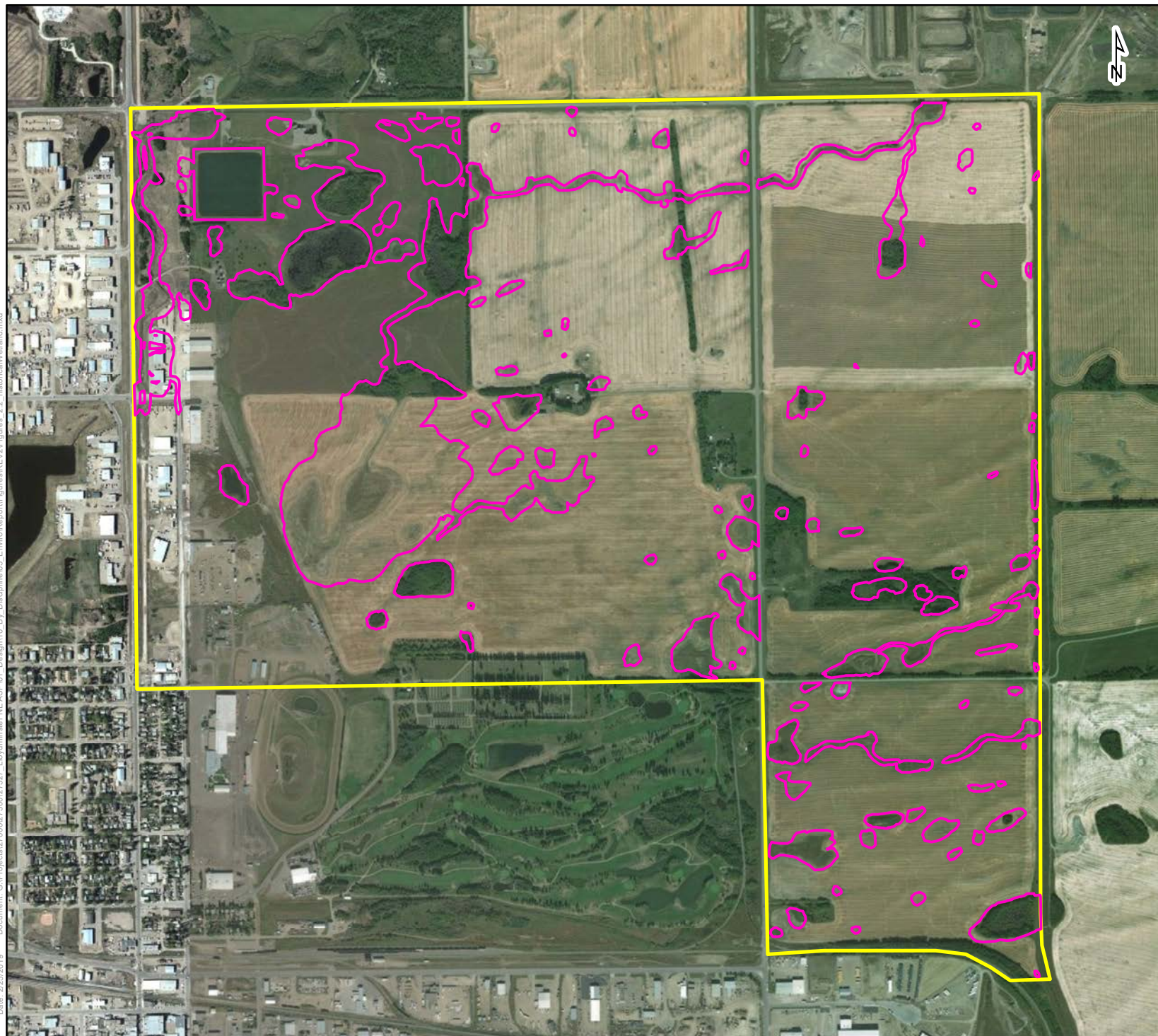


FIGURE 2.1
WETLANDS, WATERCOURSES
AND WATERBODIES
(POTENTIAL CURRENT TEXTENTS WITH
CURRENT ESRI IMAGERY)



Integrated Expertise. Locally Delivered.





Legend

- Approximate ASP Area
- Potential Wetlands, Watercourses and other Waterbodies

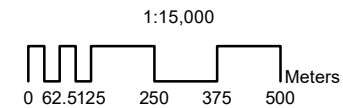
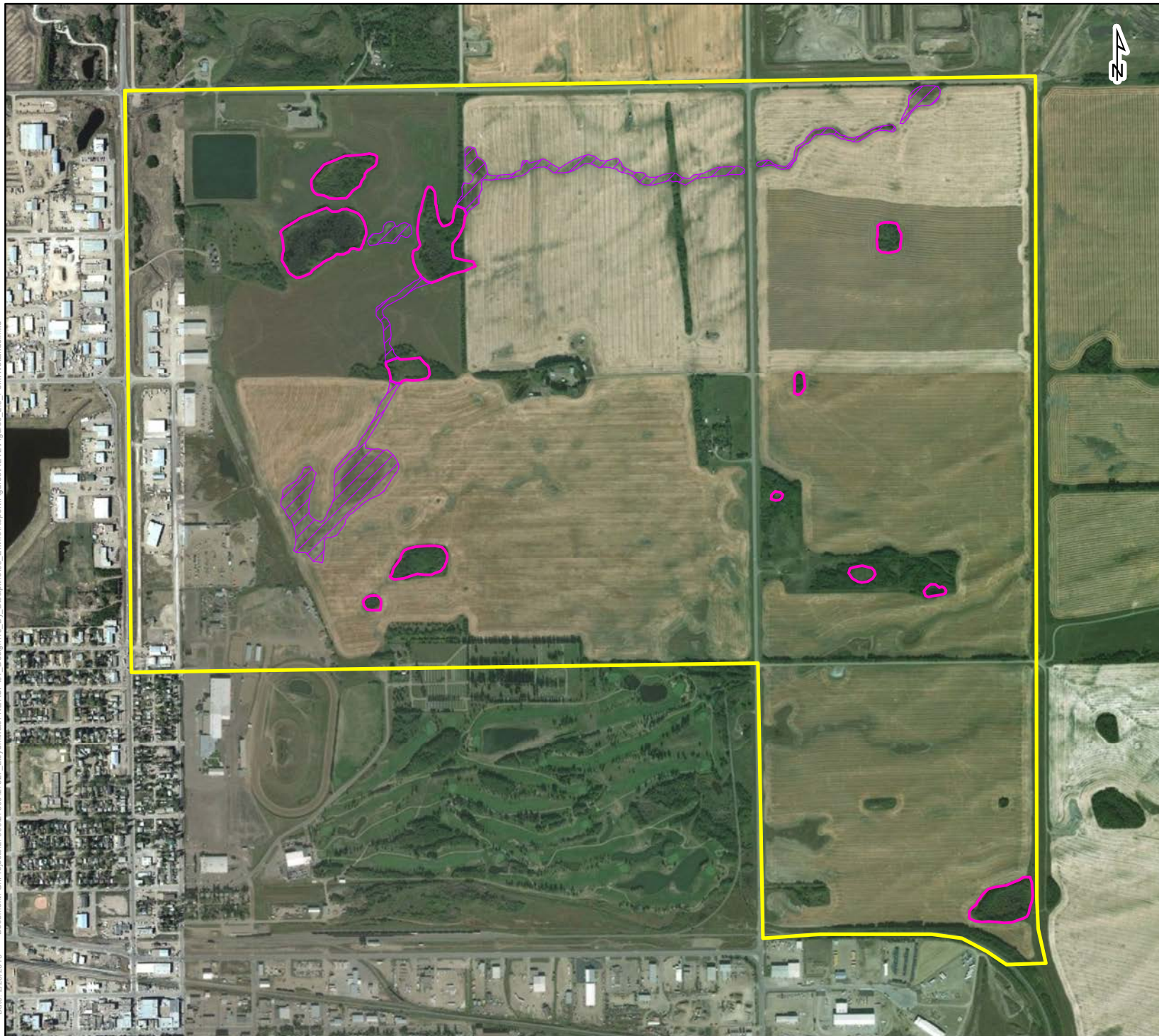


FIGURE 2.2
WETLANDS, WATERCOURSES
AND WATERBODIES
POTENTIAL CURRENT AND HISTORICAL
EXTENTS WITH CURRENT ESRI IMAGERY






Integrated Expertise. Locally Delivered.





Legend

-  Approximate ASP Area
-  Potential Permanent (Class IV and Swamp) Wetlands
-  non-permanent connections

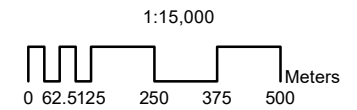


FIGURE 2.3
WETLANDS, WATERCOURSES
AND WATERBODIES
(POTENTIAL PERMANENT WETLANDS
WITH CURRENT ESRI IMAGERY)





3.0 Effects on Biophysical Elements

3.1 Study Limitations

Aerial imagery interpretation is an effective way to identify biophysical features such as wetlands during project planning stages. However, some biophysical features may not be evident on imagery and to be appropriately assessed, fieldwork should be conducted during an appropriate time of the year. Examples include wildlife such as birds, mammals, reptiles, and rare plants.

Pertaining to wetlands, the inconspicuous physical characteristics of some wetlands may have potentially hindered their identification during interpretation due to their small size or often temporary and seasonal occurrence especially on agricultural land. Additionally, Swamp wetlands are particularly difficult to differentiate from wet forest during imagery interpretation. Due to the limitations of imagery interpretation, the wetland location, size, and Class provided in Section 2 above should be used as a guideline for planning purposes only.

The absence of data available in provincial databases does not equate to the absence of species in an assessment area. Databases can only confirm presence of a species at a particular moment at the time of collection.

3.2 Prediction of Effects on Biophysical Elements

The ASP is a plan for the future neighbourhood and no immediate impacts as a direct result of the ASP are planned. The following table describes potential impacts of the future neighbourhood that may occur as a result of an ASP implementation. The table evaluates typical impacts that may occur as a result of infrastructure (residential, commercial, industrial and institutional) development on the ASP area.

Table 3.1: Potential Biophysical Effects

Potential Biophysical Impacts of Future Development in the ASP Area				
Environmental Elements	Description of Interaction (How, When, Where, Positive, Negative)	Type of Potential Impact	Mitigation Recommendations	Potential Residual Adverse Impact
Topography	Topography along the ASP Area is generally flat with depressional wetland areas. Topography is likely to change with the future construction of a neighbourhood in this area.	If permanent earthworks are planned to occur there is a risk for erosion and sedimentation across the study area. Additionally, water management will be critical if wetlands are infilled.	Implement an erosion and sediment control plan and a water management plan.	Loss of natural landscape contours, alteration of surface drainage patterns.
Hydrogeology/ Groundwater	Construction of infrastructure in the ASP area has the potential to interact with groundwater. Groundwater is expected to be a muted representation of surface water and surface water is present in multiple locations in the ASP area.	If permanent earthworks occur, this may cause a change in groundwater quality and/or quantity during construction and flow, post construction.	Implement a groundwater monitoring plan, implement erosion and sediment control as well as a spill response plan.	Alteration of groundwater flows, potential for contamination.

Aquatic Resources	Wetlands, a watercourse and dugouts occur within the ASP area. Construction has potential to interact with these aquatic resources.	Earthworks may cause a temporary change in surface water quality during construction. Loss of aquatic habitat area may occur.	Flag or fence off waterbodies that are not to be disturbed, include a buffer for protection from sedimentation.	If wetland or waterbodies are infilled, loss of aquatic habitat will occur.
Soils	Earthworks will occur during the construction of the Project. Admixing of soils has potential to occur as does erosion and sedimentation. Soils from outside the project area may be brought in.	Loss of topsoil, erosion and sedimentation. Potential admixing. It is unknown if soils have contamination issues.	-Implement an erosion and sediment control plan. -Conduct an Environmental Site Assessment to determine potential contamination issues.	Loss of capability for cultivation, admixing.
Vegetation	No historical rare plant occurrences overlap the project area, however some native areas exist and there is low to moderate potential for rare plants. Introduction of soils and dirty construction equipment may result in the introduction of weeds.	Transportation and introduction of weeds. Loss of rare plants or native plants. Loss of native plants and potential habitat for them.	-Prior to construction, manage weeds. Do not park or store vehicles/equipment on infestations and if needed, control weeds prior to use. -Ensure vehicles and soils brought on site are clean and free of weed seeds. -Flag or fence off areas of native vegetation to be retained.	Loss of rare plants, stands of native vegetation, introduction of weeds.
Wildlife and Wildlife habitat	No historical records of wildlife are in the area. However, potential bird habitat (tree stands and wetlands) exist in the ASP area therefore migratory birds and other wildlife may occur within the Project area.	Construction activities may cause sensory disturbance to wildlife species, causing avoidance. Some wetland and tree/shrub/herbaceous habitat is likely to be removed.	-Follow the recommended timing and setbacks for Species at Risk (if they occur). -Complete pre-disturbance surveys during the migratory bird nesting window. -Ensure that noise abatement equipment (e.g., mufflers) on machinery is in good working order. Turn off equipment when not in use. Enclose noisy equipment, as needed, to limit the transmission of noise beyond the construction site. -In the event that active nests, dens, burrows, etc. are found during clearing and construction activities, consultation with the appropriate regulator is required. Active nests may be subject to an appropriate buffer until the nest is no longer active or a permit may be granted for removal. -Do not harass or feed wildlife. -Avoid removal of nests and/or nest buffer, wildlife trees, important habitat features such as ungulate browse, or other habitat features, where practical.	Loss of nesting habitat, migratory refuges and foraging habitat.

Fish and Fish Habitat	<p>The ASP occurs in an area with wetlands that may be partially or completely infilled in the future. If fish are present in the wetlands, loss of aquatic habitat may impact them and their populations.</p>	<p>Construction activities have potential to cause sedimentation. Loss of aquatic habitat area is anticipated with the introduction of a permanent roadway feature.</p>	<p>-Determine if fish are present within the wetland areas- If applicable, follow guidance on screen design found in DFO's Freshwater Intake End-of- Pipe Fish Screen Guideline (DFO 1995). -Monitor to assess sediment release (i.e., turbidity and Total Suspended Solids [TSS]) if required by the applicable regulatory approvals. -If present, fish must be salvaged from within isolated work site and returned to a suitable location -Do not wash equipment or machinery near any waterbody. Control wastewater from construction activities to avoid discharge directly into water -Prohibit fuel storage, refuelling, or servicing of equipment within 100 m of any waterbody, except where secondary containment and/or tertiary containment is provided.</p>	<p>Loss of aquatic habitat, fish mortality.</p>
Species at Risk (COSEWIC, SARA)	<p>No federally listed species have been previously identified within the 2km Study Area. The Project area is unlikely to have preferred habitat, however field studies will confirm. Construction activities may cause sensory disturbance to wildlife species, causing avoidance.</p>	<p>Preconstruction surveys will provide appropriate mitigation measures specific for species found.</p>	<p>See wildlife, vegetation and fish and fish habitat, above.</p>	<p>Loss of potential habitat.</p>
Land and Resource Use	<p>No recreational or resource use of any wetland appears to occur. The current cultivation will no longer occur with infrastructure/community development.</p>	<p>Change in land use and users.</p>	<p>Public consultation will aid in mitigation for concerns over land use changes.</p>	<p>Loss of crop area.</p>



4.0 Recommendations

4.1 Regulatory Framework

ISL recommends adhering to all federal and provincial regulations and municipal policies. Provincial regulations that have potential to be applicable in the ASP Area are described below. This list should not be considered comprehensive and may be reduced or increased as the ASP project evolves and post ASP when construction occurs. Regulations often change over time, new ones introduced or repealed and requirements may change by the time of construction. Fieldwork one to two years prior to ground disturbance, and well prior to vegetation stripping or tree clearing is recommended to determine requirements that are applicable at that time.

4.1.1 Federal

Migratory Birds Convention Act

The *Migratory Birds Convention Act (MBCA)* is administered by Environment and Climate Change Canada (ECCC) to ensure protection of migratory birds, their nests, and their eggs. Birds protected by the *MBCA* include waterfowl (such as ducks, geese, and swans), insectivorous birds (such as wrens, robins, shrikes, and woodpeckers), and some nongame birds (such as herons and gulls) (ECCC 2014).

To protect migratory birds, ECCC provides general nesting periods based on geographic location (ECCC 2014). The general nesting period covers the majority of species covered under the *MBCA*; however, it may not be accurate for species that can breed at any time during optimal conditions (e.g. crossbill species), or species that may nest earlier or later (ECCC 2014).

The general migratory bird-nesting period for the Project (located within zone B5) is mid-April to late August (ECCC 2014). During this period, construction activities require a pre-construction sweep to avoid disturbance and nest sweeps every 3-7 days where habitat occurs. In the event that nesting migratory birds are identified during the nest sweep, a setback may be identified through consultation with ECCC where feasible, or a permit would be required to remove the nest.

Depending on the timing of construction, pre-disturbance mitigation such as nest sweeps may be required.

Species at Risk Act

The *Species at Risk Act (SARA)* includes several prohibitions to protect species listed on Schedule 1 of *SARA*. Under Sections 32 and 33 of *SARA*, it is an offence to:

- Kill, harm, harass, capture, or take an individual of a species listed under *SARA* as extirpated, endangered, or threatened
- Possess, collect, buy, sell, or trade an individual of a species listed under *SARA* as extirpated, endangered, or threatened, or any part or derivative of such an individual
- Damage or destroy the residence of one or more individuals of a listed endangered or threatened species or of a listed extirpated species if a recovery strategy has recommended its reintroduction into the wild in Canada

Navigation Protection Act

The *Navigation Protection Act (NPA)* includes a List of Scheduled Waters under which Transport Canada regulates works and activities that have the potential to affect navigation. Non-scheduled waterways also may be covered under the *Act*, if the works pose a risk to public navigation.

Fisheries Act

The *Fisheries Act* includes provisions to avoid causing serious harm to fish. This would apply to work being conducted in or near waterbodies supporting fish that are part of or that support a commercial, recreational, or Aboriginal fishery. If any activities associated with the Project could result in death of fish or a permanent



alteration to or destruction of fish habitat, a review by DFO may be required to determine the requirement for an Authorization and potentially an offsetting plan.

4.1.2 Provincial

Saskatchewan Environmental Assessment Act

The Saskatchewan Environmental Assessment Act pertains to impacts on the environment from new developments. Development means any project, operation or activity or any alteration or expansion of any project, operation of activity likely to have an effect on rare and unique or endangered features, substantially use a provincial resources, emit pollutants in a manner that is not regulated by another Act or regulation, cause widespread public concern or others as listed in Part 1(2(d)) of Chapter E-10.1 of the Environmental Assessment Act. This ASP and subsequent development is anticipated as unlikely be subject to the EAA.

The Saskatchewan Environmental Protection Management and Habitat Act

To conduct work in or near water, an individual or corporation must obtain an Aquatic Habitat Protection Permit. Work requiring a permit includes: road developments such as culvert or bridge installations; shoreline stabilization; recreational development such as docks, beaches and boat launches; riparian and aquatic vegetation removal; channelization; wetland infilling or drainage; ditch maintenance; and water use infrastructure such as pumphouses (Saskatchewan Water Security Agency 2017).

Applications require a technical contact. Agriculture drainage permits specifically require a Qualified Person (QP) defined as a Professional Engineer, Professional Agrologist, Applied Science Technologist, or Certified Technician.

If wetland infilling or other applicable activities are planned, a Habitat Protection Permit will be required. Allow at minimum 6 weeks for permit processing.

Saskatchewan Wildlife Habitat Protection Act (WHPA)

The Wildlife Habitat Protection Act pertains to crown lands designated as wildlife habitat and ecological lands. The Act prohibits lands alteration of designated lands (Government of Saskatchewan 1983). No WHPA lands are in or nearby the ASP area.

The Wildlife Act

The Saskatchewan Wildlife Act determines the protection of wild species considered “designated”. The minister can prepare and implement recovery plans for designated species (Government of Saskatchewan 1998). The Wildlife Act may be applicable if designated species are discovered prior to construction.

Saskatchewan Fisheries Regulation

A fisheries license is required to obtain or possess fish by any method for scientific purposes (Section 86(1)). A number of fish are considered invasive in Saskatchewan and if designated so by a Minister, prohibitions such as importation, buying, selling, transporting, introduction and deposition is prohibited. Prohibited fish species are listed in Table 10 (Section 88.1) of The Fisheries Regulations (F-16.1 REG 1). A fisheries license will be required to conduct fish studies, if required.

The Weed Control Act

The Weed Control Act designates weeds as Prohibited, Noxious or Nuisance. A prohibited weed shall be eradicated while a noxious weed is prohibited from movement by any material, machine, or domestic animal. A ministerial order designates the weed species included (Government of Saskatchewan 2010). A weed survey in the growing season may be beneficial, weed control prior to area development, if needed, is recommended.

4.2 Wetland Conservation and Protection

Generally, ISL recommends retention of reasonably permanent, large, and/or complex wetlands due to the potential landscape hydrologic impact. Typically, these basins have limited anthropogenic disturbance resulting in native plant communities, high potential for rare species, and stable wildlife habitat for waterfowl, shorebirds, amphibians, and invertebrate species. Additionally, these basins typically hold more water than other wetlands and may be significant to catchment hydrology. To infill them during development would not only displace this water, but also likely impact the overland flow dynamics, which could lead to flooding and/or spring melt and stormwater management issues.

It should also be noted that less permanent wetlands also provide important wetland functions such as stormwater retention, sediment and nutrient retention, as well as wildlife habitat, however, they occur as smaller features on the landscape within the Study Area and the impact of their disturbance is anticipated to be less since the majority of them have been historically disturbed by cultivation. ISL recommends that during development, conservation of these wetlands be considered.

4.2.1 Setbacks and Environmental Reserve

Wetland setbacks are important to consider for development planning. Setbacks provide a buffer of vegetation and help to filter water and other inputs, provide habitat for wildlife, and help protect the wetland from disturbance. Lloydminster has no mandated setbacks for wetlands, nor does the government of Saskatchewan or the Government of Alberta have required setbacks.

The Alberta government recommends 20 m for glacial till or 50 m for coarse textured sands and gravels adjacent to Class III (Stewart and Kantrud 1971) and above wetlands as well as lakes, rivers, streams, seeps and springs (Government of Alberta 2012). Class II wetlands (Stewart and Kantrud 1971) have a recommended 10 m setback (Government of Alberta 2012).

ISL recommends that permanent and intact wetlands be claimed as Environmental Reserve and have a 50 m setback applied. A 20 m setback is recommended for other intact wetlands and watercourse areas that have low disturbance and/or high potential for habitat.

4.3 Future Recommended Studies

ISL recommends field studies prior to the time of ground disturbance, as data collected for fieldwork is generally considered expired 3-5 years from collection. ISL recommends wildlife studies, specifically migratory bird assessments during the spring season to assess for protected species and the need for mitigation specific to those species and to remain in compliance with the Wildlife Act and Migratory Bird Convention Act.

ISL also recommends wetland field studies by a Qualified Person prior to ground disturbance to provide accuracy in the Habitat Protection Permit application and to provide baseline information for future Water Management Plans. Additionally, assessment for fish presence is recommended to remain in compliance with the Fisheries Act. Additional recommendations and options for mitigation at the time of construction are provided in Table 3.1, above.



5.0 Decision Making Framework

At the desktop stage, there do not appear to be encumbrances to future a development that cannot be mitigated for. Fieldwork prior to ground disturbance will provide site and species-specific mitigation and is recommended.

Table 5.1: Decision Framework

Task	Main Recommendations
Further Biological Assessments?	Recommended, See Section 4.2 and Table 3.1
Regulatory Approvals Required?	Likely, but are dependant on results of fieldwork at appropriate time of year and construction details.
Environmental Reserve and setbacks?	ISL recommends retention of wetland where possible. Preferably those that appear most permanent.



6.0 References

Alberta Environment and Parks. 2015. Fisheries and Wildlife Management Information System (FWMIS). Website: <http://aep.alberta.ca/fish-wildlife/fwmis/default.aspx>. Accessed: February 2019.

Bird Studies Canada and Nature Canada. 2015. Important Bird Areas. Website: <http://www.ibacanada.ca/mapviewer.jsp?lang=EN>. Accessed: February 2019.

Bureau of the Convention on Wetlands. 2014. The Ramsar Sites. Website: <http://www.ramsar.org/sites-countries/the-ramsar-sites>. Accessed: February 2019.

Committee on the Status of Endangered Wildlife in Canada. 2015. Wildlife Species Search. Last updated June 19, 2015. Website: http://www.registrelep-sararegistry.gc.ca/sar/index/default_e.cfm. Accessed: February 2019.

Department of Fisheries and Oceans. 2013. Fisheries Protection Policy Statement. Projects Near Water. Website: <http://www.dfo-mpo.gc.ca/pnw-ppe/pol/index-eng.html>. Accessed: February 2019.

Ducks Unlimited Canada. 2019. Duck Navigator (interactive map). Website: <http://maps.ducks.ca/ducknavigator/>. Accessed: February 2019.

Environment and Climate Change Canada. 2014. Birds Protected in Canada under the Migratory Birds Convention Act, 1994 and Regulations. Website: https://www.ec.gc.ca/nature/default.asp?lang=En&n=496E2702-1#_003. Accessed: February 2019.

Environment and Climate Change Canada. 2017a. General Nesting Periods of Migratory Birds in Canada. Website: https://www.ec.gc.ca/paom-itmb/default.asp?lang=En&n=4F39A78F-1#_01_4. Accessed: February 2019.

Environment and Climate Change Canada 2017b. Migratory Bird Sanctuaries. Website: <https://www.canada.ca/en/environment-climate-change/services/migratory-bird-sanctuaries/locations.html#sk>. Accessed: February 2019.

Government of Alberta. 2012. Stepping Back from the Water: a beneficial management practices guide for new development near water bodies in Alberta's settled region. Website: <https://open.alberta.ca/publications/9781460100592>. Accessed: February 2019.

Government of Canada. 2015. Species at Risk Public Registry. Website: http://www.sararegistry.gc.ca/species/default_e.cfm. Accessed: February 2019.

Government of Saskatchewan. 1980. The Environmental Assessment Act. Accessed at: <http://www.publications.gov.sk.ca/freelaw/documents/English/Statutes/Statutes/E10-1.pdf>. Accessed: February 2019.

Government of Saskatchewan. 1983. The Wildlife Habitat Protection Act. Accessed at: <http://www.publications.gov.sk.ca/freelaw/documents/English/Statutes/Statutes/W13-2.pdf>. Accessed: February 2019.

Government of Saskatchewan. 2010. The Weed Control Act. Accessed at: <http://www.publications.gov.sk.ca/freelaw/documents/English/Statutes/Statutes/W11-1.pdf>. Accessed: February 2019.

Government of Saskatchewan. 2010. Ministers Order: Designation of Prohibited, Noxious and Nuisance Weeds in Accordance with the Weed Control Act. Accessed at: <http://publications.gov.sk.ca/documents/20/84083-44fb5d3e-a7e0-461c-84d5-876f651a3ed4.pdf>. Accessed: February 2019.



Government of Saskatchewan. 2015. NAWMP Target Landscapes for the WSA Southwest Region. Website: http://crwatershed.ca/wp-content/uploads/2018/01/NAWMP_Target_Landscapes_SW_11x17.pdf. Accessed: February 2019.

Parioplan. 2013. Lloydminster Municipal Development Plan. Website: <https://www.lloydminster.ca/en/business-and-growth/resources/Documents/Municipal-Development-Plan.pdf>. Accessed: February 2019.

Saskatchewan Conservation Data Centre. 2014. Saskatchewan's Ecoregions. Website: <http://www.biodiversity.sk.ca/eco.htm>. Accessed: February 2019.

Saskatchewan Conservation Data Centre. 2014. Taxa-list: Non-Native Species (Current as of November 2014). Website: <http://www.biodiversity.sk.ca/SppList/non-native.pdf>. Accessed: February 2019.

Saskatchewan Conservation Data Centre. 2019. HABISask Database. Accessed at: <https://gisappl.saskatchewan.ca/html5ext/?viewer=habisask>. Accessed: February 2019.

Saskatchewan Conservation Data Centre. February 2019. Tracked Vascular Plant Taxa by Ecoregion. Regina, Saskatchewan. Website: <http://www.biodiversity.sk.ca/SppList.htm>. Accessed: February 2019.

Padbury, G.A., D. Acton, and C. Stushnoff. 1998. Ecoregions of Saskatchewan. University of Regina. Canadian Plains Research Centre. University of Regina Press. 205pp.

Shields, J.A., H.P.W., Rostad, and J.S. Clayton. 1968. A guide to Soil Capability and Land Inventory Maps in Saskatchewan (Second Edition). Publication No. M8. Saskatchewan Institute of Pedology, University of Saskatchewan, Saskatoon, Saskatchewan. 60 pp.

Government of Saskatchewan. 1995. The Fisheries Regulations (Chapter F-16.1 REG 1). Accessed at: <http://www.qp.gov.sk.ca/documents/English/Regulations/Regulations/F16-1R1.pdf#page=50>. Accessed: February 2019.

Government of Saskatchewan. 1998. The Wildlife Act. Accessed at: <http://www.qp.gov.sk.ca/documents/English/Statutes/Statutes/W13-12.pdf>. Accessed: February 2019.

Saskatchewan Water Security Agency. 2017. Aquatic Habitat Protection. Website: <https://www.wsask.ca/Water-Programs/Aquatic-Habitat-Protection/>. Accessed: February 2019.

Stewart, Robert E., and Harold A. Kantrud. 1971. Classification of natural ponds and lakes in the glaciated prairie region. Resource Publication 92, Bureau of Sport Fisheries and Wildlife, U.S. Fish and Wildlife Service, Washington, D.C. Jamestown, ND: Northern Prairie Wildlife Research Center Online. Website: <http://www.npwrc.usgs.gov/resource/wetlands/pondlake/index.htm> (Version 16APR1998). Accessed: May 2016.

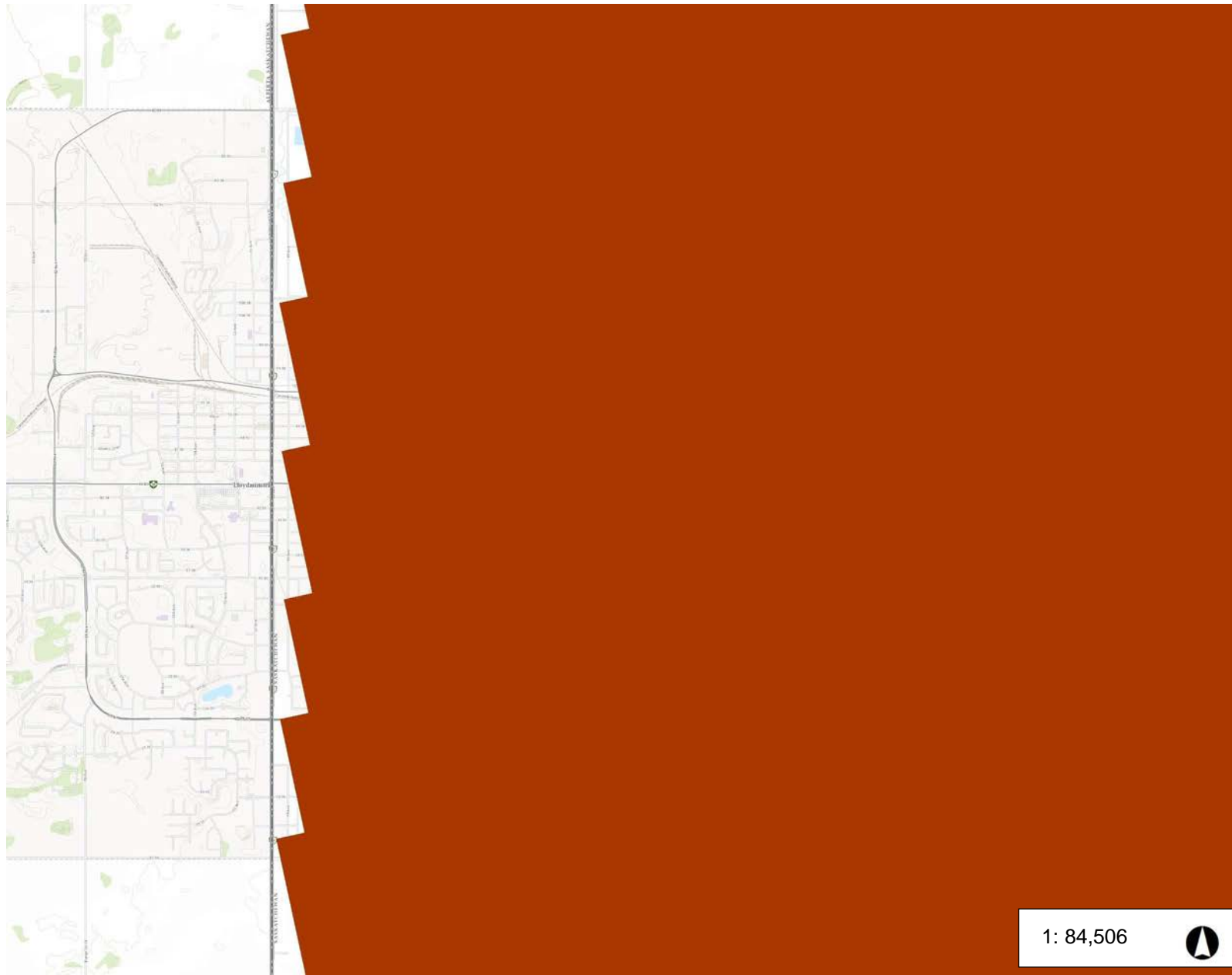
United Nations Educational, Scientific and Cultural Organization. 2015. World Network Biosphere Reserves. Website: <http://unesdoc.unesco.org/images/0023/002314/231407M.pdf>. Accessed: February 2019.

Western Hemisphere Shorebird Reserve Network. 2012. Sites in the Western Hemisphere Shorebird Reserve Network (interactive map). Website: <https://www.whsrn.org/sites-1>. Accessed: February 2019.



APPENDIX
HABISask Soil Output

A



Legend

- Provincial Boundary
- National Park
- Provincial Park
- Saskatchewan Soil Capability
 - Class 1
 - Class 2
 - Class 3
 - Class 4
 - Class 5
 - Class 6
 - Class 7
 - Organic

1: 84,506



4.3 0 2.15 4.3 Kilometers

WGS_1984_Web_Mercator_Auxiliary_Sphere
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Notes



APPENDIX

Photo Plates

B



Plate 1 Google Streetview southeast on 67th Street with AB-17 to the right (NW 11-50-28 W3M) (Google Streetview 2013).



Plate 2 View on 67th Street in the NW portion of the ASP area showing a culvert and drainage (NW 11-50-28 W3M). Also evident is a Canada thistle infestation (arrow) (Google Streetview 2013).



Plate 3 View south on 67th Street showing cultivated field and potential wetland (arrow) in NW 11-50-28 W3M (Google Streeview 2013).



Plate 4 View south on 67th Street, at the intersection of the CNR East Till Battery, showing a windrow in NE/NW 11-50-28 W3M(Google Streeview 2013).



Plate 5 View southwest near the intersection of 67th Street and 40th Avenue, showing cultivation in NE 11-50-28 W3M (Google Streeview 2013).



Plate 6 View southeast near the intersection of 67th Street and 40th Avenue, showing cultivation in NW 12-50-27 W3M (Google Streeview 2013).



Plate 7 View east on 40th Avenue, showing wetland (arrow) in NE 11-50-28-W3M (Google Streetview 2013).

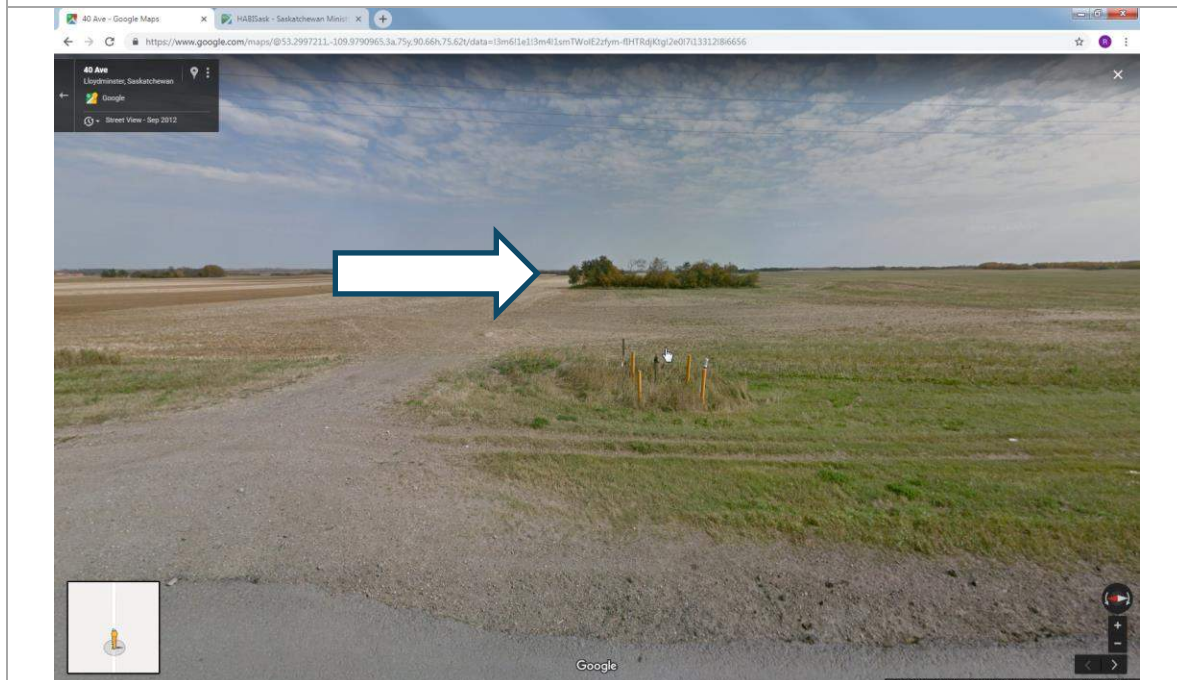


Plate 8 View east on 40th Avenue, showing wetland (arrow) in SW 12-50-27-W3M (Google Streetview 2013).



Plate 9 View west on 40th Avenue, showing wetland (arrow) in NE/SE 11-50-28-W3M (Google Streeview 2013).



Plate 10 View west on 40th Avenue, showing wetland (arrow) in SE 11-50-28-W3M (Google Streeview 2013).



Plate 11 View southeast on 40th Avenue into NW 1-50-28 W3M, showing wetlands (arrow) (Google Streetview 2013).



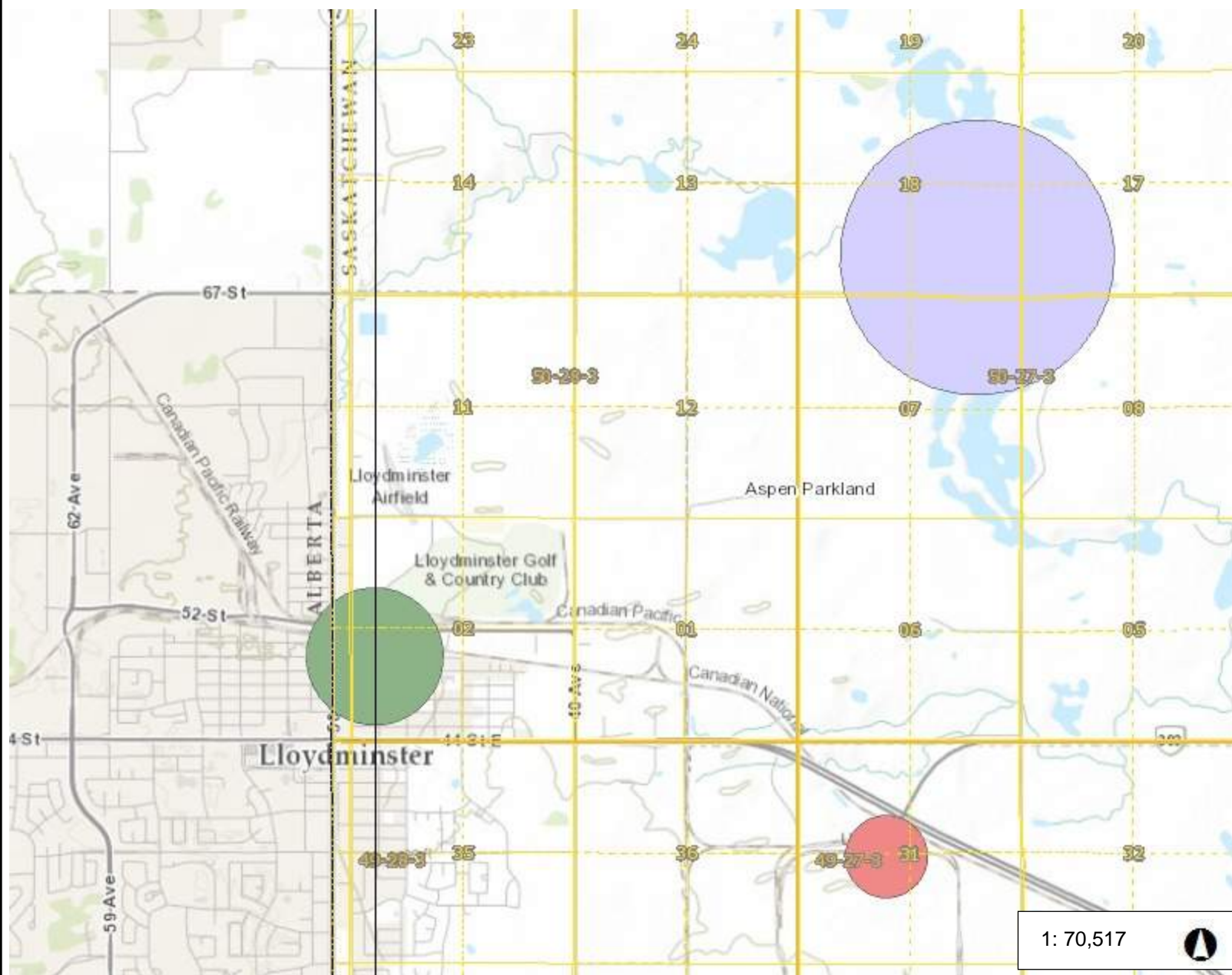
Plate 12 View east on 40th Avenue near the intersection with 52nd Street, view into NW 1-50-28 W3M (Google Streetview 2013).



APPENDIX
HABISask Rare Species Public Output

C

HABISask-Rare Species



Legend

- Provincial Boundary
- Natural Ecoregions
- Township
- Section
- Quarter Section
- Rare and Endangered Species**
 - Vertebrate Animal
 - Invertebrate Animal
 - Animal Assemblage
 - Vascular Plant
 - Nonvascular Plant
 - Other (Botanical)
 - Fungus
- Game Preserve
- National Wildlife Area
- Migratory Bird Sanctuary
- Wildlife Habitat Protection (WH)
- Wildlife Refuge
- National Park
- Provincial Park

Notes

3.6 0 1.79 3.6 Kilometers

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APPENDIX
iMapInvasives Output

D



Saskatchewan User Tools

Generated Report

Report for Municipality : Lloydminster , Buffer_distance: 100

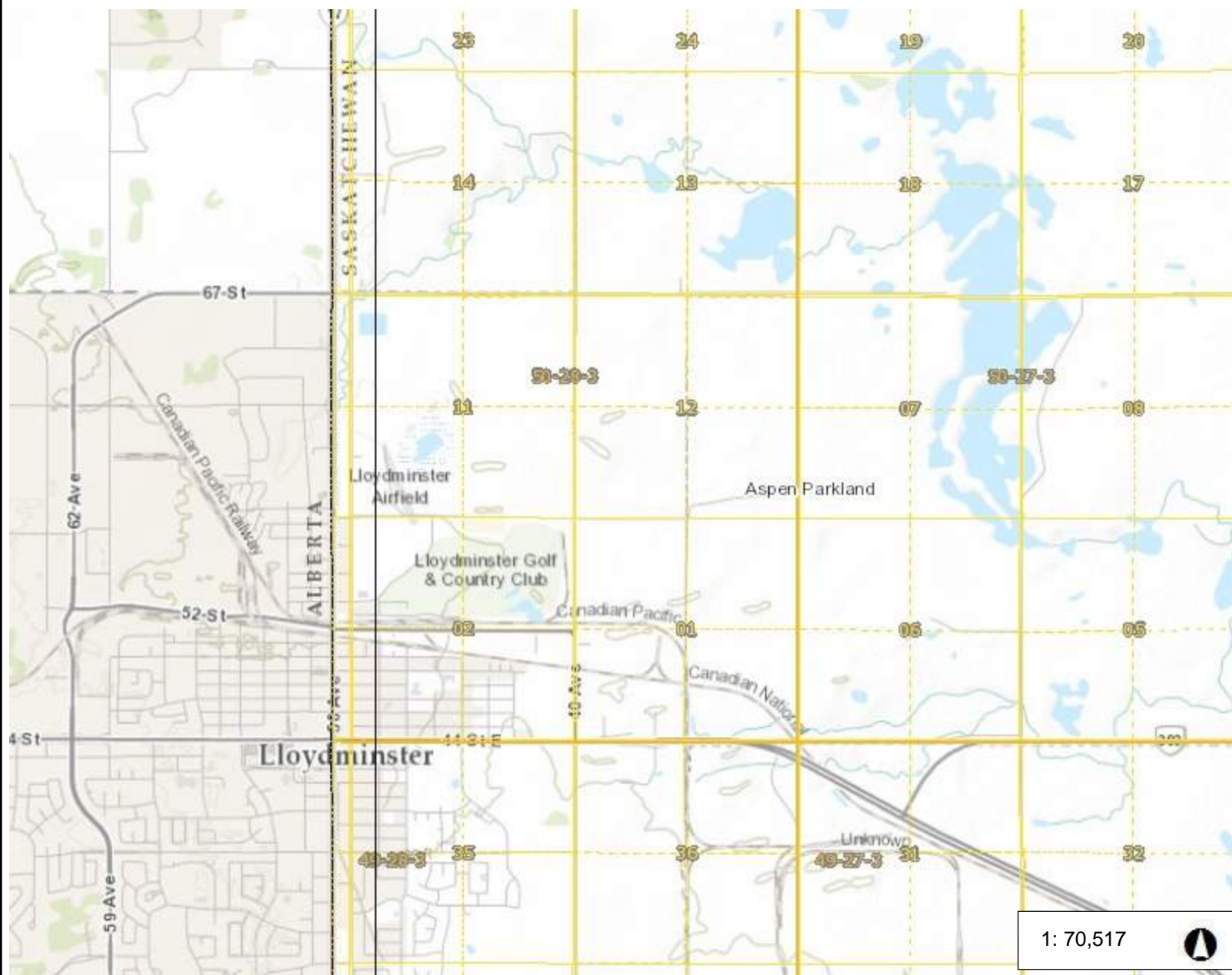
No records found



APPENDIX
HABISask Important Habitat Public Output

E

HABISask-Biodiversity



- Legend**
- Bird Species
 - Provincial Boundary
 - Natural Ecoregions
 - Township
 - Section
 - Quarter Section
 - Game Preserve
 - National Wildlife Area
 - Migratory Bird Sanctuary
 - Wildlife Habitat Protection (WH)
 - Wildlife Refuge
 - National Park
 - Provincial Park
 - SK Woodland Caribou Range

Notes

3.6 0 1.79 3.6 Kilometers

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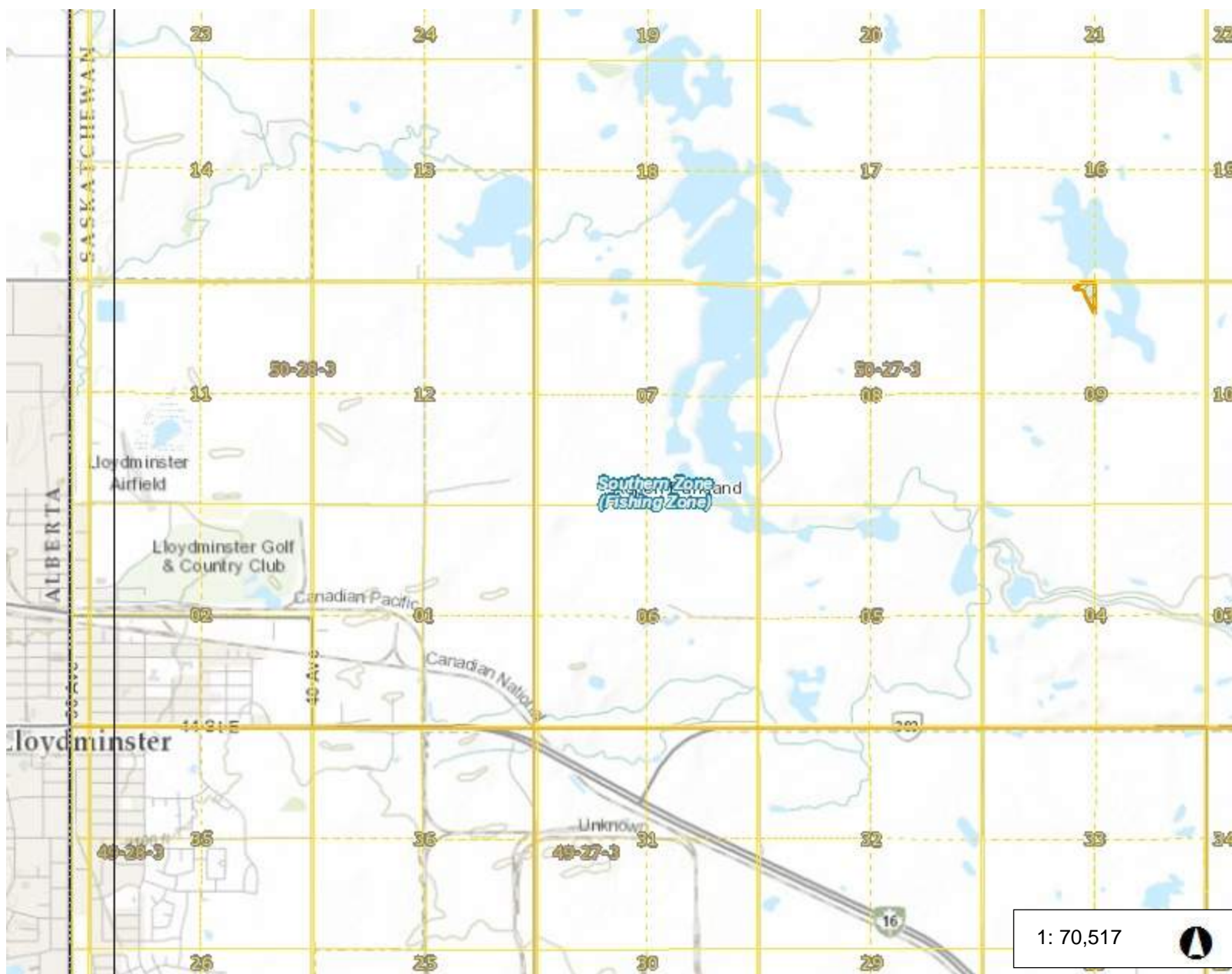
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APPENDIX
HABISask Fisheries Output

F



Legend

- Provincial Boundary
- Sport Fish Management Zones
- Natural Ecoregions
- Township
- Section
- Quarter Section
- Game Preserve
- National Wildlife Area
- Migratory Bird Sanctuary
- Wildlife Habitat Protection (WH)
- Wildlife Refuge
- National Park
- Provincial Park

Fisheries - Special Regulations

- Special Regulations Info Available
- 2 - 4
- 5 - 7
- 8 - 10
- 11+

1: 70,517



3.6 0 1.79 3.6 Kilometers

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Notes



APPENDIX
FWMIS Output

G

Fish and Wildlife Internet Mapping Tool (FWIMT)

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

Species Summary Report

Report Created: 10-Feb-2019 16:50

Species present within the current extent :

Fish Inventory

BROOK STICKLEBACK

Wildlife Inventory

No Species Found in Search Extent

Stocked Inventory

No Species Found in Search Extent

Buffer Extent

Centroid (X,Y):

832621, 5914039

Projection

10-TM AEP Forest

Centroid: (Qtr Sec Twp Rng Mer)

NE 1 50 1 4

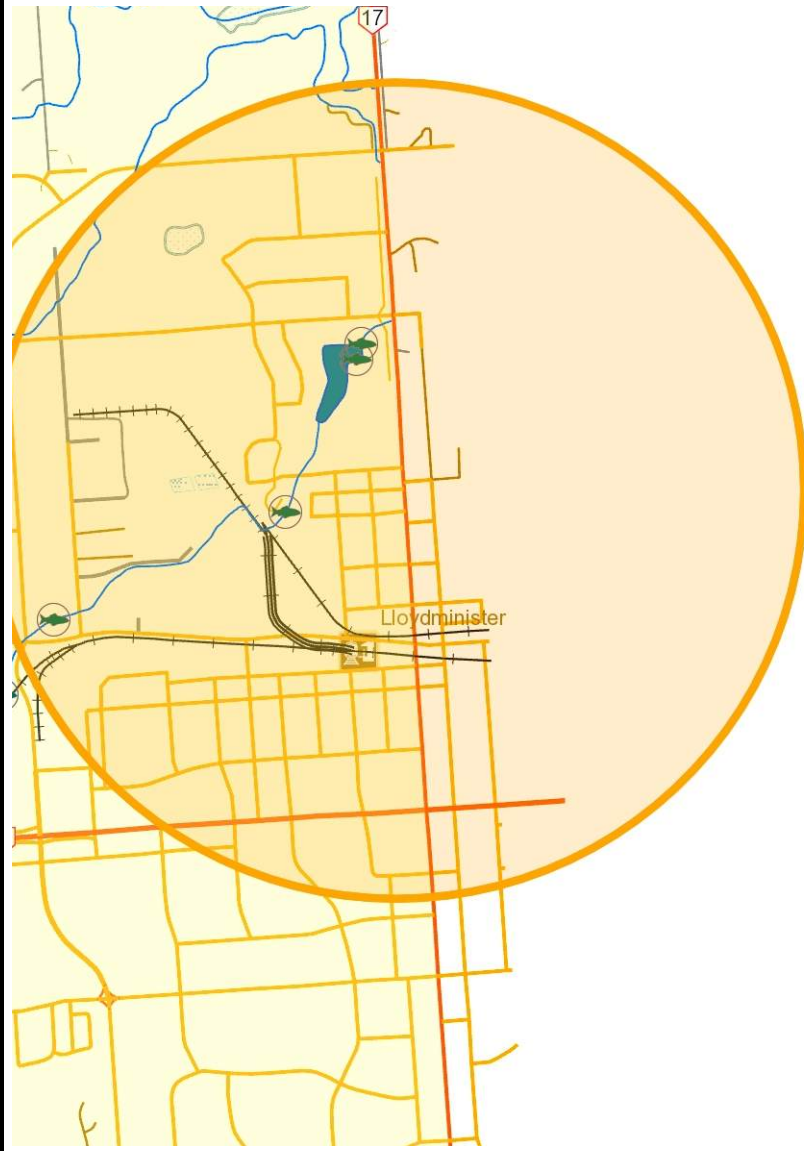
Radius or Dimensions

2 kilometers

Contact Information

For contact information, please visit:

<http://aep.alberta.ca/about-us/contact-us/fisheries-wildlife-management-area-contacts.aspx>



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


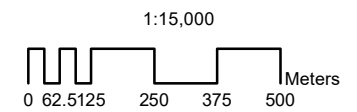
APPENDIX Historical Photography

H



Legend

-  Approximate ASP Area
-  Potential Wetlands, Watercourses and other Waterbodies

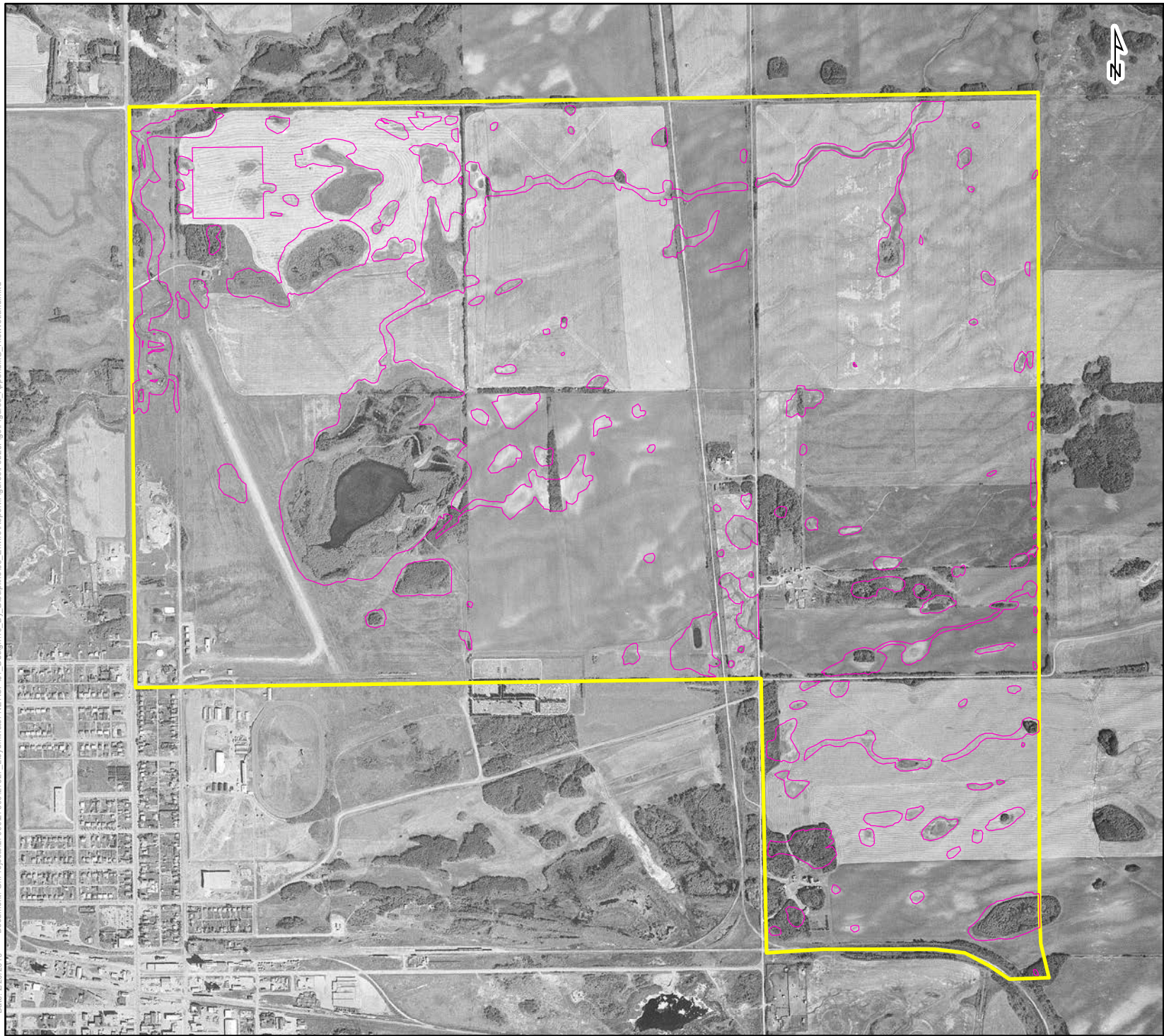


HISTORICAL PHOTOGRAPHY
(1949)



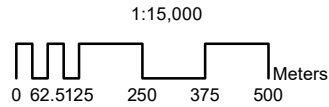
Integrated Expertise. Locally Delivered.





Legend

- Approximate ASP Area
- Potential Wetlands, Watercourses and other Waterbodies



HISTORICAL PHOTOGRAPHY
(1965)





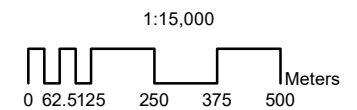
Integrated Expertise. Locally Delivered.





Legend

-  Approximate ASP Area
-  Potential Wetlands, Watercourses and other Waterbodies

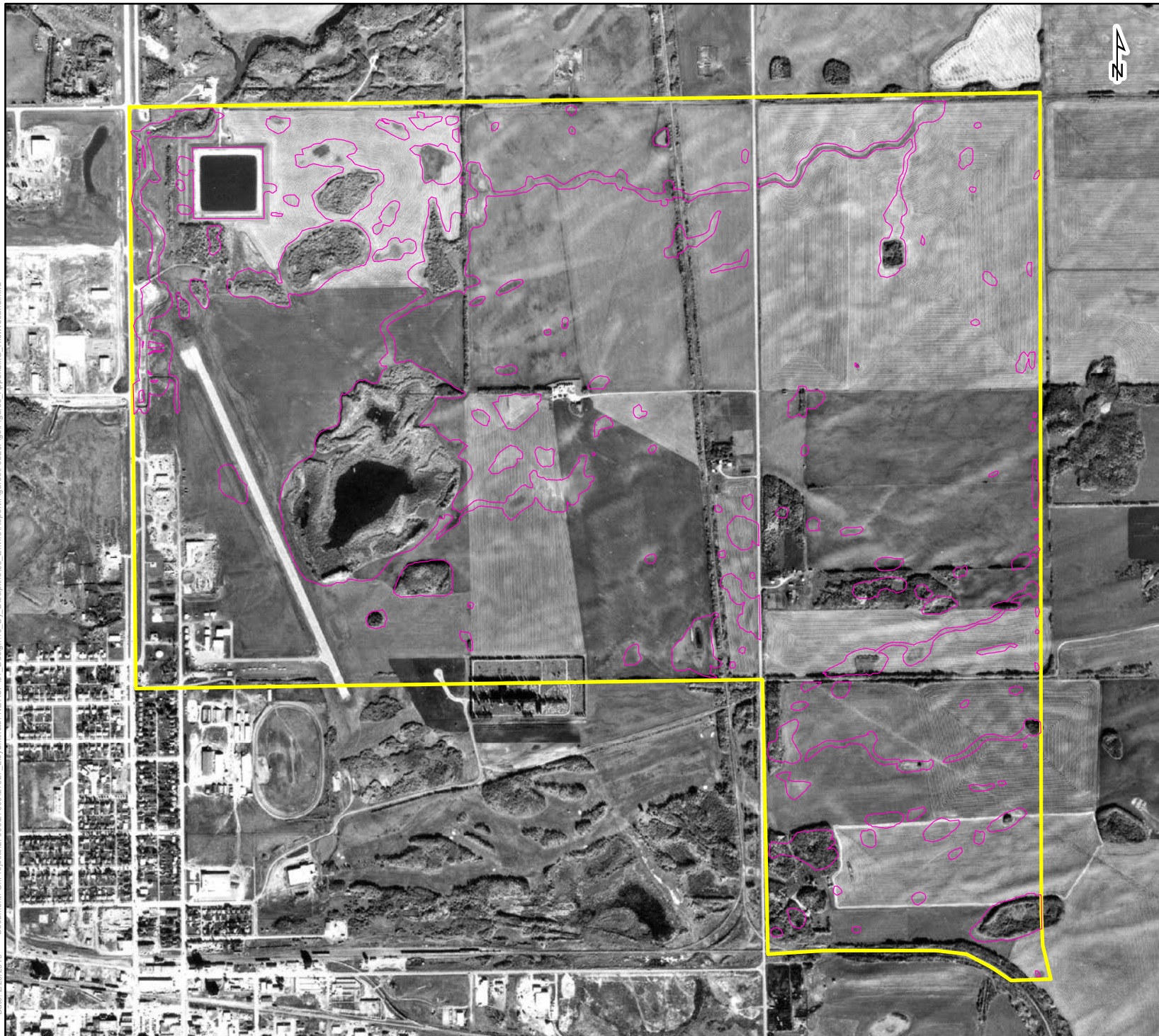


HISTORICAL PHOTOGRAPHY
(1971)





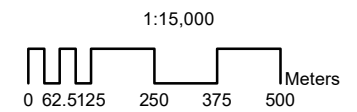
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Legend

-  Approximate ASP Area
-  Potential Wetlands, Watercourses and other Waterbodies

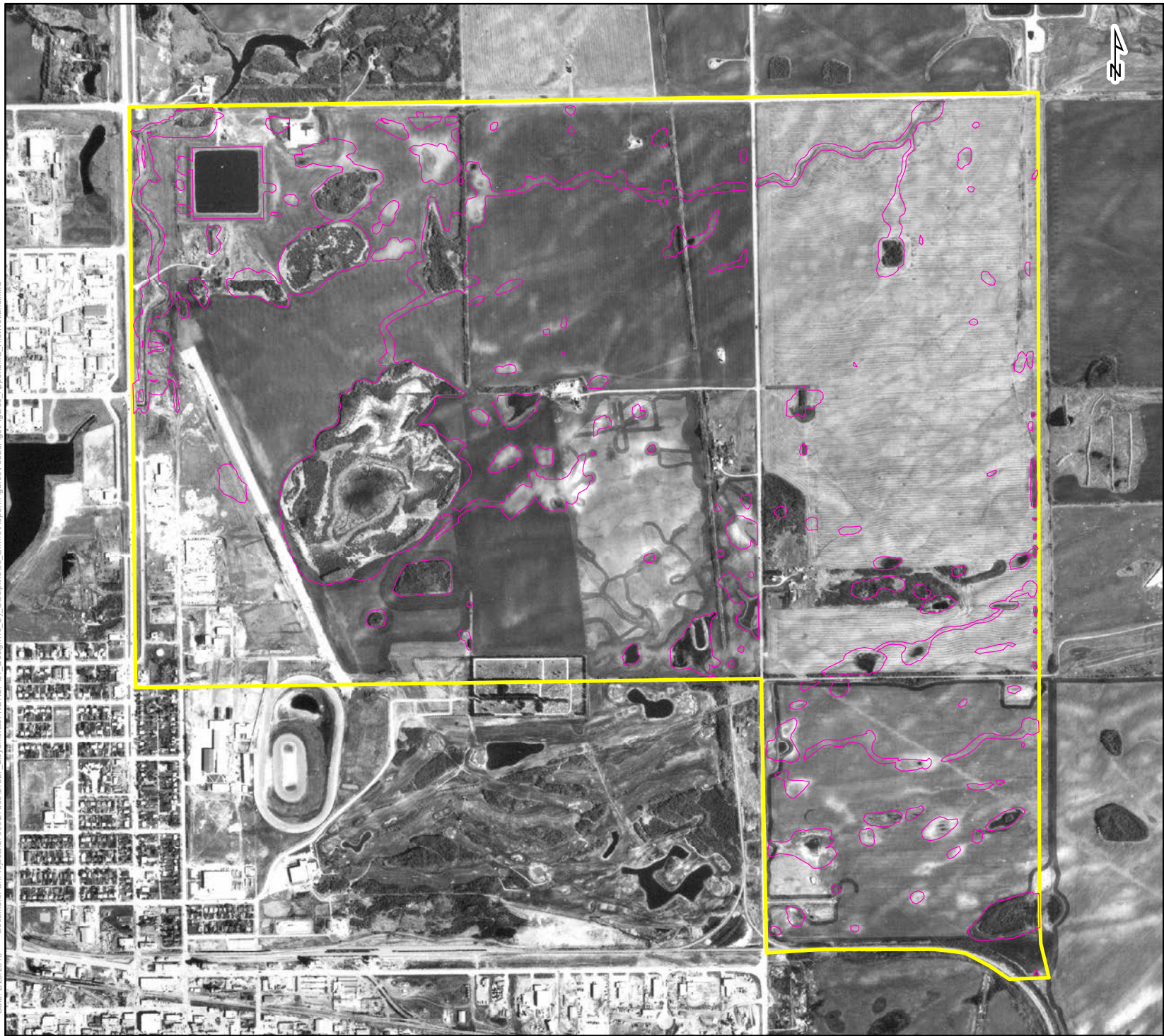


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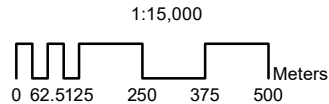
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Legend

-  Approximate ASP Area
-  Potential Wetlands, Watercourses and other Waterbodies

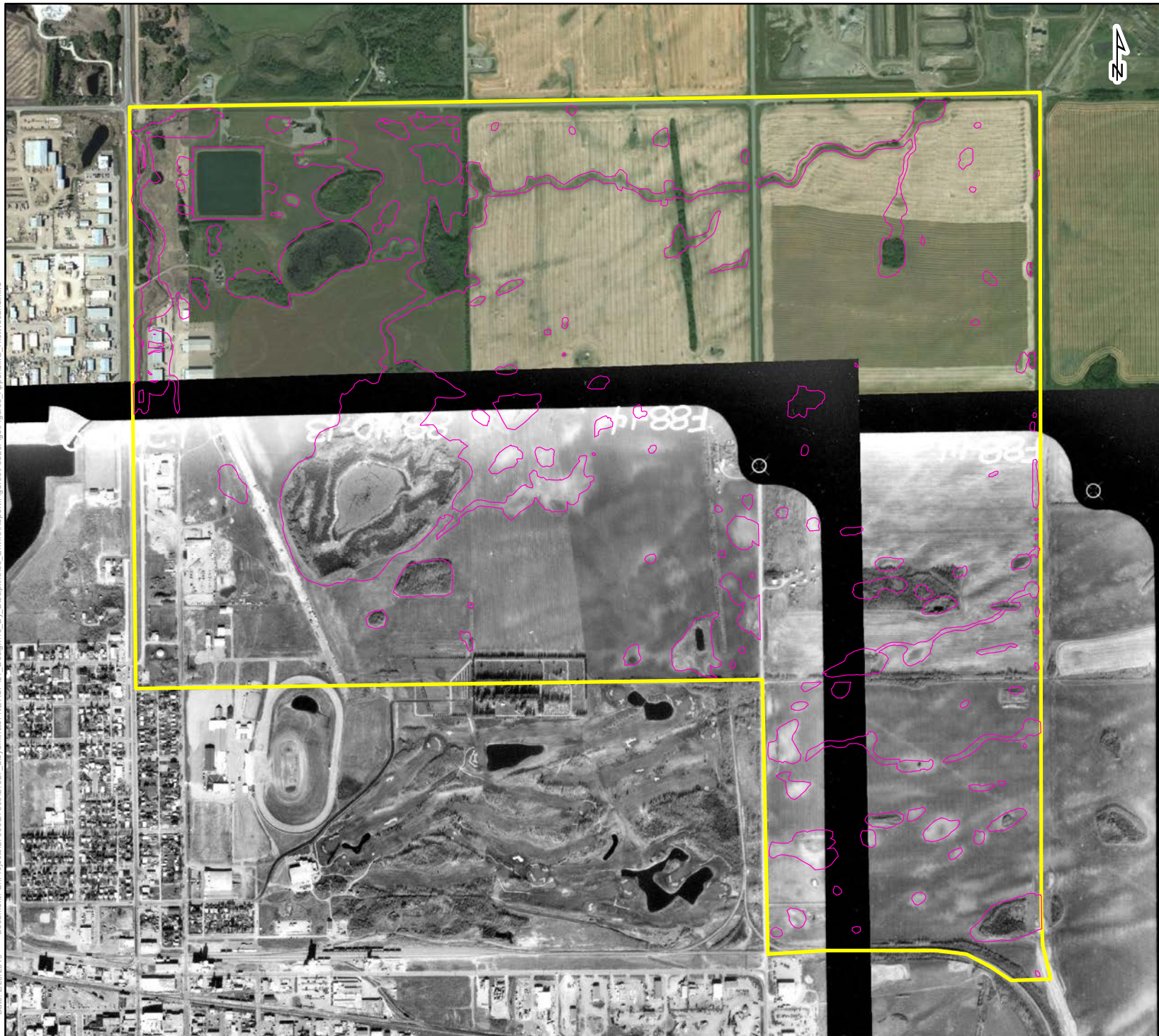


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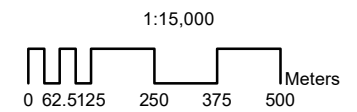
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Legend

- Approximate ASP Area
- Potential Wetlands, Watercourses and other Waterbodies



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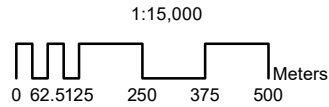
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Legend

- Approximate ASP Area
- Potential Wetlands, Watercourses and other Waterbodies

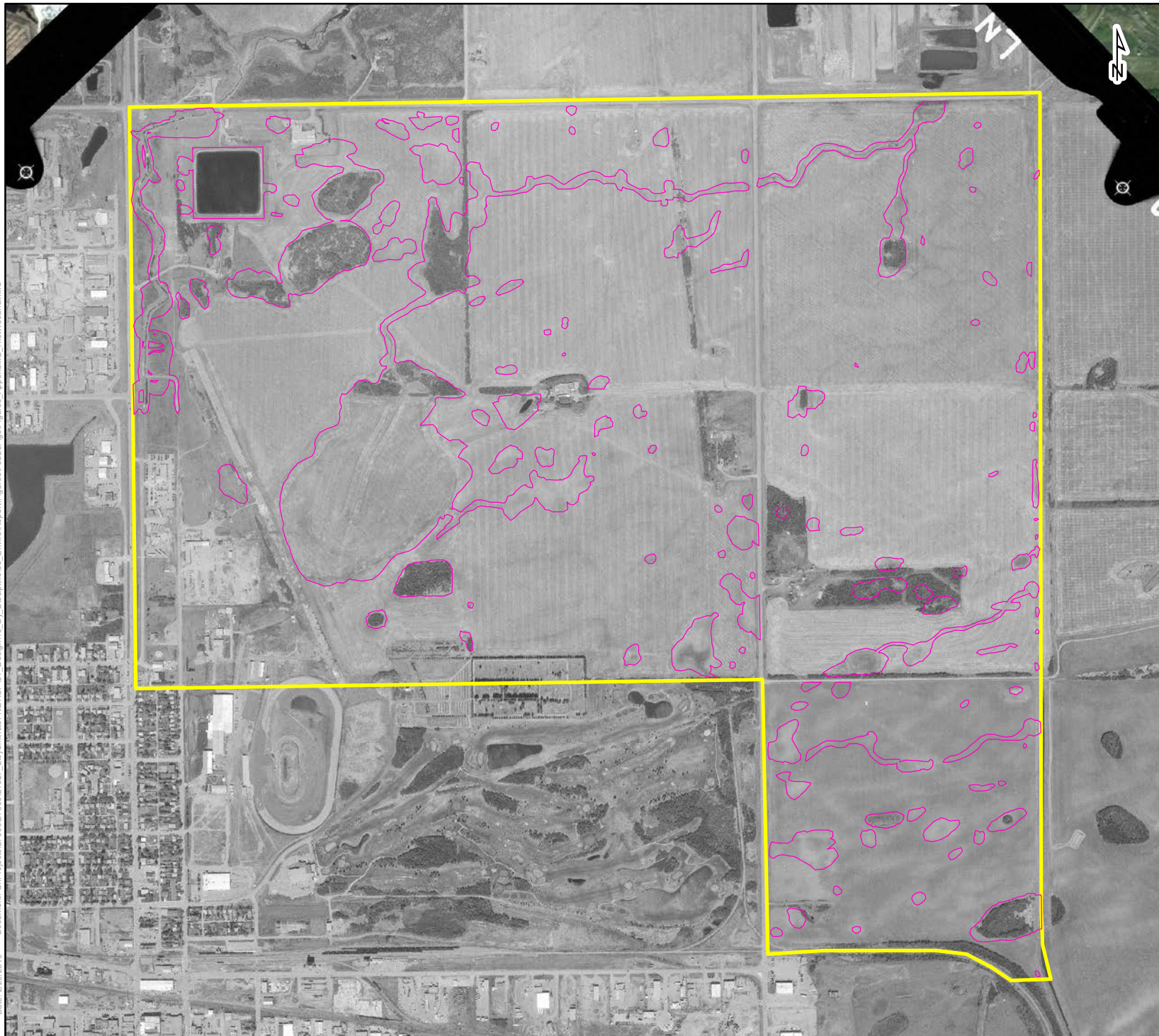


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


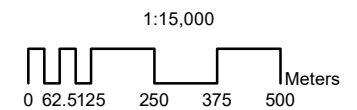
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Legend

-  Approximate ASP Area
-  Potential Wetlands, Watercourses and other Waterbodies

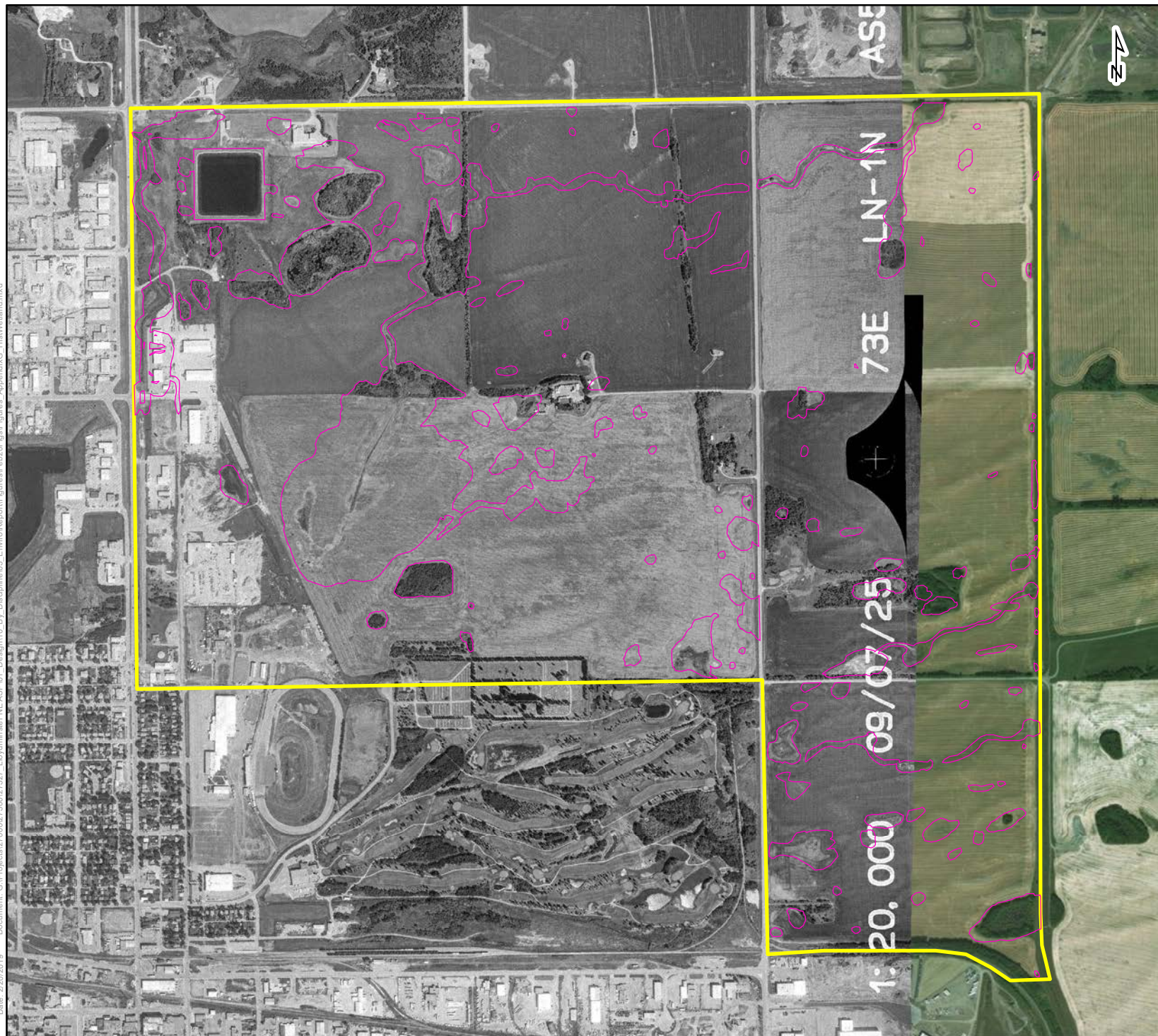


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


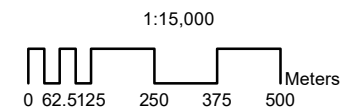
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Legend

-  Approximate ASP Area
-  Potential Wetlands, Watercourses and other Waterbodies



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APPENDIX July 2019 Field Visit Memorandum

I

To: **City of Lloydminster**

Date: **July 3, 2019**

Attention:

Project No.: **27327**

Cc: **Sue Paton RPP, MCIP (ISL Engineering)**

Reference: **Lloydminster NE ASP**

From: **Robyn Gamber, B.Sc., B.GIS., P. Biol., R.P. Bio (ISL Engineering)**

As part of the Lloydminster ASP Project, ISL completed a desktop Environmental Impact Assessment (EIA) in February 2019 for the ASP Area (Figure 1) to direct future environmental considerations and potential regulatory requirements. This memorandum confirms the results on the desktop EIA and provides information additional to the EIA that was obtained during the field visit on June 21, 2019. Photographs obtained during the field visit are provided in an attachment.

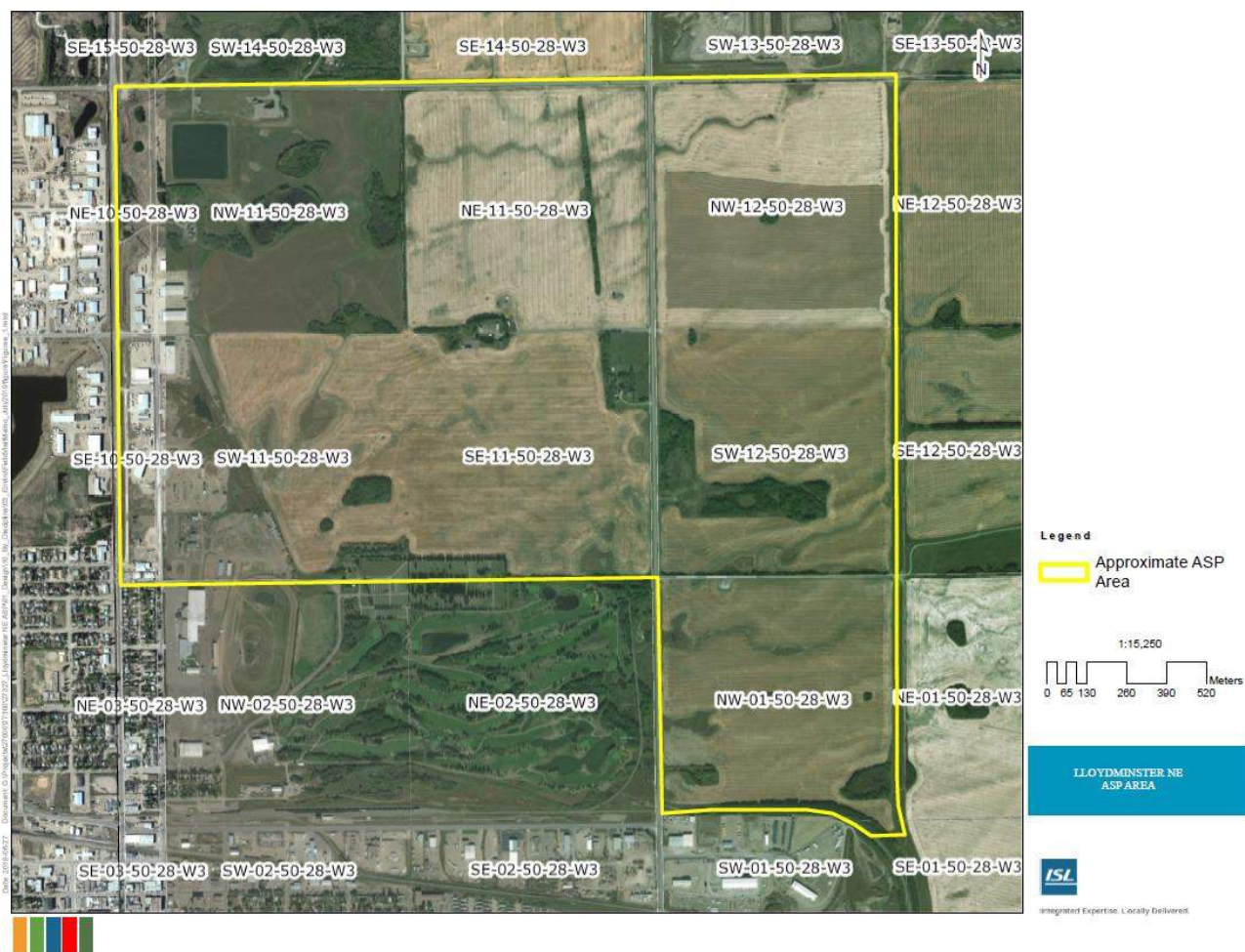


Figure 1: ASP Location



Wildlife

Wildlife incidentally observed visually during the field visit included red-winged blackbirds and mallard ducks in some wetlands. Amphibians were also audibly observed in some wetlands. The remaining natural spaces (within cropland) such as forested areas, wetlands and the watercourse area offer good potential wildlife habitat.

Wetlands

An area delineated as wetland in the Environmental Impact Assessment is upland remnant forest (Figure provided in an Attachment). To complete the Aquatic Habitat Protection Permit, the locations of proposed disturbance will need to be field confirmed by a Qualified Person. The number of wetlands confirmed by fieldwork are expected to vary slightly from the number provided in desktop wetlands map in the EIA.

Watercourses and Waterbodies

Fish are likely to be present in the watercourse within the northwestern portion of the ASP area (NE 10-50-28 W3M). Avoidance of any disturbance to this watercourse, including the proposed 20 meter vegetated buffer, is recommended. Installation of fencing at the buffer edge would be prudent to ensure protection.

Additional Environmental Concerns

Clubroot Sanitization

Clubroot, caused by *Plasmodiophora brassicae*, is a serious disease of cruciferous crops (*i.e.* mustards, canola, etc.) which can result in reduced to severe yield losses. Clubroot is a listed pest under Saskatchewan's Pest Control Act (Clubroot Management Plan 2018). In rural municipality 502, adjacent to Lloydminster, 1-9 fields have shown clubroot symptoms (Clubroot Distribution in Saskatchewan: Cumulative Testing 2008-2018).

During the site visit canola appeared to be in production in at least two quarter sections of the ASP area. Given the potential for clubroot disease, soil handling specifications should include sanitization procedures to prevent the spread of clubroot disease via machinery. Typical mitigation measures include inspecting machinery for cleanliness and pressure washing prior to entry and exit.

Closure

Information requests can be directed to Ms. Gamber at 403.254.0544 or rgamber@islengineering.com.

Regards,

Robyn Gamber, P. Biol
Environmental Scientist
ISL Engineering and Land Services

Attachments: Photo Plates
Wetland Update Figure



Plate 1 View south of the watercourse in the NW area of the ASP (12U 566317/ 5906851; NE 10-50-28 W3M) (June 21, 2019).



Plate 2 View southeast of the watercourse in the NW area of the ASP (12U 566304/ 5906829; NE 10-50-28 W3M) (June 21, 2019).



Plate 3 View east showing the culvert of the watercourse in the NW area of the ASP (12U 566487/ 5906886; NW 11-50-28 W3M) (June 21, 2019).



Plate 4 View south showing cultivation, arrow points to a wetland (12U 566487/ 5906886; NE 11-50-28 W3M) (June 21, 2019).



Plate 5 View south showing cultivation (likely Canola) (12U 567682/ 5906891; NE 11-50-28 W3M) (June 21, 2019).



Plate 6 View south showing wetland (12U 5685462/ 5906924; NW 12-50-28 W3M) (June 21, 2019).



Plate 7 View south showing cropland (12U 568203/ 5906910; NW 12-50-28 W3M) (June 21, 2019).



Plate 8 View northwest showing cultivation (likely canola) (12U 568019/ 5906106; NW 12-50-28 W3M) (June 21, 2019).



Plate 9 View east showing cultivation and treed wetland (at arrow) (12U 568042/ 5906103; SW 12-50-28 W3M) (June 21, 2019).



Plate 10 View west showing cultivation and wetland (at arrow) (12U 568048/ 59055433; SE 11-50-28 W3M) (June 21, 2019).



Plate 11 View southeast showing cultivation (12U 568048/ 59055433; SW 12-50-28 W3M) (June 21, 2019).



Plate 12 View northwest showing wetland (12U 568032/ 5905280; SE 11-50-28 W3M) (June 21, 2019).



Plate 13 View south showing roadside (12U 568032/ 5905280; SE 11-50-28 W3M) (June 21, 2019).



Plate 14 View northwest showing cultivation (12U 568061/ 5904663; NW 1-50-28 W3M) (June 21, 2019).



Plate 15 View north showing cultivation (12U 568165/ 5905285; SW 12-50-28 W3M) (June 21, 2019).



Plate 16 View south showing wetland in foreground with a cultivated field (12U 568277/ 5905288; NW 1-50-28 W3M) (June 21, 2019).



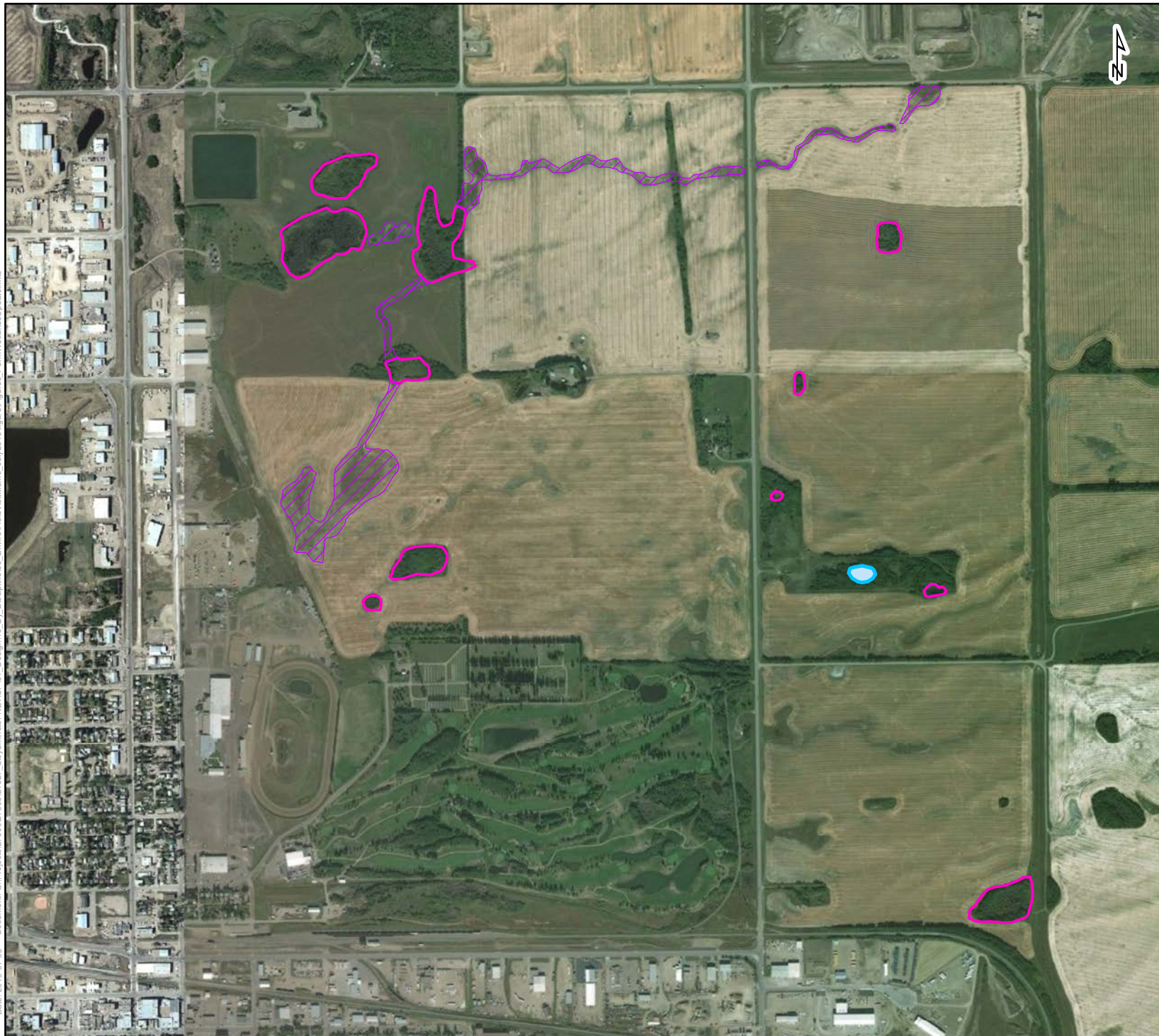
Plate 17 View north showing cultivation and wetland (12U 568427/ 5905295; SW 12-50-28 W3M) (June 21, 2019).



Plate 18 View north showing cultivation and remnant treed area (12U 568617/ 5905299; NW 1-50-28 W3M) (June 21, 2019).

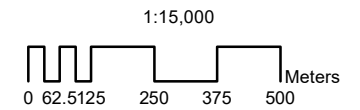


Plate 19 View southeast showing cultivation (12U 568826/ 5905293; NW 1-50-28 W3M) (June 21, 2019).



Legend

- Approximate ASP Area
- Potential Permanent (Class IV and Swamp) Wetlands
- non-permanent connections
- Not a Wetland



WETLANDS, WATERCOURSES
AND WATERBODIES
(POTENTIAL PERMANENT WETLANDS
WITH CURRENT ESRI IMAGERY)



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C

SERVICING REVIEW

The following report is provided for reference purposes
and does not form part of this bylaw.



City of Lloydminster

Final Report

Northeast ASP Amendment Servicing Study

September 2022





ISL Engineering and Land Services Ltd. is an award-winning full-service consulting firm dedicated to working with all levels of government and the private sector to deliver planning and design solutions for transportation, water, and land projects.

4015 7 Street SE, Calgary AB T2G 2Y9, T: 403.254.0544 F: 403.254.9186

September 8, 2022

Our Reference: 16188

City of Lloydminster
4420 – 50 Avenue
Lloydminster, AB/SK
T9V 0W2

Attention: Vicki Dodge – Annexation Project Manager, Office of the City Manager

Dear Vicki:

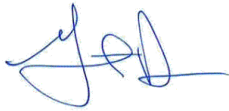
Reference: Northeast ASP Amendment Servicing Study – Final Report

Enclosed is the final report for the Northeast Area Structure Plan (ASP) Amendment Servicing Study. We trust that it meets your expectations.

The key objectives of this project are to review the water, wastewater, and stormwater servicing systems proposed in each associated Master Plan and to recommend servicing systems to accommodate the amended ASP land use scenario. The Servicing Study will provide the City of Lloydminster (the City) with direction on servicing into more detailed stages of analysis and design for the ASP area in the future. This information will provide solutions for efficient, economic, and sustainable municipal services for the area.

We sincerely appreciate the opportunity to undertake this project on behalf of the City. Should you have any questions or concerns, please do not hesitate to contact the undersigned at 403.254.0544.

Sincerely,



Garnet Dawes, P.Eng., DBIA
Community Development Manager

Corporate Authorization

This document entitled “Northeast ASP Amendment Servicing Study” has been prepared by ISL Engineering and Land Services Ltd. (ISL) for the use of City of Lloydminster. The information and data provided herein represent ISL’s professional judgment at the time of preparation. ISL denies any liability whatsoever to any other parties who may obtain this report and use it, or any of its contents, without prior written consent from ISL.



2022-09-08

Krista Audia, P.Eng.
Technical Author

Permit to Practice

ISL Engineering and Land Services Ltd.

RM Signature: 

RM APEGA ID: **91996**

Date: **2022-09-08**

Permit Number P4741

The Association of Professional Engineers
and Geoscientists of Alberta

Garnet Dawes, P.Eng., DBIA
Senior Reviewer

Executive Summary

Introduction

The City of Lloydminster (the City) has commissioned ISL Engineering and Land Services Ltd. (ISL) to complete a Servicing Study encompassing water, wastewater, and stormwater infrastructure to support the preparation of the Northeast Area Structure Plan (ASP). The ultimate intent of the Servicing Study is to provide a high-level evaluation of the potential future water and wastewater servicing systems in the area as well as stormwater drainage systems. This includes the necessary parameters for the design, including recommendations for water distribution, wastewater collection, and stormwater management and conveyance.

The Servicing Study represents an investment in the infrastructure and will help support sustainable and cost-effective growth in the Northeast ASP study area. It should be noted however, that this document is considered a high-level study and is not intended to replace more detailed analyses further into the design process.

The Northeast ASP area is comprised of approximately 600 ha of land within the City of Lloydminster. The study area is bounded by 67 Street to the north, 52 Street to the south, 50 Avenue to the west, and the East Drainage Channel to the east. The setting of the study area, being situated along the City boundary, introduces a number of servicing opportunities and constraints. These opportunities and constraints will be addressed as part of this Servicing Study.

The Water Master Plan, Sanitary Sewer Master Plan, and Stormwater Master Plan were adopted in 2016, 2016, and 2015, respectively. These documents outline how infrastructure systems are to be upgraded or expanded in the City for future development opportunities. The study area is to incorporate commercial, industrial/commercial, industrial, utilities, and open space areas. A sound servicing strategy is useful for both administration and elected officials in carrying out short- and long-term infrastructure planning and budgeting.

In 2019, the City retained ISL to prepare the Northeast ASP, which included a mix of residential, commercial, industrial, and public land uses. The project included the completion of the Northeast ASP Servicing Study to evaluate water and wastewater servicing as well as stormwater management and drainage.

In 2022, an amendment to the Northeast ASP is necessary due to a shift in the proposed land uses to primarily industrial and impending development in the Northeast ASP area subject to approval of the Northeast ASP Amendment. Therefore, an amendment to the associated Servicing Study is required to incorporate the changes to the proposed land use concept as well as direction from the City to maintain ASP supporting studies as high-level, conceptual documents with detailed analysis to be undertaken in subsequent studies to support further planning stages for the developments within the Northeast ASP boundary.

Following the preparation of the Servicing Study in support of the April 2022 land use concept, a revised land use concept was finalized in July 2022 based on the City's public open house held on June 16, 2022. Therefore, the City requested a high-level comparison of the impact of these land use revisions on the overall water system demands, wastewater system flows, and stormwater management facility requirements to support the development of the area.

Purpose of Study

Water Servicing

- To recommend systems to provide water servicing to the study area.
- To layout potential water distribution infrastructure based on the 2016 Water Master Plan.
- To provide a framework for future development of detailed water system studies or analysis.

Wastewater Servicing

- To recommend systems that will provide wastewater servicing to the study area.
- To layout potential wastewater collection infrastructure based on the 2016 Sanitary Sewer Master Plan.
- To provide a framework for future development of detailed wastewater system studies or analysis.

Stormwater Drainage

- To develop high-level stormwater management strategies to manage increased runoff resulting from future growth.
- To ensure the planned stormwater management system meets regulatory authority requirements.
- To provide a framework for future development of detailed stormwater studies or analysis including, but not limited to, Stormwater Management Reports (SWMRs) to design stormwater management and erosion control measures.

Conclusions and Recommendations

Water Servicing

- The proposed water distribution system is comprised of a grid main network of 300 mm diameter watermain.
- The proposed water distribution system is to be tied into the existing network at 49 Avenue and south of 67 Street, downstream of the water treatment plant to provide adequate looping for the area.
- The proposed water distribution system is not anticipated to be significantly impacted by the revised land use concept prepared in July 2022.
- The ADD, MDD, and PHD demands for the study area were determined based on the City of Lloydminster Municipal Development Standards Section 6 – Water Distribution Systems.
- Reservoir storage requirements were based on the Saskatchewan Ministry of Environment Water Security Agency Waterworks Design Standard.
- It is recommended that a detailed network analysis be completed to assess the adequacy of this system as well as impacts to the City's existing system once more detailed population and employment densities are available.
- It is recommended that the currently available capacity of both the reservoir storage and the WTP be evaluated to confirm whether additional upgrades are required to facilitate the proposed Northeast ASP development and land uses once more detailed population and employment densities are available.

- The costs associated with the proposed water distribution system and the reservoir and pumping system upgrades is approximately \$13.7 million. Costs are not anticipated to be significantly impacted by the revised land use concept. It should be noted that the annual inflation rate is currently over 7%, which is the highest it has been in approximately 20 years based on the Consumer Price Index (CPI); therefore, the costs provided may increase if this trend continues.

Wastewater Servicing

- The proposed wastewater collection system is comprised of a gravity sewer network that connects to the WWTP northeast of the study area.
- The proposed system is to include the East Trunk Twin and Northwest Trunk as proposed in the 2016 Sanitary Sewer Master Plan.
- The proposed wastewater collection system is not anticipated to be significantly impacted by the revised land use concept prepared in July 2022.
- The wastewater generation flows and corresponding conveyance system sizing were based on the City of Lloydminster Municipal Development Standards Section 4 – Sanitary Sewer Systems.
- Non-residential wastewater generation rate applied was 0.2 L/s/ha with a peaking factor of 3.0.
- The costs associated with the proposed wastewater collection system is approximately \$10.0 million. Costs are not anticipated to be significantly impacted by the revised land use concept. It should be noted that the annual inflation rate is currently over 7%, which is the highest it has been in approximately 20 years based on the Consumer Price Index (CPI); therefore, the costs provided may increase if this trend continues.

Stormwater Drainage

- The proposed stormwater system consists of pipe and culvert connections to and from stormwater management facilities with runoff from the study area being conveyed to the East Drainage Channel, which ultimately discharges to the Neale Edmunds Stormwater Complex.
- The proposed stormwater system is not anticipated to be significantly impacted by the revised land use concept prepared in July 2022, with the exception of changes to the SWMF sizing.
- The minor system was sized to the 1:5 year storm event.
- Stormwater management facilities were sized to the 1:100 year storm event.
- The maximum allowable area release rate from proposed stormwater management facilities was limited to 1.5 L/s/ha.
- All stormwater management facilities were sized and costed as wet ponds according to the following additional criteria:
 - Active storage depth was considered to be 1.5 m.
 - Permanent storage depth was considered to be 2.0 m.
 - A freeboard of 0.3 m was applied.
 - Side slopes of 7:1 (H:V) were applied.
- The use of source control Best Management Practices is encouraged to reduce the total runoff volume and enhance stormwater treatment.



- The costs associated with the proposed stormwater management system is approximately \$19.1 million. Costs are anticipated to increase in the order of \$100,000 due to the revised land use concept. It should be noted that the annual inflation rate is currently over 7%, which is the highest it has been in approximately 20 years based on the Consumer Price Index (CPI); therefore, the costs provided may increase if this trend continues.



Table of Contents

1.0	Introduction	1
1.1	Authorization	1
1.2	Background	1
1.3	Purpose of Study	2
2.0	Plan Area	3
2.1	Location	3
2.2	Existing Development	3
2.3	Future Development	3
3.0	Water	5
3.1	Existing Infrastructure	5
3.2	Design Criteria	6
3.3	Proposed Water Distribution System	9
3.4	Cost Estimates	10
4.0	Wastewater	12
4.1	Existing Infrastructure	12
4.2	Design Criteria	12
4.3	Proposed Wastewater Collection System	13
4.4	Cost Estimates	15
5.0	Stormwater	16
5.1	Analysis Methodology	16
5.2	Existing Drainage System	17
5.3	Proposed Drainage System	18
6.0	Revised Land Use Concept	24
6.1	Land Use Concept Comparison	24
6.2	Water System Demands	25
6.3	Wastewater System Flows	26
6.4	Stormwater Management Facility Sizing	27
6.5	Summary	28
7.0	Conclusions and Recommendations	29
7.1	Water Servicing	29
7.2	Wastewater Servicing	30
7.3	Stormwater Drainage	30
8.0	References	32

APPENDICES

Appendix A Preliminary Cost Estimates



TABLES

On Page

Table 2.1: Summary of Existing Land Use	3
Table 2.2: Proposed Land Use	4
Table 3.1: Water Consumption Data	7
Table 3.2: Fire Flow Requirements	8
Table 3.3: Total Water Demands	9

Following Page

Table 3.4: Water Demand Estimation	9
--	---

On Page

Table 3.5: Reservoir Storage Requirements	10
Table 3.6: Summary of Water Servicing Cost Estimates	111
Table 4.1: Total Wastewater Flows	13

Following Page

Table 4.2: Wastewater Generation Estimation	13
---	----

On Page

Table 4.3: Minimum Design Slopes for Sewers	14
Table 4.4: Summary of Wastewater Servicing Cost Estimates	15
Table 5.1: Percent Impervious	16
Table 5.2: Runoff Parameters	17
Table 5.3: Proposed Catchments	199

Following Page

Table 5.4: Stormwater Management Facility Parameters	21
--	----

On Page

Table 5.5: Source Control Practice Table	22
Table 5.6: Summary of Stormwater Servicing Cost Estimates	23
Table 6.1: Proposed Land Use Comparison	24
Table 6.2: Total Water Demands - April Land Use Concept	25
Table 6.3: Total Water Demands - July Land Use Concept	25
Table 6.4: Total Wastewater Flows - April Land Use Concept	26
Table 6.5: Total Wastewater Flows - July Land Use Concept	26



Table 6.6: Stormwater Management Facility Parameters - April Land Use Concept	27
---	----

Table 6.7: Stormwater Management Facility Parameters - July Land Use Concept	27
--	----

FIGURES

Following Page

Figure 2.1: Study Area	4
Figure 2.2: Topography.....	4
Figure 2.3: Minimum Ground Elevation.....	4
Figure 2.4: Existing Land Use	4
Figure 2.5: Future Land Use	4
Figure 3.1: Existing Water System.....	11
Figure 3.2: Proposed Water System	11
Figure 4.1: Existing Wastewater System	15
Figure 4.2: Proposed Wastewater System.....	15
Figure 5.1: Existing Stormwater System	23
Figure 5.2: Proposed Stormwater Catchments	23
Figure 5.3: Proposed Stormwater System	23
Figure 6.1: Revised Land Use Concept	28



LIST OF ACRONYMS

Acronym	Meaning
ADD	Average Day Demand
ADWF	Average Dry Weather Flow
AEP	Alberta Environment and Parks
ASP	Area Structure Plan
DWF	Dry Weather Flow
FF	Fire Flow
I-I	Inflow-Infiltration
ICI	Industrial, Commercial, Institutional
ISL	ISL Engineering and Land Services Ltd.
MDD	Maximum Day Demand
MDF	Maximum Daily Flow
PDWF	Peak Dry Weather Flow
PHD	Peak Hour Demand
PRV	Pressure Reducing Valve
PWWF	Peak Wet Weather Flow
ROW	Right of Way
SWMF	Stormwater Management Facility
WTP	Water Treatment Plant
WWF	Wet Weather Flow
WWTP	Wastewater Treatment Plant

1.0 Introduction

1.1 Authorization

The City of Lloydminster (the City) has commissioned ISL Engineering and Land Services Ltd. (ISL) to complete a Servicing Study encompassing water, wastewater, and stormwater infrastructure to support the preparation of the Northeast Area Structure Plan (ASP) Amendment. The ultimate intent of the Servicing Study is to provide a high-level evaluation of the potential future water and wastewater servicing systems in the area as well as stormwater drainage systems. This includes the necessary parameters for the design, including recommendations for water distribution, wastewater collection, and stormwater management and conveyance.

The Servicing Study represents an investment in the infrastructure and will help support sustainable and cost-effective growth in the Northeast ASP study area. It should be noted however, that this document is considered a high-level study and is not intended to replace more detailed analyses further into the design process.

1.2 Background

The Northeast ASP area is comprised of approximately 600 ha of land within the City of Lloydminster. The study area is bound by 67 Street to the north, 52 Street to the south, 50 Avenue to the west, and the East Drainage Channel to the east. The setting of the study area, being situated along the City boundary, introduces a number of servicing opportunities and constraints. These opportunities and constraints will be addressed as part of this Servicing Study.

The Water Master Plan, Sanitary Sewer Master Plan, and Stormwater Master Plan were adopted in 2016, 2016, and 2015, respectively. These documents outline how infrastructure systems are to be upgraded or expanded in the City for future development opportunities. The study area is to incorporate commercial, industrial/commercial, industrial, utilities, and open space areas. A sound servicing strategy is useful for both administration and elected officials in carrying out short- and long-term infrastructure planning and budgeting.

In 2019, the City retained ISL to prepare the Northeast ASP, which included a mix of residential, commercial, industrial, and public land uses. The project included the completion of the Northeast ASP Servicing Study to evaluate water and wastewater servicing as well as stormwater management and drainage.

In 2022, an amendment to the Northeast ASP is necessary due to a shift in the proposed land uses to primarily industrial and impending development in the Northeast ASP area subject to approval of the Northeast ASP Amendment. Therefore, an amendment to the associated Servicing Study is required to incorporate the changes to the proposed land use concept as well as direction from the City to maintain ASP supporting studies as high-level, conceptual documents with detailed analysis to be undertaken in subsequent studies to support further planning stages for the developments within the Northeast ASP boundary.



1.3 Purpose of Study

The purpose of developing a Servicing Study for the Northeast ASP area is outlined below.

1.3.1 Water

- To recommend systems to provide water servicing to the study area.
- To layout potential water distribution infrastructure based on the 2016 Water Master Plan.
- To provide a framework for future development of detailed water system studies or analysis.

1.3.2 Wastewater

- To recommend systems that will provide wastewater servicing to the study area.
- To layout potential wastewater collection infrastructure based on the 2016 Sanitary Sewer Master Plan.
- To provide a framework for future development of detailed wastewater system studies or analysis.

1.3.3 Stormwater Drainage

- To develop high-level stormwater management strategies to manage increased runoff resulting from future growth.
- To ensure the planned stormwater management system meets regulatory authority requirements.
- To layout potential stormwater infrastructure based on the 2015 Stormwater Master Plan.
- To provide a framework for future development of detailed stormwater studies or analysis including, but not limited to, Stormwater Management Reports (SWMRs) to design stormwater management and erosion control measures.

2.0 Plan Area

2.1 Location

The Northeast ASP area lies within the City of Lloydminster along the east boundary. The study area is bound by 67 Street to the north, Lloydminster Golf and Curling Centre to the south, 50 Avenue to the west, and the East Drainage Channel to the east. The extent of the study area is approximately 600 ha and shown in Figure 2.1.

Generally speaking, the study area drains towards the northeast. Within the study area, elevations range from a high point of approximately 645 m in the southwest to a low point of 625 m in the northeast. A topographical map is shown in Figure 2.2 based on the 2016 LiDAR data provided by the City. The Northwest Drainage Channel is located within the northwest portion of the Northeast ASP area, and the East Drainage Channel is located along the eastern Northeast ASP boundary. There are approximately 12 wetland features located within the study area with the largest features in the west.

2.2 Existing Development

The predominant land use within the study area is currently Urban Transition. Other land uses within the study area include service commercial and light industrial. Figure 2.3 shows the existing land use for the study area. A summary of the existing land use scenario is outlined in Table 2.1.

Table 2.1: Summary of Existing Land Use

Land Use	Area
	ha
Urban Transition	380.38
Service Commercial	1.84
Light Industrial	94.39
Urban Park	95.79
Road Right-of-Way	24.53
Total	596.92

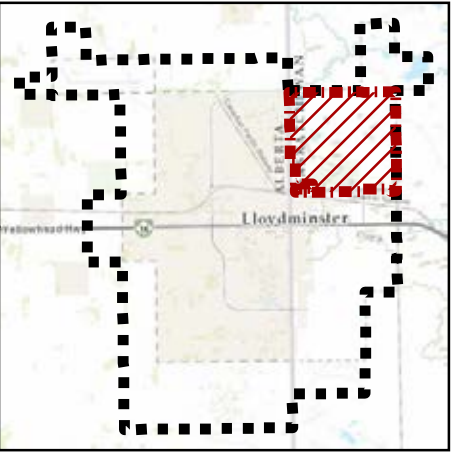
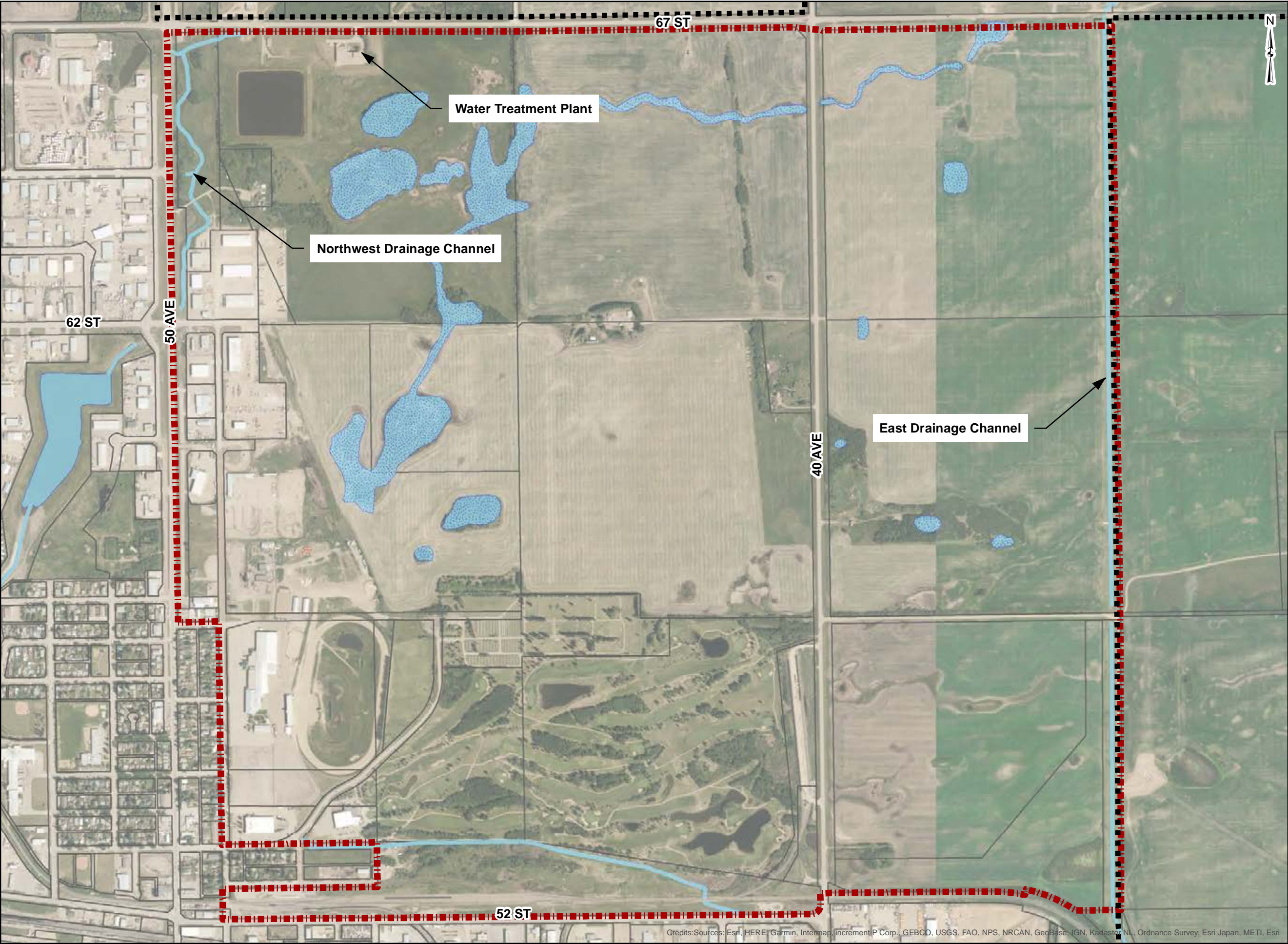
2.3 Future Development

There have been five (5) primary land use areas identified for the Northeast ASP area, including commercial, commercial/industrial, and industrial development. Land for utilities has been allocated for the water treatment plan and its expansion. Open space is included throughout the study area, with a large open space area located in the west. An approximate breakdown of the proposed land use is given in Table 2.2 as well as shown in Figure 2.4.



Table 2.2: Proposed Land Use

Land Use	Area
	ha
Commercial	11.41
Commercial/Industrial	27.45
Industrial	286.87
Utilities	22.59
Open Space	204.86
Other	15.33
Road	28.41
Total	596.92



- Legend
- Storm Channel
 - Lake
 - Potential Currently Existing Wetland, Watercourse, and Waterbody Areas
 - ASP Boundary
 - City Boundary

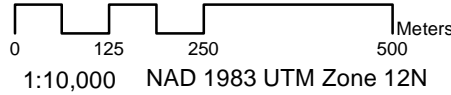
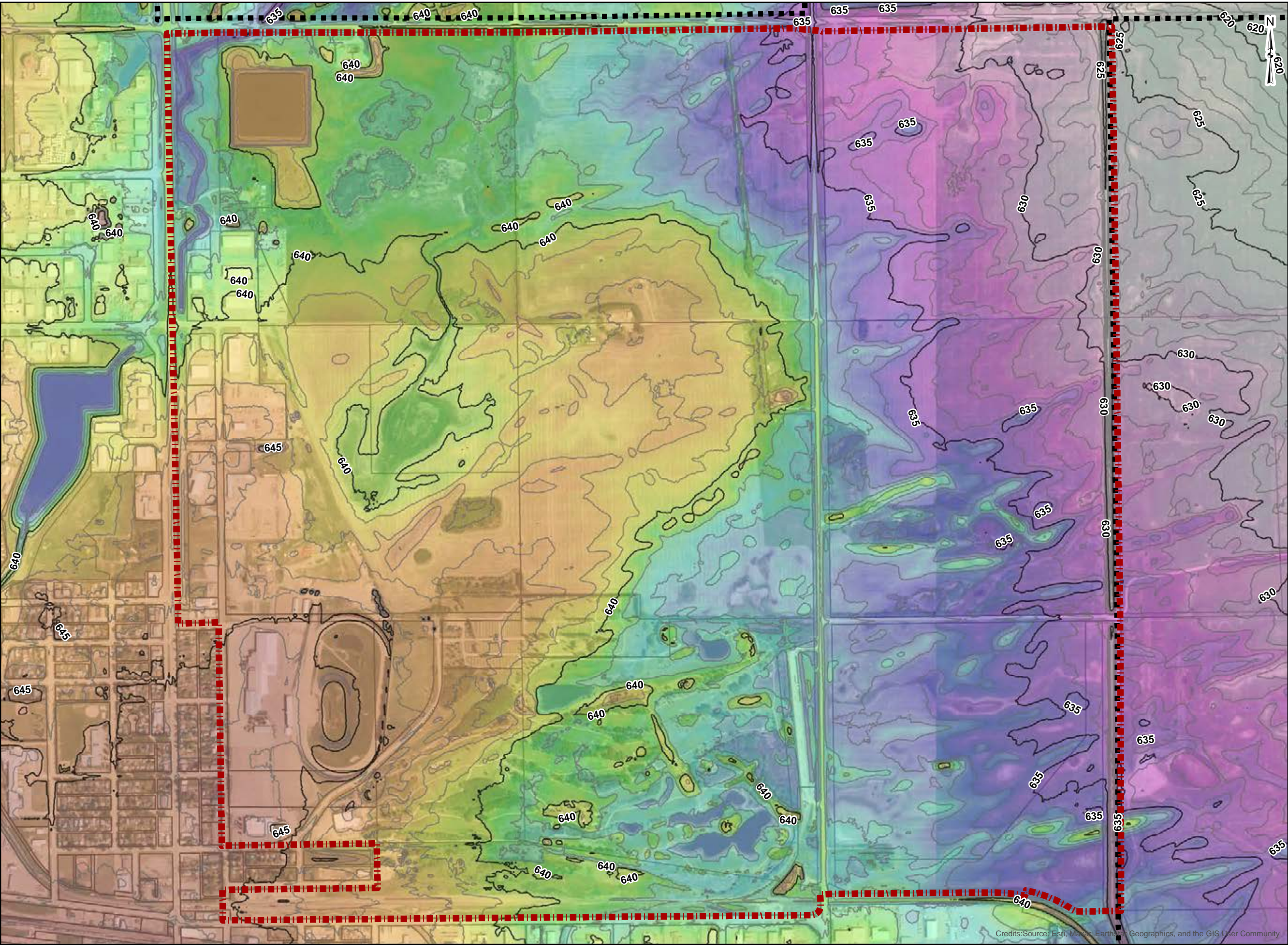


FIGURE 2.1
STUDY AREA
CITY OF LLOYDMINSTER
NE ASP SERVICING STUDY AMENDMENT





Legend

- Major Contour - 5m Interval
- Minor Contour - 1m Interval
- ASP Boundary
- City Boundary

Ground Elevation (m)

High : 647.57

Low : 617.423

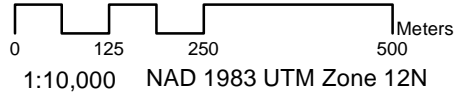
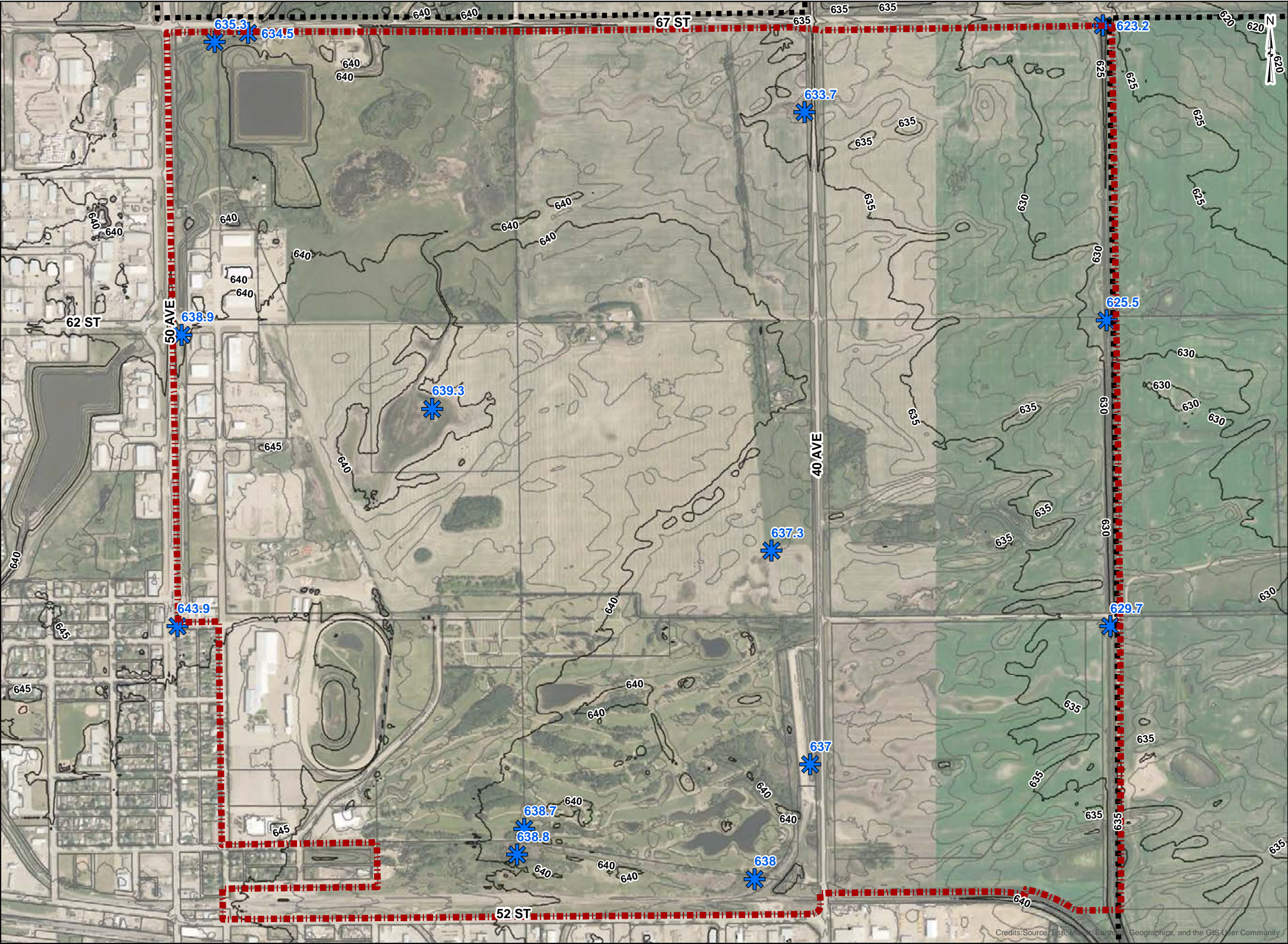


FIGURE 2.2
TOPOGRAPHY
CITY OF LLOYDMINSTER
NE ASP SERVICING STUDY AMENDMENT





Legend

- Quarter Section Minimum Elevation
- Major Contour - 5m Interval
- Minor Contour - 1m Interval
- ASP Boundary
- City Boundary

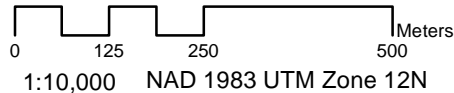
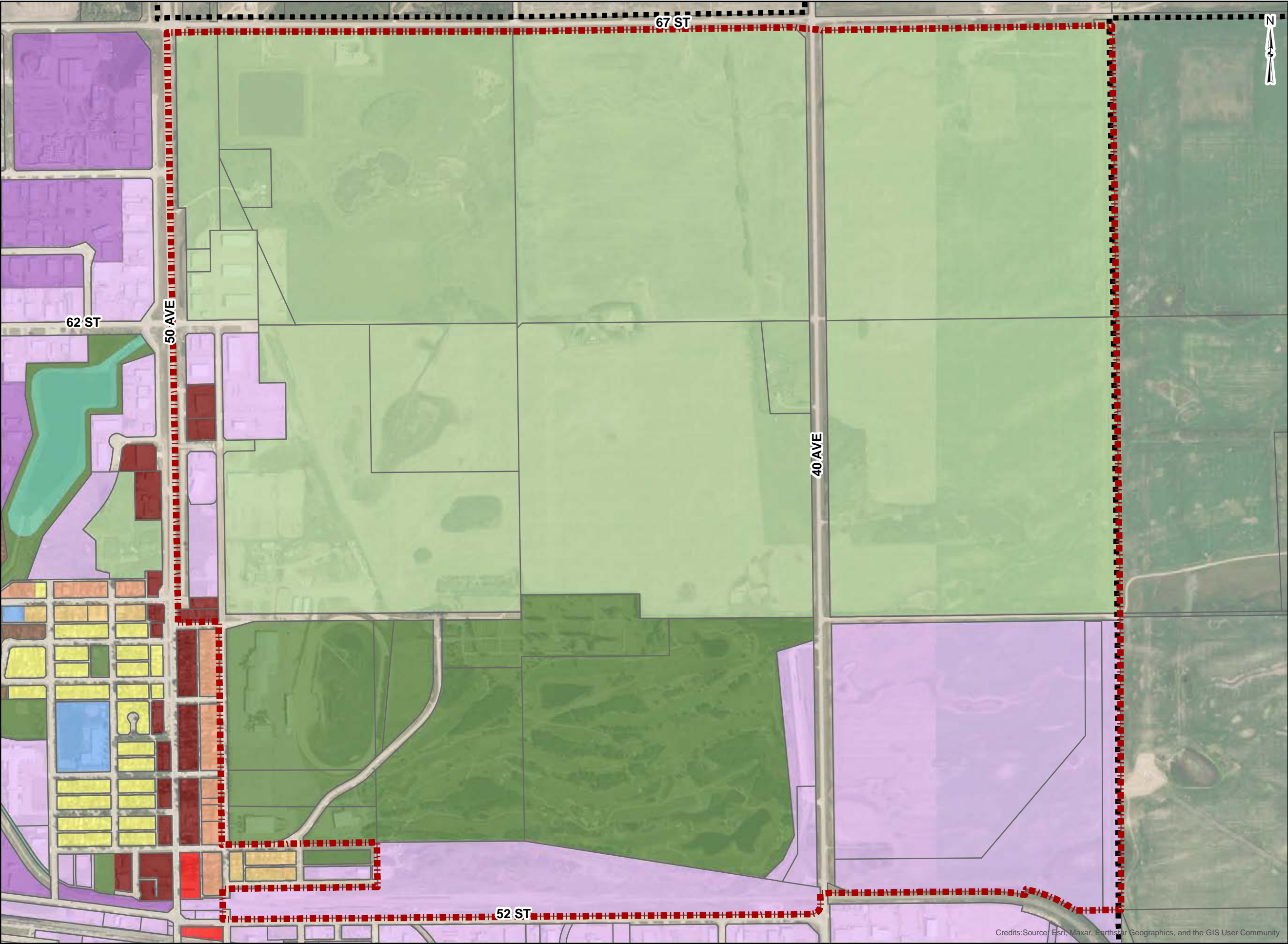


FIGURE 2.3
MINIMUM GROUND ELEVATION
CITY OF LLOYDMINSTER
NE ASP SERVICING STUDY AMENDMENT



Credits: Source: Esri, Maxar, Earthstar, Geographics, and the GIS User Community



Legend

Existing Land Use

- Single-Detached Residential
- Row House Residential
- Medium Density Residential
- Residential Manufactured Home
- Central Commercial
- Service Commercial
- Light Industrial
- Medium Industrial
- Public Service
- Public Utility
- Urban Park
- Urban Transition
- ASP Boundary
- City Boundary

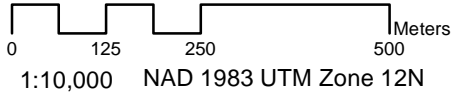
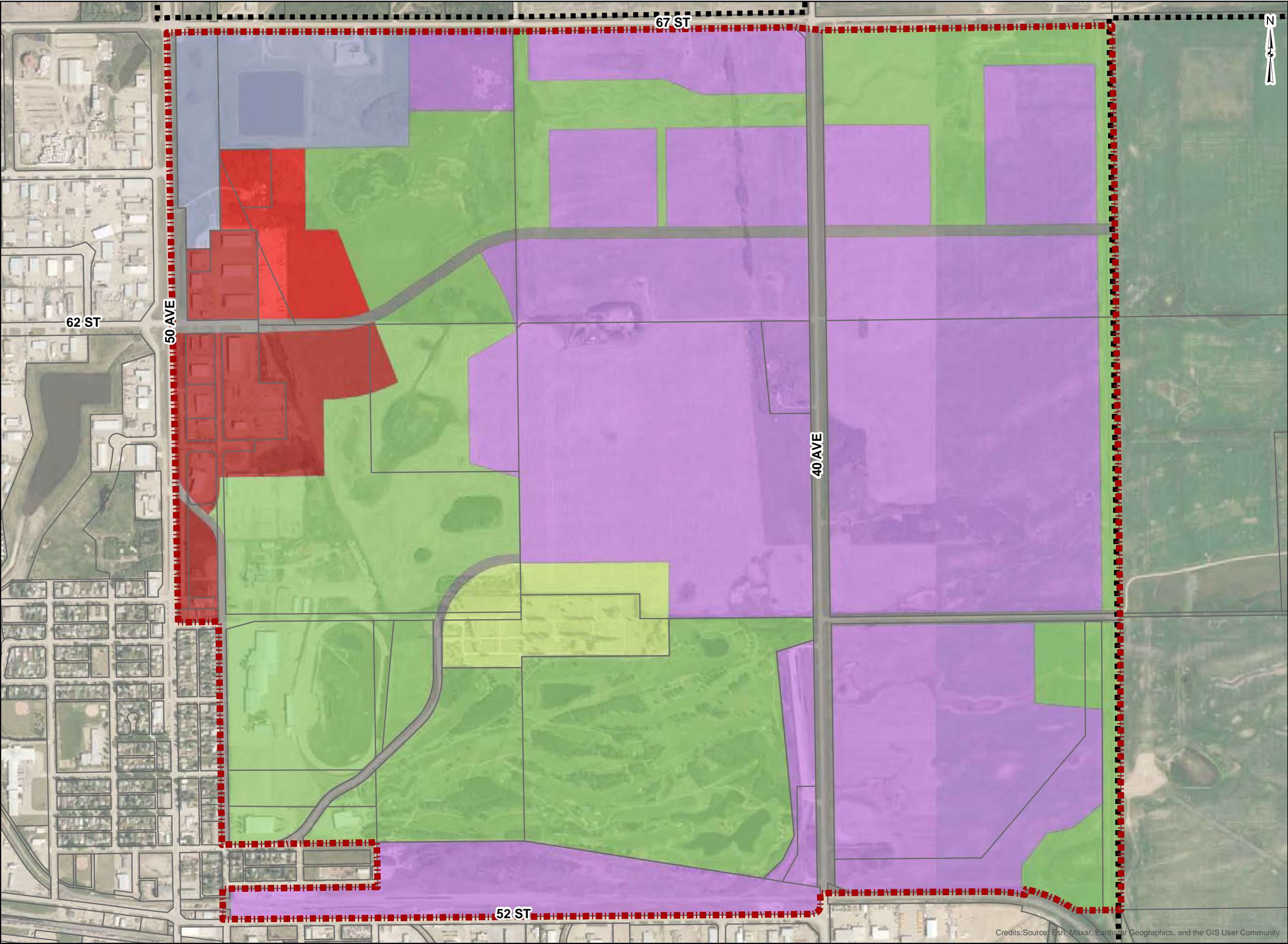


FIGURE 2.4
EXISTING LAND USE
CITY OF LLOYDMINSTER
NE ASP SERVICING STUDY AMENDMENT



Credits:Source Esri, Maxar, Earthstar Geographics, and the GIS User Community



Legend

Proposed Land Use

- Commercial
- Commercial/Industrial
- Industrial
- Utilities
- Recreation
- Cemetery
- Environmental Reserve
- Stormwater Channel
- Road
- ASP Boundary
- City Boundary

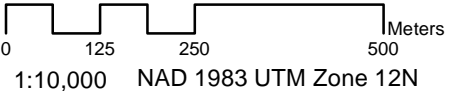


FIGURE 2.5
PROPOSED LAND USE
CITY OF LLOYDMINSTER
NE ASP SERVICING STUDY AMENDMENT



Credits:Source Esri, Maxar, Earthstar Geographics, and the GIS User Community

■ 3.0 Water

3.1 Existing Infrastructure

3.1.1 Existing Water Sources

The City's existing water distribution system is supplied by the North Saskatchewan River. The raw water from the North Saskatchewan River is supplied to the City's existing water treatment plant (WTP), large industrial users, as well as some smaller users. The license for raw water withdrawal is 9,000 acre-feet or approximately 30,500 m³/day based on gross diversion, with a current average daily demand of approximately 11,000 m³ (ISL, 2016).

3.1.2 Existing Water Infrastructure

Water Treatment Plant No. 2

The existing WTP (WTP 2) is located in the northwest corner of the study area and is currently accessed via 67 Street. The WTP is operated from 6:00 am to 11:00 pm except during peak days when it may operate up to 24 hours per day. The WTP 2 has an average flow of 10,500 m³/day with a net production capacity of 21,125 m³/day (ISL, 2016).

Reservoir

The City currently stores treated water at the West End Reservoir, which is comprised of a 4,545 m³ above ground reservoir built in 1971 and a 20,201 m³ underground reservoir built in 2006, with a combined capacity of 24,746 m³. The WTP also has 1,090 m³ of storage located at the clearwell; however, this volume is not considered part of the overall water system storage capacity (ISL, 2016).

Water Distribution System

The study area is largely undeveloped; therefore, minimal water infrastructure exists within the area. Existing infrastructure is located along 49 Avenue in the west of the study area. In addition to this, an existing 350mm raw water main runs along 40 Avenue. A SaskWater water line runs along the north and east boundaries of the Northeast ASP area. These mains are connected to the WTP in the northwest corner of the study area.

3.1.3 Existing Capacities

Water Treatment Plant No. 2

It was anticipated that a major upgrade to the existing WTP would be required in 2026 based on population projections and the assessment performed as part of the Water Master Plan (ISL, 2016). As much of the study area was considered to be outside of this growth horizon, it is likely that an upgrade is required to facilitate the development of the ASP area. However, this is to be determined once more detailed densities of the study area have been identified and the phasing of growth of the study area compared to other portions of the City has been evaluated.



Reservoir

Based on the projected storage required for 2019, the existing reservoir facility is already over capacity (ISL, 2016). Therefore, it has been assumed that there is no capacity currently available and the storage required to service the study area would be required to be provided in the form of an expansion to the existing reservoir at its current location. There may be potential for a new reservoir location; however, this is to be reviewed as part of the 2022 Water Master Plan update.

It should be noted that the available reservoir capacity is based on the storage summary presented in the 2016 Water Master Plan; however, this may not accurately represent the City's actual available storage based on current demands. Therefore, it is recommended that this be reviewed following the completion of the 2022 Water Master Plan update.

Water Distribution System

No upgrades to the existing water distribution system were proposed to be completed in order to service the study area; however, the land uses applied previously have since been modified. Therefore, it is recommended that the capacities of the existing infrastructure to facilitate these land uses be confirmed once more detailed development type and density information is available.

3.2 Design Criteria

The design criteria used when considering the water servicing network were derived from the City of Lloydminster Municipal Development Standards Section 6 – Water Distribution Systems, Saskatchewan Ministry of Environment's Design Standards, and Alberta Environment and Parks' Standards and Guidelines for consistency with the 2016 Water Master Plan.

The detailed analysis of the preliminary proposed water distribution network was not completed as part of this Servicing Study as the study area is to be tied-in to the City's existing water distribution network and should be assessed as such to determine overall system impacts.

Although the entire study area was accounted for in the 2016 Water Master Plan, there have been some modifications to the land uses that were applied within the study area. Therefore, it is recommended that the network be analyzed further once more detailed employment density information is available for the study area.

To further analyze a proposed water distribution system, it is recommended that Bentley's WaterCAD CONNECT Edition or a similar computer model be used. WaterCAD is a powerful analysis tool that hydrodynamically routes flows through the physical distribution system. In this manner, pressure results are obtained, and available fire flow at any location in the water distribution system can be estimated. The network should be assessed under average day demand, peak hour demand, and maximum day demand plus fire flow to analyze the performance of a proposed system.

3.2.1 Water Consumption Rates

The 2016 Water Master Plan recommended a per capita Average Day Demand (ADD) of 250 L/c/d. As detailed employment densities for the non-residential developments have not been prepared at this stage, area-based water consumption rates for all development types may be utilized. These consumption rates are outlined below in Table 3.1.

Table 3.1: Water Consumption Data

Land Use	Consumption Rate
	L/ha/d
Commercial	20,500
Commercial/Industrial	17,750
Industrial	15,000

The determination of these consumption rates is based on the Water Master Plan (ISL, 2016) and is detailed as follows:

- As a detailed classification of the commercial lands has not been outlined, the average consumption rate for local commercial and highway commercial was used.
- The commercial/industrial area was considered to be half commercial and half industrial development; therefore, the average consumption rate for local and highway commercial as well as the average of light industrial and heavy industrial was used.
- As a detailed classification of the industrial lands has not been outlined, the average consumption rate for light industrial and heavy industrial was used.
- For the utilities area, the average consumption rate applied was consistent with institutional.

It should be noted that the current 2020 Municipal Development Standards stipulate a sanitary generation rate for industrial development of 0.2 L/s/ha, which equates to 17,280 L/ha/d, compared to the water consumption rate of 15,000 L/ha/d. The typical expectation is that wastewater flows are 80% of water demands due to the relationship that exists between water consumption and wastewater generation. As such, the rates stipulated in the 2020 Municipal Development Standards are not consistent with this general assumption. Therefore, it is recommended that these rates be reviewed as part of the City's 2022 updates to the Water Master Plan and Sanitary Sewer Master Plan.

3.2.2 Peaking Factors

The following factors are to be used to establish Maximum Day Demand and Peak Hour Demand for future development:

- Maximum Day Demand – 2.0 x Average Day Demand
- Peak Hour Demand – 3.0 x Average Day Demand



3.2.3 Reservoir Storage Requirements

Reservoir storage volumes were calculated in two manners for comparison purposes: the formulas recommended by the Saskatchewan Ministry of Environment (SME) and Alberta Environment and Parks (AEP) for consistency with the 2016 Water Master Plan.

Saskatchewan Ministry of Environment (Waterworks Design Standard)

$$Volume = ADD \times 2$$

Where,

Volume=Total storage requirement, m³

ADD=Average Day Demand, m³

Alberta Environment and Parks (Standards and Guidelines for Municipal Waterworks, Wastewater and Stormwater Drainage Systems)

$$S = A + B + (\text{the greater of } C \text{ or } D)$$

Where,

S=Total storage requirement, m³

A=Fire storage, m³

B=Equalization storage (25% of Maximum Day Demand), m³

C=Emergency storage (minimum of 15% of Average Day Demand), m³

D=Disinfection contact time storage to meet CT requirements, m³

3.2.4 Fire Flow Protection Requirements

The 2016 Water Master Plan recommends fire flow requirements for various land use types based on the Fire Underwriters Survey. Table 3.2 below outlines these fire flow rates, durations and storage volumes required for various development types.

Table 3.2: Fire Flow Requirements

Land Use Type	Fire Flow Required	Duration	Fire Storage Required
	L/s	Hours	m ³
Commercial - Local	185	2.5	1,665
Commercial – Highway	225	3.0	2,430
Industrial	225	3.0	2,430
Institutional	225	3.0	2,430

The values for highway commercial, industrial, and institutional govern for the required fire storage as they are the most conservative. It should be noted that fire flow requirements can typically be reduced by up to 50% for facilities equipped with sprinkler systems as per the Fire Underwriters Survey recommendations.

3.2.5 Distribution Pressure Requirements

The future water system is to be assessed using the following criteria based on the City's Municipal Development Standards:

- Normal pressure range in the system under Maximum Day Demand of 350 kPa to 550 kPa.
- Minimum residual pressure in the system under Peak Hour Demand of 273 kPa.
- Maximum pressure allowable before a pressure reducing valve (PRV) is required of 700 kPa.
- Minimum residual pressure in the system under Maximum Day Demand plus Fire Flow of 150 kPa.

3.2.6 Maximum Velocity Requirements

Main line flow velocities should not exceed 3.0 m/s and be preferably below 2.0 m/s if possible, during peak flow conditions and maximum day plus fire flow conditions.

3.3 Proposed Water Distribution System

3.3.1 Water System Demands

Following the determination of the water system design criteria that would be used, the required water demands were derived for each service area as shown in Figure 3.2. The analysis indicates that the proposed total water demands are as follows:

Table 3.3: Total Water Demands

Service Area ID	Total Water Demands					
	ADD		MDD = 2x ADD		PHD = 3 x ADD	
	L/s	m ³ /d	L/s	m ³ /d	L/s	m ³ /d
W1	4.74	409	9.48	819	14.22	1,228
W2	3.60	311	7.19	622	10.79	932
C1	10.83	936	21.66	1,871	32.49	2,807
C2	6.45	557	12.90	1,114	19.35	1,671
C3	3.08	266	6.17	533	9.25	799
E1	7.86	679	15.71	1,357	23.57	2,036
E2	10.22	883	20.44	1,766	30.66	2,649
E3	6.49	561	12.97	1,121	19.46	1,682
Total	53.26	4,602	106.52	9,204	159.79	13,805

A detailed breakdown of the calculated water demands for each service area are shown in Table 3.4.



Table 3.4: Water Demand Estimation

Service Area	Area	Water Consumption	Average Day Demand		MDD		PHD	
					2 x ADD		3 x ADD	
	ha	L/ha/d	L/s	m³/d	L/s	m³/d	L/s	m³/d
W1	23.06	17,750	4.74	409	9.48	819	14.22	1,228
W2	15.75	19,735	3.60	311	7.19	622	10.79	932
C1	62.38	15,000	10.83	936	21.66	1,871	32.49	2,807
C2	37.14	15,000	6.45	557	12.90	1,114	19.35	1,671
C3	17.77	15,000	3.08	266	6.17	533	9.25	799
E1	45.25	15,000	7.86	679	15.71	1,357	23.57	2,036
E2	58.87	15,000	10.22	883	20.44	1,766	30.66	2,649
E3	37.37	15,000	6.49	561	12.97	1,121	19.46	1,682
Total	297.59		53.26	4,602	106.52	9,204	159.79	13,805



3.3.2 Reservoir Storage

As previously noted, the West End Reservoir has a combined capacity of 24,746 m³. An evaluation of the reservoir volume required to service the study area was completed as part of the Servicing Study. This volume of water storage required was determined using the formulas provided by SME and AEP for comparison. Table 3.5 summarizes the storage requirements.

Table 3.5: Reservoir Storage Requirements

Fire Storage ¹	ADD	MDD	SME Storage ²	AEP Storage ³
m ³	m ³	m ³	m ³	m ³
2,430	4,602	9,204	9,204	5,421

¹ Fire storage required determined based on 225L/s for 3.0 hours (i.e. industrial development)

² SME storage volume required determined based on the following formula: $ADD \times 2$

³ AEP storage volume required determined based on the following formula: $Fire\ Storage + 25\% \text{ of } MDD + 15\% \text{ of } ADD$

It is recommended that the currently available capacity of both the reservoir storage and the WTP be evaluated to confirm whether additional upgrades are required to facilitate the proposed ASP development and land uses once more detailed employment densities are available.

3.3.3 Water Pipe Network

The preliminary proposed water pipe system was developed based on a grid main network according to standard approaches to planning water distribution systems and municipal servicing standards as well as the 2016 Water Master Plan. This grid main network was provided on an approximate quarter section basis, following the major roadways in the study area.

The proposed watermains are to be tied into the existing network at 49 Avenue as well as to the existing SaskWater water line along 67 Street and the East Drainage Channel to provide adequate looping for the area. As previously noted, it is recommended that a detailed network analysis be completed to assess the adequacy of this system as well as the impacts to the City's existing system once more detailed employment densities are available.

3.4 Cost Estimates

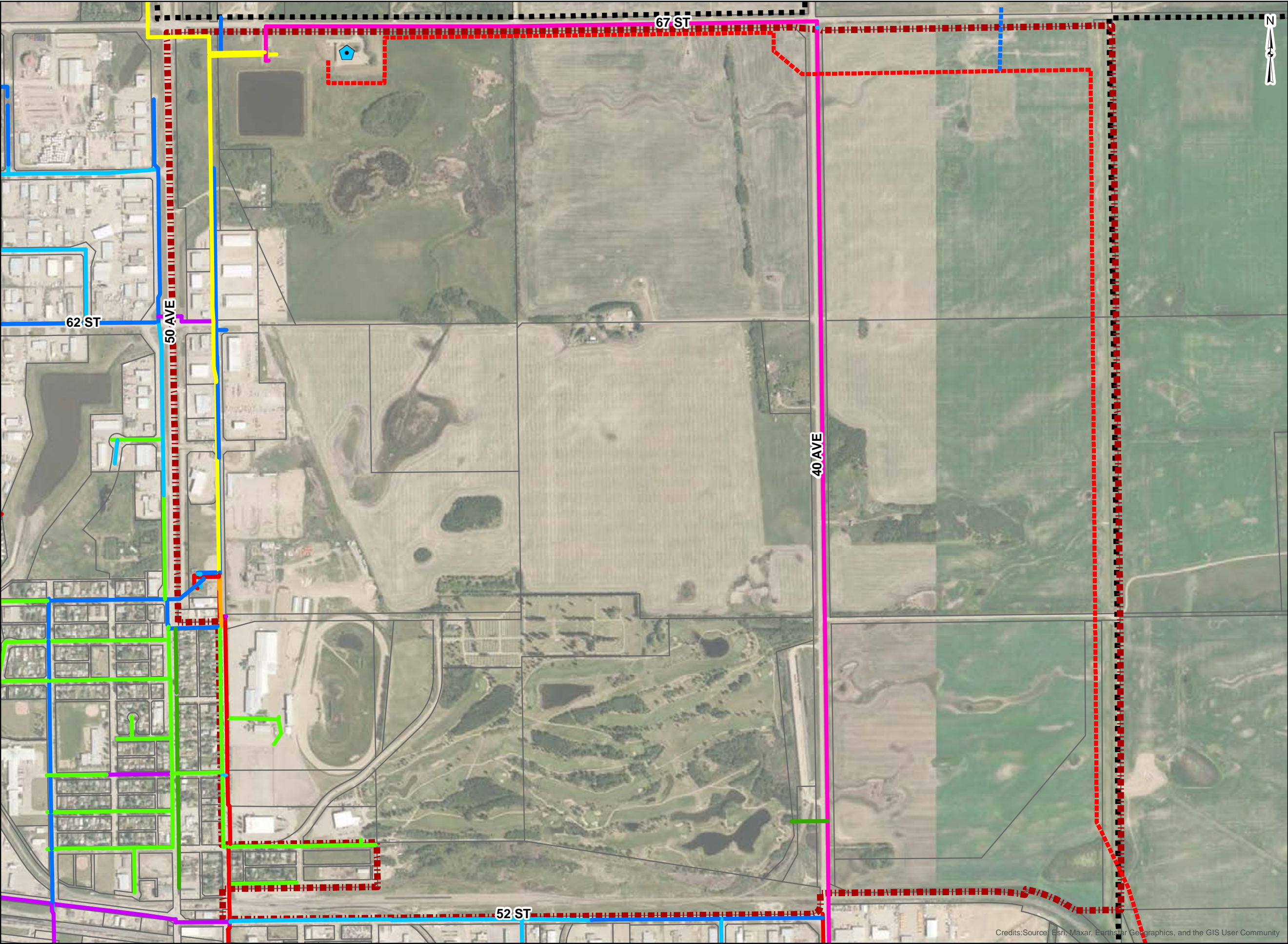
Cost estimates were prepared for the proposed water distribution system and are summarized in Table 3.6 and provided in detail in Appendix A. It should be noted that costs to upgrade the existing WTP have not been included in the below estimate; however, reservoir storage and pumping have been included based on the SME storage requirements outlined previously.

Table 3.6: Summary of Water Servicing Cost Estimates

Item	Sub-Total	Contingency	Engineering	Total (Rounded)
		30%	15%	
Reservoir Storage & Pumping Upgrades ¹	\$5,630,000	\$1,689,000	\$1,097,850	\$8,415,000
300mm Watermain	\$5,009,400	\$1,502,820	\$976,833	\$7,490,000
Total (Rounded)	\$10,640,000	\$3,190,000	\$2,075,000	\$15,905,000

¹ The unit cost associated with reservoir storage and pumping upgrades was based on the proportion of the Future 3 Year West End Reservoir capacity required compared to the required reservoir storage capacity to facilitate the ASP. An average annual inflation rate of 2.57% was applied to this unit cost and contingency/engineering added. It should be noted that neither the costs for the demolition of the existing above ground reservoir nor the construction of a new reservoir and pumphouse facility have been included in this cost.

It should be noted that the annual inflation rate is currently over 7%, which is the highest it has been in approximately 20 years based on the Consumer Price Index (CPI); therefore, the costs provided may increase if this trend continues (Government of Alberta, 2022).



Legend

- Water Treatment Plant
- 400 mm SaskWater Line (Alignment Approximated)
- 250 mm SaskWater Line (Alignment Approximated)

Pipe Diameter

- 100 mm
- 150 mm
- 200 mm
- 250 mm
- 300 mm
- 350 mm (Raw Water)
- 400 mm
- 600 mm
- 750 mm
- Unknown

- ASP Boundary
- City Boundary

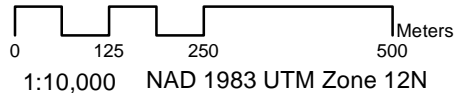
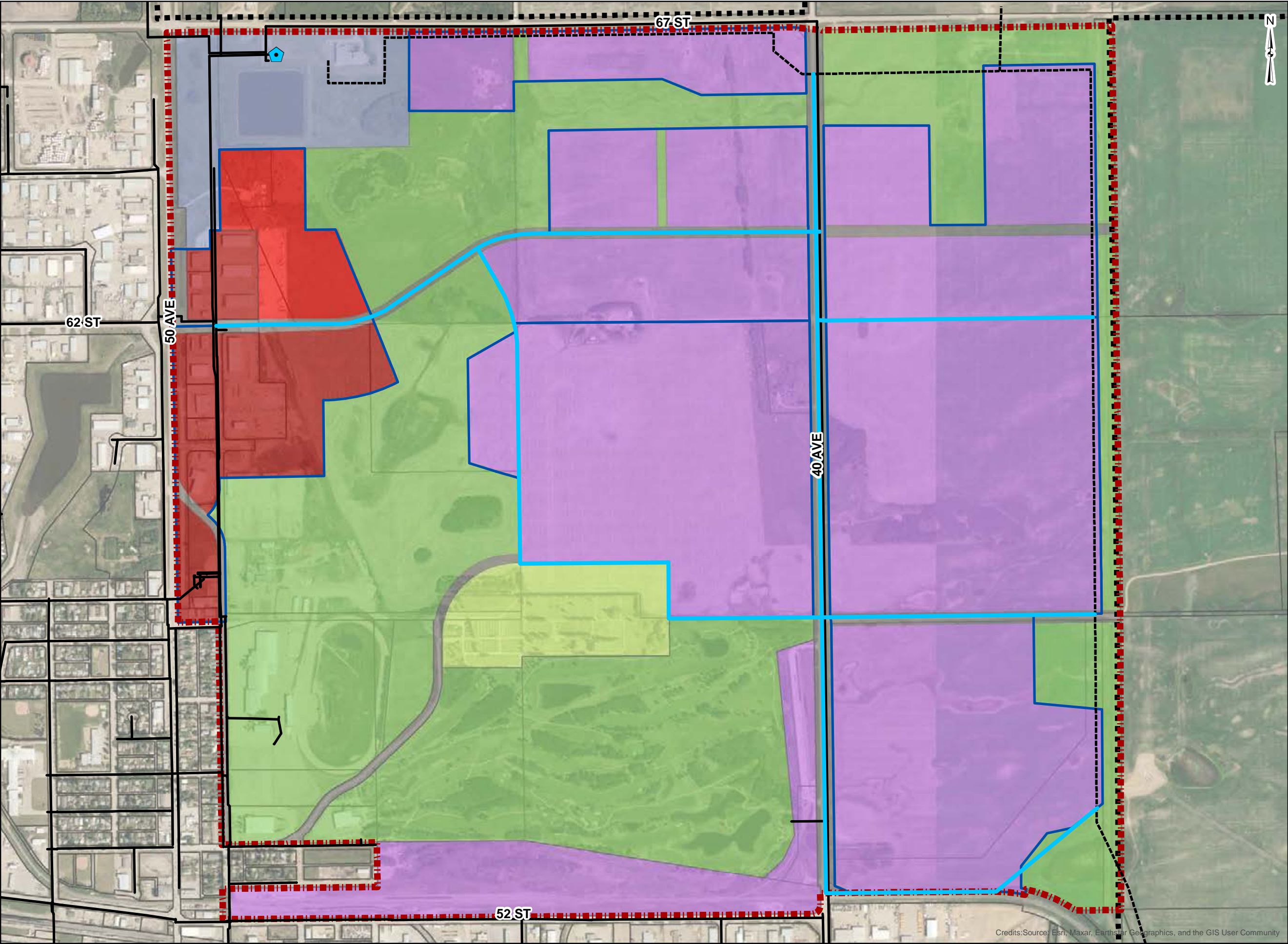


FIGURE 3.1
EXISTING WATER SYSTEM
CITY OF LLOYDMINSTER
NE ASP SERVICING STUDY AMENDMENT



Credits:Source Esri, Maxar, Earthstar Geographics, and the GIS User Community



Legend

Water Treatment Plant

Proposed 300mm Watermain

Existing Watermain

Existing SaskWater Line
(Alignment Approximated)

Service Area Boundary

Proposed Land Use

Commercial

Commercial/Industrial

Industrial

Utilities

Open Space

Other

Road

ASP Boundary

City Boundary

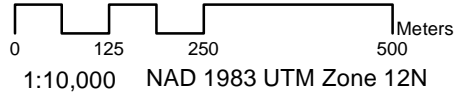


FIGURE 3.2
PROPOSED WATER SYSTEM
CITY OF LLOYDMINSTER
NE ASP SERVICING STUDY AMENDMENT



■ 4.0 Wastewater

4.1 Existing Infrastructure

The existing wastewater system conveys flows to the Wastewater Treatment Plant (WWTP) located north of 67 Street and approximately 800 m east of 40 Avenue. The East Trunk is one of the two primary wastewater trunks in the City, which runs along the east boundary of the study area. The other primary trunk runs along 67 Street and connects to the East Trunk south of the WWTP at the northeast corner of the study area. The existing wastewater system is shown in Figure 4.1.

4.1.1 Existing Capacities

There is minimal existing capacity in the East Trunk, as such it was recommended that this trunk be twinned in order to service future development. The existing East Trunk is intended to maintain its service of the current collection area with the exception of the 19 Street Trunk and South Trunk flows in order to accommodate future development in the Wigfield Industrial area (AECOM, 2016).

Although there is currently capacity in the North Trunk, it is anticipated to be largely used by future development upstream. Therefore, no additional development was considered to be serviced by this trunk.

4.2 Design Criteria

The design criteria used when considering the wastewater servicing network were derived from the City of Lloydminster Municipal Development Standards Section 4 – Sanitary Sewer Systems.

4.2.1 Dry Weather Flow Conditions

As detailed employment densities for non-residential areas have not been prepared at this stage, an area-based wastewater generation rate of 0.2 L/s/ha was applied in accordance with City of Lloydminster Municipal Development Standards. It should be noted that lower contributions for commercial or institutional may be applied on a per case basis at the discretion of the City.

It should be noted that the current 2020 Municipal Development Standards stipulate a sanitary generation rate for industrial development of 0.2 L/s/ha, which equates to 17,280 L/ha/d, compared to the water consumption rate of 15,000 L/ha/d. The typical expectation is that wastewater flows are 80% of water demands due to the relationship that exists between water consumption and wastewater generation. As such, the rates stipulated in the 2020 Municipal Development Standards are not consistent with this general assumption. Therefore, it is recommended that these rates be reviewed as part of the City's 2022 updates to the Water Master Plan and Sanitary Sewer Master Plan.

4.2.2 Peaking Factors

The peaking factor applied for non-residential flows was 3.0 in accordance with the City of Lloydminster Municipal Development Standards.

4.2.3 Wet Weather Flow Conditions (Inflow-Infiltration)

A constant inflow-infiltration (I-I) allowance of 0.28 L/s/ha was applied to the development area in the study area to simulate wet weather response.

4.3 Proposed Wastewater Collection System

4.3.1 Wastewater System Flows

Following the determination of the wastewater system design criteria that would be used, an estimation of the anticipated sanitary flows was derived for each service area as shown in Figure 4.2. The analysis indicates that the proposed wastewater flows are as follows in Table 4.1.

Table 4.1: Total Wastewater Flows

Service Area ID	Total Wastewater Generation					
	ADWF		PDWF		PWWF	
	L/s	m ³ /d	L/s	m ³ /d	L/s	m ³ /d
W1	4.61	399	13.84	1,196	20.30	1,754
W2	3.15	272	9.45	816	13.86	1,197
C1	12.48	1,078	37.43	3,234	54.89	4,743
C2	7.43	642	22.29	1,926	32.69	2,824
C3	3.55	307	10.66	921	15.63	1,351
E1	9.05	782	27.15	2,346	39.82	3,440
E2	11.77	1,017	35.32	3,052	51.81	4,476
E3	7.47	646	22.42	1,937	32.88	2,841
Total	59.52	5,142	178.55	15,427	261.88	22,626

A detailed breakdown of the calculated wastewater flows for each service area are shown in Table 4.2.

4.3.2 Wastewater Collection System Sizing and Configuration

As previously noted, there was assumed to be no available capacity in the North or East Trunks to facilitate development in the study area. Therefore, new sanitary sewers from within the development are proposed to be tied into the future East Trunk Twin and Northwest Trunk. The proposed wastewater collection system is presented in Figure 4.2.

Service Areas E1, E2, and E3 are proposed to be connected to the East Trunk Twin in keeping with the 2016 Sanitary Sewer Master Plan. As such, a 1200 mm diameter sewer is proposed to twin the existing East Trunk (AECOM, 2016). It is recommended that the proposed alignment of this twinning project be reviewed as part of the current update to the City's Sanitary Sewer Master Plan.



Table 4.2: Wastewater Generation Estimation

Service Area	Developable Area	Cumulative Development Area	DWF Generation Rate	Cumulative Average Dry Weather Flow (ADWF)		Peaking Factor	Peak Dry Weather Flow (PWWF)		I-I Rate		I-I Flow	Peak Wet Weather Flow (PWWF)	
	ha	ha	L/s/ha	L/s	m³/d		L/s	m³/d	L/s/ha	m³/ha/d	L/s	L/s	m³/d
W1	23.06	23.06	0.2	4.61	399	3.0	13.84	1,196	0.28	24.19	6.46	20.30	1,754
W2	15.75	38.81	0.2	7.76	671	3.0	23.29	2,012	0.28	24.19	10.87	34.16	2,951
C1	62.38	62.38	0.2	12.48	1,078	3.0	37.43	3,234	0.28	24.19	17.47	54.89	4,743
C2	37.14	99.52	0.2	19.90	1,720	3.0	59.71	5,159	0.28	24.19	27.87	87.58	7,567
C3	17.77	117.29	0.2	23.46	2,027	3.0	70.37	6,080	0.28	24.19	32.84	103.21	8,918
W/C	0.00	156.10	0.2	31.22	2,697	3.0	93.66	8,092	0.28	24.19	43.71	137.37	11,869
E1	45.25	45.25	0.2	9.05	782	3.0	27.15	2,346	0.28	24.19	12.67	39.82	3,440
E2	58.87	104.12	0.2	20.82	1,799	3.0	62.47	5,398	0.28	24.19	29.15	91.63	7,916
E3	37.37	141.49	0.2	28.30	2,445	3.0	84.89	7,335	0.28	24.19	39.62	124.51	10,758
Outfall	0.00	297.59	0.2	59.52	5,142	3.0	178.55	15,427	0.28	24.19	83.32	261.88	22,626



Small portions of Service Areas W1 and W2 were accounted for in the capacity evaluation of the North Trunk; however, not all of this area was proposed to be development within the assessment horizon. Therefore, it is recommended that either the new development in the area be tied into the future Northwest Trunk or the capacity of the North Trunk be reevaluated to determine whether the entirety of these service areas can be accommodated. For the purpose of this study, the North Trunk was considered to have no available capacity for the future development and a new sewer connection to the future Northwest Trunk is proposed.

In keeping with the 2016 Sanitary Sewer Master Plan, the downstream portion of the Northwest Trunk, namely the 1050 mm diameter portion from 40 Avenue east, is proposed to facilitate development in the study area. Service Areas C1, C2, and C3 are proposed to be tied into this trunk at 40 Avenue.

It should be noted that the industrial area along 52 Street and the south boundary of the Northeast ASP area has not been accounted for the sizing of the proposed sewers as this area has been assumed to be accommodated for in the East Trunk system. It is recommended that this be reviewed as part of the City's 2022 update to the Sanitary Sewer Master Plan. Additionally, it is recommended that the alignment of the East Trunk Twin be reviewed as part of this update as well.

The sanitary network sizing was completed using a spreadsheet approach based on the dry-weather non-residential generation rates, peaking factors, recommended velocities, as well as the I-I allowance rate outlined in the design criteria section above.

Generally, the conveyance system drains from the southwest to northeast. The specified pipe sizes are the smallest possible determined based on the required minimum design slope to provide a self-cleansing full-pipe velocity, under the derived peak wet weather flows, based on the roughness coefficient (n) of 0.013 in accordance with the City of Lloydminster Municipal Development Standards as presented in Table 4.3.

Table 4.3: Minimum Design Slopes for Sewers

Nominal Pipe Size	Minimum Design Slope	
	%	m/m
mm		
200	0.40	0.0040
250	0.28	0.0028
300	0.22	0.0022
375	0.15	0.0015
450	0.12	0.0012
525	0.10	0.0010
600 and Larger	0.10	0.0010

If flatter slopes are preferred or required at the detailed design stages, this can be reviewed, though it would have negative repercussions. If this was acceptable, the determined pipe sizes would need to be increased to meet the specified design flows as presented in Table 4.1.

It is worth noting that for the purposes of laying out the conceptual network of the future sanitary system, a quarter section grid was assumed to illustrate the intent of the servicing scheme. As a result, the proposed trunk routing may not necessarily follow within the stipulated alignments. Ultimately, it will be up to the developer to fulfill the intent of the servicing concept presented herein. Therefore, a developer may choose to adjust the alignment of the specified trunks as needed, to accommodate the sanitary system within future developments.

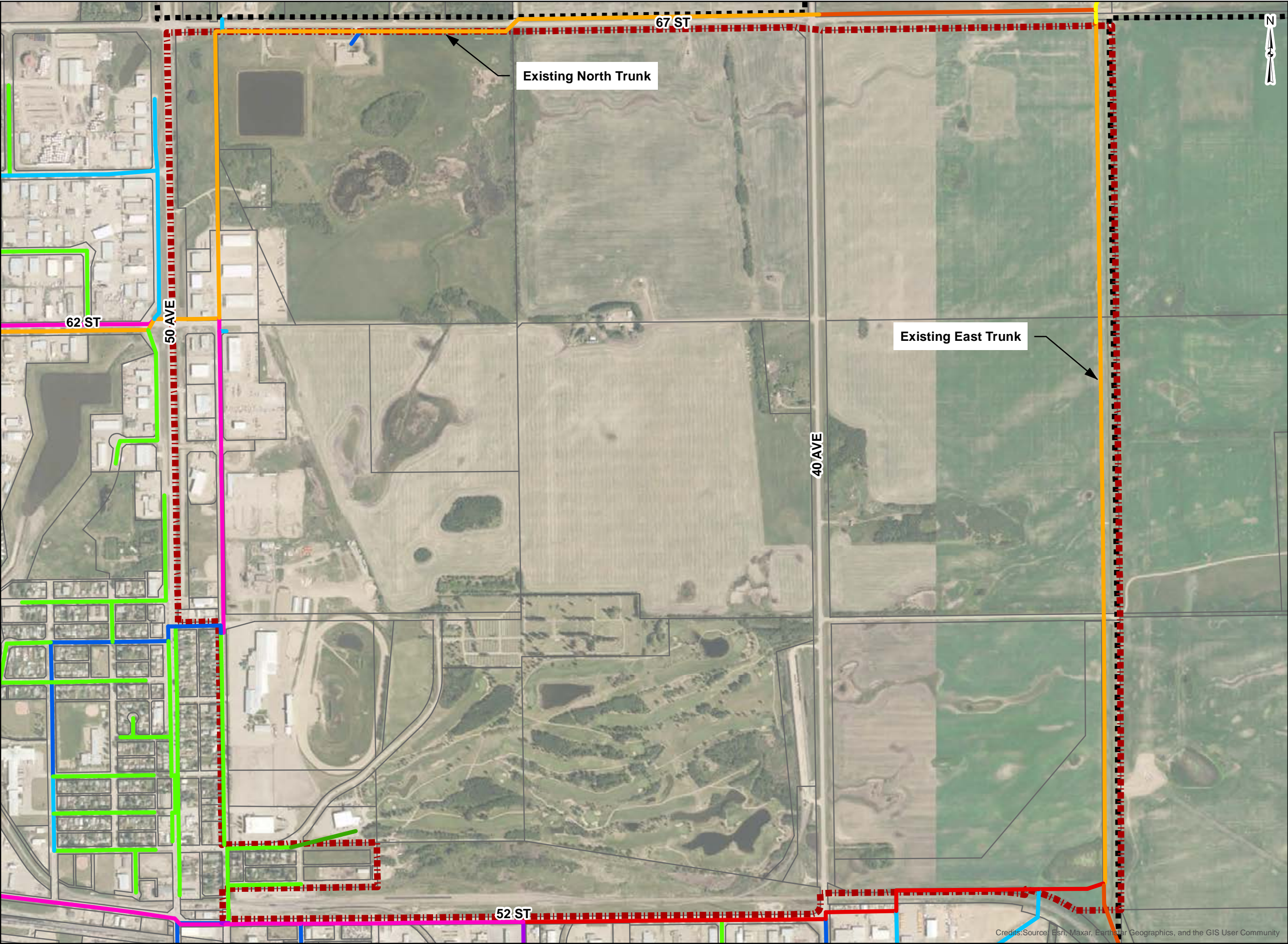
4.4 Cost Estimates

Cost estimates were prepared for the proposed wastewater collection system and are summarized in Table 4.4 and provided in detail in Appendix A. It should be noted that costs to upgrade the existing WWTP have not been included in the below estimate.

Table 4.4: Summary of Wastewater Servicing Cost Estimates

Item	Sub-Total	Contingency	Engineering	Total (Rounded)
		30%	15%	
250mm Gravity Sewer	\$220,800	\$66,240	\$43,056	\$330,000
375mm Gravity Sewer	\$1,216,025	\$364,808	\$237,125	\$1,820,000
450mm Gravity Sewer	\$804,000	\$241,200	\$156,780	\$1,200,000
525mm Gravity Sewer	\$227,768	\$68,330	\$44,415	\$340,000
1050mm Gravity Sewer	\$1,124,200	\$337,260	\$219,219	\$1,680,000
1200mm Gravity Sewer	\$2,705,751	\$811,725	\$527,621	\$4,050,000
1650mm Gravity Sewer	\$378,180	\$113,454	\$73,745	\$570,000
Total (Rounded)	\$6,675,000	\$2,005,000	\$1,300,000	\$9,990,000

It should be noted that the annual inflation rate is currently over 7%, which is the highest it has been in approximately 20 years based on the Consumer Price Index (CPI); therefore, the costs provided may increase if this trend continues (Government of Alberta, 2022).



Legend

Pipe Diameter

- 100 mm
- 200 mm
- 250 mm
- 300 mm
- 375 mm
- 450 mm
- 600 mm
- 900 mm
- 1050 mm
- 1200 mm

- ASP Boundary
- City Boundary

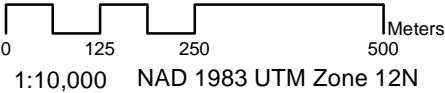
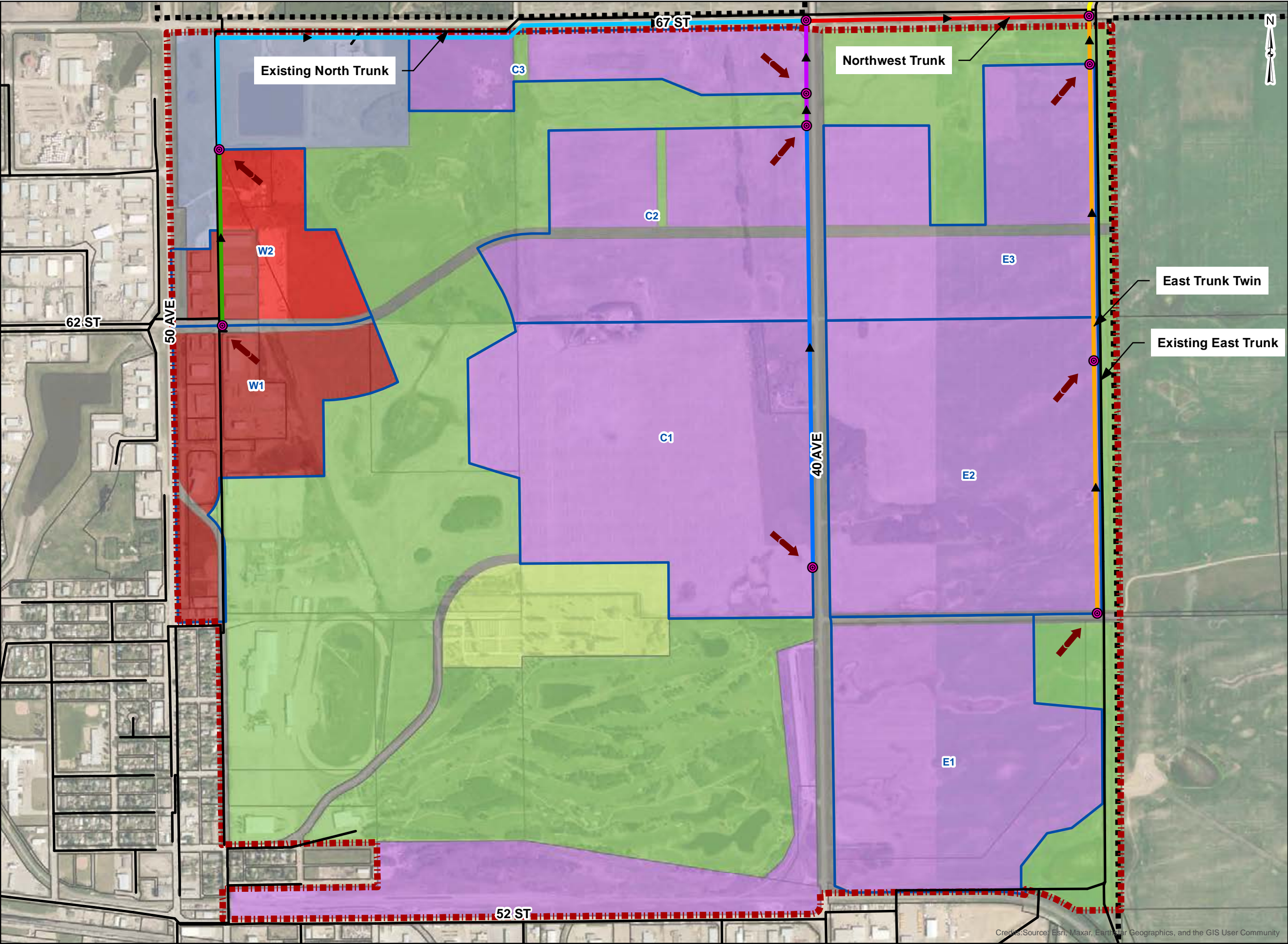


FIGURE 4.1
EXISTING WASTEWATER SYSTEM
CITY OF LLOYDMINSTER
NE ASP SERVICING STUDY AMENDMENT



Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community





Legend

Service Area Lowest Elevation

Proposed Gravity Sewer

- 250 mm
- 375 mm
- 450 mm
- 525 mm
- 1050 mm
- 1200 mm
- 1650 mm

Service Area Boundary

Proposed Land Use

- Commercial
- Commercial/Industrial
- Industrial
- Utilities
- Open Space
- Other
- Road

ASP Boundary

City Boundary

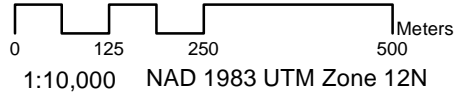


FIGURE 4.2
PROPOSED WASTEWATER SYSTEM
CITY OF LLOYDMINSTER
NE ASP SERVICING STUDY AMENDMENT





5.0 Stormwater

5.1 Analysis Methodology

5.1.1 Design Criteria

The design criteria used to assess the study area was taken from a variety of sources including the City of Lloydminster Municipal Development Standards and the Saskatchewan Ministry of Environment Water Security Agency Stormwater Guidelines. The design criteria selected was then used for input into a XPSWMM model to assess the future stormwater drainage system for the study area.

Percent Impervious

The design criteria were used along with the proposed land use data for the area, to determine imperviousness for each proposed future catchment of the study area consistent with the existing drainage patterns. Imperviousness data for different land uses is detailed in Table 5.1. The hydrologic data was used to calculate runoff for each area.

Table 5.1: Percent Impervious

Land Use	Imperviousness
Commercial	85%
Commercial/Industrial	75%
Industrial	65%
Utilities	40%
Open Space	10%
Other	10%
Road	100%

The determination of these impervious percentages is based on the City of Lloydminster Municipal Development Standards Section 5 – Storm Drainage Systems and is detailed as follows:

- As a detailed classification of the commercial lands has not been outlined, the average imperviousness for neighbourhood commercial and commercial was used.
- The commercial/industrial area was considered to be half commercial and half industrial development; therefore, the average imperviousness for neighbourhood commercial and commercial as well as the average of light industrial and heavy industrial was used.
- As a detailed classification of the industrial lands has not been outlined, the average imperviousness for light industrial and heavy industrial was used.
- For the utilities area, the imperviousness applied was consistent with institutional.

Design Rainfall Events

In determining future development requirements, there are several hydraulic design criteria necessary to conceptualize a future stormwater management system for the study area. The following criteria were utilized to develop the model under proposed conditions:

- New piped (minor system) components were sized using the 1:5 year design storm based on the 4-hour Modified Chicago distribution.
- New stormwater management facilities (SWMF) were sized using a 1:100 year design storm. This was based on the greater of the 4-hour Modified Chicago distribution or the 24-hour Huff distribution.

Runoff Parameters

Several assumptions were made to establish the future model with full development of the necessary stormwater conveyance and storage infrastructure. Slopes are considered to remain constant through future development of the area, thus existing surface data was used to determine these values.

Infiltration is based on the Horton approach using the values outlined in the 2015 Stormwater Master Plan. Table 5.2 summarizes the runoff parameters used in the XPSWMM model.

Table 5.2: Runoff Parameters

Runoff Calculation Parameter		Value
Depression Storage	Impervious Areas	0.75 mm
	Pervious Areas	2.5 mm
Manning's 'n'	Impervious Areas	0.017
	Pervious Areas	0.03
Horton Infiltration	Maximum Infiltration Rate	76.32 mm/hr
	Minimum (Asymptotic) Infiltration Rate	5.69 mm/hr
	Infiltration Decay Rate ('k' value)	0.0011/s

5.2 Existing Drainage System

5.2.1 Existing Drainage Patterns

Under existing conditions, stormwater generally drains to the northeast via either the potential currently existing wetland, watercourse, and waterbody areas, which largely originate in the southwest corner of the study area and eventually crosses 40 Avenue close to 67 Street, or the East Drainage Channel, which runs along the east boundary of the study area. Flows are combined at the downstream end of the East Drainage Channel prior to discharge north of 67 Street and ultimately to the Neale Edmunds Stormwater Complex.



5.2.2 Existing Drainage Infrastructure

There is minimal existing drainage infrastructure within the study area. The Northwest Drainage Channel runs through the study area on the west side and the East Drainage Channel runs through the study area on the east side. Additionally, there is an existing 375 mm diameter storm sewer that runs along 49 Avenue prior to discharge to the Northwest Drainage Channel. The existing stormwater system is shown in Figure 5.1.

There are likely existing culverts within the study area that are not shown in Figure 5.1, namely crossing 40 Avenue. However, no digital information pertaining to roadway culverts was available; therefore, the approximate locations of these are not shown.

5.3 Proposed Drainage System

5.3.1 Unit Area Release Rate

According to the 2015 Stormwater Master Plan, the maximum unit area release rate based on pre-development runoff conditions to be applied to future developments is 1.5 L/s/ha. This rate was utilized to size the SWMFs within the study area.

5.3.2 Proposed Drainage Patterns

Existing drainage patterns are generally maintained for the study area under proposed conditions. The existing development area just east of 50 Avenue is to continue draining to the Northwest Drainage Channel in keeping with the 2015 Stormwater Master Plan. The proposed development area west of 40 Avenue continues to drain to the existing wetland and drainage course area. This area is proposed to be converted to a series of SWMFs to control the additional runoff generated by the proposed development. It should be noted that the Lloydminster Agricultural Exhibition Association has purchased additional land from the City in Catchment. As directed by the City, no future development is planned in this area nor in the area bound by 57 Street to the north, 52 Street to the south, 40 Avenue to the east, and 49 Avenue to the west.

The area east of 40 Avenue continues to drain to the East Drainage Channel via controlled release from SWMFs. A portion of the Lloydminster Golf & Curling Centre is to be connected to the East Drainage Channel via a piped connection to maintain existing drainage patterns. A SMWF for this area may be developed; however, this project is at a preliminary stage and is to be considered outside of this Servicing Study.

Proposed catchments have been delineated for each SWMF or minor system connection as shown in Figure 5.2. The parameters of these catchments are outlined in Table 5.3.

Table 5.3: Proposed Catchments

Catchment	Area	Percent Impervious
	ha	
Existing Catchment	71.22	58%
1	77.77	24%
2	118.72	50%
3	63.84	48%
4	59.59	66%
5	65.15	63%
6	79.34	16%
7	61.27	56%
Total	596.92	46%

It should be noted that the Lloydminster Agricultural Exhibition Association grounds were considered to be open space area for the purpose of this Servicing Study, as there appears to be storage on the existing Lloydminster Agricultural Exhibition Association grounds to the south. However, if the entirety of the exhibition grounds is to be tied into the proposed SWMF, this should be accounted for in its sizing. Additionally, future SWMFs, or expansions to those proposed herein, to accommodate any redevelopment in the existing area or on the newly purchased land, are considered to be the responsibility of the Lloydminster Agricultural Exhibition Association.

5.3.3 Proposed Stormwater Conveyance System

For this study area, a stormwater conveyance system providing the overall framework for the ultimate drainage system has been developed. This system will consider proposed SWMF sites and provide surface conveyance linking the ponds to each other and ultimately downstream drainage courses. Stormwater management facilities are discussed in detail in later sections.

Generally speaking, a SWMF is proposed within each catchment. Catchment 6 is proposed to be connected to the East Drainage Channel via a 600 mm diameter storm sewer. This could be connected in to SWMF 4 to reduce the number of discharge locations to the East Drainage Channel if this were to be preferable depending on future development implementation. SWMF 1, 2, and 3 are connected via roadway culverts, which are required to have a minimum diameter of 600 mm. SWMF 4 is connected to SWMF 2 via a 600 mm diameter storm sewer along 40 Avenue. SWMF 3, 5, and 7 are connected to the East Drainage Channel via 300 mm diameter storm sewers.

It should be noted that the location of SWMF 3 may be difficult to accommodate due to the proximity of existing pipelines in the area. As the required SWMF volume and surface area as well as the available open space area is dependent on more detailed development planning, it is recommended that gravity conveyance and grading as well as potential pumping requirements be reviewed to accommodate runoff from this catchment in SWMF 2.

The detailed design of the future conveyance system is to be in accordance with the City of Lloydminster Municipal Development Standards Section 5 – Storm Drainage Systems.



5.3.4 Proposed Stormwater Management System

In assessing the stormwater management system in the area, a number of SWMFs are proposed to be utilized to control the additional runoff being generated by the new development. Generally speaking, the facilities were provided for each catchment in which future development is planned. It should be noted that the stormwater management facility layout indicated can be revised as development proceeds with facilities being combined as desired to integrate best with the actual development plans of the area. This could be accomplished through the use of Staged Master Drainage Plans or Subdivision Stormwater Management Reports that are normally developed to provide a greater level of detail than this study is able to provide as an overall planning document.

Location

The approximate locations and preliminary sizing of SWMFs is provided in the following section as part of this study. Potential SWMF locations were selected based primarily on the 2015 Stormwater Master Plan in addition to the potential currently existing wetland, watercourse, and waterbody areas proposed to be converted into connected SWMFs. Additional considerations included:

- Minimizing the number/size of facilities situated in the core build areas to leverage open spaces and support the densification of development and achieve construction/maintenance economies for the City. This is balanced by the dedication of significant new open spaces.
- Maintaining the existing topography as much as possible to minimize the required re-grading of the study area as well as cut and fill necessary for the facility construction.
- Utilizing existing flow paths and natural drainage courses to minimize the extent of conveyance ditches or storm sewer that would need to be added to link the facilities in the study area.

Sizing

The preliminary sizing of stormwater management facilities was completed using the XP-SWMM model to determine the active storage volume. This storage volume was based on the proposed land uses as described in the Northeast ASP. It should be noted that some localized areas may need to experience regrading to ensure all runoff from the proposed developable area enters one of the proposed stormwater management facilities prior to discharging the East Drainage Channel.

As the stormwater storage capacity of the existing wetland areas are currently unknown and proximal development is likely to impact the functionality of the wetland areas, SWMFs 1, 2, and 3 have been sized and costed as completely new facilities. These facilities were sized based on a unit area release rate for each catchment (i.e. there is a separate control structure for each facility). There may be an opportunity to combine these in to one facility; however, more detailed analysis of this functionality would need to be completed to incorporate the proposed grading of the facilities and surrounding areas. Should these facilities be converted in to constructed wetlands rather than simply wet ponds, the design is required to comply with the Wetland Design Guidelines prepared for the City of Saskatoon (CH2MHILL, 2014) as well as the City's additional design considerations. SWMF 4 has been sized based on the unit area release rate prior to connection to SWMF 2 for consistency with other quarter sections; however, there may be opportunities to combine storage volumes with SWMF 2 following a detailed analysis of the existing wetland capacity. SWMFs 5 and 7 have been sized separately.

All ponds have been considered to be constructed as wet ponds at this time to act as community amenities as well as functional stormwater system elements. The following parameters were applied in the sizing of these facilities:

- Active storage volume was based on the 1:100 year storm event.
- Active storage volume was based on the 1.5 L/s/ha release rate.
- Active storage depth was considered to be 1.5 m.
- Permanent storage depth was considered to be 2.0 m.
- A freeboard of 0.3 m was applied.
- Side slopes of 7:1 (H:V) were applied.

The parameters of each of the proposed ponds are summarized in Table 5.4.

It should be noted that the use of synthetic rainfall events has limitations in the overall effectiveness of considering longer periods of rainfall where antecedent moisture conditions may result in increased runoff potential. It is recommended that continuous simulations be utilized in more detailed assessments.

The detailed design of the future SWMFs is to be in accordance with the City of Lloydminster Municipal Development Standards Section 5 – Storm Drainage Systems.

5.3.5 Environmental Considerations

There are a number of environmental considerations to be noted, specifically pertaining to the potential currently existing wetland, watercourse, and waterbody areas within the study area. All environmental considerations evaluated for this study area are outlined in the 2019 Lloydminster NE ASP Environmental Impact Assessment. As the study area is located on the Saskatchewan side, environmental approvals such as those under the Environmental Protection and Enhancement Act that apply in Alberta, are not required for the study area. Based on discussions with the Saskatchewan Water Security Agency, the only permit/approval required to convert the existing the potential currently existing wetland, watercourse, and waterbody areas into connected stormwater management facilities is the Aquatic Habitat Protection Permit. This permit allows for construction in or near water and takes a minimum of six week for processing (ISL, 2019).

5.3.6 Source Control Best Management Practices

Source control practices are becoming of increasing value in terms of stormwater management. A primary focus of these practices is sustainability in the form of pollution prevention strategies. These strategies involve the reduction of runoff volume and rate of flow as well as reduction of overall environmental impact in terms of water quality.

Several low impact development (LID) considerations may be integrated into the future stormwater system to ensure these guidelines are met. Potential source control options are summarized in Table 5.5, below.



Table 5.4: Stormwater Management Facility Parameters

SWMF ID	Storage Bottom Area		Permanent Volume	Storage Top Area		Storage Volume	Freeboard Top Area		Freeboard Volume	Total Pond Volume
	ha	m ²	m ³	ha	m ²	m ³	ha	m ²	m ³	m ³
1	0.86	8,575	25,464	2.42	24,152	30,780	2.57	25,710	7,479	63,723
2	2.43	24,309	61,297	4.75	47,526	63,385	4.97	49,739	13,629	139,272
3	1.02	10,231	29,360	2.68	26,831	34,470	2.85	28,477	7,792	72,127
4	1.45	14,483	39,184	3.34	33,393	43,570	3.52	35,237	8,332	93,048
5	1.42	14,199	38,534	3.30	32,965	42,975	3.48	34,797	8,825	91,673
7	1.14	11,424	32,139	2.87	28,712	37,070	3.04	30,417	7,984	78,078

Table 5.5: Source Control Practice Table

Source Control Practice	Description	Driving Forces
Evaporation Facilities	Large stormwater management facilities could be designed to promote evaporation. These could either be wet or dry ponds with designs governed by continuous simulation to ensure that adequate volumes can be evaporated on an annual basis. To work properly, outlet rates must be virtually non-existent with at most an overflow provided for wet years.	<ul style="list-style-type: none"> • Relatively simple facilities to design • Eliminates up to 100% of runoff volume • Stormwater pollutants retained in the pond • Highly applicable to residential, commercial or industrial areas
Stormwater Re-use/ Rainwater Harvesting	Stormwater could be captured in stormwater management facilities and used for non-potable uses. Guidelines for household non-potable water usage are currently under development by Alberta Environment and Parks. This would need to be assessed at the time of development as to whether suitable guidelines exist at that stage. Stormwater could also be used for irrigation. The larger the discharge area, the larger the volume reduction as evaporation could be considered over the net irrigated area, thus further enhancing the benefit of this stormwater volume reduction method.	<ul style="list-style-type: none"> • Irrigation water could be readily used with minimal, if any, treatment • Potentially significant use of stormwater runoff • Stormwater pollutants retained by storage ponds • Highly applicable to both residential and commercial areas
Bioretention Areas	Stormwater is diverted into holding areas that allow for infiltration. Significant vegetation is planted in the area to provide additional quality treatment. Evaporation also contributes to volume reduction.	<ul style="list-style-type: none"> • Could work well upstream in subdivisions • Provides high amount of volume / rate control • Provides a high amount of stormwater pollutant control by retaining pollutants within the bioretention area • Highly applicable to both residential and low-intensity commercial areas
Bioswales /Vegetated Swales	Stormwater is diverted into surface drainage swales that are vegetated. The net effect is similar to a combination of a grassed swale and an infiltration trench. Significant vegetation is planted to provide additional quality treatment. Ditch blocks are often installed to promote pollutant settling. Subdrains are often installed in soils with infiltration rates below 12.5 mm/hr.	<ul style="list-style-type: none"> • Provides high amount of volume / rate control • Provides high amount of stormwater pollutant control by retaining pollutants in the swales • Highly applicable to both residential, light commercial, and industrial areas
Adsorbent Landscapes	Stormwater runoff is reduced by promoting infiltration into the soil as runoff flows overland. This is often accomplished by designing for significant greenspace. Increased depth of topsoil and reduced soil compaction are also provided. This promoted infiltration can allow the soil to work like a sponge to absorb stormwater. However, the local geology may not be conducive to adsorbent landscapes. A geotechnical report is required if this source control is to be implemented.	<ul style="list-style-type: none"> • Provides high amount of volume / rate control • Highly applicable for low-intensity commercial areas • Somewhat applicable for residential areas • Minimal maintenance required

Source Control Practice	Description	Driving Forces
Permeable Pavement	Stormwater runoff is reduced by promoting infiltration into pavement by providing a permeable surface. Stormwater is then either infiltrated into the underlying soil or diverted to a storage tank for later use. However, the local geology may not be conducive to permeable pavements. A geotechnical report is required if this source control is to be implemented.	<ul style="list-style-type: none"> • Works well for parking lots in commercial and industrial areas and residential back lanes • Provides high amount of volume / rate control • Reduces the size of stormwater management facilities downstream • Can be used as on-lot stormwater control for commercial and residential areas
Green Roofs	Stormwater runoff is reduced by using vegetated roofs. Stormwater is absorbed into soil and is then either evaporated naturally or collected by a subdrain system.	<ul style="list-style-type: none"> • Works well for roofs of larger buildings (normally commercial and industrial) • Provides high amount of volume / rate control, particularly for small events • Can be used as on-lot stormwater control for commercial / industrial areas

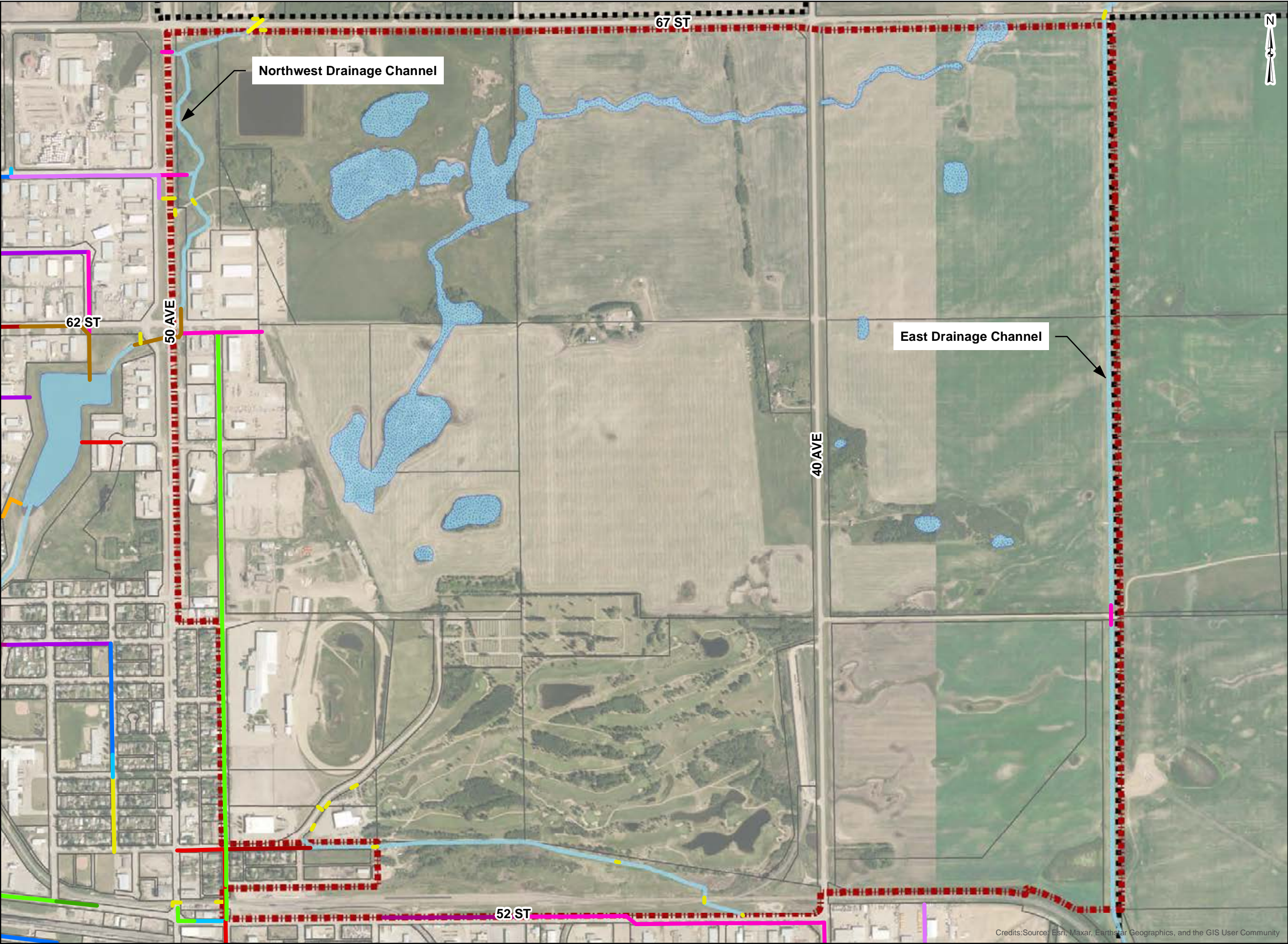
5.3.7 Cost Estimates

Cost estimates were prepared for the proposed stormwater conveyance and management systems and are summarized in Table 5.6 and provided in detail in Appendix A. As previously noted, all facilities have been sized and costed to be wet ponds.

Table 5.6: Summary of Stormwater Servicing Cost Estimates

Item	Sub-Total	Contingency	Engineering	Total (Rounded)
		30%	15%	
Pond 1	\$1,370,000	\$410,000	\$265,000	\$2,045,000
Pond 2	\$2,640,000	\$790,000	\$515,000	\$3,945,000
Pond 3	\$1,510,000	\$455,000	\$295,000	\$2,260,000
Pond 4	\$1,865,000	\$560,000	\$365,000	\$2,785,000
Pond 5	\$1,840,000	\$550,000	\$360,000	\$2,750,000
Pond 7	\$1,610,000	\$485,000	\$315,000	\$2,410,000
300mm Storm Pipe	\$987,000	\$296,100	\$192,465	\$1,475,000
600mm Storm Pipe	\$974,400	\$292,320	\$190,008	\$1,455,000
Total (Rounded)	\$12,795,000	\$3,840,000	\$2,495,000	\$19,125,000

It should be noted that the annual inflation rate is currently over 7%, which is the highest it has been in approximately 20 years based on the Consumer Price Index (CPI); therefore, the costs provided may increase if this trend continues (Government of Alberta, 2022).



Legend

Pipe Diameter

- 300 mm
- 375 mm
- 450 mm
- 525 mm
- 600 mm
- 675 mm
- 750 mm
- 900 mm
- 1050 mm
- 1200 mm
- 1350 mm
- 1500 mm
- 1800 mm
- Unknown

Storm Channel

Lake

Potential Currently Existing
Wetland, Watercourse, and
Waterbody Areas

ASP Boundary

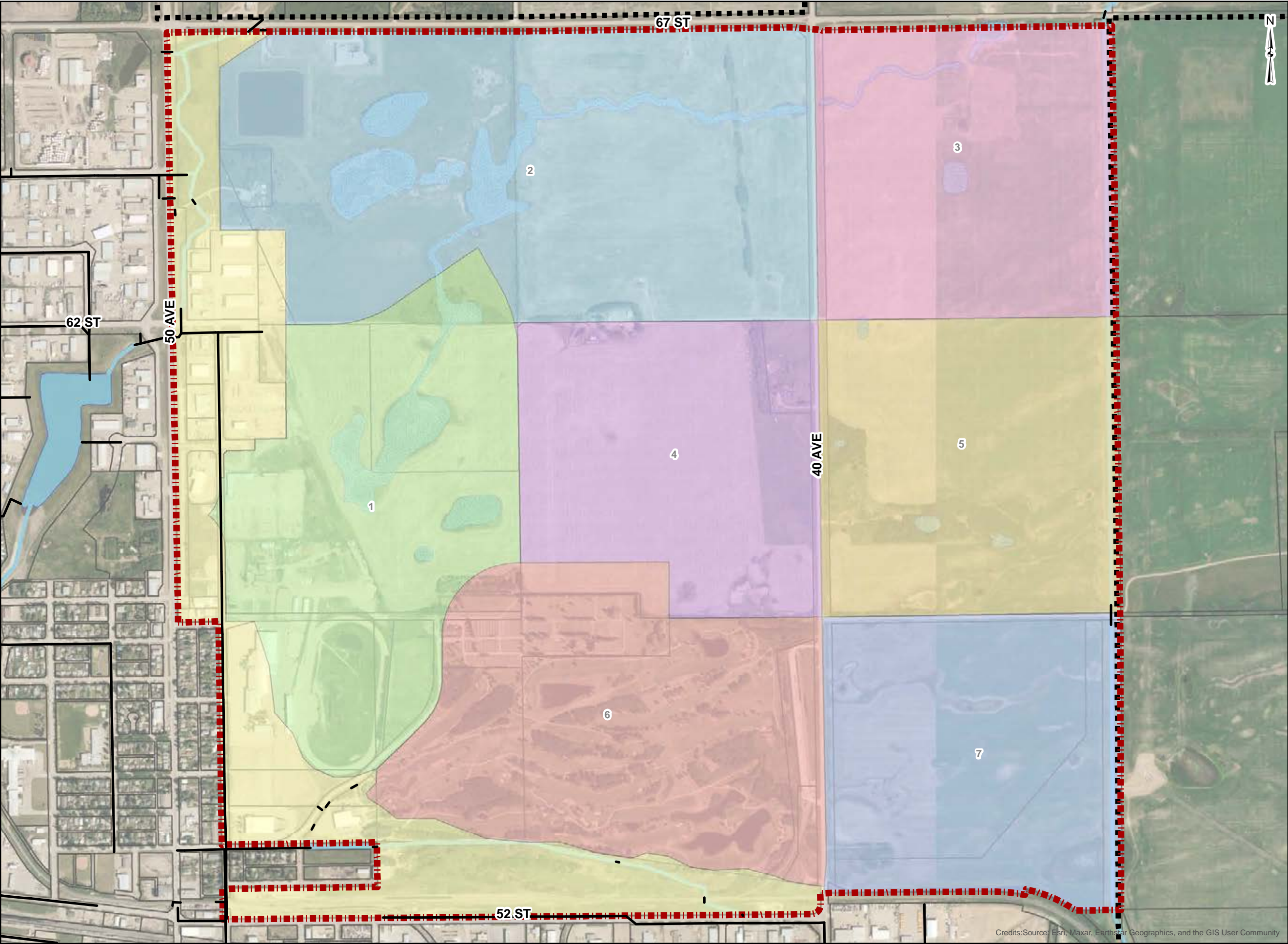
City Boundary

0 125 250 500 Meters
1:10,000 NAD 1983 UTM Zone 12N

FIGURE 5.1
EXISTING STORMWATER SYSTEM
CITY OF LLOYDMINSTER
NE ASP SERVICING STUDY AMENDMENT



Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community



Legend

- Existing Storm Pipe
- Storm Channel
- Lake
- Potential Currently Existing Wetland, Watercourse, and Waterbody Areas

Storm Catchments

- Existing Catchment
- Catchment 1
- Catchment 2
- Catchment 3
- Catchment 4
- Catchment 5
- Catchment 6
- Catchment 7

- ASP Boundary
- City Boundary

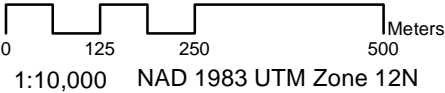
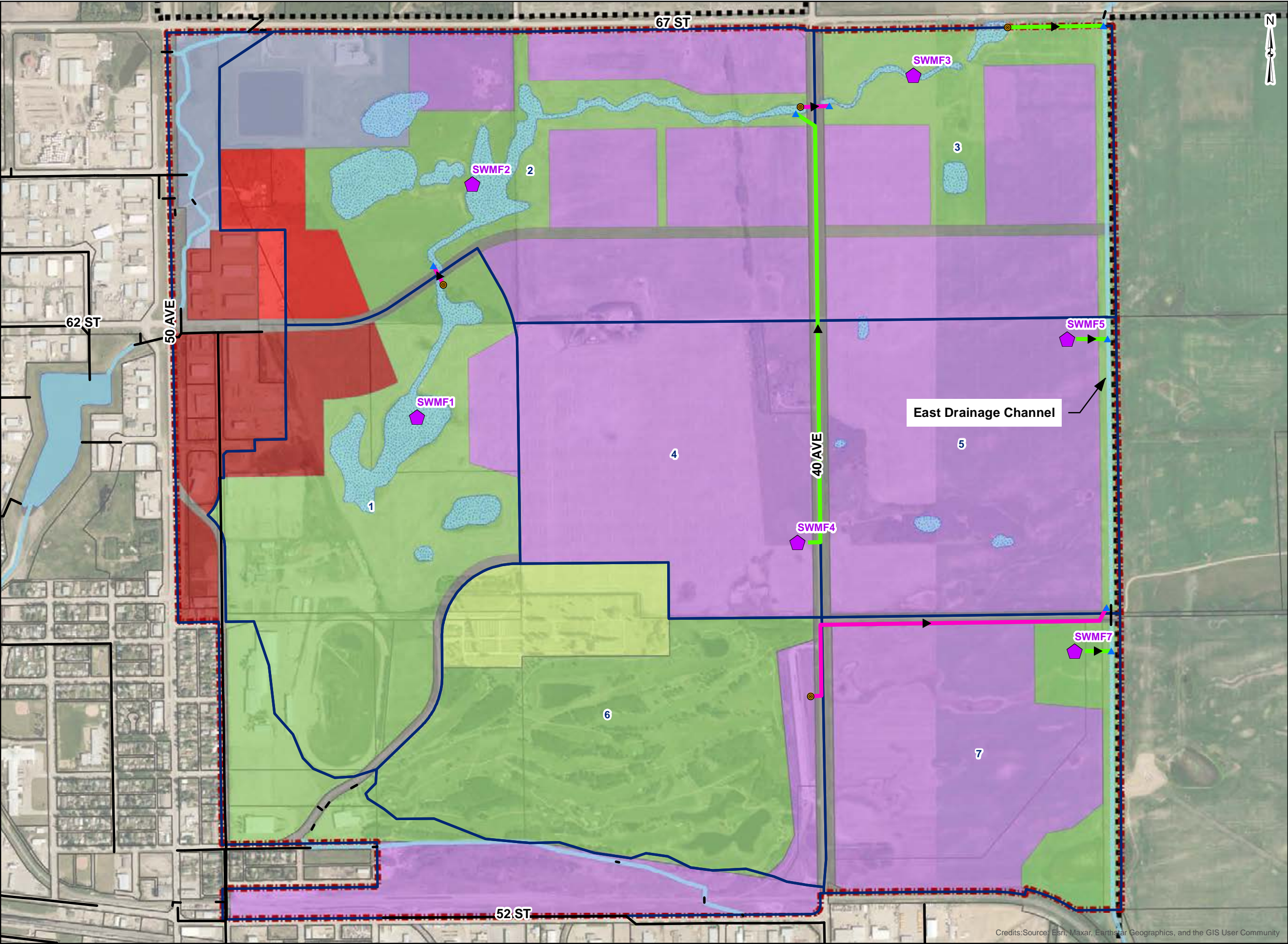


FIGURE 5.2
PROPOSED STORMWATER CATCHMENTS
CITY OF LLOYDMINSTER
NE ASP SERVICING STUDY AMENDMENT



Credits:Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community





Legend

- Proposed Outfall
- Proposed Inlet
- Proposed SWMF
- Proposed Storm Pipe**
 - 300 mm
 - 600 mm
- Existing Storm Pipe
- Storm Channel
- Lake
- Potential Currently Existing Wetland, Watercourse, and Waterbody Areas
- Storm Catchment Boundary
- Proposed Land Use**
 - Commercial
 - Commercial/Industrial
 - Industrial
 - Utilities
 - Open Space
 - Other
 - Road
- ASP Boundary
- City Boundary

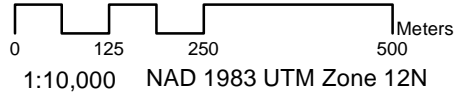


FIGURE 5.3
PROPOSED STORMWATER SYSTEM
CITY OF LLOYDMINSTER
NE ASP SERVICING STUDY AMENDMENT



6.0 Revised Land Use Concept

Following the preparation of the Servicing Study in support of the April 2022 land use concept, a revised land use concept was finalized in July 2022 based on the City's public open house held on June 16, 2022. Therefore, the City requested a high-level comparison of the impact of these land use revisions on the overall water system demands, wastewater system flows, and stormwater management facility requirements to support the development of the area.

6.1 Land Use Concept Comparison

A comparison of the April and July 2022 land use concepts was prepared in order to outline the impacts of these changes to the original conclusions and recommendations. The proposed land uses for the development area are largely maintained between the two concepts, consisting of non-residential land uses including commercial, commercial/industrial, and industrial as shown in Figures 2.5 and 6.1 for the April and July concepts, respectively. This comparison is summarized in Table 6.1.

Table 6.1: Proposed Land Use Comparison

Land Use	April Land Use Area	July Land Use Area	Change in Area	Grouped Change in Area ¹
	ha	ha	ha	ha
Commercial	11.41		-11.41	-1.34
Commercial/Industrial	27.45	50.04	22.59	
Industrial	286.87	274.35	-12.52	
Utilities	22.59	40.21	17.62	-0.68
Open Space	204.86		-204.86	
Buffer Area		79.83	79.83	
Recreation		106.73	106.73	
Other	15.33	15.33	0.00	0.00
Road	28.41	30.43	2.02	2.02
Total	596.92	596.92	0.00	0.00

¹ The land uses have been grouped to provide an overall comparison in the proposed area to be developed.

As outlined above, the overall development (commercial, commercial/industrial, and industrial) land decreases as does the undevelopable area (utilities, open space, buffer area, and recreation); however, the road area within the ASP boundary increases. It should be noted that areas have shifted between the April and July land use concepts; therefore, the areas contributing to a specific service area or catchment area have also changed with some experiencing increases rather than decreases to development area.

6.2 Water System Demands

Applying the same water system design criteria that was applied in Section 3.2, the required water demands were derived for each service area based on the revised land use concept. The water demands resulting from this analysis with the application of the original land use are provided in Table 6.2, which is consistent with Table 3.3, for comparison with the demands of the revised land use concept as shown in Table 6.3.

Table 6.2: Total Water Demands – April Land Use Concept

Service Area ID	Total Water Demands					
	ADD		MDD = 2x ADD		PHD = 3 x ADD	
	L/s	m ³ /d	L/s	m ³ /d	L/s	m ³ /d
W1	4.74	409	9.48	819	14.22	1,228
W2	3.60	311	7.19	622	10.79	932
C1	10.83	936	21.66	1,871	32.49	2,807
C2	6.45	557	12.90	1,114	19.35	1,671
C3	3.08	266	6.17	533	9.25	799
E1	7.86	679	15.71	1,357	23.57	2,036
E2	10.22	883	20.44	1,766	30.66	2,649
E3	6.49	561	12.97	1,121	19.46	1,682
Total	53.26	4,602	106.52	9,204	159.79	13,805

Table 6.3: Total Water Demands – July Land Use Concept

Service Area ID	Total Water Demands					
	ADD		MDD = 2x ADD		PHD = 3 x ADD	
	L/s	m ³ /d	L/s	m ³ /d	L/s	m ³ /d
W1	5.12	442	10.24	885	15.36	1,327
W2	5.15	445	10.31	890	15.46	1,336
C1	9.01	778	18.01	1,556	27.02	2,334
C2	6.84	591	13.68	1,182	20.51	1,772
C3	2.51	217	5.01	433	7.52	650
E1	7.90	682	15.79	1,364	23.69	2,047
E2	9.46	818	18.93	1,635	28.39	2,453
E3	6.90	596	13.80	1,192	20.70	1,789
Total	52.88	4,569	105.77	9,138	158.65	13,707

As outlined in the tables above, the overall water demands decrease from the April land use concept to the revised July land use concept due to the decrease in overall development (commercial, commercial/industrial, and industrial) area.



6.3 Wastewater System Flows

Applying the same wastewater system design criteria that was applied in Section 4.2, the required water demands were derived for each service area based on the revised land use concept. The water demands resulting from this analysis with the application of the original land use are provided in Table 6.4, which is consistent with Table 4.3, for comparison with the demands of the revised land use concept as shown in Table 6.5.

Table 6.4: Total Wastewater Flows – April Land Use Concept

Service Area ID	Total Wastewater Generation					
	ADWF		PDWF		PWWF	
	L/s	m³/d	L/s	m³/d	L/s	m³/d
W1	4.61	399	13.84	1,196	20.30	1,754
W2	3.15	272	9.45	816	13.86	1,197
C1	12.48	1,078	37.43	3,234	54.89	4,743
C2	7.43	642	22.29	1,926	32.69	2,824
C3	3.55	307	10.66	921	15.63	1,351
E1	9.05	782	27.15	2,346	39.82	3,440
E2	11.77	1,017	35.32	3,052	51.81	4,476
E3	7.47	646	22.42	1,937	32.88	2,841
Total	59.52	5,142	178.55	15,427	261.88	22,626

Table 6.5: Total Wastewater Flows – July Land Use Concept

Service Area ID	Total Wastewater Generation					
	ADWF		PDWF		PWWF	
	L/s	m³/d	L/s	m³/d	L/s	m³/d
W1	4.98	431	14.95	1,292	21.93	1,895
W2	5.02	433	15.05	1,300	22.07	1,907
C1	10.38	896	31.13	2,689	45.65	3,944
C2	7.88	681	23.63	2,042	34.66	2,995
C3	2.89	249	8.66	748	12.70	1,098
E1	9.10	786	27.29	2,358	40.02	3,458
E2	10.90	942	32.71	2,826	47.97	4,145
E3	7.95	687	23.85	2,060	34.98	3,022
Total	59.09	5,105	177.26	15,316	259.99	22,463

As outlined in the tables above, the overall wastewater flows decrease from the April land use concept to the revised July land use concept due to the decrease in overall development (commercial, commercial/industrial, and industrial) area.

6.4 Stormwater Management Facility Sizing

Applying the same stormwater system design criteria that was applied in Sections 5.1 and 5.3, the required SWMF parameters were derived for each catchment area based on the revised land use concept. The SWMF parameters resulting from this analysis with the application of the original land use are provided in Table 6.6, which is consistent with Table 5.4, for comparison with the SWMF parameters of the revised land use concept as shown in Table 6.7.

Table 6.6: Stormwater Management Facility Parameters – April Land Use Concept

SWMF ID	Storage Bottom Area	Permanent Volume	Storage Top Area	Storage Volume	Freeboard Top Area	Freeboard Volume	Total Pond Volume
	ha	m ³	ha	m ³	ha	m ³	m ³
1	0.86	25,464	2.42	30,780	2.57	7,479	63,723
2	2.43	61,297	4.75	63,385	4.97	13,629	139,272
3	1.02	29,360	2.68	34,470	2.85	7,792	72,127
4	1.45	39,184	3.34	43,570	3.52	8,332	93,048
5	1.42	38,534	3.30	42,975	3.48	8,825	91,673
7	1.14	32,139	2.87	37,070	3.04	7,984	78,078
Total	8.32	225,978	19.36	252,250	20.43	54,041	537,921

Table 6.7: Stormwater Management Facility Parameters – July Land Use Concept

SWMF ID	Storage Bottom Area	Permanent Volume	Storage Top Area	Storage Volume	Freeboard Top Area	Freeboard Volume	Total Pond Volume
	ha	m ³	ha	m ³	ha	m ³	m ³
1	0.92	26,861	2.51	32,110	2.67	7,479	66,746
2	2.52	63,336	4.88	65,180	5.10	13,629	143,492
3	1.18	32,950	2.93	37,825	3.10	7,792	79,810
4	1.21	33,790	2.98	38,605	3.16	8,332	81,602
5	1.37	37,345	3.22	41,885	3.40	8,825	89,156
7	1.19	33,225	2.94	38,080	3.12	7,984	80,396
Total	8.39	227,507	19.46	253,685	20.54	54,041	541,202

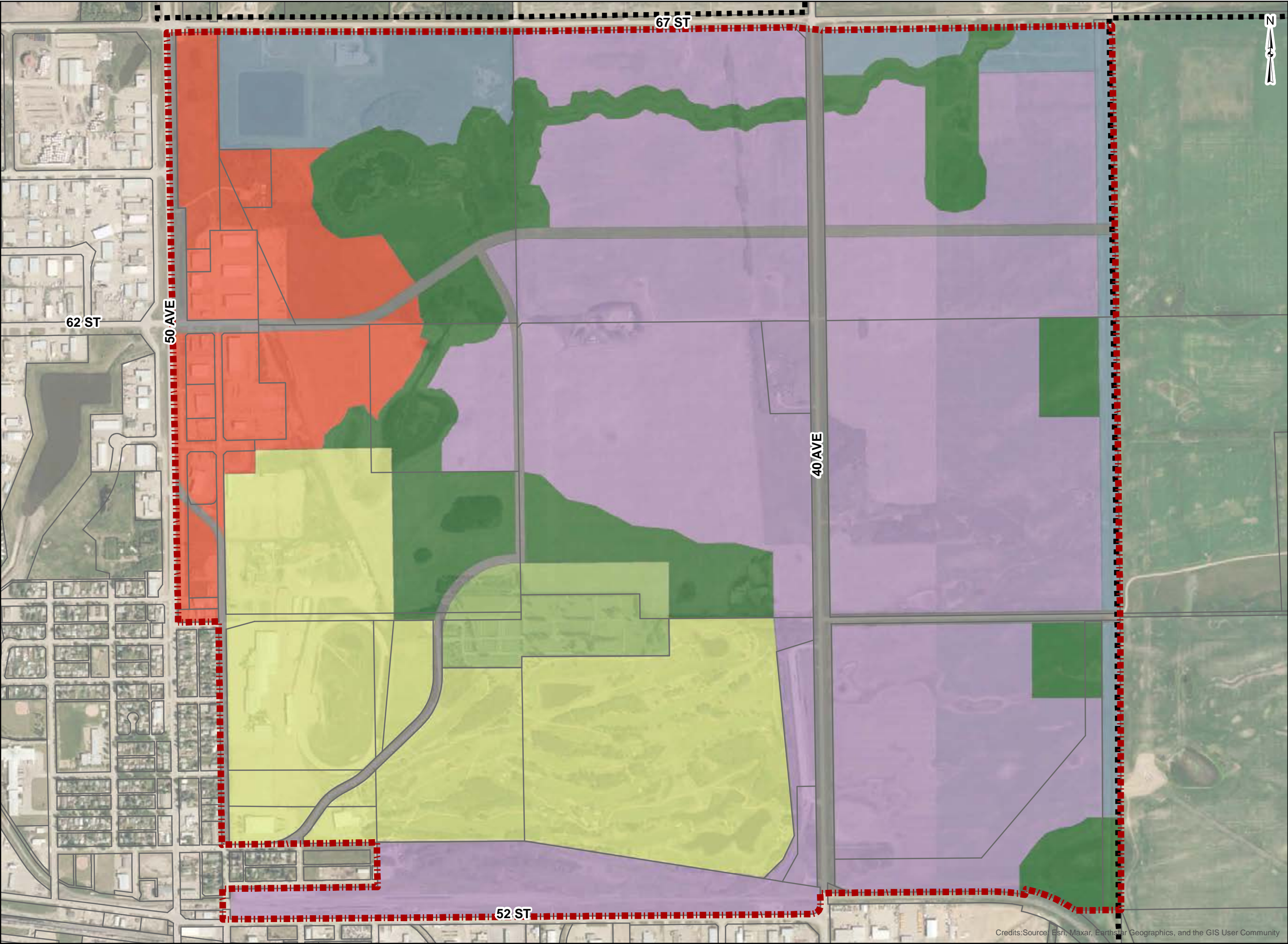
As outlined in the tables above, the overall SWMF area and volume increase from the April land use concept to the revised July land use concept due to shifts in the proposed developable area locations as well the increase in proposed roadway area.



6.5 Summary

As outlined above there is minimal change in the proposed land use when comparing the April and July concepts. Both the overall water demands and wastewater flows decrease due to the decrease in overall development (commercial, commercial/industrial, and industrial) area. However, the overall SWMF area and volume increase due to shifts in the proposed developable area locations as well the increase in proposed roadway area.

These changes are not anticipated to significantly impact the proposed servicing concepts or associated cost estimates for the water and wastewater systems. As the stormwater conveyance concept is dictated primarily by the unit area release rate and minimum pipe size requirements, this concept and associated cost estimates are not anticipated to be significantly impacted. Although, the overall SWMF area and volume have increased, this does not significantly impact the proposed stormwater management concept or the associated cost estimates, with cost increases likely being in the order of \$100,000.



Legend

Proposed Land Use

- Commercial/Industrial
- Industrial
- Utilities
- Recreation
- Cemetery
- Buffer Area
- Road
- ASP Boundary
- City Boundary

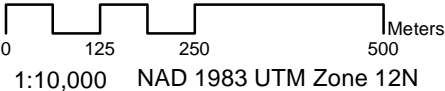


FIGURE 6.1
REVISED LAND USE CONCEPT
CITY OF LLOYDMINSTER
NE ASP SERVICING STUDY AMENDMENT



Credits:Source Esri, Maxar, Earthstar Geographics, and the GIS User Community

7.0 Conclusions and Recommendations

The objectives of the Northeast ASP Servicing Study can be largely grouped as follows:

- To review the 2016 Water Master Plan and recommend a distribution system layout. The water servicing system includes water distribution infrastructure.
- To review the 2016 Sanitary Sewer Master Plan and recommend a collection system layout.
- To review the 2015 Stormwater Master Plan and develop high-level stormwater management strategies to manage the increased runoff imposed by the intended future growth areas. This includes stormwater management facilities as well as best management practices to control stormwater runoff release rates, volume, and water quality.

The completed Northeast ASP Servicing Study will provide a guiding document for future development of the study area that can be used in preparation of future more detailed studies such as Subdivision Servicing Reports, Staged Master Drainage Plans, and Subdivision Stormwater Management Reports.

7.1 Water Servicing

Conclusions and recommendations for the overall water servicing system for the study area can be summarized as follows:

- The proposed water distribution system is comprised of a grid main network of 300 mm watermains.
- The proposed system is to be tied into the existing network at 40 Avenue and 49 Avenue to provide adequate looping for the area.
- The proposed water distribution system is not anticipated to be significantly impacted by the revised land use concept prepared in July 2022.
- The ADD, MDD, and PHD demands for the study area were determined based on the City of Lloydminster Municipal Development Standards Section 6 – Water Distribution Systems and.
- Reservoir storage requirements were based on the Saskatchewan Ministry of Environment Water Security Agency Waterworks Design Standard.
- It is recommended that a detailed network analysis be completed to assess the adequacy of this system as well as impacts to the City's existing system once more detailed employment densities are available.
- It is recommended that the currently available capacity of both the reservoir storage and the WTP be evaluated to confirm whether additional upgrades are required to facilitate the proposed ASP development and land uses once more detailed employment densities are available.
- The costs associated with the proposed watermain network and the reservoir and pumping system upgrades is approximately \$13.7 million. Costs are not anticipated to be significantly impacted by the revised land use concept. It should be noted that the annual inflation rate is currently over 7%, which is the highest it has been in approximately 20 years based on the Consumer Price Index (CPI); therefore, the costs provided may increase if this trend continues.



7.2 Wastewater Servicing

Conclusions and recommendations for the overall wastewater servicing system for the study area can be summarized as follows:

- The proposed wastewater collection system is comprised of a gravity sewer network that connects to the WWTP northeast of the study area.
- The proposed system is to include the East Trunk Twin and Northwest Trunk as proposed in the 2016 Sanitary Sewer Master Plan.
- The proposed wastewater collection system is not anticipated to be significantly impacted by the revised land use concept prepared in July 2022.
- The wastewater generation flows and corresponding conveyance system sizing were based on the City of Lloydminster Municipal Development Standards Section 4 – Sanitary Sewer Systems.
- Non-residential wastewater generation rate applied was 0.2 L/s/ha with a peaking factor of 3.0.
- The costs associated with the proposed wastewater collection system is approximately \$10.0 million. Costs are not anticipated to be significantly impacted by the revised land use concept. It should be noted that the annual inflation rate is currently over 7%, which is the highest it has been in approximately 20 years based on the Consumer Price Index (CPI); therefore, the costs provided may increase if this trend continues.

7.3 Stormwater Drainage

Conclusions and recommendations for the overall stormwater drainage system in the study area can be summarized as follows:

- The proposed stormwater system consists of pipe and culvert connections to and from stormwater management facilities with runoff from the study area being conveyed to the East Drainage Channel, which ultimately discharges to Neale Lake.
- The proposed stormwater system is not anticipated to be significantly impacted by the revised land use concept prepared in July 2022, with the exception of changes to the SWMF sizing.
- The minor system was sized to the 1:5 year storm event.
- Stormwater management facilities were sized to the 1:100 year storm event.
- The maximum allowable area release rate from proposed stormwater management facilities was limited to 1.5 L/s/ha.
- All stormwater management facilities were sized and costed as wet ponds according to the following additional criteria:
 - Active storage depth was considered to be 1.5 m.
 - Permanent storage depth was considered to be 2.0 m.
 - A freeboard of 0.3 m was applied.
 - Side slopes of 7:1 (H:V) were applied.
- The use of source control Best Management Practices is encouraged to reduce the total runoff volume and enhance stormwater treatment.

- The costs associated with the proposed stormwater management system is approximately \$19.1 million. Costs are anticipated to increase in the order of \$100,000 due to the revised land use concept. It should be noted that the annual inflation rate is currently over 7%, which is the highest it has been in approximately 20 years based on the Consumer Price Index (CPI); therefore, the costs provided may increase if this trend continues.



8.0 References

AECOM. 2016. City of Lloydminster Sanitary Sewer Master Plan. Saskatoon, Saskatchewan.

Bank of Canada. 2022. Inflation Calculator. Retrieved from:
<https://www.bankofcanada.ca/rates/related/inflation-calculator/>

City of Lloydminster. 2019. Municipal Development Standards. Lloydminster, Alberta.

Government of Alberta. 2012/2013/2021. Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems. Edmonton, Alberta.

Government of Alberta. 2022. Consumer Price Index Change. Retrieved from:
<https://economicdashboard.alberta.ca/ConsumerPriceIndexChange>

ISL Engineering and Land Services Ltd. 2016. City of Lloydminster Water Master Plan. Edmonton, Alberta.

ISL Engineering and Land Services Ltd. 2019. Lloydminster NE ASP Environmental Impact Assessment. Calgary, Alberta.

Sameng Inc. 2015. The City of Lloydminster Stormwater Master Plan 2015. Edmonton, Alberta.

Saskatchewan Ministry of Environment Water Security Agency. 2012. Waterworks Design Standard EPB 501. Regina, Saskatchewan.

Saskatchewan Ministry of Environment Water Security Agency. 2013. Guidelines for Sewage Works Design EPB 203. Regina, Saskatchewan.

Saskatchewan Ministry of Environment Water Security Agency. 2014. Stormwater Design Guidelines EPB 322. Regina, Saskatchewan.



APPENDIX

Preliminary Cost Estimates

A

Water Cost Estimates								
Item		Quantity	Units	Unit Cost	Sub-Total	Contingency (30%)	Engineering (15%)	Total Cost (Rounded)
1	Reservoir Storage & Pumping Upgrades ¹	1	item	\$5,630,000	\$5,630,000	\$1,689,000	\$1,097,850	\$8,415,000
2	300mm Watermain	11,385	metre	\$440	\$5,009,400	\$1,502,820	\$976,833	\$7,490,000
Total (Rounded):					\$10,640,000	\$3,190,000	\$2,075,000	\$15,905,000

¹ The unit cost associated with reservoir storage and pumping upgrades was based on the proportion of the Future 3 Year West End Reservoir capacity required compared to the required reservoir storage capacity to facilitate the ASP. An average annual inflation rate of 1.82% was applied to this unit cost and contingency/engineering added.

Wastewater Cost Estimates								
Item		Quantity	Units	Unit Cost	Sub-Total	Contingency (30%)	Engineering (15%)	Total Cost (Rounded)
1	250mm Gravity Sewer	711	metre	\$460	\$220,800	\$66,240	\$43,056	\$330,000
2	375mm Gravity Sewer	1,666	metre	\$635	\$1,216,025	\$364,808	\$237,125	\$1,820,000
3	450mm Gravity Sewer	1,202	metre	\$670	\$804,000	\$241,200	\$156,780	\$1,200,000
4	525mm Gravity Sewer	88	metre	\$800	\$227,768	\$68,330	\$44,415	\$340,000
6	1050mm Gravity Sewer	769	metre	\$1,460	\$1,124,200	\$337,260	\$219,219	\$1,680,000
7	1200mm Gravity Sewer	1,620	metre	\$1,670	\$2,705,751	\$811,725	\$527,621	\$4,050,000
8	1650mm Gravity Sewer	163	metre	\$2,292	\$378,180	\$113,454	\$73,745	\$570,000
Total (Rounded):					\$6,675,000	\$2,005,000	\$1,300,000	\$9,990,000

Stormwater Cost Estimates								
Item		Quantity	Units	Unit Cost	Sub-Total	Contingency (30%)	Engineering (15%)	Total Cost (Rounded)
1A	Stripping	25,710	square metre	\$5	\$128,552	\$38,566	\$25,068	\$192,000
1B	Excavation	63,723	cubic metre	\$15	\$955,843	\$286,753	\$186,389	\$1,429,000
1C	Landscaping	17,135	square metre	\$2	\$34,270	\$10,281	\$6,683	\$51,000
1A	Outlet Control Structure	1	item	\$180,000	\$180,000	\$54,000	\$35,100	\$269,000
SWMF 1 Sub-Total (Rounded):					\$1,300,000	\$390,000	\$255,000	\$1,940,000
2A	Stripping	46,499	square metre	\$5	\$232,493	\$69,748	\$45,336	\$347,500
2B	Excavation	128,818	cubic metre	\$15	\$1,932,265	\$579,679	\$376,792	\$2,888,500
2C	Landscaping	24,451	square metre	\$2	\$48,902	\$14,671	\$9,536	\$73,000
2D	Outlet Control Structure	1	item	\$180,000	\$180,000	\$54,000	\$35,100	\$269,000
SWMF 2 Sub-Total (Rounded):					\$2,395,000	\$720,000	\$465,000	\$3,580,000
3A	Stripping	26,770	square metre	\$5	\$133,849	\$40,155	\$26,100	\$200,000
3B	Excavation	66,928	cubic metre	\$15	\$1,003,916	\$301,175	\$195,764	\$1,501,000
3A	Landscaping	17,567	square metre	\$2	\$35,134	\$10,540	\$6,851	\$52,500
3B	Outlet Control Structure	1	item	\$180,000	\$180,000	\$54,000	\$35,100	\$269,000
SWMF 3 Sub-Total (Rounded):					\$1,355,000	\$405,000	\$265,000	\$2,025,000
4A	Stripping	28,597	square metre	\$5	\$142,985	\$42,895	\$27,882	\$214,000
4B	Excavation	72,492	cubic metre	\$15	\$1,087,383	\$326,215	\$212,040	\$1,625,500
4A	Landscaping	18,293	square metre	\$2	\$36,585	\$10,976	\$7,134	\$54,500
4B	Outlet Control Structure	1	item	\$180,000	\$180,000	\$54,000	\$35,100	\$269,000
SWMF 4 Sub-Total (Rounded):					\$1,445,000	\$435,000	\$280,000	\$2,165,000
5A	Stripping	30,268	square metre	\$5	\$151,341	\$45,402	\$29,512	\$226,500
5B	Excavation	77,619	cubic metre	\$15	\$1,164,292	\$349,288	\$227,037	\$1,740,500
5A	Landscaping	18,937	square metre	\$2	\$37,873	\$11,362	\$7,385	\$56,500
5B	Outlet Control Structure	1	item	\$180,000	\$180,000	\$54,000	\$35,100	\$269,000
SWMF 5 Sub-Total (Rounded):					\$1,535,000	\$460,000	\$300,000	\$2,295,000
7A	Stripping	27,418	square metre	\$5	\$137,092	\$41,128	\$26,733	\$205,000
7B	Excavation	68,898	cubic metre	\$15	\$1,033,466	\$310,040	\$201,526	\$1,545,000
7C	Landscaping	17,827	square metre	\$2	\$35,655	\$10,696	\$6,953	\$53,500
7D	Outlet Control Structure	1	item	\$180,000	\$180,000	\$54,000	\$35,100	\$269,000
SWMF 7 Sub-Total (Rounded):					\$1,385,000	\$415,000	\$270,000	\$2,075,000
1	300mm Storm Pipe	1,645	metre	\$600	\$987,000	\$296,100	\$192,465	\$1,475,500
2	600mm Storm Pipe	1,160	metre	\$840	\$974,400	\$292,320	\$190,008	\$1,456,500
Pipe Sub-Total (Rounded):					\$1,960,000	\$590,000	\$380,000	\$2,930,000
Total (Rounded):					\$11,375,000	\$3,415,000	\$2,215,000	\$17,010,000

D TRANSPORTATION IMPACT ASSESSMENT

The following report is provided for reference purposes
and does not form part of this bylaw.



City of Lloydminster

Final Report

TRAFFIC IMPACT ASSESSMENT UPDATE

September 2022





ISL Engineering and Land Services Ltd. Is an award-winning full-service consulting firm dedicated to working with all levels of government and the private sector to deliver planning and design solutions for transportation, water, and land projects.

Proudly certified as a leader in quality management under Engineers and Geoscientists BC's OQM Program from 2014 to 2021.



Corporate Authorization

This document entitled "Traffic Impact Assessment Update" has been prepared by ISL Engineering and Land Services Ltd. (ISL) for the use of the City of Lloydminster. The information and data provided herein represent ISL's professional judgment at the time of preparation. ISL denies any liability whatsoever to any other parties who may obtain this report and use it, or any of its contents, without prior written consent from ISL.




APEGA # 96374 2022-09-09

Daniel Zeggelaar, P.Eng., PTOE, PTP
Transportation Project Manager

Permit to Practice

ISL Engineering and Land Services Ltd.

RM Signature: 

RM APEGA ID: 63067

Date: September 9 2022

Permit Number P4741

The Association of Professional Engineers
and Geoscientists of Alberta

Table of Contents

1.0	Introduction.....	1
1.1	Site Location	1
1.2	Land Use	2
1.3	Study Purpose.....	2
1.4	Existing Roadway Network.....	2
1.5	Future Roadway Network.....	3
1.6	Study Intersections.....	3
2.0	Traffic Volumes.....	4
2.1	Background Traffic	4
2.2	Updated 56,000 Horizon Traffic Volumes.....	4
3.0	Traffic Analysis	5
3.1	Analysis Methodology	5
3.2	56,000 Horizon Traffic Analysis.....	6
3.3	Final Land Use Plan	8
4.0	Other Considerations	9
4.1	Active Transportation Network	9
4.2	Rail	9
4.3	Access Management.....	10
5.0	Conclusion and Recommendations.....	11

APPENDICES

Appendix A	Roadway Cross Sections by Classification
Appendix B	Traffic Analysis Zone System – VISUM Model

TABLES

Figure 1.1:	Plan Area	1
Table 3.1:	LOS Criteria for Vehicles.....	5
Table 3.2:	Site Generated Traffic Comparison – TIA and Final Land Use Plan Volumes	8
Table 3.1:	TAC Access Management Requirements for All-Directional Access.....	10

FIGURES

Figure 1.1:	Plan Area	1
Figure 3.1:	Cemetery Road Existing Conditions.....	7
Figure 3.2:	Urban Industrial / Commercial Roadway (Drawing 1-102 – Lloydminster Standard Cross Sections).....	7

EXHIBITS

Following Page

Exhibit 1.1:	Proposed ASP Land Uses.....	2
Exhibit 1.2:	Existing Road Network	2
Exhibit 1.3:	Proposed Roadway Network Connections	3
Exhibit 1.4:	56 000 Population Horizon Lane Numbers.....	3
Exhibit 1.5:	Study Intersections.....	3
Exhibit 2.1:	56 000 Population Horizon Traffic Volumes	4
Exhibit 2.2:	56 000 Population Horizon PM Peak Hour Traffic Movements	4
Exhibit 3.1:	Intersection Geometric and Control Requirements	6
Exhibit 3.2:	Final Amended Land Use	8

1.0 Introduction

The City of Lloydminster (the City) has commissioned ISL Engineering and Land Services Ltd. (ISL) to complete a Traffic Impact Assessment (TIA) update to support the preparation of the Northeast Area Structure Plan (ASP) amendment. The ultimate intent of the TIA is to provide a high-level evaluation of the potential future transportation network in the area, as well as evaluate the potential impacts the land uses as proposed in the Northeast ASP may have on existing transportation infrastructure. This includes a review of the existing and future roadway network, and traffic analysis on the arterial intersections at a 56,000 population horizon to determine the intersection geometry and traffic control, high level timings of the intersection upgrades, and a mobility review.

The TIA represents an investment in the infrastructure and will help support sustainable and cost-effective growth in the Northeast ASP study area. It should be noted however, that this document is considered a high-level study and is not intended to replace more detailed analyses further into the design process.

1.1 Site Location

The Northeast ASP area is in the northeast corner of the city. The plan area is bounded by 40 Avenue to the east, 67 Street to the north, 50 Avenue to the west and built-up areas to the south, including the Lloydminster Golf and Curling Centre and the Lloydminster Agricultural and Exhibition Association. The plan area is shown in Figure 1.1 below.



Figure 1.1: Plan Area

1.2 Land Use

The previous plan area consisted of a combination of industrial, light industrial, commercial, mixed use, institutional (school), and residential land uses. The amended land use removes the mixed use, school, and residential land uses, and replaces it with industrial, light industrial and commercial land uses. The amended land use concept for the plan area is provided in Exhibit 1.1.

1.3 Study Purpose

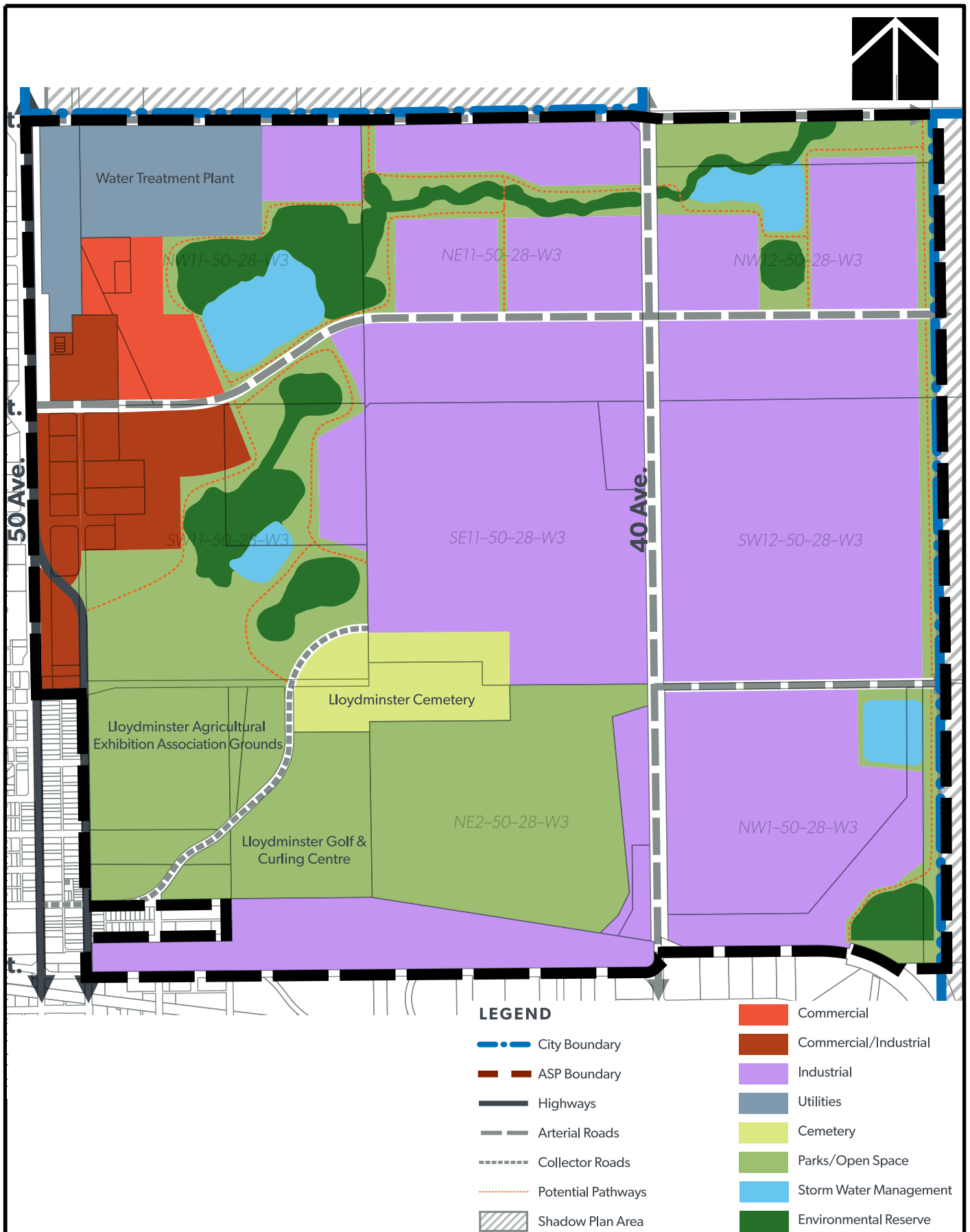
This Traffic Impact Assessment (TIA) is primarily focused on the intersections along 50 Avenue and 40 Avenue as these will be the major corridors through and within the plan area. This study will determine the following:

- The lane configuration, intersection geometry, and traffic requirements at the study intersections in the 56,000 population horizon – full buildout of the Northeast ASP
- The timing of roadway improvements
- Railway crossing impacts
- The active transportation network within the Northeast ASP area and to/from external connections
- Review access management requirements.

1.4 Existing Roadway Network

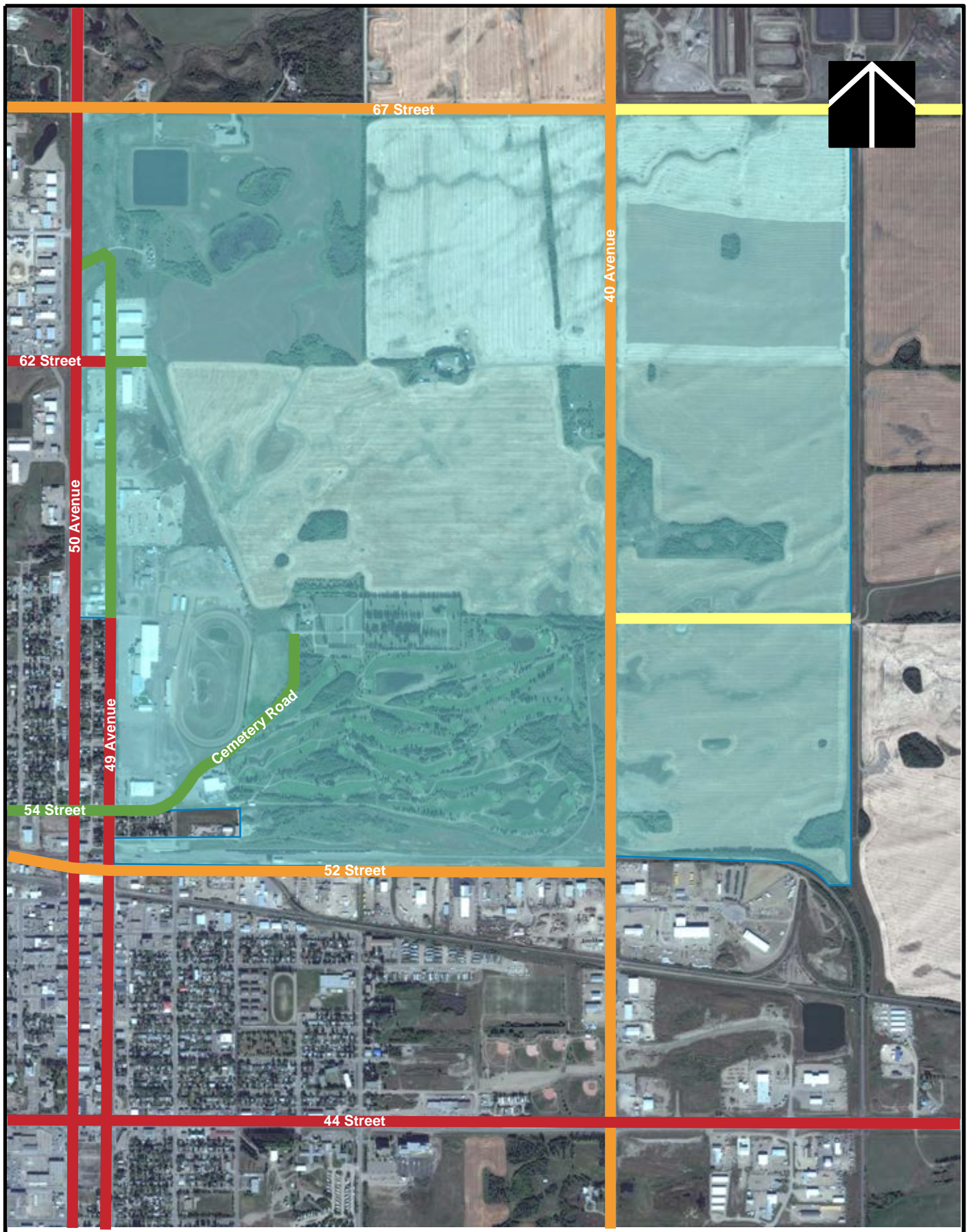
The existing roadway network is discussed below and is illustrated in Exhibit 1.2.

- **50 Avenue (57 Street to 67 Street)**, otherwise known as Highway 17 outside of City limits, forms the western boundary of the plan area and is the primary northern access into the City. The roadway is classified as a highway in the 2016 Transportation Master Plan (TMP) and is paved with two northbound travel lanes and one southbound travel lane adjacent to the plan area. The roadway is constructed to a rural standard and is a designated truck route and dangerous goods route providing access to several industrial and commercial sites. Highway 17 outside the City's limits is under Alberta Transportation's jurisdiction and is classified as a Level 2 highway.
- **40 Avenue (52 Street to east of 67 Street)** is a north-south roadway spanning the plan area. This roadway exists as a paved two lane rural standard roadway with ditches on both sides. It is classified as an arterial in the 2016 TMP and is a designated truck route and dangerous goods route.
- **67 Street (50 Avenue to 40 Avenue)** forms the northern boundary of the plan area. This roadway exists as a paved two lane rural standard roadway with ditches on both sides. It is classified as an arterial in the 2016 TMP between 50 Avenue and 40 Avenue. This roadway provides access to a water treatment plant in the northwest corner of the plan area as well as a few rural farms and residents. East of 40 Avenue 67 Street is a rural gravel road. It is a designated truck route and dangerous goods route.
- **49 Avenue (57 Street to south of 65 Street)** parallels 50 Avenue and terminates approximately 450 m from the northern boundary of the plan area. A portion of the two-lane roadway within the plan area is paved to an urban standard (curb and gutter) while the remaining portion is gravel. It is classified as local roadway within the plan area, and an arterial south of 57 Street. The roadway is primarily used for industrial activities within the plan area. It is not designated as a truck route and dangerous goods route.



LLOYDMINSTER NORTHEAST AREA STRUCTURE PLAN - TRAFFIC IMPACT ASSESSMENT UPDATE

EXHIBIT 1.1 : AMENDED ASP LAND USES



- Highway
- Arterial
- Local
- Rural
- Plan Area

LLOYDMINSTER NORTHEAST AREA STRUCTURE PLAN - TRAFFIC IMPACT ASSESSMENT

EXHIBIT 1.2 : EXISTING ROADWAY NETWORK

SEPTEMBER, 2022

- **62 Street (50 Avenue to 40 Avenue)** is an east-west roadway that is currently discontinuous within the plan area, with a 230 m segment east of 50 Avenue that provides access to industrial lands. Most of this roadway within the plan area is paved with curb and gutter. It is classified as an arterial west of 49 Avenue and a local roadway to the east. It is a designated truck route but not a dangerous goods route.
- **Cemetery Road** currently extends northeast from 54 Street and terminates south of the ASP area at the Lloydminster Cemetery. The roadway exists as a two lane rural standard roadway with ditches on both sides. It is classified as a local road in the 2016 TMP. It is a designated truck route and dangerous goods route.

1.5 Future Roadway Network

The proposed roadway network within the Northeast ASP area is provided in Exhibit 1.3. Connection locations are not finalized and are provided for the purposes of distributing traffic between the Northeast ASP and the adjacent roadway network for this TIA. All connections must meet the City's access management requirements. Access management requirements are discussed further in Section 4.3. Cross sections for the proposed roadways are based on their classification and provided in Appendix A.

A major traffic analysis exercise was conducted in the City's 2016 TMP that identified road improvements for the short, medium, and long term horizons. Future road improvements identified that will impact the Northeast ASP area transportation network are discussed below.

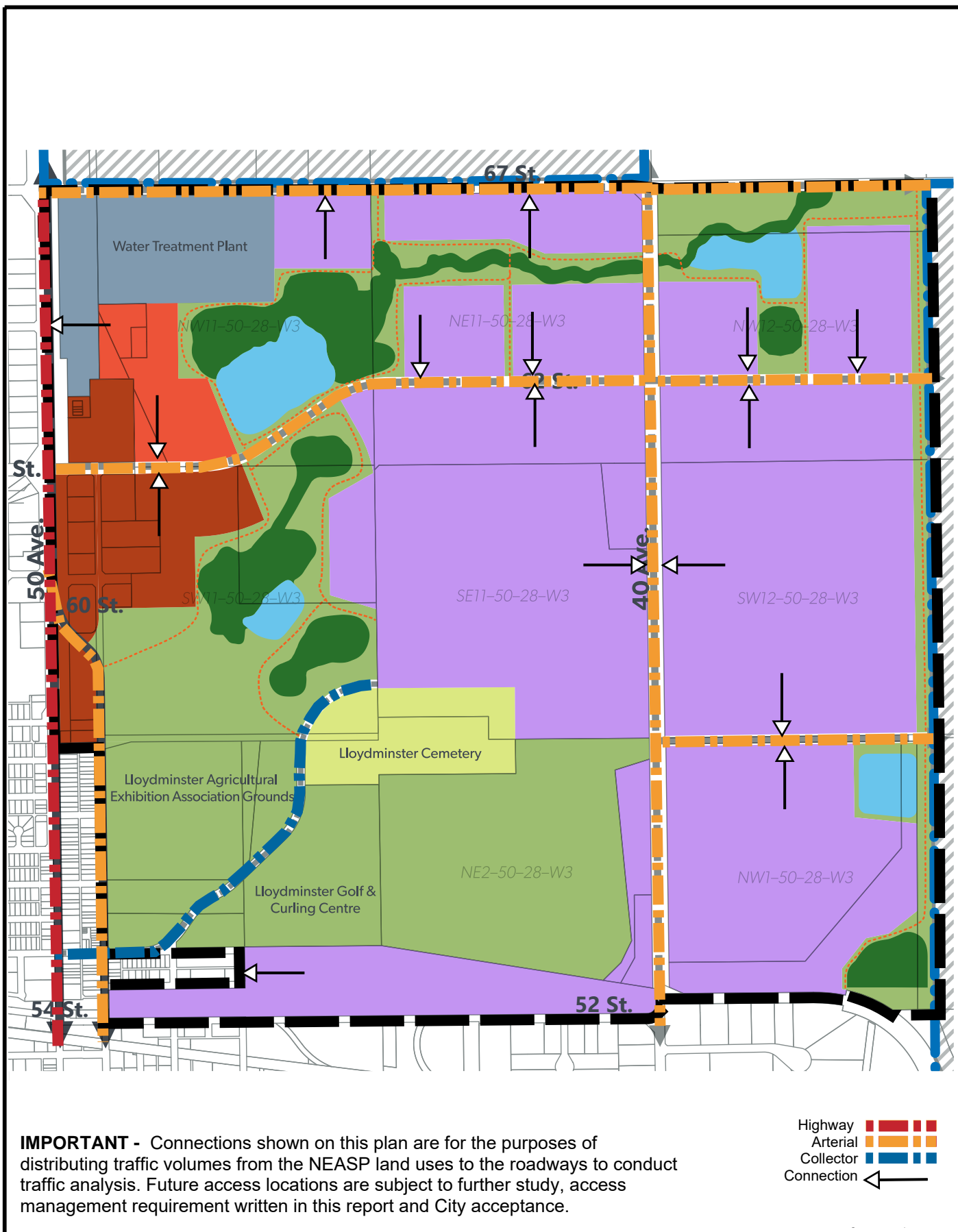
- **North South Corridor:** This project consists of converting 50 Avenue into a one-way southbound roadway, transitioning at 42 Street and 49 Avenue into a one-way northbound roadway transitioning at 57 Street back to two-way flow. Phase one of the North-South Corridor is from 35 Street to 62 Street and is included in the TMP as a three-year capital plan project. For the purpose of this study, it is assumed that the North South Corridor is not complete by the 56,000 population horizon.
- **62 Street:** Extension from 40 Avenue to 49 Avenue in the 20 year capital plan projects. The roadway is classified as an arterial in the 56,000 horizon within the 2016 TMP.
- **40 Avenue:** Twinning from 52 Street to 62 Street in the 10 year capital plan projects. The roadway is classified as an arterial in the 56,000 horizon within the 2016 TMP.

A map showing the number of lanes within the Northeast ASP is provided in Exhibit 1.4. Cemetery Road is shown as a connection point in the Northeast ASP road network. There is potential for extending the Cemetery Road and connecting into 40 Avenue. This extension was not included in the TMP and is not included in the Northeast ASP analysis. The roadway is classified as a collector in the proposed roadway network.

1.6 Study Intersections

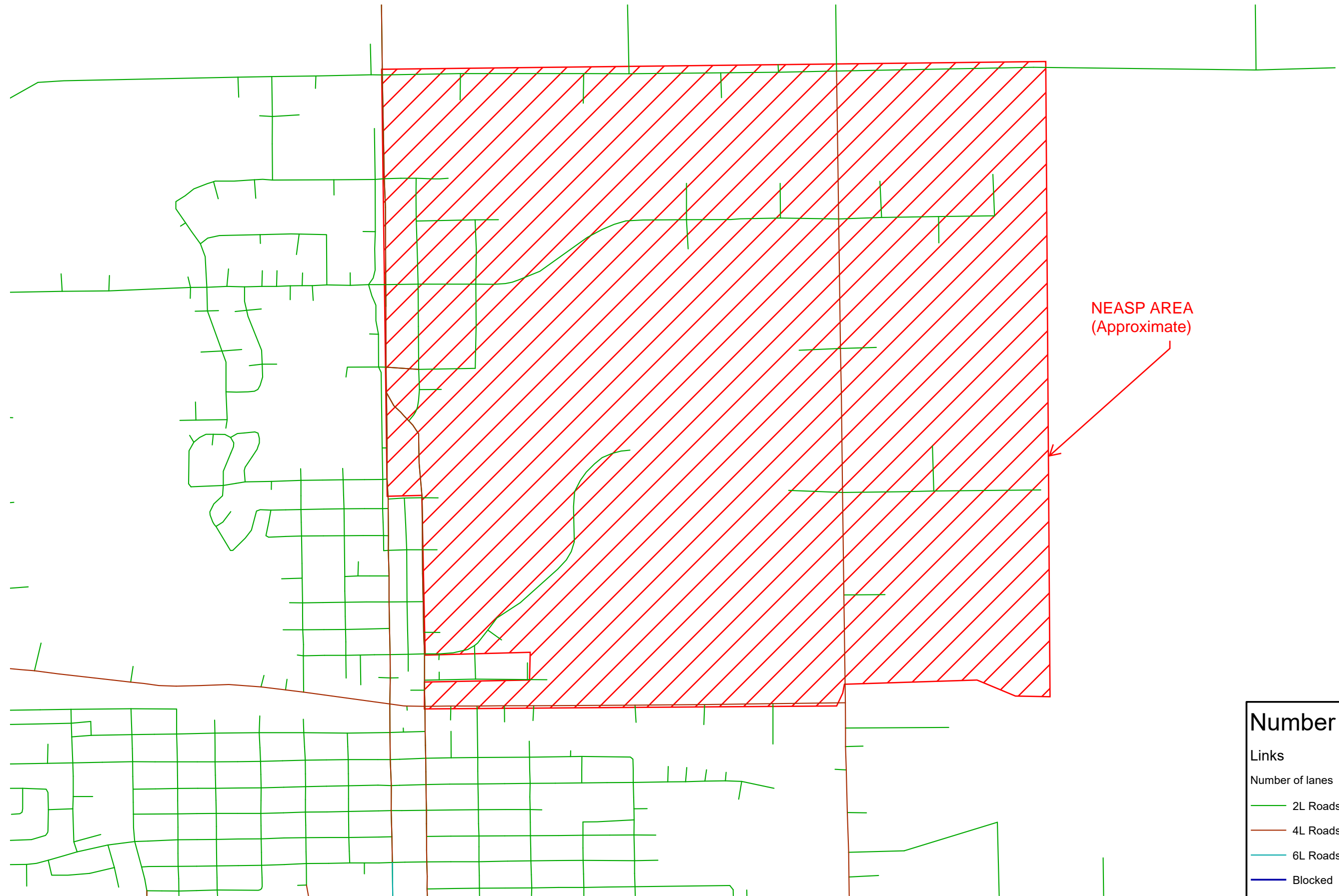
The transportation analysis focuses on key intersections connecting between the Northeast ASP and the external roadway network and connectivity within the plan area. The study intersections are shown in Exhibit 1.5 and listed below:

- | | |
|--|----------------------------|
| 1. Internal ASP roadway and 49 Avenue (#1) | 6. 67 Street and 50 Avenue |
| 2. 60 Street and 50 Avenue | 7. 67 Street and 40 Avenue |
| 3. 62 Street and 49 Avenue | 8. 62 Street and 40 Avenue |
| 4. 62 Street and 50 Avenue | 9. 52 Street and 40 Avenue |
| 5. 65 Street and 50 Avenue | |



LLOYDMINSTER NORTHEAST AREA STRUCTURE PLAN - TRAFFIC IMPACT ASSESSMENT

EXHIBIT 1.3 PROPOSED ROADWAY NETWORK CONNECTIONS



NEASP AREA
(Approximate)

Number of Lanes

Links

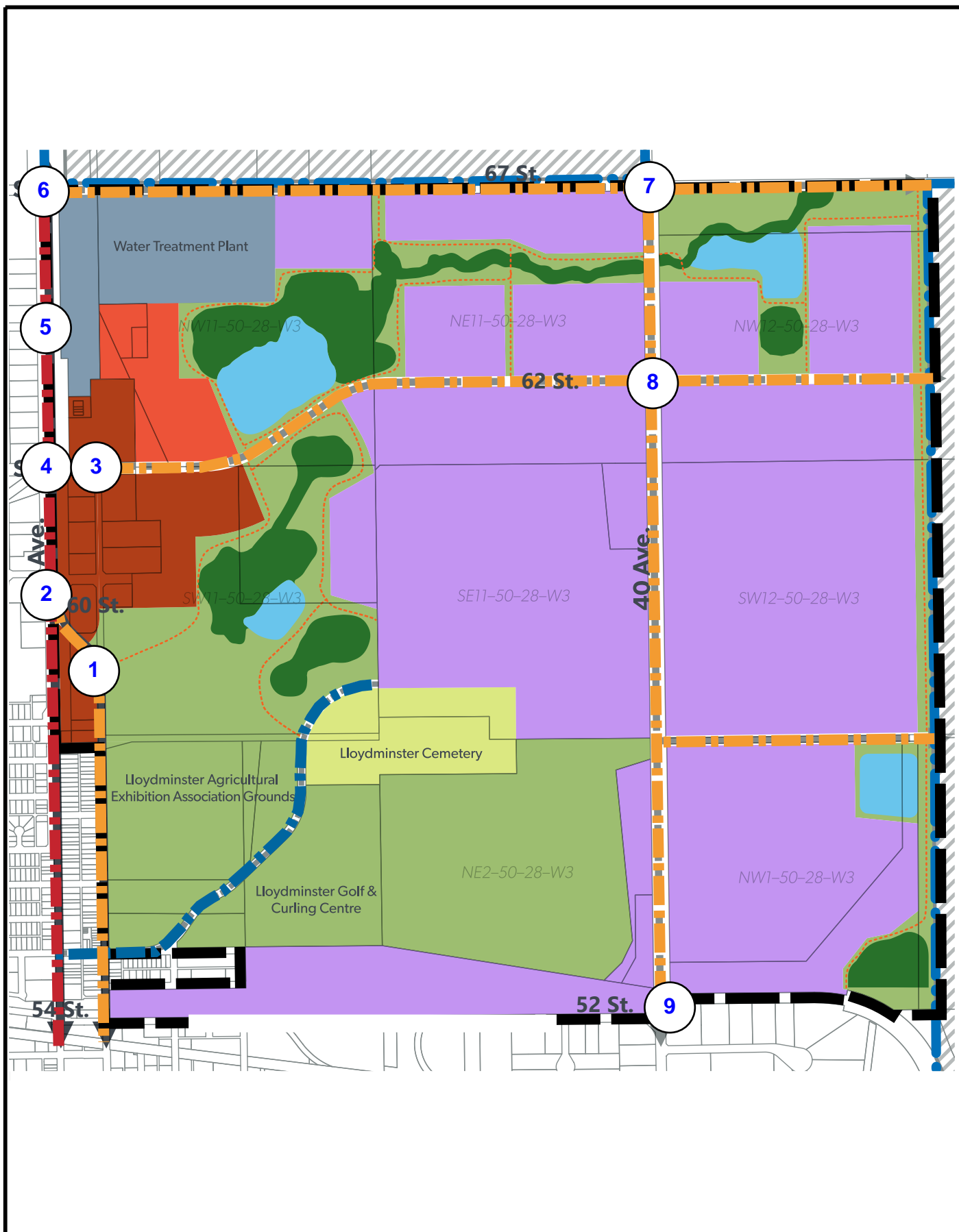
Number of lanes

- 2L Roads
- 4L Roads
- 6L Roads
- Blocked

LLOYDMINSTER NORTHEAST AREA STRUCTURE PLAN - TRAFFIC IMPACT ASSESSMENT

56,000 POPULATION HORIZON NUMBER OF LANES

EXHIBIT 1.4



LLOYDMINSTER NORTHEAST AREA STRUCTURE PLAN - TRAFFIC IMPACT ASSESSMENT

EXHIBIT 1.5 STUDY INTERSECTIONS



2.0 Traffic Volumes

2.1 Background Traffic

In 2016, ISL created a 56,000 population horizon traffic model of the City's roadway network for the TMP using VISUM. The traffic volumes in the model were generated based on employment and population statistics, then assigned to roadways based on the shortest possible travel time. The plan area is comprised of model zones 101, 102, 201 and 301 within the VISUM model and highlighted in the traffic analysis zone map in appendix B.

2.2 Updated 56,000 Horizon Traffic Volumes

The TMP VISUM model includes a population of 2,440 (900 households) in the plan area (TMP model zones 101, 102 and 201) from the previous NEASP zoning and was replaced with the employment for the proposed rezoning. The 2,440 population from the current zoning was reallocated to zones 2908 and 2909 to maintain the population/employment ratio in the updated model, based on discussions with ISL land use planning. Traffic zones 2908 and 2909 are located in the City's southwest and where the residential land use is expected to growth in replacement of the residential land use growth previously expected. The 2016 TMP model zones 101, 102, and 201 have been updated to remove the residential, mixed use, and institutional land uses and replaced with the employment and commercial statistics per the Northeast ASP proposed land uses.

The updated 56,000 horizon traffic volumes for the City and movements for the PM peak hour are illustrated in Exhibit 2.1 and Exhibit 2.2, respectively.

The following is noted based on the updated 56,000 horizon traffic volumes:

- The southbound traffic volumes on 40 Avenue are significantly higher than those on 50 Avenue in the 56,000 horizon. Traffic appears to be using 62 Street and 67 Street via 40 Avenue to avoid driving through the City on 50 Avenue. This route is more efficient because there are significantly fewer intersections along 40 Avenue, as compared to 50 Avenue. The southbound traffic volumes are higher on 40 Avenue in the TMP model as well, but the difference in the distribution is much less pronounced.
- Most of the trips on 40 Avenue appear to be destined to or originating from the industrial area along 40 Avenue, or the commercial area on 50 Avenue via 62 Street. It is likely traffic volumes northbound on 40 Avenue are higher during the AM peak hour from trips destined to the industrial areas for work.
- It appears 62 Street is being used for travel between 40 Avenue and 50 Avenue. Half the traffic entering 62 Street from 40 Avenue remains on 62 Street west of the industrial lands. A more significant drop in traffic volumes would be expected if 62 Street were primarily being used to access the industrial lands.
- Much of the traffic on 67 Street appears to be originating from Township Road 502 to the west as opposed to the study corridors.

PM Peak Hour Traffic Volume
60K Population Horizon (2039)
With Improvements

Link Bars

Volume PrT [veh] (AP)

0 500 1000 2000

PM_COUNTS

0 500 1000 2000

NEASP AREA
(Approximate)



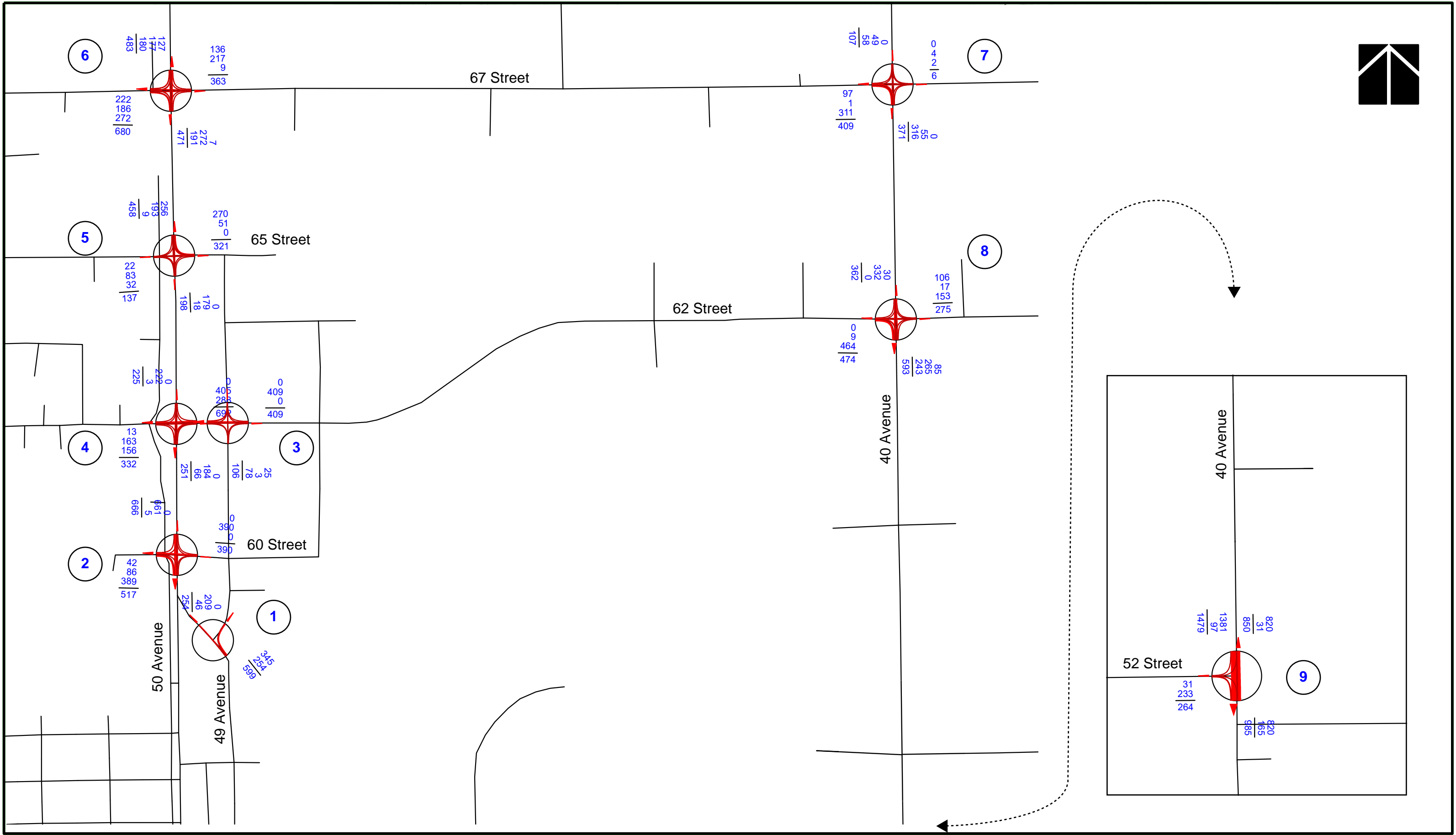
LLOYDMINSTER NORTHEAST AREA STRUCTURE PLAN - TRAFFIC IMPACT ASSESSMENT

EXHIBIT 2.1

56,000 POPULATION HORIZON TRAFFIC VOLUMES



SEPTEMBER, 2022



LLOYDMINSTER NORTHEAST AREA STRUCTURE PLAN - TRAFFIC IMPACT ASSESSMENT

56,000 POPULATION HORIZON PM PEAK HOUR TRAFFIC MOVEMENTS

EXHIBIT 2.2

3.0 Traffic Analysis

Traffic impacts were assessed using turning movement counts provided by the City, and creating a transportation model in Synchro, with the proposed roadway network and assumed number of lanes. Traffic volumes generated by the plan area were applied to the plan area roadway network to determine the required intersection geometry and traffic control within the plan area.

3.1 Analysis Methodology

Trafficware Synchro 9.0 was used to analyze the operational characteristics of the intersections. Level of Service (LOS) is a key performance indicator that is calculated by the model:

- LOS “A” represents the highest level of service or generally “free flowing conditions”,
- LOS “F” generally represents a “breakdown” or “gridlock” condition in vehicular flow,
- LOS “D” is representative of “normal” peak hour congestion, and is generally the accepted performance criterion for design analysis in rural areas.
- LOS “E” is representative of an intersection nearing its capacity, and may be accepted for certain movements only.

Typically, a LOS “D” or better for all intersection movements is the accepted standard for peak hour operations on provincial highways in urban areas. Based on AT’s Highway Geometric Design Guide, a minimum of LOS “D” (in terms of total delay – HCM) is required as a measure of acceptable performance at a Level 2 highway access intersection in urban areas outside of metropolitan areas. The LOS criteria for intersections are based on average delay per vehicle, and are summarized in table 3.1 below.

Table 3.1: LOS Criteria for Vehicles

LOS	Average Delay per Vehicle (s/veh)	
	Signalized	Unsignalized
A	< 10	< 10
B	10 – 20	10 – 15
C	20 – 35	15 – 25
D	35 – 55	25 – 35
E	55 – 80	35 – 50
F	> 80	> 50

Synchro also calculates each movement’s volume to capacity ratio (v/c). A v/c ratio of 1.0 represents an intersection or movement at full capacity with no ability to facilitate extra vehicles. Typically, a v/c ratio of 0.85 or better for all intersection movements is an accepted standard for peak hour operations.

The standard for the study intersection movements are as follows:

- LOS “D” or better
- V/c ratio of 0.85 or better

3.2 56,000 Horizon Traffic Analysis

A Synchro model was created to assess the intersections on 50 Avenue, 49 Avenue, and 40 Avenue with the 56,000 population horizon traffic volumes, assuming the Northeast ASP area is fully developed. It is assumed that all intersections will have pedestrian crossings.

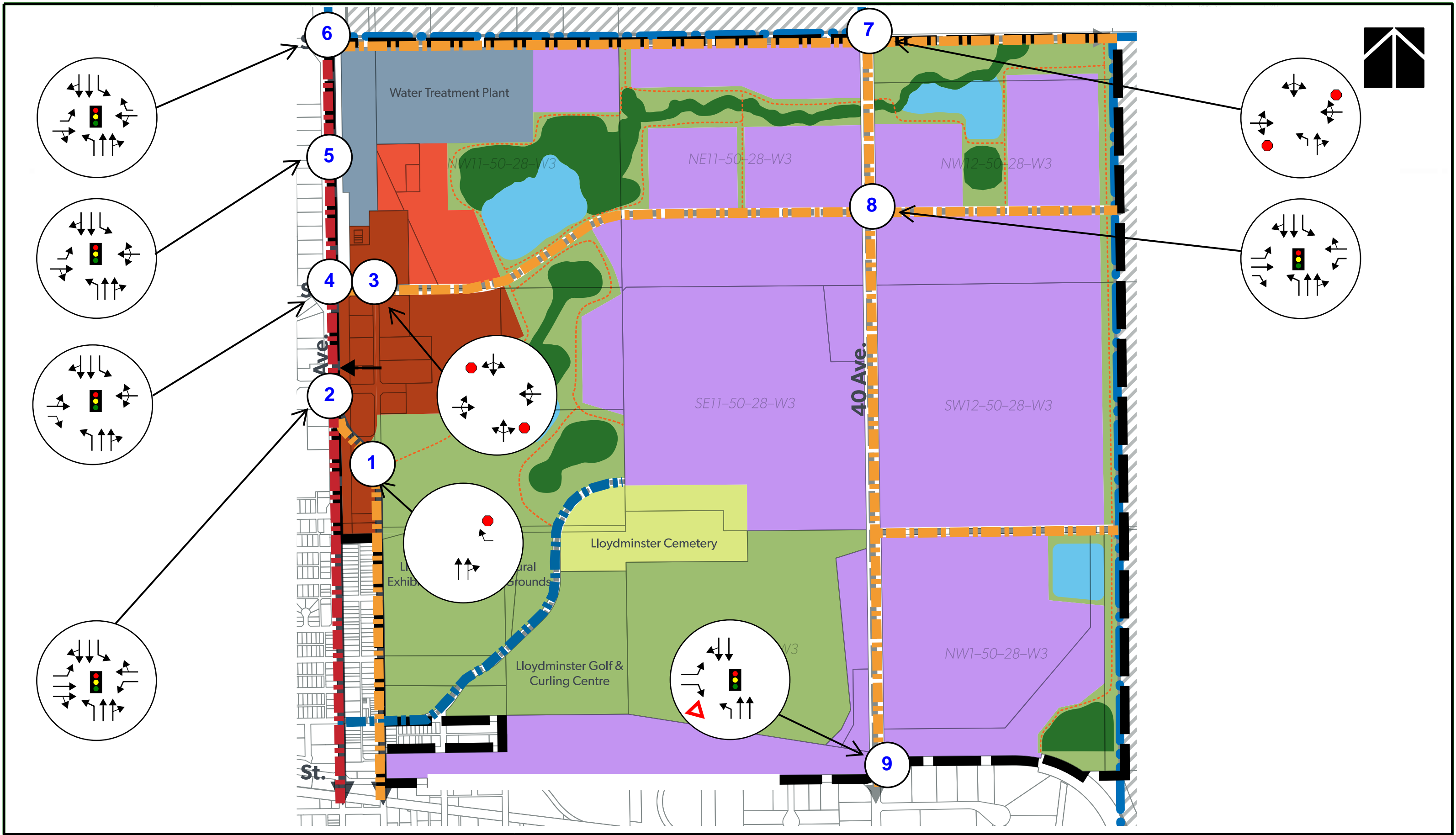
The recommended intersection geometry and controls are provided in Exhibit 3.1. Traffic movements at intersections must achieve a LOS of “D” and a v/c ratio of 0.85 to be deemed acceptable. Turn lanes and/or traffic signals were added to intersections that did not meet an LOS of “D” or better and a v/c ratio of 0.85 or less for all movements. Left turn lanes are assumed for all intersections along arterials.

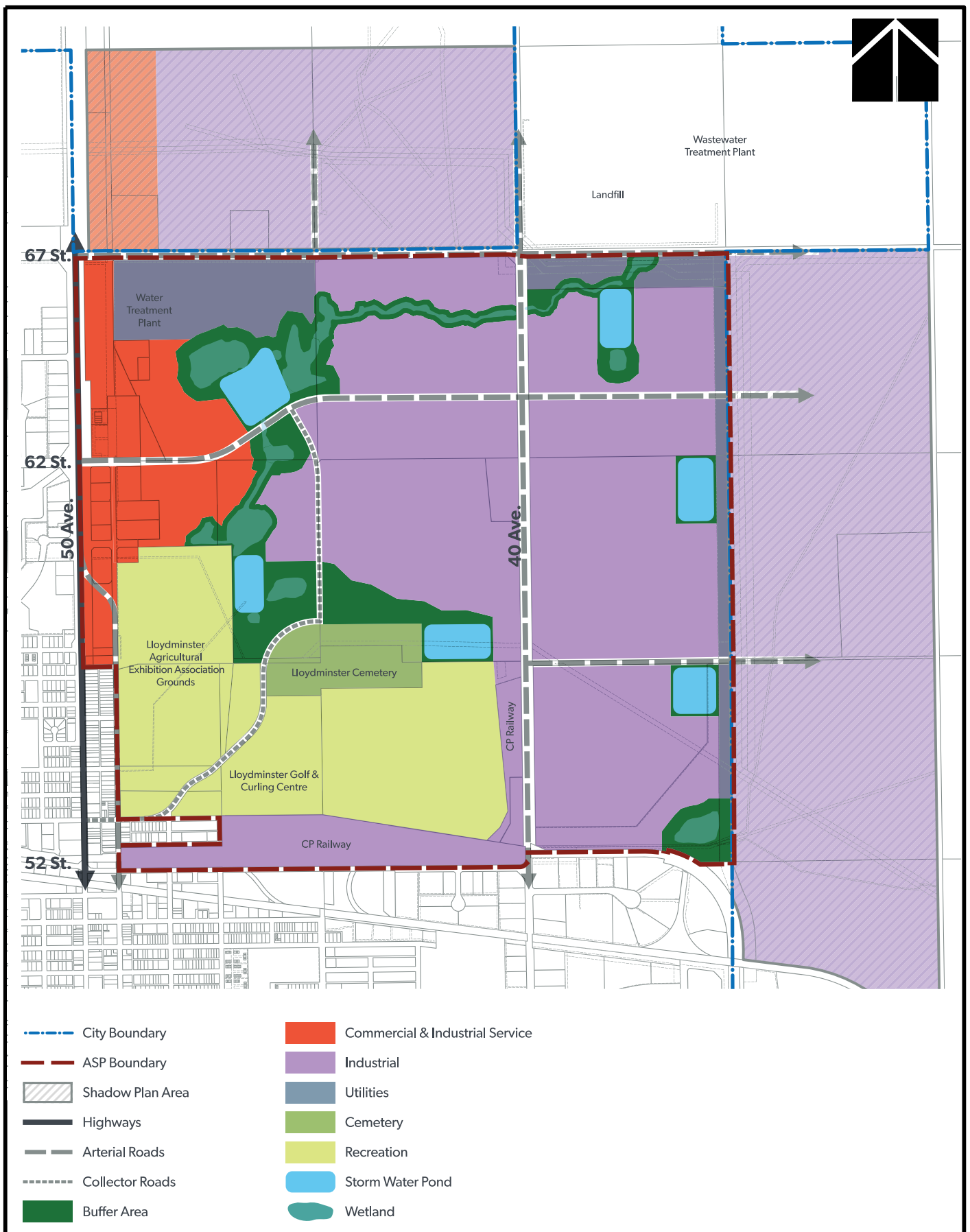
Intersection signalization was generally triggered by high turning volumes at the intersections. Through volumes on 50 Avenue and 40 Avenue were often high enough to limit the opportunities for vehicles to turn left off the arterials or to get onto the arterials. This is particularly the case on 40 Avenue, where the denser development of the industrial area on 40 Avenue resulted in higher through and turning volumes along the corridor than on 50 Avenue.

Timing of Improvements

The twinning of 50 Avenue, 49 Avenue, and 40 Avenue were included in the original 56,000 population VISUM model for the TMP. The timing of the intersection improvements is dependent on the timing of the development. A high-level analysis was conducted to determine the timing for traffic signals. In the analysis, the side street traffic (east leg traffic on Intersections 1 to 6, east and west legs traffic on Intersections 7 to 9) of the 56,000 population traffic, which represents the ASP development traffic, were reduced by up to fifty percent. It is noted the through traffic was maintained. The traffic operations with the reduced side street traffic were assessed in Synchro with stop control on the minor leg. The following was noted from the analysis:

- 60 Street and 50 Avenue: The eastbound and westbound legs have at least one movement with LOS “E” or LOS “F” with 50 % percent of the Northeast ASP traffic, which indicates that signalization may be needed prior to 50 percent buildout of the entire Northeast ASP area.
- 62 Street and 50 Avenue: The westbound leg is LOS “E” with 50 percent of the Northeast ASP traffic, which indicates that signalization may be needed by 50 percent buildout of the entire Northeast ASP area.
- 65 Street and 50 Avenue: The eastbound left turn movement is LOS “E” with 65 percent of the Northeast ASP traffic, which indicates that signalization may be needed by 65 percent buildout of the entire Northeast ASP area.
- 67 Street and 50 Avenue: The eastbound and westbound legs are LOS “F” at 50 percent of the Northeast ASP traffic. This indicates that signalization may be required at this intersection earlier than 50 percent buildout of the entire Northeast ASP area.
- 62 Street and 40 Avenue: 62 Street and 40 Avenue: The westbound leg is LOS “F” with 50 percent of the Northeast ASP traffic. This indicates that signalization may be required at this intersection prior to 50 percent buildout of the entire Northeast ASP area.
- 52 Street and 40 Avenue: The eastbound left turn movement has LOS “E” with 50 percent volume of the Northeast ASP traffic. This indicates that signalization may be required at this intersection prior to 50 percent buildout of the entire Northeast ASP area.





LLOYDMINSTER NORTHEAST AREA STRUCTURE PLAN - TRAFFIC IMPACT ASSESSMENT UPDATE

EXHIBIT 3.2 : FINAL AMENDED ASP LAND USES

The above is a high level analysis of signalization timing. It is recommended to update the signalization timing analysis in the future, when the staging and timing of the ASP is known. Also, the Transportation Association of Canada has a traffic signal warrant sheet that evaluates the need for signalization. It is recommended that the warrants be used to confirm the need for signalization as unwarranted signals may reduce the safety of the intersection. Two hour traffic counts during the AM peak, midday, and PM peak are required for this signal warrant.

Cemetery Road

A portion of traffic destined to and originating from the Northeast ASP area is expected to use Cemetery Road. While a relatively small portion of the total traffic, it is likely that the existing portion of the roadway will require upgrades to support the increased traffic volumes. Cemetery Road is currently a paved two lane rural standard roadway with ditches on both sides and no shoulder, as shown in Figure 3.1.



Figure 3.1: Cemetery Road Existing Conditions

The extension is classified as a collector within the proposed roadway network and services industrial land uses, therefore the roadway's cross section should align with the City's Urban Industrial / Commercial Roadway cross section Drawing 1-102. This cross section includes curb and gutter, lighting and pedestrian facilities, which is a significant upgrade from the existing conditions. No additional right of way is expected for this improvement as the available right of way is approximately 24 m and matches the proposed cross section. The cross section is provided in Appendix A, as well as shown in the figure below. This roadway should be upgrade with development of the NEASP.

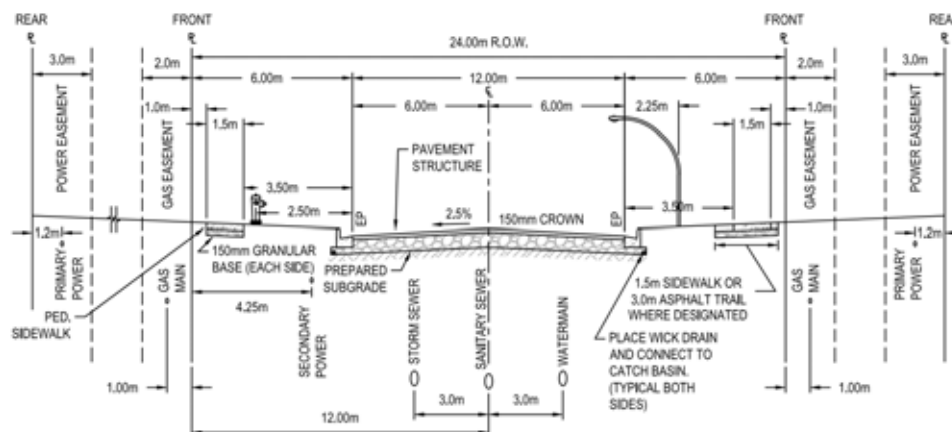


Figure 3.2: Urban Industrial / Commercial Roadway (Drawing 1-102 – Lloydminster Standard Cross Sections)

3.3 Final Land Use Plan

The land use plan was finalized after completing the original TIA and traffic analysis described in Section 3.2. The final plan includes a reduction in retail, non-retail, and industrial lands in Zone 101. As a result, the plan area is anticipated to generate 195 (4%) less trips during the PM peak hour. No TIA update is required because the site generated traffic volumes decreases with the final land use plan and the moderate decrease is not anticipated to impact the type or timing of the recommended roadway network improvements.

This reduction in site generated traffic is summarized in the table below.

Table 3.2: Site Generated Traffic Comparison – TIA and Final Land Use Plan Volumes

Land Use Plan	Zone 101				Plan Area
	Retail	Non-Retail	Industrial	Total	
TIA	1428	1029	1023	3480	4755
Final	1276	1007	1002	3285	4560
Change	-152	-21	-21	-195	-195
% Change	-11%	-2%	-2%	-6%	-4%

The final land use plan as amended is provided in Exhibit 3.2.

4.0 Other Considerations

The following sections discuss other areas related to the Northeast ASP for consideration, including connectivity with the active transportation network, rail and access management.

4.1 Active Transportation Network

A comprehensive active transportation network is important to promote healthy options for residents and commuters to get around the city. There are no existing pedestrian / bicycle connections in the area because most of the existing lands in the proposed Northeast ASP development are currently under agricultural use. Cycling facilities would offer an environmentally friendly way to get around while also contributing to better overall health of the user and potentially reducing the number of vehicles on the roadways.

Pedestrian and cycling accommodations on the Northeast ASP arterial roadway network include the following:

- 40 Avenue: As per Policy 4.9.4 in the proposed Northeast ASP, a central pedestrian / cycle crossing will be provided to ensure a safe and convenient connection between this road.
- 50 Avenue: As per Policy 4.10.4 in the proposed Northeast ASP, sidewalks and pedestrian access within the Corridor shall be provided to the satisfaction of the Development Authority.

4.2 Rail

CP operates a main track freight rail line that is part of the Lloydminster subdivision and spans across 50 Avenue, 49 Avenue, and 40 Avenue, to the south of the plan area and to the north of 52 Street. Parallel to the CP rail line is an active CN main freight rail line. The CN line is part of the Blackfoot subdivision and also crosses the same roads as the CP line. The CP and CN tracks have an average of two and three trains per day, respectively, based on the Government of Canada Grade Crossing Inventory, accessed May 16, 2022.

The distance between 50 Avenue and 40 Avenue, approximately 1.75 kilometers, is shorter than some freight train hauls. The Railway Association of Canada recorded the average cars per freight train was 120 in 2017, with data from previous years showing a 10-year trend towards longer trains in their 2018 rail trends report. Rail car lengths range from 20 feet to 89 feet in CN's Equipment Guide, with most cars over 50 feet. Assuming an average car length of 50 feet, the average freight train spans over 1.8 kilometers. There is a chance that a single train will block all three intersections (50 Avenue, 49 Avenue and 40 Avenue), cutting the plan area off the shortest path to the City's hospital. Long delays and/or emergency vehicle response is an issue.

A grade separation railway crossing may be considered to ensure timely emergency vehicle response in the future. The most likely candidate for a grade separation is 40 Avenue, as the area is less developed than along 50 Avenue. It is noted that there are two rail crossings at 40 Avenue and 50 Avenue, therefore regardless of which is selected, there would need to be multiple grade separations to ensure emergency vehicle access. Any grade separation project would be dependent on the cooperation of CN and CP, available right-of-way, and utilities. The number of trains per day at these crossings was not provided, therefore the risk to emergency response cannot be evaluated. A detailed assessment of rail activities within the city would be required to determine if grade separations are appropriate.

4.3 Access Management

This TIA assumes access locations for analysis purposes. Access management requirements need to be considered for the planning of the subject lands. Access management guidelines unique to the City are not available. The City's Municipal Development Standards require designs to be in accordance with Transportation Association of Canada's (TAC) Geometric Design Guide. The access management requirements for all-directional access differ between roadway classifications and are provided in the following table.

Table 3.1: TAC Access Management Requirements for All-Directional Access

Access Level	Connection Characteristics	Intersection Spacing
Arterials	The desired spacing per access is 400 m based on a speed of 50 km/h. The optimal access spacing increases as the speed increases. Existing accesses more than one per 400 m may remain on a temporary basis and may be eliminated at the time of future road upgrading. Traffic movement is the primary consideration while land access is a secondary function. A minimum spacing of 200 m is generally only applicable in areas of existing development as this spacing allows for minimum storage lengths.	200 - 400 m
Collectors	A network of roads providing access to important market areas serving agricultural, industrial, and recreational needs. The typical minimum spacing along an urban collector road is 60 m.	60 m
Local Roads	The main function is access. A minimum spacing of 60 m is desired along local roads. A 40 m spacing is acceptable for three-legged intersections.	60 m (4-way) 40 m (3-way)

The potential all-directional access opportunities for the Northeast ASP area are discussed below.

50 Avenue is classified as an arterial and accesses are recommended to be restricted to the intersections at 60 Street, 62 Street, and 65 Street.

62 Street is classified as an urban arterial west of 49 Avenue and a local roadway to the east. Intersection spacing for arterials roads is recommended to be 200 - 400 m.

67 Street is classified as an arterial in the future roadway network. Intersection spacing for arterials roads is recommended to be 200 - 400 m.

40 Avenue is classified as an arterial in the future roadway network and will be upgraded to four-lanes in the future. Intersection spacing for arterials roads is recommended to be 200 - 400 m.

Cemetery Road is designated a collector roadway for the Northeast ASP. Minimum intersection spacing for collector roads is recommended to be 60 m.

Internal Roadways may be classified as collector or local roads. Urban collector roadways have a minimum access spacing requirement of 60 m. Local road accesses may be spaced every 60 m for four-way intersections. A 40 m spacing is acceptable for three-legged intersections.

■ 5.0 Conclusion and Recommendations

The 56,000 horizon traffic analysis was completed using a previous version of the amended land use plan. No updates to the TIA traffic analysis findings are recommended as the final land use plan is anticipated to generate slightly less traffic than the version used for the traffic analysis. The reduction in trips is not anticipated to have an impact on the type or timing of the recommended roadway network improvements.

A traffic volume review found that traffic generated by the Northeast ASP are generally concentrated on 40 Avenue. This is due to the density of industrial development along the corridor and having fewer intersections than 50 Avenue. The following is recommended for the Northeast ASP area:

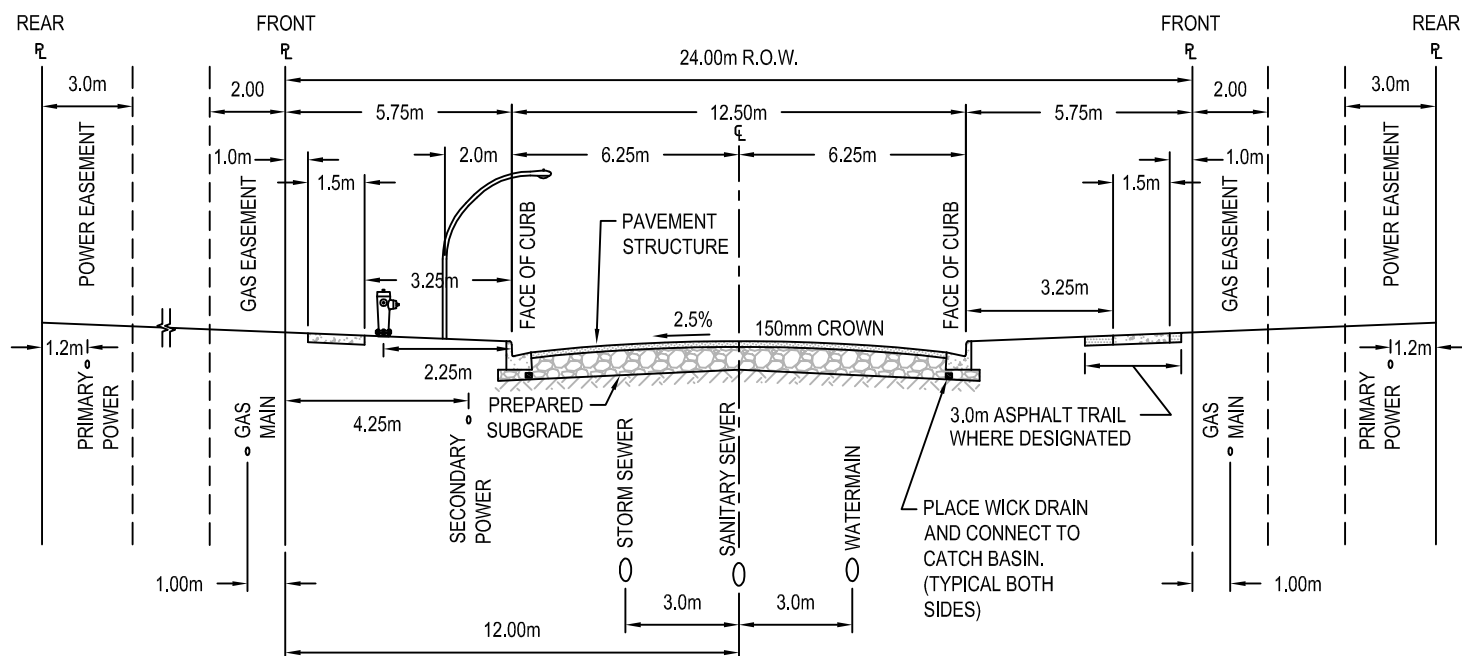
- The recommended intersection geometry is provided in Exhibit 3.1
- Traffic signals are recommended at the following stages of Northeast ASP development:
 - Prior to 50 percent Northeast ASP buildout
 - 60 Street and 50 Avenue
 - 67 Street and 50 Avenue
 - 62 Street and 40 Avenue
 - 52 Street and 40 Avenue
 - By 50 percent Northeast ASP buildout
 - 62 Street and 50 Avenue
 - By 65 percent Northeast ASP buildout
 - 65 Street and 50 Avenue
- 67 Street, 62 Street and 40 Avenue be classified as arterial roadways and Cemetery Road as a collector road.
- Upgrades to an Urban Industrial / Commercial Roadways cross section drawing 1-102 is recommended for the existing and potential future extended portion of Cemetery Road due to the proposed classification and anticipated traffic volumes on the roadway. This roadway should be upgraded with development of the NEASP.
- Sidewalk and pedestrian connections are proposed in the Northeast ASP and will be provided to ensure connected and accessible pathways to the area as per policies highlighted in Section 4.0.
- Connections between the subject land uses and the adjacent roadways illustrated in Exhibit 1.3 are shown for the purposes of distributing traffic volumes for this TIA. These connections are not exact locations as these can be determined at a future planning stage, subject to the access management requirements outlines in Section 4.3.



APPENDIX A

Roadway Cross Sections by Classification





NOTES:

- PAVEMENT STRUCTURES PROVIDED BY GEO-TECHNICAL INVESTIGATION AS PER DESIGN STANDARDS SECTION 3.4.

The City of Lloydminster

Planning & Engineering



Checked by:

[Signature]

Approved by:

[Signature]

Drawn by:

L. LEEPER

**URBAN INDUSTRIAL /
COMMERCIAL ROADWAYS**

Date:

Feb. 22, 2011

Drawing #:

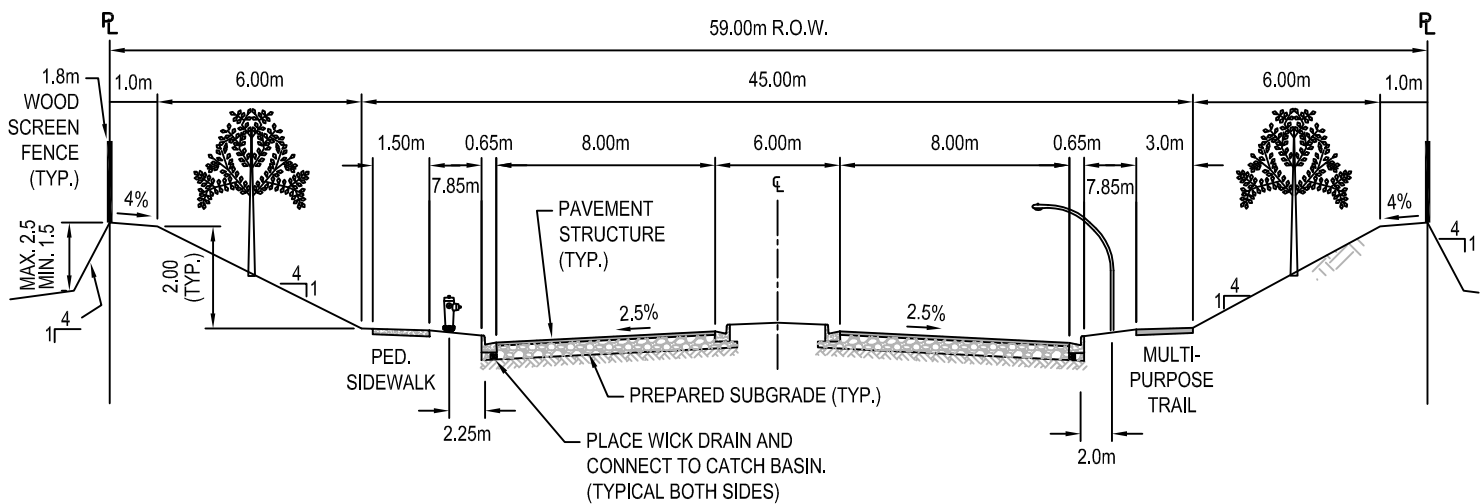
1-102

Scale:

N.T.S.

NO.	DATE	REVISION
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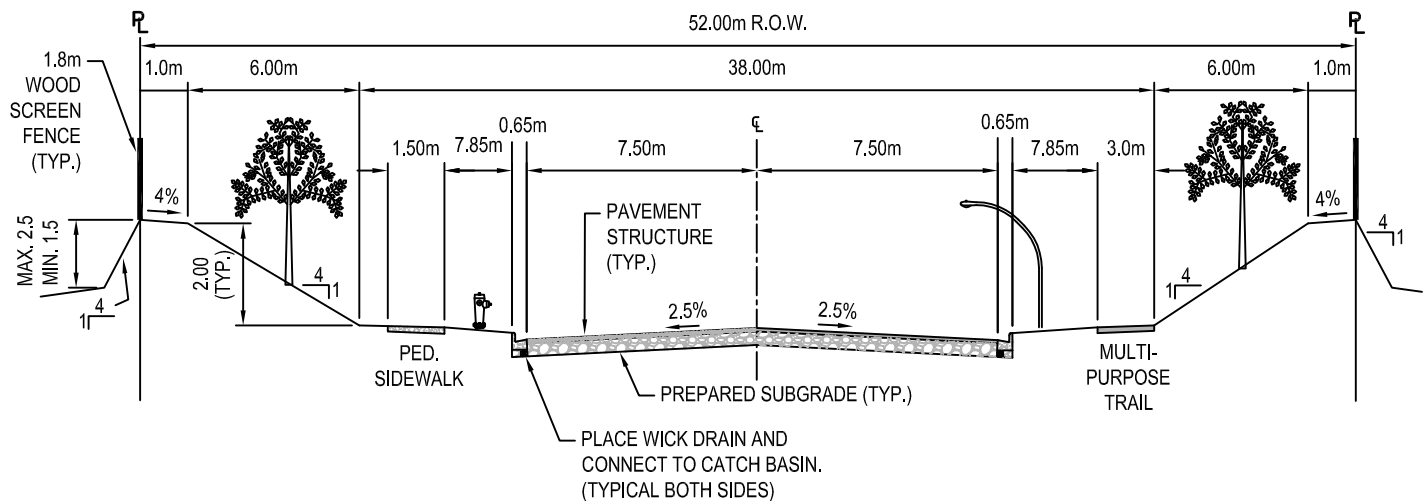
Drawing path: Z:\Engineering\PE&PW\Engineering & Transportation (ET)\ET Project Files\Capital Budget\2006\ET 651 - 2006 Design and Construction Standards Update\2011 Standard Drawings (Final)\1-103 Urban A



4 LANE URBAN DIVIDED ARTERIAL ROADWAY

NOTES:

1. PAVEMENT STRUCTURES PROVIDED BY GEO-TECHNICAL INVESTIGATION AS PER DESIGN STANDARDS SECTION 3.4.



4 LANE URBAN UNDIVIDED ARTERIAL ROADWAY

The City of Lloydminster

Planning & Engineering



Checked by:

[Signature]

Approved by:

[Signature]

Drawn by:

L. LEEPER

URBAN ARTERIAL ROADWAYS

Date:

Feb. 22, 2011

Drawing #:

1-103

Scale:

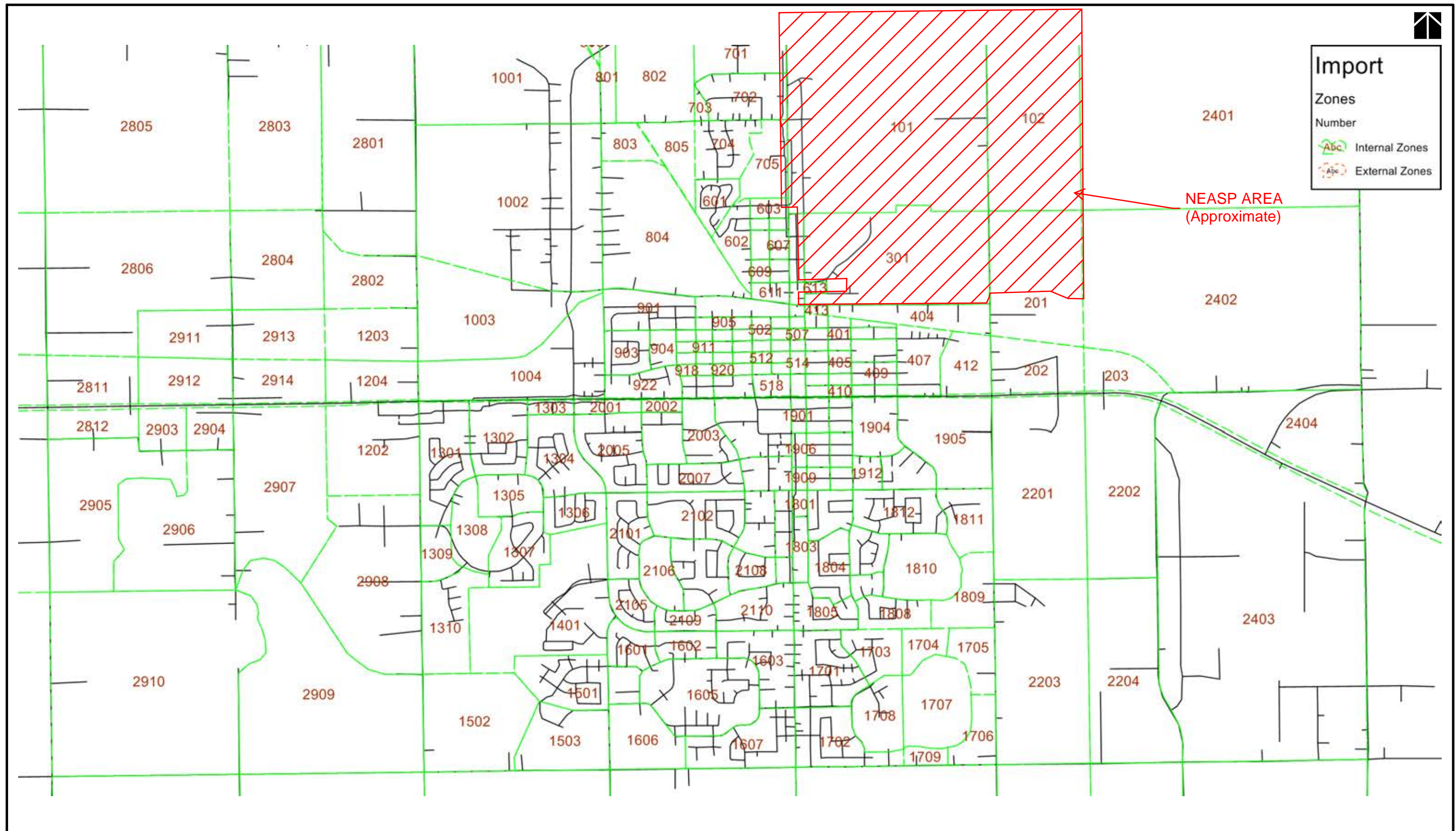
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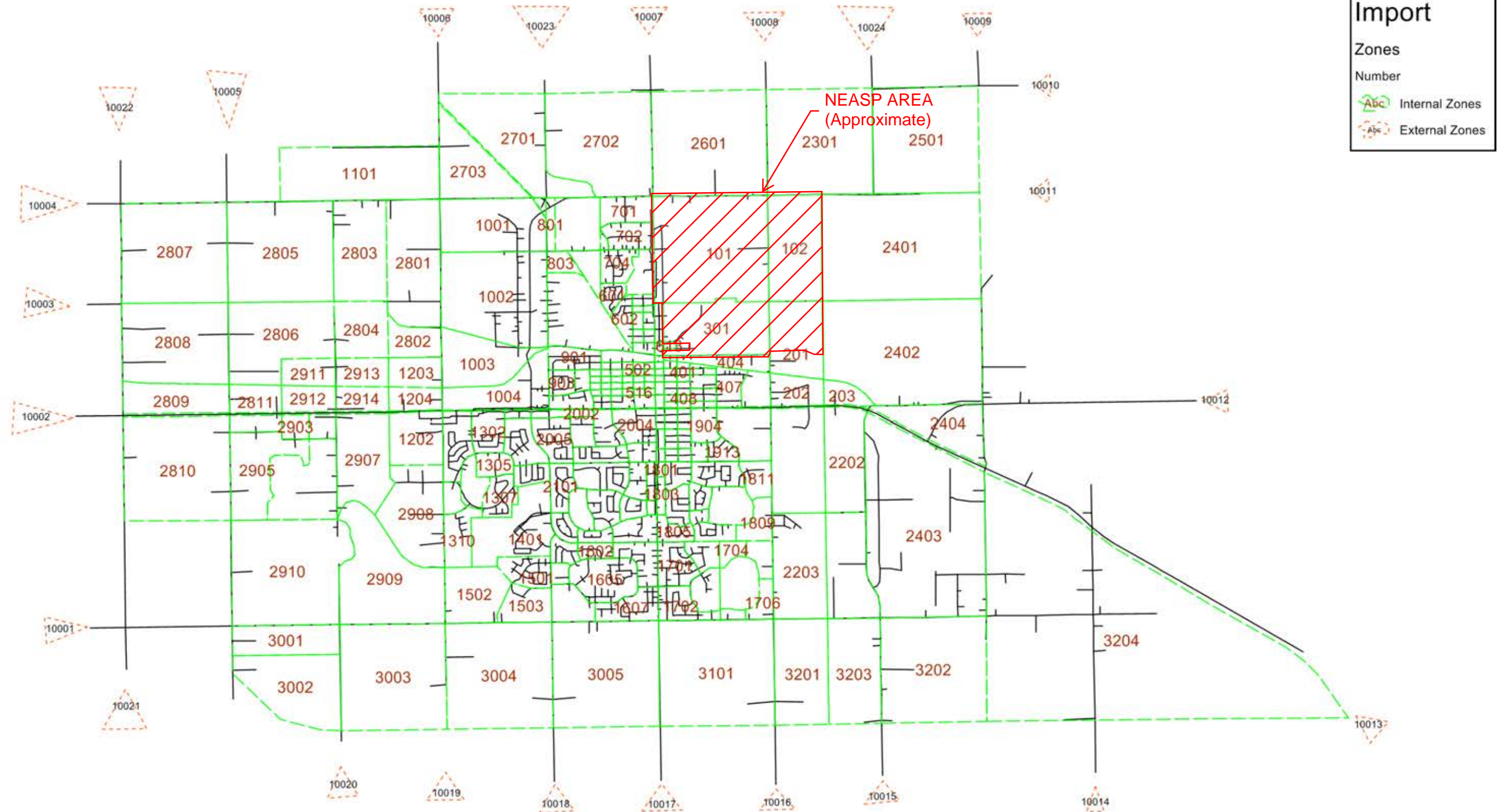
NO. DATE REVISION

APPENDIX B

56000 Population Horizon information from TMP







City of Lloydminster

TRAFFIC ANALYSIS ZONES - REGION WIDE

E

PHASE 1 ENVIRONMENTAL SITE ASSESSMENT

The following report is provided for reference purposes
and does not form part of this bylaw.

PHASE I ENVIRONMENTAL SITE ASSESSMENT

**Lloydminster Northeast Area Structure Plan
Lloydminster, Saskatchewan**

Prepared for:

City of Lloydminster

Date:

26 August 2020

Project File #: PG20-1519.2000

EXECUTIVE SUMMARY

This report presents the findings of a Phase I Environmental Site Assessment (Phase I ESA) conducted the properties identified below and located in Lloydminster, Saskatchewan.

- NW $\frac{1}{4}$ 1-50-28 W3M (includes Lot 1, Block 1, Plan 90B11438)
- NW $\frac{1}{4}$ 11-50-28 W3M (includes Block A, Plan 71B02795 and Block A, Plan 102084409)
- Block Z, Plan 60B09193
- LSD 3, 4, 5 of 11-50-28 W3M
- LSD 6-11-50-28 W3M
- SE $\frac{1}{4}$ 11-50-28 W3M
- NW $\frac{1}{4}$ and SW $\frac{1}{4}$ 12-50-28 W3M

The Phase I ESA was completed by SolidEarth Geotechnical Inc. (SolidEarth) at the request of Mr. Anthony Andre with the City of Lloydminster (the City). Authorization to proceed with the work was received on 24 June 2020.

The methodology used by SolidEarth in conducting the Phase I ESA was based on the requirements of the Canadian Standards Association and included the following:

- review of publicly available historical records for the subject property and surrounding properties
- visual inspection of the subject property and perimeter viewing of neighbouring properties
- interview of personnel knowledgeable of the current and/or historical use of the subject property and surrounding properties
- preparation of this report summarizing the methodology and findings

Key Findings

The Phase I ESA identified the following key findings. The locations of areas of potential concern that were considered to pose a moderate to high risk of environmental impact to the Site are shown on Figure 9.

- There were two onsite spills in the northeast portion of the Site (NW $\frac{1}{4}$ 12-50-28 W3M) along with three offsite spills to the north and east of the Site. The spills were associated with nearby oil and gas infrastructure and the COL Landfill to the north and presented a high potential for environmental impact to the northeast portion of the Site.

- Remaining impacted areas within the COL Public Works Shop and Yard. The items of concern included:
 - PHC, chloride, and nitrate impacted zones in the yard and offsite to the east of the yard.
 - The presence of an in-floor hydraulic lift inside the building.
 - Floor drains/sumps inside the building.
- Potential for impacts to the western portion of the Site (LSD 4 and 5 of 11-50-28 W3M) due to the presence of upgradient industrial operations.
- Potential for PFAS impacts to the soil and groundwater in the fire fighting training area located in NW ¼ 11-50-28 W3M.

Recommendations

Information provided in the previous ESAs completed by EcoVision Consulting Group Inc. (EcoVision) identified remaining PHC, chloride, and nitrate impacts in the COL Public Works Yard that have yet to be remediated. Items of concern were also identified inside the building including the in-floor hydraulic lift, contamination in the drains, and hazardous building materials.

Based on this information, the following recommendations are made with regard to the COL Public Works Shop and Yard:

- The remediation of the remaining impacted areas of the yard and implementation of the measures recommended by EcoVision.
- Appropriate safety procedures be implemented and followed prior to any renovation or demolition activities regarding the shop building, due to the confirmed presence of mould, mice infestation and droppings (potential viral hazard), PCB-containing ballasts, ODS, and mercury containing materials.
- A Phase II ESA is recommended to assess the potential for onsite impacts due to the presence of the in-floor hydraulic lift and contaminated drains. The Phase II ESA would consist of drilling boreholes inside the building in the vicinity of the hydraulic lift to assess the condition of nearby soil and groundwater.

A Phase II ESA is also recommended in order to confirm the presence/absence of PHC impacts in the northeast (NW ¼ 12-50-28 W3M) and western portions (LSD 4 and 5 of 11-50-28 W3M) of the Site, as well as investigate the potential PFAS impacts to the soil and groundwater in the fire fighting training grounds (NW ¼ 11-50-28 W3M). The Phase II ESA would consist of drilling boreholes along the perimeter of the northeast and western portions of the Site to assess the condition of the soil and groundwater.

Table of Contents

	Page
1.0 INTRODUCTION	1
2.0 PROJECT BACKGROUND AND ASSESSMENT OBJECTIVE	1
3.0 ASSESSMENT METHODOLOGY	1
4.0 OVERVIEW OF SITE AND SURROUNDING LAND	2
4.1 SITE LOCATION AND DESCRIPTION	2
4.2 SITE TOPOGRAPHY AND DRAINAGE	3
4.3 ADJACENT LAND USE	3
5.0 REGIONAL GEOLOGY	4
6.0 RECORDS SEARCH AND REVIEW	5
6.1 AERIAL PHOTOGRAPHS	5
6.2 LAND TITLES	10
6.3 SASK SPILLS DATABASE	12
6.4 SASKATCHEWAN UPSTREAM OIL AND GAS SPILL DATABASE	12
6.5 ALBERTA ENVIRONMENTAL SITE ASSESSMENT REPOSITORY (ESAR)	13
6.6 NATIONAL POLLUTANT RELEASE INVENTORY	15
6.7 WATER WELLS.....	15
6.8 CANADIAN LEGAL INFORMATION INSTITUTE	15
7.0 CORRESPONDENCE WITH GOVERNMENT AGENCIES	16
7.1 SASKATCHEWAN MINISTRY OF ENVIRONMENT (SKMOE).....	16
7.2 CITY OF LLOYDMINSTER	18
8.0 SITE VISIT	21
8.1 SITE STRUCTURES	22
8.2 SITE APPEARANCE	24
8.3 APPEARANCE OF SURROUNDING PROPERTIES	26
8.4 BULK STORAGE TANKS	28
8.5 CHEMICAL STORAGE AND HANDLING	29
8.6 WASTE HANDLING AND DISPOSAL.....	29
8.7 HYDRAULIC HOISTS AND ELEVATORS	29
8.8 SUMPS AND DRAINS	29
8.9 HAZARDOUS MATERIALS AND EQUIPMENT	29
8.10 SPECIAL ITEMS.....	29
8.11 OTHER ITEMS	30
9.0 INTERVIEWS	30
10.0 SUMMARY OF FINDINGS AND DISCUSSIONS	31
11.0 RECOMMENDATIONS	37
12.0 CLOSURE	39
13.0 STATEMENT OF QUALIFICATIONS	41

Appendix A:

Historical Aerial Photographs

Appendix B:

Historical Land Titles

Findings of Database Searches

Correspondence with Governmental Agencies

Appendix C1:

Site Photographs Taken During the Site Visit – Former City of Lloydminster Public Works Shop and Yard

Appendix C2:

Site Photographs Taken During the Site Visit – Remaining Portions of the Site

1.0 INTRODUCTION

This report presents the findings of a Phase I Environmental Site Assessment (Phase I ESA) conducted on the properties identified below, which are located in Lloydminster, Saskatchewan.

- NW ¼ 1-50-28 W3M (also includes Lot 1, Block 1, Plan 90B11438)
- NW ¼ 11-50-28 W3M (also includes Block A, Plan 71B02795 and Block A, Plan 102084409)
- Block Z, Plan 60B09193
- LSD 3, 4, 5 of 11-50-28 W3M (includes 5709 – 50 Avenue, Lloydminster, Saskatchewan)
- LSD 6-11-50-28 W3M
- SE ¼ 11-50-28 W3M
- NW ¼ and SW ¼ 12-50-28 W3M

The Phase I ESA was completed by SolidEarth Geotechnical Inc. (SolidEarth) at the request of Mr. Anthony Andre with the City of Lloydminster (COL). Authorization to proceed with the work was received on 24 June 2020.

2.0 PROJECT BACKGROUND AND ASSESSMENT OBJECTIVE

Based on the current project understanding, it was understood that the City wishes to create an area structure plan (ASP) for the referenced properties in the northeast portion of the City. The Phase I ESA was required for project due diligence purposes as part of the ASP process.

The objective of the Phase I ESA was to identify potential or actual environmental concerns from current or historical uses of the site and surrounding properties, document the current environmental site status, and to determine if additional environmental assessment is recommended.

3.0 ASSESSMENT METHODOLOGY

The methodology used by SolidEarth in conducting the Phase I ESA was based on the requirements of the Canadian Standards Association¹ and included the following:

- review of publicly available historical records for the subject property and surrounding properties

¹ Canadian Standards Association (CSA), November 2001 (reaffirmed 2016), *Phase 1 Environmental Site Assessment (CSA Z768-01)*, Ottawa, Canada.

- visual inspection of the subject property and perimeter viewing of neighbouring properties
- interview of personnel knowledgeable of the current and/or historical use of the subject property and surrounding properties
- preparation of this report summarizing the methodology and findings

4.0 OVERVIEW OF SITE AND SURROUNDING LAND

4.1 SITE LOCATION AND DESCRIPTION

The properties in the ASP evaluated in this Phase I ESA (collectively referred to as the Site) consisted of the above-mentioned quarter sections and parcels (see Section 1.0 “Introduction”). The Site was situated between 50 Avenue as the western boundary to approximately 800 m east of 40 Avenue as the eastern boundary; and 67 Street as the northern boundary to approximately 52 Street as the southernmost boundary.

The following general observations were made regarding the Site:

- The Lloydminster Water Treatment Plant (WTP) was situated within the northwest corner of the Site, in the north portion of NW ¼ 11-50-28 W3M.
- Portions of LSD 4-11-50-28 W3M, which comprised the southwest corner of the Site, consisted of light industrial properties and contained the former COL Public Works Shop and Lloydminster Agricultural Exhibition grounds (the latter was not included in this Phase I ESA).
- The lot within LSD 4-11-50-28 W3M which was situated at 5709 – 50 Avenue, Lloydminster, Saskatchewan and was largely vacant and contained a two-storey building that did not appear to be in use. The lot was historically operated as the COL WTP.
- The remaining portions of the Site, which were made up of LSD 3, 5, 6 of 11-50-28-W3M, SE ¼ 11-11-50-28 W3M, NW ¼ 12-11-50-28 W3M, SW ¼ 12-11-50-28 W3M, and NW ¼ 1-11-50-28 W3M, largely consisted of agricultural cropland with scattered low-lying sloughs and some rural residential developments.

Current zoning at the Site, as per the COL Land Use District and Overlay Map (dated August 2018) is as follows:

- **S ½ 11-50-28 W3M:** UT – Urban Transition
- **W ½ 12-50-28 W3M:** UT – Urban Transition
- **NW ¼ 11-50-28 W3M and NW ¼ 1-50-28 W4M:** I1 – Light Industrial

Definition of the above zones according to the COL Land Use Bylaw (5-2016):

Urban Transition: The purpose of this district is to allow for a limited range of agricultural and rural land use activities in an undeveloped state and awaiting urban development and utility servicing.

Light Industrial: The purpose of this district is to allow for light industrial developments that create no nuisance factor outside an enclosed building.

Figure 1, Appendix A, shows the approximate Site location on a 2020 aerial photograph.

4.2 SITE TOPOGRAPHY AND DRAINAGE

The following observations were made with regard to topography and drainage:

- A northbound storm drainage channel was situated in the northwest portion of the Site within NW ¼ 11-50-28 W3M. The channel originated offsite to the west of 50 Avenue and entered the Site directly northeast of 62 Street and 50 Avenue and extended to west of the access road to the COL WTP, where it crossed 67 Street via culvert to continue flowing northwards.
- The land around the cell at the COL WTP in the northwest portion of the Site sloped down towards the surrounding environment.
- The agricultural lands within the Site consisted of rolling terrain and drainage was expected to follow Site topography.
- A northbound drainage channel was situated along the eastern boundary of the property.
- The former COL Public Works Yard was generally flat.
 - The west section of the yard gently sloped to the south.
 - A naturally occurring drainage channel was noted in the gravel surface and appeared to be sloped downwards to the south.
 - The east section of the yard sloped downwards to the east. Drainage was expected to follow Site topography.

No other significant observations regarding drainage and topography were made.

4.3 ADJACENT LAND USE

The adjacent land use was noted based on observations made during the Site visit as well as a review of the COL Land Use District and Overlay Map (dated August 2018) and Land Use Bylaw (5-2016). The surrounding land usage is summarized in Table 1 below.

Table 1: Surrounding Land Usage

Direction	Land Use
North	<p>A portion of the lands to the north (section S ½ 14-50-28 W3M) were located outside of the City limits. These lands generally appeared to be a mix of agricultural cropland, rural residential land, and commercial land.</p> <p>The land north of the northeast portion of the Site (SW ¼ 13-50-28 W3M) was zoned under <i>PU - Public Utility</i> and was operated as the COL Landfill and WWTF.</p>
East	The lands to the east were outside of the City limits. They appeared to be agricultural cropland.
South	<p>The land to the south of the southeast portion of the Site was zoned under <i>I1 Light Industrial</i> and was developed as an industrial subdivision.</p> <p>The land to the south of the central and western portions of the Site was zoned under <i>UT Urban Transition</i> and consisted of the Lloydminster Agricultural Exhibition grounds, Lloydminster Golf and Curling Club, and Lloydminster Cemetery</p>
West	The lands to the west of the Site consisted of commercial and industrial properties and were zoned under <i>I1 Light Industrial</i> , <i>I2 Medium Industrial</i> , and <i>C5 Service Commercial</i> .

As per the COL Land Use Bylaw, the following definitions are provided:

Medium Industrial: The purpose of this district is to provide for industrial uses that carry out a portion of their operations outdoors.

Service Commercial: The purpose of this district is to provide for commercial and industrial businesses that operate in such a manner that no nuisance factor is created.

5.0 REGIONAL GEOLOGY

The surficial geology at the Site and surrounding area is characterized by fluted moraine, which consists of furrowed and ridged land features comprised mainly of till (sand, silt, clay, and gravel)².

Bedrock in the area belongs to the Lea Park Formation, which consists of mudstone, siltstone, sandstone, and bentonite³.

² Simpson, M.A. (compiler) (1997): Surficial geology map of Saskatchewan; Sask. Energy/Mines/Sask. Researc. Coun., 1: 1 000 000 scale.

³ Macdonald, R. and Slimmon, W.L. (compilers) (1999): Geological map of Saskatchewan; Sask. Industry and Resources, 1: 1 000 000 scale.

6.0 RECORDS SEARCH AND REVIEW

Several sources of records were searched and reviewed. The sources and findings are discussed in the following subsections.

6.1 AERIAL PHOTOGRAPHS

Aerial photographs of the Site and surrounding area were obtained to determine the historic land use and development. Aerial photographs were obtained through the National Air Photo Library, Alberta Environment and Parks (AEP)-Air Photo Services, as well Google Earth Pro.

As aerial photographs do not provide a continuous record of Site development, it is possible that features of interest may have been present on Site but removed between the dates of coverage. In addition, photographic quality and scale are variable and may make features difficult to identify or their purpose difficult to establish.

Aerial photographs that were reviewed included the years 2020, 2011, 2001, 1988, 1975, 1965, 1956, and 1950. Reproduction of these specific photographs is provided in Figures 1 to 8 (Appendix A). A summary of the aerial photograph review is provided in Table 2.

Table 2: Historical Aerial Photograph Review

Year	Scale	Description
1950	NA	<p>Note: The north portions of S ½ 11-50-28 W3M, SW ¼ 12-50-28 W3M, and all of NW ¼ 11-50-28 W3M and NW ¼ 12-50-28 W3M were not visible in this aerial photograph.</p> <ul style="list-style-type: none"> The Site appeared to be largely undeveloped agricultural land with some treed areas. A body of water was noted in SW ¼ 11-50-28 W3M. A roadway was observed intersecting SE ¼ 11-50-28 W3M in a northwest/southeast orientation. A dugout was observed in SE ¼ 11-50-28 W3M. Rural residential developments were noted in SE ¼ 12-50-28 W3M and NW ¼ 1-50-28 W3M surrounded by treed land. The land to the south of SW ¼ 11-50-28 W3M appeared to have been developed and an oval track was observed along with approximately 12 rectangular buildings (likely present-day Lloydminster Agricultural Exhibition). The land was intermixed treed and grassland, along with an area that was likely the present-day Lloydminster cemetery. What appeared to be residential areas were noted to the southwest across a roadway (likely present-day 50 Avenue). A railway right-of-way (ROW) was noted immediately to the south of NW1/4 1-50-28 W3M and possibly extended north on the west side of NW ¼ 1-50-28 W3M and through SE ¼ 11-50-28 W3M.
1956	NA	<p>Note: The north portions of NW ¼ 11-50-28 W3M and NW ¼ 12-50-28 W3M were not visible in this aerial photograph.</p> <ul style="list-style-type: none"> A linear man-made feature was noted in W ½ 11-50-28 W3M in a northwest/southeast orientation (likely former Lloydminster Airport airstrip). A small square building was noted in the south portion of SW ¼ 11-50-28 W3M. A rural residential property was noted in the northeast corner of SE ¼ 11-50-28 W3M. Developments of unknown nature (possibly commercial/industrial) were noted directly to the west of SW ¼ 11-50-28 W3M. No other significant changes to the Site or surrounding properties were noted from what was observed in the 1950 aerial photograph.
1965	1: 31,680	<p>Note: Only NW ¼ 12-50-28 W3M was visible in this aerial photograph.</p> <ul style="list-style-type: none"> The visible portion of the Site consisted of agricultural cropland. The lands to the west, north, and east also appeared to be agricultural cropland. No other items of significance were noted on the Site or surrounding properties.

1975	1: 15,840	<p>Note: The eastern portions of NW ¼ 12-50-28 W3M, SW ¼ 12-50-28 W3M, and NW ¼ 1-50-28 W3M were not visible in this aerial photograph.</p> <ul style="list-style-type: none"> • A large square lagoon and small square building with access from a roadway to the north (likely present-day 67 Street) were noted within the north portion of NW ¼ 11-50-28 W3M (likely present-day COL WTP). • A rural residential property was noted to the south of the square lagoon with access from 50 Avenue to the west. • A paved airstrip was noted intersecting W ½ 11-50-28 W3M and the former Lloydminster Airport was noted in the south portion of SW ¼ 11-50-28 W3M. Ten new buildings (likely hangars) along with nine visible airplanes were noted in the southwest corner of SW ¼ 11-50-28 W3M. • A new industrial development was noted in the west portion of SW ¼ 11-50-28 W3M and consisted of a building and storage yard to the east and south (likely present-day former COL Public Works Shop and Yard). Parked vehicles were observed on the north side of the building and various indiscernible objects were noted in the yard. • A rural residence and farm along with multiple round objects (likely grain silos) were noted on the north boundary of SE ¼ 11-50-28 W3M. • No other significant changes to the Site were noted from what was observed in the 1965 aerial photograph. • A new industrial development was noted to the west of SW ¼ 11-50-28 W3M and consisted of a rectangular building surrounded by a yard that contained vehicles and other indiscernible objects. • An industrial property was noted directly west of the former COL Public Works Shop and contained two rectangular buildings (one large and one small) along with various indiscernible objects in the yard and along the perimeter. A square building was also noted further west near 50 Avenue. • Lagoons along with a square building and a circular object (likely a water storage tank) were noted southwest of the former COL Public Works Shop and (likely former COL WTP). • A large industrial development was noted west of NW ¼ 11-50-28 W3M and a large circular tank was noted along with a building that appeared to be in development (possibly present-day Foremost). • A development was noted across 67 Street to the north of the Site and consisted of a rectangular building with associated infrastructure to the north (possibly present-day Diamond 7 Meats). • The remaining land to the north consisted of rural residential and agricultural cropland. • No other significant changes to the surrounding properties were noted from what was observed in the 1965 aerial photograph.
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1988	1: 10,000	<p>Note: Only portions of W ½ 11-50-28 W3M were visible in this aerial photograph.</p> <ul style="list-style-type: none"> • An additional wing was noted on the south side of the former COL Public Works Shop. • Soil stockpiles were observed east of the former COL Public Works Yard. • The airstrip observed in the previous aerial photographs appeared to be in the process of being removed. • The former Lloydminster Airport appeared to have undergone changes as new buildings were noted and some old buildings were no longer observed. • No other significant changes to the Site were noted from what was observed in the 1975 aerial photograph. • A new industrial subdivision was noted to the west of NW ¼ 11-50-27 W3M past 50 Avenue along with a roadway (likely present-day 62 Street). • A manmade body of water was noted further west (likely present-day Lake V Park). • New industrial buildings were noted to the west between 49 and 50 Avenue (northwest of the former COL Public Work Shop). • A new building was noted on the industrial property that was observed to the west of the former COL Public Works Shop in the 1975 aerial photograph. • The lagoons which were noted in the 1975 aerial photograph were no longer observed. • New large buildings/additions were noted on the land to the south (present-day Lloydminster Agricultural Exhibition). • A large new development was noted to the south (likely present-day Lloydminster Golf and Curling Club). • No other significant changes to the surrounding properties were noted from what was observed in the 1975 aerial photograph.
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2001	1: 30,000	<ul style="list-style-type: none"> • A new building was noted to the northeast of the square lagoon in the north portion of NW ¼ 11-50-28 W3M (likely part of present-day COL WTP). • A new yard was observed directly east of the old yard belonging to the former COL Public Works Shop. A structure was noted at the north end of the yard and stockpiles were noted in the central and south portions. • No other significant changes to the Site were noted from what was observed in the 1988 aerial photograph. • New long rectangular objects (possibly truck trailers or modular trailers) were noted directly to the west of the former COL Public Works Shop, between 49 and 50 Avenue. • New industrial developments were noted to the west of SW ¼ 11-50-28 W3M past 50 Avenue. • Some of the buildings that were previously noted on the Lloydminster Agricultural Exhibition grounds to the south were no longer observed. • New industrial developments were noted to the south and southwest of NW ¼ 1-50-28 W3M across the railway. • A well lease was noted in the southeast corner of NE ¼ 11-50-28 W3M. • No other significant changes to the surrounding properties were noted from what was observed in the 1988 aerial photograph.
2011	NA	<ul style="list-style-type: none"> • Six (6) round, white objects were observed to the south of the former COL Public Works Shop (likely aboveground storage tanks). Various equipment and vehicles were noted in the western yard and stockpiles were observed in the eastern yard. • No other significant changes to the Site were noted from what was observed in the 1988 aerial photograph. • An electrical substation was noted to the southwest of the former COL Public Works Shop • Multiple industrial properties and shops were noted to the north of 62 Street along 49 Avenue. • The industrial property that was noted to the west of the former COL Public Works Shop, across 49 Avenue, appeared to have been cleared of structures and a vacant graded yard was observed. • Four industrial developments were observed directly to the south of NW ¼ 1-50-28 W3M. • Pipelines were noted directly to the east of NW ¼ 1-50-28 W3M (possibly oil and gas infrastructure). • A well lease was noted to the north of NW ¼ 11-50-28 W3M across 67 Street. • The COL Landfill and Wastewater Treatment Facility (WWTF) was noted to the north of NW ¼ 12-50-28 W3M. • No other significant changes to the surrounding properties were noted from what was observed in the 2001 aerial photograph.

2020	NA	<ul style="list-style-type: none"> The round, white tanks that were noted to the south of the former COL Public Works Shop in the 2011 aerial photograph were no longer observed. The equipment and soil stockpiles that were noted in the yard in the previous aerial photographs were no longer observed. White objects were scattered east and northeast of the yard. Their nature could not be discerned. Multiple greyish objects were noted directly east of the yard. Their nature could not be discerned. No other significant changes to the Site were noted from what was observed in the 2011 aerial photograph. A new industrial building was noted directly west of the former COL Public Works Shop. A new development was noted directly north of the former COL Public Works Shop (likely a fill station). The round tank that was noted to the southwest of the former COL Public Works Shop in the previous aerial photographs was no longer observed. No other significant changes to the surrounding properties were noted from what was observed in the 2011 aerial photograph.
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The potential for environmental impact to the Site from the railway ROW, suspected ASTs in the former COL Public Works Yard, electrical substation to the southwest of the former COL Public Works Shop, presence of oil and gas infrastructure, presence of the COL Landfill and WWTF is discussed in Section 10 "Summary of Findings and Discussions".

6.2 LAND TITLES

SolidEarth reviewed available historical land titles dating back to 11 January 1974 to identify current and previous landowners. Land title searches were obtained from Information Services Corporation. A summary of the ownership history is provided in Table 3 below. Copies of the reviewed land titles are provided in Appendix B.

Table 3: Site Ownership History

Site Ownership	Time Period
NW ¼ 11-50-28 W3M	
City of Lloydminster	11 January 1974 to Present
SE ¼ 11-50-28 W3	
City of Lloydminster	22 December 2011
Lawrence Raymond Leach and Christina Ramsay Leach	27 July 2006 to 22 December 2011

LSD 3-11-50-28 W3M	
City of Lloydminster	18 January 1995 to Present
LSD 4-11-50-28 W3M	
City of Lloydminster	6 August 2002 to Present
LSD 5-11-50-28 W3M	
City of Lloydminster	6 August 2002 to Present
LSD 6-11-50-28 W3M	
City of Lloydminster	22 December 2011 to Present
NW ¼ 12-50-28 W3M	
City of Lloydminster	30 January 1989 to Present
SW ¼ 12-50-28 W3M	
City of Lloydminster	5 February 1988 to Present
NW ¼ 1-50-28 W3M	
City of Lloydminster	30 December 2004 to Present
Rocky Robert Payne	18 June 1993 to 30 December 2004
Lot 1, Block 1, Plan 90B11438	
City of Lloydminster	30 December 2004 to Present
Bernard William Payne	8 January 2004 to 30 December 2004
Viterra Inc.	23 October 2002 to 8 January 2004
Saskatchewan Wheat Pool	13 August 1990 to 23 October 2002
Block A, Plan 71B02795	
City of Lloydminster	1 November 2002 to Present
Block A, Plan 102084409	
City of Lloydminster	15 May 2012
Block Z, Plan 60B09193	
City of Lloydminster	18 July 2014 to Present

No items of concern were identified in the historical land title review.

6.3 SASK SPILLS DATABASE

The SaskSpills Program database was reviewed for information regarding storage of hazardous materials and contaminant spills. The search was limited to the quarter sections within the Site and the surrounding quarter sections.

The search revealed the following:

Onsite

- A spill occurred on 24 May 2002 (incident #2002-0112) in NW1/4 12-50-28 W3M and involved the release of 30,000 L of crude oil. No other information was provided.

Offsite

- Incident #120368 occurred on 27 June 2012 at the Lloydminster Landfill in SW ¼ 13-50-28 W3M (north of the northeast portion of the Site) and involved the release of an unidentified contaminant. No other information was provided.

The potential for environmental impact to the Site from the records identified above is discussed in Section 10 “Summary of Findings and Discussion”.

6.4 SASKATCHEWAN UPSTREAM OIL AND GAS SPILL DATABASE

A review of the Saskatchewan Upstream Oil and Gas Spill Database, an online database provided by the Government of Saskatchewan - Ministry of the Energy and Resources, was conducted for information relating to nearby oil and gas spill sites. The search was conducted for the Site and surrounding quarter sections. The following records were identified:

Onsite Incidents

- Incident #4707 on 8 June 1998 involving the release of 44 m³ of oil from a Husky Oil Operations Pipeline in LSD 6-11-50-28 W3M. It was reported that 42 m³ was recovered and reclamation was completed.
- Incident #7554 on 25 May 2002 involving the release of 40 m³ of oil from a Canadian Natural Resources Limited (CNRL) pipeline in LSD 14-12-50-28 W3M. No recovery data was reported, and it was indicated that the reclamation was completed.
- Incident #12155 on 24 June 2008 involving the release of 0.17 m³ of crude oil and water from a Husky Oil Operations Limited pipeline in LSD 11-1-50-28 W3M. No recovery data was provided, and reclamation was completed.

- Incident #18856 on 14 February 2017 involving the release of 2 m³ of oil in LSD 14-12-50-28 W3M. The incident was reported as closed and no other information was provided in the record.

Offsite Incidents

- Incident #19971119 involving the release of 26 m³ of oil from a tank in LSD 16-11-50-28 W3M. The incident occurred on infrastructure listed to Lash Oil Company Ltd. and it was reported that 10 m³ of the material was recovered using a vacuum truck.
- Incident #1460 on 8 September 1993 on a well lease listed to Koch Exploration Canada ULC in LSD 3-14-50-28 W3M. It was reported that 5 m³ of oil was released (all recovered) and reclamation was completed.
- Incident #6339 on 19 October 2000 involving the release of 29 m³ of water and 1 m³ of oil on a CNRL well lease on LSD 1-14-50-28 W3M. It was reported that 5.5 m³ of material was recovered and reclamation was completed.
- Incident #10537 on 25 August 2006 involving the release of 0.703 m³ of unspecified fluid, which was completely recovered. The incident occurred in connection with a Husky Oil Operations Limited well lease in NE ¼ 1-50-28 W3M (east of Site). Reclamation was completed.
- Incident #13684 on 14 August 2010 involving the release of 100 m³ of unspecified fluid from a CNRL flow line in LSD 15-12-50-28 W3M (east of Site). Reclamation was completed.
- Incident #14416 on 18 July 2011 involving the release of 3 m³ of oil from a facility listed to Emerge Oil & Gas Inc. in LSD 13-1-50-28 W3M. All material released was reported as recovered and reclamation was completed.

The potential for environmental impact to the Site from the records identified above is discussed in Section 10 "Summary of Findings and Discussion".

6.5 ALBERTA ENVIRONMENTAL SITE ASSESSMENT REPOSITORY (ESAR)

An online search of the *AEP-Environmental Site Assessment Repository* (ESAR) database was completed to identify technical information about assessed and/or reclaimed sites and remediation/reclamation certificates. The search was limited to the properties to the west of the Site located on the Alberta side of the border (within 300 m of the Site).

The following records were identified:

Husky Fuel Station and Car Wash – 5906 - 50 Avenue, Lloydminster, Alberta

The most recent document associated with this property was a Phase III ESA completed by Dillon Consulting Ltd. (report dated 28 March 2003). A Preliminary Site Assessment by HBT AGRA Limited (30 March 1993) and Phase II ESA by ESG Environmental Solutions Group Ltd. (15 September 2001) were also completed at the property. The Phase III ESA report provided the following information:

- The scope of the Phase III ESA consisted of delineating hydrocarbon contamination in the vicinity of USTs at the property.
- Five (5) boreholes were advanced and two (2) groundwater monitoring wells were installed.
- Soil and groundwater samples were collected and submitted for benzene, toluene, ethylbenzene, and xylene (BTEX), petroleum hydrocarbon fractions F1 – F4 and F1 – F2, respectively.
- Samples were compared against *Risk Management Guidelines for Petroleum Storage Tank Sites* (Alberta Environment, 2001).
- All of the samples collected met criteria for the tested parameters. No further recommendations were made.

North Side Fas Gas Service Station – 5640 – 50 Avenue, Lloydminster, Alberta

The most recent document pertaining to this property was a Groundwater and Subsurface Vapour Monitoring program completed by Stantec Consulting Ltd. (Stantec; report dated 3 February 2010). The report provided the following information:

- Eleven (11) assessments/monitoring events were historically completed by Jacques Whitford Environmental Limited (JWEL) and Jacques Whitford AXYS Ltd. (JWA) beginning with the removal of USTs at the property in 2000 to a Spring 2009 Groundwater Monitoring/Sampling Program.
- The Stantec program consisted of purging and sampling two (2) onsite vapour wells and 12 groundwater monitoring wells.
- Gas samples were collected and submitted for analytical chemistry testing for BTEX and petroleum hydrocarbons (PHC).
- Groundwater samples were collected and submitted for analytical chemistry testing for BTEX, F1 – F2.
- The program identified continued PHC impacts to the groundwater on the property near the building and pump islands.

- Hydrophobic and oxygen release compound (ORC) socks were installed in Spring 2009 at monitoring well locations to enhance bioremediation.
- Stantec recommended delineation of the zone of impacted soil and groundwater followed by the development of a remedial action plan (RAP) to eliminate contaminant sources and reduce PHC concentrations. No other recommendations were made.

No other records were found within the specified search parameters. A copy of the AER search is provided in Appendix B.

The potential for environmental impact to the Site from the records identified above is discussed in Section 10 “Summary of Findings and Discussion”.

6.6 NATIONAL POLLUTANT RELEASE INVENTORY

The National Pollutant Release Inventory (NPRI) database was searched for information relating to substance releases. The NPRI is Canada’s legislated, publicly accessible inventory of pollutant releases (to air, water, and land), disposals, and transfers for recycling. The search was limited to the Site and adjacent LSDs (within 300 m of the Site).

The search did not reveal records of substance releases within the specified search parameters.

A copy of the NPRI search is provided in Appendix B.

6.7 WATER WELLS

The Saskatchewan Water Security Agency *Online Driller Reports* database was reviewed to obtain information regarding water wells that may be present on the Site and surrounding lands within approximately 400 m of the Site boundary.

A total of 43 water wells were found within the specified search parameters.

A copy of the search results is provided in Appendix B.

6.8 CANADIAN LEGAL INFORMATION INSTITUTE

The Canadian Legal Information Institute (Canlii) is a non-profit organization that was created by the Canadian Federation of Law Societies that provides access to legal cases, legislation, and documents, and spans multiple legal databases.

A search of the Canlii database was completed to find cases or documents relating to the current or previous owners of the Site under the context of the Alberta Environmental Protection and Enhancement Act (EPEA).

The search did not reveal any records within the specified search parameters. A copy of the search results is provided in Appendix B.

7.0 CORRESPONDENCE WITH GOVERNMENT AGENCIES

SolidEarth initiated correspondence with government agencies/officials to gather information about the history and operation of the site. A summary of this task is provided below.

A copy of the correspondence received is presented in Appendix B.

7.1 SASKATCHEWAN MINISTRY OF ENVIRONMENT (SKMOE)

The Government of Saskatchewan - Ministry of Environment, Environmental Protection Division was contacted under the Freedom of Information and Protection of Privacy Act for available information relating to environmental incidents, spills, soil and groundwater contamination, enforcement orders, prosecutions, and bulk storage tank records at the Site.

The search identified the following records:

Report ID 2015-04-30OT114518 - Incident on 30 April 2015

The incident involved the discharge of 250 grams of fluorescein (green dye) into stormwater management system. The impacted location includes 67 Street and the Legion ball diamond. It was understood that the fluorescein fluorescent compound dissipated overtime. No other records were found in relation to this incident.

Report ID 2015-09-26T092301 - Crude Oil Discharge on 26 September 2015

The incident involved the release of 100 L of crude from a tank trailer near a COL water fill station (near 49 Avenue and 57 Street; exact location unknown). It was indicated that the spill was cleaned up with spill pads and vacuum truck and stained surficial gravel was removed and disposed.

Environmental Investigation - UST Removal and Excavation Monitoring - Former COL Shop - 5905 49 Avenue by HBT AGRA Limited (HBT) - 23 December 1993 - Project no. AE03463

Two USTs (1,000 and 250 gallons) were removed from the former COL Public Works Shop sometime prior to 2 November 1993. The following information was provided:

- The 250-gallon tank was located directly north of the northwest building corner. The 1,000-gallon tank was located directly south of the central portion of the building.
- HBT monitored excavations on 2 and 3 November 1993 (USTs had already been removed but the exact date was not provided).
- Samples collected from the walls and bases of both excavations.

- Criteria used at the time are *Decommissioning of Petroleum Storage Facilities - Saskatchewan Environment and Public Safety* (Draft 1990).
- All samples met criteria with the exception of one sample collected from the north excavation, where total petroleum hydrocarbons (TPH) were measured at 310 mg/kg and exceeded Level 1 criteria (TPH Level 1 criteria is 40 mg/kg).
- No other recommendations were provided.

Discharge ID 2016-02-03T171057 - 3 February 2016

The incident involved two frac-outs that occurred in the northeast corner of NW ¼ 12-50-28-W3M during the horizontal drilling of a Husky Oil Operations Limited pipeline. The following information was provided:

- The first incident occurred on 3 February 2016 and involved the release of freshwater gel that impacted an approximate area of 10m².
- The second incident occurred on 4 February 2016 and also involved the release of freshwater gel.
- Summit Liability Solutions (Summit) conducted sampling on 11 February 2016 and collected two (2) confirmatory samples from the release area and two (2) control samples from the nearby agricultural area.
- Confirmatory soil samples met *Saskatchewan Upstream Sites Remediation Guidelines* (SPIGEC4, 2009).
- No further actions were recommended.

Discharge ID 2017-02-14T142502 – 14 February 2017

The incident involved the release of 2m³ of crude oil from a tank trailer into the ditch on the south side of 67 Street, directly south of the COL WWTF.

- This record was identified by SKMOE as well as through the Saskatchewan Upstream Oil and Gas Spill Database (see incident #18856 in Section 6.4 “Saskatchewan Upstream Oil and Gas Spill Database”).
- It was indicated that the spill was cleaned up under supervision of COL staff and post cleanup soil and groundwater sampling was conducted by X-Terra.
- Impacted soils were removed on 14 and 16 February 2017 (approximately 41 tonnes of soil removed) and confirmatory soil samples were submitted for analytical chemistry testing for BTEX, F1 - F4 and met the chosen Alberta Tier 1 Soil and Groundwater Remediation Guidelines (AB Tier 1 Guidelines) (February 2016).
- Surface water samples were collected from the drainage channel both upstream and downstream of the release point and were submitted for PHCs. It was indicated that the concentration of PHCs were below the analytical method detection limits. The direction of water flow in the drainage channel was indicated to have been to the north.
- No further action was recommended.

Discharge ID 2017-06-1010T141549 – Discharge at COL WWTF on 10 June 2017

The incident involved the discharge of treated effluent sewage water from the COL WWTF lagoons due to excessive rainfall. No other relevant information (i.e. quantity of release and precise location of release) was provided in the record.

The correspondence received indicated that the search has identified no records of such concerns.

The potential for environmental impact to the Site from the records identified above is discussed in Section 10 “Summary of Findings and Discussion”.

7.2 CITY OF LLOYDMINSTER

The City of Lloydminster was contacted for available records regarding development permits, bylaw infractions, or any environmental-related incidents pertaining to the Site. The COL records identified the following:

Previous ESAs Completed along Highway 17/50 Avenue

Phase I ESA - 47 to 62 Street along HWY 17 (50 Avenue) and 49 Avenue - Thurber Engineering - 11 March 2011 - File No. 19-598-352

The Phase I ESA identified the following items of potential concern:

- Presence of two service stations west of 50 Avenue west service road
- City of Lloydminster Public Works Yard
- ATCO Electric Ltd. substation
- Husky Oil pipeline south of 60 Street and north of 57 Street
- Former Lloydminster airport hangars
- Former water treatment plant and sewage lagoons
- L & L Oilfield and Sandstone Centre Truck Wash

The Phase I ESA recommended a soil/groundwater investigation program to confirm the presence of contamination from the mentioned items.

Geotechnical Investigation - HWY 17 Couplet - Thurber Engineering - 29 April 2011 - File No. 19-598-353

Fourteen (14) boreholes were drilled between 55 Street and 62 Street along 50 Avenue - no signs of impact were noted in any of the borehole logs.

Phase II ESA - HWY 17 Couplet - Thurber Engineering - 35 to 44 ST and 57 to 62 ST – 30 September 2011 - File No. 19-598-367

The Phase II ESA provided the following information:

- Twelve (12) test holes were advanced between 57 and 62 Street.
- Soil samples were collected and Submitted for BTEX, F1 - F4, metals, salinity, and polychlorinated biphenyls (PCB).
- All soil samples met CCME 2008 criteria for PHCs.
- All samples met CCME 2011 Canadian Environmental Quality Guidelines (CEQG) and 2010 AB Tier 1 Guidelines for a commercial land use setting for BTEX, F1 - F4, metals, and PCBs.
- Two (2) soil samples from TH11-7 did not meet CCME 2011 CEQG for electrical conductivity. These samples were collected from 2.25 and 3 mbgs from area of 5709 – 50 Avenue (Lot SE, Block Sec10, PlanT50-R28-W3).

Previous ESAs Completed at Former COL Public Works Shop and Yard

Building Hazardous Materials Report - Former COL Public Works Yard - COL (5905 – 49 Avenue) Lloydminster, Saskatchewan - EcoVision Consulting Group Inc (EcoVision). 8 December 2014 - Project No. 2014169

The report identified the following items in relation to the former COL Public Works Shop building:

- No asbestos-containing materials (ACM) were identified in collected samples.
- Lead samples collected fell below regulatory limits and did not require abatement.
- PCB-containing light ballasts were found.
- Suspected mercury containing materials (fluorescent light bulbs, thermostats) were found. The report recommended that suspected mercury-containing equipment be disposed of or recycled.
- Radioactive components were not identified in the building.
- No urea foam formaldehyde insulation (UFFI) was present.
- Mould was observed in the building. The report recommended that the extent of mould growth be assessed prior to sale, renovation, or demolition.
- ODS containing equipment were noted in the building. The report recommended that ODS equipment be handled, recycled, and disposed.
- Waste oil remained in the hydraulic hoist in the building and would need to be removed.

Phase I ESA - 5905 - 49 Avenue - EcoVision - 15 December 2014 - Project No. 2014170

The Phase I ESA identified the following items of potential concern:

- Former USTs removed between 1988 and 1990 due to leakage (actual date of removal was prior to November 1993 as reported in Section 7.1 “Saskatchewan Ministry of Environment SKMOE”).
- Fueling area consisting of a pump island and ASTs in the yard to the south of the building.
- Ground staining was identified throughout the yard.
- Contaminants were identified in the floor drain of the main garage bay adjacent to the main gate.
- An in-floor hydraulic lift remained in the main garage bay with oil still present.
- ODS and mercury containing equipment were identified in the building.

The Phase I ESA recommended a Phase II ESA to investigate some of the above items.

Phase II ESA - 5905 50 Avenue - Ecovision - 15 April 2015 - Project No. 2015016

The Phase II ESA consisted of drilling seven (7) boreholes, installed seven (7) groundwater monitoring wells, and advancing 13 test pits. The following information was identified:

- Twenty-two (22) soil samples were collected and submitted for analytical testing for salinity.
- Twenty-three (23) soil samples were collected and submitted for analytical testing for BTEX, F1 - F4.
- Eight (8) groundwater samples were collected and submitted for analytical testing for BTEX, F1 - F2, dissolved metals, total and fecal coliforms, CCME routine water chemistry, biochemical oxygen demand (BOD), chemical oxygen demand (COD), and dissolved organic carbon (DOC).
- Soil PHC impacts were detected in the northwest portion of yard by the shop building and in the eastern yard. Soil impact summary:
 - High concentrations of benzene were detected in BH6 at 4 mbgs (by former pump island).
 - High concentrations of F2 and F3 were detected in TPD-01 at 0.5 mbgs (north of BH6 in the northwest corner of the yard).
 - High concentrations of F3 were detected in GS-1 (taken from the eastern yard).
- Groundwater impact summary:
 - benzene and ethylbenzene concentrations exceeded criteria in MW06 by pump island.
 - Total coliforms exceeded criteria by MW03, which was located northeast of the yard.
 - Manganese, selenium, and uranium concentrations were above criteria in all groundwater samples.
 - Boron and copper concentrations were above criteria in MW01.
 - Cadmium concentrations were above criteria in MW02 and 03.

- Copper concentrations were above criteria in MW07.
- All samples exceeded sulphate, sodium, manganese, TDS.

Conclusions:

- Onsite surficial and deeper PHC, chloride, and nitrate impacts were identified.
- Offsite chloride and nitrate impacts were identified to the east of the yard (downgradient).

Site Remediation Plan - 5905 - 49 Avenue - EcoVision - 9 May 2015 - Project No. 2015083

A Remediation Plan (RP) was prepared by EcoVision and presented the following recommendations:

- Excavation and disposal of impacted soils in the storage yard. Impacted soils were expected to range from 1 to 2 mbgs with an estimated volume of 100 to 200 m³.
- Installation of a retention pond with site grading to minimize offsite contaminated runoff as well as the installation of an additional groundwater monitoring well downstream of the retention pond.
- Completing biannual monitoring of the groundwater monitoring wells and testing for potability and salinity.
- Completion of a closure report following remedial activities.

Borrow Evaluation Near 40 Avenue and 52 Street – Hardy BBT Limited Project No. AX03198 – 11 October 1989

A borrow evaluation was completed by Hardy BBT Limited and involved the excavation of three (3) test pits in NW1/4 1-50-28 W3M. No signs of impacted soil were noted in the report.

Development Permits at the Site

The COL records also identified development permit applications and issued permits for residential, commercial, and public utility developments within NW ¼ 11, NW ¼ 12, SW ¼ 11, and SW ¼ 12 of 50-28 W3M. No items of concern were identified.

The potential for environmental impact to the Site from the above items identified in the COL records is discussed in Section 10 “Summary of Findings and Discussions”.

8.0 SITE VISIT

SolidEarth Environmental Technologists conducted a visual inspection of the site on 30 July 2020. Observations made are summarized below. Photographs taken during the Site visit are presented in Appendix C.

8.1 SITE STRUCTURES

At the time of the visit, multiple structures were noted throughout the Site and are summarized below:

LSD 3, 4, 5, and 6 of 1-50-28 W3M and Vacant Lot at 5709 – 50 Avenue

The former COL Public Works Shop and Yard was observed in LSD 4-11-50-28 W3M and the former COL WTP building was observed at 5709 – 50 Avenue, Lloydminster, Saskatchewan.

Summary of observations made in former COL Public Works Shop:

- The former COL Public Works Shop was located on the east side of 49 Avenue.
- The building was industrial in nature and consisted of a central two-storey office area with two attached industrial wings to the south and east.
- The building was constructed on top of a concrete slab.
- The building was connected to water, electricity, and natural gas utilities.
- Heating was provided by a natural gas-powered forced air furnace in the office and garage bays. Radiative pipes and suspended heaters were also identified in the garage bays.
- The building contained 12 garage bays. The south bays were generally empty; however, tools and equipment were stored in the east bays including furniture, minor debris, wooden pallets, metal racks, empty drums, industrial and construction related tools, tarps, and vehicle wash fluids, as well as other miscellaneous items.
- Oil dispensers were situated in the eastern wing. They did not appear to be connected to any ASTs at the time.
- The concrete floor of the garage bays was stained; however, no major signs of damage (i.e. large cracks) were observed. Dirt and debris were observed on the floors throughout the building.
- No major signs of damage were observed to the building walls or floors.

Summary of observations made at sheds to the east of the former COL Public Works Shop:

- A green shed with a white garage door was located directly to the east of the shop. The shed was closed at the time of the visit.
- A long open storage shed was located to the east of the green shed. The south side of the shed was open and it was empty at the time of the visit.
- No signs of concern were noted near either shed.

Summary of observations at former COL WTP building:

- The building exterior was grey, black, and orange and it was two-stories high.
- No signs of damage were observed to the building exterior.
- The interior of the building was not available for observation.
- No signs of concern were noted around the building exterior.

NW ¼ 11-50-28 W3M

The new COL WTP and associated buildings were noted on the north end of the quarter section in the northwest corner of the Site. The COL WTP buildings were protected by a chain-link fence that also prevented access to the buildings. No observations were made.

A number of abandoned houses were noted in a fenced area directly southwest of the COL WTP cell.

- Access to this area was via an access road from 50 Avenue to the west. The area was protected by a gated, chain-link fence.
- The houses were vacant and appeared to be in a state of disrepair; direct observations of their interiors were not made.
- Junk cars, two Sea-can containers, and various articles of furniture were noted in the northwest corner of the area.
- No major signs of concern were noted.

SE ¼ 11-50-28 W3M

A rural residential property was noted at the north end of the quarter section in a central portion of the Site. A residence along with storage sheds and grain silos were noted from the property's access road. No major signs of concern were noted.

SW ¼ 12-50-28 W3M

A paintball business "Gopher Hill Paintball" was noted on the west side of SW ¼ 12-50-28 W3M in the east central portion of the Site. The business property was protected by a gated fence and observations were made from 40 Avenue.

- The area appeared to be largely grassed and tree covered.
- Green Sea-can containers were assembled at the entrance.
- Picnic benches and lawnmowers were noted.

- No major signs of concern were noted.

No other major structures were noted on the Site.

The potential for environmental impact to the Site from the above items identified is discussed in Section 10 “Summary of Findings and Discussions”.

8.2 SITE APPEARANCE

LSD 3, 5, and 6 of 11-50-28 W3M

- LSD 3 appeared to consist of agricultural cropland as observed from east of the former COL Public Works Yard. Direct access to the LSD was not possible at the time. No major signs of concern were noted.
- LSD 4 contained the former COL Public Works Shop and Yard in the northern half and the Lloydminster Agricultural Exhibition grounds in the southern half (excluded from this Phase I ESA).
 - The former Public Works Yard was divided into western and eastern portions separated by a chain-link fence.
 - The western yard was largely empty at the time of the visit and was gravel covered. Some invasive vegetation growth was noted in the south portion of the western yard.
 - A concrete wash pad was noted near the yard entrance along with a square catch basin. The wash pad was partly covered in sediment at the time of the visit. No stains or odours were noted.
 - A storage area with concrete blocks along the north, and south walls was noted on the east side of the western yard. It was empty at the time of the visit and no stains or odours were noted.
 - A concrete pad was noted on the eastern side of the western yard and appeared to have been formerly used for a tarped storage area (i.e. Quonset). A portion of the pad was covered with coarse uniform gravel with minor invasive vegetation growth. No stains or odours were noted.
 - A concrete pad was noted to the south of the shop and was connected to underground electricity. The pad appeared to be the location of former fuel pumps. None of the former fueling infrastructure remained other than yellow safety barriers and an aboveground electrical outlet.
 - Groundwater monitoring wells with red metal stickup casing were noted in the yard.

- The eastern yard was generally empty with the exception of concrete blocks stored at the southeast corner.
- The eastern yard was gravel covered and no stains, discolorations, or odours were noted.

SE ¼ 11, NW ¼ 12, SW ¼ 12, and NW ¼ 1 of 50-28 W3M

- These portions of the Site appeared to consist almost entirely of agricultural cropland with minor interspersed tree stands and low-lying sloughs. At the time of the visit, these portions of the Site were planted with canola and wheat.
- No major signs of concern including disturbances, spillage, staining, discolorations, patchy vegetation, or odours were noted.

NW ¼ 11-50-28 W3M

- The central portion of contained a low-lying slough.
- The southern half and northeast corner consisted of agricultural pastureland.
- The northwest portion was largely occupied by the COL WTP which was inaccessible.
- No major signs of concern including disturbances, spillage, staining, discolorations, patchy vegetation, or odours were noted.

Block A, Plan 102084409

- This parcel was situated to the west of NW ¼ 11-50-28 W3M and was facing 50 Avenue and 67 Street.
- The parcel was part of the highway corridor and contained a drainage channel that flowed northwards.
- No major signs of concern were noted.

5709 – 50 Avenue

- This parcel was situated to the west of LSD 4-11-50-28 W3M and was between 49 and 50 Avenue.
- The parcel was generally flat and contained the former COL WTP building.
- The parcel was generally grass covered. The south portion of the parcel was gravel covered and was a former water fill station.
- No signs of concern were noted.

8.3 APPEARANCE OF SURROUNDING PROPERTIES

The lands adjacent to the Site were visually inspected from the perimeter of the Site to identify evidence of environmental contamination in the form of soil disturbance, waste storage/spillage, staining or discoloration of soils and hazardous or chemical materials. A summary of observations of the surrounding properties is provided in Table 4 below.

Table 4: Observations of Surrounding Land

Direction	Observations
North	<ul style="list-style-type: none"> The Site was bound to the north by 67 Street followed by agricultural cropland. Diamond 7 Meats was situated north of the northwest portion of the Site along with a residence several hundred metres due east. An oil and gas lease was situated approximately 100 m north of NW ¼ 11-50-28 W3M. Large black storage tanks were noted on the lease. The COL Landfill and WWTF was situated north of the northeast portion of the Site. No signs of staining, discolorations, or odours were detected from the northern Site boundary.
East	<ul style="list-style-type: none"> The land to the east consisted of agricultural cropland. A Husky Oil Operations Limited lease was observed approximately 40 to 50 m east of the southeast portion of the Site. The land around the lease was gravel covered and generally flat. No signs of staining, discolorations, or odours were detected. In general, no signs of concern were noted.

South	<ul style="list-style-type: none"> • The lands to the south consisted of a mix of industrial, commercial, and recreational lands. • The land to the south of the southwest portion of the Site consisted of the Lloydminster Agricultural Exhibition grounds. <ul style="list-style-type: none"> ◦ The grounds contained multiple shop-type buildings as well as a larger rectangular building further south. The grounds were downgradient of the former COL Public Works Yard and were protected by a chain-link fence. ◦ The land around the shops/garages was used for storing various equipment including Sea-can containers, metal racks, bricks, waste bins, pallets, cattle fencing and chutes, and straw piles. ◦ No signs of concern were noted. • The land to the south of the central portion consisted of the Lloydminster Golf and Curling Club. The land was partly grass-covered and partly treed. No signs of concern were noted. • The lands to the south of the southeast portion of the Site consisted of commercial/industrial properties with large shops and storage yards. <ul style="list-style-type: none"> ◦ Direct observation of the properties from the south side of the Site was not possible due to the topography and the presence of the rail ROW. ◦ The property south of the southwest corner of NW ¼ 1-50-28 W3M was a Peterbilt truck dealership. The yard was filled with transport trucks along the perimeter. ◦ No signs of concern were noted.
West	<ul style="list-style-type: none"> • The properties to the west were generally commercial/industrial in nature. • The properties to the west of the northwest portion consisted of (from north to south): <ul style="list-style-type: none"> ◦ Foremost ◦ Bottle Depot ◦ TEK Mechanical Ltd. ◦ RL Electric Motor Rewinding Ltd. ◦ Feldspar ◦ South Ridge Playschool. • Industrial businesses were also situated west of the Site, along the east side of 50 Avenue. They included: <ul style="list-style-type: none"> ◦ Sandstone Centre Truck Wash ◦ Messer Canada Inc. ◦ Paladin Security ◦ Double Edge Rentals ◦ Vertex ◦ Apex Distribution Inc. ◦ L & L Oilfield Construction ◦ Kichton Contracting Ltd. ◦ Lloydminster Source

	<ul style="list-style-type: none"> ○ Reid Design ○ Relay Distributing ○ AGAT Laboratories ○ STRAND • The Sandstone Centre was directly adjacent to the western Site boundary. <ul style="list-style-type: none"> ○ The property contained a large industrial building surrounded by a gravel yard to the south, east, and north. ○ Transport trucks were parked in the eastern portion of the yard. ○ No signs of staining, discolorations, or odours were noted. • The L & L Oilfield yard was directly adjacent to the western Site boundary. <ul style="list-style-type: none"> ○ The yard was gravel covered and protected with a chain-link fence. ○ The yard contained Sea-can containers, pipe racks, and other equipment. • No stains, discolorations, or odours were noted. • The Kichton Contracting Ltd. property was directly adjacent to the western Site boundary. A white AST and multiple chemical storage bins were noted in the Kichton Contracting Ltd. yard along the southern and eastern perimeters. <ul style="list-style-type: none"> ○ The AST did not appear to be in used and no signs of damage, staining, or odours were detected. • The chemical bins (possibly vehicle oil) were placed on wooden pallets. No staining, discolorations, or signs of spillage were noted. • The industrial property operated by Reid Design, STRAD, AGAT Laboratories, and Lloydminster Sources was directly west of the Site and was situated between 49 and 50 Avenue. <ul style="list-style-type: none"> ○ The property contained a large industrial building with multiple garage bays surrounded by a gravel yard. ○ The yard contained numerous plastic objects of an unknown purpose stacked along the eastern property boundary. ○ A transformer was noted along the eastern property boundary. • The lands to the west of the Site on the western side of 50 Avenue included: <ul style="list-style-type: none"> ○ North Border Husky and Car Wash ○ Precision Contractors ○ Country Quilts and Stitches
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The potential for environmental impact to the Site from the oil and gas leases, AST, and chemical bins in Kichton yard is discussed in Section 10 “Summary of Findings and Discussions”.

8.4 BULK STORAGE TANKS

No bulk storage tanks were observed during the Site visit.

8.5 CHEMICAL STORAGE AND HANDLING

No major chemical storage and handling was identified during the Site visit.

8.6 WASTE HANDLING AND DISPOSAL

No waste handling and disposal were noted during the Site visit.

8.7 HYDRAULIC HOISTS AND ELEVATORS

An underground hydraulic hoist was observed in the former COL Public Works Shop. The hoist was located in the floor in the east wing of the shop portion of the building.

The potential for environmental impact to the Site from the underground hydraulic hoist identified above is discussed in Section 10 “Summary of Findings and Discussions”.

8.8 SUMPS AND DRAINS

Drains were noted inside the former COL Public Works Shop building. The drains were noted in the south and east wings. Due to metal covers, the interiors of the drains were not directly observed.

Two large sumps were noted in the wash bay (bay #12), located at the east end of the east wing. The sumps were covered with metal grates and were filled with sediment. No liquids or odours were detected. No major signs of damage to the sump walls were observed.

The potential for environmental impact to the Site from the sumps and drains identified above is discussed in Section 10 “Summary of Findings and Discussions”.

8.9 HAZARDOUS MATERIALS AND EQUIPMENT

No hazardous or radioactive materials were observed during the Site visit.

8.10 SPECIAL ITEMS

Based on information contained in the Hazardous Building Materials report summarized in Section 7.2 “City of Lloydminster”, the following hazardous materials were suspected or confirmed:

- PCBs (confirmed)
- Mould (confirmed)
- Mercury-containing materials (suspected)

- ODS (confirmed)

The report also indicated that ACM, lead-based paints (LBP), and UFFI were not present in the building (ACM and LBP were verified as not present through sampling and testing of building materials by EcoVision).

No major odour, noise, or vibration concerns were noted during the Site visit.

Herbicide or pesticide usage was suspected within the agricultural portions of the Site during the visit.

Radon is a tasteless, odourless, invisible gas that could be associated with building materials or native/fill soils. Specialized equipment is generally required for its detection. It is not known if a radon survey had been undertaken at this Site.

The potential for environmental impact to the Site from mould, PCB-containing ballasts, mercury-containing materials, and ODS is discussed in Section 10 “Summary of Findings and Discussions”.

8.11 OTHER ITEMS

No other items of significance were observed.

9.0 INTERVIEWS

SolidEarth conducts interviews with individuals familiar with the history and operation of the Site to seek information of any environmental concern associated with the Site of which they are aware.

A brief in-person interview was conducted with Mr. Nick Dunstan with COL regarding the former COL Public Works Shop and Yard. The interview revealed the following:

- The shop building had been infested with mice and posed a human health hazard due to the presence of droppings throughout.
- The shop building was historically used for storing pipe and utility repair related work.
- No major renovations were undertaken.
- The green shed to the east of the shop was used for storing traffic signs.
- The Quonset on the east side of the western yard was used for seasonal storage.
- No waste incineration was historically conducted on the property.
- The concrete storage pad on the east side of the western yard was used for storing aggregates.

- The concrete pad on the west side of the western yard (near the access gate) was used for washing street sweeping vehicles.
- Road salts were historically stored in the eastern yard.

No other information was provided.

Email correspondence with Mr. Anthony Andre with the COL identified the following:

- The area protected with a chain-link fence and containing what appeared to be old residential homes in disrepair (identified during the Site visit to the south of the existing COL WTP, see Section 8.0 “Site Visit”) was operated by the Fire Department as a fire training facility. The Fire Department would no longer be using this property for training purposes as of the end of August 2020.
- No remediation or additional investigations have been undertaken at the former COL Public Works Shop and Yard since the most recent assessment completed by EcoVision in May 2015.

The potential for environmental impact to the Site from items identified above is discussed in Section 10 “Summary of Findings and Discussions”.

10.0 SUMMARY OF FINDINGS AND DISCUSSIONS

There were no findings associated with the following issues:

- Asbestos Containing Materials
- Lead and Lead-Based Paint
- Urea Formaldehyde Foam insulation
- Nuisance, odours, vibrations, and noise
- Air and water emissions
- Radon
- Groundwater wells
- Pipelines, oil and gas installations, and spills
- Chemical storage and handling
- Hazardous materials and equipment
- Waste handling and disposal

Findings associated with the current/historical operation of the Site and surrounding properties are noted below. The locations of areas of potential concern that were considered to pose a moderate to high risk of environmental impact to the Site are shown on Figure 9.

Historical Operations Site

Remaining Items of Concern Identified at the Public Works Shop and Yard

Records provided by the COL identified previous ESAs that were completed by EcoVision at the COL Public Works Shop and Yard.

- Items of concern identified in the yard included the historical presence of USTs (removed at some time before November 1993), fueling area with ASTs, and ground staining.
- Items identified inside the building included contaminants in the building floor drains, an in-floor hydraulic lift (with waste oil still in place), ODS and mercury containing equipment, mould, and PCB containing light ballasts.
- The Phase II ESA completed in April 2015 identified onsite PHC, chloride, and nitrate impacts as well as offsite chloride and nitrate impacts to the northeast and downgradient of the yard.

EcoVision prepared a Site Remediation Plan in May 2015 that recommended excavation and disposal of impacted soils in the yard and installation of a retention pond to minimize offsite runoff. Based on the available information as of the issuance of this report, remediation of the site as per these recommendations has not been completed and the environmental health of the Site remains impacted.

In-floor Hydraulic Lift in COL Public Works Shop

An in-floor hydraulic lift was identified by EcoVision in 2014 and by SolidEarth during the current Phase I ESA. Hydraulic lifts operate using hydraulic fluids, the composition of which can vary between petroleum hydrocarbons, water, mineral oils, and phosphate esters. As such, the environmental impact posed by hydraulic lift systems is partly based on the properties of the fluids in use such as their toxicity and biodegradability. It is also based on the condition of the in-ground containment and whether any leaks or malfunctions have occurred in the past.

Given the age of the portion of the building where the sump was located (constructed at some time between 1956 and 1975), it was suspected that the fluids within these lifts would have likely been hydrocarbon based. As such, the potential risk of environmental impact to the soil and groundwater in the vicinity of the hoist was considered high.

Fire Department Training Grounds

Email correspondence with COL identified a Fire Department training area located south of the existing COL WTP. The access road leading to this area was located on the east side of 55 Avenue approximately 500 m south of 67 Street.

Fire fighting training activities in the past may have involved the usage of fire fighting foams that contain chemicals that pose an impact to human and environmental health. Key compounds of concern that are associated with fire fighting foams are Perfluoro-alkylated substances (PFAS), which are known to pose a human and environmental health hazard. In 2008 Canada prohibited the use, sale, and import of Perfluoro-octane sulfonic acid (PFOS – a specific type of PFAS) or PFOS-containing products with exceptions for products used in fire fighting and the military as well as some ink and photo media use.

Based on this information, the potential for environmental impact to the Site was considered high.

Spill Incidents from Oil and Gas Infrastructure and Other Miscellaneous Events

A review of records provided by the SaskSpills Database, Saskatchewan Upstream Oil and Gas Spill Database, Saskatchewan Ministry of Environment, and COL identified 12 spill incidents that have occurred on the Site. A summary of the incidents in chronological order is provided below:

- Incident #4707 on 8 June 1998 involving the release of 44 m³ of oil from a Husky Oil Operations Pipeline in LSD 6-11-50-28 W3M. It was reported that 42 m³ was recovered and reclamation was completed. Based on the date of occurrence and information provided in the record indicating the spill was remediated/reclaimed, the potential for environmental impact to the corresponding portion of the Site was considered low.
- A spill occurred on 24 May 2002 (incident #2002-0112) in NW ¼ 12-50-28 W3M (northeast portion of the Site) and involved the release of 30,000 L of crude oil. No other relevant information was provided in this record, including involved parties or remediation status. Based on this information, the potential for environmental impact to the corresponding portion of the Site was expected to be high.
- Incident #7554 on 25 May 2002 involving the release of 40 m³ of oil from a Canadian Natural Resources Limited (CNRL) pipeline in LSD 14-12-50-28 W3M (northeast portion of the Site). No recovery data was reported, but reclamation was indicated to have been completed. No other records regarding this spill were found. Based on this information, the potential for environmental impact to the corresponding portion of the Site was considered moderate.
- Incident #12155 on 24 June 2008 involving the release of 0.17 m³ of crude oil and water from a Husky Oil Operations Limited pipeline in LSD 11-1-50-28 W3M. No recovery data

was provided, but reclamation was indicated to have been completed. Based on the relatively small quantity released and the reclamation status, the potential for environmental impact to the corresponding portion of the Site was considered low.

- Discharge ID 2015-04-30OT114518 occurring on 30 April 2015 and involving the release of 250 grams of fluorescein into the local stormwater management system and migrating to the outflow ducts located near the Legion ball diamond. It was further understood that fluorescein is widely used in applications involving the tracing of water sources and is generally not considered hazardous. Based on this information, the potential for environmental impact to the corresponding portion of the Site was considered low.
- Discharge ID 2015-09-26T092301 occurring on 26 September 2015 and involving the release of 100 L of crude from a tank trailer near a COL water fill station (near 49 Avenue and 57 Street, the exact location was not provided). It was indicated that the spill was cleaned up using spill pads and vacuum truck and the stained surficial gravel was removed and disposed. Based on the information provided indicating that the spill was cleaned up and affected soils were removed, the potential for environmental impact to the corresponding portion of the Site was considered low.
- Discharge ID 2016-02-03T171057 occurring on 3 February 2016 and involving two frac-outs that occurred in the northeast corner of NW ¼ 12-50-28-W3M during the horizontal drilling of a Husky Oil Operations Limited pipeline. Summit conducted sampling on 11 February 2016 and collected two (2) confirmatory samples from the release area and two (2) control samples from the nearby agricultural area. Confirmatory soil samples met SPIGEC4, 2009 criteria. No further actions were recommended by Summit. Based on this information, the potential for environmental impact to the corresponding portion of the Site was considered low.
- Incident #18856 (SKMOE discharge ID 2017-02-14T142502) on 14 February 2017 involving the release of 2 m³ of oil in LSD 14-12-50-28 W3M. The release occurred from a tank trailer into the ditch on the south side of 67 Street, directly south of the COL WWTF. Post spill activities involved excavation and removal of impacted soils (approximately 41 tonnes of soil were removed). Confirmatory soil and surface water sampling conducted by X-Terra indicated that concentrations of BTEX, F1 – F4, and PHCs were below AB Tier 1 Guidelines and no further remedial actions were recommended by X-Terra. Based on this information, the potential for environmental impact to the corresponding portion of the Site was considered low.

Herbicide Usage on Agricultural Portions of Site

The usage of herbicides on agricultural cropland is common practice in the area and its usage was suspected onsite. Herbicides are generally considered safe when used in accordance with manufacturer prescribed dosages and application rates. Based on this information, the potential for environmental impact to the Site from suspected herbicide usage was expected to be low.

Historical Operation of Surrounding Properties

Spill Incidents from Oil and Gas Infrastructure and Other Miscellaneous Events

- Incident #19971119 on 19 November 1997 involving the release of 26 m³ of oil from a tank in LSD 16-11-50-28 W3M (east of NW ¼ 11-50-28 W3M and west of NW ¼ 12-50-28 W3M). The incident occurred on infrastructure listed to Lash Oil Company Ltd. and it was reported that 10 m³ of the material was recovered using vacuum truck. No other information was provided. Based on the available records, the potential for environmental impact to the northwest portion of NW ¼ 12-50-28 W3M, which is the portion of the Site closest to the incident release location, was considered moderate.
- Incident #1460 on 8 September 1993 on a well lease listed to Koch Exploration Canada ULC in LSD 3-14-50-28 W3M. It was reported that 5 m³ of oil was released, all of which was recovered, and reclamation was completed. Based on this information, the potential for environmental impact to the north portion of the Site (NW ¼ 11-50-28 W3M and NW ¼ 12-50-28 W3M) was considered low.
- Incident #6339 on 19 October 2000 involving the release of 29 m³ of water and 1 m³ of oil on a CNRL well lease on LSD 1-14-50-28 W3M. It was reported that 5.5 m³ of material was recovered and reclamation was completed. Based on the nature of the material released, its distance from the Site, and completed reclamation, the potential for environmental impact to the north portion of the Site (NW ¼ 11-50-28 W3M and NW ¼ 12-50-28 W3M) was considered low.
- Incident #10537 on 25 August 2006 involving the release of 0.703 m³ of unspecified fluid, which was completely recovered. The incident occurred in connection with a Husky Oil Operations Limited well lease in NE ¼ 1-50-28 W3M (east of the Site). Reclamation was reported to have been completed. Based on this information, the potential for environmental impact to the Site was considered low.
- Incident #13684 on 14 August 2010 involving the release of 100 m³ of unspecified fluid from a CNRL flow line in LSD 15-12-50-28 W3M (east of the northeast portion of the Site). Reclamation was reported to have been completed. Based on the volume of material spilled and lack of any other information, the potential for environmental impact to the northeast portion of the Site (east portion of NW ¼ 12-50-28 W3M) was considered moderate.
- Incident #14416 on 18 July 2011 involving the release of 3 m³ of oil from a facility listed to Emerge Oil & Gas Inc. in LSD 13-1-50-28 W3M (east of the southeast portion of the Site). All material released was reported as recovered and reclamation was completed. Based on this information, the potential for environmental impact to the Site was considered low.
- Incident #120368 occurred on 27 June 2012 at the Lloydminster Landfill in SW ¼ 13-50-28 W3M (north of the northeast portion of the Site) and involved the release of an unidentified contaminant. No other information was provided. Based on this information,

and the presence of the COL Landfill to the north, the potential for environmental impact to the northeast portion of the Site was considered moderate.

- Discharge ID 2017-06-1010T141549 occurring on 10 June 2017 and involving the discharge of treated effluent sewage water from the COL WWTF lagoon due to excessive rainfall. No other relevant information (i.e. quantity of release and precise location of release) was provided in the record. Based on the available information indicating that the material released was treated effluent and the distance of the lagoons from the Site (approximately 220 m), the potential for environmental impact to the corresponding portion of the Site was considered low.

Electrical Substation to the southwest of the former COL Public Works Shop

Based on the historical aerial photograph review, an electrical substation was identified to the southwest of the Site (2011 and 2020 aerial photographs). The substation would have been deployed at some time between 1988 and 2011.

Substations typically contain electrical transformers, which could potentially contain PCBs which are known to pose risks to environmental and human health. The use of PCBs in Canada was banned in 1971; however, equipment containing PCBs that was still in service has been allowed to remain in place until the end of service life.

Based on the date the substation was installed (sometime between 1988 and 2011), distance of the station from the Site, which is approximately 80 to 100 m from 5709 – 50 Avenue (southwest lot within the Site boundaries), and the limited mobility of PCBs due their hydrophobic nature, the potential for environmental impact to the southwest corner of the Site was considered low.

Railway Right-of-Way (ROW) South and West of NW ¼ 1-50-28 W3M

The typical activities at a railway involve the transport of cargo and materials. As such, the primary environmental concern with such activities would involve the spillage of hazardous materials (e.g. crude oil) during transport. The secondary environmental concern associated with the presence of a railway is the migration of polycyclic aromatic hydrocarbons (PAH) from creosote-coated railway ties.

No records of spillage in connection with the railway were found in the historical record review. Additionally, the railway was approximately 20 to 40 m from the southern and western boundaries of NW ¼ 1-50-28 W3M (southeast portion of the Site), which would make the migration of PAH to the Site relatively unlikely (significant PAH lateral migration from railway ties does not typically exceed several metres). Based on this information, the potential for environmental impact from the historical existence of the railway was considered low.

Industrial Properties to the West along 49 Avenue

Industrial operations were situated to the west of the Site and included Sandstone Centre (truck wash), Kichton Contracting Ltd. (construction contracting), and L & L Oilfield (oil and gas services). Kichton Contracting Ltd. and L & L Oilfield were located uphill of the western portion of the Site and surface runoff from was expected to flow to toward the Site. At the time of the visit, ASTs (fuel and chemicals/oil) were noted in the Kichton yard.

Based on these observations, the potential for environmental impact to the Site from these operations was considered low to moderate.

Impacted Sites to the West of 50 Avenue

A search of the Alberta ESAR database identified records of two impacted fuel station properties located at 5906 – 50 Avenue (Husky Fuel Station and Car Wash) and 5640 – 50 Avenue (North Side Fas Gas), Lloydminster, Alberta.

- At Husky Fuel Station and Car Wash, a Phase III ESA was completed by Dillon Consulting Ltd. in March 2003 and indicated that soil and groundwater samples met Alberta Environment (2001) guidelines for BTEX, F1 – F4. No further recommendations were made in the Phase III ESA.
- At North Side Fas Gas, a Groundwater and Subsurface Vapour Monitoring program completed by Stantec in February 2010 and identified PHC impacts to the groundwater near the onsite building and pump islands. Stantec recommended delineation of the zone of impacted soil and groundwater followed by the development of a remedial action plan (RAP) to eliminate contaminant sources and reduce PHC concentrations. No other recommendations were made.

Based on the distance of these two properties from the Site (approximately 150 to 200 m), the potential for environmental impact to the Site was considered low.

11.0 RECOMMENDATIONS

Based on the information provided in this report, the potential for environmental impact to specific portions of the Site was considered high. The impacted portions are identified below:

COL Public Works Shop and Yard

Information provided in the previous ESAs completed by EcoVision identified remaining PHC, chloride, and nitrate impacts in the COL Public Works Yard that have yet to be remediated. Items of concern were also identified inside the building including the in-floor hydraulic lift, contamination in the drains, and hazardous building materials.

Based on this information, the following recommendations are made with regard to the COL Public Works Shop and Yard:

- The remediation of the remaining impacted areas of the yard and implementation of the measures recommended by EcoVision.
- Appropriate safety procedures be implemented and followed prior to any renovation or demolition activities regarding the shop building, due to the confirmed presence of mould, mice infestation and droppings (potential viral hazard), PCB-containing ballasts, ODS, and mercury containing materials.
- A Phase II ESA is recommended to assess the potential for onsite impacts due to the presence of the in-floor hydraulic lift and contaminated drains. The Phase II ESA would consist of drilling boreholes inside the building in the vicinity of the hydraulic lift to assess the condition of nearby soil and groundwater.

Fire Fighting Training Grounds Located – Within a Portion of NW ¼ 11-50-28 W3M

A Phase II ESA is recommended to confirm the presence/absence of impacted soils and groundwater from the historical usage of the aforementioned property as a fire fighting training ground.

NW ¼ 12-50-28 W3M (Northeast Portion of the Site)

Two onsite and three offsite spill incidents were identified that create a potential for environmental impact to the northeast portion of the Site and as such, a Phase II ESA is recommended in order to confirm the presence/absence of PHC impacts in the northeast portion of the Site. The Phase II ESA would consist of drilling boreholes along the perimeter of the northeast portion of the Site to assess the condition of the soil and groundwater.

LSD 4 and 5 of 11-50-28 W3M (Western Portion of the Site)

The western portion of the Site was adjacent to industrial properties that were situated upgradient of the Site. Impacted runoff from historical spills or leaks (if any) on these properties would likely flow toward the Site. As such, a Phase II ESA is recommended at the western boundary of LSD 4 and 5 of 11-50-28 W3M and would consist of drilling boreholes along the perimeter of the western portion of the Site to assess the condition of the soil and groundwater.

12.0 CLOSURE

This report was prepared for the exclusive use of the City of Lloydminster for the specific application described in this report. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of the third party. This report is subject to the scope, time and budget limitations, and contract terms and conditions outlined in the proposal and established between SolidEarth and the City of Lloydminster for this project. This report has been completed within the generally accepted assessment practices. No other warranty expressed or implied is provided.

Should additional parties require reliance on this report, written authorization from SolidEarth will be required, and all third parties will be bound by the contractual agreement established between SolidEarth and the City of Lloydminster for this project. Provided that the report is less than one year old, SolidEarth will issue reliance letters to third parties upon payment of applicable fees and agreement by third parties to accept the contractual terms and conditions established with the City of Lloydminster. SolidEarth has no liability or responsibility for losses of any kind whatsoever, including direct or consequential financial effects on transactions or property values, or requirements for follow-up actions and costs.

This report was based on the conditions of the Site encountered at the time of the Site visit on 30 July 2020, a review of historical information and data obtained by SolidEarth as described in this report, and discussions with owner/occupant(s), as outlined in the report. Our findings cannot and should not be extended to other portions of the Site or structures which were not reasonably available, in SolidEarth's opinion for observation. SolidEarth will not have any obligation to update this report should additional information become available to SolidEarth after the date the report was issued, unless specifically agreed to in writing.

The report is based on data and information collected by SolidEarth as described in the report. In evaluating the property, SolidEarth has relied in good faith and to a large degree on information provided by other individuals noted in this report including the current owner/occupant. SolidEarth has assumed that the information provided is factual and accurate. No attempt has been made to verify the accuracy of any information provided. SolidEarth accepts no responsibility for any deficiency, misstatement or inaccuracy contained in this report as a result of omissions, misinterpretations or fraudulent acts of persons interviewed or contacted.

The Phase I ESA may assist in reducing, but not eliminating, uncertainty about potential environmental liabilities associated with the Site. Due to the limitations stated above, different environmental conditions may exist from what was observed during the completion of this assessment. Should such a situation arise, SolidEarth should be given the opportunity to review such information and determine if modification to the findings, conclusions, and recommendations is warranted.

SolidEarth makes no other representations whatsoever, including those concerning the legal significance of its findings, or as to other legal matters touched on in this report. With respect to regulatory compliance issues, regulatory statutes are subject to interpretation and change. Such interpretations and regulatory changes should be reviewed with legal counsel.

Thank you for giving us the opportunity to be of service. If you have any questions or require additional information, please feel free to contact our office.

Respectfully submitted,
SolidEarth Geotechnical Inc.

Alex Khamis, B.Sc., EP
Environmental Professional

Jay Jaber, M.Sc., P.Eng.
Senior Geo-environmental Engineer
Managing Partner

Signatures found on original report

13.0 STATEMENT OF QUALIFICATIONS

Jay Jaber, M.Sc., P.Eng., Senior Geo-Environmental Engineer

Mr. Jay Jaber, M.Sc., P.Eng., is a geo-environmental engineer with over 25 years of engineering consulting experience. He holds a Master's degree in geotechnical engineering from the University of Texas in Austin and is a registered professional engineer in the provinces of Alberta and Saskatchewan.

Mr. Jaber's experience includes: (i) Environmental engineering including environmental site assessment, groundwater monitoring, and remediation and re-development programs; (ii) Geo-environmental engineering including the design of landfill liners and caps, lagoons, and containment systems; (iii) Geotechnical engineering for infrastructure projects including pipeline alignment, roadways, and utilities upgrade projects; (iv) Foundation engineering for bridges, heavy industrial plants, commercial developments, and high rise buildings; (v) Slope stability engineering for deep excavation, embankments over weak soils, and natural slopes; and (vi) Materials engineering and testing for infrastructure, heavy foundations, and roadway projects.

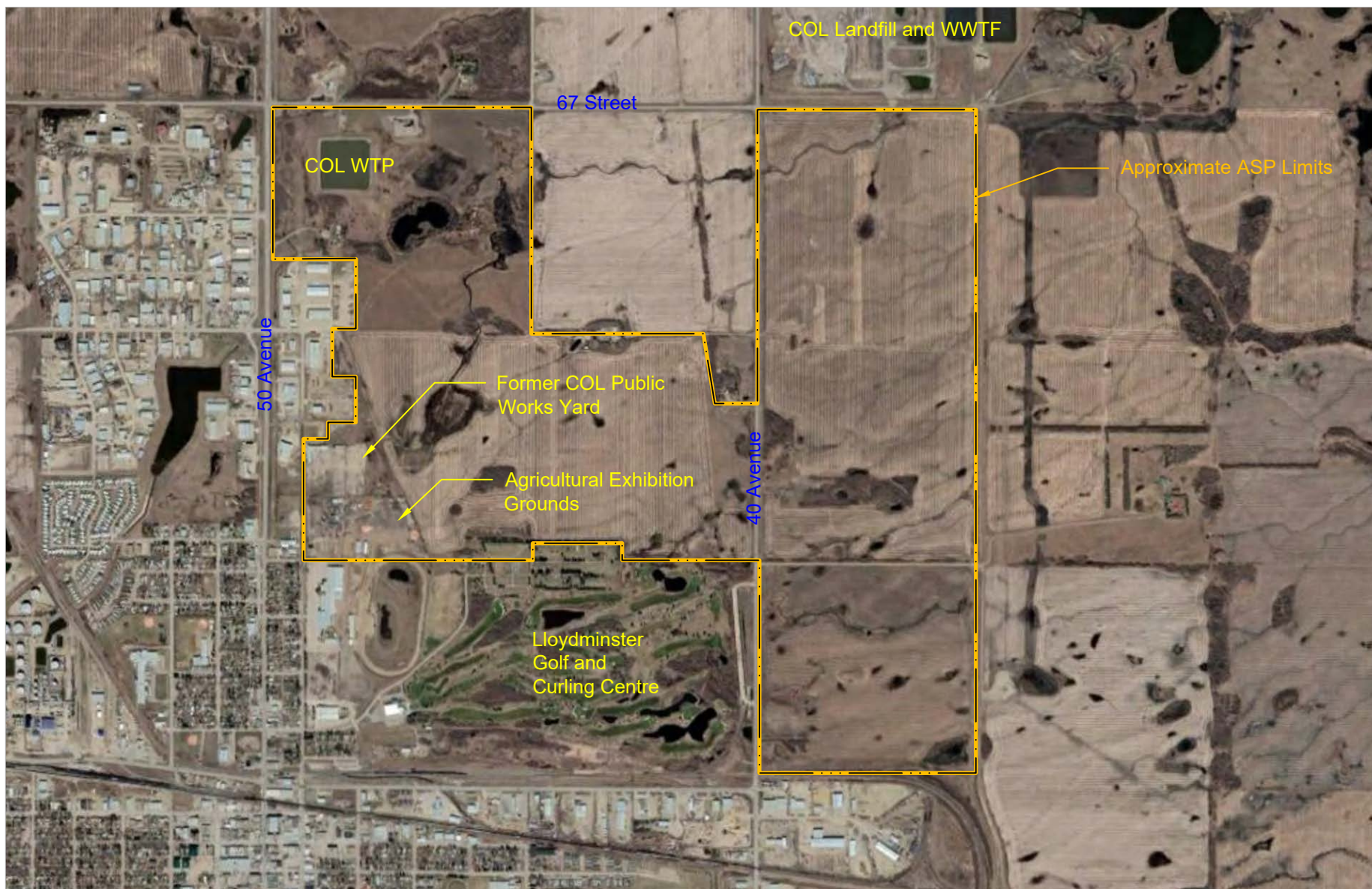
Mr. Alex Khamis, B.Sc., EP, Environmental Professional



Mr. Alex Khamis, B.Sc., EP, is an environmental professional with over seven years of environmental consulting experience. He holds a Bachelor's degree in General Sciences from the University of Alberta in Edmonton and is a registered environmental professional with ECO Canada.

Mr. Khamis's experience includes environmental site assessments (Phase I, II, and III ESAs), remediation programs, groundwater monitoring for landfills, and environmental monitoring activities in support of civil construction projects.

Appendix A



Historical Aerial Photographs



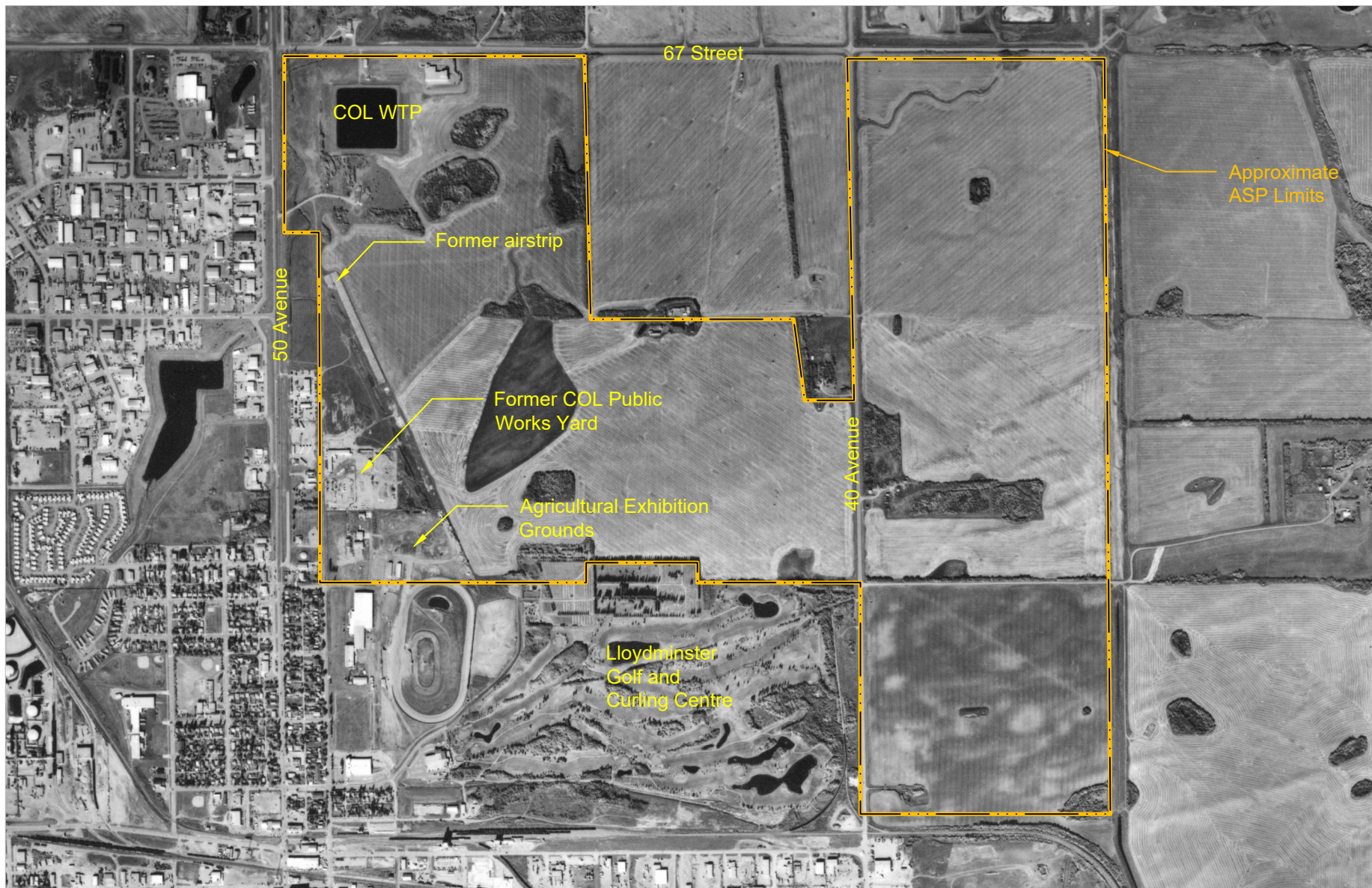
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DATUM:	XXX	DATE:	July 2020	PROJECT No.:		PG20-1519.2000				
SolidEarth Geotechnical Inc. #105, 4604 50 Street, Cold Lake, AB, T9M 1S6						DRAWING TITLE: Approximate Site Location Shown on a 2020 Aerial Photograph				



#105, 4604 50 Street, Cold Lake, AB, T9M 1S6

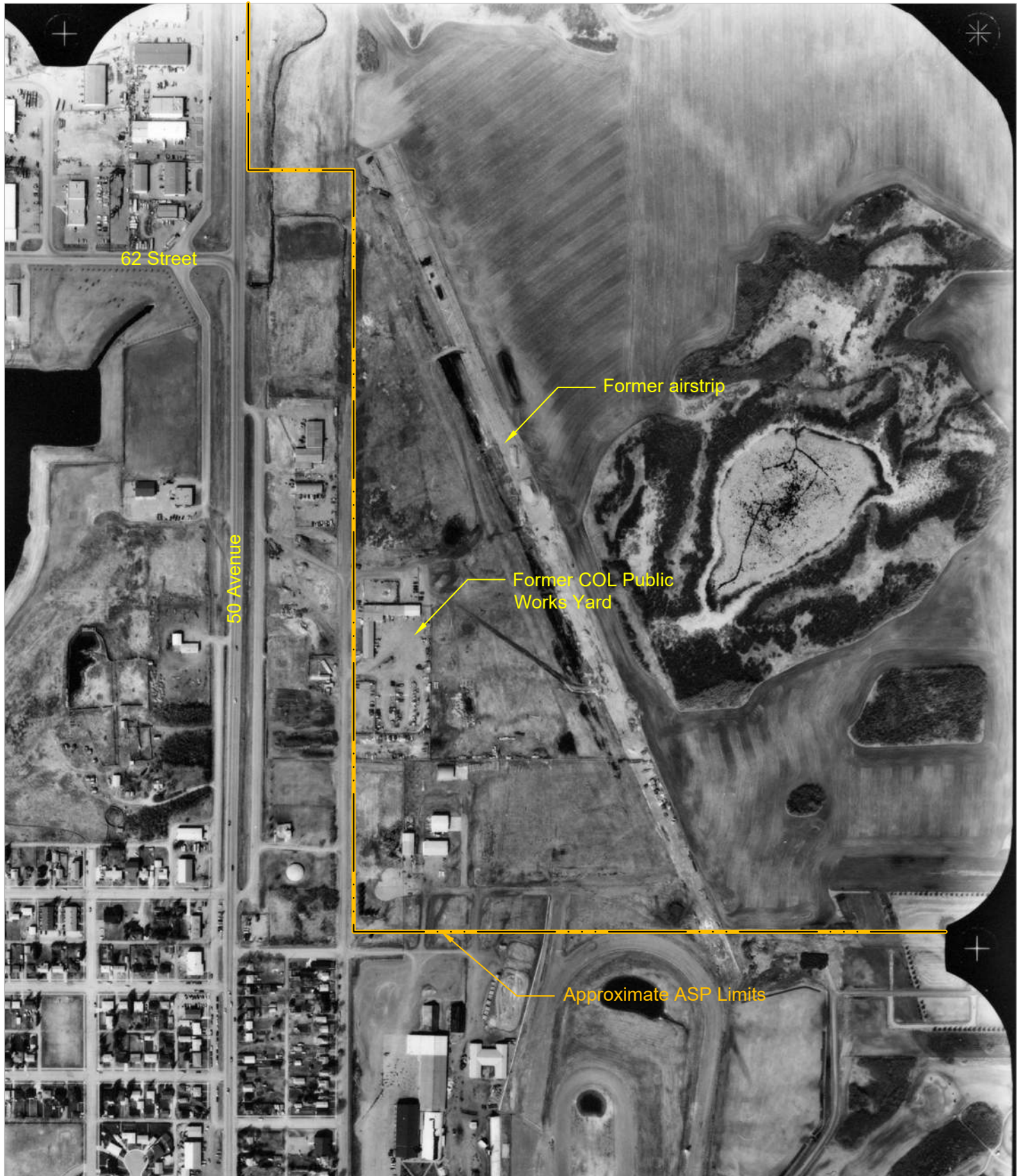




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DATUM: XXX	DATE: July 2020	PROJECT No.: PG20-1519.2000			
SolidEarth Geotechnical Inc. #105, 4604 50 Street, Cold Lake, AB, T9M 1S6				DRAWING TITLE: Approximate Site Location Shown on a 2011 Aerial Photograph	

#105, 4604 50 Street, Cold Lake, AB, T9M 1S6




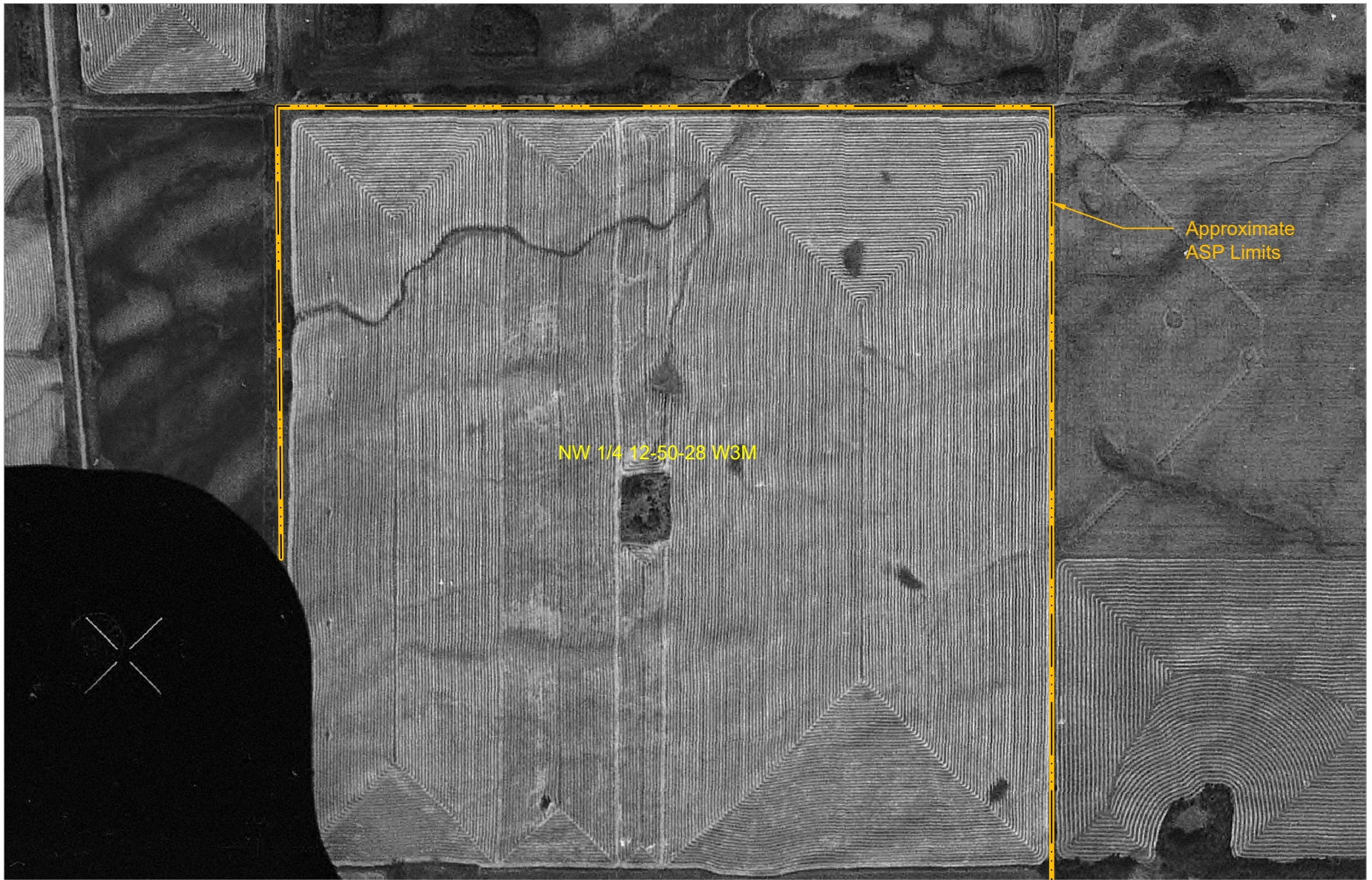
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DATUM:	XXX	DATE:	July 2020	PROJECT No.: PG20-1519.2000			DRAWING TITLE:				
SolidEarth Geotechnical Inc.											
#105, 4604 50 Street, Cold Lake, AB, T9M 1S6											





SCALE: NTS	DRAWN BY: AK	FIGURE No.: 7	REVISION No.: 0	PROJECT NAME: Phase I Environmental Site Assessment Northeast Area Structure Plan Lloydminster, Saskatchewan	CLIENT:  LLOYDMINSTER
DATUM: XXX	DATE: July 2020	PROJECT No.: PG20-1519.2000			
SolidEarth Geotechnical Inc. #105, 4604 50 Street, Cold Lake, AB, T9M 1S6				DRAWING TITLE: Approximate Site Location Shown on a 1988 Aerial Photograph	





SCALE:	NTS	DRAWN BY:	AK	FIGURE No.:	5	REVISION No.:	0	PROJECT NAME:	Phase I Environmental Site Assessment Northeast Area Structure Plan Lloydminster, Saskatchewan		CLIENT:
DATUM:	XXX	DATE:	July 2020	PROJECT No.:	PG20-1519.2000						
SolidEarth Geotechnical Inc.				SolidEarth GEOTECHNICAL		DRAWING TITLE:		Approximate Site Location Shown on a 1975 Aerial Photograph			
#105, 4604 50 Street, Cold Lake, AB, T9M 1S6											




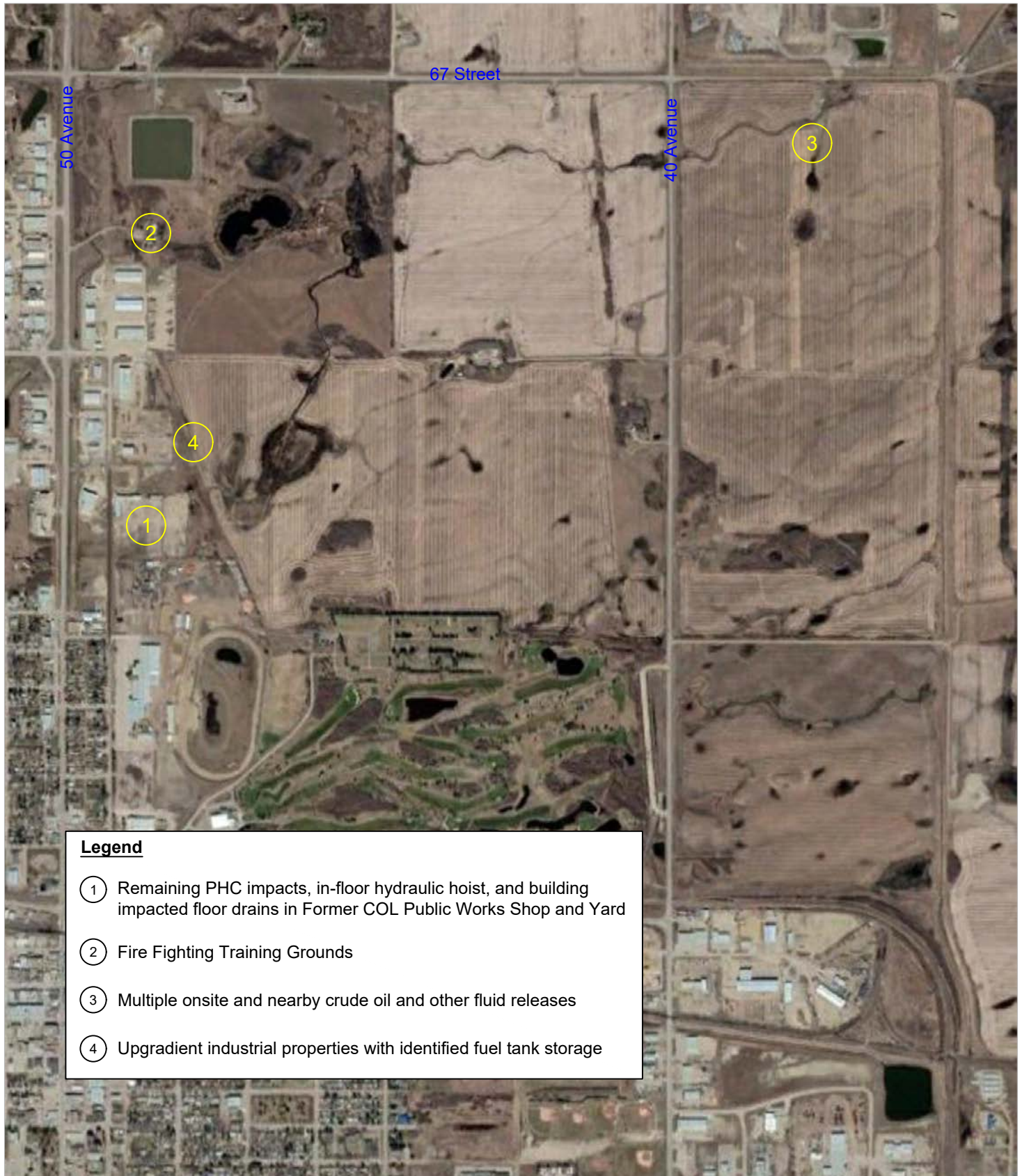
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DATUM:	XXX	DATE:	July 2020	PROJECT No.: PG20-1519.2000			DRAWING TITLE:				
SolidEarth Geotechnical Inc. #105, 4604 50 Street, Cold Lake, AB, T9M 1S6											



SCALE:	NTS	DRAWN BY:	AK	FIGURE No.:	7	REVISION No.:	0	PROJECT NAME:	Phase I Environmental Site Assessment Northeast Area Structure Plan Lloydminster, Saskatchewan	CLIENT:	
DATUM:	XXX	DATE:	July 2020	PROJECT No.:	PG20-1519.2000						
SolidEarth Geotechnical Inc.						DRAWING TITLE:					
#105, 4604 50 Street, Cold Lake, AB, T9M 1S6						Approximate Site Location Shown on a 1956 Aerial Photograph					


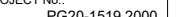


SCALE:	NTS	DRAWN BY:	AK	FIGURE No.:	8	REVISION No.:	0	PROJECT NAME:	Phase I Environmental Site Assessment Northeast Area Structure Plan Lloydminster, Saskatchewan		CLIENT:
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SolidEarth Geotechnical Inc.				SolidEarth GEOTECHNICAL		DRAWING TITLE:		Approximate Site Location Shown on a 1950 Aerial Photograph			
#105, 4604 50 Street, Cold Lake, AB, T9M 1S6								 LLOYDMINSTER			



Legend

- ① Remaining PHC impacts, in-floor hydraulic hoist, and building impacted floor drains in Former COL Public Works Shop and Yard
- ② Fire Fighting Training Grounds
- ③ Multiple onsite and nearby crude oil and other fluid releases
- ④ Upgradient industrial properties with identified fuel tank storage

SCALE: NTS	DRAWN BY: AK	FIGURE No.: 9	REVISION No.: 0	PROJECT NAME: Phase I Environmental Site Assessment Northeast Area Structure Plan Lloydminster, Saskatchewan	CLIENT:  LLOYDMINSTER
DATUM: XXX	DATE: July 2020	PROJECT No.: PG20-1519.2000			
SolidEarth Geotechnical Inc. #105, 4604 50 Street, Cold Lake, AB, T9M 1S6				DRAWING TITLE: Approximate Locations of Areas of Potential Concern Shown on a 2020 Aerial Photograph	

Appendix B

Historical Land Titles Findings of Database Searches Correspondence with Governmental Agencies

Appendix C1

Site Photographs Taken During the Site Visit - Former COL Public Works Shop and Yard



Photograph 1: Looking southeast toward the former COL Public Works Shop



Photograph 2: Looking south from central portion former COL Public Works Shop



Photograph 3: View of concrete floor in south garage bay at the former COL Public Works Shop



Photograph 4: Hydraulic lift located in the eastern wing of the shop building former COL Public Works Shop



Photograph 5: Sumps located in the eastern wash bay former COL Public Works Shop



Photograph 6: Drains located in the southern wing of the shop building



Photograph 7: Looking southeast towards former pump island in former COL Public Works Yard



Photograph 8: Looking north toward sheds located east of the shop building in the former COL Public Works Yard

Appendix C2

Site Photographs Taken During the Site Visit – Remaining Portions of the Site



Photograph 9: Looking north from south side of 5709 – 50 Avenue.



Photograph 10: Looking west toward former COL WTP building



Photograph 11: Looking northwest toward Kichton Contracting yard located to the west of the Site



Photograph 12: Looking east from western portion of LSD 5-11-50-28 W3M



Photograph 13: Looking south toward NW 12-50-12 W3M from 67 Street



Photograph 14: Looking south at drainage channel along eastern property boundary



Photograph 15: Looking northwest toward Site from eastern property boundary



Photograph 16: Husky Oil Operations Limited lease east of the Site



Photograph 17: Looking southeast at rail right-of-way located to the south of the Site



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