COUNTY OF MINBURN NO. 27

BYLAW 1342-23

A BYLAW OF THE COUNTY OF MINBURN NO. 27, IN THE PROVINCE OF ALBERTA TO ADOPT THE EAST INDUSTRIAL PARK AREA STRUCTURE PLAN.

WHEREAS, Council of the County of Minburn No. 27 deems it necessary to adopt, in accordance with Sections 633 and 636 of the Municipal Government Act, the East Industrial Park Area Structure Plan, being Bylaw No. 1342-23, to specify policy and regulatory direction for the lands located per the attached Schedule "A".

AND WHEREAS, Council of the County of Minburn No. 27 deems it advisable to adopt the East Industrial Park Area Structure Plan in accordance with Schedule "A" attached and forming part of Bylaw No. 1342-23, to refine and further specify the general policy direction applicable to this area in the Village of Mannville/County of Minburn No. 27 Intermunicipal Development Plan, being County of Minburn No. 27 Bylaw No. 1240-15, as amended;

AND WHEREAS, notice of a public hearing for this Bylaw held on July 17, 2023_has been given in accordance with Sections 606 and 692 of the *Municipal Government Act*, 2000 RSA, ch. M-26, as amended;

NOW THEREFORE, Council of the County of Minburn No. 27, in the Province of Alberta, duly assembled enacts as follows:

1. That Bylaw No. 1342-23, being the East Industrial Park Area Structure Plan, attached hereto and forming part of this Bylaw, be adopted.

2. That this Bylaw be cited as the East Industrial Park Area Structure Plan.

3. That this Bylaw becomes effective upon the date of the final passing thereof.

SEVERABILITY

If any Section or parts of this bylaw are found in any court of law to be illegal or beyond the power of Council to enact, such Section or parts shall be deemed to be severable and all other Sections or parts of this Bylaw shall be deemed to be separate and independent there from and to be enacted as such.

FIRST READING ....June 19, 2023

PUBLIC HEARING held on the 17th day of July, 2023

SECOND READING..................................July 17, 2023

THIRD READING ....July 17, 2023

Reeve

P. Podoborozny

Chief Administrative Officer

BYLAW 1342–23

East Industrial Park
Area Structure Plan

East Industrial Park
Area Structure Plan

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Prepared by:
Red Willow Planning

1.0 Location, Background & Purpose

1.1 Location

The East Industrial Park Area Structure Plan (ASP) study area is located immediately east of the Village of Mannville in the County of Minburn, Alberta, Canada comprising seven parcels:

1. NW 20-50-8-4
2. North half 19-50-8-4 (north of the CN Railway)
3. NW 19-50-8-4 (south of the CN Railway)
4. NE 19-50-8-4 (south of the CN Railway)
5. Lot 1, Block 1, Plan 062 6818
6. Lot 1, Block 1, Plan 212 2252
7. Block A, Plan 852 0860 (Shadow Plan lands in the Village of Mannville)

The ASP location is also adjacent to the Yellowhead, Highway 16. See **Figure 1** for location and context map.

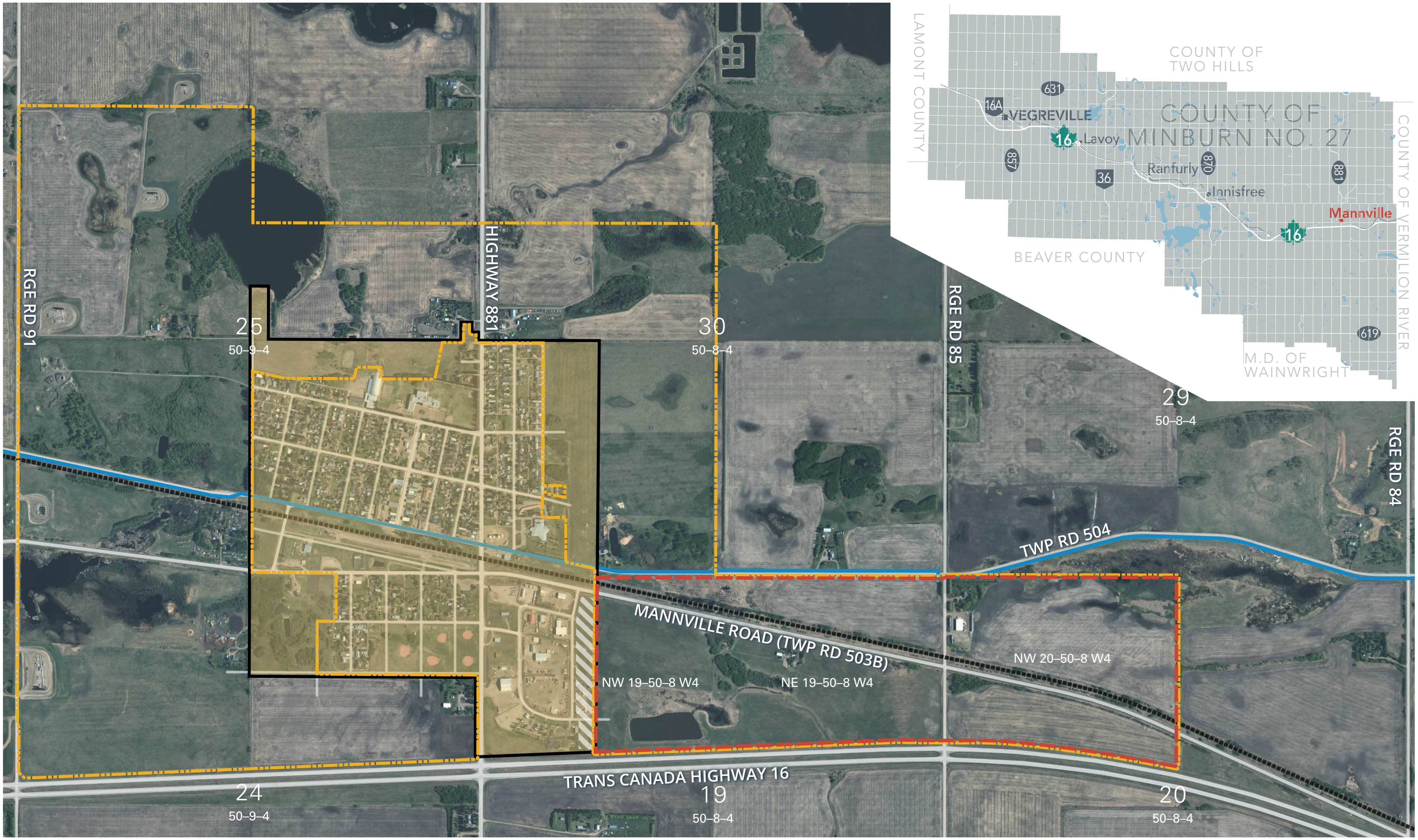

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FIGURE 1
LOCATION & PLAN BOUNDARY

LEGEND

- IDP Boundary
- Plan Boundary
- Shadow Plan Area
- Village of Mannville
- Canadian National Railway
- ACE Regional Waterline

1.2 IDP Background & Shadow Plan Area

Section 6.6 of the *Village of Mannville – County of Minburn Intermunicipal Development Plan* (IDP) speaks to the preparation of joint area structure plans in the locations shown in the IDP's Figure 7 Future Land Use & Joint Planning Areas. There are two areas identified, one to the west of the Village and the other to the east. The east area is addressed by this ASP.

Additionally, the County and the Village discussed their mutual interest in coordinating development of a strip of undeveloped land within the Village's existing industrial park immediately west of the ASP boundary. Consequently, a 'Shadow Plan' area was established for discussion purposes only (**Figure 1**), and no policies in this ASP are applied to the Shadow Plan area.

1.3 Regional Economic Development

The mutual interest described above relates to the desire to jointly promote the area for non-residential development to investors. Coordination of development, and servicing if the parties jointly agree, will support regional economic development.

That being said, the parties wish to avoid competition with each other. The County supports the Village's desire to develop its existing supply of serviceable non-residential land in the Shadow Plan area prior to the County developing similarly sized and serviced lots within the ASP boundary. The sequence of development, discussed in more detail in section 4.6 below, demonstrates this support.

2.0 Legislative Context

2.1 Municipal Government Act

The *Municipal Government Act* (MGA) in s. 633 states the purpose of an Area Structure Plan (ASP) is to provide a framework for future subsequent subdivision and development of an area of land. Further, the MGA directs that an ASP:

1. Must describe
   a. The sequence of development proposed for an area,
   b. The land uses proposed for an area either generally or specifically,
   c. The density of population proposed for the area,
   d. The general location of major transportation routes and public utilities, and
2. May contain any other matters, including matters relating to reserves, as the council considers necessary.

2.2 Provincial Land Use Policies

Section 618.4(1) of the MGA requires that every statutory plan be consistent with the Provincial Land Use Policies established by Order in Council 522/96. This ASP has been prepared in consideration of the Provincial Land Use Policies.

2.3 Intermunicipal Development Plan

The IDP requires that the joint ASPs are prepared by a Registered Professional Planner, are consistent with the requirements of the MGA and pursuant to the General Terms of Reference for the Preparation of a Conceptual Scheme or Area Structure Plan, found in Appendix B of the IDP. This ASP complies with all three of these requirements.

2.4 Municipal Development Plan

The *Municipal Development Plan* (MDP) identifies specific initiatives in Section 1.5, including the preparation of joint planning initiatives within existing intermunicipal development plans, including that between the Village of Mannville and the County of Minburn.

Section 3.4 provides objectives and policies for commercial and industrial lands. Key policies that influence and are upheld by this ASP include:

3.4.3 The County shall use the following site criteria in determining rural industrial site suitability for the intended use:

a. has stable, well drained soils;

b. has (or will have) safe and convenient access to public roads built to County standards;

c. located where rail access exists or could be provided if required;

d. has necessary services and utilities available if required;

e. has suitable local climate conditions, especially for noxious industries;

f. has an appropriate buffer from land designated for AR-Acreage Residential District when considering a subdivision or development application for rural industry;

g. is suitably located in relation to waterbodies; and

h. is not located within significant scenic, recreational or open space areas

3.4.6 The County shall encourage the creation of industrial parks in order to provide industrial development opportunities in a manner that concentrates industrial development, rather than scatters it, minimizes conflicts with adjacent land uses and facilitates the economic provision of services (including roads). The County shall encourage new industrial developments to locate in one of the following industrial parks and locations:

a. East Industrial Park;

b. West Industrial Park;

c. Crossroads Industrial Park;

d. Within existing hamlets in accordance with the existing ASPs; and

e. Within intermunicipal fringe areas in accordance with the IDPs.

3.4.16 The County may allow convenience retail services to locate in industrial parks, acreage residential developments or manufactured home communities where adequate services do not exist nearby. The size of commercial outlets shall be relative to the immediate population being served.

3.4.17 The County may allow commercial activities in industrial parks where the development is ancillary to the industrial use on that parcel.

3.4.26 The County shall ensure highway commercial uses maintain the functional integrity of adjacent highways through the use of service road systems or controlled highway access points that are approved by Alberta Transportation, or the County Operations Department.

3.0 Existing Features

3.1 Natural Environment

X-Terra Environmental Services Ltd. was retained to undertake a desktop biophysical assessment of the ASP lands. The following sections present the findings from X-Terra's report, found in its entirety in **Appendix A**. Additionally, SolidEarth Geotechnical Inc. prepared a report (**Appendix B**) detailing the soils suitability for development. The findings of that report are summarized in subsection 3.1.1 below.

3.1.1 Soils & Topography

The ASP lands are within the Aspen Parkland Ecoregion and exhibit nearly level to gently rolling topography with slopes between 0.5% to 2% and low risk for erosion potential. The soils in this are consist of Orthic Black Chernozem on moderately coarse textured sediments deposited by wind or water.

SolidEarth Geotechnical undertook a field assessment in March 2023 to assess the subsurface soil and groundwater conditions at selected locations across the proposed development area (see bore hole locations on Figure 5). A drilling rig bore six holes to depths ranging from 5.8m to 7.3m below existing ground surface. The analysis concluded that soil conditions at the borehole locations are considered suitable for the proposed development, and that site grading, installation of underground utilities, construction of stormwater management ponds and pavement structures would all be feasible. Based on subsurface conditions, deep pile foundations are considered the most suitable for future structures.

3.1.2 Wetlands

A desktop analysis of historic aerial photographs between the years 1980 and 2021 was used to identify potential wetland areas. In total, eight graminoid marsh wetlands and one ephemeral wetland were identified, totaling 20.98 ha (see **Figure 2**) within the ASP boundary. Wetlands W2 and W9 extend beyond the ASP boundary, but only those portions of the wetlands within the ASP boundary are included in the total wetland area, and in Table 1 below. Future in-field surveys may find more wetlands than identified by the biophysical desktop analysis. Moreover, wetland W1 is partially formed by a human-made borrow pit.

There are also two main drainage ditches/channels, assumed to have been created to assist with local drainage. It is unknown if Alberta Water Act approval or license was obtained for any of the human-made wetlands/watercourse features.

Any wetlands impacted by future development will require Alberta Water Act approval. Wetlands are assigned values from A to D, with D being the lowest. In terms of wetland impact mitigation and compensation, preference is to avoid impacting wetlands; however, that may not always be practical. It appears the wetlands likely to be impacted by future development are of the lowest value, D class. It is recommended that an Alberta Wetland Rapid Evaluation Tool assessment take place prior to development to determine the exact class of wetland and appropriate mitigation measures for wetland impact, including development setbacks.[1]

Wetland impact compensation rate for this area of Alberta is $18,600/ha in 2022, and is subject to change. The compensation values for impacting the nine identified wetlands are summarized below in **Table 1** and will need to be confirmed based on future field verified wetland assessments. Future Water Act applications for direct impacts to wetlands within the ASP boundary will need to include planning, best management practices, and mitigation measures to avoid and minimize impact in order to protect those areas of wetland outside of ASP lands.

[1] Although the desktop analysis report does not make recommendations on development setbacks around wetlands, common practice is to employ 30-50m setbacks. This ASP assumes a 30m setback in the FLUC.

Furthermore, current values should be obtained by the developer as necessary. Wetland Compensation Summary, sourced from Table 2 in the biophysical assessment found in **Appendix A** of this ASP.

TABLE 1 — **Wetland Compensation Summary**

Wetland ID	Estimated Wetland Value*	AWCS Classification	Approx. Wetland Area within ASP (ha)	Total In–Lieu Replacement Cost**
W1	D	Temporary Graminoid Marsh — M[G][II] with man–made component	6.3	$117,180.00
W2	D	Seasonal Graminoid Marsh — M[G][III]	6.2	$115,320.00
W3	D	Temporary Graminoid Marsh — M[G][II]	0.6	$11,160.00
W4	D	Ephemeral Wetland — M[G][I]	0.03	$558.00
W5	D	Temporary Graminoid Marsh — M[G][II]	0.6	$11,160.00
W6	D	Temporary Graminoid Marsh — M[G][II]	0.6	$11,160.00
W7	D	Temporary Graminoid Marsh — M[G][II]	0.5	$9,300.00
W8	D	Seasonal Graminoid Marsh — M[G][III]	0.05	$930.00
W9	D	Seasonal Graminoid Marsh — M[G][III]	6.1	$113,460.00
			20.98	**$390,228.00**

**Assumptions within table are based on historic values assigned to similar wetlands within the region. The wetlands have been delineated wetlands as per ABWRET–D directive but have not been submitted for and ABWRET Score.*

***Based on desktop wetland delineations, a summary of the approximate wetland replacement for ASP lands. The values were calculated based on a replacement ratio of 1:1, relative wetland value assessment unit of 7, and an in–lieu rate of $18,600.00.*

3.1.3 Vegetation

The growing season in this area is between 174 and 187 days on average. The area is primarily cultivated for agricultural purposes. There were no rare plants found during a database search although field surveys prior to development should be undertaken.

Soil disturbance during the construction of new development could attract invasive weed species and measures should be taken during construction phases to control noxious weeds.

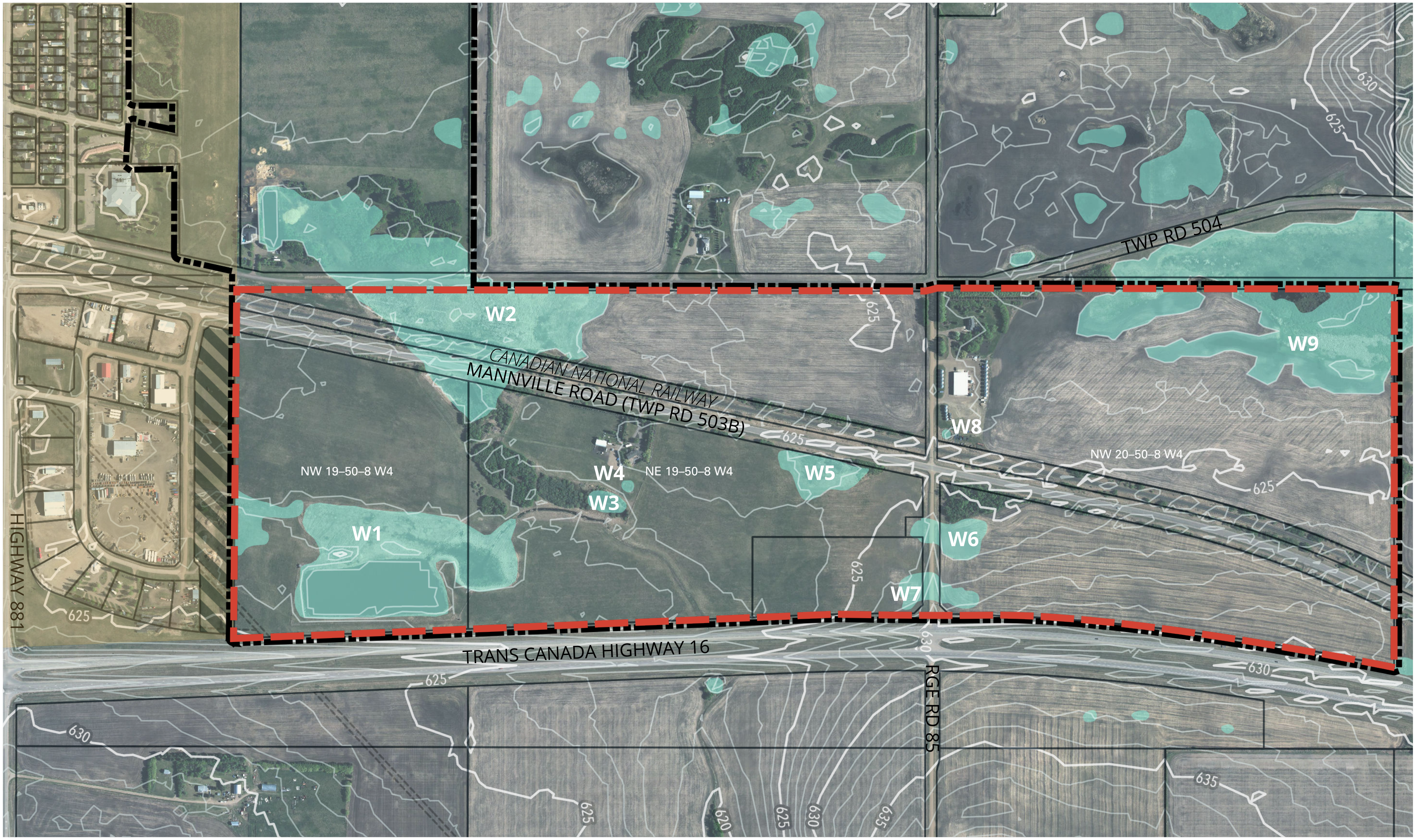

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FIGURE 2
EXISTING FEATURES: NATURAL ENVIRONMENT

LEGEND

- IDP Boundary
- Plan Boundary
- Shadow Plan Area
- Village of Mannville
- Wetland
- Pond/Dugout
- 5 m Major/1 m Minor Contour

3.1.4 Wildlife

A database search revealed that no sensitive wildlife species were found within a 3km radius of the centre of the ASP area. The ASP lands are within the range of Sharptailed Grouse and Bald Eagle, however, there is potential for other sensitive species to occur in the area. Wildlife and nest sweeps should be undertaken within 7 days of the onset of development, including vegetation clearing between April 1 and August 15.

3.2 Built Environment

3.2.1 Existing Residences

There are two existing residences within the ASP boundary, each with outbuildings and structures. See **Figure 3** Existing Features: Built Environment. One residence is located north of the railway east of Range Road 85 on NW 20-50-8-W4, and the other is located south of the railway and west of Range Road 85 on NE 19-50-8-W4.

The Future Land Use Concept (**Figure 5**) identifies Agricultural land on which two residences exist. Over time, should landownership and development plans change, the land on which the residences are located could be identified for rural industrial development through an amendment to this ASP to change the designation from Agricultural to Industrial/Commercial.

3.2.2 Roads & Rails

The ASP is serviced by Township Road 503B, locally known as Mannville Road, Township Road 504, and Range Road 85.

Township Road 503B is a two-lane paved rural collector road with a posted speed limit of 80 km/hr. Range Road 85 is a two-lane gravel collector road with a posted speed limit of 80 km/hr. Township Road 504 is a two-lane rural collector road with a graveled surface. The posted speed limit is 80 km/hr.

The Canadian National Railway (CN Railway) line passes diagonally from southeast to northwest through the plan area adjacent to Township Road 503A and has an uncontrolled, at-grade crossing at Range Road 85.

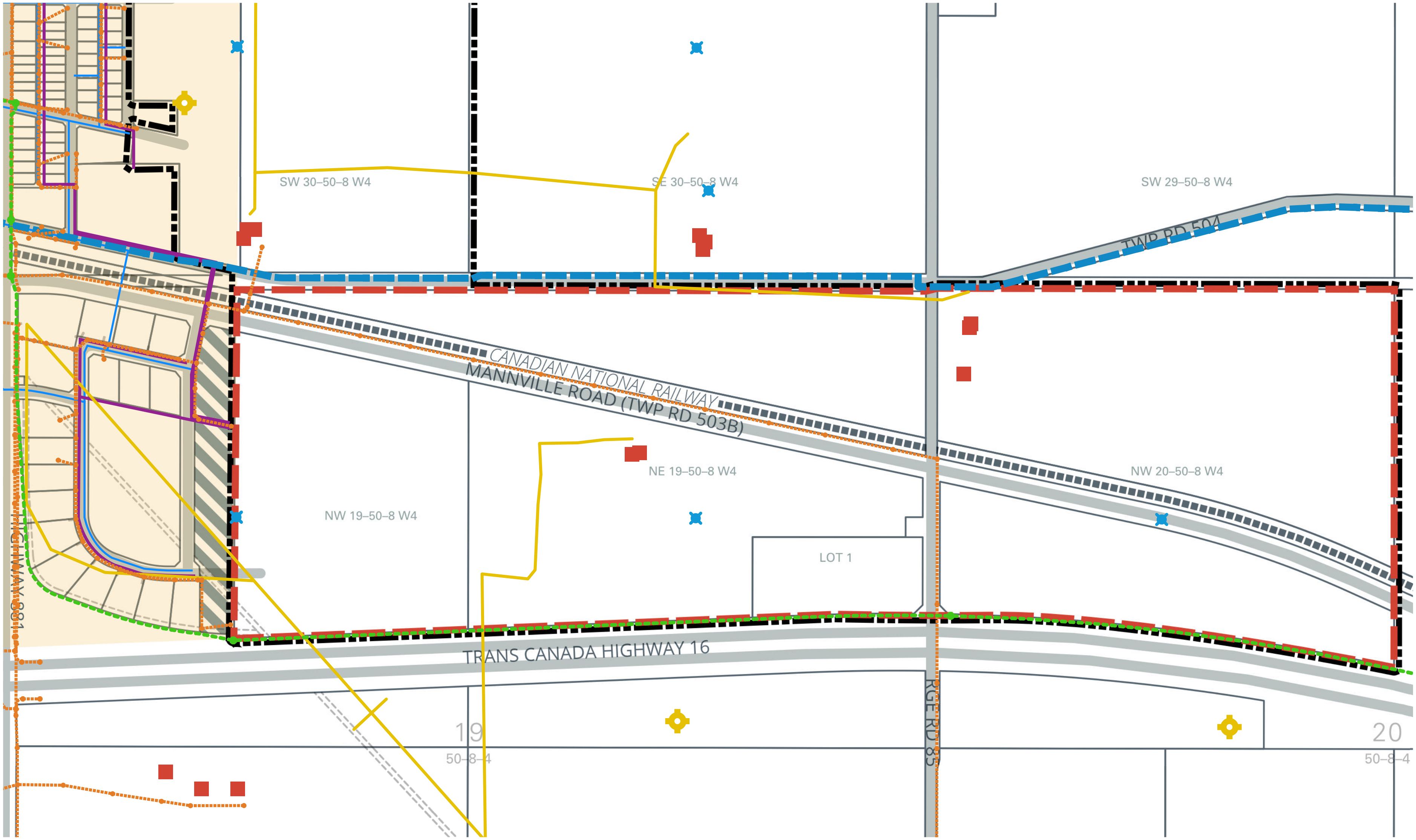

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FIGURE 3
EXISTING FEATURES: BUILT ENVIRONMENT

LEGEND

- IDP Boundary
- Plan Boundary
- Shadow Plan Area
- Village of Mannville
- Building/Structure
- Roadway
- Railway
- ACE Regional Waterline
- Water Main
- Water Well
- Sanitary Sewer
- Powerline
- Natural Gas Line
- Oil & Gas Well
- Fiber Optic Line

3.2.3 Utility & Communications Infrastructure

3.2.3.1 Potable Water

The ACE Regional Waterline runs along the Township Road 504 right-of-way and partially along the north boundary of the ASP. The feasibility of connecting to this waterline needs to be determined by the developer.

3.2.3.2 Village of Mannville Lagoon

The Village of Mannville's sewage lagoon is permitted to discharge treated effluent from the lagoon's storage cells into the Vermilion River once per year during a three-week period between March 1st and November 30th (BAR Engineering, 2009).

In response to the Village experiencing difficulty being able to retain the volume of treated effluent within its storage cells to allow for the annual discharge at the same time every year, BAR Engineering was retained in 2009 to undertake an analysis of the lagoon capacity (BAR Engineering, 2009).

The 2009 analysis concluded that existing anerobic cells of the lagoon are adequately sized to meet the current and future needs of the Village. However, the storage cells of the lagoon could be challenged to provide adequate storage capacity to accommodate any population growth or unanticipated additional flows caused by inflow and infiltration during a wet, rainy year or major storm event (BAR Engineering, 2009). These circumstances could require a premature discharge of the effluent from the storage cells to avoid the storage berms from being over-topped (BAR Engineering, 2009).

3.2.3.3 Power

A power line runs along the Range Road 85 right-of-way from south of Highway 16 and veers west along Township Road 503A into the Village of Mannville. It branches south to service the lands adjacent to the Shadow Plan area within the Village of Mannville.

3.2.3.4 Communications

The MCSNet fiber optic line runs along the north side of Highway 16 and enters the Village of Mannville along Highway 881. The line runs through the Village's existing industrial park just west of the ASP boundary and ties back into the Highway 16 alignment. The line can be extended into the East Mannville Industrial Park from a point just outside the very southwest corner of the plan as well as from a point at Range Road 85 where it intersects with Highway 16.

FIGURE 4
EXISTING FEATURES: LAND USE

LEGEND

- IDP Boundary
- Plan Boundary
- Shadow Plan Area
- County – A: Agricultural
- County – DC: Direct Control
- County – RC: Rural Commercial
- Village – P1: Public Service
- Village – R1: Residential Low Density Single Dwelling
- Village – UH: Urban Holding
- Village – IB1: Industrial Business Park

3.2.4 Oil & Gas Infrastructure

There are no oil and gas wells within the ASP boundary. There are natural gas pipelines servicing the two residences in the plan area. A natural gas pipeline is also located in the Shadow Plan area.

3.2.5 Existing Land Use

The land use districts applied to the land within the ASP include Agricultural District, Direct Control District, and Rural Commercial District as shown on **Figure 4**. The majority of the land is districted (or zoned) Agricultural. Approximately 32 ha are districted Direct Control and a single 4 ha parcel was previously redistricted from Agricultural to Rural Commercial in anticipation of a development that did not occur.

Lands within the Shadow Plan area in the Village are districted Industrial Business Park.

3.2.6 Cultural and Historical Resources

A search of the Alberta Listing of Historic Resources July 2022 did not identify any historic resources value and therefore a Historical Resources Act clearance will not be required to support future development.

4.0 Future Land Use Concept

The Future Land Use Concept, depicted in Figure 5, proposes a rural industrial park development with hybrid servicing options, as detailed in the following sections.

4.1 Future Land Use Concept

The Future Land Use Concept (FLUC) comprises agricultural lands and land identified for future rural commercial/industrial, with independently serviced lots (eastern half of ASP boundary) and potentially municipally serviced lots (western half of ASP boundary). The road layout is simple and designed to minimize additional development costs. The subdivision layout shown is conceptual and for discussion purposes only. Changes to the subdivision concept shown will not require an amendment to the ASP.

The total ASP area is approximately 120 ha, of which approximately 47 ha is identified for future rural industrial development and 13 ha is dedicated for road rights-of-way (see **Table 2** below).

TABLE 2 — Land Use Statistics

Land Use Type	Area (ha)	Area (ac)	% Of GDA
PLAN AREA	**hectares**	**acres**	**% of GDA**
Gross Developable Area (GDA)	**120.01**	**296.5**	**100.0%**
Agricultural	53.59	132.4	44.65%
Industrial	47.13	116.5	39.27%
Road	13.04	32.2	10.87%
Rail	6.25	15.4	5.21%
SHADOW PLAN	**hectares**	**acres**	**% of GDA**
Gross Developable Area (GDA)	**3.55**	**8.8**	**100.0%**
Industrial	3.22	8.0	90.70%
Road	0.33	0.8	9.30%
TOTAL	**hectares**	**acres**	**% of GDA**
Gross Developable Area (GDA)	**123.56**	**305.3**	**100.0%**
Agricultural	53.59	132.4	43.37%
Industrial	50.35	124.4	40.75%
Road	13.37	33.0	10.82%
Rail	6.25	15.4	5.06%

The Shadow Plan area within the Village of Mannville is identified with grey hatching and comprises 3.22 ha of land. The Shadow Plan area highlights continuity of land uses and future roadway connections to meet the market needs for smaller, fully serviced industrial lots. There are two roadway connection points from the Shadow Plan area to the ASP lands, one at the north and one at the south.

Existing wetlands represent approximately 21 ha of land, and setbacks around these wetlands may be dedicated as environmental reserve or environmental reserve easement. Setbacks will need to be determined by a qualified professional prior to subdivision based on future field verified wetland assessment.

It is important to the Village's economic development that its supply of existing industrial land be mostly built out before the smaller lots identified in the western half of the ASP boundary are subdivided, serviced and marketed.

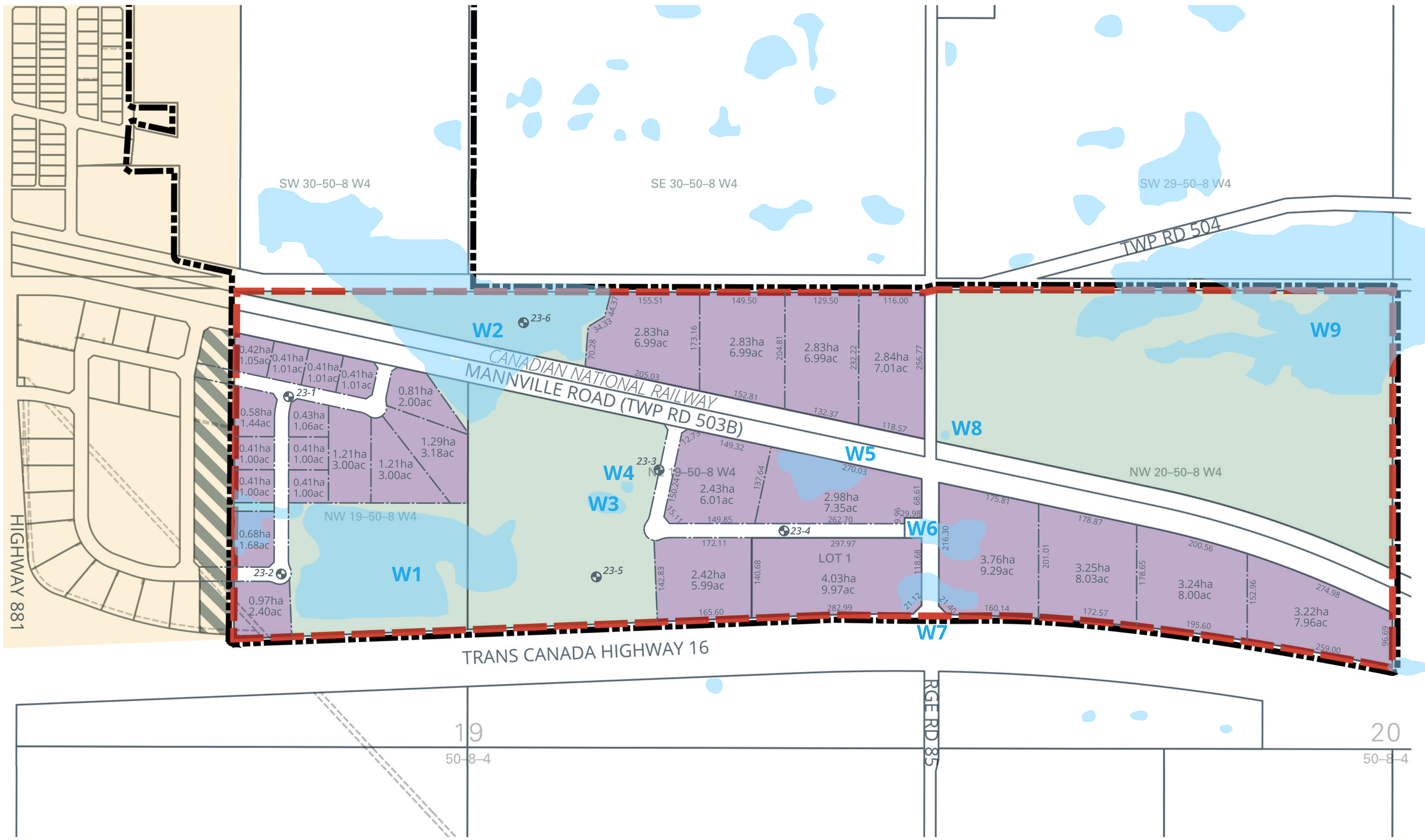

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FIGURE 5
FUTURE LAND USE CONCEPT

LEGEND

- IDP Boundary
- Plan Boundary
- Shadow Plan Area
- Village of Mannville
- Industrial/Commercial
- Agricultural
- 23-1 Borehole Location (with ID)

Two residences exist within the ASP boundary as discussed in 3.2.1. above. The land on which these residences sit may be converted to the Industrial or Rural Commercial designations in the future, but that would require an amendment to this ASP.

4.2 Industrial/Commercial

The intent of this ASP is to support the future conversion of agricultural land within the ASP boundary designated Industrial/Commercial for either rural industrial or appropriate rural commercial uses. This could include light industrial uses that are more commercial in nature, and which could benefit from smaller parcels that have access to full municipal servicing, as well as those rural industrial uses that are a bit more intensive and require larger tracts of unserviced land. That being said, Agricultural uses can continue as they currently do in perpetuity if that is the will of the landowners.

It is expected that rural industrial types of uses on larger parcels are best suited for development within the County. Uses that require smaller, serviced lots would be directed to the Village's existing serviced industrial lots in the first instance. Access to the smaller, potentially serviced lots shown in **Figure 5** would be promoted after the Village's existing supply of small-lot serviced industrial lots are mostly developed. Should demand for smaller, serviced lots not arise within the County's ASP, the smaller lots shown in **Figure 5** could be reconfigured as larger parcels with independent servicing. A reimagining of the lot layout and servicing methods for the smaller lots within the ASP boundary could require an amendment to this ASP as the changes could impact overall stormwater management. Additional engineering analysis of the impacts of reconfiguring the smaller lots on stormwater management should accompany an amendment application.

Careful consideration of the siting and screening of future industrial development is required in consideration of the existing residential uses within the Agricultural land use district. Uses suitable for adjacency to the existing residences should not produce excessive light trespass, noise, dust, smells or other nuisance that is in excess of what one might experience living next to an agricultural operation. Such uses should be directed away from the existing residences.

Additionally, screening and fencing should be employed to reduce negative visual impact of laydown yards, outdoor storage of equipment and other uses with potential for unsightliness where proposed to be located adjacent to the existing residences or within sightlines of Highway 16.

CN Rail sets out guidelines for development in proximity to rail lines. It is expected that developers will avail themselves of these guidelines and development proposals will reflect the design parameters contained therein.

4.3 Agricultural

Agriculture is the current dominant use within the ASP boundary. This ASP upholds the right to farm for existing and legally permitted agricultural operations. Agricultural landowners can continue to use their agricultural properties in the ways they currently do in perpetuity, in compliance with the County's land use bylaw and applicable policies.

On the other hand, should the owners of the existing residences desire to sell or develop their land for industrial uses, the conversion from Agriculture designation to Industrial designation is generally supported by this ASP. However, an amendment to this ASP would be required, and may warrant further engineering analysis depending on the extend of the amendment.

4.4 Sequence of Development

The anticipated sequence of development is shown in **Figure 6.** It should be noted that the timeframe for full build out of this area is likely decades, and many factors that are unknown at this time could influence the sequence of development.

However, it is expected that the larger, unserviced lots within eastern half of the ASP boundary with visibility from Highway 16 will develop first. The next group of unserviced lots to develop will likely be those north of the CN Railway, west of Range Road 85. Finally, those smaller, potentially serviced lots in the western half of the ASP boundary adjacent to the Village's east boundary will likely develop last in consideration of the County's commitment to avoiding direct competition with the Village for serviced industrial lots.

Changes in the sequence of development may require an amendment to this ASP depending on their impact on servicing, stormwater management and other factors determined by the Development Authority.

4.5 Reserve Lands

The MGA enables municipalities to obtain land through the subdivision process for reserves: municipal, school, municipal and school, and environmental. The MGA also enables certain lands to be dedicated as environmental reserve easements and conservation easements.

It is the policy of this ASP that reserve dedication be maximized pursuant to the MGA. Also, municipal reserve dedication may be provided in the form of cash in lieu of land as local park space is not the best use of reserves in this area of the county. It is recommended that the County not accept municipal reserve deferral considering the timeframe for full build-out of this land could be decades, possibly deferring provision of municipal reserve, and the broader community benefits it could provide, indefinitely.

It is expected that further in-field analysis by a qualified professional in support of future subdivision and development will determine appropriate development setbacks to retained wetlands. The setbacks around wetlands, as well as the retained wetlands themselves, can be identified as environmental reserve at the time of subdivision.

Stormwater management (SWM) ponds will not be identified as environmental reserve. Further, the land around SWM ponds that is above the high-water mark cannot be used as credit for municipal reserve dedication. Finally, SWM ponds should not be identified as public utility lots through subdivision on private land because the County should not take on responsibility of maintenance for private stormwater management ponds. Rather, the County should encourage owners to naturalize private stormwater management ponds to reduce maintenance requirements and to dissuade human access.

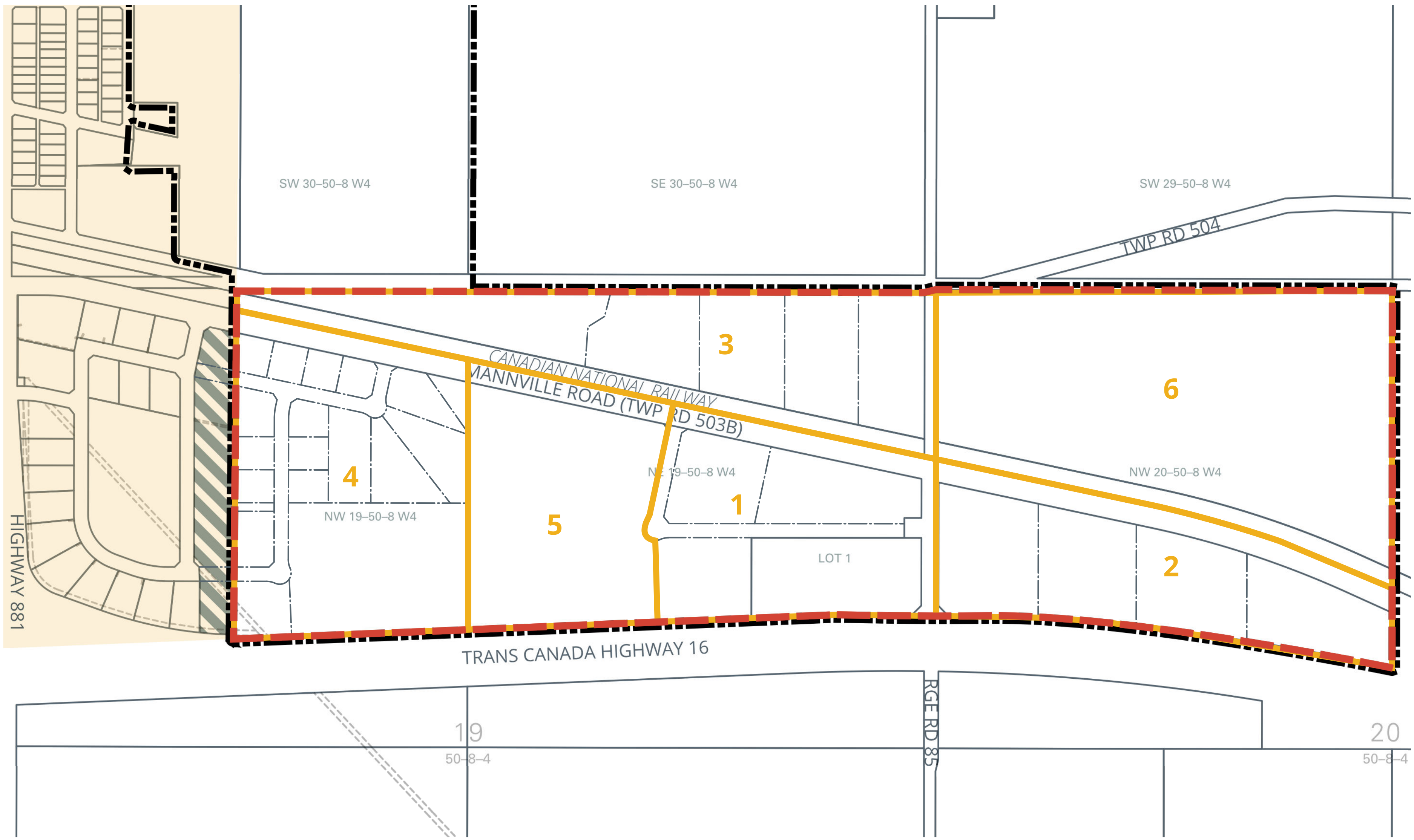

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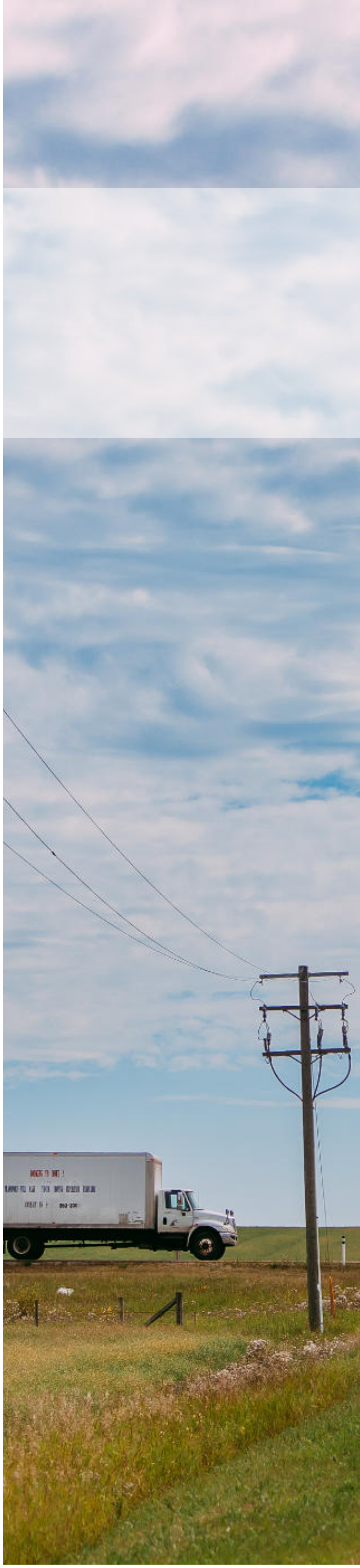
FIGURE 6
SEQUENCE OF DEVELOPMENT

LEGEND

- IDP Boundary
- Plan Boundary
- Shadow Plan Area
- Village of Mannville
- 3 Development Phasing

5.0 Transportation Network



Bunt & Associates Engineering was retained to undertake a desktop transportation review (see **Appendix D**). BAR Engineering was retained to prepare a Servicing Brief (**Appendix E**). The recommendations of these two reports are presented below.

5.1 Local Roads

All proposed roadways within the ASP will be developed to a rural cross section to the County's most up-to-date required standards, with roadside ditches to provide drainage and convey stormwater runoff. In any case, roadways should be constructed to accommodate a minimum 9m finished top width to support truck traffic.

5.2 Access Management

Access management is important in maintaining acceptable levels of service and safety on roadways. It is recommended that intersection spacing on Range Road 85 is 60m, this includes spacing from the intersection of Range Road 85 and the CN Railway. In other words, from the intersection of Range Road 85 and the CN Railway in either direction, the next closest intersection should be no closer than 60m.

With the anticipated future interchange, the east-west collector roads may see greater traffic volumes and therefore intersection spacing along Mannville Road (Township Roads 503B) and 504 is recommended to be 100m.

5.3 Off-Site Improvements

Development pressures within the western half of the ASP boundary may necessitate off-site improvements to the transportation network within the Village. In particular, the intersection of 48 Avenue (Township Road 503B/Mannville Road) and 45 Street may need enhancement. Necessary improvements will be determined through the preparation of a Transportation Impact Assessment at the time of subdivision or development, and all costs associated with transportation network improvements in support of proposed development will be the responsibility of the developer.

5.4 Highway 16/881 Interchange

Highway 16 is classified as a rural freeway divided highway within Alberta Transportation's roadway hierarchy. Highway 16's freeway status requires the closure of at-grade intersections and development of interchanges at key locations.

Alberta Transportation's Highway 16 access management plan identifies the closure of the at-grade intersection of Highway 16 and Range Road 85 (and Range Road 84 east of the ASP boundary). It also identifies the location of an interchange at the intersection of Highway 16 and Highway 881 (see **Figure 7**). After at-grade intersections are closed and the interchange is constructed, access to the ASP area from Highway 16 will be through the Village of Mannville via Highway 881 and Township Roads 503B and 504.

The construction of the interchange will also impact existing developed properties and roadways within the Village's existing industrial park. As shown in **Figure 7**, roadways from within the Village's industrial park are proposed to extend eastward into the ASP lands. The southernmost road extension may be impacted by the footprint of the proposed interchange. The ASP internal roadway design anticipates this possibility and maintains public road access to all parcels post-interchange construction.

5.5 CN Railway

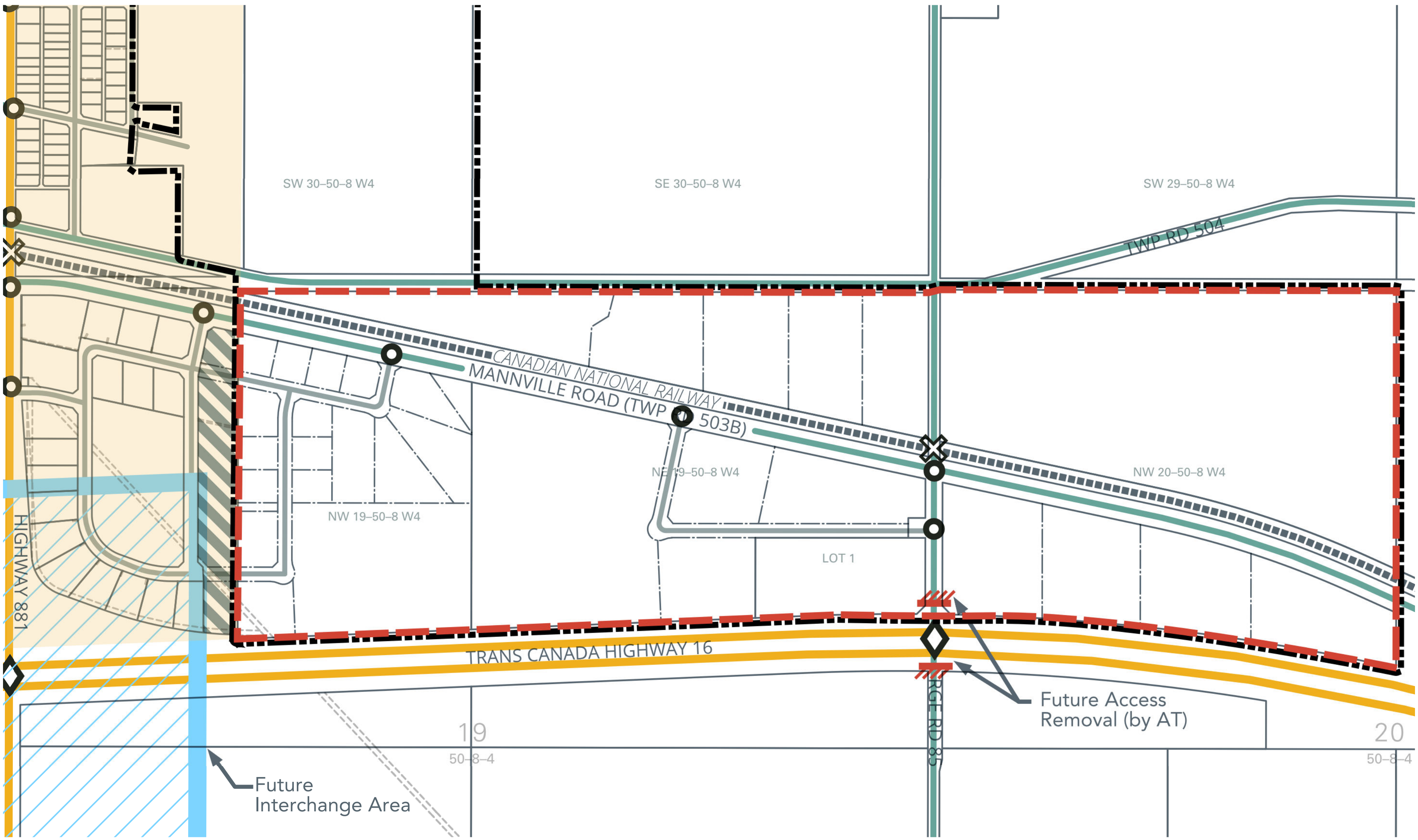
The existing access spacing along Range Road 85 relative to the CN Railway and Township Road 503B may not meet the minimum 60m spacing recommended by Bunt & Associates, although it may meet the Government of Canada's Grade Crossing Standard of a minimum 30m from the edge of the travelled way to the nearest rail of the grade crossing. The spacing will impact the stacking distance for larger vehicles, like a WB-21 semi-trailer or a WB-23 double trailer. If stacking distance becomes a safety issue over time, Township Road 503B may need to be realigned south of its current Range Road 85 intersection location.

The existing CN Railway crossing controls in and adjacent to the ASP may also need to be upgraded over time as traffic volumes increase to maintain safety.

5.6 Additional Analyses

The desktop review undertaken for this ASP does not provide sufficient level of analysis to support subdivision and development. The developer may be required to undertake a traffic impact assessment (TIA) in support of subdivision to determine if intersection upgrades or controls are required because of development.

In addition to a TIA, a geotechnical investigation for roadway construction to confirm soil stratigraphy, suitability of existing soil for construction, and to recommend road pavement structures based on soils and vehicular loading.



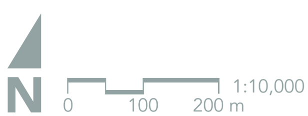


FIGURE 7
TRANSPORTATION NETWORK

LEGEND

- IDP Boundary
- Plan Boundary
- Shadow Plan Area
- Village of Mannville
- Canadian National Railway
- Highway
- Collector/Rural Roadway
- Local Roadway
- Major Intersection
- Minor Intersection
- CNR Crossing
- Future Access Removal

6.0 Servicing

BAR Engineering prepared a Servicing Brief (**Appendix E**) and a Stormwater Management Plan (**Appendix F**) to provide high level engineering review, analysis and recommendations for the ASP lands. The discussions below are derived from and informed by this document.

6.1 Water

The lands within the ASP boundary are not currently serviced with a municipal water distribution system. If a municipal water distribution system were to be extended into the ASP area, it would extend from the Shadow Plan area. All costs associated with accessing the ACE waterline and obtaining necessary utility right-of-way would be the responsibility of the developer.

The Village of Mannville is supplied with water from the ACE Waterline Corporation. A watermain, owned and operated by the County, would be required from the connection points at 47A Avenue/45 Street and 45 Street and looped throughout the development to provide service (see **Figure 8**).

Although a municipal water distribution system within the ASP is contemplated, it would not be considered until most of the serviced industrial lots within the Village of Mannville have built out to avoid creating competition for serviced industrial land that could be detrimental to the economic well-being of the Village. It is anticipated that rural water servicing consisting of individual water wells or cisterns will be used in the interim.

Water well servicing will require supporting groundwater/hydrogeological assessments prior to and as part of the subdivision process and will require approval and authorization from the Alberta Environment and Protected Areas to use groundwater.

6.2 Wastewater

The ASP lands are not serviced by a municipal wastewater system. However, services could be extended from the Shadow Plan area to the western lots of the ASP boundary (**Figure 8**). Sanitary sewage for the Village is treated at the Village lagoon.

6.2.1 Servicing Feasibility

A municipal wastewater collection system for the ASP lands could consist of a low-pressure collection system and/or gravity sanitary mains in combination with lift stations. The cost-effectiveness of such a system needs further analysis and is outside the scope of this ASP.

However, with the possible capacity challenges of the Village's lagoon storage cells discussed above, and the possible need for one or more lift stations to support sanitary servicing in the ASP boundary, a municipal wastewater system to service the ASP lands could be cost-prohibitive. If this proved to be the case, then the smaller lots shown in **Figure 8** in the western half of the ASP may not be large enough to support independent servicing, such as septic tanks and treatment fields/mounds, and would instead be required to be serviced with holding tanks in order to meet provincial setback requirements.

Municipal servicing feasibility within the ASP boundary requires additional discussion between the Village of Mannville and the County of Minburn.

6.2.2 Village Lagoon Capacity

To inform consideration of urban service provision to the smaller industrial lots within the western half of ASP boundary, BAR Engineering (BAR) was retained to update its 2009 capacity analysis of the Village's lagoon. A summary is provided below, and the detailed analysis can be found in **Appendix C**.

In summary, the 2023 report confirms the 2009 report findings, and identifies that providing servicing for development outside of the Village's boundary will require lagoon capacity upgrades. While a lagoon upgrade is contemplated by the Village in the future, the timing of such a project would be subject to the Village's capital budgeting prioritization process.

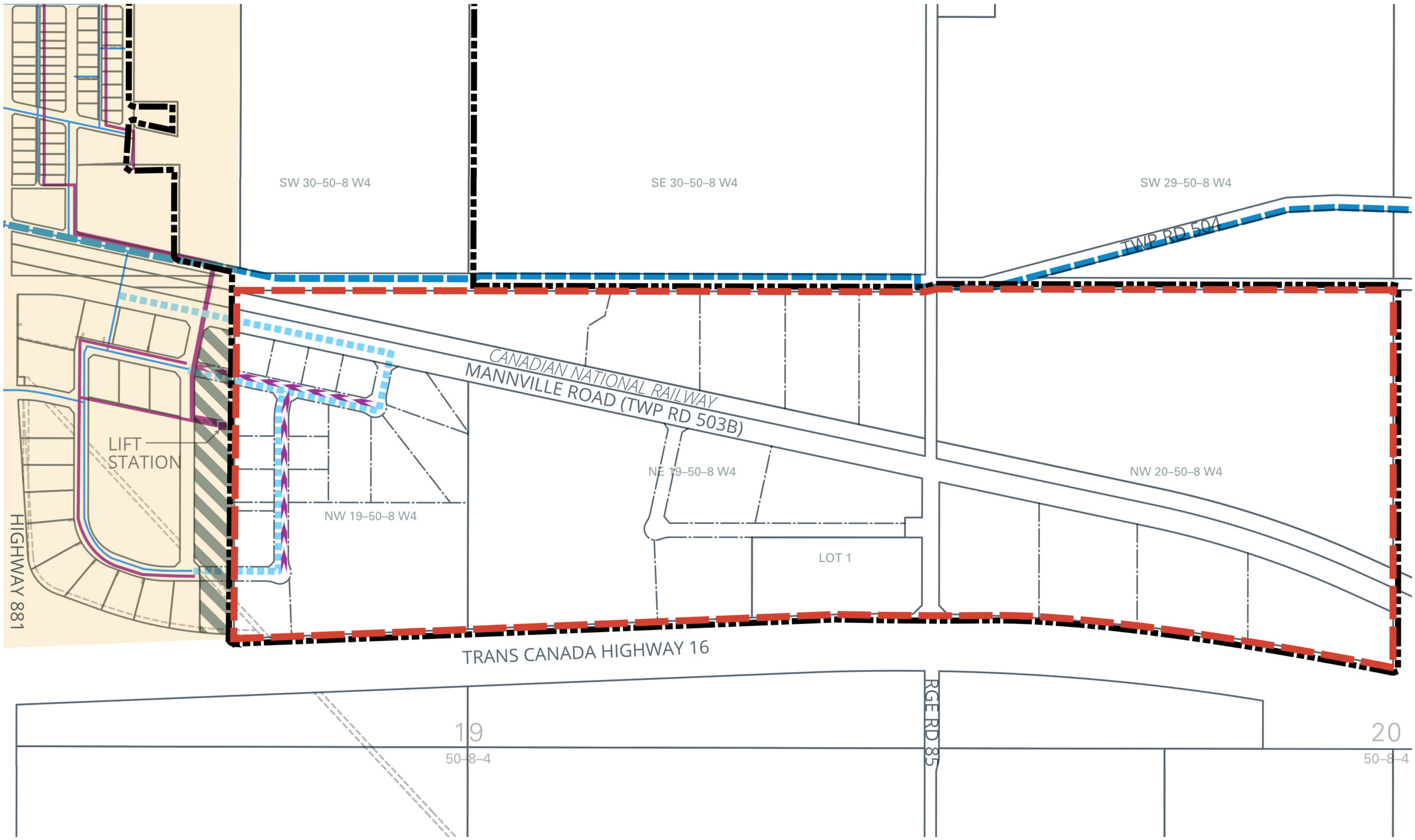
6.3 Stormwater Management

Two stormwater management scenarios in the Stormwater Management Plan (**Appendix F**) were developed and analyzed to support maximum flexibility of development in the future. The two stormwater management concepts are illustrated conceptually in **Figures 9A** and **9B**.

Both scenarios assumed wetponds (stormwater management ponds) would be used to provide water quality enhancement through settling of runoff pollutants within the permanent pool, or the normal water levels. Rain event runoff is assumed to be stored above the permanent pool and released downstream at a restricted rate after the rain fall event has ended. The rate of release is generally kept at the same rate as at pre-development to mitigate impacts on downstream watercourse. The storage area of the wetpond is within 2m above the permanent pool and can store 1 in 100-year storm runoff or the 1 in 25-year storm runoff for a period of 24 hours. Additional design assumptions and details can be found in **Appendix F**.

Scenario 1 (**Figure 9A**) includes an overall stormwater management system consisting of interconnected stormwater management ponds for all the proposed development areas.

Scenario 2 (**Figure 9B**) consists of a dedicated stormwater management pond for the smaller, potentially serviced lots adjacent to the Village coupled with private on-site stormwater management storage ponds on the remaining parcels.



LEGEND

- IDP Boundary
- Plan Boundary
- Shadow Plan Area
- Village of Mannville
- ACE Regional Waterline
- Existing Water Main
- Proposed Water Main
- Existing Sanitary Sewer
- Proposed Sanitary Sewer

FIGURE 8
SERVICING

Further review and refinement of the stormwater management plan will be required at the subdivision stage once phasing has been confirmed as phasing may impact the proposed stormwater management pond locations.

The minimum setback required by Alberta Transportation for stormwater management ponds is 40m from the edge of the road right-of-way. This setback distance may be reduced by Alberta Transportation to 30 m if the pond is protected by a berm and/or fence and/or guard rail. The current dugout/stormwater pond has a setback distance of 30 m. Any new stormwater management facilities should be installed no closer to Highway 16 than the current dugout/stormwater pond. Additionally, the developer will require a roadside development permit from Alberta Transportation for construction of all stormwater management ponds and infrastructure within 800m of the centerline of Highway 16 prior to development.

6.4 Shallow Utilities

Shallow utilities will be brought into sites as needed by the developers, and rights-of-way will be established at the time of subdivision as needed. Specifically, ATCO Gas requires that a suitable alignment be provided within the boulevards of all arterial and major roads for the ATCO Gas feeder mains.

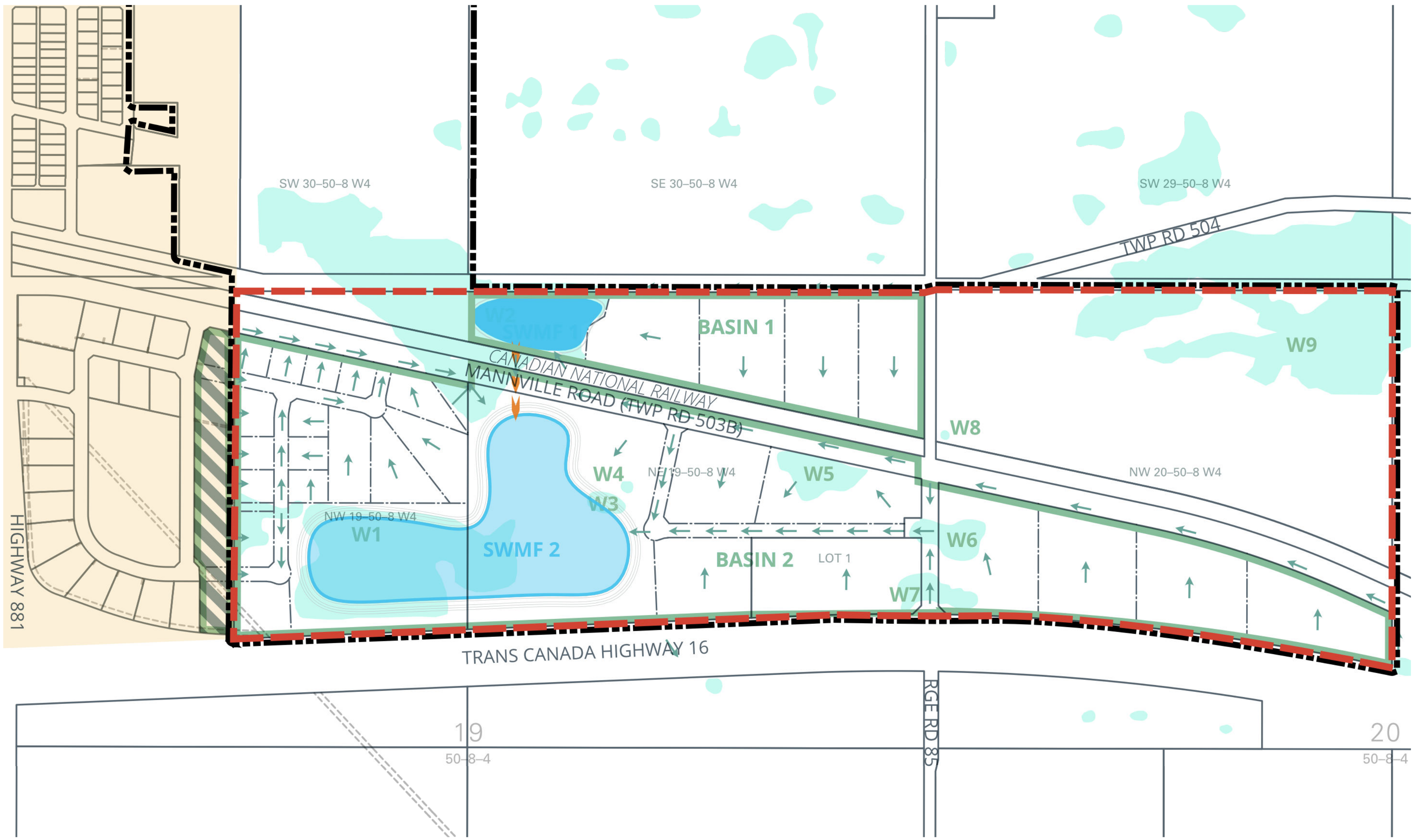


FIGURE 9A

STORM WATER: SCENARIO 1

LEGEND

- IDP Boundary
- Plan Boundary
- Shadow Plan Area
- Village of Mannville
- Wetland
- Storm Pond
- General Drainage Direction
- Proposed Storm Sewer
- Catchment Boundary

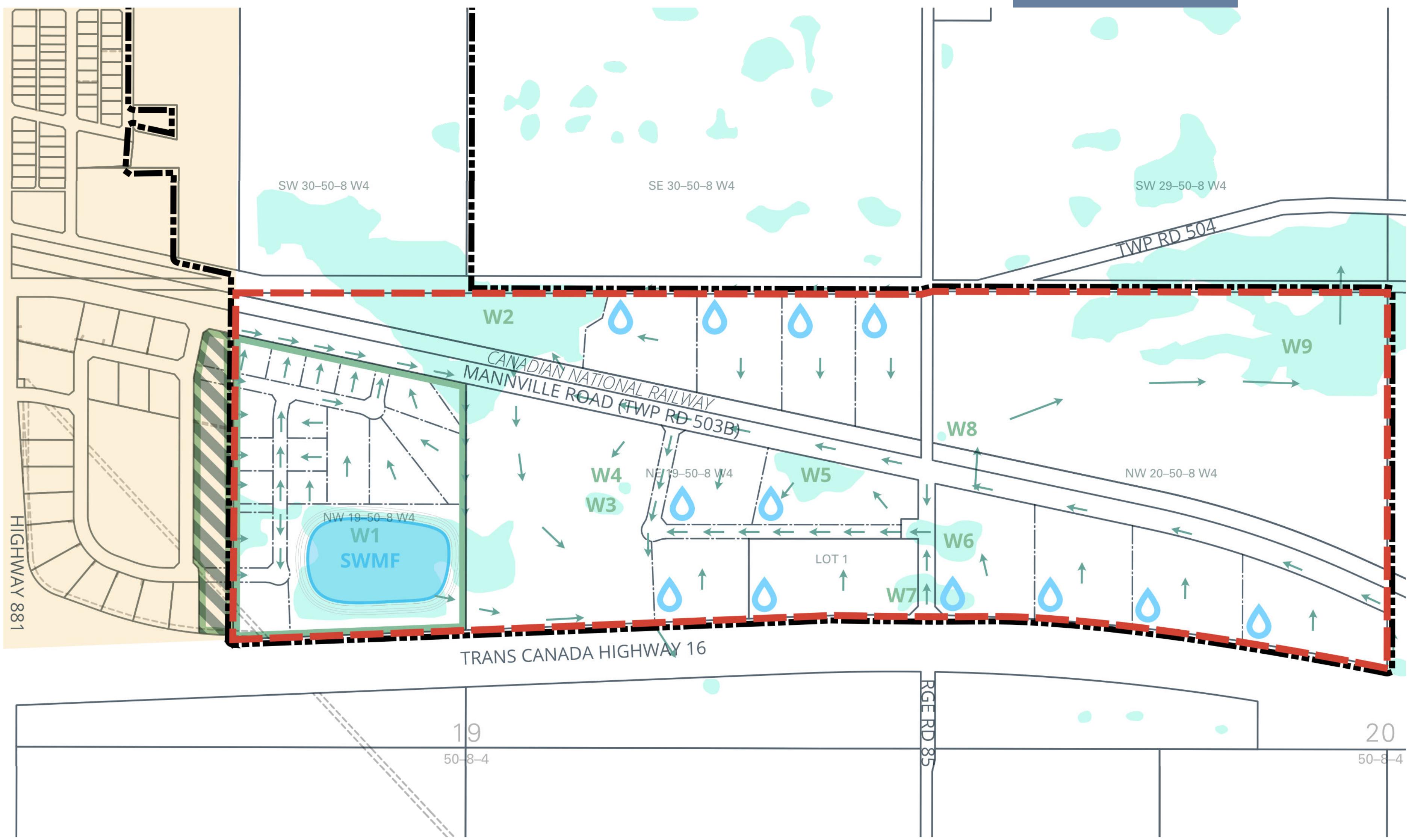


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FIGURE 9B
STORM WATER: SCENARIO 2

LEGEND

- IDP Boundary
- Plan Boundary
- Shadow Plan Area
- Village of Mannville
- Wetland
- Storm Pond
- General Drainage Direction
- Catchment Boundary
- Private On–Site Storm Water Management Requried

7.0 Earthworks

The field analysis undertaken by SolidEarth Geotechnical led to numerous findings and recommendations for development in its report, found in **Appendix B**. It should be noted that the recommendations are preliminary only and should not be used in detailed design. A detailed geotechnical investigation should be completed for each proposed development lot/ building site during the detailed design stage.

Findings and recommendations were developed for site development, foundation options and preliminary design, stormwater management pond, installation of buried utilities, and pavement structure.

The recommendations for site development are summarized below. For details and full discussion of the other key areas of analysis, please reference the source document.

Subgrade Preparation

1. During initial site grading, all topsoil should be stripped and removed from the site.

2. Topsoil should not be mixed with mineral soils or be used as engineered fill material.

3. Construction traffic on unprotected subgrade should be kept to a minimum and restricted to low pressure track equipment to the extent possible

   a. Exposed subgrade may be sensitive to heavy rubber-tire construction equipment, especially in wet conditions,

   b. Soft subgrade conditions may be encountered at some locations, particularly following snow melt and heavy rain events.

4. All exposed subgrade, following achievement of rough grades, should be inspected by a geotechnical engineer, and include a proof-roll test to confirm that deflections from construction traffic are minimal. Soft and weak areas identified during inspection should be strengthened and improved.

5. Engineered fill should consist of low to medium plastic clay or a well-graded, granular material.

6. All fill soils should be free from any organic materials, contamination, deleterious construction debris, and stone greater than 150mm in diameter.

Requirement for Engineered Fill

1. Engineered fill should be thawed when placed and placed during non-frozen conditions.

2. All engineered fill should be compacted to a minimum of 98% of standard Proctor maximum dry density (SPMDD) within the proposed building envelopes, and to a minimum 95% of SPMDD within graveled yards and paved areas.

3. The upper 300mm of the subgrade within the paved areas should be compacted to 98% of SPMDD.

4. Fill should be compacted in lift thickness of 300mm (loose) or less, and within two percent of the optimum moisture content of the soil.

5. Engineered fill within the building footprint should extend at least 1.5m, or the thickness of the fill, beyond the footprint of the building.

6. Fill placement procedures and quality of the fill oils should be monitored by geotechnical personnel.

7. Field monitoring should include compaction testing at regular frequencies.

8. Settlement in the order of one to three percent of the fill thickness should be anticipated for engineered fill compacted between 98% and 95% SPMDD. The majority of this settlement is expected to occur within the first year following construction.

Site Drainage

1. A minimum grade of 2% is recommended at the subgrade level to accommodate surface water runoff away from the development area.

2. The upper 300mm of the backfill around buildings (where no pavement structure is proposed) should consist of compacted clay to act as a seal against runoff water. The clay should extend a minimum distance of 3m away from the building and should be graded at a slope of 5% or more.

3. Positive surface drainage should be provided in the early stages of construction to prevent ponding of water and softening of the subgrade.

8.0 Interpretation & Implementation

8.1 Interpretation

Policies are written using "*shall*", "*should*" or "*may*" statements. The interpretations of "*shall*", "*should*" and "*may*" that follow provide the reader with a greater understanding of the intent of each policy statement:

'**Shall**' — denotes compliance or adherence to a preferred course of action.

'**Should**' — denotes compliance is desired or advised but may be impractical or premature because of valid planning principles or unique/extenuating circumstances.

'**May**' — denotes discretionary compliance or a choice in applying policy.

8.2 Monitoring & Amendment

Plan implementation will be primarily through the subdivision and development of land in ways consistent with the policies and vision of this ASP. Variances to the requirements of this ASP should not be considered unless supported by defensible planning rationale. Part of implementation is monitoring the document for continued consistency with the County's plans and policies, as well as higher-order statutory documents. This ASP should be reviewed at least every five years to ensure its continued relevance.

Occasionally, it will be desired or necessary to amend the ASP to keep it consistent with changing policies, market needs, or to address housekeeping matters. Housekeeping amendments consisting of correcting typos, grammatical errors and the like will not necessitate a formal amendment process. However, major amendments, such as changing land use designations, locations of major infrastructure or other similarly substantive changes, will trigger a formal amendment process including notification, public engagement and circulation to agencies pursuant to the MGA.

9.0 Policies

9.1 General

Development Control

POLICY 1 The developer shall be required to seek a Roadside Development Permit from Alberta Transportation for all development proposals.

Compliance with ASP

POLICY 2 The County of Minburn shall ensure that all future land use, subdivision and development, and amendment decisions made with respect to lands within the boundary of the Mannville East Industrial Park ASP comply with the provisions contained within this ASP, including the Figures. Decisions related to document 'housekeeping' or those that would be considered minor deviations, relaxations, or variations from the provisions of this ASP would not require an amendment to this document where it can be demonstrated that the deviation, relaxation or variance does not substantively alter the intent, force or effect of the provisions of this ASP.

POLICY 3 The developer shall ensure that all site preparation, public road, and any other public facility/improvement is professionally engineered and constructed to the satisfaction of the County of Minburn in accordance with the County's standards.

9.2 Environment

POLICY 4	Developers shall undertake an Alberta Wetland Rapid Evaluation Tool assessment prior to development, and in support of subdivision, to determine the exact class of wetland and appropriate mitigation measures for wetland impact, including development setbacks, contained within development area or plan of subdivision.
POLICY 5	The developer shall require Alberta Water Act approval prior to impacting existing wetlands.
POLICY 6	The developer shall employ measures during construction to control noxious weeds.
POLICY 7	The developer shall develop and employ a sedimentation and erosion control plan, especially around retained wetlands.
POLICY 8	The developer should undertake a field survey prior to development to determine the presence of rare plant species.
POLICY 9	The developer should undertake wildlife and nest sweeps between April 1 and August 15 and within seven (7) days of the onset of development, including vegetation clearing.

9.3 Industrial

POLICY 10	The County shall ensure that Industrial uses proposed to be located immediately adjacent existing residences should not produce excessive light trespass, noise, dust, smells or other nuisance that is, in the opinion of the Development Authority, in excess of what one might experience living next to an agricultural operation.
POLICY 11	The County shall require screening and/or fencing to be employed to reduce negative visual impact of laydown yards, outdoor storage of equipment and other uses with potential for unsightliness in proximity to existing residences.
POLICY 12	Developers shall avail themselves of the CN Rail Proximity Guidelines and development proposals shall be respectful of and reflect the suggested design parameters contained therein.

9.4 Agricultural

POLICY 13 The County shall allow existing agricultural operations to continue in perpetuity at the will of the landowner.

POLICY 14 The County should ensure that existing agricultural operations in the Agricultural designation are not unduly impeded and/or impacted upon by future adjacent non-agricultural development within the ASP boundary.

POLICY 15 The County shall allow the existing residences within the Agricultural designation to remain or to be renovated or reconstructed in compliance with all applicable bylaws and building codes.

POLICY 16 The County shall not support new residential developments within the ASP boundary.

POLICY 17 The County should support conversion of Agricultural designated land to Industrial/Commercial designation with an amendment application supported by additional analysis proving suitability of the land for the intended use.

9.5 Sequence of Development

POLICY 18 The County should ensure the development of the smaller, potentially serviced lots within the western half of the ASP boundary occurs after the Village of Manville's supply of existing industrial land within the Shadow Plan area is mostly built out.

9.6 Reserve Lands

POLICY 19 The County shall maximize reserve dedication pursuant to the MGA.

POLICY 20 The County should allow for municipal reserve dedication in the form of cash in lieu of land.

POLICY 21 The County should not permit municipal reserve deferral.

POLICY 22 The County shall dedicate the setbacks around wetlands, as well as the retained wetlands themselves, as environmental reserve or environmental reserve easement at the time of subdivision.

POLICY 23 The County shall not identify naturalized or converted wetland stormwater management ponds as environmental reserve.

POLICY 24 The County shall not give municipal reserve credit for land above the high-water mark of stormwater management ponds.

9.7 Transportation

Roads & Access

POLICY 25 The County shall require that all proposed roadways within the ASP are engineered, designed, and developed to a rural cross section with roadside ditches to provide drainage and convey stormwater runoff, to the County's current road standards.

POLICY 26 The County should require that roadways are constructed to accommodate a minimum 9m finished top width to support truck traffic.

POLICY 27 The County should require intersection spacing on Range Road 85 is a minimum 60m.

POLICY 28 The County should require intersection spacing on Township Roads 503B and 504 is a minimum 100m.

POLICY 29 The County shall ensure that a suitable alignment is provided within the boulevards of all arterial and major roads for the ATCO Gas feeder mains.

Traffic Impact Assessment

POLICY 30 The developer may be required to prepare a Traffic Impact Assessment (TIA), at their sole expense, in support of a subdivision or development permit application. The scope of the TIA will be determined by Alberta Transportation and the County of Minburn. If a TIA should be required, it will be prepared to the satisfaction of Alberta Transportation, in consultation with the County.

POLICY 31 The developer shall undertake a Traffic Impact Assessment to determine if the at-grade intersection of Hwy 16 & RR85 will need improvements to make sure that the intersection will be able to safely accommodate the traffic generated by the development.

On– and Off–Site Improvements

POLICY 32 The developer shall undertake, at the sole cost of the developer, any engineering, requirements or improvements identified in or resulting from the TIA approved by the County and/or Alberta Transportation, or any other engineering, requirement or improvement specified by Alberta Transportation in relation to Highway 16 or Highway 881 as a result of or that is attributable to the development of land within this ASP must be undertaken to the satisfaction of Alberta Transportation, in consultation with the County.

POLICY 33 The developer shall be responsible for all costs associated with transportation network improvements in support proposed development as identified in an approved Traffic Impact Assessment.

CN Railway

POLICY 34 The County may need to consider realigning Township Road 503B south of its current Range Road 85 intersection location if stacking distance between the CN Railway and Township Road 503B becomes a safety issue.

POLICY 35 The County may need to collaborate with CN Railway to improve crossing controls in and adjacent to the ASP over time as traffic volumes increase, in order to maintain safety.

Additional Analyses

POLICY 36 The developer shall undertake a geotechnical investigation to confirm soil stratigraphy, suitability of existing soil for construction, and to recommend road pavement structures based on soils and vehicular loading.

9.8 Services

General

POLICY 37 The County shall require that the smaller lots adjacent to the Village's eastern boundary, as depicted conceptually in Figure 5, be serviced by municipal services if those services are available at the time of development. All costs associated with connecting to municipal services shall be borne by the developer.

Water

POLICY 38 Water well servicing will require supporting groundwater/hydrogeological assessments prior to and as part of the subdivision process and will require approval and authorization from Alberta Environment and Protected Areas to use groundwater.

POLICY 39 The Developer shall bear all costs associated with accessing and distributing potable water from the ACE water line in support of their development.

Wastewater

POLICY 40 The County shall require sanitary sewer holding tanks on lots 2.02ha in area or smaller to ensure provincial setback requirements are met.

POLICY 41 The County shall discuss municipal sanitary sewer servicing options within the ASP boundary with the Village of Mannville.

Stormwater Management

POLICY 42 The County shall not identify private stormwater management ponds as public utility lots at the subdivision process.

POLICY 43 The County shall require that stormwater management ponds have a setback of a minimum of 40m from the edge of the Highway 16 right-of-way unless otherwise approved by Alberta Transportation.

Shallow Utilities

POLICY 44 The developer shall make all arrangements and provide all necessary rights-of-way for shallow utilities to service the lot.

POLICY 45 Stormwater management ponds should be naturalized to eliminate the need for mowing maintenance and to dissuade access by people.

9.9 Lighting, Landscaping & Screening

Lighting

POLICY 46 The County of Minburn shall encourage dark night skies.

POLICY 47 The County of Minburn should require developers to mitigate light trespass from new developments through use lighting with full cut-off fixtures and avoiding unnecessary up-lighting into the night sky.

Landscaping & Screening

POLICY 48 The County of Minburn should not vary minimum standards of the Land Use Bylaw for screening and landscaping on new developments in the ASP boundary, especially in proximity to existing residences, a public road or Highway 16.

POLICY 49 The County of Minburn shall encourage an elevated standard both with respect to landscaping standards and architectural appearance, with respect to all new development or any redevelopment within 300m of Highway 16.

9.10 Implementation

POLICY 50 The County of Minburn will ensure that when amendments are made to this ASP in the future, any complementary amendments to the Municipal Development Plan or Intermunicipal Development Plan are also made to ensure conformance with Section 638(2) of the Municipal Government Act.

POLICY 51 Housekeeping amendments consisting of correcting typos, grammatical errors and the like shall not necessitate a formal ASP amendment process.

POLICY 52 Changes to the subdivision concept shown shall not require an amendment to the ASP.

POLICY 53 Major amendments such as changing land use designations, changing major infrastructure or other similarly substantive changes shall require a formal ASP amendment process including notification, public engagement and circulation to agencies pursuant to the MGA.

POLICY 54 In accordance with the Village of Mannville-County of Minburn Intermunicipal Development Plan, the County shall refer applications for amendment of this ASP to the Village for review and comment.

POLICY 55 The exercise of discretion and variance related to any matter or decision rendered with respect to this ASP, as well as any amendment to this ASP, shall be guided by the following principles:

a) The exercise of variance or discretion in deciding an application or amendment to this ASP must be both reasonable and defensible within the letter and spirit of this ASP as well as widely accepted planning principles.

b) If a requirement or provision of this ASP is to be deviated from or if an amendment is to be made, it is essential that those exercising the discretion or deciding upon variance or making the amendment clearly understand the rationale behind the requirement or provision they are being asked to vary or amend.

c) Discretion, variance and amendment shall only be considered if it can be demonstrated that the discretion, variance or amendment being considered will, at a minimum, not jeopardise the policies of this ASP and, at best, better serve them.

d) Any variance or discretion exercised, or any amendment made, shall be fully documented so that the reasons and rationale for the variance or discretion exercised or amendment made are accurately recorded and clearly understood.

POLICY 56 The County of Minburn should monitor the Mannville East Industrial Park ASP on an on-going basis and undertake more thorough review every five years.

A

Appendix A
Biophysical Report

Does not form part of this Bylaw.

Prepared by: X-Terra Environmental Services Ltd.

X-TERRA Environmental Services Ltd.
A THUNDERCHILD ENERGY SERVICES COMPANY

Red Willow Planning on Behalf of County of Minburn No. 27 and Village of Mannville

BIOPHYSICAL DESKTOP ASSESSMENT

NW-19, NE-19 & NW-20-050-08 W4M

PREPARED BY:

X-Terra Environmental Services Ltd.

August 5, 2022

XTES File # 22148

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Environmental Services Ltd.
A THUNDERCHILD ENERGY SERVICES COMPANY

August 5, 2022

Red Willow Planning
1800, 736-6th Avenue SW
Calgary, AB T2P 3T7

Subject: Biophysical Desktop Assessment
NW-19, NE-19 & NW-20-050-08 W4M
County of Minburn No. 27

X-Terra Environmental Services Ltd. is pleased to present the final copy of the above referenced report.

Yours truly,

X-Terra Environmental Services Ltd.

Lacey Teasdale, RT(Ag)
Manager AB Environmental Assessment

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APPENDICES

1 INTRODUCTION

X-Terra Environmental Services Ltd. (X-Terra) was retained by Red Willow Planning on behalf of the County of Minburn No. 27 (COM) and Village of Mannville (VOM) to complete a Desktop Review and Biophysical Environmental Assessment (BEA) to provide background and overview of potential regulatory requirements and recommendations for Red Willow Planning's Area Structure Plan (ASP). The ASP will be developed for the COM and VOM in relation to portions NW-19, NE-19 and NW-20-050-08 W4M located east of Mannville, Alberta.

This BEA includes preliminary desktop assessments of the ASP lands and any sensitive environmental features or concerns that may require consideration to meet environmental protection expectations and relevant regulations. As such, the identified ASP lands and immediate surrounding lands were considered as part of the BEA.

The overall objective of the BEA is to identify and calculate the environmental importance and sensitivity of the ASP Lands and those adjacent, and to provide recommendations to avoid or minimize environmental impacts. In addition, the BEA identifies any applicable regulatory processes and provides a high-level outline of potential regulatory requirements and approvals needed for future development of the ASP lands.

1.1 Location, Purpose, Size and Scope

The Area Structure Plan (ASP) area includes approximately 136 hectares (335 acres) of land on the east-central side of the COM. It is located within the NW and NE of 19 and NW-20-050-08 W4M, on the south-east portion of Mannville, Alberta.

The ASP area has been identified as a future growth corridor for Intermunicipal Development Plan (IDP) between the COM and the VOM.

Figure 1 - Aerial Overview Map of the ASP lands area NW & NE-19, NW-20-050-08 W4M.

2 INVENTORY

2.1 Land Use

The current land uses within the future development project footprint include agricultural, wetlands and developed land. The developed land areas consist of residential development. This area is located north as well as south of the Canadian National (CN) rail mainline and Township Road 503B. Highway 16 makes the south boundary of the subject ASP footprint. The natural areas are located intermittently and in small areas within the ASP lands footprint, and are identified as aspen stands, and small wetland areas.

2.2 Surrounding Land Use

The current land uses outside of the ASP lands footprint includes agricultural (both cultivated and hayland), commercial and residential (intermittent with natural areas of aspen parkland and less commonly, grassland areas).

2.3 Biological Resources

2.3.1 Natural Region and Soil Characteristics

The ASP lands are found within the Aspen Parkland Ecoregion of east-central Alberta (Strong and Leggat, 1992). Topography varies across the region from nearly level, to gently rolling areas. The Central Parkland Natural Subregion is bordered by the Dry Mixed-wood Natural Subregion to the north and west, and the Foothills Fescue, Foothills Parkland, and Northern Fescue Natural Subregions to the south. The Parkland Natural Region consists of highly productive cropland and a vast majority of the region has been cultivated. Areas that have not been converted for agricultural purposes are characterized by a mosaic of aspen and prairie vegetation on remnant native parkland areas (Natural Regions Committee, 2006).

The soil polygon for the area consists of Orthic Black Chernozem on moderately coarse textured (sandy loam) sediments deposited by wind or water. The polygon includes soils with Rego profiles. The landscape for the area is a very gently slope of 15% (Alberta Agriculture and Forestry 2016).

2.3.2 Vegetation

The area of the ASP lands has statistical data gathered by the Government of Alberta between the years of 1971-2000 which indicates the growing season starts between April 17-24 and ends between October 15- 21 (GoA, 2018), lasting between 174 - 187 days. According to the Alberta Soil Information Viewer, the future project development areas have a Land Sustainability Rating System ((LSRS) of 3(10) and 4(8) - 5W(2)). As per the LSRS for Agricultural Crops, the above-mentioned classifications are as follows:

- 3(10) indicates moderate limitations that restrict the growth of specific crops;
- 4(8) - 5W(2) indicates lands in this area may have severe to very severe limitations that restrict the growth of specific crops, in some areas due to excess water (not due to inundation).

Air photo review indicates the future development area is used for primarily agricultural purposes, varying from crop production to presumed pasture/hay land to support livestock production.

2.3.2.1 Annual Crop Inventory

The 2020 Annual Crop Inventory (Government of Canada 2020) was used to identify vegetation/habitat types for the project area. The digital map shows the area is covered by annual crops (40%), pasture/forage (30%), wetland (15%), water (10%) and broadleaf (5%). (Due to excessive insurance claims, the 2021 data has not all been collected for release)

2.3.2.2 Rare Plant Definition

Rare plants/Indigenous plant species are considered wildlife under the National Wildlife Policy for Canada and must be protected. Government of Alberta standards indicate that vegetation assessments and rare species habitat assessments, if required, will be completed during appropriate surveys.

For this assessment, rare plants refer to the provincial tracking list (Alberta Conservation Information Management System; ACIMS). Plants within the database are rated and follow the NatureServe ranking methodology (ACIMS (Alberta Conservation Information Management System) 2022):

S1: Five or fewer occurrences in the province or may be vulnerable to extirpation because of other factor(s)

S2: Twenty or fewer occurrences in the province or may be vulnerable to extirpation because of other factor(s)

S3: Twenty-one to 100 occurrences in the province or somewhat vulnerable due to other factors, such as restricted range, relatively small population sizes, or other factors.

S4: Apparently secure in present conditions with typically >100 occurrences, may be rare in different parts of province

S5: Secure, common, widespread and abundant

Rare species of S1, S2 and S3 ratings are found across all moisture regimes but are most found in very dry and very wet sites. Locations are dependant on sunlight, soil type and exposure. These features combine to create common habitats where rare and endangered species can be found:

- Groundwater seepage areas (springs, seeps)
- Stream banks
- Steep eroding slopes
- Sandstone outcrops
- Wetlands
- Disturbed ground
- Native grasslands

Within the ASP lands no groundwater seepage areas, stream banks or steep eroding slopes were identified.

2.3.2.3 ACIMS Database Search

The Alberta Conservation Information Management System (ACIMS) database was searched (online June 16, 2022) for the ASP lands regarding the occurrence of any species at risk. The ACIMS search indicated that there are no non-sensitive or sensitive elemental occurrences within proximity to the ASP lands.

2.3.3 Wildlife

2.3.3.1 Wildlife Habitat

Natural Regions Committee 2006 which shows the Natural Regions and Subregions of Alberta was reviewed to determine key wildlife habitat features that could be present in the ASP lands as well as the overall Subregion.

The Aspen Parkland Subregion is a broad arc from southwestern Manitoba, northwest through Saskatchewan to central Alberta.

Specific areas, such as wetlands and riparian habitats, provide key and critical wildlife habitat potential; when planning projects and activities, all efforts must be made to reduce impacts to critical habitats to ensure proposed timing and activities will not detrimentally affect potential avian, fish and/or wildlife habitat.

2.3.3.2 Sensitive Wildlife Database Search

The Fish and Wildlife Internet Mapping Tool (FWIMT; AEP 2022) was used to generate fish and wildlife reports for the ASP lands as well as a 3km radius. These reports show which sensitive wildlife species have been previously documented in the area. To identify which of these species may be of provincial or federal conservation concern, the status of all reported species was then classified according to the General Status of Alberta Wild Species report (Government of Alberta 2017a), the Alberta *Wildlife Act* and *Wildlife Regulation* (Government of Alberta 1997; Government of Alberta 2000), the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and status under the federal *Species at Risk Act* (SARA) as provided in the Species at Risk Public Registry (Government of Canada 2020).

According to the FWMIS database, no sensitive wildlife species were found within a 3km radius of the centre of the subject area. The FWMIS Search does, however, show the ASP lands occur within a Sharp-tailed Grouse and Bald Eagle range. There was mention of Sharp-tailed Grouse (Tympanuchus. phasianellus) north-west of the future development and should be noted for future projects.

2.3.4 Environmentally Significant Areas

The ASP lands were reviewed to determine if any Environmentally Significant Areas or other protected areas were within its boundary. ESAs have been defined as places that are vital to the long-term maintenance of biological diversity, soil, water, or other natural processes at multiple scales, that can be used as a strategic conservation tool for land use planning and policy.

According to the provincial dataset no quarter sections within the ASP lands are classed as a provincial ESA. The ASP lands do not contain any provincially designated parks or protected areas (Government of Alberta 2017b).

2.3.5 Landscape Analysis Tool (LAT) Report

A Landscape Analysis Tool (AER 2015) report was generated for the ASP land area for use during the desktop review. The LAT report identifies the area as a Sharp-tailed Grouse Survey area, as well as identifies that development within 100m of an active nest site between April 15 and August 15 is required for specific grassland bird species. As such, species-specific surveys may be required to be completed as per the Sensitive Species Inventory Guidelines (AEP, 2013). *Appendix D*

2.3.6 Caveats on Land Title

Land titles were obtained for each property within the Project Area and were assessed for any applicable caveats. No environmental concerns were identified based on the review of the current titles; however, several utility rights-of-way are present (see *Appendix D).*

2.4 Hydrology, Water Bodies and Wetlands

2.4.1 Hydrology

The project area is located within the North Saskatchewan River Basin (NSR). The NSR originates in the ice fields of Jasper and Banff National Parks and follows the North Saskatchewan River, flowing east towards the Alberta-Saskatchewan border. The North Saskatchewan River basin is divided into 12 watersheds, with the project area located in the Vermilion River watershed near the southern edge of the NSR basin. The Vermilion River watershed covers approximately 7860km^2, or 14% of the total NSR basin. Farming and oil and gas development are primary economical means as the watershed is home to soils highly suitable for agriculture and petroleum reserves (State of the Watershed Report, North Saskatchewan River Watershed Alliance, 2005).

Vermilion River Watershed and Flood Hazard Map for the project area can be found in *Appendix B*.

2.4.2 Wetlands

The ASP lands footprint was reviewed using historic air photos and information provided by Alberta Merged Wetland Inventory geospatial dataset (GoA, 2018) for the presence of water features, including wetlands, waterbodies and watercourses. Historic aerial photographs between the years of 1980 to 2021 were reviewed and compared focusing on the presence of, and changes to, sensitive environmental features within the ASP lands footprint wetland and watercourse areas. The photographs were reviewed in combination with relevant climate and precipitation data to provide preliminary wetland delineation and permanency.

In total, eight graminoid marsh wetlands and one ephemeral wetland have been identified within the ASP footprint; it should be noted that the findings of any future field assessments have the potential to identify further wetlands based on soil, vegetation and topography features. It should also be noted that a man-made component is present within the boundaries of wetland 1 (W1); it is believed this area was used as a borrow excavation at some point and is now likely utilized as a dug out for agricultural purposes. The desktop assessment also identified what appear to be two man-made drainage ditches/canals, assumed to have been created to facilitate area drainage. It is unknown if *Water Act* approval or Licence was obtained for any of the man-made wetland/watercourse features.

The table below is a summary of desktop wetland assessment to include wetland classification and approximate wetland area for portions of wetland within the ASP lands boundary.

Wetland ID	AWCS Classification	Approx Wetland Area Within ASP Lands (ha)
Wetland 1	Temporary Graminoid Marsh - M[G][II] with man-made component	6.3
Wetland 2	Seasonal Graminoid Marsh - M[G][III]	6.2
Wetland 3	Temporary Graminoid Marsh - M[G][II]	0.6
Wetland 4	Ephemeral Wetland - M[G][I]	0.03
Wetland 5	Temporary Graminoid Marsh - M[G][II]	0.6
Wetland 6	Temporary Graminoid Marsh - M[G][II]	0.6
Wetland 7	Temporary Graminoid Marsh - M[G][II]	0.5
Wetland 8	Seasonal Graminoid Marsh - M[G][III]	0.05
Wetland 9	Seasonal Graminoid Marsh - M[G][III]	6.1
		20.98

**Assumptions within table are based on historic values assigned to similar wetlands within the region. The wetlands have been delineated wetlands as per ABWRET-D directive but have not been submitted for an ABWRET Score.*

Table 1 – Wetland Assessment Summary

Any wetlands directly impacted by future development will require *Water Act* (GoA, 2000) approval supported by reporting and documentation as outlined in the Alberta Wetland Policy (GoA, 2013). The historic aerial imagery, including delineations of notable wetlands is located in *Appendix* C.

In general, wetland classes range from A to D, with D being the lowest valued wetland (AEP, 2016); it is anticipated that the impacted wetlands within the potential development area will be valued as 'D" wetlands, with slight chance for 'C' value in instances of the larger wetland complexes. An Alberta Wetland Rapid Evaluation Tool assessment should take place prior to development of the project area to determine the exact class of wetland, as well as to determine the appropriate mitigation measures for wetland impact.

2.5 Topography

2.5.1 Local and Regional Topography

The regional topography is relatively flat to gently sloping with slopes ranging from 0.5% to 2%. Topography within the ASP footprint is overall generally characteristic of the regional topography of the surrounding area. In general, the topography of the entire region is level to gently sloping slightly rolling with low risk of erosion potential.

2.6 Geology

The surficial geology in the area of the ASP lands is mainly composed of moraine - Diamicton (till) deposited directly by glacial ice with a mixture of clay, silt, and sand, as well as minor pebbles, cobbles, and boulders; characterized by a lack of distinctive topography. Locally, this unit may contain blocks of bedrock, stratified sediment, or lenses of glaciolacustrine and/or glaciofluvial sediment (Fenton et al. 2013).

Beneath the surficial sediments the composition is Lea Park Formation which is composed of dark shale with minor siltstone. Calcite veins and ironstone concretions as well as bentonite beds are found throughout the formation.

2.7 Cultural and Historical Resources

The Listing of Historic Resources (Alberta Culture and Tourism, May 2022) is a tool that may assist developers, industry representatives and municipalities in determining if a proposed development might affect historic resources. The listing identifies lands that contain or have a high potential to contain historic resources, including archaeological sites, paleontological sites, aboriginal traditional use sites of a historic resource nature (burials, ceremonial sites, etc.), and/or historic structures. The listing can provide proponents with advance notification of possible historic resource concerns and may be used as a tool in planning projects.

The Listing of Historic Resources (accessed online July 2022) was searched for the ASP lands area. The search indicated NW and NE-19 and NW-20-50-8 W4M have no historic resources value (HRV), therefore a *Historical Resources Act* clearance is not required.

3 EXISTING POLICY

This section provided a summary of municipal policies and federal and provincial legislation that may be applicable to the project. The summary is intended as a guide, but the proponent must ensure that the project adheres to the current policies, plans and legislation at the time of development as they are subject to change.

3.1 Municipal Land Use

3.1.1 County of Minburn Intermunicipal Development Plan

The County of Minburn consists of the Hamlet of Lavoy, the Hamlet of Ranfurly, the Hamlet of Minburn, the Village of Innisfree, the Village of Mannville, the Town of Vegreville and surrounding rural areas. The Intermunicipal Development Plan (IDP) was adopted by the County of Minburn and Village of Mannville to investigate any potential areas of mutual interest in a joint planning area. The ASP lands area is within the area identified in the IDP.

3.1.2 County of Minburn Municipal Development Plan

The Municipal Development Plan (MDP) outlines any potential for altering land uses throughout the county and guidance for the type of development required to do so. This is completed with planning goals to maintain the balance of conservation of existing agricultural areas along with development of economics.

3.2 Provincial

3.2.1 Environmental Protection and Enhancement Act

The *Environmental Protection and Enhancement Act*, RSA 2000, c. E-12 (EPEA) supports and promotes the protection, enhancement and wise use of Alberta's environment. Only those activities designated in the EPEA Schedule of Activities are subject to EPEA. The development of certain projects requires either an

Environmental Impact Assessment (EIA) report, approval, registration, or notification under EPEA. A list of mandatory activities that require an EIA is located in the *Environmental Assessment (Mandatory and Exempted Activities) Regulation*, Alta Reg 111/1993. This regulation also lists activities which are exempt from an EIA, or are discretionary (not on either list and require a decision by the Director). The *Activities Designation Regulation*, Alta Reg 276/2003 lists activities that require an approval, registration, or notification under EPEA. Whether or not activities on the ASP lands will need an application under EPEA will depend on the specifics of the development.

3.2.2 Municipal Government Act

Under the *Municipal Government Act,* RSA 2000, c. M-26, section 664(1), a municipality may require a portion land subject to a proposed subdivision to be retained in its natural state as environmental reserve if it consists of:

a) A swamp, gully, ravine, coulee, a natural drainage course.

b) Land that is unstable or subject to flooding.

c) A strip of land adjacent to the bed and shore of any water body, no less than 6 m in width. This includes any lake, river, stream or other body of water.

A municipal government can designate land as environmental reserve for the purpose of preserving natural land features, to prevent pollution of the land or body of water, to endure public access to the waterbody, or to prevent development where natural features may pose a risk to personal safety or property.

3.2.3 Public Lands Act

All Crown land, including the bed and shores of all permanent watercourses and water bodies, are considered Alberta public lands unless they are owned by the Government of Canada. As such, approvals from AEP under the *Public Lands Act*, RSA 2000, c. P-40 are required for any activity on public lands or the bed or shore of Crown owned rivers, streams, or lakes. A list of activities that require a *Public Lands Act* approval is available from the AEP website.

3.2.4 Water Act

All water resources located within the province of Alberta are owned by the Provincial Government. AEP administers the *Alberta Water Act*, RSA 2000, c. W-3, which is the primary legislation governing the use and management of Alberta's water resources, including wetlands. Alberta's Water Act requires approval, code of practice notification, and/or attainment of a license before undertaking construction in a surface water body or activities related to a water body which have the potential to impact the aquatic environment.

A Water Act Code of Practice Notification is required for specific activities that adhere to the Codes of Practice. There are four types of activities that have an associated Code of Practice:

- Code of Practice for Pipelines and Telecommunication Lines Crossing a Water Body
- Code of Practice for the Temporary Diversion of Water for Hydrostatic Testing of Pipelines
- Code of Practice for Watercourse Crossings

- Code of Practice for Outfall Structures on Water Bodies

Specific construction and mitigation standards/conditions are outlined within the codes of practice that vary depending on the type of activity and the class of the waterbody being impacted. If the requirements outlined in the Code of Practice cannot be followed, the project must obtain approval under the *Water Act*.

Wetland management in Alberta is regulated through Section 36 of Alberta's *Water Act*. A *Water Act* approval is required prior to any works that may impact a wetland. AEP released Alberta's new Wetland Policy in September 2013, which applies to all wetlands in the province. Applicants proposing an activity in a wetland must submit a wetland assessment to the regulatory body with the application and other required plans. Most activities will require an Alberta Wetland Assessment and Impact Report (WAIR) to be prepared by an Authenticating Professional to be submitted with the application. Certain low risk activities allow an Alberta Wetland Assessment and Impact Form (WAIF) to be submitted in place of a WAIR. The Alberta Wetland Rapid Evaluation Tool – Actual (ABWRET-A) must be used when a WAIR is required to determine the relative value of the wetland, which is then used to inform decisions about avoiding high-value wetlands and determines cost and replacement ratios for wetland replacement when avoidance is not possible. The Alberta Wetland Rapid Evaluation Tool – Desktop (ABWRET-D) can be used when a WAIF is required for the activity.

3.2.5 Weed Control Act

The Alberta *Weed Control Act*, SA 2008, c.W-5.1 regulates noxious weeds, prohibited noxious weeds, and weed seeds through inspection and enforcement measures, as well as outlines provisions for cases of non-compliance. The Act requires that a person must control noxious weeds and destroy prohibited noxious weeds that are on a property they own or occupy, as well as not facilitate the spread of weeds or weed seeds. The plant species listed in Schedule 1 of the *Weed Control Regulation*, Alta Reg 19/2010 are designated as prohibited noxious weeds in Alberta, and those listed under Schedule 2 are listed as noxious weeds in Alberta.

3.2.6 Wildlife Act

Alberta's *Wildlife Act*, RSA 2000, c.W-10 protects the residences of wildlife on private and public lands. More specifically, a person must not wilfully molest, disturb or destroy a house, nest, or den of prescribed species. Section 96 of the *Wildlife Regulation*, Alta Reg 143/1997 outlines the wildlife species, areas, and time of year when the Act applies. All endangered wildlife, upland game birds, some migratory birds, snake and bat dens, and beavers (in some instances) are species of which Section 36 of the Act applies to. For most wildlife, disturbing the habitat of these animals is prohibited year-round throughout Alberta. AEP staff may recommend timing restrictions on activities to minimize disturbance to the nest of breeding wildlife and birds. The *Wildlife Act* also protects endangered plant species (both vascular and non-vascular) listed in the *Wildlife Regulation*.

3.3 Federal

3.3.1 Fisheries Act

The *Fisheries Act,* RSC 1985, c. F-14 applies to all Canadian fisheries waters and Fisheries and Oceans Canada (DFO) has the responsibility to administer and enforce the conservation and protection of fish habitat on private property, as well as on provincial and federal lands. Section 36(3) of the *Fisheries Act* prohibits the discharge of deleterious substances into a water body frequented by fish; Section; Section 35(1) prohibits any work or activity that results in harmful alteration, disruption, or destruction of fish habitat; and Section 34.4(1) states that no person shall carry on any work, undertaking or activity, other than fishing, that results in the death of fish.

DFO has provided a list of measures to protect fish and fish habitat that apply to clear span bridges, bridge maintenance, on-land mineral exploration activities, and decking repairs. If a project can't completely implement the measures and doesn't fall under the standards and codes of practice, a request for project review must be sent to DFO. Activities that are covered under the standards and codes of practice include: beaver dam removal, culvert maintenance, fish protection screens, routine maintenance dredging, temporary cofferdams and diversion channels, and temporary stream crossings. If a project can follow all procedures, practices, and standards within the standards and codes of practice, a notification form must be submitted to DFO.

If a project does not meet the criteria established by DFO to avoid serious harm to fish and the effects cannot be mitigated by an applicable standards and codes of practice, a Request for Review must be submitted for consideration by the Minister of Fisheries and Oceans. If activities are determined to cause serious harm to fish, an Application for Authorization will be required that will include a fish and fish habitat report, available design information, a description of effects on fish and fish habitat, a description of measures and standards to avoid or mitigate serious harm to fish and an offsetting plan.

3.3.2 Migratory Birds Convention Act

The *Migratory Birds Convention Act*, SC 1994, c. 22 (MBCA) and *Migratory Birds Regulations*, CRC, c. 1035 prohibit the harm of migratory birds, their nests, eggs, and habitat. Environment Canada recommends timing restrictions and setbacks to help identify when the risk of contravening the MBCA is particularly high. According to the Map of Nesting Zones in Canada (Government of Canada 2017), the ASP lands area is located in Nesting Zone B4 withing the Prairie Bird Conservation Region. In this nesting zone, birds are actively nesting between April 14 and August 28 (Government of Canada 2017), with some variation between different bird species and habitat types.

Environment Canada advises that habitat destruction activities (e.g., vegetation clearing, flooding, draining, construction, etc.) in areas attractive to migratory birds are prohibited during the active nesting period to reduce the risk of contravening the MBCA. In select cases where vegetation is open and nests can be readily identified (e.g., a few trees in a city park or isolated patch of trees), a wildlife sweep can be conducted by a qualified biologist prior to beginning activities to ensure no nests are within the area to be disturbed, and no contraventions under the MBCA occur.

The MBCA and its associated regulation specify that efforts should be made to preserve and protect habitat necessary for the conservation of migratory birds. This includes nesting and wintering grounds, migratory bird corridors, and encompasses such activities as tree clearing, wetland consolidation, and temporary and permanent disturbances occurring in proximity to migratory bird habitat.

3.3.3 Species at Risk Act

The Species at Risk Act, SC 2002, c. 29 (SARA) provides protection for species listed as “Endangered” or “Threatened” under the Act. Protections for these species under SARA only apply on federal lands (oceans and waterways; national parks; military training areas; national wildlife areas; some migratory bird sanctuaries; and First Nations reserve lands). SARA does not apply to lands held by the Province of Alberta or its private citizens unless “the laws of Alberta do not effectively protect the species or the residences of its individuals”. The Minister may issue an order in council to protect federally listed species that occur on provincial or private lands, but his has not occurred within the ASP lands or surrounding area.

4 IMPACTS MITIGATIONS AND MONITORING

4.1 Impact Assessment Results

4.1.1 Potential Impact to Vegetation

Almost exclusively non-native vegetation makes up the ASP lands with the exception of the semi-permanent marshes and ditch areas. For this reason, the potential impact on vegetation is minimal. Soil disturbance during the construction of the new development welcomes potential for invasive species and a weed control program should be developed for any future development activities of the ASP lands.

4.1.2 Potential Impact to Wildlife

It is recommended that a pre-construction wildlife sweep be conducted within 7 days prior to the onset of vegetation clearing or construction activities if activities are to be carried out between April 1st and August 15th.

The residual effects of the project on wildlife are anticipated to be low. Overall, impacts on wildlife are expected to be relatively minimal due to the proximity of the project to existing developments and location on agricultural lands. However, temporary indirect impacts on wildlife may result from increased noise and stimuli extending for distances into adjacent habitats. This noise and stimuli may cause edge effects, resulting in some species avoiding areas of adjacent habitats during construction. The impacts of disturbances associated with potential future development may cause some wildlife species to favor or avoid areas adjacent to the project during the activity. However, these residual impacts are expected to be low due to the high level of development in the surrounding area.

4.1.3 Potential Impact to Hydrology

As the ASP lands are being converted, there is a possibility of natural surface water absorption becoming more limited. This could be alleviated by retaining some wetlands within the new landscape.

4.1.4 Potential Impact to Wetlands

Based on the assessment future development plans, nine wetlands within the ASP lands have been identified.

As per the Alberta Wetland Mitigation Directive, the most desired option for any wetland is avoidance. There are many instances where avoidance is the only option considered, crown ownership, special designated lands, presence of endangered species, etc. For purpose of this BEA, avoidance of wetlands is likely not feasible as future development plans may encompass several wetlands.

Minimization is the second preference when planning a project if avoidance is not possible. It refers to minimizing both the direct and indirect effects on the wetland and the value of the wetland during the future development plans. For purpose of this BEA, minimization of wetland impacts may be feasible as development plans may be altered to reduce impacts to the wetlands within the ASP lands. In order to achieve this goal, alternate activities may be considered, or development plans may be modified. Water Act Approval, and other related applications and approvals under the Act, are required if the wetland under the minimization strategy option.

If permanent wetland loss is expected, a Replacement Proposal must accompany the *Water Act* application. The desktop delineation identified nine wetlands within the project area totalling approximately 21ha. The desktop assessment also identified what appear to be two man-made drainage ditches/canals, assumed to have been created to facilitate area drainage. In the event these wetlands are eliminated due to potential future development, a replacement payment may be required; this would be required to be submitted to the Wetland Replacement Agency for this area. This area of Alberta falls under the in-lieu fee rate of $18,600.00/ha, and the in-lieu fees would be payable to the Wetland Replacement Agency for this area. The approximate potential in-lieu fees per wetland are itemized within the table below:

Wetland ID	Est. Wetland Value *	AWCS Classification	Approx Wetland Area Within ASP Lands (ha)	Total In-Lieu Replacement Cost**
Wetland 1	D	Temporary Graminoid Marsh - M[G][II] with man-made component	6.3	$117,180.00
Wetland 2	D	Seasonal Graminoid Marsh - M[G][III]	6.2	$115,320.00
Wetland 3	D	Temporary Graminoid Marsh - M[G][II]	0.6	$11,160.00
Wetland 4	D	Ephemeral Wetland - M[G][I]	0.03	$558.00
Wetland 5	D	Temporary Graminoid Marsh - M[G][II]	0.6	$11,160.00
Wetland 6	D	Temporary Graminoid Marsh - M[G][II]	0.6	$11,160.00
Wetland 7	D	Temporary Graminoid Marsh - M[G][II]	0.5	$9,300.00
Wetland 8	D	Seasonal Graminoid Marsh - M[G][III]	0.05	$930.00
Wetland 9	D	Seasonal Graminoid Marsh - M[G][III]	6.1	$113,460.00
			20.98	

**Assumptions within table are based on historic values assigned to similar wetlands within the region. The wetlands have been delineated wetlands as per ABWRET-D directive but have not been submitted for an ABWRET Score.*

*** Based on desktop wetland delineations, a summary of the approximate wetland replacement for ASP lands. The values were calculated based on a replacement ratio of 1:1, relative wetland value assessment unit of 7, and an in-lieu rate of $18,600.00.*

Table 2 – Wetland Loss Replacement Proposal

In addition, any permanent or semi-permanent, shallow open water or marsh wetlands are likely to have their ownership claimed by the provincial Crown under Section 3 of the *Public Lands Act* (GoA, 2000). Further investigations and regulatory applications may be required for assessing the permanence of the wetlands situated within the proposed development area

4.1.5 Topography Impact

It is anticipated that future development of the ASP lands will have minor impacts to the topography at the regional scale, due to the already present, relatively flat conditions. It is assumed that grading, soil stripping, and infill would occur during future development, therefore, there will likely be an impact at the local scale. Due to the lack of ravines, coulees, and or escarpments (of greater than 15% slope), no mitigation measures are currently required at an Environmental Assessment stage.

4.1.6 Geographical and Geological Impact

It is anticipated that future development of the ASP lands will have negligible impacts to the geography and geology, due to the specific landscape position and the landscape features around the ASP lands area. No unique landforms were identified. No major disruption, in general, of regional drainage patterns are expected due the relative flat nature of the geographic landforms.

Localized minor impacts would be expected. Also, due to no known mapped bedrock surface exposures, no mitigation measures are required for geographical and geological impacts

4.1.7 Historical Resources Impact

The Alberta Listing of Historic Resources Spring 2022 Edition (csw-listing-of-historic-resources-spring-2022-03) was reviewed for the subject lands; the future development area does not have an HRV value. If historic resources are discovered during development activities, findings must be reported to the Heritage Division of Alberta Culture, Multiculturalism and Status of Women before continuing work.

4.1.8 Socio-Economic Impact

There is potential for the future development of the ASP lands to disturb the surrounding community, however this disturbance will be low and effect more commercial areas than residential. There is potential for noise disturbance, interrupted usage of certain roads in the area and potential of construction waste on-site. Disturbances will be short-term, and the long-term impact will be an economic growth potential for the community.

4.2 Impact Assessment and Recommendations

The ASP lands area is somewhat disturbed with roads, farms and other developments. Future development will shift the land use from agriculture to rural industrial and commercial which will cause a loss of vegetation. Although this could cause a reduction of breeding opportunities for grassland birds and small mammals, much of the areas surrounding the ASP lands area are similar quality habitats.

If any impacts to wetlands are to occur, *Water Act* approval is required. In addition to *Water Act* approval, wetland replacement is required for the disturbance of all wetlands (excluding ephemeral wetlands), and in-lieu fees may be required for permanent impacts to wetlands. In addition, any permanent or semi-permanent, shallow open water or marsh wetlands, are likely to have their ownership claimed by the provincial Crown under Section 3 of the *Public Lands Act* (GoA, 2000).

The ASP lands are located within Sharp-tailed Grouse range and have the potential for other sensitive and species of concern to occur in the project area. Prior to development activities, sensitive species surveys are to be conducted as per the applicable Sensitive Species Inventory Guidelines (GOA, 2013).

All activities pertaining to future development of the ASP lands must follow the *Migratory Bird Convention Act*. A pre-construction wildlife and nest sweep is recommended within 7 days prior to the onset of any future development activities.

Noise, access issues and other potential disturbances from development will be short-term and will be outweighed by the long-term socio-economic impacts the ASP lands area will have on the region when complete.

Appropriate planning, the use of current best practices, knowledgeable/experienced supervisors and equipment operators will help mitigate the potential impacts on soil such as compaction, erosion, significant soil loss, severe admixing and reduces soil quality. Prior to any development activities, it would be beneficial to develop specific plans such as an environmental construction and operational plan that outline strategies to protect the soil, minimize erosion, retain, and re-establish vegetation, and control invasive weed species. Also, a construction/development plan should be developed to include strategies to minimize the initial environmental impacts and reduce the overall environmental footprint caused by future development activities.

4.3 Conclusion

On behalf of the County of Minburn No. 27, X-Terra Environmental Services Ltd. completed a Biophysical Environmental Assessment (BEA) of ASP lands within the NW-19, NE-19 and NW-20-050-08 W4M, east of Mannville, Alberta.

The information gathered throughout the BEA including the proposed preliminary development plans were interpreted to determine the potential for negative environmental impacts that may result from the future development activities. Findings revealed that significant environmental features were not present within the above mentioned ASP areas.

5 EVALUATION OF INFORMATION AND REPORTING

This report has been prepared and the work referred to within, has been undertaken by X-Terra Environmental Services Ltd. (X-Terra) for the named client using generally accepted environmental consulting practices. The material within reflects X-Terra's best judgment based on the material available at the time of preparation. It is intended for the exclusive use of the client, its affiliated companies and partners, their respective insurers, agents, employees, advisors, and applicable regulatory agencies. Any use, reliance on, or decision based on this report made by any person other than those identified above, is the sole responsibility of such other person. X-Terra makes no representation or warranty to any other person with regard to this report and the work referred to within and accepts no duty or care to any other person or any liability or responsibility whatsoever for any losses, expenses, damages, fines, penalties, or other harm that may be suffered or incurred by any other person as a result of the use of, reliance on, any decision made, or any action taken based on this report, or the work referred to in this report.

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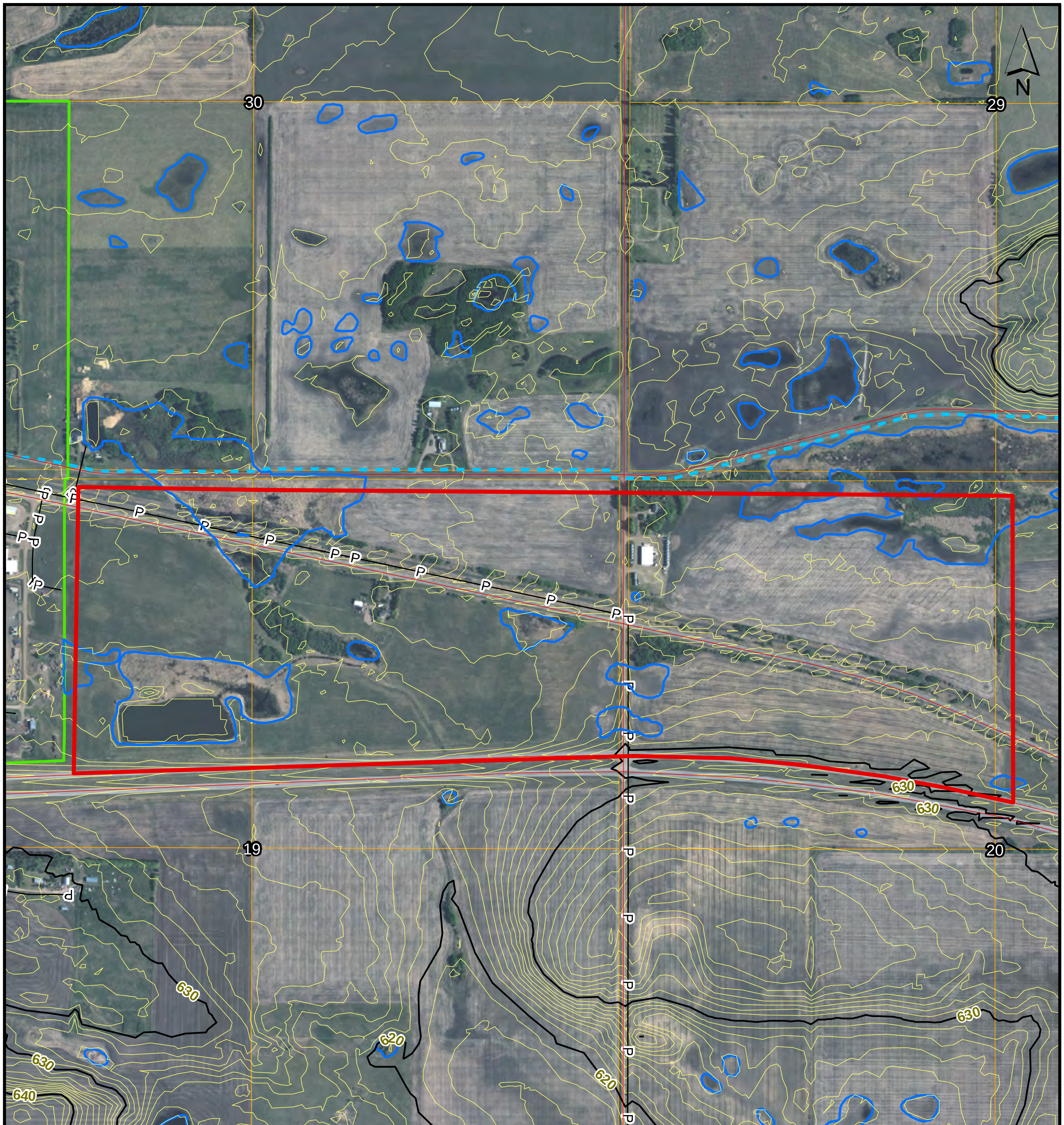
APPENDIX A: FIGURE 2: PROJECT LOCATION OVERVIEW



LEGEND

- QUARTERSECTION
- PROJECT FOOTPRINT
- VILLAGE OF MANVILLE
- WETLAND BOUNDARY
- HIGHWAY
- WATER LINE
- P— PRIMARY POWER LINE
- CONTOUR LINE (10M)
- CONTOUR LINE (1M)

PROJECT:

RED WILLOW PROJECT

TITLE:

OVERVIEW

0 500 M

SCALE	DATUM	PROJECTION	DATE	DRAWN	REVIEWED	VERSION
1:12,500	NAD 83	UTM Z12	2022-08-04	JC	CB	R1

X-TERRA Environmental Services Ltd.

THUNDERCHILD Energy Services

FIGURE: **2**

REFERENCE: NATURAL RESOURCES CANADA, CENTRE FOR TOPOGRAPHIC INFORMATION, 2012; ALBERTA ENVIRONMENT AND SUSTAINABLE RESOURCE DEVELOPMENT AIR PHOTO DISTRIBUTION; GOOGLE EARTH, ESRI, BING IMAGERY
NAD_1983_10TM_AEP_FOREST

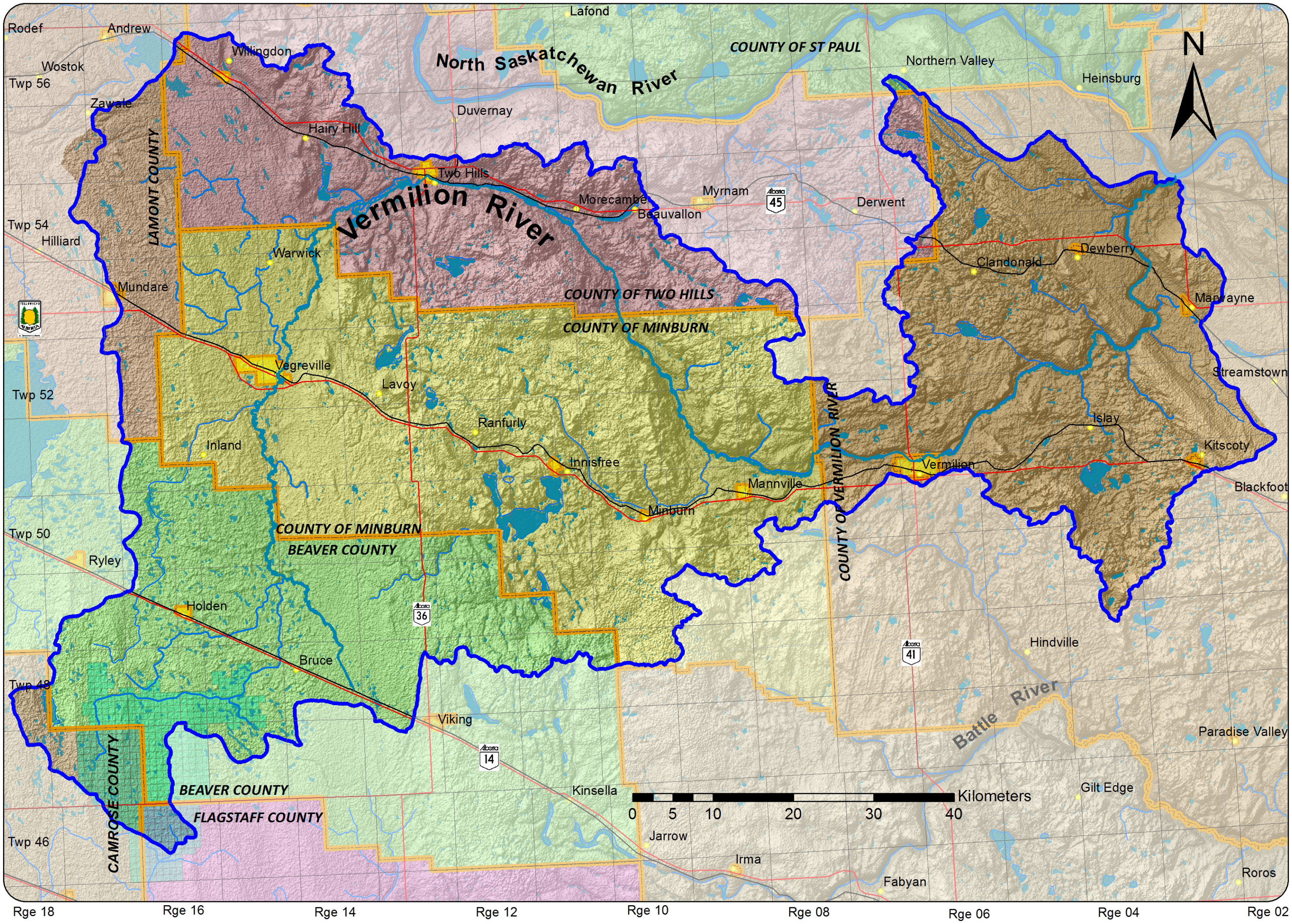
S:\GIS\2022_Projects\County of Minburn\22148_County of Minburn(Red Willow) ASP 2022\MXDs\1 - Report\22148 COUNTY OF MINBURN RED WILLOW.mxd

10TM AEP F

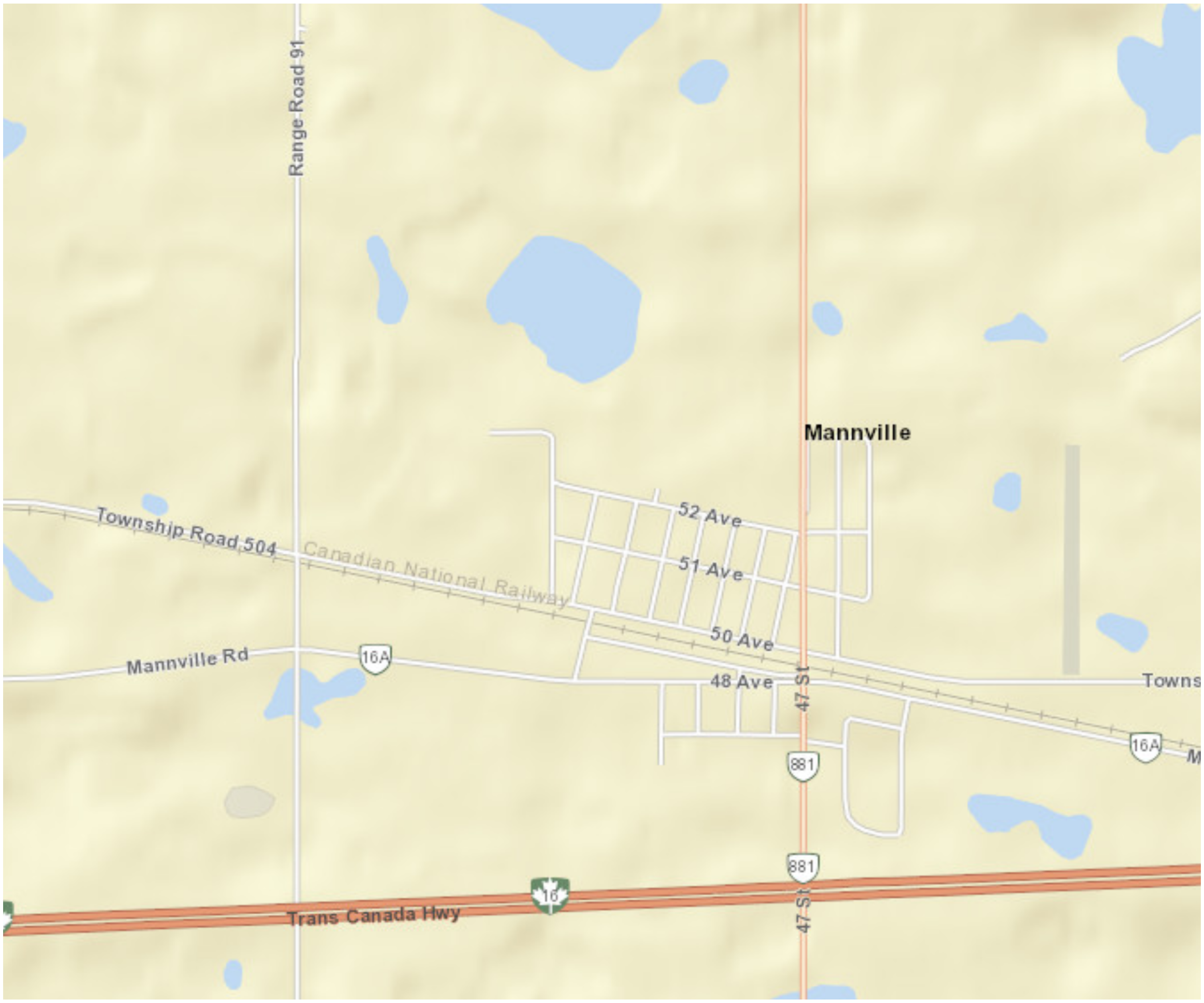
APPENDIX B: WATERSHED/FLOOD HAZARD MAP

Agriculture and Agri-Food Canada Agriculture et Agroalimentaire Canada

Vermilion River Watershed Basemap



Flood Hazard Map



Design Flood

0 0.3 0.6 0.9 1.2 km

- Floodway
- Flood Fringe
- Overland Flow (Flood Fringe)
- Under Review
- 855.09 m Cross Section and Design Flood Level

Map Projection: Mercator Auxiliary Sphere
Map Datum: World Geodetic System 1984
Flood Level Datum: Canadian Geodetic Vertical Datum of 1928

The flood information as depicted is subject to change, therefore the Government of Alberta assumes no responsibility for discrepancies at the time of use.

Flood Hazard Maps

Flood hazard maps define floodway and flood fringe areas for the 1:100 design flood. These maps are typically used for long range planning and to make local land use decisions, and are available to all levels of government and the public to help build resilient communities.

Flood Study Details

Vegreville Flood Hazard Study

This study assesses and identifies flood hazards along 14 km of the Vermilion River and 13 km of an unnamed tributary through Vegreville. Open water flooding is the design condition for this study. The design flow for the Vermilion River and the unnamed tributary are 73.0 m^3/s and 3.3 m^3/s respectively.

Study Status: Final

Report Name: Vegreville Flood Risk Mapping Study

Report Author: SNC-Lavalin Inc., Edmonton, Alberta

Report Date: April 1994

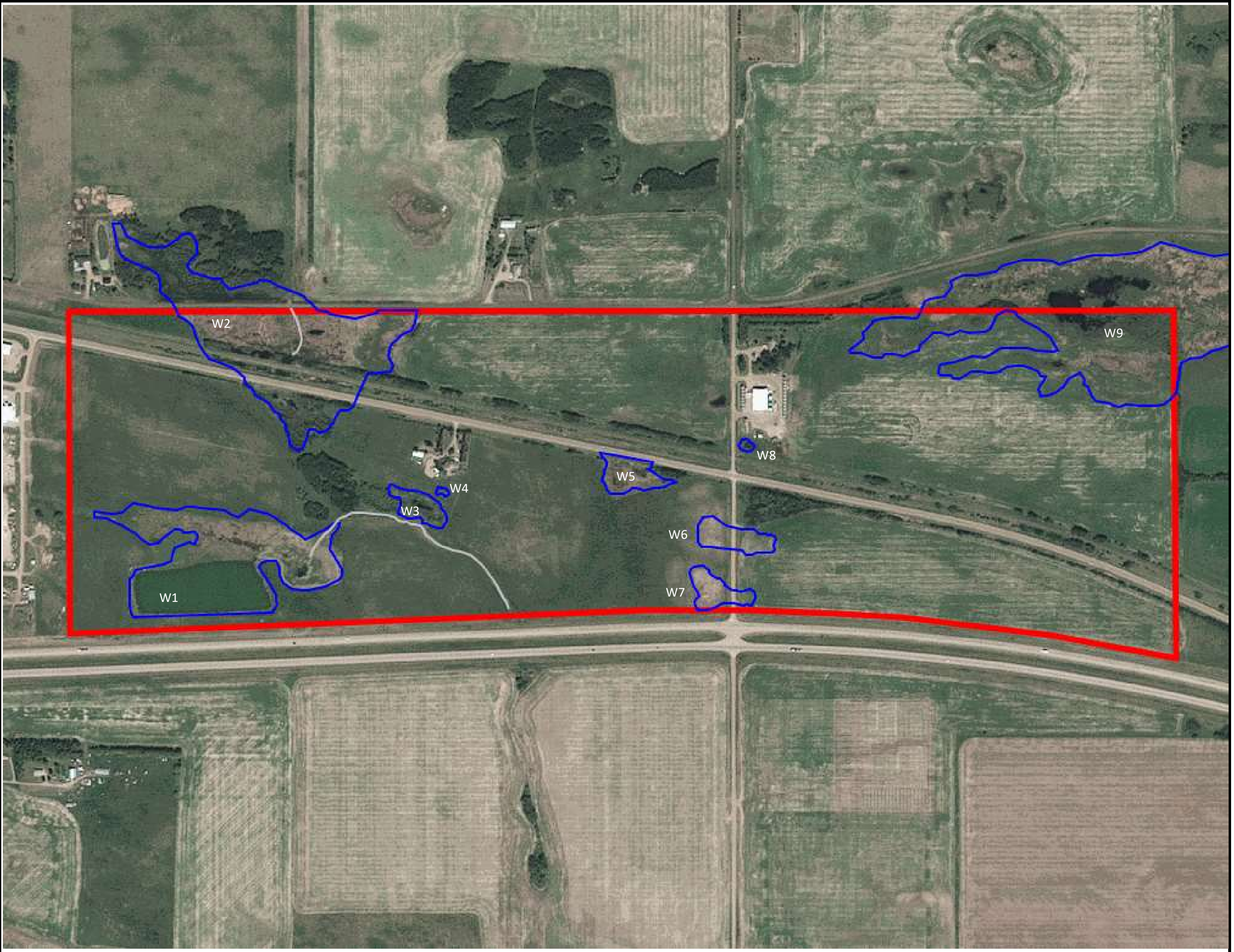
Limitations

The flood extents shown on this map are not expected to match previous floods due to different river flows, variations in local conditions, and assumptions made as part of the flood study. The flood mapping and other information presented were prepared in accordance with generally accepted engineering practices, using the best data available when the flood study was conducted. Information is subject to change, and the Government of Alberta assumes no responsibility for discrepancies at the time of use.

Contact Us

For more information about flood maps and the provincial Flood Hazard Identification Program please visit www.floodhazard.alberta.ca or email us at aep.flood@gov.ab.ca.

APPENDIX C: FIGURE 3: WETLAND DELINEATIONS/HISTORIC AERIAL IMAGERY



DESCRIPTION

Photo Description: 2019 Abadata Aerial Image
X-Terra File No.: 22148

LEGEND

ASP Lands:
Desktop Deliniated Wetland/Tributary:
Drainage Ditch/Canal

NOT TO SCALE

REFERENCE

2019 Abadata

County of Minburn No. 27
Biophysical Environmental Assessment

X-TERRA Environmental Services Ltd.
A THUNDERCHILD ENERGY SERVICES COMPANY

FIGURE 1

DESCRIPTION

Photo Description: 1980 Air Photo
X-Terra File No.: 22148

LEGEND

Proposed Project Area:
Railway:
Highway:

REFERENCE

1980 AER

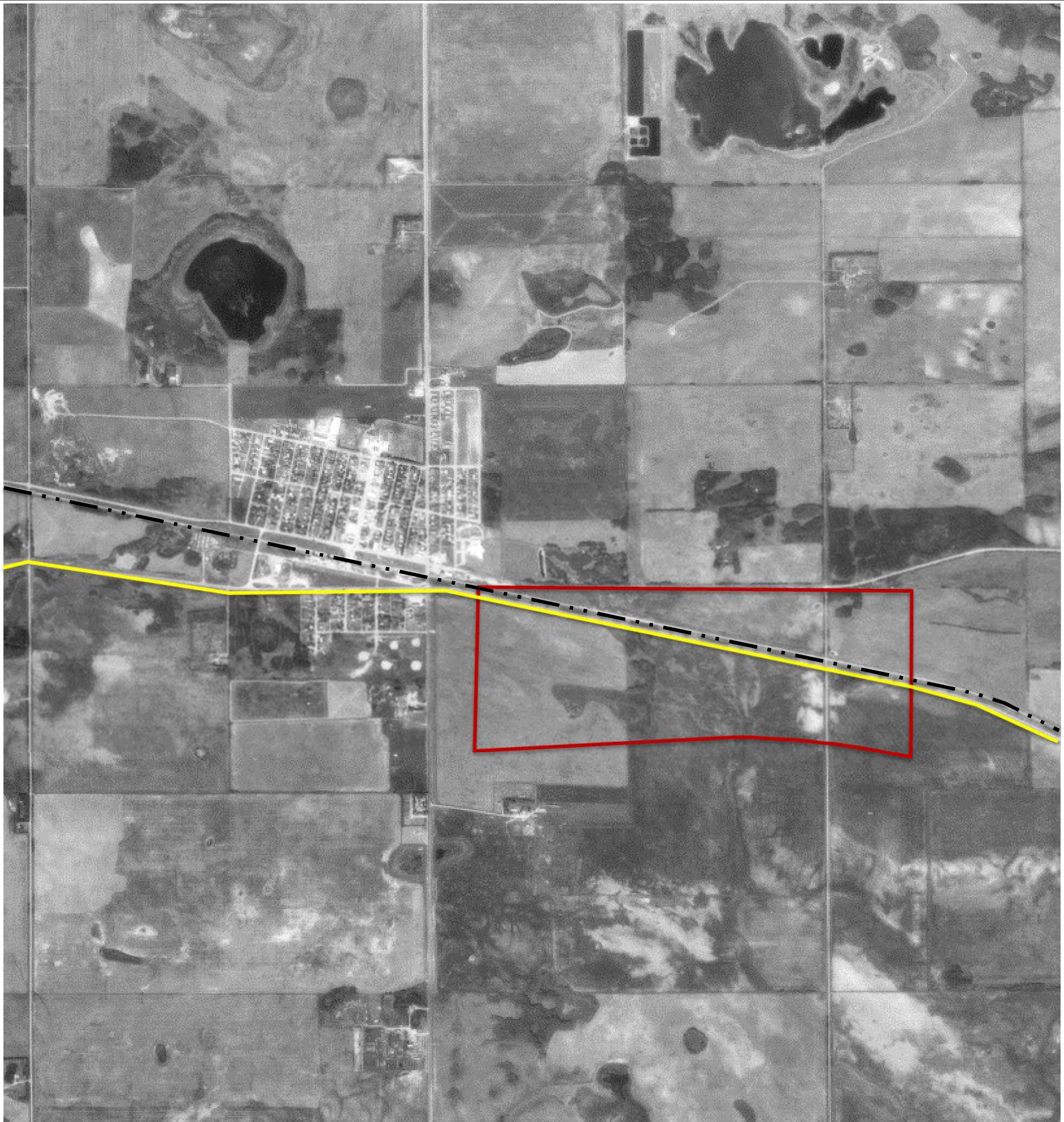
Scale: 1:17,000

COUNTY OF MINBURN NO. 27

County of Minburn No. 27 Biophysical Environmental Assessment

X-TERRA Environmental Services Ltd.
A THUNDERCHILD ENERGY SERVICES COMPANY

FIGURE 1



DESCRIPTION

Photo Description: 1983 Air Photo
X-Terra File No.: 22148

LEGEND

Proposed Project Area:
Railway:
Highway:

REFERENCE

1983 AER

Scale: 1:19,000

COUNTY OF NO. MINBURN 27

County of Minburn No. 27
Biophysical Environmental Assessment

X-TERRA Environmental Services Ltd.
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FIGURE 2

DESCRIPTION

Photo Description: 1987 Air Photo
X-Terra File No.: 22148

LEGEND

Proposed Project Area:
Railway:
Highway:

REFERENCE

1987 AER

Scale: 1:16,000

COUNTY OF MINBURN NO. 27

County of Minburn No. 27 Biophysical Environmental Assessment

X-TERRA Environmental Services Ltd.
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FIGURE 3

DESCRIPTION

Photo Description: 1993 Air Photo
X-Terra File No.: 22148

LEGEND

Proposed Project Area:
Railway:
Highway:

REFERENCE

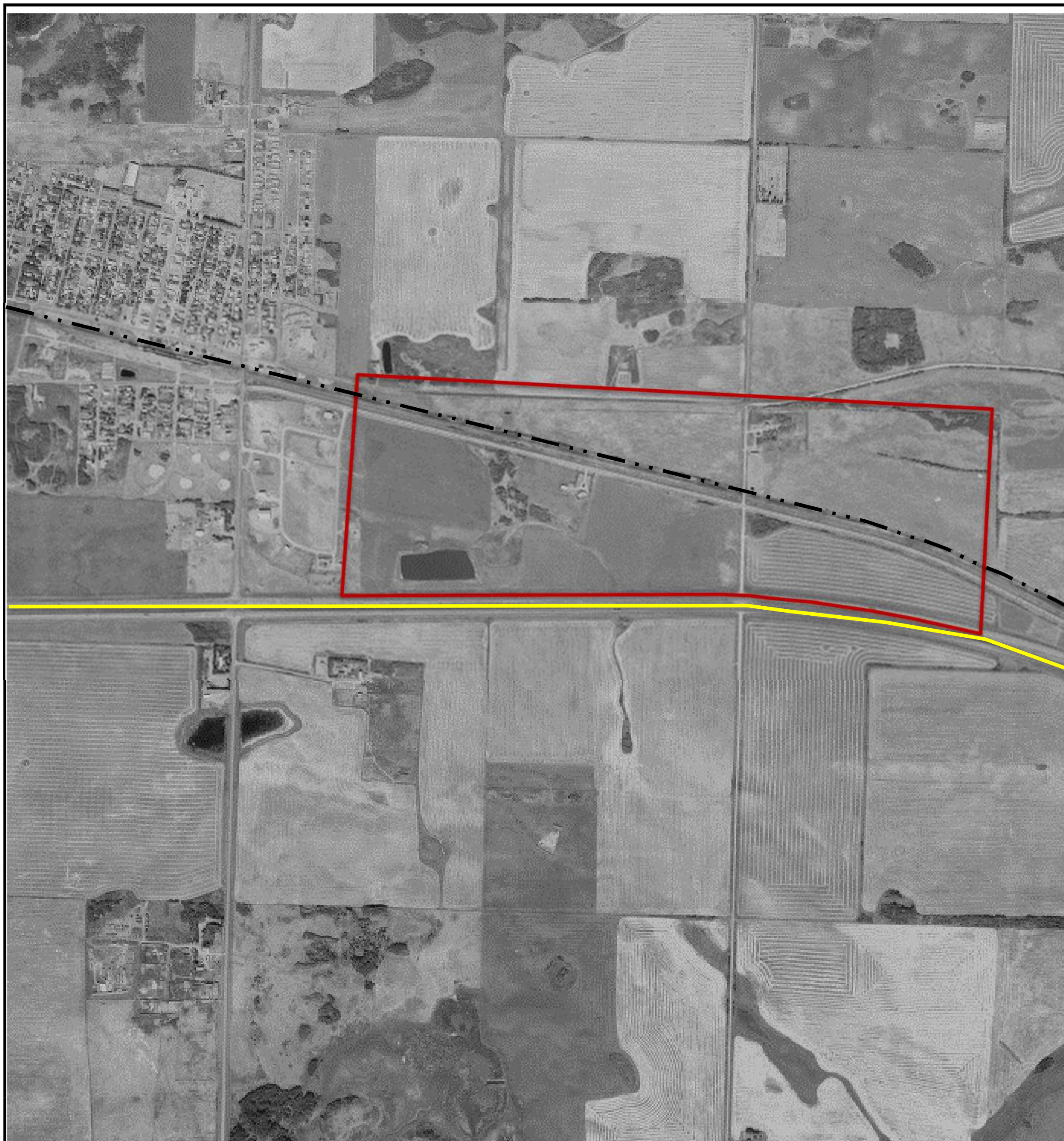
1993 AER

Scale: 1:17,100

County of Minburn No. 27 Biophysical Environmental Assessment

X-TERRA Environmental Services Ltd.
A THUNDERCHILD ENERGY SERVICES COMPANY

FIGURE 4



DESCRIPTION

Photo Description: 1998 Air Photo
X-Terra File No.: 22148

LEGEND

Proposed Project Area:
Railway:
Highway:

REFERENCE

1998 AER

Scale: 1:34,000

COUNTY OF MINBURN NO. 27

County of Minburn No. 27
Biophysical Environmental Assessment

X-TERRA Environmental Services Ltd.
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FIGURE 5

DESCRIPTION

Photo Description: 2004 Air Photo
X-Terra File No.: 22148

LEGEND

Proposed Project Area:
Railway:
Highway:

REFERENCE

2004 AER

Scale: 1:17,000

COUNTY OF MINBURN NO. 27

County of Minburn No. 27
Biophysical Environmental Assessment

X-TERRA Environmental Services Ltd.
A THUNDERCHILD ENERGY SERVICES COMPANY

FIGURE 6

DESCRIPTION

Photo Description: 2006 Air Photo
X-Terra File No.: 22148

LEGEND

Proposed Project Area:
Railway:
Highway:

REFERENCE

2006 Abadata

Scale: 1:33,000

County of Minburn No. 27
Biophysical Environmental Assessment

X-TERRA Environmental Services Ltd.

FIGURE 7

DESCRIPTION

Photo Description: 2007 Air Photo
X-Terra File No.: 22148

LEGEND

Proposed Project Area:
Railway:
Highway:

REFERENCE

2007 Google Earth

Scale: 1:17,194

COUNTY OF MINBURN NO. 27

County of Minburn No. 27 Biophysical Environmental Assessment

X-TERRA Environmental Services Ltd.
A THUNDERCHILD ENERGY SERVICES COMPANY

FIGURE 8

DESCRIPTION

Photo Description: 2009 Air Photo
X-Terra File No.: 22148

LEGEND

Proposed Project Area:
Railway:
Highway:

REFERENCE

2009 Abadata

Scale: 1:17,194

COUNTY OF MINBURN NO. 27

County of Minburn No. 27
Biophysical Environmental Assessment

X-TERRA Environmental Services Ltd.
A THUNDERCHILD ENERGY SERVICES COMPANY

FIGURE 9

DESCRIPTION

Photo Description: 2011 Air Photo
X-Terra File No.: 22148

LEGEND

Proposed Project Area:
Railway:
Highway:

REFERENCE

2011 Google Earth

Scale: 1:12,000

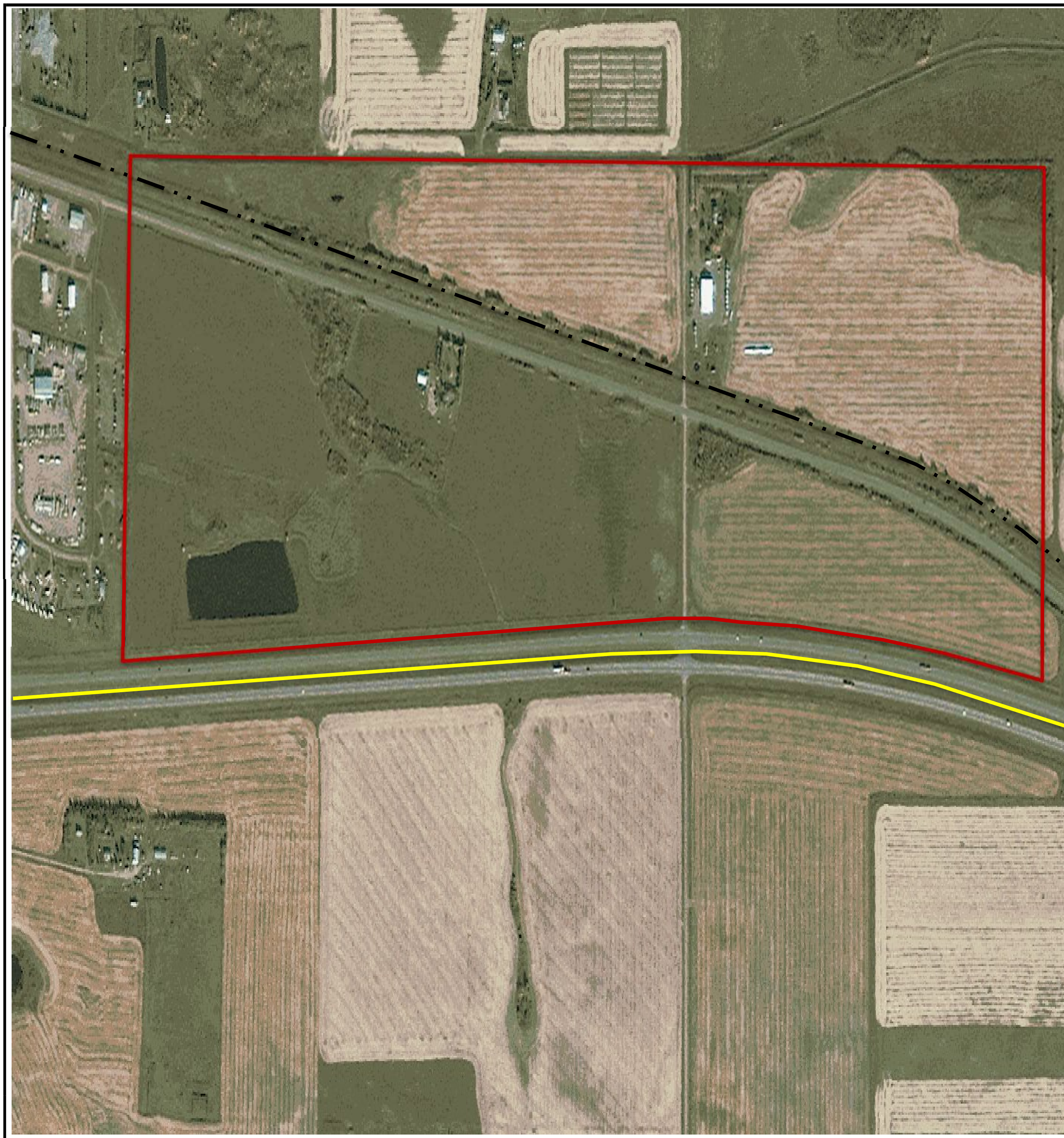
COUNTY OF MINBURN NO. 27

County of Minburn No. 27 Biophysical Environmental Assessment

X-TERRA Environmental Services Ltd.

A THUNDERCHILD ENERGY SERVICES COMPANY

FIGURE 10



DESCRIPTION

Photo Description: 2013 Air Photo
X-Terra File No.: 22148

LEGEND

Proposed Project Area:
Railway:
Highway:

REFERENCE

2013 Abadata

Scale: 1:16,042

COUNTY OF MINBURN NO. 27

County of Minburn No. 27
Biophysical Environmental Assessment

X-TERRA Environmental Services Ltd.
A THUNDERCHILD ENERGY SERVICES COMPANY

FIGURE 11

DESCRIPTION

Photo Description: 2016 Air Photo
X-Terra File No.: 22148

LEGEND

Proposed Project Area:
Railway:
Highway:

REFERENCE

2016 Google Earth

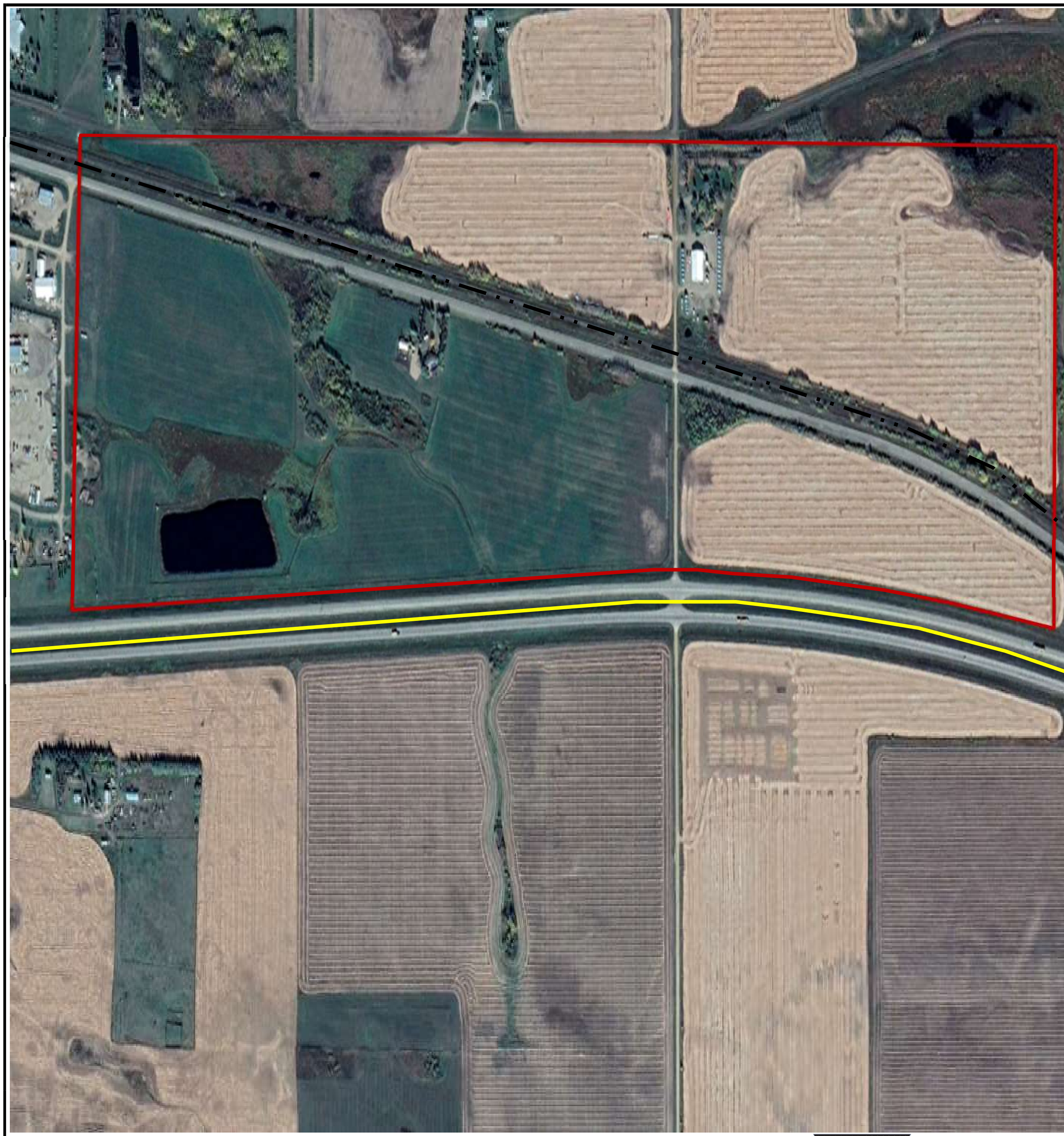
Scale: 1:16,000

COUNTY OF MINBURN NO. 27

County of Minburn No. 27
Biophysical Environmental Assessment

X-TERRA Environmental Services Ltd.

FIGURE 12



DESCRIPTION

Photo Description: 2019 Air Photo
X-Terra File No.: 22148

LEGEND

Proposed Project Area:
Railway:
Highway:

REFERENCE

2019 Google Earth

Scale: 1:12,032

COUNTY OF MINBURN NO. 27

County of Minburn No. 27
Biophysical Environmental Assessment

X-TERRA Environmental Services Ltd.
A THUNDERCHILD ENERGY SERVICES COMPANY

FIGURE 13

DESCRIPTION

Photo Description: 2021 Air Photo
X-Terra File No.: 22148

LEGEND

Proposed Project Area:
Railway:
Highway:

REFERENCE

2021 Google Earth

Scale: 1:16,050

COUNTY OF MINBURN NO. 27

County of Minburn No. 27
Biophysical Environmental Assessment

X-TERRA Environmental Services Ltd.
A THUNDERCHILD ENERGY SERVICES COMPANY

FIGURE 14

APPENDIX D: LAT REPORT/ACIMS/FWMIS/HRIA REPORTS/LAND TITLES

Landscape Analysis Tool (LAT) Report

LAT Number:	000005E2C8	**LAT Date:** 2022-08-01	19:03:28
Project Name:	ASP Lands 19 and 20-50-8 W4M		
Project Description:			
Disposition Type:	DML	Miscellaneous Lease	
Purpose Type:	PURL	Public Works	
Activity Type:	PURL07DMLP	Other Facility	

Responsibility of Applicants:

It is the applicant's responsibility to conduct a full review of the generated LAT Report, ensuring that you are aware and have a full understanding of the identified standards and conditions, and any additional limitations that may also be imposed by an approved higher level plan, reservation or notation or any other law or Order of the Province or the Government of Canada that may impact the placement, construction or operation of the proposed disposition, purpose and activity.

The applicant must assess if the proposed disposition, purpose and activity can meet the applicable standards, conditions and any limitations which will subsequently determine if the application can be submitted to the regulatory body. Applicants should complete a thorough review of regulatory and application processes including supporting procedural documents and the generated LAT Reports prior to making this determination.

Where the applicant chooses not to meet, or is not able to meet, one or more Approval Standards or higher level plans within the generated LAT Report as submitted as part of the application, or any affected reservations as identified within the land status report, the applicant is required to complete the appropriate mitigation as part of their supplement submission that addresses individually each of the items not being met.

The information provided within the LAT Tool is a spatial representation of features provided to the applicant for activity and land use planning. The accuracy of these layers varies depending on the resource value being represented. The regulatory body insists that site visits, wildlife surveys and groundtruthing efforts are completed to ensure that you, the applicant can meet the procedures detailed within the *Pre-Application Requirements for Formal Dispositions*, the identified approval standards, operating conditions and *Best Management Practices* as represented within the *Master Schedule of Standards and Conditions*.

Proximity to Watercourse/Waterbodies:

Applicants will ensure that standards or conditions for Watercourse/Waterbody features as identified within the generated LAT Report are followed. It is the responsibility of the applicant to ensure the identified setbacks and buffers are properly established through a pre-site assessment and maintained.

NOTE: Be aware that the submission of a LAT Report as part of an application submission does not imply approval of the activity. The standards and conditions identified within the LAT Report may be subject to change based on regulatory review.

Base Features

Green/White Area	White Area
Municipality	County of Minburn No. 27
FMA	
FMU	
Provincial Grazing Reserve	
Rocky Mountain Forest Reserve	
PLUZ Areas	
Protected Areas	

Provincial Sanctuaries

Wildlife Corridors	
Restricted Area	
Game Bird	Zone 3
Seasonal	

Higher Level Plans

Integrated Resource Plan (Local)	
Integrated Resource Plan (Subregional)	
Access Management Plan	
Landscape Management Plan	

Additional Application Requirements

Wildlife Survey	Yes	DND Area	

Historical Resources

HRV Rating	Category

Historic Resources Application Required: No

While no specific historic resource concerns have been identified within the proposed activity area, Section 31 of the *Historical Resources Act* states that "a person who discovers a historic resource in the course of making an excavation for a purpose other than for the purpose of seeking historic resources shall forthwith notify the Minister of the discovery." Should a historic resource be encountered with the construction or operation of this disposition, information on who to contact can be found on the Ministry of Culture and Tourism's website in; Standard Requirements under the Historical Resources Act: Reporting the Discovery of Historic Resources.

Sensitive Features

Wildlife and Other Sensitive Species

	Intersected
Burrowing Owl Range	
Caribou Range	
Caribou Range - Zone A	
Caribou Range - Zone B	
Colonial Nesting Birds	
Critical Habitat of Aquatic Species at Risk	
Endangered and Threatened Plants Ranges	
Greater Short-horned Lizard Habitat	
Greater Short-horned Lizard Range	
Greater Sage Grouse Core Area	
Greater Sage Grouse Recovery Area	
Greater Sage Grouse Leks and Buffer	
Grizzly Bear Zone	
High Risk Watersheds	
Key Wildlife and Biodiversity Areas	
Mountain Goat and Sheep Zone	

	Intersected
Mountain Goat and Sheep Areas Disease Buffer	
Ord's Kangaroo Rat Range	
Ord's Kangaroo Rat Key Habitat Area	
Piping Plover Waterbodies	
Provincial Hibernacula Buffer	
Sensitive Amphibian Ranges	
Sensitive Raptor Range	
Sensitive Snake Habitat	
Sensitive Snake Hibernacula Range	
Sharp-tailed Grouse Leks and Buffer	
Sharp-tailed Grouse Survey	Yes
Special Access Area	
Swift Fox Range	
Trumpeter Swan Waterbodies/Watercourse	
Trumpeter Swan Watercourse Buffer	

Federal Orders:

	Intersected
Greater Sage Grouse	

Grassland and Natural Regions:

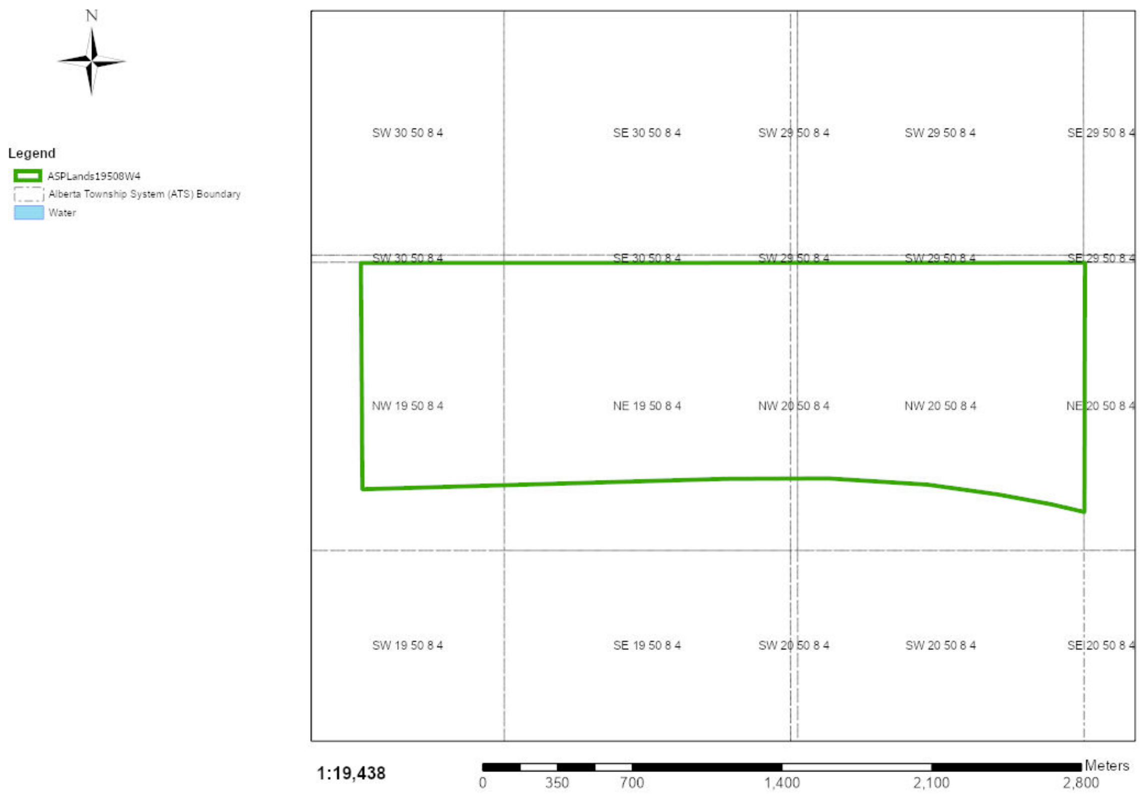
	Intersected
Central Parkland	Yes
Central Parkland and Northern Fescue	
Chinook Grasslands	
Dry Mixed Grass	
Foothills Fescue	
Foothills Parkland Grasslands	
Grassland and Parkland Natural Region	Yes

	Intersected
Mixed Grass Sub-region layer	
Montane	
Northern Fescue	
Peace River Parkland	
Permafrost	
Rough Fescue PNT	
Subalpine or Alpine	

Alberta Township System (ATS) Land List

Quarter	Section	Township	Range	Meridian	Road Allow.	Sensitive Features Identified
NW	20	50	8	4	RW	Grassland and Parkland Natural Region,Sharp-tailed Grouse Survey,Central Parkland,Green / White Area
NE	19	50	8	4		Grassland and Parkland Natural Region,Sharp-tailed Grouse Survey,Central Parkland,Green / White Area
NW	19	50	8	4		Grassland and Parkland Natural Region,Sharp-tailed Grouse Survey,Central Parkland,Green / White Area
NW	20	50	8	4		Grassland and Parkland Natural Region,Sharp-tailed Grouse Survey,Central Parkland,Green / White Area
NE	20	50	8	4		Grassland and Parkland Natural Region,Sharp-tailed Grouse Survey,Central Parkland,Green / White Area

Landscape Analysis Tool (LAT) Report



Land Management

Report ID	Approval	Condition
1	1030-AS	Where an Integrated Resource Plan or a Reservation/Protective Notation identifies a greater set back, the greater set back will prevail.
2	1031-AS	Where a Higher Level Plan* exists, the Disposition Holder must follow any direction provided within that plan.
3	1033-AS	With the exception of pipelines, for activities that fall within any Protective Notation (PNT) lands with a purpose code 400 Series encompassing a section of land (259 hectares) or less, located in the Provincial White Area, the Disposition Holder must construct all activities within lands previously disturbed or cleared. Where no previous disturbance exists, activities must occur within 100 metres of the PNT.
4	1041	The Disposition Holder must maintain proper drainage of surface water.
5	1044-AS	The Disposition Holder must not locate activities within 45 metres from the top of any coulees* with the exception of activities such as; access, pipelines and linear easements crossing those features.
6	1049	The Disposition Holder must remove all garbage and waste material from this site.
7	1053	The Disposition Holder must not enter the boundaries of any research or sample plot unless consent is received from the reservation holder.
8	1061	Where FireSmart activities are considered, the Disposition Holder must follow Information Letter- “Authorization of FireSmart Activities on Public Land” as amended from time to time.

Vegetation

Report ID	Approval	Condition
9	1300	The disposition holder must manage all regulated weeds to the satisfaction of the regulatory body.
10	1302	"The Disposition Holder must remove all deciduous or coniferous merchantable timber from the Activity as per the following utilization standards; - Deciduous Timber: 15 cm Base/10 cm Top - Coniferous Timber: 15 cm Base/11cm Top and haul said timber to the location of end use."
11	1304	For fire control purposes on forested lands, the Disposition Holder must dispose of excess coarse woody debris* not utilized for rollback* or stockpiled for reclamation*.
12	1305	Within FireSmart Community Zones*, the Disposition Holder must dispose of coarse woody debris* by burning unless a Debris Management Plan has been approved under the Forest and Prairie Protection Act.

Soil

Report ID	Approval	Condition
13	1356	The Disposition Holder must not conduct the Activity during adverse ground conditions*.
14	1357	The Disposition Holder must prevent erosion* and sedimentation on to adjacent* Lands or Water bodies * that results from the activity.
15	1359-AS	The Disposition Holder must not remove from the Lands topsoil* or subsoil* unless approved in writing by the Regulatory Body.
16	1360	"Where activities have occurred on the Lands that do not involve minimal disturbance* construction, the Disposition Holder must salvage topsoil* for land reclamation as follows: a. Salvage all topsoil* from: i. Mineral soils ii. Shallow organic soils* iii. Reclaimed soils b. Where the depth of the topsoil* is less than 15 cm, the topsoil* and part of the subsoil* to a total depth of 15 centimetres must be salvaged, unless the upper subsoil* is considered chemically unsuitable*."
17	1363	All reclamation material* must be considered suitable as defined in the May 2001 Salt Contamination Assessment Guidelines and meet the February 2016 Alberta Tier 1 Soil and Groundwater Remediation Guidelines, as amended or replaced from time to time.
18	1365	"The Disposition Holder must store reclamation material* in accordance with all of the following: a. reclamation material* must not be placed beneath the ground surface or buried in any way; b. coarse woody debris* stored for reclamation purposes for greater than 12 months must be mixed with topsoil*; and c. topsoil* and subsoil* must be stored separately."
19	1367	The Disposition Holder must not mix wood chips with any reclamation material*.
20	1368	The Disposition Holder must not apply wood chips to the lands at a depth greater than five (5) centimeters.
21	1369	The Disposition Holder must manage wood chips in accordance with the directive ID 2009-01 Management of Wood Chips on Public Land as amended from time to time.
22	1370	The Disposition Holder must not store piles or windrows of reclamation material* within standing timber.
23	1371	The Disposition Holder must not use soil sterilant on the Lands.

Watercourse / Waterbody

Report ID	Approval	Condition
24	1402-AS	The Disposition Holder must not conduct the Activity within the following watercourse* setbacks from the top of the breaks: a. Intermittent watercourses* including springs must have a setback of at least 45 metres. b. Small Permanent watercourses* must have a setback of at least 45 metres. c. Large Permanent watercourses* must have a setback of at least 100 metres.
25	1412	The Disposition Holder must acquire an authorization for access (off-disposition) for water withdrawal activities.
26	1419	For use of equipment within the bed of a water body*, the Disposition Holder must prior to operations follow the “Decontamination Protocol for Work in or Near Water”, as amended from time to time.
27	1420	The Disposition Holder must provide a completed Record of Decontamination form as proof of decontamination to the Regulatory Body upon request.

Reclamation

Report ID	Approval	Condition
28	1451	For progressive reclamation* on forested lands*, the Disposition Holder must replace all reclamation materials* that have been salvaged in accordance with all of the following: a. all salvaged subsoil* must be replaced, then all salvaged topsoil*; and b. reclamation materials* must be replaced over the entire progressive reclamation area*; unless otherwise approved in writing by the Regulatory Body.
29	1453	The Disposition Holder must complete temporary reclamation* on the Lands within 1 growing season of construction phase* for all topsoil* and subsoil* stockpiles required for final reclamation*.
30	1454	The Disposition Holder must prior to seeding herbaceous seed in forested* or peatlands* submit a Request for Seeding in writing to the Regulatory Body that contains all of the following: a. rationale for conducting seeding of herbaceous species*; b. a description of the proposed site for seeding including information with respect to the following: i. whether the Lands are subject to high erosion* and; ii. whether the Lands are prone to invasion from agronomic or weed species. c. a proposed seed mix composition for re-vegetation of the Lands in accordance with the Native Plant Revegetation Guidelines for Alberta, 2001 as amended or replaced from time to time or a rationale for alternate species; d. provide a seed certificate in accordance with the Seed Act for the seed mixed mix to be used for re-vegetation* and; any other information requested by the Regulatory Body.

31	1455	The Disposition Holder must only conduct seeding in accordance with the written authorization of the Regulatory Body.
32	1456	The Disposition Holder must when seeding cultivated lands*; a. use agronomic or forage seed that meets or exceeds Certified #1 as outlined in the Seeds Act and Seeds Regulations; b. use seed mixes that are free of species listed in the Weed Control Act and; c. provide a seed certificate to the Regulatory Body within 30 days of request.
33	1457	Within the Green Area* of the Province, the Disposition Holder must re-vegetate the Lands with trees or shrubs that meet the requirements of the December 2016 Alberta Forest Genetic Resource Management and Conservation Standards document, as amended or replaced from time to time.
34	1459	The Disposition Holder must not have slash and rollback* accumulations within five (5) metres of the perimeter of the disposition boundary, greater than the percent ground cover on the surrounding undisturbed forest floor.
35	1461	The Disposition Holder must complete progressive reclamation* on forested lands* for all associated and incidental disturbances to the Disposition.
36	1462	The following activities are excluded from progressive reclamation* requirement on forested lands*: a) Lands that have received authorization for clay pad construction; and b) Lands with a 4:1 or steeper slopes where a cut and fill has been constructed to level the ground surface.
37	1463	For final reclamation*, the Disposition Holder must complete all of the following: a. contour the disturbed land to the pre-disturbance landform or to the landform approved by the Regulatory body; b. replace all stockpiled subsoil*, then replace all stockpiled topsoil*; c. spread all coarse woody debris* on forested lands* and; d. reclamation materials* must be replaced over the entire area from which they were removed unless otherwise approved in writing by the Regulatory Body.
38	1464	The Disposition Holder must reclaim the Lands to the pre-disturbance land use type* unless otherwise authorized in writing by the Regulatory Body.

Wildlife

Report ID	Approval	Condition
39	1600	The Disposition Holder must conduct a complete and immediate Wildlife Sweep* of the Lands subject to the disposition prior to any activity, as per the “Wildlife Sweep Protocol”.
40	1601	The Disposition Holder must submit observations from a Wildlife Sweep* to the Fisheries and Wildlife Management Information System (FWMIS) and notify the issuing Regulatory Body in writing upon request that the Wildlife Sweep* was completed.

Landscape Analysis Tool (LAT) Report

41	1602-AS	The Disposition Holder must incorporate a buffer* zone of a minimum width of 100m undisturbed vegetation, where an established buffer* does not already exist for any and all key habitat features including, but not limited to leks*, nests, dens and houses identified in the Wildlife Sweep*.
42	1603	When Wildlife Surveys* are required, the Disposition Holder must submit results as defined by the sensitive species inventory guidelines from Wildlife Survey* to the Fisheries and Wildlife Management Information System (FWMIS).
43	1608	The Disposition Holder must incorporate buffers*, setbacks and activity timing restrictions for any and all key habitat features including, but not limited to leks*, nests, dens and houses identified in the wildlife survey*.
44	1611-AS	The Disposition Holder must conduct appropriate pre-construction wildlife* surveys as per the direction of the Sensitive Species Inventory Guidelines as amended from time to time where you intersect any of the following sensitive species; - Sensitive Raptor Range - Burrowing Owl Range - Sensitive Snake Hibernacula Range - Sharp-tailed Grouse Survey - Swift Fox Range - Ords Kangaroo Rat Range - Piping Plover Waterbodies - Endangered and Threatened Plant Ranges - Grassland and Parkland Natural Regions (Grassland Bird Surveys)

Sharp-Tailed Grouse Survey / Leks and Buffers

Report ID	Approval	Condition
45	1740-AS	The Disposition Holder must not conduct any activities* within 500 metres of the perimeter of any known or identified active sharp-tailed grouse lek* sites.

Other Sensitive and Endangered Species

Report ID	Approval	Condition
46	1880-AS	Between April 15 and August 15, the Disposition Holder must not conduct any activities* within 100 metres of an active nest site for Federally listed species.

Grassland and Parkland Natural Region

Report ID	Approval	Condition
47	2054	On native grasslands*, the Disposition Holder must not crimp straw* subject to the following exceptions: a) The straw* used for crimping must be sourced from a native species* from the same ecological range site* as the Lands; b) The weed analysis for the straw* used for crimping must comply with the Weed Control Act, as amended or replaced from time to time.

48	2062	For activities that fall within native grasslands* as identified by the Central Parkland Subregion that requires Assisted Natural Recovery*, the Disposition Holder must submit a request for Assisted Natural Recovery in writing to the Regulatory Body that contains all of the following: 1. Rationale for conducting Assisted Natural Recovery*; 2. A description of the proposed site for Assisted Natural Recovery* including information with respect to the following: a. whether the Lands are subject to high erosion; b. whether the soil on the Lands has been disturbed to an area greater than 50m2; c. whether the Lands are prone to invasion from agronomic or weed species; 3. A proposed seed mix composition for re-vegetation of the Lands: a. that is consistent with native plant communities that are adjacent to and in the immediate vicinity of the Lands as determined by the A Preliminary Classification of Plant Communities in the Central Parkland Natural Subregion of Alberta, as amended or replaced from time to time; b. provide a seed certificate in accordance with the Seed Act for the seed mix to be used for Assisted Natural Recovery* and; c. any other information requested by the Regulatory Body.
49	2068	The Disposition Holder must not construct activities on native grassland* within the Grassland and Parkland Natural Region between April 15th and August 15th, unless grassland bird surveys are completed as per the Sensitive Species Inventory Guidelines Protocol as amended.
50	2069	The Disposition Holder must not conduct any activities within 100 metres of an active nest site between April 15th and August 15th for the following species: • short-eared owl • mountain plover • long-billed curlew • upland sandpiper • Sprague’s pipit • Chestnut-collared longspur • Loggerhead Shrike • Bank Swallow
51	2070-AS	On native grasslands* identified in the Central Parkland and Northern Fescue layer, the Disposition Holder must conduct a conservation assessment as outlined in Conservation Assessments in Native Grassland Strategic Siting and Pre-disturbance Site Assessment Methodology for Industrial Disturbances as amended or replaced from time to time. Upon request by the Regulatory Body, the Disposition Holder must submit the conservation assessment report in writing to the Regulatory Body within 30 days of the request.

52	2071-AS	The Disposition Holder must not conduct activities on loamy soils* in the Central Parkland and Northern Fescue layer as confirmed by the Disposition Holder through the required Conservation Assessment, subject to the following exceptions; a) using existing disturbances* for activities; and b) locating activities adjacent* to existing occupied dispositions and non-native vegetation areas.

Date: 16/6/2022
Requestor: Consultant
Reason for Request: Environmental Assessment
SEC: 19 **TWP:** 050 **RGE:** 08 **MER:** 4

Alberta Parks

Non-sensitive EOs (updated: October 2017)

M_RR_TTT_SS	EO_ID	ECODE	S_RANK	SNAME	SCOMNAME	LAST_OBS_D

No Non-sensitive EOs Found: Next Steps - See FAQ (https://www.albertaparks.ca/albertaparksca/management-land-use/alberta-conservation-information-management-system-acims/faqs.aspx#2 - Process)

Sensitive EOs (updated: October 2017)

M-RR-TTT	EO_ID	ECODE	S_RANK	SNAME	SCOMNAME	LAST_OBS_D

No Sensitive EOs Found: Next Steps - See FAQ (https://www.albertaparks.ca/albertaparksca/management-land-use/alberta-conservation-information-management-system-acims/faqs.aspx#2 - Process)

Date: 16/6/2022
Requestor: Consultant
Reason for Request: Environmental Assessment
SEC: 20 **TWP:** 050 **RGE:** 08 **MER:** 4

Non-sensitive EOs (updated: October 2017)

M_RR_TTT_SS	EO_ID	ECODE	S_RANK	SNAME	SCOMNAME	LAST_OBS_D

No Non-sensitive EOs Found: Next Steps - [See FAQ (https://www.albertaparks.ca/albertaparksca/management-land-use/alberta-conservation-information-management-system-acims/faqs.aspx#2 - Process)](https://www.albertaparks.ca/albertaparksca/management-land-use/alberta-conservation-information-management-system-acims/faqs.aspx#2)

Sensitive EOs (updated: October 2017)

M-RR-TTT	EO_ID	ECODE	S_RANK	SNAME	SCOMNAME	LAST_OBS_D

No Sensitive EOs Found: Next Steps - [See FAQ (https://www.albertaparks.ca/albertaparksca/management-land-use/alberta-conservation-information-management-system-acims/faqs.aspx#2 - Process)](https://www.albertaparks.ca/albertaparksca/management-land-use/alberta-conservation-information-management-system-acims/faqs.aspx#2)

Fish and Wildlife Internet Mapping Tool (FWIMT)

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

Species Summary Report

Report Date: 16-Jun-2022 14:39

Species present within the current extent

Fish Inventory	Wildlife Inventory	Stocked Inventory
No Species Found in Search Extent	No Species Found in Search Extent	No Species Found in Search Extent

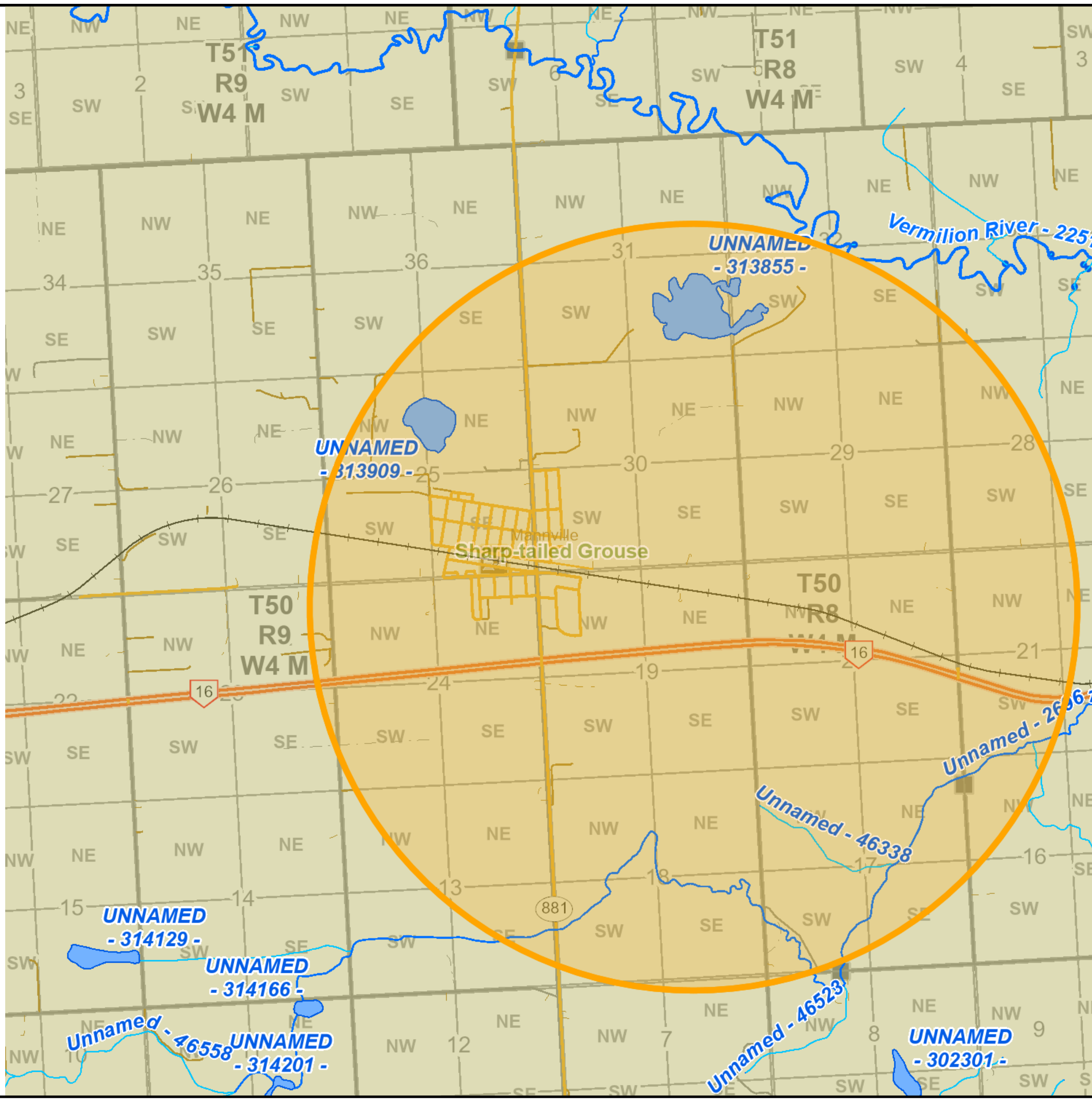
Buffer Extent

Centroid (X,Y)	Projection	Centroid (Qtr Sec Twp Rng Mer)	Radius or Dimensions
755758, 5913816	10-TM AEP Forest	NE 19 50 8 4	3 kilometers

Contact Information

For contact information, please visit:
https://www.alberta.ca/fisheries-and-wildlife-management-contacts.aspx

16-Jun-2022 14:39	**Map Results**



Display may contain: Base Map Data provided by the Government of Alberta under the Alberta Open Government Licence. Cadastral and Dispositions Data provided by Alberta Data Partnerships. (c)GeoEye, all rights reserved. Information as depicted is subject to change, therefore the Government of Alberta assumes no responsibility for discrepancies at time of use

Fish and Wildlife Internet Mapping Tool (FWIMT)

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

Species Summary Report

Report Date: 16-Jun-2022 14:36

Species present within the current extent

Fish Inventory	Wildlife Inventory	Stocked Inventory
No Species Found in Search Extent	No Species Found in Search Extent	No Species Found in Search Extent

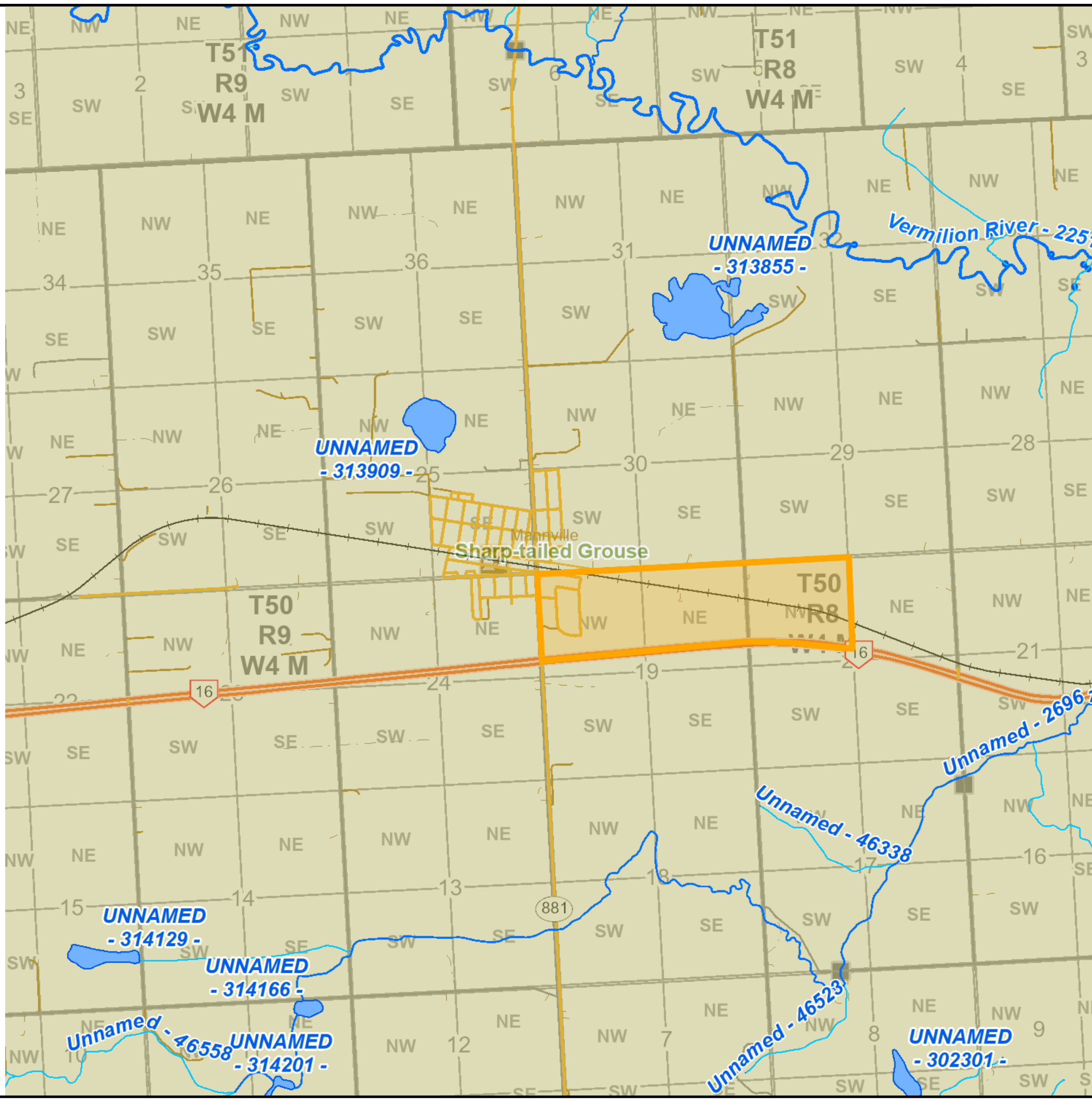
Buffer Extent

Centroid (X,Y)	Projection	Centroid (Qtr Sec Twp Rng Mer)	Radius or Dimensions
755768, 5913801	10-TM AEP Forest	NE 19 50 8 4	2465, 812 meters

Contact Information

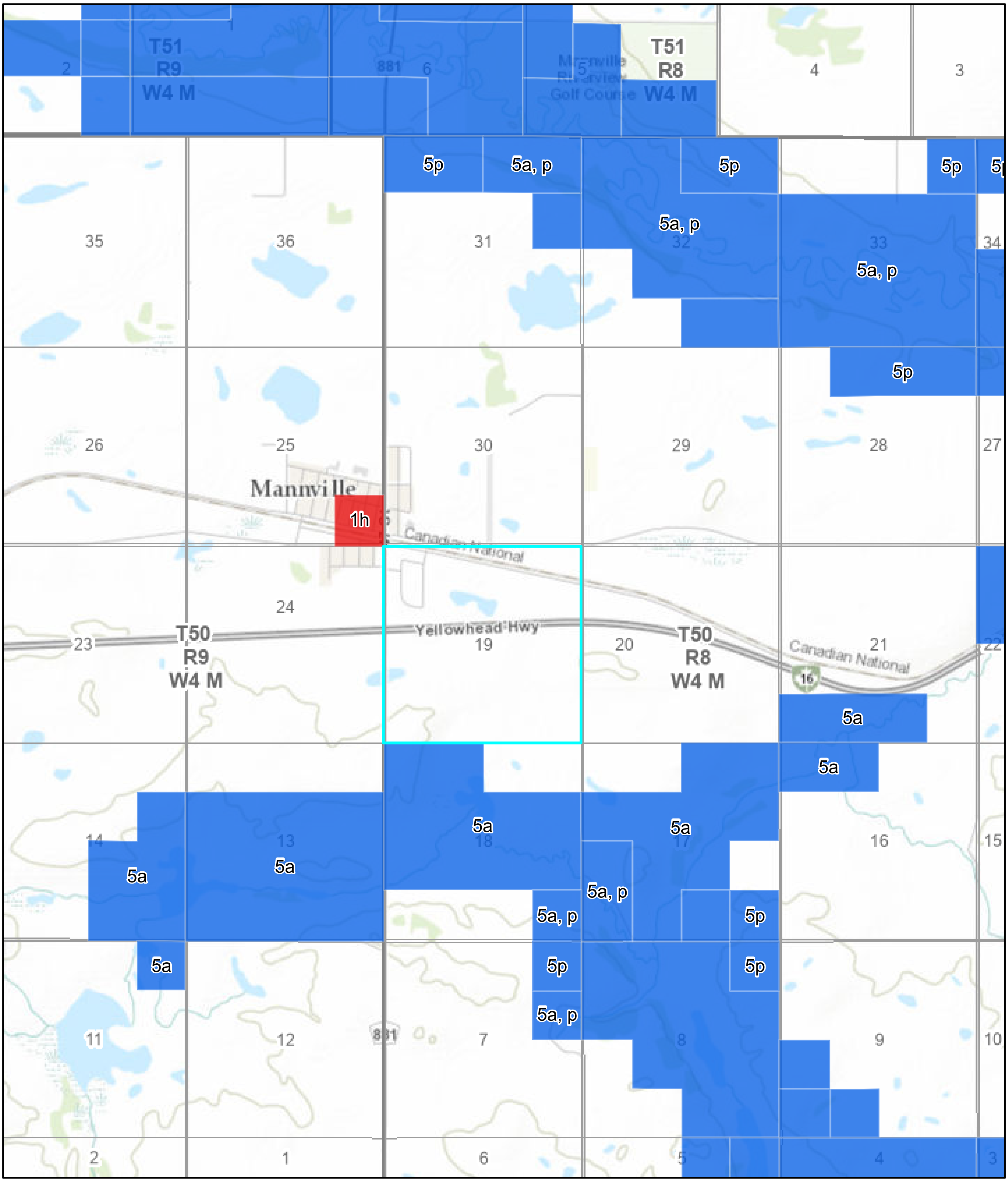
For contact information, please visit:
https://www.alberta.ca/fisheries-and-wildlife-management-contacts.aspx

16-Jun-2022 14:36 **Map Results**



Display may contain: Base Map Data provided by the Government of Alberta under the Alberta Open Government Licence. Cadastral and Dispositions Data provided by Alberta Data Partnerships. (c)GeoEye, all rights reserved. Information as depicted is subject to change, therefore the Government of Alberta assumes no responsibility for discrepancies at time of use

Listing of Historic Resources - Historic Resource Values



6/16/2022, 2:21:06 PM

1:72,224

0 0.38 0.75 1.5 mi

0 0.5 1 2 km

Listing of Historic Resources Public- HRV 1

ATS Township Index Label Above Hydro

ATS Section with Road Allowance Label Below Hydro

ATS Township Index Outline 5

ATS Section with Road Allowance Outline 1

Activities planned for lands not included in the Listing of Historic Resources may still require Historical Resources Act approval. The results of a Listing search MUST be used in conjunction with the

LAND TITLE CERTIFICATE

S

LINC	SHORT LEGAL	TITLE NUMBER
0035 392 456	4;8;50;19;NW,NE	132 151 036

LEGAL DESCRIPTION

MERIDIAN 4 RANGE 8 TOWNSHIP 50
SECTION 19
ALL THAT PORTION OF THE NORTH HALF
WHICH LIES NORTH EAST OF RAILWAY RIGHT OF WAY PLAN 3999R
CONTAINING 16.08 HECTARES (39.74 ACRES) MORE OR LESS
EXCEPTING THEREOUT:

		HECTARES	(ACRES)	MORE OR LESS
A) PLAN 1223892	ROAD	0.222	0.55	(N.W. 1/4)
		0.415	1.03	(N.E. 1/4)

EXCEPTING THEREOUT ALL MINES AND MINERALS
AND THE RIGHT TO WORK THE SAME

ESTATE: FEE SIMPLE

MUNICIPALITY: COUNTY OF MINBURN NO. 27

REFERENCE NUMBER: 122 322 418

REGISTERED OWNER(S)

REGISTRATION	DATE(DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
132 151 036	28/05/2013	TRANSFER OF LAND	$80,000	$80,000

OWNERS

MICHAEL BURY

AND
MELANIE BURY
BOTH OF:
BOX 118
MANNVILLE
ALBERTA T0B 2W0
AS JOINT TENANTS

(CONTINUED)

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
862 005 167	09/01/1986	UTILITY RIGHT OF WAY GRANTEE - ALBERTA GOVERNMENT TELEPHONES. "N.W. PART AS DESCRIBED"
862 005 168	09/01/1986	UTILITY RIGHT OF WAY GRANTEE - ALBERTA GOVERNMENT TELEPHONES. "N.E. PART AS DESCRIBED"
902 243 518	17/08/1990	UTILITY RIGHT OF WAY GRANTEE - MINCO GAS CO-OP LTD. AS TO NE

TOTAL INSTRUMENTS: 003

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 19 DAY OF JULY, 2022 AT 08:07 A.M.

ORDER NUMBER: 44975375

CUSTOMER FILE NUMBER:

END OF CERTIFICATE

LAND TITLE CERTIFICATE

S

LINC	SHORT LEGAL	TITLE NUMBER
0013 055 208	4;8;50;19;NE	862 046 396 A

LEGAL DESCRIPTION

ALL THAT PORTION OF THE NORTH EAST QUARTER CF SECTION NINETEEN (19)
TOWNSHIP FIFTY (50)
RANGE EIGHT (8)
WEST OF THE FOURTH MERIDIAN, WHICH LIES SOUTH OF ROAD PLAN 8420925,
CONTAINING 9.90 HECTARES (24.45 ACRES) MORE OR LESS.
EXCEPTING THEREOUT ALL MINES AND MINERALS
AND THE RIGHT TO WORK THE SAME

ESTATE: FEE SIMPLE

MUNICIPALITY: COUNTY OF MINBURN NO. 27

REGISTERED OWNER(S)

REGISTRATION	DATE(DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
862 046 396	04/03/1986			SEE INSTRUMENT

OWNERS

RAYMOND NYDOKUS

AND
MARILYN NYDOKUS
BOTH OF:
R.R. #3, MANNVILLE
ALBERTA
AS JOINT TENANTS

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
872 081 342	16/04/1987	UTILITY RIGHT OF WAY GRANTEE - MINCO GAS CO-OP LTD.

(CONTINUED)

TOTAL INSTRUMENTS: 001

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 19 DAY OF JULY, 2022 AT 08:07 A.M.

ORDER NUMBER: 44975375

CUSTOMER FILE NUMBER:

END OF CERTIFICATE

LAND TITLE CERTIFICATE

S

LINC	SHORT LEGAL	TITLE NUMBER
0038 962 544	4;8;50;19;NE	212 218 378

LEGAL DESCRIPTION

MERIDIAN 4 RANGE 8 TOWNSHIP 50
SECTION 19
ALL THAT PORTION OF THE NORTH EAST QUARTER
WHICH LIES TO THE SOUTH OF ROAD PLAN 1061JY AND NORTH OF ROAD PLAN 8420925
CONTAINING 26.6 HECTARES (65.85 ACRES) MORE OR LESS
EXCEPTING THEREOUT:

		HECTARES	(ACRES) MORE OR LESS
A) PLAN 9420258	ROAD	0.130	0.32
B) PLAN 2122252	SUBDIVISION	4.047	10.00
C) PLAN 2122253	ROAD	0.105	0.26

EXCEPTING THEREOUT ALL MINES AND MINERALS
AND THE RIGHT TO WORK THE SAME

ESTATE: FEE SIMPLE

MUNICIPALITY: COUNTY OF MINBURN NO. 27

REFERENCE NUMBER: 212 218 373 +1

REGISTERED OWNER(S)

REGISTRATION	DATE(DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
212 218 378	06/10/2021	ROAD PLAN		

OWNERS

BARRY LEE ELLIS SYMINGTON

AND
LISA DAWN SYMINGTON
BOTH OF:
BOX 222
MANNVILLE
ALBERTA T0B 2W0
AS JOINT TENANTS

(CONTINUED)

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
892 028 071	06/02/1989	UTILITY RIGHT OF WAY GRANTEE - MINCO GAS CO-OP LTD.
122 419 438	20/12/2012	MORTGAGE MORTGAGEE - THE TORONTO DOMINION BANK. 500 EDMONTON CITY CENTER EAST, 10205-101 STREET, 5TH FLOOR EDMONTON ALBERTA T5J5E8 ORIGINAL PRINCIPAL AMOUNT: $410,500
162 337 294	29/11/2016	MORTGAGE MORTGAGEE - THE TORONTO DOMINION BANK. 500 EDMONTON CITY CENTRE EAST 10205- 101ST STREET, 5TH FLOOR EDMONTON ALBERTA T5J5E8 ORIGINAL PRINCIPAL AMOUNT: $410,500

TOTAL INSTRUMENTS: 003

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 19 DAY OF JULY, 2022 AT 08:07 A.M.

ORDER NUMBER: 44975375

CUSTOMER FILE NUMBER:

REGISTRAR OF LAND TITLES

END OF CERTIFICATE

LAND TITLE CERTIFICATE

S

LINC	SHORT LEGAL	TITLE NUMBER
0018 183 186	4;8;50;19;NW	942 139 090 +1

LEGAL DESCRIPTION

ALL THAT PORTION OF THE NORTH WEST QUARTER OF SECTION NINETEEN (19)
TOWNSHIP FIFTY (50)
RANGE EIGHT (8)
WEST OF THE FOURTH MERIDIAN
WHICH LIES SOUTH OF ROAD PLAN 8420925 AND EAST OF ROAD PLAN 8221651
CONTAINING 7.11 HECTARES (17.57 ACRES) MORE OR LESS.
EXCEPTING THEREOUT ALL MINES AND MINERALS
AND THE RIGHT TO WORK THE SAME

ESTATE: FEE SIMPLE

MUNICIPALITY: COUNTY OF MINBURN NO. 27

REFERENCE NUMBER: 862 049 140 A

REGISTERED OWNER(S)

REGISTRATION	DATE(DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
942 139 090	10/05/1994	TRANSFER OF LAND		SEE INSTRUMENT

OWNERS

478232 ALBERTA LTD.
OF BOX 925
VERMILION
ALBERTA T0B 4M0

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
390JU	20/08/1954	UTILITY RIGHT OF WAY GRANTEE - ATCO GAS AND PIPELINES LTD. 10035-105 ST EDMONTON ALBERTA T5J2V6

(CONTINUED)

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
		AS TO PORTION OR PLAN:5943HW (DATA UPDATED BY: TRANSFER OF UTILITY RIGHT OF WAY 012026215)
7748LI	20/07/1959	UTILITY RIGHT OF WAY GRANTEE - ALBERTA POWER LIMITED. AS TO PORTION OR PLAN:5943HW "DATA UPDATED BY: TRANSFER OF UTILITY RIGHT OF WAY #6699SQ"
792 136 874	15/06/1979	UTILITY RIGHT OF WAY GRANTEE - ALBERTA POWER LIMITED.

TOTAL INSTRUMENTS: 003

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 19 DAY OF JULY, 2022 AT 08:07 A.M.

ORDER NUMBER: 44975375

CUSTOMER FILE NUMBER:

END OF CERTIFICATE

LAND TITLE CERTIFICATE

S

LINC	SHORT LEGAL	TITLE NUMBER
0018 183 178	4;8;50;19;NW	072 513 616

LEGAL DESCRIPTION

ALL THAT PORTION OF THE NORTH WEST QUARTER OF SECTION NINETEEN (19)
TOWNSHIP FIFTY (50)
RANGE EIGHT (8)
WEST OF THE FOURTH MERIDIAN
WHICH LIES NORTH OF ROAD PLAN 8420925, EAST OF SUBDIVISION PLAN 8520860
AND SOUTH OF ROAD PLAN 1061JY CONTAINING 19.9 HECTARES (49.27 ACRES)
MORE OR LESS
EXCEPTING THEREOUT ALL MINES AND MINERALS
AND THE RIGHT TO WORK THE SAME

ESTATE: FEE SIMPLE

MUNICIPALITY: COUNTY OF MINBURN NO. 27

REFERENCE NUMBER: 012 072 384

REGISTERED OWNER(S)

REGISTRATION	DATE(DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
072 513 616	25/08/2007	TRANSFER OF LAND		SEE INSTRUMENT

OWNERS

BARRY LEE ELLIS SYMINGTON

AND
LISA DAWN SYMINGTON
BOTH OF:
BOX 222
MANNVILLE
ALBERTA T0B 2W0
AS JOINT TENANTS

(CONTINUED)

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
390JU	20/08/1954	UTILITY RIGHT OF WAY GRANTEE - ATCO GAS AND PIPELINES LTD. 10035-105 ST EDMONTON ALBERTA T5J2V6 AS TO PORTION OR PLAN:5943HW (DATA UPDATED BY: TRANSFER OF UTILITY RIGHT OF WAY 012026215)
7748LI	20/07/1959	UTILITY RIGHT OF WAY GRANTEE - ALBERTA POWER LIMITED. AS TO PORTION OR PLAN:5943HW "DATA UPDATED BY: TRANSFER OF UTILITY RIGHT OF WAY #6699SQ"
792 136 874	15/06/1979	UTILITY RIGHT OF WAY GRANTEE - ALBERTA POWER LIMITED.
872 122 589	02/06/1987	UTILITY RIGHT OF WAY GRANTEE - THE VILLAGE OF MANNVILLE. AS TO PORTION OR PLAN:8721438
882 076 453	14/04/1988	UTILITY RIGHT OF WAY GRANTEE - ATCO GAS AND PIPELINES LTD. 10035-105 ST EDMONTON ALBERTA T5J2V6 (DATA UPDATED BY: TRANSFER OF UTILITY RIGHT OF WAY 012019921)
142 098 440	03/04/2014	DISCHARGE OF UTILITY RIGHT OF WAY 882076453 PARTIAL EXCEPT PLAN/PORTION: 8721438

TOTAL INSTRUMENTS: 006

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 19 DAY OF JULY, 2022 AT 08:07 A.M.

ORDER NUMBER: 44975375

CUSTOMER FILE NUMBER:

END OF CERTIFICATE

(CONTINUED)

LAND TITLE CERTIFICATE

S

LINC	SHORT LEGAL	TITLE NUMBER
0013 955 829	4;8;50;20;NW	902 244 497

LEGAL DESCRIPTION

ALL THAT PORTION OF THE NORTH WEST QUARTER OF SECTION
TWENTY (20)
TOWNSHIP FIFTY (50)
RANGE EIGHT (8)
WEST OF THE FOURTH MERIDIAN
LYING NORTH OF THE NORTH BOUNDARY OF A RAILROAD AS SHOWN
ON PLAN OF SURVEY 3999R CONTAINING 29 HECTARES
(72 ACRES) MORE OR LESS
EXCEPTING THEREOUT ALL MINES AND MINERALS

ESTATE: FEE SIMPLE

MUNICIPALITY: COUNTY OF MINBURN NO. 27

REFERENCE NUMBER: 812 191 843

REGISTERED OWNER(S)

REGISTRATION	DATE(DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
902 244 497	17/08/1990	TRANSFER OF LAND	$30,000	$1

OWNERS

MICHAEL BURY (FARMER)

AND
MELANIE BURY (SECRETARY)
BOTH OF:
BOX 118
MANNVILLE
ALBERTA T0B 2W0
AS JOINT TENANTS

(CONTINUED)

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
802 019 983	29/01/1980	CAVEAT CAVEATOR - PARAMOUNT ENERGY OPERATING CORP. ATTN: LAND MANAGER BOX 2776, STATION M CALGARY ALBERTA T2P3C2 (DATA UPDATED BY: TRANSFER OF CAVEAT 932102705) (DATA UPDATED BY: TRANSFER OF CAVEAT 932237464) (DATA UPDATED BY: CHANGE OF NAME 062264351) (DATA UPDATED BY: TRANSFER OF CAVEAT 072573424) (DATA UPDATED BY: CHANGE OF ADDRESS 082117367)
862 006 623	13/01/1986	UTILITY RIGHT OF WAY GRANTEE - ALBERTA GOVERNMENT TELEPHONES. "PART"
902 232 387	07/08/1990	UTILITY RIGHT OF WAY GRANTEE - MINCO GAS CO-OP LTD.

TOTAL INSTRUMENTS: 003

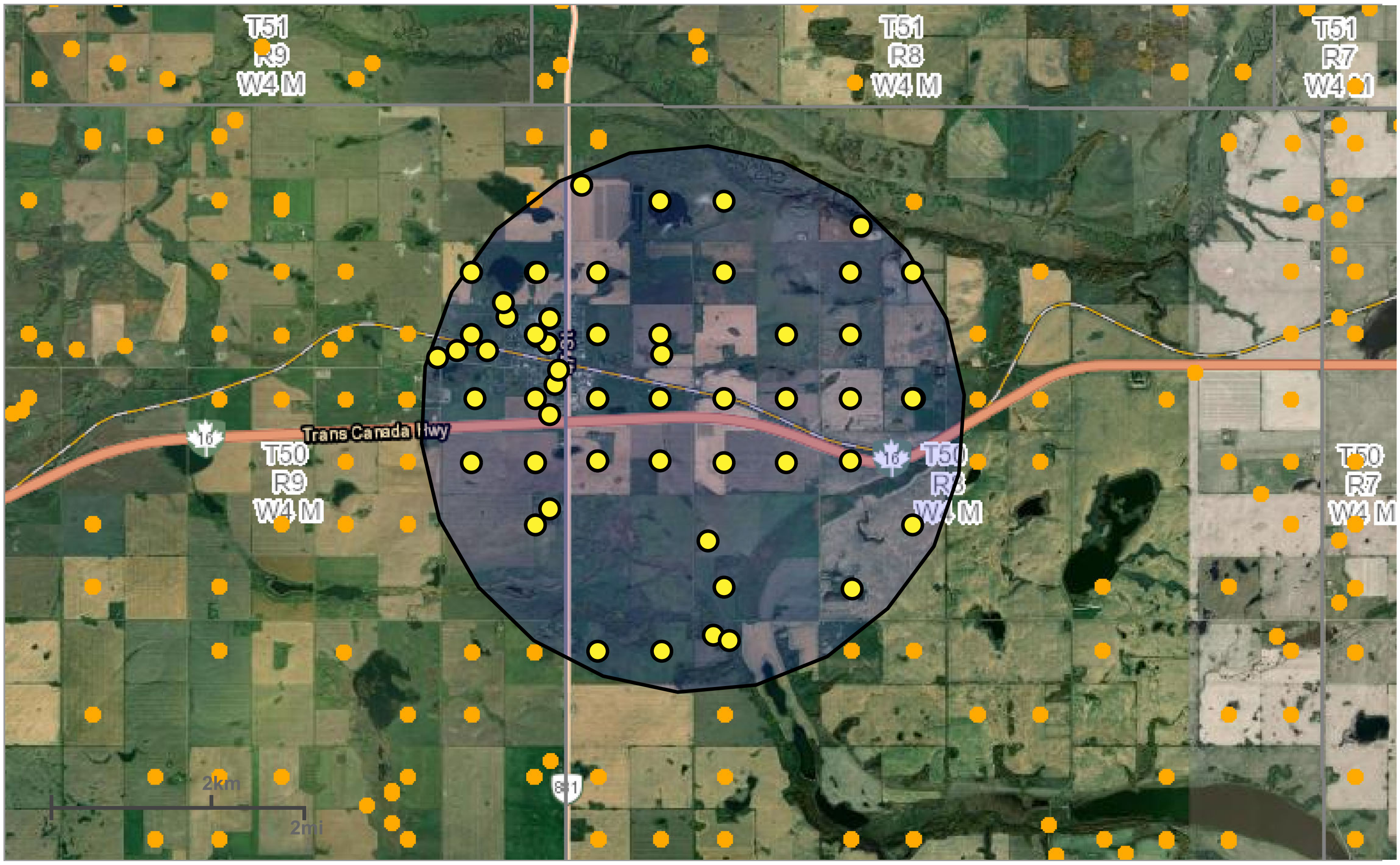
THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 19 DAY OF JULY, 2022 AT 08:07 A.M.

ORDER NUMBER: 44975375

CUSTOMER FILE NUMBER:

END OF CERTIFICATE

APPENDIX E: WATER WELL SEARCH



Alberta Water Well Information Database Map

Projection
Web Mercator (Auxillary Sphere)
Datum
WGS 84
Date
6/21/2022, 12:54:58 PM

Legend
- Groundwater Drilling Report
- Baseline Water Well Report

http://groundwater.alberta.ca/WaterWells/d/

Information as depicted is subject to change, therefore the Government of Alberta assumes no responsibility for discrepancies at time of use.

Alberta

Reconnaissance Report

View in Imperial

Export to Excel

Groundwater Wells

Please click the water Well ID to generate the Water Well Drilling Report.

GIC Well ID	LSD	SEC	TWP	RGE	M	DRILLING COMPANY	DATE COMPLETED	DEPTH (m)	TYPE OF WORK	USE	CHM	LT	PT	WELL OWNER	STATIC LEVEL (m)	TEST RATE (L/min)	SC_DIA (cm)
151955	SW	30	50	8	4	MORTON'S WATER WELL DRILLING LTD.	1989-11-09	73.15	New Well	Domestic		16	28	KAZLECHKO, STAN	24.08	36.37	12.70
158319	NE	28	50	8	4	FRED'S WATER WELL DRILLING LTD.	1976-08-14	50.60	New Well	Stock		15		HENDERSON, ALEX	36.58	18.18	11.43
158428	1	30	50	8	4	MARTIN WATER WELLS	1991-04-17	29.26	Deepened	Domestic		3		KITT, JIM	21.03	90.92	49.78
161546	NW	20	50	8	4	UNKNOWN DRILLER		67.06	Chemistry	Domestic				BURY, MICHAEL			0.00
161547	NW	20	50	8	4	UNKNOWN DRILLER		54.86	Chemistry	Domestic				BURY, MICHAEL			0.00
169596	SE	24	50	9	4	UNKNOWN DRILLER		83.82	Chemistry	Domestic				WAGNER, DON			0.00
169820	1	26	50	9	4	MARTIN WATER WELLS	1992-10-07	25.60	New Well	Domestic & Stock		13		WUSYK, PAUL	1.52	9.09	0.00
232273	16	24	50	9	4	MCALLISTER WATERWELLS LTD.	1993-08-27	73.15	New Well	Domestic		14		POLIAKIWSKI, ED/LINDA	28.04	36.37	12.70
241080	12	17	50	8	4	UNKNOWN DRILLER		7.32	Federal Well Survey	Domestic & Stock				CRAWFORD			0.00
241081	NW	21	50	8	4	FRED'S WATER WELL DRILLING LTD.	1977-05-04	71.02	New Well	Domestic		19		PHILLIPS, BARRY	35.97	29.55	11.43
241083	SE	29	50	8	4	UNKNOWN DRILLER		68.88	Chemistry	Domestic				ANDERSON, ALBERT	54.86		0.00
241084	SE	29	50	8	4	MORTON'S WATER WELL DRILLING LTD.	1980-11-03	76.20	New Well	Domestic & Stock		14		ANDERSON, ALBERT	26.21	45.46	11.43
242034	NW	25	50	9	4	PROSSER & BECKETT	1959-09-21	71.63	New Well	Domestic	1	20		PARKS, J.H.	24.38	18.18	11.43
242100	5	31	50	8	4	MCALLISTER DRILLING LTD.	1969-10-09	60.35	New Well	Stock		13		SARGENT BROS.	37.80		10.31
250716	NW	7	50	8	4	FRED'S WATER WELL DRILLING LTD.	1978-08-26	77.42	New Well	Domestic		14		PULYK, JIM	17.37		11.68
250719	NE	7	50	8	4	UNKNOWN DRILLER		76.20	Chemistry	Domestic				PULYK, JIM	75.59		0.00
250741	NE	16	50	8	4	UNKNOWN DRILLER		24.38	Chemistry	Domestic				BAIN, WILLIAM			0.00
250743	SE	19	50	8	4	UNKNOWN DRILLER		76.20	Chemistry	Domestic				MCLEOD, JOHN			0.00
250744	SW	19	50	8	4	UNKNOWN DRILLER		12.19	Federal Well Survey	Domestic & Stock		2		MCLEOD			60.96
250745	NW	19	50	8	4	UNKNOWN DRILLER		60.96	Chemistry	Domestic				MCLEOD, J.	42.67		0.00

Reconnaissance Report

View in Imperial

Export to Excel

GIC Well ID	LSD	SEC	TWP	RGE	M	DRILLING COMPANY	DATE COMPLETED	DEPTH (m)	TYPE OF WORK	USE	CHM	LT	PT	WELL OWNER	STATIC LEVEL (m)	TEST RATE (L/min)	SC_DIA (cm)
250747	NW	19	50	8	4	MCALLISTER DRILLING LTD.	1965-07-09	73.76	New Well	Domestic		14		MCLEOD, J.	29.87	36.37	0.00
250750	NE	19	50	8	4	FRED'S WATER WELL DRILLING LTD.	1987-03-02	57.61	New Well	Domestic & Stock		12		GOLISH, JAMES	19.81	45.46	12.70
250753	SE	20	50	8	4	UNKNOWN DRILLER		30.48	Federal Well Survey	Unknown				WHARUFE			0.00
250755	SW	20	50	8	4	UNKNOWN DRILLER		18.29	Federal Well Survey	Unknown				WOODS			0.00
250756	NE	20	50	8	4	MCALLISTER DRILLING LTD.	1978-04-26	73.15	New Well	Domestic & Stock		13		LANGLEY, MICHAEL	25.60	31.82	11.68
250759	NE	20	50	8	4	FRED'S WATER WELL DRILLING LTD.	1988-09-09	35.97	New Well	Stock		9		BURY, JOHN	19.51	50.01	12.70
250761	SW	21	50	8	4	UNKNOWN DRILLER		6.40	Federal Well Survey	Unknown				CRAWFORD			0.00
250762	NW	21	50	8	4	FRED'S WATER WELL DRILLING LTD.	1977-05-09	73.15	New Well	Domestic		17		DAIVES, A.J.	35.97	18.18	11.68
250766	NE	21	50	8	4	UNKNOWN DRILLER	1935-08-19	27.43	Federal Well Survey	Unknown				ROMAIUK			0.00
250768	NE	21	50	8	4	UNKNOWN DRILLER		53.34	Chemistry	Domestic				WANLIN, BOB			0.00
250769	NE	21	50	8	4	UNKNOWN DRILLER		67.06	Chemistry	Domestic				MACLEOD, MALCOLM			0.00
250771	NE	21	50	8	4	UNKNOWN DRILLER		68.58	Chemistry	Domestic				WANLIN, BOB			0.00
250983	SW	28	50	8	4	MCALLISTER DRILLING LTD.	1977-09-20	73.15	New Well	Domestic & Stock		7		POLIAKIWSKI, BRIAN	32.31	31.82	11.68
250985	NW	28	50	8	4	UNKNOWN DRILLER	1935-01-01	33.53	Federal Well Survey	Domestic & Stock		4		SLOAN, T.	21.34		0.00
250986	NE	28	50	8	4	UNKNOWN DRILLER	1948-01-01	48.77	Chemistry	Domestic				HENDERSON, ALLAN	37.19		0.00
250987	NE	28	50	8	4	UNKNOWN DRILLER		54.86	Chemistry	Unknown							0.00
250989	SE	29	50	8	4	PROSSER & BECKETT	1959-01-01	57.91	New Well	Domestic & Stock		11		ANDERSON, ALBERT	24.38	22.73	11.68
250991	NW	29	50	8	4	DOWNEY GORDON B		32.00	New Well	Domestic & Stock		3		ANDERSON, ARTHUR	21.34	22.73	11.68
250992	NW	29	50	8	4	UNKNOWN DRILLER		29.87	Federal Well Survey	Unknown		3		MACMILLAN	21.95		60.96
250993	SE	30	50	8	4	UNKNOWN DRILLER		27.43	Federal Well Survey	Domestic & Stock				EMSLAND	25.91		0.00

Reconnaissance Report

View in Imperial

Export to Excel

GIC Well ID	LSD	SEC	TWP	RGE	M	DRILLING COMPANY	DATE COMPLETED	DEPTH (m)	TYPE OF WORK	USE	CHM	LT	PT	WELL OWNER	STATIC LEVEL (m)	TEST RATE (L/min)	SC_DIA (cm)
250994	4	30	50	8	4	BYRT, STAN & SONS LTD.	1983-05-10	66.14	New Well	Municipal	1	17		MANNVILLE, VILL OF	26.21	136.38	17.78
250995	SW	30	50	8	4	UNKNOWN DRILLER		0.00	Chemistry	Domestic				MANNVILLE#HOSPITAL			0.00
250996	NW	30	50	8	4	FRED'S WATER WELL DRILLING LTD.	1988-12-06	67.36	New Well	Domestic & Stock		15		MARON, MARVIN	25.30	22.73	12.70
250997	SE	31	50	8	4	UNKNOWN DRILLER		85.34	Chemistry	Unknown				SARGENT, W.			0.00
251000	SW	32	50	8	4	UNKNOWN DRILLER		0.00	Chemistry	Unknown				ANDERSON, ARTHUR			0.00
251053	NE	13	50	9	4	FRED'S WATER WELL DRILLING LTD.	1979-09-26	50.90	New Well	Domestic & Stock		10		BURY, JOHN	39.62	25.00	11.68
251054	16	13	50	9	4	PROSSER & BECKETT	1960-09-23	68.58	New Well	Domestic		11		BURY, STAN/JOHN	39.62	22.73	11.43
251156	SE	24	50	9	4	UNKNOWN DRILLER		76.20	Chemistry	Domestic				WAGNER, RICHARD			0.00
251158	SW	24	50	9	4	UNKNOWN DRILLER		0.00	Chemistry	Domestic & Stock				STORCH, MARGARET			0.00
251159	SE	25	50	9	4	BYRT, STAN & SONS LTD.	1974-01-03	66.75	New Well	Municipal		9	66	MANNVILLE, VILL OF #3	25.60	113.65	13.97
251171	NE	24	50	9	4	UNKNOWN DRILLER		0.00	Chemistry	Stock				POLIAKIWSKI, ED			0.00
251174	9	24	50	9	4	MCALLISTER DRILLING LTD.	1964-08-17	68.88	New Well	Unknown		11		POLIAKIWSKI, E.	24.69	40.91	0.00
251176	SE	25	50	9	4	DOWNEY GORDON B	1950-06-30	11.58	New Well	Unknown		4		VUMA, W.	4.57	9.09	0.00
251178	SE	25	50	9	4	UNKNOWN DRILLER		75.59	Chemistry	Domestic				MANNVILLE#HOSPITAL	39.01		0.00
251179	7	25	50	9	4	WESTERN WATER WELLS LTD.	1956-10-09	70.10	New Well	Municipal	5	6		MANNVILLE, VILL OF #2	42.67		21.92
251179	7	25	50	9	4	WESTERN WATER WELLS LTD.	1956-10-09	70.10	New Well	Municipal	5	6		MANNVILLE, VILL OF #2	23.16	113.65	21.92
251181	SE	25	50	9	4	UNKNOWN DRILLER		32.31	Federal Well Survey	Unknown		3		BROWN	14.02		0.00
251182	SE	25	50	9	4	UNKNOWN DRILLER		0.00	Chemistry	Domestic				STADEN, KENT			0.00
251184	SW	25	50	9	4	UNKNOWN DRILLER	1953-06-17	51.82	Chemistry	Domestic				MANNVILLE#SHOOL	9.14		0.00
251185	SE	25	50	9	4	RANGELAND DRILLING	1965-05-11	68.58	New Well	Domestic		15		RODER, FRITZ	25.60	31.82	11.68

Reconnaissance Report

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Export to Excel

GIC Well ID	LSD	SEC	TWP	RGE	M	DRILLING COMPANY	DATE COMPLETED	DEPTH (m)	TYPE OF WORK	USE	CHM	LT	PT	WELL OWNER	STATIC LEVEL (m)	TEST RATE (L/min)	SC_DIA (cm)
251185	SE	25	50	9	4	RANGELAND DRILLING	1965-05-11	68.58	New Well	Domestic		15		RODER, FRITZ	25.60	13.64	11.68
251198	3	25	50	9	4	MCALLISTER HOLDINGS LTD.	1979-05-25	60.96	New Well	Domestic		10		KAZIECHKO, STAN	27.74	36.37	11.43
251201	4	25	50	9	4	UNKNOWN DRILLER		21.95	Test Hole	Unknown		6		ALTA ENV/WATER RES			0.00
251204	NE	25	50	9	4	UNKNOWN DRILLER		0.00	Chemistry	Domestic				DELISLE, JOSEPH			0.00
251207	NE	25	50	9	4	FRED'S WATER WELL DRILLING LTD.	1988-03-06	63.09	New Well	Domestic & Stock		13		PRIESTON, AUSTIN/RITA	26.21	25.00	12.70
251212		25	50	9	4	UNKNOWN DRILLER		60.96	Chemistry	Unknown				PEMBERTON	21.34		0.00
258223	NW	29	50	8	4	BIG IRON DRILLING LTD.	1995-06-20	42.06	New Well	Domestic		11	15	ANDERSON, AURTHER	26.52	45.46	15.24
281255	7	25	50	9	4	UNKNOWN DRILLER	1980-03-19	0.00	Chemistry	Domestic	1			ROBIN, ROLAND			0.00
281265	NW	25	50	9	4	UNKNOWN DRILLER	1973-05-10	60.96	Chemistry	Domestic	1			WEAVER, ROBERT			0.00
287661	SW	17	50	8	4	MORTON'S WATER WELL DRILLING LTD.	1997-09-03	79.25	New Well	Domestic		8	13	ROLAND, ROBIN	37.98	36.37	12.70
287999	8	25	50	9	4	UNKNOWN DRILLER		26.82	Test Hole	Observation				MANNVILLE			8.89
289352	SW	25	50	9	4	MARTIN WATER WELLS	1998-05-20	15.85	Reconditioned	Stock		2		WUSYK, PAUL	1.83	136.38	59.99
290832	SW	19	50	8	4	MANNVILLE WATER WELL SERVICES LTD.	1998-09-26	44.20	New Well	Domestic		10	7	MORTON, ALAN	25.60	54.55	12.70
292026	NW	19	50	8	4	MANNVILLE WATER WELL SERVICES LTD.	1998-10-29	64.01	New Well	Observation		16		MANNVILLE, VILL OF			0.00
293960	NE	20	50	8	4	MORTON'S WATER WELL DRILLING LTD.	2000-04-07	73.15	New Well	Domestic		9	25	HENDERSON, ALEX D.	25.82	36.37	12.70
1025507	3	33	50	8	4	ACCESS WATERWELLS INC.	2013-03-17	149.96	New Well	Industrial		24	10	PERPETUAL ENERGY	42.67	26.50	17.78
1025508	3	33	50	8	4	ACCESS WATERWELLS INC.	2013-03-19	59.44	New Well	Observation		16	17	PERPETUAL ENERGY	44.20	11.37	14.12
1485043	NE	25	50	9	4	MANNVILLE WATER WELL SERVICES LTD.	2002-08-14	67.97	New Well	Domestic & Stock		18	25	KONIECZNY, KELLY	26.24	50.01	12.70
1485047	NW	24	50	9	4	MANNVILLE WATER WELL SERVICES LTD.	2002-05-04	68.58	New Well	Domestic		12	25	GAUSVIK, DOUG	29.17	54.55	12.70
1485099	SW	16	50	8	4	MANNVILLE WATER WELL SERVICES LTD.	2006-06-08	79.55	New Well	Domestic & Stock		12	25	WEATHERAL, STANLEY	31.42	45.46	12.70

Reconnaissance Report

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1485136	SE	25	50	9	4	MANNVILLE WATER WELL SERVICES LTD.	2007-07-11	67.06	New Well	Domestic		17	25	KAZIECHKO, STANLEY	29.14	27.28	12.70
1490347	13	8	50	8	4	MARTIN WATER WELLS	2008-08-21	17.07	New Well	Domestic		4	24	ELLIOT, DOUG	4.40	272.77	73.66
1490784	14	8	50	8	4	MARTIN WATER WELLS	2018-06-07	12.19	New Well	Stock		7	26	ELLIOTT, DOUG	6.88	18.18	
1924509	NE	21	50	8	4	MORTON'S WATER WELL DRILLING LTD.	2007-11-29	79.25	New Well	Domestic		6	16	FAHSELT, RON	38.62	27.28	12.70
2092710	16	24	50	9	4	UNKNOWNDRILLINGCOMP11		66.75	Well Inventory	Municipal		4		MANNVILLE, TOWN OF	25.60		
9556000	1	25	50	9	4	WESTERN WATER WELLS LTD.	1953-12-01	76.20	New Well	Municipal		12	1	MANNVILLE, TOWN OF	21.95	181.84	21.92
9556000	1	25	50	9	4	WESTERN WATER WELLS LTD.	1953-12-01	76.20	New Well	Municipal		12	1	MANNVILLE, TOWN OF	21.95	113.65	21.92
9556000	1	25	50	9	4	WESTERN WATER WELLS LTD.	1954-10-15	76.20	Reconditioned	Municipal		1	9	MANNVILLE, TOWN OF	24.08	113.65	21.92

APPENDIX F: SITE PHOTOGRAPHS

X-TERRA Environmental Services Ltd.
A THUNDERCHILD ENERGY SERVICES COMPANY

200, 4201 66th Ave.
Lloydminster, AB
T9V 2Y7
TEL (780) 875-1442
FAX (780) 871-0925

100 - 303 Wheeler Place
Saskatoon, SK
S7P 0A4
TEL (306) 373 1110
FAX 306 373 2444

PHOTOGRAPHIC LOG

Proponent: County of Minburn No. 27
Date: July 20, 2022
Project Name: Biophysical Assessment
X-Terra Project: 22148
Location: NW-19, NE-19 & NW-20-050-08 W4M4-21-044-24 W3M

Photo: 1
Direction: W
Date: June 22, 2022
Description: Overview of future development area facing west.

Photo: 2
Direction: W
Date: June 22, 2022
Description: Viewing west at Ditch Wetland.

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PHOTOGRAPHIC LOG

Proponent: County of Minburn No. 27
Date: July 20, 2022
Project Name: Biophysical Assessment
X-Terra Project: 22148
Location: NW-19, NE-19 & NW-20-050-08 W4M4-21-044-24 W3M

Photo: 3
Direction: E
Date: June 22, 2022
Description: Viewing east at Ditch Wetland.

Photo: 4
Direction: W
Date: June 22, 2022
Description: Viewing west at Ditch Wetland 2.

200, 4201 66th Ave.
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PHOTOGRAPHIC LOG

Proponent: County of Minburn No. 27
Project Name: Biophysical Assessment
Location: NW-19, NE-19 & NW-20-050-08 W4M4-21-044-24 W3M

Date: July 20, 2022
X-Terra Project: 22148

Photo: 5
Direction: E
Date: June 22, 2022
Description: Viewing east at Ditch Wetland 2.

Photo: 6
Direction: W
Date: June 22, 2022
Description: Viewing west at 16-19 Wetland.

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PHOTOGRAPHIC LOG

Proponent: County of Minburn No. 27
Project Name: Biophysical Assessment
Location: NW-19, NE-19 & NW-20-050-08 W4M4-21-044-24 W3M

Date: July 20, 2022
X-Terra Project: 22148

Photo: 7
Direction: N
Date: June 22, 2022
Description: Viewing north at 16-19 Wetland.

Photo: 8
Direction: E
Date: June 22, 2022
Description: Viewing east at the CN Ditch.

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PHOTOGRAPHIC LOG

Proponent: County of Minburn No. 27

Date: July 20, 2022

Project Name: Biophysical Assessment

X-Terra Project: 22148

Location: NW-19, NE-19 & NW-20-050-08 W4M4-21-044-24 W3M

Photo: 9
Direction: W
Date: June 22, 2022
Description: Viewing west at CN Ditch.

Photo: 10
Direction: W
Date: June 22, 2022
Description: Viewing west at CN Ditch Wetland.

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PHOTOGRAPHIC LOG

Proponent: County of Minburn No. 27
Date: July 20, 2022
Project Name: Biophysical Assessment
X-Terra Project: 22148
Location: NW-19, NE-19 & NW-20-050-08 W4M4-21-044-24 W3M

Photo: 11
Direction: N
Date: June 22, 2022
Description: Viewing North at CN Ditch Wetland.

Photo: 12
Direction: N
Date: June 22, 2022
Description: Viewing north at CN Ditch Wetland.

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PHOTOGRAPHIC LOG

Proponent: County of Minburn No. 27
Date: July 20, 2022
Project Name: Biophysical Assessment
X-Terra Project: 22148
Location: NW-19, NE-19 & NW-20-050-08 W4M4-21-044-24 W3M

Photo: 13
Direction: E
Date: June 22, 2022
Description: Viewing east at CN Ditch Wetland.

Photo: 14
Direction: W
Date: June 22, 2022
Description: Viewing west at ASP Lands area.

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PHOTOGRAPHIC LOG

Proponent: County of Minburn No. 27
Project Name: Biophysical Assessment
Location: NW-19, NE-19 & NW-20-050-08 W4M4-21-044-24 W3M

Date: July 20, 2022
X-Terra Project: 22148

Photo: 15
Direction: E
Date: June 22, 2022
Description: Viewing east at ASP Lands area.

Photo: 16
Direction: SW
Date: June 22, 2022
Description: Viewing southwest at ASP Lands area.

X-TERRA Environmental Services Ltd.
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PHOTOGRAPHIC LOG

Proponent: County of Minburn No. 27
Project Name: Biophysical Assessment
Location: NW-19, NE-19 & NW-20-050-08 W4M4-21-044-24 W3M

Date: July 20, 2022
X-Terra Project: 22148

Photo: 17
Direction: N
Date: June 22, 2022
Description: Viewing north at the watercourse in the northwest corner of the ASP Lands area.

Photo: 18
Direction: E
Date: June 22, 2022
Description: Viewing east at watercourse in the northwest corner of the ASP Lands area.

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PHOTOGRAPHIC LOG

Proponent: County of Minburn No. 27
Project Name: Biophysical Assessment
Location: NW-19, NE-19 & NW-20-050-08 W4M4-21-044-24 W3M

Date: July 20, 2022
X-Terra Project: 22148

Photo: 19
Direction: NW
Date: June 22, 2022
Description: Viewing northwest at ASP Lands area.

Photo: 20
Direction: W
Date: June 22, 2022
Description: Viewing west at ASP Lands area.

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PHOTOGRAPHIC LOG

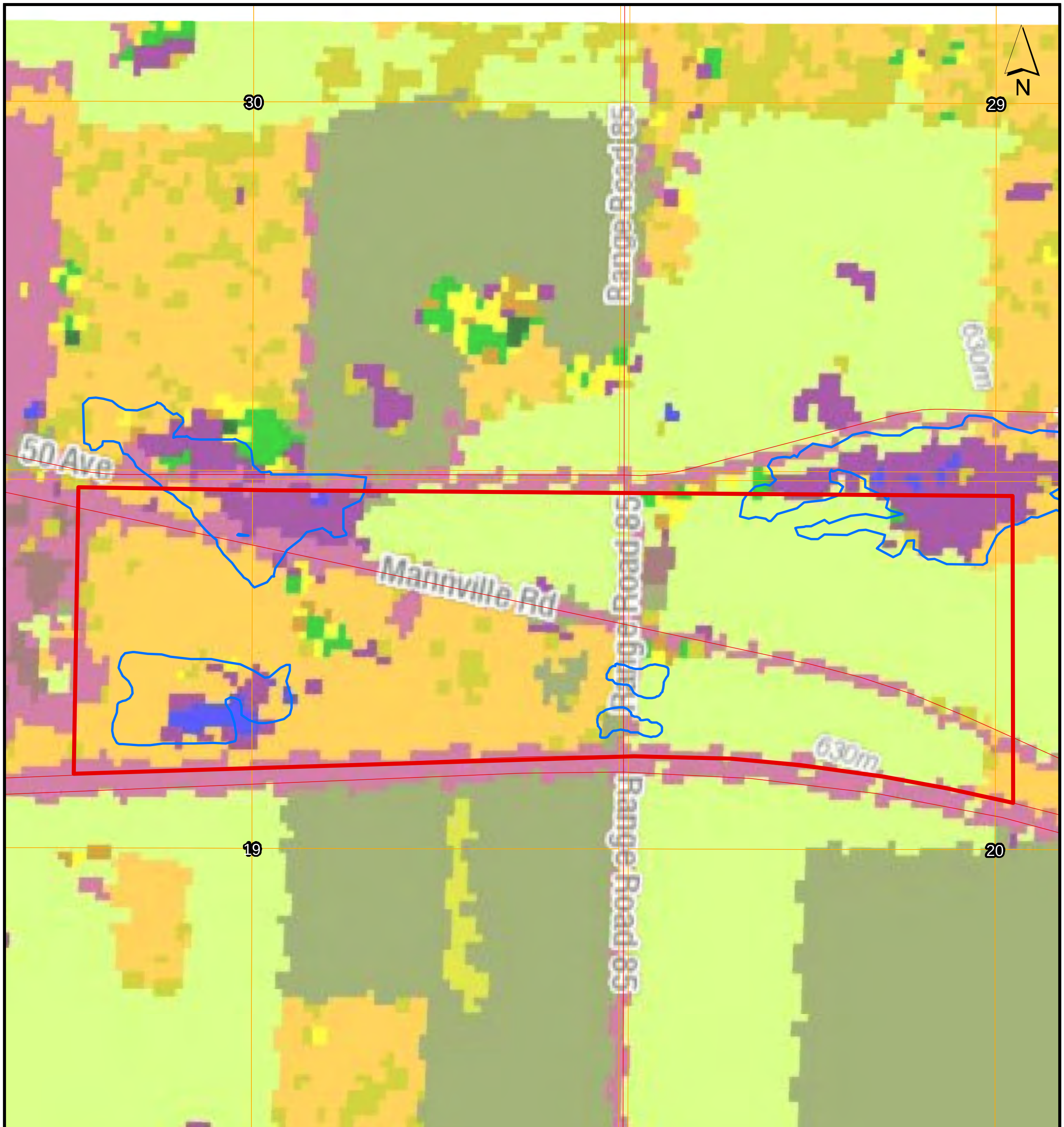
Proponent: County of Minburn No. 27
Project Name: Biophysical Assessment
Location: NW-19, NE-19 & NW-20-050-08 W4M4-21-044-24 W3M

Date: July 20, 2022
X-Terra Project: 22148

Photo: 21
Direction: SE
Date: June 22, 2022
Description: Viewing southeast at the borrow pit/wetland near the southwest corner of the ASP Lands area.

Photo: 22
Direction: W
Date: June 22, 2022
Description: Viewing west at the borrow pit/wetland near the southwest corner of the ASP Lands area.

APPENDIX G: ANNUAL CROP INVENTORY



S:\GIS\2022_Projects\County of Minburn\22148_County of Minburn(Red Willow) ASP 2022\MXDs\1 - Report\22148 COUNTY OF MINBURN RED WILLOW.mxd

LEGEND

- QUARTERSECTION
- PROJECT FOOTPRINT
- HIGHWAY

Annual Crop Inventory 2020

Water	Rye	Beans
Exposed land/barren	Triticale	Fababeans
Urban/developed	Sorghum	Lentils
Greenhouses	Winter wheat	Potatoes
Shrubland	Spring wheat	Sugarbeets
Wetland	Corn	Other vegetables
Grassland	Camelina	Orchards
Agriculture (undifferentiated)	Canola/rapeseed	Vineyards
Pasture/forages	Flaxseed	Herbs
Too wet to be seeded	Mustard	Canaryseed
Fallow	Sunflower	Hemp
Barley	Soybeans	Coniferous
Millet	Peas	Broadleaf
Oats	Chickpeas	Mixedwood

REFERENCE: NATURAL RESOURCES CANADA, CENTRE FOR TOPOGRAPHIC INFORMATION, 2012; ALBERTA ENVIRONMENT AND SUSTAINABLE RESOURCE DEVELOPMENT AIR PHOTO DISTRIBUTION; GOOGLE EARTH, ESRI, BING IMAGERY AGRICULTURE AND AGRI-FOOD CANADA, NAD_1983_10TM_AEP_FOREST

PROJECT:

RED WILLOW PROJECT

TITLE:

2020 ANNUAL CROP INVENTORY

0 — 500 M

SCALE	DATUM	PROJECTION	DATE	DRAWN	REVIEWED	VERSION
1:12,500	NAD 83	UTM Z12	2022-08-04	JC	CB	R1

X-TERRA Environmental Services Ltd.

THUNDERCHILD Energy Services

FIGURE: 3

10TM AEP F

B

Appendix B
Geotechnical Report

Does not form part of this Bylaw.

Prepared by: SolidEarth Geotechnical Inc.

GEOTECHNICAL INVESTIGATION

Proposed East Industrial Park ASP
Within Portions of N ½ 19-50-8 W4M
Village of Mannville Alberta

Prepared for:

BAR Engineering Co. Ltd.

Date:

4 April 2023

Project File #: PG23-1691

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1.0 INTRODUCTION

This report presents the results of the geotechnical investigation conducted for the proposed East Industrial Park, located on the east side of the Village of Mannville, Alberta. The geotechnical investigation was carried out by SolidEarth Geotechnical Inc. (SolidEarth) at the authorization of Mr. Scott Simons, P.Eng. of BAR Engineering Co. Ltd. (BAR Engineering).

The purpose of the geotechnical investigation was to assess the subsurface soil and groundwater conditions at selected locations across the proposed subdivision and to provide geotechnical recommendations associated with the proposed development.

2.0 PROJECT DESCRIPTION AND INVESTIGATION SCOPE

Based on information provided to SolidEarth, it was understood that BAR Engineering is preparing an area structure plan (ASP) for the project, which involves expanding the industrial subdivision.

The scope of work completed by SolidEarth included a desktop review of published aerial imagery and geological information; drilling boreholes, conducting laboratory review and testing on recovered soil samples; and undertaking geotechnical engineering analysis and preparation of this report.

3.0 SITE DESCRIPTION

The site was located within portions of N ½ 19-50-8 W4M, on the east side of the Village. At the time of the field investigation, the site was generally agricultural cropland and was relatively flat. The western side of the project area bordered on the existing industrial area. A dugout was present within the southwestern portion of the site.

A Canadian National (CN) railway and Township Road 503B traversed the site diagonally northwest to southeast. A residential acreage existed within the central portion of the site, on the south side of Township Road 503B.

The overall site development plan on an aerial photograph is presented as Figure 1. Photographs showing site conditions that existed at the time of the field investigation are presented in Appendix A.

4.0 FIELD AND LABORATORY INVESTIGATION

4.1 GROUND DISTURBANCE AND SAFETY PERFORMANCE

Prior to field drilling, a SolidEarth representative completed internal ground disturbance procedures, which included placing an Alberta One Call. Before starting onsite work, a daily field level hazard assessment was conducted and was communicated with all workers involved during the tailgate meeting. The field work was completed without any near misses or incidents.

4.2 FIELD DRILLING AND TESTING

The borehole locations were selected and marked in the field by BAR Engineering. The borehole location plan on an aerial photograph is presented as Figure 1.

SolidEarth subcontracted Evergreen Drilling Ltd. of Wetaskiwin, Alberta to drill the boreholes. Drilling was completed using a track and truck-mounted auger drill rig utilizing 150 mm solid-stem continuous flight augers.

The field investigation was undertaken on 9 March 2023 and consisted of drilling six (6) boreholes (BH23-1 to -6). The boreholes were drilled to approximate depths ranging between 5.8 and 7.3 m below the existing ground surface.

During drilling, soil samples were collected at approximately 0.75 m intervals along the depth of the boreholes. Pocket penetrometer testing was conducted on selected cohesive soil samples to obtain an indication of the unconfined compressive strength of disturbed soil samples from the auger. Standard Penetration Tests (SPT) were conducted at selected depths (typically every 1.5 m) to assess the in-situ strength of the soils encountered. The soil sampling and testing sequences are shown on the borehole logs, Appendix B.

A SolidEarth geotechnical engineer monitored the drilling operations and logged the recovered soil samples from the auger cuttings and the SPT samples. The soils were logged according to the Modified Unified Soil Classification System, which is described in the Explanation of Terms and Symbols in Appendix B. Due to the method by which the soil cuttings were returned to surface, the depths noted on the borehole logs may vary by ± 0.3 m from those recorded.

Groundwater seepage conditions were monitored during and immediately following completion of drilling. Slotted standpipe piezometers were installed at all borehole locations at completion of drilling to monitor short term groundwater levels.

The lateral and vertical coordinates (northing, easting and elevation) of the ground surface at the borehole locations were surveyed by BAR Engineering and provided to SolidEarth. These coordinates are shown on the borehole logs.

4.3 LABORATORY INVESTIGATION

All collected samples were submitted to the laboratory for further examination and testing. Laboratory testing conducted included visual examination, determination of the natural moisture content on all collected samples; grain size distribution and Atterberg limits on selected samples. The results of the laboratory testing are presented on the borehole logs, Appendix B.

5.0 SUBSURFACE CONDITIONS

The subsurface soil conditions encountered at the borehole locations generally consisted of cultivated topsoil followed by sand and underlain by clay till. A brief summary of the subsurface conditions encountered is presented below. A detailed description of the subsurface conditions encountered at each borehole location is provided on the borehole logs.

Cultivated Topsoil

Cultivated topsoil was encountered at the ground surface of all borehole locations and was generally less than 75 mm thick.

Sand

Near surface sand was encountered below the topsoil at the majority of borehole locations and extended to approximate depths ranging between 0.5 and 0.8 m below ground surface.

The sand was classified as “sand, some to and gravel, trace to some silt, trace to some clay”, was poorly graded, fine to coarse grained, brown, and damp to very moist.

Clay Till

Clay till was encountered below the near surface sand at all borehole locations and extended to beyond the borehole exploration depths.

The clay till was generally classified as “clay, sandy to and sand, and silt”, was low to medium plastic, brown to grey, and moist. The natural moisture content of the clay till samples ranged between 8 and 19 percent, with an average of 14 percent. Liquid and plastic limits of samples were in the order of 31 to 35 percent, and 10 to 11 percent, respectively. Based on the comparison of the plastic limit of the soil, it is expected that the average moisture content of the clay till was generally near to the optimum moisture content of the soil.

The consistency of the clay till was assessed based on SPT “N” and pocket penetrometer values to be generally firm to stiff within the upper 2 m of the soil profile, becoming stiff to very stiff below that depth.

Groundwater Levels

The measured groundwater levels are shown in Table 1. The groundwater levels are expected to fluctuate seasonally depending upon several factors that include the local geology, hydrogeology, and surface infiltration.

Table 1: Measured Groundwater Levels

Borehole ID	Depth of Borehole (mbgs) Note 1	Approximate Ground Elevation (m) Note 2	Groundwater Levels			
			(At Drilling Completion)		20 March 2020	
			Depth (mbgs)	Elevation (m)	Depth (mbgs)	Elevation (m)
BH23-1	5.8	623.7	Dry	Dry	Dry	Dry
BH23-2	6.6	624.2	6.6	617.6	4.0	613.6
BH23-3	7.3	626.1	Dry	Dry	Dry	Dry
BH23-4	7.3	625.0	Dry	Dry	Dry	Dry
BH23-5	7.3	625.3	Dry	Dry	Dry	Dry
BH23-6	7.3	626.6	Dry	Dry	1.9	624.7

Note 1: mbgs – metres below existing ground surface
Note 2: Provided to SolidEarth by the Client

6.0 REVIEW OF AVAILABLE INFORMATION

Aerial Photographs

Aerial photographs of the project site were obtained to determine the historic land features, use, and the changes that occurred within the project area. Aerial photographs were obtained through Google Earth Pro®. Aerial photographs that were reviewed included the years of 2021, 2016, and 2007.

As aerial photographs do not provide a continuous record of site development, it is possible that features of interest may have been present in the study area between the dates of coverage. In addition, photographic quality and scale are variable and may make features difficult to identify or their nature difficult to determine.

A reproduction of the 2021, 2016, and 2007 aerial photographs are presented in Figures 1 to 3, respectively. A review of these photographs indicated that the study area appeared to be mainly agricultural cropland throughout the review period with no major changes in land use or site features. A residential unit was noted within the middle of the site. Potentially wet and treed areas were noted within the central portion of the site. A dugout/pond was visible within the southwestern portion of the site. A drainage pathway crossing the site in the north-south direction and crossing the CN ROW and highway were also noted.

The review of historical aerial photographs identified no major historical land disturbance within the site. The review also identified the presence of potentially wet and vegetated areas within the middle portion of the site.

Site Topography and Drainage

Site topography and drainage was assessed by reviewing Atlas of Canada-Toporama from the Natural Resources Canada website, as shown on Figure 4.

According to the Atlas of Canada-Toporama, the elevation of the study area has a relief of less than 10 m. In addition, there appeared to be a low-lying area within the southwest portion of the site.

Surficial and Bedrock Geological Maps

The surficial geology of Alberta (*Alberta Geological Survey Map 601 – Surficial Geology of Alberta* by M.M. Fenton, E.J. Waters, S.M. Pawley, N.Atkinson, D.J. Utting and K. Mckay) was reviewed to assess the surficial geology of the study area. The reviewed information revealed that the surficial geology of the study area was composed of glacial moraine till which consists of clay, silt, and sand, with trace pebbles, cobbles, and boulders. It is characterized by a lack of distinctive topography. This deposit may also contain blocks of bedrock, stratified sediments, or lenses of glaciolacustrine and/or glaciofluvial sediments.

Based on the bedrock geology by Alberta Geological Survey and Alberta Energy Regular (*Alberta Geological Survey Map 600 – Bedrock Geology of Alberta*), the bedrock was composed of Lower Belly River Group (KBR-l). The bedrock was described as very fine to medium grained, buff weathering sandstone; thin coal layers; brownish-grey, carbonaceous silty mudstone; sandstone-dominated, coarsening-upward members interlocked with mudstone.

Water Wells Drilling Logs

The Alberta Water Well Drilling Reports database was reviewed to obtain information regarding wells that may be present on the site and around the study area. The search indicated the presence of two (2) water wells within the vicinity and in the study area.

The well logs indicated that the soil profile mainly consisted of clay and sand deposits and underlain by bedrock consisting of shale and sandstone. The top of the bedrock was noted to be approximately 28 to 41 m below ground surface. The static water level was measured at 19.8 m below ground surface. A copy of the search results is provided in Appendix C.

Oil and Gas Installations

The *Abacus Datagraphics Limited* (AbaData) database was reviewed for information available to the Alberta Energy Regulator (AER) on oil and gas wells, facilities, batteries, and environmental spills related to the Site.

The search indicated the followings:

- An ATCO gas pipeline running diagonally and entering the southwest corner of the study area across Highway 16 and exiting towards the Village of Mannville.
- A Mitco gas pipeline entering the study area across Highway 16 towards the existing residential building located in the site.
- A Mitco gas pipeline entering the northeast corner of the study area across Range Road 85 and exiting across Township Road 504.
- Three parallel Telus utility lines running diagonally along Canadian National Railway and one Telus utility line running horizontally along Township Road 504.
- Two water wells, one within the eastern portion of the study area and one within the western portion.

Figure 5 presents the approximate site location and oil and gas infrastructure, from the AbaData database.

7.0 PRELIMINARY GEOTECHNICAL ANALYSIS AND RECOMMENDATIONS

It should be noted that the provided recommendations and considerations, particularly as it relates to building foundations, should be treated as preliminary only. A detailed geotechnical investigation should be completed for each proposed industrial building/lot in the future during the detailed design stage.

7.1 FOREWORD

The subsurface soil conditions encountered at the borehole locations were considered suitable for the proposed development. Site grading, installation of underground utilities, construction of storm water management facility (SWMF), and pavement structures were considered feasible.

Based on the subsurface conditions encountered, deep pile foundations were considered most suitable foundations options for proposed future structures.

7.2 SITE DEVELOPMENT CONSIDERATIONS

7.2.1 Subgrade Preparation

During initial site grading, all topsoil should be stripped and removed from the site. Topsoil should not be mixed with mineral soils or be used as engineered fill material.

The near surface soil consisted of sand (up to 1 m thick) and clay till. As such, variability in subgrade conditions should be anticipated. The near surface sand, where encountered, was generally poorly graded, and damp to moist. The near surface clayey soils were low to medium plastic. It is anticipated that:

- The exposed subgrade may be sensitive to disturbance from heavy rubber-tire construction equipment, especially if exposed to wet conditions.
- Soft subgrade conditions may be encountered at some locations across the site, particularly following snow melt and heavy rain events.

Construction traffic on the unprotected subgrade should be kept to a minimum and restricted to low pressure track equipment to the extent possible. The use of heavy rubber-tire equipment (such as rock trucks) during construction will likely lead to significant disturbance to the subgrade and should be avoided to the extent possible.

All exposed subgrade, following achievement of rough grades (in areas under cut) and prior to placement of engineered fill (in areas under fill) should be inspected by the geotechnical engineer. The inspection may include a proof-roll test to confirm that deflections from construction traffic are minimal. Soft and weak areas identified during inspection, should be strengthened and improved.

Regardless of the above, it is recommended that where subgrade support is required, the upper 300 mm of the subgrade soil be strengthened/improved. Subgrade strengthening/improvement would include scarifying and re-compacting the subgrade (if good weather conditions prevail) or the soft wet material removed and replaced with drier clay or granular material placed as engineered fill. Requirements for engineered fill are discussed below.

7.2.2 Requirement for Engineered Fill

Engineered fill should consist of low to medium plastic clay or a well-graded granular material. Silt or sand which is uniformly graded, or which contains more than 10 percent passing the 0.080 mm sieve is not recommended as these materials are generally frost susceptible and are difficult to compact (require strict control of moisture content). All fill soils should be free from any organic materials, contamination, deleterious construction debris, and stones greater than 150 mm in diameter.

The low to medium plastic native clay till soil encountered at the borehole locations was generally considered suitable for re-use as engineered fill. Moisture conditioning of these soils may be required at some locations and will depend on weather conditions during construction.

The sand encountered below the topsoil at the borehole locations was considered “marginal” for engineered fill application. These soils are generally frost susceptible in the presence of water and may be become weak if inundated with water. These may be re-used as general fill and where subgrade support is not required.

Engineered fill should be thawed when placed and placed during non-frozen conditions. If winter construction is proposed, SolidEarth can provide additional recommendations once the overall development plan has been finalized.

All engineered fill should be compacted to a minimum of 98 percent of standard Proctor maximum dry density (SPMDD) within the proposed building envelopes, and to a minimum of 95 percent of SPMDD within the graveled yards and paved areas. Notwithstanding the above, the upper 300 mm of the subgrade within the paved areas should be compacted to 98 percent of SPMDD.

The fill should be compacted in lift thicknesses of 300 mm (loose) or less, and within two percent of the optimum moisture content of the soil. Engineered fill within the building footprint should extend at least 1.5 m, or the thickness of the fill, beyond the footprint of the building. Fill placement procedures and quality of the fill soils should be monitored by geotechnical personnel. Field monitoring should include compaction testing at regular frequencies.

Even for well compacted fill, some fill settlement under self-weight will occur. Settlement in the order of one to three percent of the fill thickness should be anticipated for engineered fill compacted to between 98 and 95 percent SPMDD. The majority of this settlement is expected to occur within the first year following construction.

7.2.3 Site Drainage

To minimize the potential for water ponding and saturation of the subgrade during and following construction, a minimum grade of two percent is recommended at the subgrade level to accommodate surface water runoff away from the development area. The upper 300 mm of backfill around the buildings (where no pavement structure is proposed) should consist of compacted clay to act as a seal against runoff water. The clay should extend a minimum distance of 3 m away from the building and should be graded at a slope of five percent or more.

It is also recommended that positive surface drainage be provided in the early stages of construction to prevent ponding of water and softening of the subgrade.

7.3 FOUNDATION OPTIONS AND PRELIMINARY DESIGN CONSIDERATIONS

As outlined above, the provided recommendations and considerations should be treated as preliminary only and should not be used in detailed design. A detailed geotechnical investigation should be completed for each proposed industrial building/lot in the future, during the detailed design stage.

7.3.1 Foundation Options

The strength of the near surface soils (within the upper 1 to 3 m of soil profile) showed some degree of variability, and were relatively weak at a few borehole locations. As such, footings were not considered as a favourable foundation alternative at this time. The suitability of shallow footings at specific locations should be addressed at the detailed design stage by site specific geotechnical investigations.

Based on the subsurface conditions encountered, deep pile foundations were considered to be the most suitable foundation option to supporting future proposed structures. Pile foundations may include cast-in-place (CIP) concrete piles, continuous flight auger piles (CFA), or driven steel piles. CIP concrete piles are anticipated to be the most economical deep pile foundation option. Preliminary recommendations for CIP concrete piles are provided in this report.

7.3.2 Foundations Design Method

The current design standard in foundation engineering is based on limit state design. Accordingly, geotechnical recommendations associated with such standard are provided in this report.

The *2006 Canadian Foundation Engineering Manual (2006 CFEM)* defines limit states "as conditions under which a structure or its component members no longer perform their intended function". Limit states are generally classified into two main groups: ultimate limit state and serviceability limit state. Below is a brief discussion on both states.

<u>*Ultimate Limit State (ULS)*</u>

Ultimate limit states are primarily concerned with collapse mechanisms for the structure and, hence, safety. For foundation design, the ULS consists of: ultimate bearing capacity failure, sliding, overturning, loss of stability, uplift, or large deformation.

The basic foundation design equation using ULS approach is presented as:

$$\Phi R_n \geq \Sigma \alpha_i S_{ni}$$ [1]

where:

- ΦR_n - is the factored geotechnical resistance
- Φ - geotechnical resistance factor
- R_n - the nominal (ultimate) geotechnical resistance determined using unfactored values for geotechnical parameters or performance data (such as pile load test)

[1] Page 136 of the *Canadian Foundation Engineering Manual* – 4th Edition, January 2007

$\Sigma\alpha_i S_{ni}$ - is the summation of the factored overall load effects for a given load combination condition

α_i - is the load factor corresponding to a particular load

S_{ni} - is a specified load component of the overall load effects (e.g. dead load due to weight of structure or live load due to wind)

i - represents various types of loads such as dead load, live load, wind load, etc.

Geotechnical resistance factors as provided by the 2006 CFEM for foundations are provided in Table 2. The critical design events and their corresponding load combination and load factors should be assessed and determined by the structural engineer.

Table 2: Geotechnical Resistance Factors for Foundations

Foundation Type	Loading Condition	Geotechnical Resistance Factor (ULS)
Deep Foundations	resistance to axial load (i) semi-empirical analysis (ii) analysis using static loading test results (iii) analysis using dynamic monitoring results (iv) uplift resistance by semi-empirical analysis (v) uplift resistance using load test results	 0.4 0.6 0.5 0.3 0.4
	resistance to horizontal load	0.5

Serviceability Limit State (SLS)

Serviceability limit states are primarily concerned with mechanisms that restrict or constrain the intended use, occupancy, or function of the structure under working loads. For foundation design, SLS are usually associated with:

- excessive foundation movements (e.g. settlement, differential settlement, heave, etc.)
- unacceptable foundation vibrations
- local damage or deterioration

In general, the SLS criteria can be expressed as follows:

Serviceability Limit ≥ Effect of Service Loads

The soil bearing pressure under SLS conditions is evaluated using unfactored geotechnical parameters (settlement and compressibility properties), such that the bearing pressure does not cause the foundation to exceed the specified serviceability criteria.

The soil-structure interaction and load-deformation characteristics of soils are non-linear and complex and depend on several considerations (e.g., foundations size and configuration, range of movement, etc.). The number of possible combinations is infinite and generic design charts cannot be prepared. Specific design charts under SLS conditions can be provided upon request and once preliminary design requirements have been established.

7.3.3 CIP Concrete Piles

Cast-in-place piles was considered suitable for the proposed development. The piles may require casing to maintain a dry and stable hole during construction if thick layers of saturated silt and sand layers are encountered.

Although cobbles/boulders were not encountered during drilling, this does not rule out the possibility of their existence within the clay till. Generally, if boulders are encountered at shallow depth, then excavation and removal of the boulders may be required. Deeper boulders may cause the abandonment of the pile and replacing it with a pile group with a cap that supports the columns. The piling contractor should be prepared to deal with cobbles/boulders, if encountered during pile installation.

Both straight shaft and belled piles may be considered for this site. Straight shaft piles should only be designed based on skin friction contribution. Belled piles may be designed based on skin friction and end bearing contribution.

The recommended unfactored (ultimate) shaft friction and end bearing parameters are provided in Table 3. These parameters were based on the soil profiles encountered during drilling and were determined mainly through semi-empirical correlations with the SPT and moisture content results. Accordingly, a geotechnical resistance factor of 0.4 should be used.

Table 3: Preliminary Recommended Unfactored (Ultimate) Shaft Friction Resistance

Depth (mbgs) Note 1	Soil Type	Un-factored (Ultimate) Shaft Friction (kPa)	Un-factored (Ultimate) End Bearing (kPa)
0 to 2	Sand / Clay Till	--	
2 to 6	Clay Till	45	
6 to 7	Clay Till	45	750

Note 1: mbgs - metres below the ground surface that existed at the time of the investigation

For SLS conditions, straight shaft piles designed with 70 to 80 percent of the factored ULS parameters are expected to undergo settlement equivalent to approximately 0.2 to 0.5 percent of the shaft diameter (for straight shaft piles) and 0.5 to 1 percent of the bell diameter for (belled piles) plus the elastic shortening of the pile.

In the design and installation of CIP piles, the following recommendations should be followed:

- A minimum pile spacing of 2.5 pile diameters, centre-to-centre, is recommended for friction piles. For belled piles, a minimum bell edge-to-edge spacing of 0.5 bell diameter should be maintained.
- The minimum recommended shaft diameter is 400 mm for straight shaft.
- The minimum recommended bell diameter is 750 mm.
- Seepage and sloughing conditions may be encountered during the installation of the CIP concrete piles, where thick layers of saturated sand or silt are intercepted by the pile hole. A steel casing should be used to allow for the construction of a dry and clean pile hole. The level of the fresh concrete in the casing should be maintained well above the level of the seepage zones as the casing is withdrawn to offset hydrostatic seepage pressures.
- End bearing contribution should only be considered if mechanical cleaning of the bell base is able to produce a bearing surface that is free of loose disturbed material and standing water. The geotechnical inspector should visually inspect (from the ground surface) the bell base and confirm suitable concrete placement conditions.
- For the design of pile foundations, it is important that the foundation designer accounts for the elevation difference between the final site grades and grades that existed at the time of the investigation. This will ensure that the pile bell is based on the proper soil strata during construction.
- The pile bell should be completely formed in the clay till. The base of the bell should be at least 0.3 m above any sand layer to prevent water seepage and to allow for the formation of a clean bell base. Similarly, the roof of the bell should be formed at least 1 m below the bottom of any sand layer to prevent cave-in of the bell roof during construction or concrete placement.
- The piling contractor should be prepared to extend the pile length and form the bell as recommended, if sand layers are encountered in the pile hole at the design depth of the bell.
- Piles should be reinforced and be of adequate structural strength to resist compressive and frost uplift forces both during construction and the operational life of the structure.
- In order to resist the upward frost jacking forces, the minimum recommended pile embedment depth under heated and unheated structures are 6 m and 7 m below final grades, respectively.
- The dead weight of the pile may be neglected when calculating the pile vertical load resistance.
- Concrete should be placed in the pile hole in a timely manner. The top part of the pile should be vibrated to reduce potential for voids within the concrete.

Tensile Load Resistance of Piles

The resistance to uplift loads will be provided by shaft friction only (under the depth of frost penetration) and sustained vertical compressive load supported by the pile. For sustained tensile loads (other than those due to frost action) a geotechnical resistance factor of 0.3 should be used in conjunction with the shaft resistance values provided in Tables 3.

Additional recommendations concerning the resistance of piles against frost action are given in the section below.

7.3.4 Frost Considerations for Piles and Grade Beams

Piles supporting components that will be outside the influence of any beneficial heat transfer may be subject to upward frost jacking forces. For those foundation components within the depth of frost penetration, frost jacking pressures are likely to develop along pile shafts, and along the underside and sides of pile caps or grade beams. If not properly resisted, frost uplift forces may cause irrecoverable vertical movement in the pile and may lead to impaired functionality of the structure.

To reduce the effects of upward frost forces on pile caps and grade beams, it is recommended that a compressible material, such as “voidform” (or equivalent), be placed between the underside of the pile cap or grade beam and the soil. In such a case, uplift pressure acting on the underside of the pile caps or grade beams may be taken as the crushing strength of the compressible medium. The minimum thickness of the voidform should be 100 mm.

The finished grade adjacent to each pile cap or grade beam should be capped with clay, and sloped away, so that surface runoff is not allowed to infiltrate and collect in the void space. If water is allowed to accumulate in the void space, then full frost heaving pressures will likely occur on the underside of the pile caps and grade beams. Frost forces up to 1800 kPa have been reported in literature and are dependent on the restraints offered by the surrounding soils.

It is to be noted that all piles should be structurally designed to resist frost heave forces if the piles are allowed to freeze during construction.

7.4 RECOMMENDATION FOR STORM WATER MANAGEMENT FACILITY

It was understood that a storm water management facility (SWMF) was planned within the site. The grading plans and the elevation of the bottom of the proposed SWMF were not available at this time. In addition, it was not known at this time if the pond will be lined. Both synthetic liner and compacted clay liner may be considered as liner systems, if deemed required.

Synthetic liner (such as geomembrane or GCL) may be considered for this site. The type of synthetic liner should consider the chemical and physical characteristics of the product being contained, temperature, and ultraviolet exposure. The type, placement standards, and protection of synthetic liners should comply with manufacturer recommendations.

Native clay till or imported clayey soil may also be considered for the construction of a compacted clay liner. The clay source should be tested for suitability once identified, and additional recommendations regarding liner thickness and placement will be provided. General considerations for compacted clay liner are provided below.

7.4.1 Anticipated Subsurface Conditions

The majority of the SWMF excavation is anticipated to be in clayey soils. Near surface sand layers (generally less than 1 m thick) should be anticipated at some areas. These soils can be readily excavated with standard size earth moving equipment.

Rocks and boulders were not encountered, however that does not rule out the possibility of their existence in clay till deposits. If encountered, large rocks and boulders should be removed from the footprint of the lagoon.

7.4.2 Subgrade Preparation and Inspection

During initial site grading, all topsoil should be stripped and removed from the site. Topsoil should not be mixed with mineral soils or be used as engineered fill material.

Where sand is encountered at the exposed rough grade elevation (likely within the side slopes near the ground surface), these soils should be sub-excavated and replaced with compacted clay soils. If the thickness of these soils in the subgrade was less than 0.6 m, then complete removal of these soil is recommended. If these soils within the exposed subgrade are thicker than 0.6 m, then partial excavation of these soils and the placement of a 0.6 m thick clay cap above these soil is recommended. This will aid in sealing off the subgrade and improve its stability during the construction of the compacted clay or synthetic liner.

It is also recommended that the upper 300 mm of the exposed subgrade soil within the bottom of the proposed SWMF and side slopes be scarified and re-compacted as engineered fill with strict control of moisture content and density. The scarified material should be compacted to a minimum of 95 percent of SPMDD, using a sheeps foot compactor. It is recommended that the material be moisture conditioned to between 1 and 3 percent of the optimum moisture content of the soil. This will aid in sealing off the subgrade and improve its stability.

It is recommended that the exposed subgrade (following the achievement of design rough grade elevation) be inspected by the geotechnical engineer. The inspection may include a proof-roll test to confirm that deflections from construction traffic are minimal. Soft and weak areas identified during inspection, should be strengthened and improved.

7.4.3 Long-term slope stability consideration

For stability purposes, long term excavations are expected to be stable with an overall slope angle of 3.0 horizontal to 1.0 vertical (3H:1V). Flatter side slopes may be required for safety and operational consideration. Basal heave potentially leading to instability is unlikely to be encountered within the excavation depth of the proposed SWMF.

The following construction related factors affecting excavation stability should be followed:

- All temporary surcharge loads should be kept back from the excavated faces a distance of at least one-half the depth of the excavation.
- Wheel loads should be kept back at least 2.0 m from the crests of the cell slopes.
- The latest edition of the Construction Safety Regulations of the Occupational Health and Safety Act of Alberta should be followed.

7.4.4 Groundwater Management during Construction

The groundwater levels measured in the boreholes are summarized in Table 1. Seepage from the walls and base of the excavation should be anticipated for excavations extending to below the water table. As the excavation will be mainly in clayey soils with relatively low permeability (and thus low water yield potential), groundwater seepage is expected to be relatively low and can be controlled with drainage trenches equipped with pumps.

The volume of water seeping will increase with increasing size and depth of the excavation. The rate of water seepage is also expected to increase if the excavation encountered saturated interbedded sand layers. The water storage and seepage from these sand units will depend on the vertical and lateral extents of the sand layers. If the lateral and vertical extents of such layers are relatively small, they can be drained relatively easily with a sump pump system.

To minimize the potential for water ponding during construction, a minimum grade of two percent is recommended at the subgrade level to accommodate surface water runoff away from the subgrade.

7.4.5 Compacted Clay Liner Consideration

All fill used for the construction of the liner should be placed as engineered fill. Engineered fill should consist of suitable clayey material, be free from any organic materials, contamination, deleterious construction debris, frozen lumps, and stones greater than 50 mm in diameter.

Engineered fill should be frost free and placed during non-frozen conditions. If winter construction is proposed, SolidEarth can provide additional recommendations at that time and once the overall development plan has been finalized.

The clay liner should be compacted to a minimum of 95 percent of SPMDD, and in lift thicknesses of 200 mm or less (loose). It is recommended that clayey materials used for liner construction be placed between 2 and 3 percent above the optimum moisture content of the soil.

The thickness of the compacted clay liner should be no less than 0.6 m on the bottom and 1.2 m at the side slope (measured perpendicular to the slope). The clay liner should be compacted to the recommended density using sheeps foot compactor. The final surface of the liner should be compacted using a smooth drum compactor to establish a smooth and sealed liner surface.

Fill placement procedures and quality of the fill soils should be monitored by geotechnical personnel on a full-time basis. Field monitoring should include compaction testing at regular frequencies.

Compacted Clay Liner Material Properties

The design and construction of compacted clay liners and the properties of clay soils suitable for the construction of compacted clay liners are discussed based on published literature. Published literature generally suggests that the suitable clay material for liner construction (with a coefficient of hydraulic conductivity lower than $1x10^{-7}$ cm/sec as measured in the laboratory) should have the following properties:

- Fines content (clay and silt sizes) > 30 percent by weight
- Clay content > 20 percent by weight
- Well graded
- Liquid Limit > 30 percent
- Plasticity Index > 10 percent

Based on the laboratory test results, it appears that the properties of the clay till deposit within the proposed SWMF footprint generally met the minimum requirements of compacted clay liner materials. Relatively low hydraulic conductivity can be achieved by compacting the native clayey soils to 95 percent of SPMDD. Moisture conditioning (drying) of the soils is expected to be required during the construction.

If materials for liner construction are imported from other sources, they should be tested to determine if they meet the liner suitability requirements.

Post Construction Protection of the Liner

The liner base should not be allowed to dry out or be exposed to freezing temperatures following construction. Ideally, the liner should be flooded as soon as possible after construction and acceptance. It is also recommended that water be maintained in the ponds during the winter season.

The surface of the liner should be protected against desiccation, mechanical damage, and damage from wildlife. At a minimum, a 150 mm layer of soil should be placed above the liner. Gravel and riprap are recommended around the inlet structure to prevent erosion.

7.5 INSTALLATION OF BURIED UTILITIES

The majority of trench excavation is anticipated to be in clayey soils. Near surface sand layers (generally less than 1 m thick) should be anticipated at some areas.

7.5.1 Trench Excavation

For stability purposes, short-term (less than two days) trench excavations in the clayey soils, and above the water table, are expected to be stable with 1 horizontal to 1 vertical (1H:1V) side slopes. Flatter side slopes (up to 3H:1V) or excavation support will be required for deeper excavations, excavations below the water table, and where sand or water seepage is encountered.

The sand encountered at the borehole locations in the near surface soils was anticipated to be prone to sloughing. As such, to reduce the risk of sloughing and for the protection of workers, it is recommended to over-excavate the sand from the edges of the trench by a distance of 1 m, and/or slope it no steeper than 2H:1V.

The degree of excavation stability decreases with time and, therefore, construction should be directed at minimizing the length of time excavations are left open. The excavation should be checked regularly for drying and sloughing of the side slopes and for any tension cracks along top edges of the excavation.

The excavation should extend sufficient distance past the edge of the bottom of the excavation to provide adequate space and protection for the workers. The latest edition of the Construction Safety Regulations of the *Occupational Health and Safety Act of Alberta* should be followed.

Surface grading should be undertaken to prevent surface water from ponding adjacent to or entering the excavation. Stockpiles of materials and excavated soil should be placed away from the crest of the excavation slope by a distance equal to at least half the depth of the excavation. Similarly, wheel loads should be kept back at least 2 m from the crests of the excavation. Larger setback distances should be established for heavy trucks such as those hauling soil or concrete. Greater setbacks, and flatter side slopes, are recommended for excavations that remain open for extended periods of time.

7.5.2 Trench Backfill

The clayey soils excavated from the excavation may be used for backfilling. All fill soils should be free from any organic materials, contamination, deleterious construction debris, and stones greater than 150 mm in diameter.

With all soils, moisture conditioning of these soils may be required during construction and will depend on weather conditions at the time of construction.

Engineered fill should be thawed and placed during non-frozen conditions. If winter construction is proposed, SolidEarth can provide additional recommendations at the time and once the overall development plan has been finalized.

Trench backfill should be uniformly compacted to a minimum of 98 percent of SPMDD to within 0.3 m of the finished subgrade, and to a minimum of 100 percent of SPMDD for the upper 0.3 m of trench backfill. The fill should be placed at moisture contents within 3 percent of optimum moisture content.

All engineered fill should be compacted in lift thicknesses of 300 mm or less (loose), and within two percent of the optimum moisture content of the soil. Fill placement procedures and quality of the fill soils should be monitored by geotechnical personnel on a full-time basis. Field monitoring should include compaction testing at regular frequencies.

It should be recognized that some settlement of the compacted backfill in the trenches under self-weight will occur. The magnitude and rate of settlement will be dependent on the backfill soil type, the moisture condition of the backfill at the time of placement, thickness of the backfill, drainage conditions, and the initial density achieved during backfilling.

Generally, total settlement of one to three percent of backfill thickness is expected for cohesive soils compacted to between 98 and 95 percent of SPMDD, respectively. Wetter backfill compacted to reduced density standards may be subject to greater settlements. It is expected, however, that the majority of the settlement under self-weight will occur within the first one to two years following construction.

7.5.3 Groundwater Consideration and Control

The groundwater levels measured in the boreholes are summarized in Table 1. Seepage from the walls and base of the excavation should be anticipated for trench excavations extending to below the water table. As the trench excavation will be mainly in clayey soils with relatively low permeability (and thus low water yield potential), groundwater seepage is expected to be relatively low and can be controlled with sumps equipped with pumps.

The volume of water seeping into the trench will increase with increasing size and depth of the excavation. The rate of water seepage is also expected to increase if the excavation encountered saturated sand layers. The water storage and seepage from these units will depend on the vertical and lateral extents of these layers. If the lateral and vertical extents of such layers are relatively small, they can be drained relatively easily with a sump and pump dewatering system.

7.5.4 Installation of Underground Utilities

An observational approach combined with local experience with similar subsurface conditions is recommended. It would be desirable for the excavation contractor to be experienced in similar conditions, and/or alternatively to excavate test pits in advance of construction to familiarize field personnel with subsurface conditions. Quality workmanship is essential.

Pipe bedding material and placement standards should be in accordance with the pipe manufacturer's specification.

7.5.5 Manhole Structures

Good foundation support conditions are expected for manhole bases founded in the clay till/sand. To mitigate the potential for differential settlement of the fill around the manhole barrel, the backfill around the perimeter of the manholes should be compacted to similar standards as the adjacent trench backfill.

Buoyancy of manhole structures should be considered where the invert levels are below the groundwater table. Buoyancy uplift forces are resisted by the weight of the manhole, skin friction along the sides of the manhole and the buoyant weight of soil above any manhole base extending outside the manhole barrel. The stability of the substructures relative to buoyancy pressure can be improved by enlarging the base such that part of the backfill along the circumference may be considered as dead weight. The design groundwater level to be used in the analysis should be established with consideration of the nearest borehole location and should be adjusted for upper bound seasonal water elevations.

7.6 PAVEMENT STRUCTURE

7.6.1 Frost Susceptibility of Soils

Frost heave of the subgrade soils is generally related to the particle size distribution of the soils, moisture content, and the presence of a relatively shallow groundwater table.

The near surface sand were considered highly susceptible to frost heaving and formation of ice lenses in the presence of water.

The near surface clayey soils encountered at the locations of all boreholes were generally of low to medium plasticity. The grain size distribution of these soils generally consisted of approximately 20 percent by weight of clay size particles with the remaining portions as silt, sand and gravel size particles. These soils were generally considered to be moderately susceptible to frost heaving and formation of ice lenses in the presence of water.

The measured groundwater levels at the borehole locations were generally deeper than 1.9 m below the ground surface. The moisture content of the near surface soils was generally near to the anticipated optimum moisture content of the soil.

Given the above and with proper drainage and surface water management, the risk of frost heaving was considered to be moderate. It is to be noted that poor surface drainage leading to water inundating the subgrade soils will significantly increase the risk level.

Due to the general variability in the soil makeup and groundwater seepage paths in soil deposits, it is not possible to predict with certainty the magnitude of frost heaving at specific locations. It is generally recommended that an observational approach be adopted over the first two winter seasons to identify problematic areas.

Frequently, areas exhibiting the formation of ice lenses and frost heaving during one winter season will exhibit the same during subsequent winter seasons. If areas with problematic frost conditions are observed, then remedial measures may be implemented.

The most suitable remedial measure will have to be assessed on a case by case basis as it depends on the severity of the problem, service/use interruption of the affected area, and the sensitivity of the pavement structure to frost heaving. Remedial measures may include soil replacement, ground insulation, or periodic maintenance (in the case of low use areas).

7.6.2 Surface Water Management Considerations

The performance of the pavement structure will be enhanced to a greater degree with proper management of surface water. It is recommended that adequate slope be provided at the subgrade level, and that the pavement gravel material be properly drained into a positive gravity drainage system. This will reduce the risk of water ponding above the subgrade and potential of softening and/or volume change associated with the presence of excess water.

A minimum grade of two percent is recommended at the subgrade level to accommodate surface water runoff away from the subgrade. The final pavement surface should also be properly sloped to promote surface water runoff away from the paved surface.

Positive drainage away from the pavement surface is particularly important during the spring thaw and snow melt season. If water from melting snow is allowed to remain on the paved surface and subsequently freezes, significant damage to the pavement (and formation of potholes) may be encountered.

7.6.3 Asphalt Pavement Design Section

Recommendations presented in Section 7.2 “Site Development Considerations” regarding subgrade preparation and inspection should be followed. Recommendations presented in this section are based on the assumption that a stable and competent subgrade is achieved prior to the placement of the pavement structure.

It was understood that the proposed roadways will primarily serve industrial traffic and are thus considered heavy duty roads. The minimum recommended flexible asphalt pavement structure is provided in Table 4, and is provided for two potential traffic loadings. The recommended pavement section was based on an expected subgrade Resilient Modulus during spring thaw conditions of 25 to 30 MPa.

Option 1 refers to design traffic loading of $5.5x10^5$ Equivalent Single Axle Load (ESAL), which is equivalent to approximately 40 Single Unit Trucks (SUT) and 20 Tractor Trailer Combinations (TTC) per day with a design life of 20 years. Option 2 refers to a design traffic of $1x10^6$ ESAL, which is equivalent to approximately 90 SUT and 30 TTC per day with a design life of 20 years.

Table 4: Flexible Asphaltic Concrete Pavement Design

Material	Recommended Minimum Thickness (mm) Heavy Duty ($1x10^6$ ESAL)	
	Option 1 ($5.5x10^5$ ESAL)	Option 2 ($1x10^6$ ESAL)
Hot Mix Asphalt	125	140
20 mm Crushed Granular Base Course (AT Designation 2 Class 20)	350	400

The granular base course should be placed in maximum 150 mm thick lifts and uniformly compacted to a minimum of 100 percent of SPMDD at moisture content within two percent of the optimum moisture content. A reduced lift thickness may be required depending on the capability of the compaction equipment available to achieve the required densities.

It is recommended that locations subjected to heavy static wheel loads, such as at dumpster enclosures, truck/bus stops, or heavy forklift loading/unloading pads, be constructed with concrete pavement instead of flexible asphalt pavement to minimize the potential for rutting, which may occur in asphalt under these service conditions. At a minimum, a 175 mm thick concrete slab underlain by a minimum 150 mm thick layer of granular base course is recommended. The granular base course should be compacted to a minimum of 100 percent of SPMDD at moisture content within two percent of the optimum moisture content of the soil.

8.0 TESTING AND INSPECTION

Recommendations presented in this report may not be valid if adequate engineering inspection and testing programs during construction are not implemented, or if other building code requirements are not followed. Testing and inspection programs should consist of:

- Full-time monitoring and compaction testing during site grading, subgrade preparation and fill placement.
- Detailed geotechnical investigation for each proposed industrial building/lots.
- Design review and bearing inspection for deep foundations.

9.0 CLOSURE

The recommendations presented in this report are based on the results of soil sampling and testing at six (6) borehole locations advanced at the site during this investigation. Soil conditions by nature can vary across any given site. If different soil conditions are encountered at subsequent phases of this project, SolidEarth should be notified immediately and given the opportunity to evaluate the situation and provide additional recommendations as necessary.

The recommendations presented in this report should not be used for another site or for a different application at the same site. If the intended application of the site is changed or if the assumptions outlined in this report became invalid, SolidEarth should be notified and given the opportunity to assess if the recommendations presented should be modified.

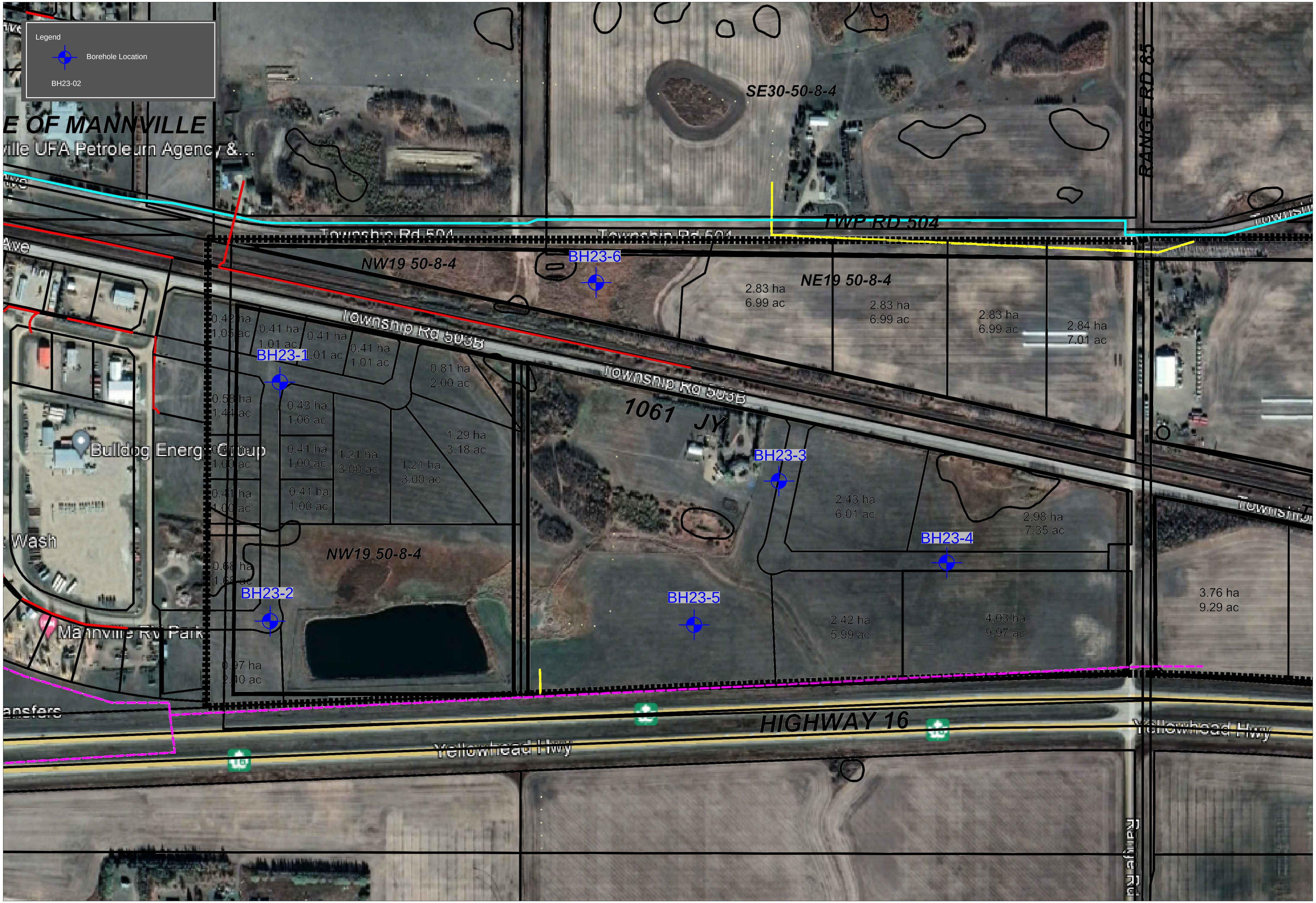
This report has been prepared for the exclusive use of BAR Engineering Co. Ltd. and their authorized users for the specific application outlined in this report. No other warranties expressed or implied are provided. This report has been prepared within generally accepted geotechnical engineering practices.

Respectfully submitted,
SolidEarth Geotechnical Inc.

Mujtaba Khidri, Ph.D., E.I.T.
Geotechnical Engineer in Training

Jay Jaber, M.Sc., P.Eng.
Principal Geotechnical Engineer
President

Figures



CLIENT:

BAR ENGINEERING

PROJECT NAME:

Proposed East Industrial Park ASP
N1/2 of 19-50-8 W4M
Village of Mannville, Alberta

DRAWING TITLE:

Project Layout and Borehole Location Plan

SCALE: NTS	DRAWN BY: MK
DATUM: -	DATE: April 2023
FIGURE No.: 1	REVISION No.: 1
PROJECT No.: PG23-1691	

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SolidEarth Geotechnical Inc.
4336 97 Street, Edmonton, AB, T6E 5R9

CLIENT: BAR ENGINEERING

PROJECT NAME: Proposed East Industrial Park ASP
N1/2 of 19-50-8 W4M
Village of Mannville, Alberta

DRAWING TITLE: 2016 Aerial Photograph of the Site

SCALE: NTS	DRAWN BY: MK	FIGURE No.: 2	REVISION No.: 1
DATUM: -	DATE: April 2023	PROJECT No.: PG23-1691	

SolidEarth GEOTECHNICAL

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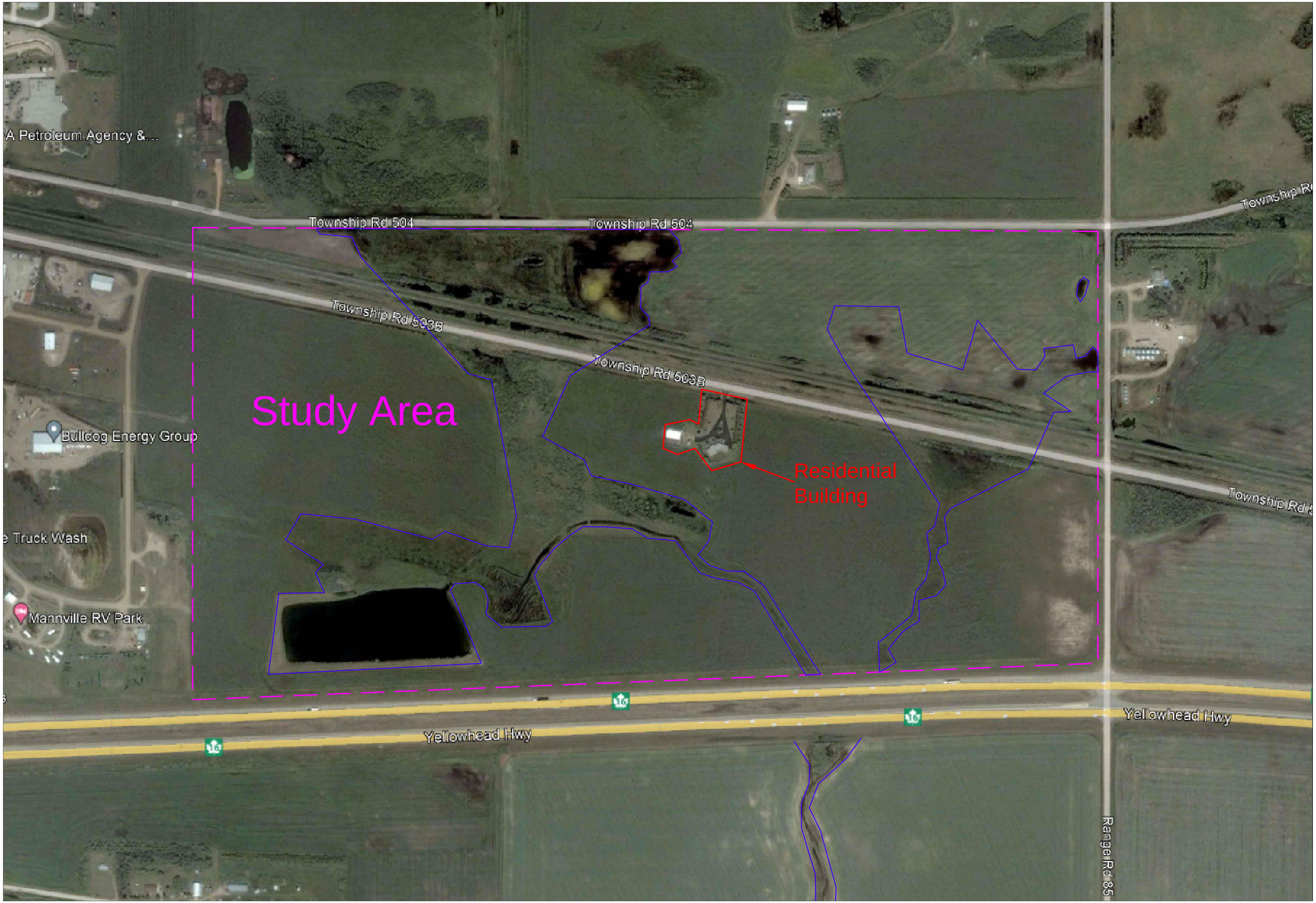

CLIENT:

BAR ENGINEERING

PROJECT NAME:

Proposed East Industrial Park ASP
N1/2 of 19-50-8 W4M
Village of Mannville, Alberta

DRAWING TITLE:

2007 Aerial Photograph of the Site

FIGURE No.: 3	REVISION No.: 1
PROJECT No.: PG23-1691	
DRAWN BY: MK	DATE: April 2023
SCALE: NTS	DATUM: -

SolidEarth GEOTECHNICAL

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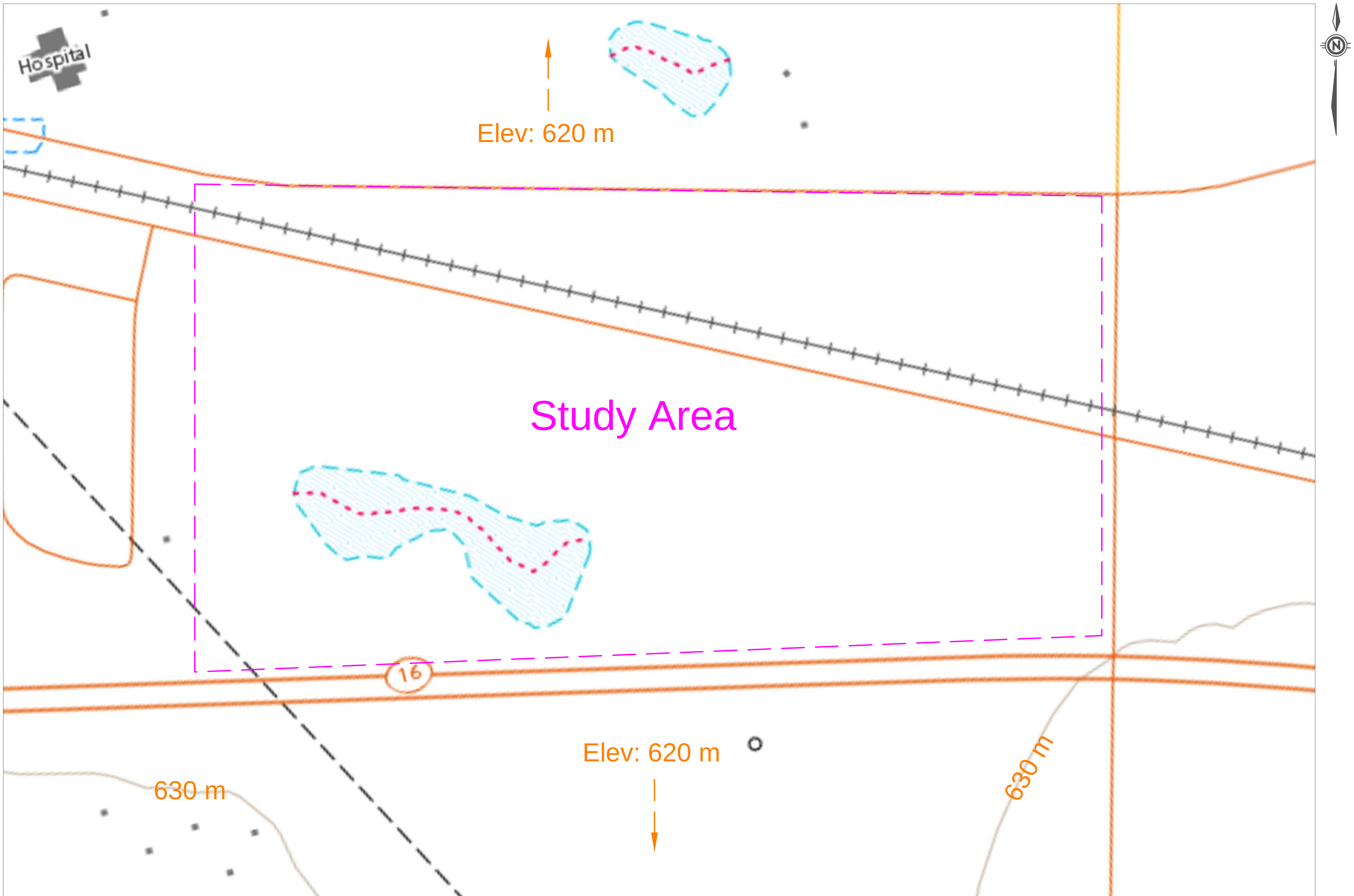

BAR ENGINEERING

CLIENT:

PROJECT NAME: Proposed East Industrial Park ASP
N1/2 of 19-50-8 W4M
Village of Mannville, Alberta

DRAWING TITLE: Atlas of Canada - Toporama Maps

REVISION No.:	1
FIGURE No.:	4
PROJECT No.:	PG23-1691
DRAWN BY:	MK
DATE:	April 2023
SCALE:	NTS
DATUM:	-

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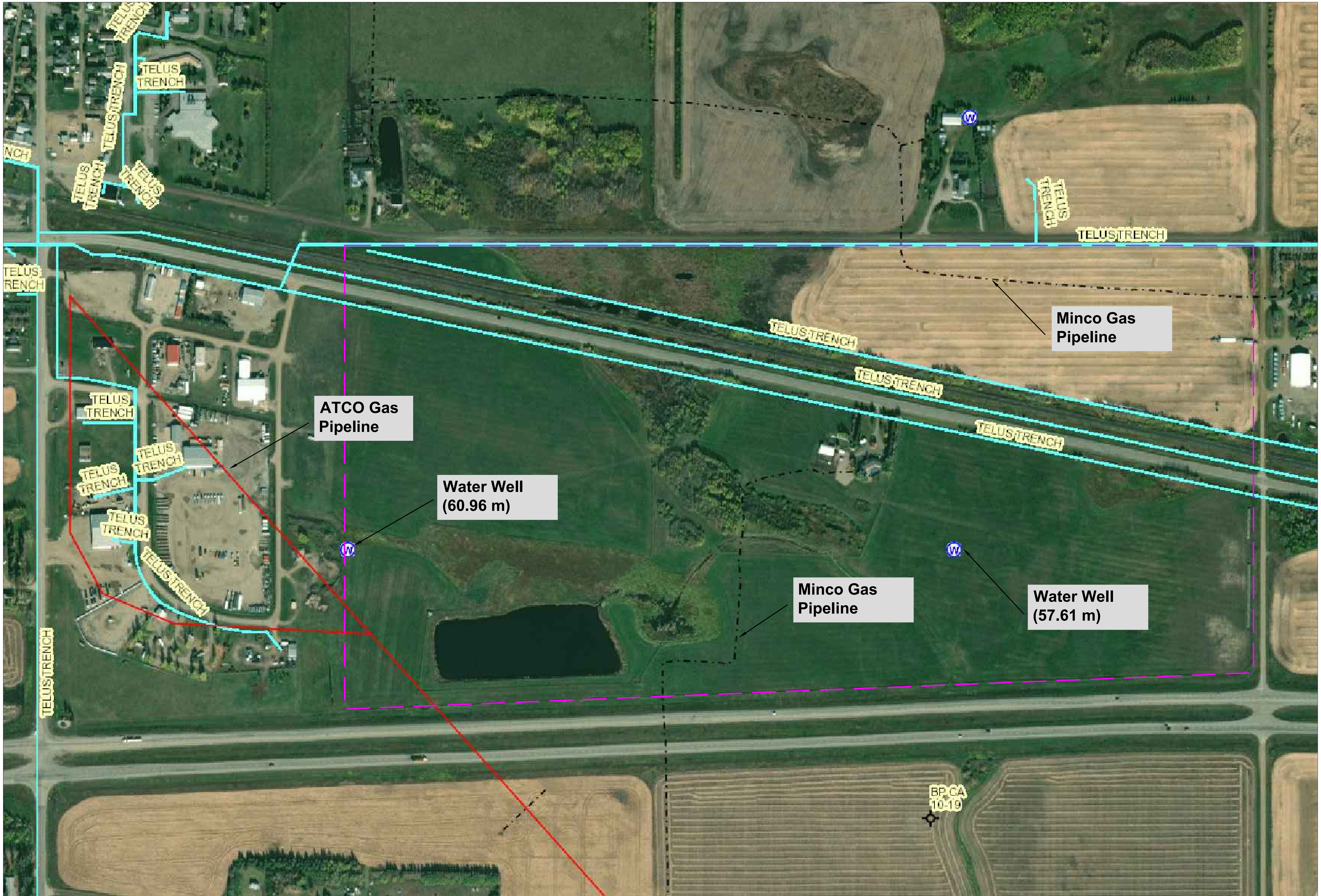


CLIENT: BAR ENGINEERING

PROJECT NAME: Proposed East Industrial Park ASP
N1/2 of 19-50-8 W4M
Village of Mannville, Alberta

DRAWING TITLE: Approximate Project Layout and Oil and Gas Infrastructure

SCALE: NTS	DRAWN BY: MK
DATUM: -	DATE: April 2023
FIGURE No.: 5	REVISION No.: 1
PROJECT No.: PG23-1691	

SolidEarth Geotechnical

SolidEarth Geotechnical Inc.
4336 97 Street, Edmonton, AB, T6E 5R9

Appendix A

Site Photographs Taken During the Field Investigation

Photograph 1: Looking south towards BH23-1

Photograph 2: Looking south towards BH23-2

Photograph 3: Looking east towards BH23-3

Photograph 4: Looking west towards BH23-4

Photograph 5: Looking north towards BH23-5

Photograph 6: Looking south towards BH23-6

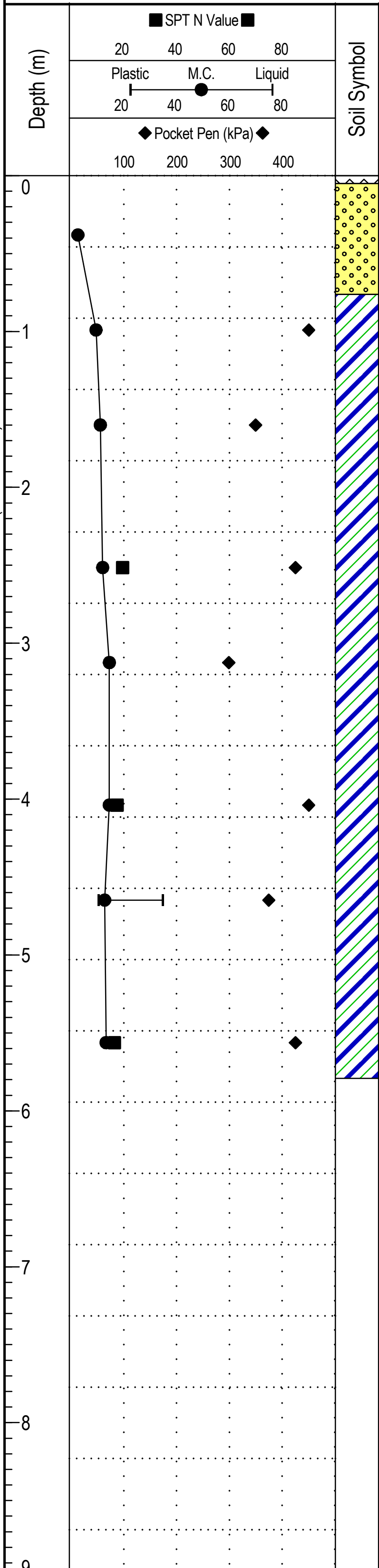
Appendix B

Borehole Logs
Explanation of Terms and Symbols

Project Name: Proposed East Industrial Park ASP	Borehole #: **BH22-1**
Client Name: Bar Engineering Co. Ltd.	Project #: PG23-1691
Site: N1/2 19-50-8 W4M, Village of Mannville, Alberta	Logged By: HC / Reviewed By: KJ
Northing: 5909450 Easting: 488826	Driller: Evergreen Drilling Ltd.
Elevation: 623.7 m	Drill Method: 150 mm Solid Stem Auger

SolidEarth GEOTECHNICAL

Completion Date: 23-3-9



Depth (m)	Soil Symbol / USCS	Material Description	Sample #	SPT (N-Value)	Additional Data & Notes	Elevation (m)
0	OR	**CULTIVATED SOIL (~ 50 mm thick)**			Frozen to ~ 0.8 m below ground surface	
	SP	**SAND**, fine to medium grained, some gravel, trace silt, trace clay, poorly graded, brown, damp	1		Grain Size Distribution: Gravel: 12% Sand: 76% Fines: 12%	623
1	CI	**CLAY (TILL)**, and sand, and silt, trace gravel, medium plastic, grey-brown, trace sand pockets, trace oxides, moist	2			
			3			622
2		- very stiff	4	20		621
3			5			
4			6	18		620
		- becoming grey-brown	7		Liquid Limit: 35% Plastic Limit: 11% Grain Size Distribution: Gravel: 1% Sand: 40% Silt: 39% Clay: 20%	619
5		- becoming grey	8	17		618
6		**COMPLETION DEPTH: 5.8 m below ground surface**			Water Level: Dry on 20 March, 2023	
7		At Completion: No ccumulation of water or slough upon completion. Slotted standpipe installed to 5.8 m below ground surface. Borehole backfilled with drill cuttings and bentonite plugs.				617
8						616
9						615

Sample Symbol: Shelby Tube, No Recovery, SPT Test (N), Grab Sample, Split-Pen, Core

Backfill Symbol: Bentonite, Pea Gravel, Slough, Grout, Drill Cuttings, Sand

SLOTTED PIEZOMETER

Project Name: Proposed East Industrial Park ASP	Borehole #: **BH22-2**	SolidEarth GEOTECHNICAL
Client Name: Bar Engineering Co. Ltd.	Project #: PG23-1691	
Site: N1/2 19-50-8 W4M, Village of Mannville, Alberta	Logged By: HC / Reviewed By: KJ	
Northing: 5909131 Easting: 488813	Driller: Evergreen Drilling Ltd.	Completion Date: 23-3-9
Elevation: 624.2 m	Drill Method: 150 mm Solid Stem Auger	Page 1 of 1

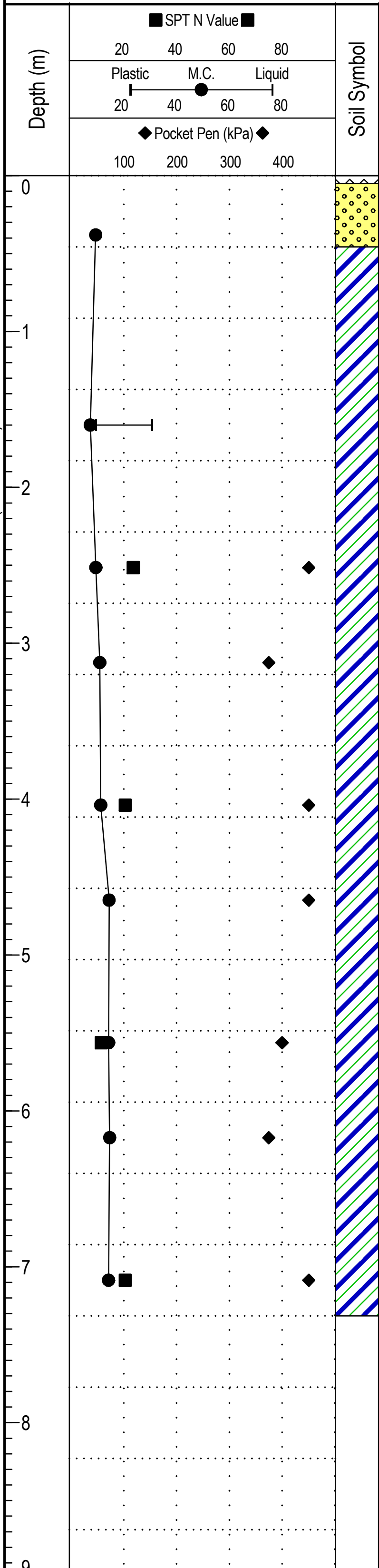
Depth (m)	■SPT N Value■ 20 40 60 80 / Plastic M.C. Liquid 20 40 60 80 / ◆Pocket Pen (kPa)◆ 100 200 300 400	Soil Symbol	USCS	Material Description	Sample Symbol	Sample #	SPT (N-Value)	SLOTTED PIEZOMETER	Additional Data & Notes	Elevation (m)
0			OR	**CULTIVATED SOIL (~ 75 mm Thick)**					Frozen to ~ 0.8 m below ground surface	624
				CLAY (TILL), and sand, and silt, trace gravel, low to medium plastic, brown, trace sand pockets, trace oxides, moist		1				
1						2				623
						3				
2										622
				- very stiff		4	16			
3				- becoming grey-brown		5				621
			CI/CL							
4						6	24			620
						7				
5										619
						8				
6						9	17			618
				- trace seepage					Water Level: 4.0 m below existing ground surface on 20 March, 2023	
7										617
8										616
9										

<u>**COMPLETION DEPTH: 6.6 m below ground surface**</u>

<u>At Completion</u>
Accumulation of water at 6.6 m below ground surface.
No accumulation of slough upon completion.
Slotted standpipe installed to 6.4 m below ground surface.
Borehole backfilled with drill cuttings and bentonite plugs.

Sample Symbol	Shelby Tube	No Recovery	SPT Test (N)	Grab Sample	Split-Pen	Core
Backfill Symbol	Bentonite	Pea Gravel	Slough	Grout	Drill Cuttings	Sand

Project Name: Proposed East Industrial Park ASP	Borehole #: **BH22-3**	SolidEarth GEOTECHNICAL
Client Name: Bar Engineering Co. Ltd.	Project #: PG23-1691	
Site: N1/2 19-50-8 W4M, Village of Mannville, Alberta	Logged By: HC / Reviewed By: KJ	
Northing: 5909318 Easting: 489492	Driller: Evergreen Drilling Ltd.	Completion Date: 23-3-9
Elevation: 626.1 m	Drill Method: 150 mm Solid Stem Auger	Page 1 of 1



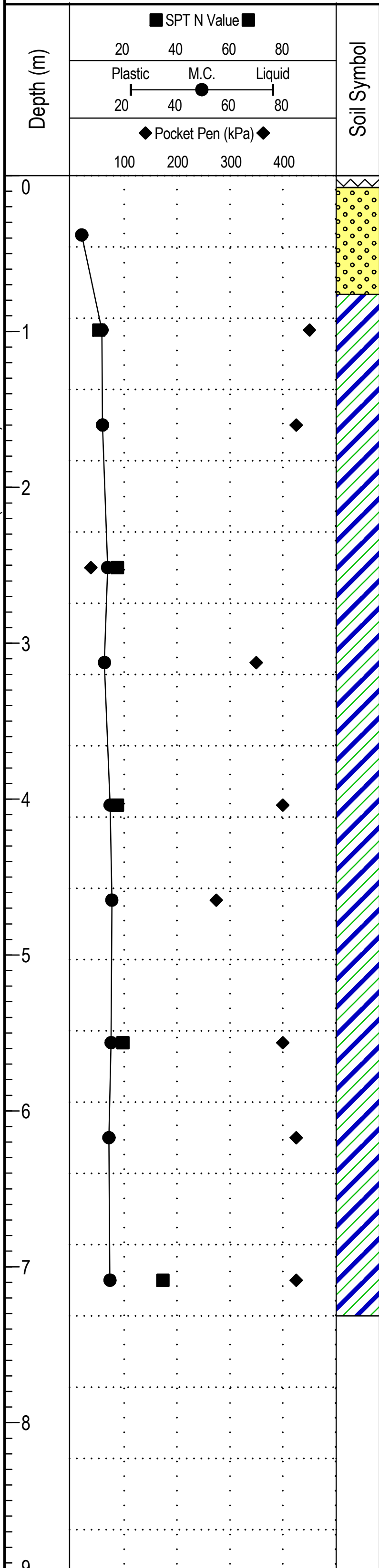
USCS	Material Description	Sample #	SPT (N-Value)	Additional Data & Notes	Elevation (m)
OR	**CULTIVATED SOIL (~ 50 mm Thick)**			Frozen to ~ 0.5 m below ground surface	626
SP	**SAND**, medium to coarse grained, and gravel, trace silt, trace clay, poorly graded, brown, trace oxides, moist	1			
	CLAY (TILL), and sand, and silt, trace gravel, low to medium plastic, brown, trace sand seams, trace oxides, moist	2			625
		3		Liquid Limit: 31% Plastic Limit: 10%	624
	- very stiff	4	24		
		5			623
CI/CL		6	21		622
	- becoming grey	7			621
	- becoming stiff	8	12		620
		9			
	- becoming very stiff	10	21		619
	COMPLETION DEPTH: 7.3 m below ground surface At Completion No accumulation of water or slough upon completion. Slotted standpipe installed to 7.3 m below ground surface. Borehole backfilled with drill cuttings and bentonite plugs.			Water Level: Dry on 20 March, 2023	618

Sample Symbol | Sample Symbol | SLOTTED PIEZOMETER

Sample Symbol: Shelby Tube, No Recovery, SPT Test (N), Grab Sample, Split-Pen, Core

Backfill Symbol: Bentonite, Pea Gravel, Slough, Grout, Drill Cuttings, Sand

Project Name: Proposed East Industrial Park ASP	Borehole #: **BH22-4**	SolidEarth GEOTECHNICAL	
Client Name: Bar Engineering Co. Ltd.	Project #: PG23-1691		
Site: N1/2 19-50-8 W4M, Village of Mannville, Alberta	Logged By: HC / Reviewed By: KJ		
Northing: 5909209 Easting: 489716	Driller: Evergreen Drilling Ltd.	Completion Date: 23-3-9	
Elevation: 625 m	Drill Method: 150 mm Solid Stem Auger	Page 1 of 1	



USCS	Material Description	Sample Symbol	Sample #	SPT (N-Value)	Additional Data & Notes	Elevation (m)
OR	**CULTIVATED SOIL (~ 75 mm Thick)**				Frozen to ~ 0.5 m below ground surface	
SP	**SAND**, fine to medium grained, some gravel, trace silt, trace clay, poorly graded, brown, damp	Grab Sample	1			
	CLAY (TILL), and sand, and silt, trace gravel, stiff, low to medium plastic, brown, trace sand/silt seams, trace sand pockets, trace oxides, moist	SPT Test (N)	2	11		624
		Grab Sample	3			623
	- becoming very stiff	SPT Test (N)	4	18		
		Grab Sample	5			622
CI/CL	- becoming grey-brown	SPT Test (N)	6	18		621
	- becoming grey	Grab Sample	7			620
		SPT Test (N)	8	20		619
		Grab Sample	9			
	- becoming hard	SPT Test (N)	10	35		618
	COMPLETION DEPTH: 7.3 m below ground surface				Water Level: Dry on 20 March, 2023	617

At Completion
No accumulation of water or slough upon completion.
Slotted standpipe installed to 7.3 m below ground surface.
Borehole backfilled with drill cuttings and bentonite plugs.

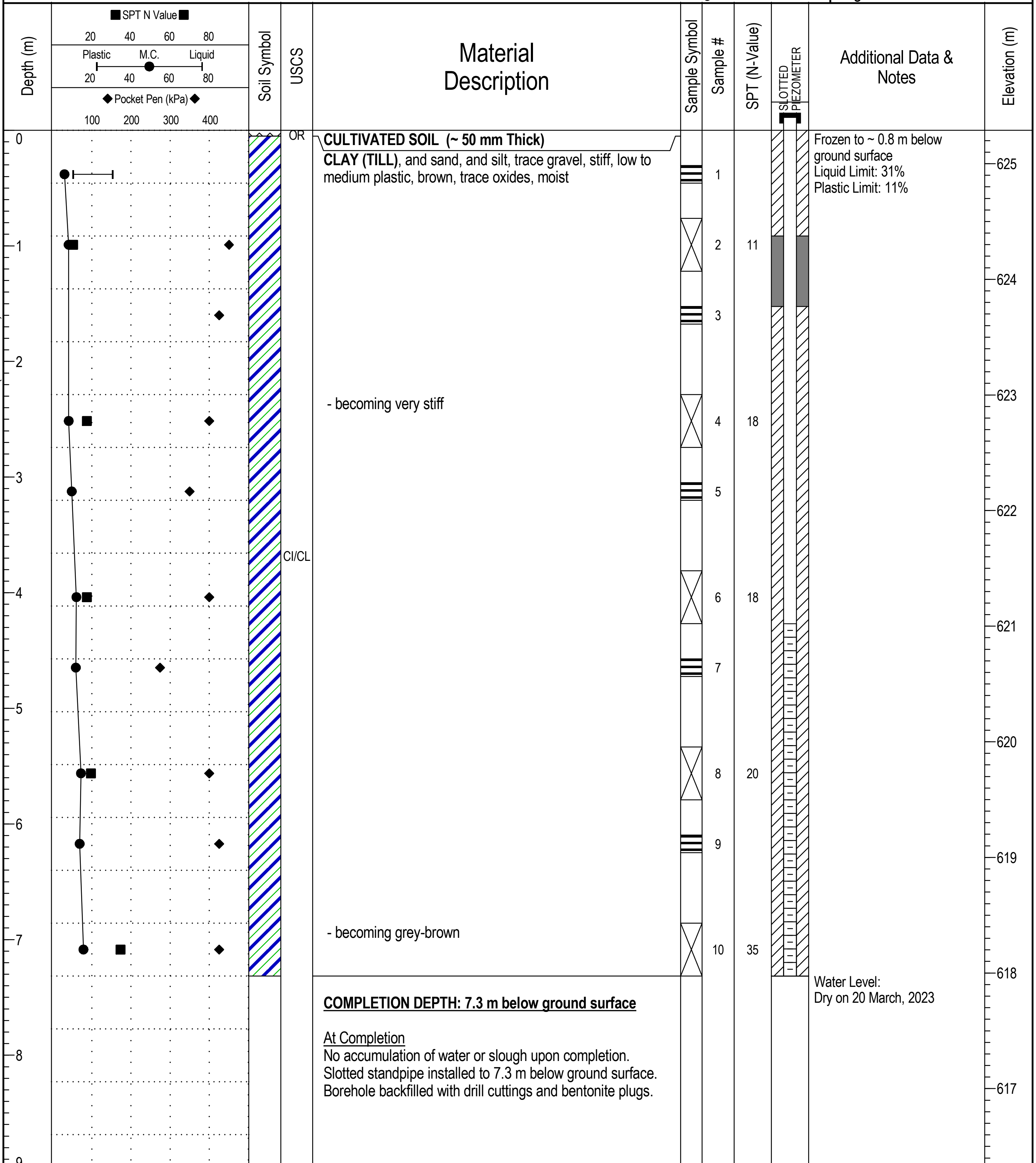
SLOTTED PIEZOMETER

Sample Symbol	Shelby Tube	No Recovery	SPT Test (N)	Grab Sample	Split-Pen	Core
Backfill Symbol	Bentonite	Pea Gravel	Slough	Grout	Drill Cuttings	Sand

Project Name: Proposed East Industrial Park ASP	Borehole #: **BH22-5**
Client Name: Bar Engineering Co. Ltd.	Project #: PG23-1691
Site: N1/2 19-50-8 W4M, Village of Mannville, Alberta	Logged By: HC / Reviewed By: KJ
Northing: 5909126 Easting: 489379	Driller: Evergreen Drilling Ltd.
Elevation: 625.3 m	Drill Method: 150 mm Solid Stem Auger

SolidEarth GEOTECHNICAL

Completion Date: 23-3-9



Depth (m)	Material Description	Sample #	SPT (N-Value)	Additional Data & Notes
0	**CULTIVATED SOIL (~ 50 mm Thick)**			Frozen to ~ 0.8 m below ground surface
	CLAY (TILL), and sand, and silt, trace gravel, stiff, low to medium plastic, brown, trace oxides, moist	1		Liquid Limit: 31% Plastic Limit: 11%
1		2	11	
		3		
	- becoming very stiff	4	18	
3		5		
4		6	18	
		7		
		8	20	
6		9		
7	- becoming grey-brown	10	35	
7.3	**COMPLETION DEPTH: 7.3 m below ground surface**			Water Level: Dry on 20 March, 2023

At Completion
No accumulation of water or slough upon completion.
Slotted standpipe installed to 7.3 m below ground surface.
Borehole backfilled with drill cuttings and bentonite plugs.

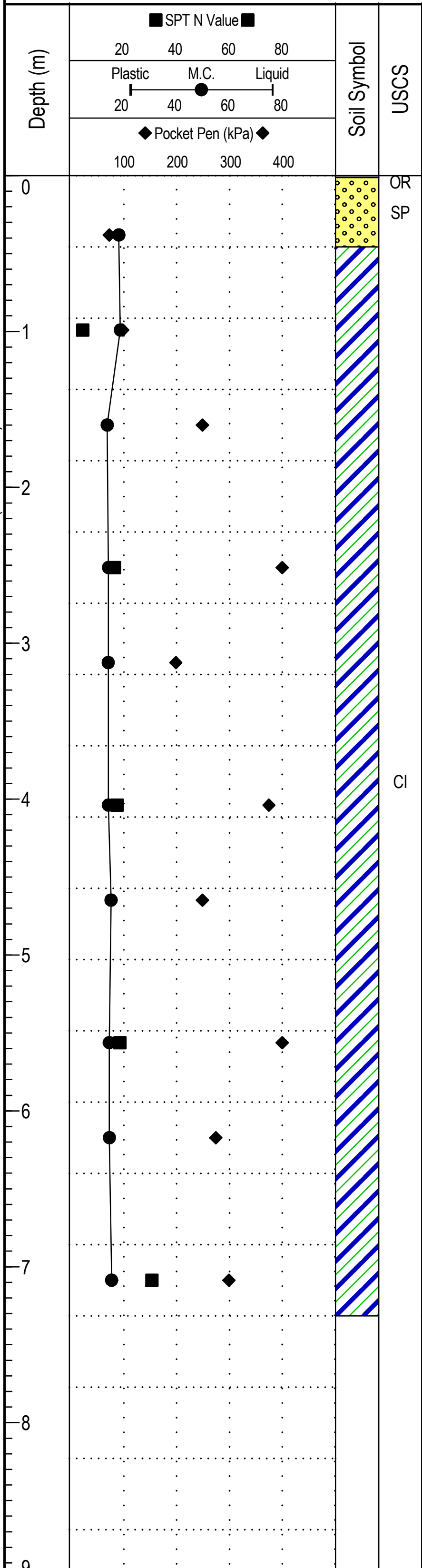
Sample Symbol	Shelby Tube	No Recovery	SPT Test (N)	Grab Sample	Split-Pen	Core
Backfill Symbol	Bentonite	Pea Gravel	Slough	Grout	Drill Cuttings	Sand

Project Name: Proposed East Industrial Park ASP	Borehole #: **BH22-6**
Client Name: Bar Engineering Co. Ltd.	Project #: PG23-1691
Site: N1/2 19-50-8 W4M, Village of Mannville, Alberta	Logged By: HC / Reviewed By: KJ
Northing: 5909583 Easting: 489248	Driller: Evergreen Drilling Ltd.
Elevation: 626.6 m	Drill Method: 150 mm Solid Stem Auger

SolidEarth GEOTECHNICAL

Completion Date: 23-3-9

Page 1 of 1



Material Description

TOPSOIL (~ 12.5 mm Thick)

SAND, medium grained, some gravel, trace silt, trace clay, poorly graded, brown, very moist

CLAY (TILL), and sand, and silt, trace gravel, firm, medium plastic, brown, trace oxides, moist

- becoming moist
- becoming very stiff
- becoming trace seepage
- becoming grey-brown
- becoming grey
- becoming hard

COMPLETION DEPTH: 7.3 m below ground surface

At Completion
Accumulation of water at 7.3 m below ground surface.
No accumulation of slough upon completion.
Slotted standpipe installed to 7.3 m below ground surface.
Borehole backfilled with drill cuttings and bentonite plugs.

Sample Symbol	Sample #	SPT (N-Value)
Grab Sample	1	
SPT Test (N)	2	5
Grab Sample	3	
SPT Test (N)	4	17
Grab Sample	5	
SPT Test (N)	6	18
Grab Sample	7	
SPT Test (N)	8	19
Grab Sample	9	
SPT Test (N)	10	31

SLOTTED PIEZOMETER

Additional Data & Notes

Frozen to ~ 0.5 m below ground surface

Water Level:
1.9 m below existing ground surface on 20 March, 2023

Elevation (m): 626, 625, 624, 623, 622, 621, 620, 619, 618

Sample Symbol: Shelby Tube, No Recovery, SPT Test (N), Grab Sample, Split-Pen, Core

Backfill Symbol: Bentonite, Pea Gravel, Slough, Grout, Drill Cuttings, Sand

EXPLANATION OF TERMS & SYMBOLS

The terms and symbols used on the borehole logs to summarize the results of the field investigation and laboratory testing are described on the following two pages.

1. VISUAL TEXTURAL CLASSIFICATION ON MINERAL SOILS

CLASSIFICATION	APPARENT PARTICLE SIZE	VISUAL IDENTIFICATION
Boulders	> 200 mm	> 200 mm
Cobbles	75 mm to 200 mm	75 mm to 200 mm
Gravel	4.75 mm to 75 mm	5 mm to 75 mm
Sand	0.075 mm to 4.75 mm	Visible particles to 5 mm
Silt	0.002 mm to 0.075 mm	Non-plastic particles, not visible to naked eye
Clay	< 0.002 mm	Plastic particles, not visible to naked eye

2. TERMS FOR CONSISTENCY & DENSITY OF SOILS

Cohesionless Soils

DESCRIPTIVE TERM	APPROXIMATE SPT "N" VALUE
Very Dense	> 50
Dense	30 to 50
Compact	10 to 30
Loose	4 to 10
Very Loose	< 4

Cohesive Soils

DESCRIPTIVE TERM	UNDRAINED SHEAR STRENGTH	APPROXIMATE SPT "N" VALUE
Hard	>200 kPa	> 30
Very Stiff	100 to 200 kPa	15 to 30
Stiff	50 to 100 kPa	8 to 15
Firm	25 to 50 kPa	4 to 8
Soft	10 to 25 kPa	2 to 4
Very Soft	< 10 kPa	< 2

* SPT "N" Values – Refers to the number of blows by a 63.5 kg hammer dropped 760 mm to drive a 50 mm diameter split spoon sampler for a distance of 300 mm after an initial penetration of 150 mm.

3. SYMBOLS USED ON BOREHOLE LOGS

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
N(■)	Standard Penetration Test (CSA A119 1-60)	SO_4	Concentration of Water-Soluble Sulphate
N_d	Dynamic Cone Penetration Test	C_u	Undrained Shear Strength
pp (♦)	Pocket Penetrometer Strength	γ	Unit Weight of Soil or Rock
q_u	Unconfined Compressive Strength	γ_d	Dry Unit Weight of Soil or Rock
w (●)	Natural Moisture Content (ASTM D2216)	ρ	Density of Soil or Rock
w_L	Liquid Limit (ASTM D 4318)	ρ_d	Dry Density of Soil or Rock
w_P	Plastic Limit (ASTM D 4318)	▽	Short-Term Water Level
I_P	Plastic Index	▼	Long-Term Water Level

SolidEarth GEOTECHNICAL

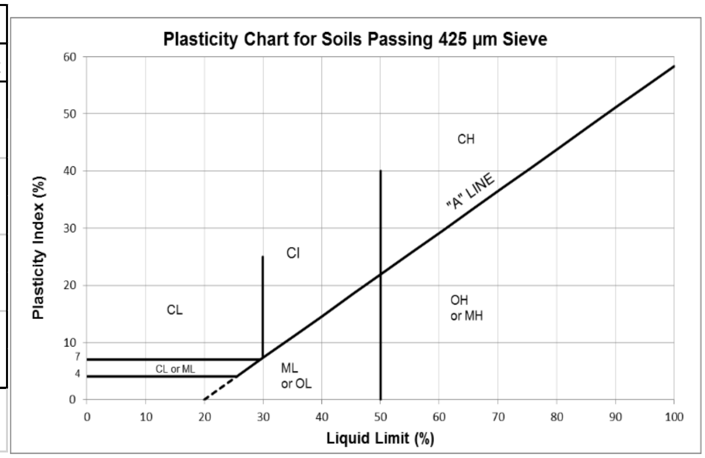
SolidEarth Geotechnical Inc.
www.solidearth.ca

MODIFIED UNIFIED CLASSIFICATION SYSTEM FOR SOILS

MAJOR DIVISION			GROUP SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA	
COARSE GRAINED SOILS (MORE THAN HALF BY WEIGHT LARGER THAN 75 µm)	**GRAVELS** (MORE THAN HALF COARSE GRAINS LARGER THAN 4.75mm)	CLEAN GRAVELS (LITTLE OR NO FINES)	**GW**	WELL GRADED GRAVELS AND GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	$C_u = D_{60}/D_{10} > 4$ $C_c = (D_{30})^2/(D_{10} \times D_{60}) = 1$ to 3	
			GP	POORLY GRADED GRAVELS AND GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS	
		GRAVELS (WITH SOME FINES)	**GM**	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES	CONTENT OF FINES EXCEEDS 12%	ATTERBERG LIMITS BELOW 'A' LINE I_p LESS THAN 4
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES		ATTERBERG LIMITS ABOVE 'A' LINE I_p MORE THAN 7
	SANDS (MORE THAN HALF COARSE GRAINS SMALLER THAN 4.75mm)	CLEAN SANDS (LITTLE OR NO FINES)	**SW**	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	$C_u = D_{60}/D_{10} > 6$ $C_c = (D_{30})^2/(D_{10} \times D_{60}) = 1$ to 3	
			SP	POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	NOT MEETING ALL GRADATION REQUIREMENTS FOR SW	
		SANDS (WITH SOME FINES)	**SM**	SILTY SANDS, SAND-SILT MIXTURES	CONTENT OF FINES EXCEEDS 12%	ATTERBERG LIMITS BELOW 'A' LINE I_p LESS THAN 4
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES		ATTERBERG LIMITS ABOVE 'A' LINE I_p MORE THAN 7
FINE GRAINED SOILS (MORE THAN HALF BY WEIGHT SMALLER THAN 75 µm)	**SILTS** (BELOW 'A' LINE NEGLIGIBLE ORGANIC CONTENT)	$W_L < 50$ %	**ML**	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT PLASTICITY	CLASSIFICATION IS BASED UPON PLASTICITY CHART (SEE BELOW)	
		$W_L > 50$ %	**MH**	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS		
	CLAYS (ABOVE 'A' LINE NEGLIGIBLE ORGANIC CONTENT)	$W_L < 30$ %	**CL**	INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY, OR SILTY CLAYS, LEAN CLAYS		
		30 % $< W_L <$ 50 %	**CI**	INORGANIC CLAYS OR MEDIUM PLASTICITY, SILTY CLAYS		
		$W_L > 50$ %	**CH**	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS		
	ORGANIC SILTS & CLAYS (BELOW 'A' LINE)	$W_L < 50$ %	**OL**	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY		
		$W_L > 50$ %	**OH**	ORGANIC CLAYS OF HIGH PLASTICITY		
HIGHLY ORGANIC SOILS			**Pt**	PEAT AND OTHER HIGHLY ORGANIC SOILS	STRONG COLOUR OR ODOUR, AND OFTEN FIBROUS TEXTURE	
BEDROCK			**BR**	SEE REPORT DESCRIPTION		

Soil Components

Component	Size Range (mm)	Descriptor	% by Weight
Cobbles	> 76	and	> 35
Gravel	76 to 4.75		
Coarse	76 to 19	-y, -ey	35 to 20
Fine	19 to 4.75		
Sand	4.75 to 0.075	some	20 to 10
Coarse	4.75 to 2		
Medium	2 to 0.425	trace	10 to 1
Fine	0.425 to 0.075		
Fines (Silt or Clay)	< 0.075		



Appendix C

Water Well Drilling Reports

Water Well Drilling Report

View in Metric **Export to Excel**

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID: 292026
GoA Well Tag No.:
Drilling Company Well ID:
Date Report Received: 1998/11/27

GOWN ID

Well Identification and Location

Measurement in Imperial

Owner Name	Address	Town	Province	Country	Postal Code
MANNVILLE, VILL OF	P.O. BOX 180 MANNVILLE				T0B 2W0

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	NW	19	50	8	4				

Measured from Boundary of
ft from
ft from

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 53.332095 Longitude -111.169062
How Location Obtained
Not Verified

Elevation ft
How Elevation Obtained
Not Obtained

Drilling Information

Method of Drilling
Rotary

Type of Work
New Well

Proposed Well Use
Observation

Formation Log

Measurement in Imperial

Depth from ground level (ft)	Water Bearing	Lithology Description
23.00		Yellow Clay
44.00		Dark Clay
60.00		Brown Sand
92.00		Yellow Coarse Grained Sand
101.00		Sand
115.00		Yellow Sand
131.00		Sandy Gravel
135.00		Gray Shale
159.00		Dark Fine Grained Sandstone
164.00		Dark Medium Grained Sandstone
170.00		Brown Shale
178.00		Dark Sandstone
186.00		Dark Shale
187.00		Rocks
206.00		Black Sandstone
210.00		Gray Shale

Yield Test Summary

Measurement in Imperial

Recommended Pump Rate igpm

Test Date	Water Removal Rate (igpm)	Static Water Level (ft)

Well Completion

Measurement in Imperial

Total Depth Drilled	Finished Well Depth	Start Date	End Date
210.00 ft		1998/10/28	1998/10/29

Borehole

Diameter (in)	From (ft)	To (ft)
0.00	0.00	210.00

Surface Casing (if applicable)

Size OD : 0.00 in
Wall Thickness : 0.000 in
Bottom at : 0.00 ft

Well Casing/Liner
Plastic

Size OD : 2.50 in
Wall Thickness : 0.276 in
Top at : 0.00 ft
Bottom at : 190.00 ft

Perforations

From (ft)	To (ft)	Diameter or Slot Width(in)	Slot Length (in)	Hole or Slot Interval(in)
190.00	200.00	0.010		2.00

Perforated by Machine

Annular Seal Bentonite Chips/Tablets
Placed from 0.00 ft to 185.00 ft
Amount

Other Seals

Type	At (ft)

Screen Type Stainless Steel
Size OD : 2.00 in

From (ft)	To (ft)	Slot Size (in)
200.00	205.00	0.010

Attachment Attached To Casing
Top Fittings Coupler
Bottom Fittings Plug

Pack
Type Artificial
Grain Size 20-40
Amount 5.00 Bags

Contractor Certification

Name of Journeyman responsible for drilling/construction of well
UNKNOWN NA DRILLER

Certification No
1

Company Name
MANNVILLE WATER WELL SERVICES LTD.

Copy of Well report provided to owner
Date approval holder signed

Alberta

Water Well Drilling Report

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

View in Metric | Export to Excel

GIC Well ID 292026
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 1998/11/27

GOWN ID

Well Identification and Location

Measurement in Imperial

Owner Name	Address	Town	Province	Country	Postal Code
MANNVILLE, VILL OF	P.O. BOX 180 MANNVILLE				T0B 2W0

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	NW	19	50	8	4				

Measured from Boundary of
ft from
ft from

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 53.332095 Longitude -111.169062
How Location Obtained
Not Verified

Elevation ft
How Elevation Obtained
Not Obtained

Additional Information

Measurement in Imperial

Distance From Top of Casing to Ground Level in
Is Artesian Flow
Rate igpm
Is Flow Control Installed
Describe

Recommended Pump Rate igpm
Recommended Pump Intake Depth (From TOC) ft
Pump Installed
Depth ft
Type
Make
H.P.
Model (Output Rating)

Did you Encounter Saline Water (>4000 ppm TDS) Depth ft
Gas Depth ft
Well Disinfected Upon Completion
Geophysical Log Taken Electric
Submitted to ESRD
Remedial Action Taken
Sample Collected for Potability
Submitted to ESRD
Additional Comments on Well

Yield Test

Taken From Ground Level Measurement in Imperial

Test Date	Start Time	Static Water Level
		ft

Method of Water Removal

Type
Removal Rate igpm
Depth Withdrawn From ft

If water removal period was < 2 hours, explain why

Water Diverted for Drilling

Water Source	Amount Taken	Diversion Date & Time
	ig	

Contractor Certification

Name of Journeyman responsible for drilling/construction of well
UNKNOWN NA DRILLER

Certification No
1

Company Name
MANNVILLE WATER WELL SERVICES LTD.

Copy of Well report provided to owner
Date approval holder signed

Water Well Drilling Report

View in Metric | Export to Excel

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GOWN ID

GIC Well ID	250750
GoA Well Tag No.	
Drilling Company Well ID	
Date Report Received	1987/03/30

Well Identification and Location

Measurement in Imperial

Owner Name	Address	Town	Province	Country	Postal Code
GOLISH, JAMES	MANNVILLE				

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	NE	19	50	8	4				

Measured from Boundary of
ft from
ft from

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 53.332095 Longitude -111.156980
How Location Obtained
Map

Elevation ft
How Elevation Obtained
Not Obtained

Drilling Information

Method of Drilling
Rotary

Proposed Well Use
Domestic & Stock

Type of Work
New Well

Formation Log

Measurement in Imperial

Depth from ground level (ft)	Water Bearing	Lithology Description
9.00		Brown Sand
24.00		Yellow Clay
36.00		Brown Sand
42.00		Blue Clay
81.00		Brown Sand & Gravel
86.00		Gray Sand
94.00		Gray Shale
152.00		Gray Sandstone & Shale Ledges
171.00		Gray Sand
179.00		Gray Sand
181.00		Rocks
189.00		Gray Sand

Yield Test Summary

Measurement in Imperial

Recommended Pump Rate 10.00 igpm

Test Date	Water Removal Rate (igpm)	Static Water Level (ft)
1987/03/02	10.00	65.00

Well Completion

Measurement in Imperial

Total Depth Drilled	Finished Well Depth	Start Date	End Date
189.00 ft		1987/02/27	1987/03/02

Borehole

Diameter (in)	From (ft)	To (ft)
0.00	0.00	189.00

Surface Casing (if applicable)
Plastic
Size OD : 5.00 in
Wall Thickness : 0.240 in
Bottom at : 182.00 ft

Well Casing/Liner
Size OD : 0.00 in
Wall Thickness : 0.000 in
Top at : 0.00 ft
Bottom at : 0.00 ft

Perforations

From (ft)	To (ft)	Diameter or Slot Width(in)	Slot Length (in)	Hole or Slot Interval(in)

Perforated by

Annular Seal Pushed
Placed from 0.00 ft to 0.00 ft
Amount

Other Seals

Type	At (ft)

Screen Type Stainless Steel
Size OD : 2.37 in

From (ft)	To (ft)	Slot Size (in)
184.00	189.00	0.020

Attachment Attached To Riser
Top Fittings Riser Pipe Bottom Fittings Plug

Pack
Type Gravel Grain Size
Amount

Contractor Certification

Name of Journeyman responsible for drilling/construction of well
UNKNOWN NA DRILLER

Certification No
1

Company Name
FRED'S WATER WELL DRILLING LTD.

Copy of Well report provided to owner Date approval holder signed

Water Well Drilling Report

View in Metric **Export to Excel**

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GOWN ID

GIC Well ID: 250750
GoA Well Tag No.
Drilling Company Well ID
Date Report Received: 1987/03/30

Well Identification and Location

Measurement in Imperial

Owner Name	Address	Town	Province	Country	Postal Code
GOLISH, JAMES	MANNVILLE				

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	NE	19	50	8	4				

Measured from Boundary of
ft from
ft from

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 53.332095 Longitude -111.156980
How Location Obtained
Map

Elevation ft
How Elevation Obtained
Not Obtained

Additional Information

Measurement in Imperial

Distance From Top of Casing to Ground Level in
Is Artesian Flow
Rate igpm
Is Flow Control Installed
Describe

Recommended Pump Rate 10.00 igpm
Recommended Pump Intake Depth (From TOC) 162.00 ft
Pump Installed Yes
Depth ft
Type SUB
Make
H.P. .5
Model (Output Rating)

Did you Encounter Saline Water (>4000 ppm TDS) Depth ft
Gas Depth ft
Remedial Action Taken
Well Disinfected Upon Completion
Geophysical Log Taken
Submitted to ESRD
Sample Collected for Potability
Submitted to ESRD

Additional Comments on Well
MED SOFT WATER

Yield Test

Taken From Ground Level — Measurement in Imperial

Test Date	Start Time	Static Water Level
1987/03/02	12:00 AM	65.00 ft

Depth to water level

Pumping (ft)	Elapsed Time Minutes:Sec	Recovery (ft)

Method of Water Removal

Type Pump & Air
Removal Rate 10.00 igpm
Depth Withdrawn From 115.00 ft

If water removal period was < 2 hours, explain why

Water Diverted for Drilling

Water Source	Amount Taken	Diversion Date & Time
	ig	

Contractor Certification

Name of Journeyman responsible for drilling/construction of well
UNKNOWN NA DRILLER

Certification No
1

Company Name
FRED'S WATER WELL DRILLING LTD.

Copy of Well report provided to owner
Date approval holder signed

C

Appendix C
Lagoon Assessment

Does not form part of this Bylaw.

Prepared by: BAR Engineering

BAR ENGINEERING

May 5, 2023 | Project No.: 22MU-495300 Rev. 1

2382634 Alberta Ltd. o/a Red Willow Planning
Box 3156
Morinville, AB
T8R 1S1

Attention: Vicki K. Dodge, RPP

Re: Village of Mannville Lagoon Assessment
County of Minburn and Village of Mannville, AB

1.0 Introduction

BAR Engineering Co. Ltd. (BAR) was retained by 2382634 Alberta Ltd. o/a Red Willow Planning to provide civil engineering services in support of the preparation of an Area Structure Plan (ASP) associated with the future development of the NW and NE ¼ Section 19-50-8-W4M and the NW ¼ Section 20-50-8-W4M adjacent to Mannville, AB. In support of the ASP, the Client has requested an update to the 2009 Sewage Lagoon Assessment, which was completed by BAR for the Village of Mannville, and to provide an order of magnitude lagoon sizing to support the development of the ASP lands.

2.0 2009 Sewage Lagoon Assessment Summary

Under EPA Approval No. 955-01-01, the Village is permitted to discharge the treated effluent from storage cells into the Vermilion River once a year between March 1st and November 30th. The 2009 report indicated the Village was experiencing difficulty retaining the required effluent volume within the storage cells for one annual discharge (i.e. the storage cells are undersized). In response, the Village requested BAR to complete an assessment of the existing lagoon.

The existing lagoon consists of four anaerobic cells, one facultative cell, and two storage cells with the following capacities:

Anerobic Cells (4)	1300 m^3 each	= 5,200 m^3
Facultative Cell (1)		= 13,600 m^3
Storage Cells (2)	49,700 m^3 + 53,900 m^3	= 103,600 m^3

Existing lagoon cell capacities were assessed according to Alberta Environment and Parks *Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage systems*. Current wastewater flows were based on historical annual water consumption records provided by the Village showing a ten year average daily flow rate of approximately 400 L/person/day. For the purposes of the assessment, it was assumed that 100% of water consumption entered the sanitary sewage system. This assumption was due to the absence of available sewage generation data records from the Village and the assumption that losses were deemed to be negligible relative to the overall water usage in the community. Furthermore, utilizing 100% of the water consumption verified the actual current conditions of the lagoon being undersized for the sewage being generated by the Village, thereby calibrating the lagoon sizing calculations. A surface water and groundwater infiltration rate of 10% was assumed for surface water and groundwater infiltration into the Village's sewage system for a total flow rate to the lagoon of 440 L/person/day (0.44 m^3/person/day). The 2009 report assumed a population of 800 people based on recent statistics.

Anaerobic cells must each have sufficient volume to allow for 2 days retention of sewage inflow for the settlement of solids within the wastewater. The anerobic cells were found to have enough capacity to allow for a population in excess of 1400 people.

The capacity of the facultative cell should allow for a retention period of 60 days. At a sewage flow rate of 440 L/person/day, the required combined capacity of the facultative cell should be about 21,120 m^3. The existing capacity of the facultative cell is 13,600 m^3 which allows for a retention period of only 38 days (or a population of 515 persons for 60 days).

The two storage cells were also found to have an insufficient combined capacity. At a flow rate of 440 L/person/day, the required combined capacity of the storage cells should allow for a volume of 128,480 m^3. The existing combined capacity of the storage cells is 103,600 m^3, which only allows for a maximum storage period of about 10 months. It was assumed that 0.3 m of sewage would remain in the lagoon after annual discharge leaving an effective capacity of 92,600 m^3, which only allows for 9 months of storage (or a population of 577 persons for 1 year). This means the storage cells need to be overfilled above the maximum design water level.

On the basis of the above criteria and calculations, it was concluded that the facultative cell and storage cells were undersized for the current population of the Village. Recommended improvements to the existing lagoon infrastructure were based on statistically based population projections and a design life of 25 years. An annual growth rate of 1.5% was assumed for the Village resulting in a population of 1186 people for the year 2034.

Since the anaerobic cells were already deemed to be adequately sized for a population of 1400 persons, no recommendations were made concerning improvements to the anaerobic cells.

It was recommended that the facultative cell be expanded to achieve a total capacity of 31,310 m^3. Two options were explored at a conceptual level. Land acquisition may be required to accommodate the expansion of the facultative cell along the south and east side of the existing facultative cell.

It was also recommended that the storage cells be expanded to accommodate a total annual storage capacity of 190,530 m^3. To achieve this annual storage volume, construction of a new cell with a minimal volume of 97,900 m^3 was recommended on the west side of the existing storage cells.

The cost to construct the new facultative cell and storage cell was estimated to be $1.5 million to serve a population of 1186 people. The cost estimate assumed that on site clay would be suitable for berm and clay liner construction and did not include the cost of land acquisition. Construction recommendations and associated cost estimates were based upon conceptual design considerations.

3.0 Current Population and Lagoon Capacities

The projected 2021 population was calculated to be 978 people at the assumed 1.5% annual growth rate used in the 2009 Sewage Lagoon Assessment Report. The Statistics Canada 2021 population for the Village was actually 765 people, a slight decrease from the estimated population of 800 persons in 2009.

Since 2009, no further expansion of the existing lagoon cells has occurred. Assuming the 2021 population of 765 persons, the facultative cell volume will only allow for a 40 day retention period rather than 60 days as required by Alberta government standards. For the 2021 population of 765 persons, the 2021 total combined effective volume requirement of the two storage cells is 122,859 m^3. Allowing for 0.3m of treated sewage to remain in the cells after cell discharge increases the total required capacity to 136,500 m^3. As previously noted, the current volumes of the storage cell can only accommodate a population of about 577 persons without overfilling the cells above the maximum design depth level and/or leaving little or no liquid in the storage cells after the annual discharge.

4.0 Village Population Projections and Estimated Sewage Wastewater Flows

The population of the Village has not changed significantly over the past 40 years with a 1981 population of 788 persons, a 2021 population of 765 persons, and a peak population of 828 persons in 2016. This assessment assumes population growth projections of 1.0% and 1.5% resulting in a required minimum capacity of the facultative and storage cells for each population growth scenario.

The 2009 wastewater flows to the lagoon were based on the Village's water consumption records resulting in a historical average for the Village of 400 L/person/day. This is a typical value for water consumption per capita. Infiltration from groundwater in the sanitary pipe network was assumed to be 10% of the water consumption value resulting in a total value of 440 L/person/day. The same average annual water consumption rate and infiltration rate has been adopted in this assessment.

The total annual volume of sewage generation may range from 60-90% of the total water consumption volume. This is due to water that does not enter the sanitary sewer system such as lawn watering and consumptive uses. In any given year, a lower percentage often reflects a higher annual water consumption volume due to a dry summer season. When wastewater flows must be estimated, a value of 80-90% is recommended for lagoon cell sizing projections. For the purpose of this order of magnitude assessment, two scenarios have been analyzed, illustrated in the tables below, as follows: (1) Wastewater volume as 100% of the average annual water consumption volume based on the 2009 report, and (2) Wastewater volume as 80% of the average annual water consumption volume.

4.1 Scenario No.1 – 100% of Annual Water Consumption

Scenario No. 1 assumes the annual wastewater volume is 100% of the average annual water consumption volume (400 L/person/day) plus a 10% infiltration rate (40 L/person/day). The required capacity of the storage cells assumes that 10% of the liquid storage will remain after discharge once every year so that the lagoon liner does not become desiccated.

4.1.1 Scenario No. 1 without Industrial Development

The table below summarizes the Scenario No. 1 lagoon sizing requirements, without the proposed Industrial Development, for design life of 25-year and 30-year horizons and population growth rates of 1.0% and 1.5%.

Required Lagoon Expansion not including Industrial Development						
	25 Year Projection Projection (2048)		30 Year Population Projection (2053)		Facultative 60 day Vol. m^3	Storage[2] Annual Vol. m^3
2023 Pop.[1]	1%	1.5%	1.0%	1.5%		
780	1000				26,400	178,444
780			1051		27,746	187,546
788		1143			30,175	203,962
788				1232	32,525	219,241
Current[3] Required					20,592	139,187
Current Actual					13,600	103,600

1. Population for 2023 is assumed to be 765 persons plus the correlating population growth rate over 2 years.
2. Effective capacity = (440L/person/day x Population x 365 days) / 0.9
3. Using an estimated population of 780 persons.

4.1.2 Scenario No. 1 with Industrial Development

Alberta Government *Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems* states the lower limit for industrial land uses for planning purposes should be 30 m^3/day/ha (0.35 L/s/ha). For the purposes of this assessment, it has been assumed that 10.5 ha of industrial property will be developed in the NW 19-50-8W4. This will require the facultative cell volume to be increased by a further 18,900 m^3 and a storage cell volume increase of 114,975 m^3. The following table illustrates population growth projections at 1.0% and 1.5% and the required minimum capacity of the facultative and storage cells with 10.5 ha of industrial development.

Required Lagoon Expansion including Industrial Development						
	25 Year Projection Projection (2048)		30 Year Population Projection (2053)		Facultative 60 day Vol. m^3	Storage[2] Annual Vol. m^3
2023 Pop.[1]	**1%**	**1.5%**	**1%**	**1.5%**		
780	1000				45,300	293,419
780			1051		46,646	302,521
788		1143			49,075	318,937
788				1232	51,425	334,216
Current[3] Required					39,492	254,162
Current Actual					13,600	103,600

1. Population for 2023 is assumed to be 765 persons plus the correlating population growth rate over 2 years.
2. Effective capacity = (440L/person/day x Population x 365 days) / 0.9 + Industrial Development
3. Estimated population of 780 persons plus development of 10.5 ha of industrial area.

4.2 Scenario No. 2 – 80% of Annual Water Consumption

Scenario No. 2 assumes the annual wastewater volume is 80% of the average annual water consumption volume (320 L/person/day) plus a 10% infiltration rate (32 L/person/day). The required capacity of the storage cells assumes that 10% of the liquid storage will remain after discharge once every year so that the lagoon liner does not become desiccated.

4.2.1 Scenario No. 2 without Industrial Development

The table below summarizes the Scenario No. 2 lagoon sizing requirements, without the proposed Industrial Development, for design life of 25-year and 30-year horizons and population growth rates of 1.0% and 1.5%.

Required Lagoon Expansion not including Industrial Development						
	25 Year Projection Projection (2048)		30 Year Population Projection (2053)		Facultative 60 day Vol. m^3	Storage[2] Annual Vol. m^3
2023 Pop.[1]	**1%**	**1.5%**	**1.0%**	**1.5%**		
780	1000				21,120	142,756

780			1051		22,197	150,036
788		1143			24,140	163,170
788				1232	26,020	175,875
Current[3] Required					16,474	111,349
Current Actual					13,600	103,600

1. Population for 2023 is assumed to be 765 persons plus the correlating population growth rate over 2 years.
2. Effective capacity = (352 L/person/day x Population x 365 days) / 0.9
3. Using an estimated population of 780 persons.

4.2.2 Scenario No. 2 with Industrial Development

The table below summarizes the Scenario No. 2 lagoon sizing requirements, with the proposed Industrial Development, for design life of 25-year and 30-year horizons and population growth rates of 1.0% and 1.5%.

Required Lagoon Expansion including Industrial Development						
	25 Year Projection Projection (2048)		**30 Year Population Projection (2053)**		**Facultative 60 day Vol. m³**	**Storage[2] Annual Vol. m³**
2023 Pop.[1]	**1%**	**1.5%**	**1%**	**1.5%**		
780	1000				40,020	257,731
780			1051		41,097	265,011
788		1143			43,040	278,145
788				1232	44,920	290,850
Current[3] Required					35,374	226,324
Current Actual					13,600	103,600

1. Population for 2023 is assumed to be 765 persons plus the correlating population growth rate over 2 years.
2. Effective capacity = (352L/person/day x Population x 365 days) / 0.9 + Industrial Development
3. Estimated population of 780 persons plus development of 10.5 ha of industrial area.

4.3 Cost Estimates

In 2009, the estimated cost to construct expansions to the facultative cell and storage cells was $1.5 million based on a conceptual design for a projected population of 1186 persons in 2034. This cost estimate was updated to reflect typical 2023 unit prices resulting in an estimated cost of $2.7 million (roughly equivalent to a 4% average annual inflation rate).

4.3.1 Scenario No. 1 Cost Estimates

The 2009 cost estimate was based on a total required volume for the facultative cells of 31,310 m³ and a total required storage volume of 190,530 m³. Current population projections (not including industrial development) result in similar required volumes for the facultative and storage cells with either a 25 year or 30 year design life. Therefore, the estimated cost for Scenario No. 1 without the Industrial Development included results in a similar cost that was identified in the 2009 Assessment in 2023 dollars as shown below.

Facultative Cell Expansion (31,310 m³)	$ 375,000
Storage Cell Expansion (190,530 m³)	$ 1,565,000
Sub-total	$ 1,940,000
40% Contingency (Class "D")	$ 776,000
Total Estimated Cost	$ **2,716,000**

The following cost estimate assumes a design life of 30 years and population growth rate of 1.5% as well as full development of 10.5 ha of industrial area.

Facultative Cell Expansion (51,425 m³)	$ 700,000
Storage Cell Expansion (334,216 m³)	$ 3,000,000
Sub-total	$ 3,700,000
40% Contingency (Class "D")	$ 1,480,000
Total Estimated Cost	$ **5,180,000**

4.3.2 Scenario No. 2 Cost Estimates

The following cost estimate assumes a design life of 25 years and population growth rate of 1.5% and does not include the proposed 10.5 ha of industrial area.

Facultative Cell Expansion (24,140 m³)	$ 300,000
Storage Cell Expansion (163,170 m³)	$ 1,340,000
Sub-total	$ 1,640,000
40% Contingency (Class "D")	$ 656,000
Total Estimated Cost	$ **2,296,000**

The following cost estimate assumes a design life of 30 years and population growth rate of 1.5% as well as full development of 10.5 ha of industrial area.

Facultative Cell Expansion (44,920 m³)	$ 610,000
Storage Cell Expansion (290,850 m³)	$ 2,610,000
Sub-total	$ 3,220,000
40% Contingency (Class "D")	$ 1,288,000
Total Estimated Cost	$ **4,508,000**

4.3.3 Cost Estimates Assumptions

The above construction cost estimates do not include costs for the following:

- Land acquisition;
- Costs for additions or improvements to upstream influent structures; or,
- Costs for additions or improvements to downstream effluent structures.

Site features such as a large adjacent slough, variations in terrain elevation, and on-site availability of suitable clay material, can significantly affect estimated construction costs. A more accurate cost estimate can be provided once detailed engineering design has been completed.

Various cost analysis options to determine the least expensive construction methods can also be completed during the detailed design process such as:

- Cost analysis comparisons of various proposed cell expansion configurations.
- Cost analysis comparisons which may avoid land acquisition.
- Cost analysis comparisons between a clay liner design and a synthetic liner design.

- Cost analysis of potential future development impacted by current design options.

5.0 Recommendations

Currently, the facultative cell and storage cells do not meet current Alberta Environment and Parks standards and are undersized. Since projected lagoon cell volume requirements are heavily dependent upon assumed population projections, and estimated wastewater flow volumes, a phased expansion of the facultative cell and storage cells is recommended. The proposed expansion recommended in the 2009 Sewage Lagoon Assessment could be adopted as a Phase 1 development in order to meet current facultative cell and storage cell volume requirements and allow for future population growth reaching 1200 persons, or, allowing for a smaller actual population growth in addition to some industrial development. Future lagoon expansion requirements can be determined as the Village population increases and/or as industrial land development increases and the actual values for each is known.

6.0 Closure

The purpose of this report is to assess the Village's existing lagoon and to provide recommendations based on assumed population projection rates and development of a Rural Industrial Subdivision adjacent to the Village, which will allow the Village to manage wastewater effectively and in compliance with Alberta Environment and Parks standards and their current Permit to Operate a Sewage Works.

Respectfully,
BAR Engineering Co. Ltd.

Kstovra

Kelly Stovra
Senior Technologist
Municipal Division

Reviewed by,
Scott Simons, P. Eng.
Manager
Municipal Division

Attachments: Village of Mannville – 2009 Sewage Lagoon Assessment Report

BAR Engineering

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May 21, 2009

BAR Project # 08-2038

Village of Mannville
P.O. Box 180
Mannville, Alberta
T0B 2W0

Attention: Candace Dueck, Village Administrator

Dear Ms. Dueck:

Re: Sewage Lagoon Assessment Report

Enclosed are five (5) copies of a Sewage Lagoon Assessment Report prepared by BAR Engineering Co. Ltd. for the Village of Mannville.

Consistent with the terms of reference established for this assignment, the report determined the capacity of the existing sewage lagoon and identified expansion requirements, consistent with Alberta Environment guidelines, to allow the Village to manage wastewater volumes both now and into the future. The proposed expansion of the existing sewage lagoon will provide sufficient capacity to satisfy the needs of the community for a population of approximately 1200 people.

BAR Engineering is pleased to have been given the opportunity to work with and for the Village of Mannville on this assignment. We would be pleased to provide the necessary engineering services for the design and implementation of the identified sewage lagoon improvements.

Should you have any questions regarding this report, please do not hesitate to contact me at your convenience.

Yours truly,
BAR Engineering Co. Ltd.

E.R. Koshuta, P. Eng.
Senior Staff Engineer (Municipal)

VILLAGE

of

MANNVILLE

SEWAGE LAGOON

ASSESSMENT

REPORT

Prepared by

BAR Engineering

BAR Project #08-2038

May, 2009

VILLAGE OF MANNVILLE

SEWAGE LAGOON ASSESSMENT

1.0 INTRODUCTION

The Village of Mannville, an urban community with a current population of approximately 800 people, is located in a rural setting in east-central Alberta along the north side of the Yellowhead Highway (Highway #16), roughly 80 kilometres west of the City of Lloydminster.

The Village operates a municipal wastewater collection and treatment system under EPEA Approval No. 955-01-01 that is comprised of a sanitary sewage collection system, two sewage lift (pumping) stations, a wastewater treatment facility (sewage lagoon), and an outfall line providing for the annual discharge of the treated effluent from the sewage lagoon to the Vermilion River.

The sanitary sewage collection system in the Village is primarily a gravity system with the exception being the Industrial Area in the southeast corner of the Village which requires a sewage lift (pumping) station. Sewage collected at this lift station is pumped into a gravity sewer main located on the north side of the Railway Tracks at 50th Avenue and 46th Street from where it then flows by gravity via the Village's sanitary sewer system network to the sewage lagoon.

The Village's sewage lagoon, located within SE¼-31-50-8-W4M approximately 1.1 km northeast of the current existing built up area of the Village, was originally constructed in 1977 and is comprised of three treatment components, namely, anaerobic, facultative (aerobic) and stabilization or storage. The anaerobic treatment component consists of four (4) equal sized cells, the facultative (aerobic) component consists of one cell, and the third component consists of two (2) stabilization or storage cells.

A sanitary sewage lift (pumping) station, located adjacent to the sewage lagoon, is an integral part of the Village sewage lagoon system operation but is not included as a part the sewage lagoon assessment.

Under their EPEA Permit to Operate, the Village is permitted to discharge the treated effluent from their stabilization or storage cells once a year during a 3-week period between March 1st and November 30th.

2.0 SEWAGE LAGOON ASSESSMENT

During the past few years, the Village has indicated that they have been experiencing more difficulty in being able to retain the volume of treated effluent within its storage cells to allow for the annual discharge at the same time each year. Concerned about this developing trend, the Village engaged BAR Engineering Co. Ltd. to undertake an evaluation on the capacity of their existing sewage lagoon and to identify potential expansion requirements to allow the Village to continue to manage wastewater volumes both now and into the future.

3.0 EXISTING SEWAGE LAGOON CAPACITY

The sanitary sewage generated within the Village is carried from the Village via a gravity trunk sanitary sewer to a sewage lift station located adjacent to the sewage lagoon. As the lift station wet well fills up, the sewage is pumped into anaerobic cell #1. Operating in series, the sewage then flows from anaerobic cell #1 into anaerobic cell #2, then into anaerobic cells #3 and #4, respectively. From anaerobic cell #4, the sewage flows into the facultative (aerobic) cell. From the facultative cell, the sewage flows into storage cell #1 and then into storage cell #2. Once a year, the effluent from the storage cells is discharged via a gravity pipeline to the Vermilion River, located approximately 1.5 km to the northeast of the sewage lagoon.

From the configuration and the dimensions of the existing sewage lagoon shown on the sewage lagoon as-built drawings provided by the Village, the capacity of each treatment component, at maximum design water level, has been determined to be as follows:

- Each anaerobic cell has a capacity of 1,300m³ (286,000 gallons). With four anaerobic cells, the total capacity of the anaerobic cells is 5,200m³ (1,144,000 gallons).
- The facultative (aerobic) cell has a capacity of 13,600m³ (2,992,000 gallons).
- The capacity of the two stabilization or storage cells is as follows:

Storage Cell #1	49,700m³	(10,934,000 gallons)
Storage Cell #2	53,900m³	(11,858,000 gallons)
Total Storage	103,600m³	(22,792,000 gallons)

4.0 WASTEWATER SEWAGE VOLUMES

The sizing of a wastewater system is largely a function of the volume of sewage that must be managed. In the case of a sewage treatment facility, such as a sewage lagoon, the design parameters for sizing to be considered, but not necessarily limited to, include the total volume of sewage that must be managed, solids loading, and the retention requirements by the components making up the facility.

In the absence of a metering device that records the volume of sewage being generated within a community and received at its sewage treatment facility, such as in the case of the Village of Mannville, it becomes necessary to estimate the volume of sewage that needs to be managed. Since wastewater flows within a community are typically directly related to water consumption, a review of water consumption records for the Village can be used to estimate the wastewater volumes.

Although the quantity of wastewater should generally be slightly less than the water consumption since some portion of the water used for fire suppression, lawn watering, street washing, hydrant flushing, and other related public uses may not necessarily find its way back into the sanitary sewer system, such quantities are generally deemed to be rather minimal relative to the overall water usage in the community. For the purpose of this assessment, it has been assumed that all the water transmitted through the Village's water distribution system will eventually enter the sanitary sewer system and will have to be managed at the sewage lagoon.

Water consumption records, based on the raw water well flows, obtained from the Village for the years 1999 to 2008 inclusive, have been reviewed and are summarized in Table 1.

Table 1 – Summary of Water Consumption Data

		Annual Volumes		Ave. daily		Per Capita Rate	
Year	Population*	m^3	gallons	m^3	gallons	Litres/day	Gallons/day
1999	(736)	115,204	25,344,880	315.6	69,438	428.8	94.3
2000	(729)	102,846	22,626,120	281.0	61,820	385.5	84.8
2001	722	102,900	22,638,000	281.9	62,022	390.4	85.9
2002	(734)	108,689	23,911,580	297.8	65,509	405.7	89.2
2003	(746)	113,450	24,959,000	310.8	68,381	416.6	91.7
2004	(758)	118,020	25,964,400	322.5	70,941	425.5	93.6
2005	(770)	103,152	22,693,440	282.6	62,174	367.0	80.7
2006	782	108,685	23,910,700	297.8	65,509	380.8	83.8
2007	(794)	118,441	26,057,020	324.5	71,389	408.7	89.9
2008	(807)	109,076	23,996,720	298.0	65,565	369.3	81.2
Average consumption rate				301.25	66,275	397.8	87.5

* ( ) Estimated Population

As illustrated in Table 1, although water consumption in the Village does vary slightly from year to year, it has been assumed that the average of the past ten (10) years can be considered to be fairly representative of the per capita water consumption rate for the Village and the projected resultant volume of sewage that will have to be managed by the sewage lagoon.

For the purpose of the sewage lagoon assessment, an average daily water consumption rate of 400 Litres per capita per day (0.40m³/capita/ day) or 88gpcd will be used.

Wastewater volumes can also be increased by inflow and infiltration of both groundwater and surface water into the sanitary sewer collection system. Quantifying the amount of inflow and infiltration into the sanitary sewer system, however, is not always easy as it can be influenced by a variety of factors including, but not limited to, the weather, natural or weather influenced water table levels, permeability of the soils, age and condition of the sanitary sewer pipe system, etc. Poor pipe joints, cracked pipes, cracks in manhole barrels, etc. permit groundwater to infiltrate into the sewer system; sag manholes and weeping tile connections directly to the sanitary sewer permit the entry of surface water into the sanitary sewer system.

For the purposes of this assessment, it has been assumed that wastewater volumes will be approximately 10% higher due to inflow and infiltration of groundwater and surface water into the sanitary sewer collection system.

The sewage lagoon may also be subject to evaporation. Evaporation rates are weather dependent, influenced by temperature, wind speed, relative humidity and other like factors. Evaporation will be most significant during hot, sunny, windy weather, particularly on larger surface areas such as the storage cells. Beyond acknowledging that evaporation will have some influence on the sewage lagoon cells, estimates regarding the amount of evaporation and how this would impact the overall capacity of the primary and secondary cells has not been carried out.

5.0 EXISTING SEWAGE LAGOON ASSESSMENT

As previously stated, the Village's existing sewage lagoon is comprised of four (4) anaerobic cells, a facultative (aerobic) cell, and two (2) stabilization or storage cells. In assessing the capacity of the existing sewage lagoon, the following criteria has been assumed and applied;

- Water consumption rate of $0.40m^3$ per capita per day (88gpcd)
- 10% allowance for inflow and infiltration

5.1 ANAEROBIC CELLS

In accordance with the Alberta Environmental Protection *"Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems"* document,

> *"Anaerobic cells shall operate at a minimum depth of 3.0 meters and retain influent flow for a 2 day period based on average daily design flow".*

Each of the existing anaerobic cells meet the minimum operating depth requirement and have a capacity of $1,300m^3$ (286,000 gallons). Based on an average water consumption rate of $0.4m^3$ per capita per day (88gpcd) plus an allowance of 10% for inflow and infiltration, theoretically each of these cells individually has sufficient capacity to provide the required 2 day influent flow retention for a population in excess of 1400 people, thereby providing sufficient flow through time to allow for the settlement of solids contained within the wastewater. The cells do, however, have to be periodically de-sludged.

5.2 FACULTATIVE (AEROBIC) CELL

In accordance with the Alberta Environmental Protection *"Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems"* document,

> *"The facultative cell shall operate at a maximum depth of 1.5 meters and retain influent wastewater for at least 60 days based on average daily design flow".*

The existing facultative (aerobic) cell meets the maximum operating depth requirement. Based on an average water consumption rate of $0.40m^3$ per capita per day (88gpcd) plus an allowance of 10% for inflow and infiltration, the existing facultative cell has sufficient capacity to retain influent wastewater for 60 days for a population of approximately 515 people. For the current population of 800 people, influent wastewater flow through the facultative cell is capable of being retained for only approximately 38 days.

5.3 STABILIZATION OR STORAGE CELLS

In accordance with the Alberta Environmental Protection *"Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems"* document,

> *"The storage cell(s) shall operate at a maximum depth of 3.0 meters and shall retain influent wastewater for a minimum retention period of 12 months based on average daily design flows".*

The two storage cells meet the maximum operating depth requirement and have a combined capacity of 103,600m³ (22,792,000 gallons). On the assumption that at least 0.3 m (one foot) of effluent remains in the storage cells at the end of the discharge, the effective combined storage volume would therefore be in the order of 92,600 m³ (20,372,000 gallons).

Based on an average water consumption rate of 0.40m³/capita/day plus an allowance of 10% for inflow and infiltration, the existing sewage lagoon has storage for a population of around 577 people. At the current population of 800 people, the two storage cells have sufficient capacity to manage wastewater for a period of approximately 9 months. All domestic wastewater beyond this period, less reduction due to evaporation, would then have to be stored within that area of the storage cells above the maximum design water level and the top of the cell berms.

On the basis of the above capacity calculations and the Alberta Environment guidelines, it can be concluded that both the facultative cell and the stabilization (storage) cells are undersized to manage wastewater from the current population of the Village. From this perspective, the Village needs to consider providing increased sewage lagoon capacity by expanding the facultative cell and the storage cell capacity.

Since wastewater systems, including the collection system and the treatment facility are typically designed and constructed to have a capacity greater than what may be required to satisfy the current needs, it is necessary to project the potential growth of the community and the resultant increases in the volume of sewage that must be managed by the system. From this information, a design life for the system can then be selected. In the case of a sewage lagoon, the design life is typically in the 20 to 30 year range. For the Village of Mannville, a 25-year design life will be used.

6.0 POPULATION PROJECTIONS

Trying to predict the rate of growth and the resultant population of a community over the next 20 or 30 years is not necessarily an exact science as a variety of factors could have an influence on the growth of the community and need to be considered.

- What has been the historic growth rate of the community?
- Does the Village have an active marketing strategy to promote growth and development within the community?
- Is there any potential for agricultural or petroleum related industrial or commercial development within the Village?
- What is the potential for the Village to become a retirement community? For local area rural residents? For residents from other areas?

- Will the Village be able to provide residential, commercial, or industrial lots at a competitive rate relative to other centres, such as Lloydminster, Vermilion, etc.
- Does Highway 16 have any impact, positive or negative, on the growth of the Village, particularly on the commercial/industrial aspect?
- How much growth can the existing infrastructure, water, sewer, etc. handle? Will the cost of upgrading the infrastructure outweigh the benefits of growth?

The historic growth rate of a community can generally provide a trend that can be useful in projecting future populations. The most significant growth in population experienced by the Village was between 1961 (632) and 1981 (788) which translates into a growth rate of almost 1.25% per year. Since 1981, the population of the Village has remained relatively constant.

With the absence of a continuous definitive growth trend, population growth rates of 0.5%, 0.75%, 1.0%, 1.25%, 1.5%, and 2.0% have been developed for the Village, as illustrated in Table 2.

Table 2: Population Growth Projections

		With an annual growth projection of					
Year	Population*	0.5%	0.75%	1.0%	1.25%	1.50%	2.0%
1961	632						
1966	683						
1971	646						
1976	681						
1981	788						
1986	778						
1991	774						
1996	758						
2001	722						
2006	782						
2011		802	812	822	832	842	863
2016		822	843	864	885	908	953
2021		843	875	908	942	978	1052
2026		864	908	954	1003	1053	1162
2029		877	929	983	1041	1101	1233
2031		886	943	1003	1067	1135	1283
2034		899	964	1033	1107	1186	1361
2036		908	978	1054	1135	1222	1416

* These populations are based on Statistics Canada data

In a community the size of Mannville, the factors outlined above need to be carefully considered when sizing a sewage treatment facility. An unanticipated, large sized water consuming development could potentially have a significant impact on the life of the facility. On the other hand, preparing for significant growth in advance of such development actually occurring could place an undue financial burden upon the Village.

For the purposes of this assessment, a population growth rate of 1.50% per year will be used.

7.0 WASTEWATER VOLUME PROJECTIONS

In projecting future wastewater volumes that will need to be managed by the sewage lagoon, the following assumptions have been used:

- Population growth of 1.50% per year;
- Average daily rate of water consumption of 0.40m³/capita/day (88gpcd)
- Inflow/infiltration rate of 10%

Table 3: Future Wastewater Volumes

Year	Projected Population	Average Daily Volumes m³	Average Daily Volumes gallons	Annual Volumes m³	Annual Volumes gallons
2006	782	344	75,680	125,560	27,623,200
2011	842	370	81,400	135,050	29,711,000
2016	908	400	88,000	146,000	32,120,000
2021	978	430	94,600	156,950	34,529,000
2026	1053	463	101,860	168,995	37,178,900
2031	1135	499	109,780	182,135	40,069,700
2034	1186	522	114,840	190,530	41,916,600
2036	1222	538	118,360	196,370	43,201,400

8.0 PROPOSED SEWAGE LAGOON IMPROVEMENTS

While it is certainly acknowledged that other sewage treatment alternatives, such as various types of mechanical plants, are potentially available to satisfy the wastewater treatment needs of the Village, the assessment contained herein deals only with the existing sewage lagoon and the upgrades that may be required to manage the sewage volumes of the Village. From our perspective, the cost of alternative sewage treatment systems from both a capital and operating perspective relative to the volumes of sewage that must be managed would likely be considerably greater than the capital and operating costs of a sewage lagoon.

Since sewage lagoons, if operated properly, can provide a simple and effective treatment process for sewage in a small community at a reasonable operating cost, it is recommended that the Village continue to manage the wastewater volumes within the Village using a sewage lagoon.

8.1 ANAEROBIC CELLS

As previously stated, the existing anaerobic component of the sewage lagoon is deemed to be adequate to meet the present and future treatment needs of the Village, provided, however, that the anaerobic cells are periodically de-sludged.

8.2 FACULTATIVE (AEROBIC) CELL

The existing facultative (aerobic) cell currently does not provide the 60-day influent retention as required by Alberta Environment guidelines. At the 25-year design horizon for a projected population of 1186 people, the facultative cell needs to be sized to minimally provide a total capacity of 31,310m³ to meet the 60 day retention requirement.

Primarily due to the location of the sewage lift (pumping) station and the gravity transmission line from the Village to the lift station, expansion of the facultative cell is only practical to the south and east of the existing cell. Two expansion options for the facultative cell that will provide sufficient capacity to meet the 60 day retention requirements have been examined, namely,

Option 1: Expansion of the existing cell by approximately 83 meters to the east for the full width of the existing cell; and

Option 2: Expansion of the existing cell by approximately 36 meters to the south and 40 meters to the east.

Based on the topographic survey of the area conducted by BAR Engineering staff, the land to the south of the existing facultative cell is relatively flat, generally consistent in elevation with the top of the south berm of the existing facultative cell. To the east of the existing facultative cell, the land drops off by approximately 1 to 2 meters in the initial 40 meters, then rather significantly towards the relatively large "slough" area.

Expanding the facultative cell under the Option 1 scenario will require the "slough" to be drained from the proposed expansion area and a considerable amount of suitable fill material to construct the berms to the required elevations. Additionally, due to the close proximity to the large "slough" area to the east, consideration will need to be given to embankment stability techniques.

Under the Option 2 scenario, primarily due to the higher ground, construction would be anticipated to be somewhat less complex however the Village will need to acquire the land to the south of the existing facultative cell.

The length of existing berms that would need to be removed in Option 2 is greater than in Option 1.

Having briefly considered both options, it is recommended that Option 2 be pursued for expansion of the facultative (aerobic) cell.

8.3 STABILIZATION (STORAGE) CELLS

For a projected population of 1186 people (25-year design horizon), the total volume of sewage that will need to be managed by the sewage lagoon to provide for once-a-year discharge of the effluent is estimated at 190,530m³. To meet this storage requirement, a third stabilization (storage) cell with an effective or working capacity in the order of 97,900m³ needs to be provided. To provide this required storage, three options were considered:

Option 1: Construction of a new storage cell to the east of existing storage cell # 2.

To provide the storage requirements through this option, the storage cell will need to be constructed to a width of at least 150 meters to the east of existing cell # 2 which will place a portion of the storage cell in the large "slough" area. Since the slough area is significantly lower in elevation than the existing sewage lagoon, in addition to having to drain the water from the slough area to facilitate construction, the area will require a significantly large amount of suitable fill material to be imported to construct the storage cell to the design grades and configuration.

It is our understanding that the area immediately to the east of existing storage cell # 2 was also used as a disposal site for all the excess topsoil and marginal material during construction of the original sewage lagoon. That being the case, all this material would need to be excavated prior to the placement of fill material suitable for constructing the storage cell.

Under this option, modifications to the effluent discharge structure will be required.

Having briefly considered this option, we are of the opinion that the cost of this option would be rather significant, likely considerably higher than the other options.

Option 2: Construction of a new storage cell to the north of the two existing storage cells.

It is possible to construct a new storage cell directly to the north of the existing storage cells (#1 and #2) utilizing the existing Golf Course water detention pond, modified to the required cell configuration and expanding it sufficiently to the west to meet the 25-year design horizon. Since it is rather unlikely that the Golf Course would be willing to part with this detention pond, this option has not been examined in any further detail.

Option 3: Construction of a new storage cell to the west of existing storage cell # 1.

Although the Village currently does not own the land to the west of storage cell #1, it would appear that this may be the most practical and economic option for providing the additional required storage capacity.

A new storage cell, 440 meters in length by 120 meters in width, immediately adjacent to the west berm of storage cell # 1 and extending directly to the north along the west berm of the Golf Course detention pond, will provide the required storage capacity for the 25 year design horizon. The advantages of this option are as follows:

- Since construction of this storage cell will primarily be all excavation, the excavated material, assuming that the soils are suitable clay material, can be used for constructing the berms and clay liners for the facultative cell expansion which will be short of material.
- Construction of the storage cell to the west will not require any modifications to the existing effluent discharge structure.

9.0 CONCLUSIONS AND RECOMMENDATIONS

9.1 CONCLUSIONS

Based on our analysis of the Village's current system, the following conclusions have been reached:

- The existing anaerobic cells are adequately sized to meet the current and future needs of the Village.
- The existing facultative (aerobic) cell has capacity to provide retention for approximately 38 days based on the current population of the Village.
- The current stabilization (storage) cells have capacity to provide storage for approximately 9 months, based on the current wastewater volumes.
- At this time, any growth experienced by the Village, as well as additional flows due to inflow and infiltration during a wet, rainy year, will likely require a premature discharge of the effluent from the storage cells to avoid the storage cell berms from being over-topped.

9.2 RECOMMENDATIONS

To meet the current and 25-year design horizon requirements for managing the wastewater volumes in the Village, it is recommended that:

- To provide the required 60 day retention, the existing facultative cell be expanded by approximately 36 meters to the south and 40 meters to the east, as illustrated in attached drawing #1.
- To provide the required 12 month storage requirement, a new storage cell approximately 440 meters by 120 meters be constructed immediately to the west of existing storage cell # 1, as illustrated in attached drawing #1.
- Geo-technical investigations to determine the nature of the soils be undertaken within the areas of proposed expansion.
- The Village initiate discussions with the landowner for the potential purchase of the land area required to facilitate construction of the proposed sewage lagoon expansion.
- A copy of the Sewage Lagoon Assessment Report be submitted to Alberta Environment for their review and comments.

10.0 COST ESTIMATE

The cost of expanding the existing sewage lagoon, as described above, is estimated to be in the order of $1,500,000, including engineering costs. This cost is based on preliminary earth volume quantities that need to be excavated and placed and compacted to increase the capacity of the facultative (aerobic) cell and to provide additional storage capacity.

The cost estimate is also based on the assumption that the soil is good quality clay material suitable for constructing the proposed expansions.

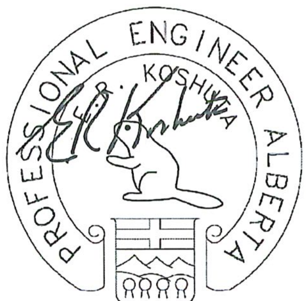
The cost estimate does not include any land costs.

11.0 CLOSURE

This report has been prepared by BAR Engineering Co. Ltd. for the Village of Mannville. The purpose of this report is to assess the existing sewage lagoon and to provide recommendations for improvements to allow the Village to continue to manage its wastewater in an effective and environmental sound manner, compliant with their Permit to Operate a Sewage Works and consistent with Alberta Environmental Protection guidelines and standards.

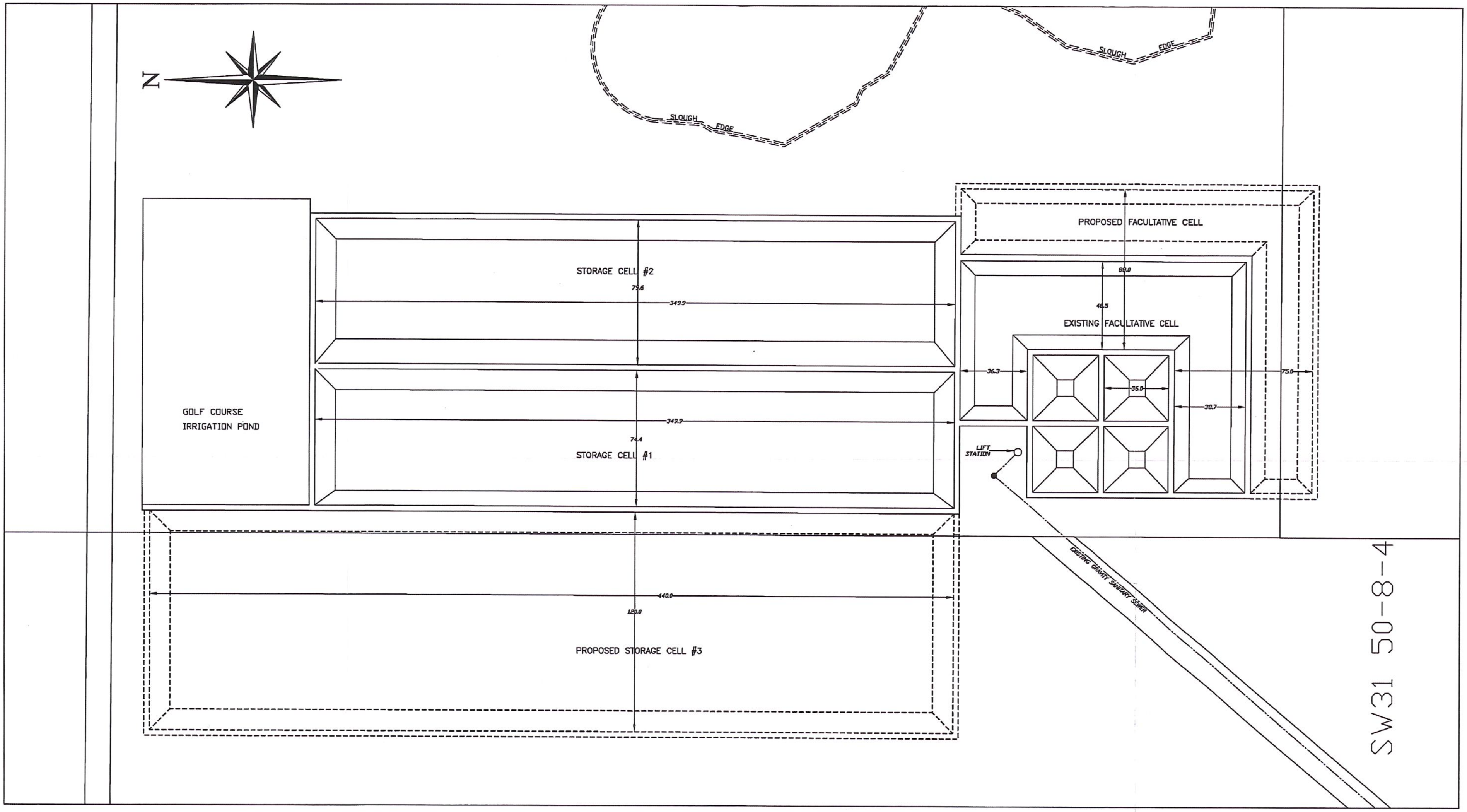
Respectfully Submitted,
BAR Engineering Co. Ltd.

E.R. Koshuta, P. Eng.
Senior Staff Engineer (Municipal)



May 21, 2009

PERMIT TO PRACTICE
BAR ENGINEERING CO. LTD.
Signature
Date 21 May 2009
PERMIT NUMBER: P7266
The Association of Professional Engineers, Geologists, and Geophysicists of Alberta



Note:

The location of the utilities shown is approximate only. The exact locations should be determined by consulting the municipal authorities and utility companies concerned. The contractor shall also verify the exact location and invert elevation by hand excavation before construction.

All chainages are calculated along the centerline of the Right of Way.

NO.	DESCRIPTION	BY	CHK	DATE
0	ISSUED FOR REVIEW	CDAB	ERK	19/05/2009

REVISIONS

ENGINEER

PERMIT

BAR Engineering

SCALE: 1:2000

PROJECT #: 08-2038

DRAWING #: 08-2038.dwg

VILLAGE OF MANNVILLE

PROPOSED SEWAGE LAGOON EXPANSION

SHEET #: 1 of 1

D

Appendix D
Transportation Review

Does not form part of this Bylaw.

Prepared by: BAR Engineering

August 11, 2022
03-22-0039

Vicki Dodge
Red Willow Planning
Unit 10, 44 St. Thomas Street
St. Albert, AB T8N 6N8

Dear Ms. Dodge:

Re: Minburn Industrial ASP
Transportation Review – Final v2.0

1. INTRODUCTION

Red Willow Planning is working with the County of Minburn and the Village of Mannville on the development of an industrial Area Structure Plan (ASP) north of Highway 16 and east of the Village of Mannville, AB. As part of the planning process, the need for a transportation review has been identified. The review is anticipated to provide an overview of the transportation opportunities and constraints in and adjacent to the study area.

2. EXISTING CONDITIONS

2.1 Study Area

The study area is generally bounded by Highway 16 to the south, Twp Rd 504 to the north, the quarter section line east of Rge Rd 85to the east, and the Village of Mannville to the west.

2.2 Roadways

The study area is currently served by the following roadways:

- ***Highway 16*** is classified as a rural freeway divided (RFD) roadway and is currently developed as a paved four-lane rural divided highway with a posted speed limit of 110 km/hr. The section of Highway 16 adjacent to the study area currently includes at-grade unsignalized intersections at Highway 881, Range Road 85, and Range Road 84.

- ***Highway 881*** is classified as a rural collector undivided (RCU) and is currently developed as a paved two-lane rural undivided highway with a posted speed limit of 50 km/hr through Mannville and a posted speed limit of 100 km/hr external to Mannville. Existing intersections at 48 Avenue (Twp Rd 503B) and 50 Avenue (Twp Rd 504) are currently unsignalized. A sidewalk is provided on the west side of Highway 881 between 48 Avenue and 50 Avenue.

- ***Twp Rd 503B*** is currently developed as a 2-lane paved rural collector roadway with a posted speed limit of 80 km/hr.

- ***Twp Rd 504*** is currently developed as a 2-lane rural collector roadway with an oiled surface. The posted speed limit along Twp Rd 504 is 80 km/hr.

- ***Rge Rd 85*** is currently developed as a 2-lane gravel collector roadway with a posted speed limit of 80 km/hr.

- ***Rge Rd 84*** is currently developed as a 2-lane gravel collector roadway with a posted speed limit of 80 km/hr.

2.3 Traffic

Table 1 summarizes the existing Average Annual Daily Traffic (AADT) volume estimates from Alberta Transportation's traffic data mapping website. The table includes data from 2016, 2019, and 2021 to reflect a variety of conditions before and during the pandemic.

Table 1: AADT Volume Estimates

LOCATION	2016	2019	2021
Highway 16 east of Highway 881	6,810 vpd*	6,930 vpd	5,320 vpd*
Highway 881 North of Highway 16	1,420 vpd*	1,390 vpd	1,400 vpd*
Highway 881 North of 48 Avenue	2,120 vpd	1,940 vpd*	1,820 vpd
48 Avenue (Twp Rd 503B) east of Highway 881	430 vpd	360 vpd*	340 vpd

*Count Year

2.4 Railway

There is an existing Canadian National Railway (CNR) main line that runs northwest to southeast through the plan area. At-grade railway crossings are provided at Highway 881, Rge Rd 85, and Rge Rd 84. The Highway 881 rail crossing currently includes flashing lights and bells, while the crossings at Rge Rd 85 and Rge Rd 84 include passive railway crossing signs.

3. FUTURE CONDITIONS

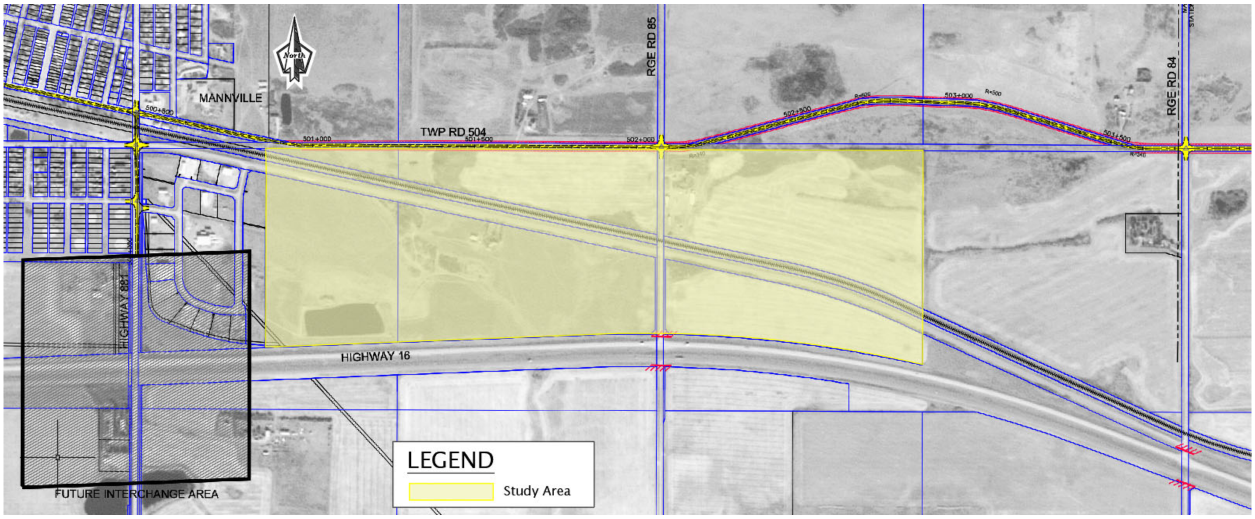
3.1 Roadways

As noted, Highway 16 is classified as a rural freeway divided (RFD) highway within Alberta Transportation's roadway hierarchy. The roadway is currently developed as an arterial facility with numerous at-grade intersections; therefore, the conversion of the roadway to a freeway standard requires the identification of future interchange locations, the closure of at-grade intersections, and the development of alternate access strategies.

CH2M Hill prepared the ***Highway 16 Access Management Plan: Highway 36 to Range Road 2-3*** in 2010 on behalf of Alberta Transportation. In the vicinity of the study area, the management plan identifies the conversion of the Highway 16/Highway 881 intersection to an interchange and the closure of all the at-grade intersections between Highway 881 and Highway 41, including the Highway 16/Rge Rd 85 and Highway 16/Rge Rd 84 intersections. Land access to the properties north of Highway 16 and east of Highway 881 will be provided via Twp Rd 504 and existing service roads. The study generally identified a rural local undivided cross-section as the minimum cross-section for the alternate access roadways.

The Highway 16 access management plan adjacent to the study area is illustrated in **Figure 1**. The study area has been highlighted in yellow. A copy of the plan from the original report is attached for reference.

Figure 1: Highway 16 Access Management Plan for Study Area



Source: CH2M Hill Highway 16 Access Management Study

4. PROPOSED DEVELOPMENT

The proposed ASP would establish the framework for industrial development in the study area. Based on a preliminary review, it is estimated that the study area includes approximately 311 acres of gross area. Based on a preliminary lot layout provided by Red Willow Planning, a range of lot sizes are proposed that could be attractive to a number of different types of industrial businesses.

The lands immediately adjacent to the Village of Mannville are anticipated to be integrated with existing industrial land uses in terms of potential future servicing, including the potential use of existing roads and access within the Village. The remaining study area is anticipated to require new access to existing township and range roads.

Trip generation varies by the type and intensity of development; however, based on a rural industrial daily trip generation rate of 20 trips/acre measured in Acheson, Parkland County, full development of the study area could generate in the order of 6,000 vpd to 6,500 vpd. Although the Acheson industrial area covers significantly more land than included in the Minburn Industrial ASP area, the proposed lot sizes and potential typology of industrial businesses that could be attracted to the study area are anticipated to be similar to the size and types of businesses currently developed in Acheson; therefore, the application of the measured Acheson trip rate is anticipate to provide an appropriate estimate for potential traffic generation at the ASP level of planning. This preliminary estimate is intended to help guide discussions regarding access and circulation and may be conservative depending on the ultimate mix and intensity of industrial uses constructed in the study area.

5. TRANSPORTATION EVALUATION

5.1 Land Access

The future upgrading of Highway 16 to a freeway will result in significant impacts to land access in the study area. While timing for the future freeway upgrade is not currently known, the roadway network servicing the plan area should be developed based on the ultimate freeway conversion plan to minimize future disruptions. The following outlines the key land access components to be considered during the development of the ASP land use concept.

5.1.1 Roadway Hierarchy

The County roadways within and adjacent to the study area are currently classified as collector roadways. As per the Transportation Association of Canada's (TAC) Geometric Design Guide for Canadian Roads, traffic movement and land access are of equal importance for roadways classified as rural collectors. The following typical characteristics are also noted:

- Daily traffic volumes <5,000 vpd
- Interrupted flow
- Design Speed 60 km/hr to 110 km/hr
- Up to 30% trucks in the 3t to 5t range
- Connect to locals, collectors, and arterials

Based on TAC, the typical minimum spacing between intersections along collector roadways is 60m; although, some counties identify intersection spacing of 100m for rural industrial major collectors.

Intersection spacing impacts overall roadway operations, level of service, and vehicle capacity. With the implementation of the Highway 16 freeway conversion program, Twp Rd 504 is anticipated to provide a cross-county function, while Twp Rd 503B is anticipated to balance traffic movement and land access within the study area. Therefore, these east-west collectors are recommended to include a minimum intersection spacing of 100m. Given the location of the CNR and the depth of the development area on either side of the CNR, minimum intersection spacing along Rge Rd 85 is recommended to be 60m.

5.1.2 Railroad Crossings

An at-grade railroad crossing is currently provided at Rge Rd 85 approximately 300m north of Highway 16 and an at-grade railroad crossing is currently provided at Rge Rd 84 approximately 65m north of Highway 16.

Based on a review of the Government of Canada's Grade Crossing Standards, a minimum spacing of 30m is required between the edge of the travelled way and the nearest rail of the grade crossing.

To be conservative, it is recommended that the first intersection north and south of the railroad on Rge Rd 85 be located a minimum of 60m from the rail crossing (nearest rail to edge of the travelled way). The provision of 60m spacing from the railroad at the planning stage provides additional flexibility in the future intersection design to ensure that the ultimate configurations provide sufficient minimum stacking distance for a semi-trailer (WB-21) or a double trailer combination (WB-23) between any future crossing protection north/south of the railroad and adjacent intersections. This is anticipated to require the realignment of Twp Rd 503B south of its current location.

The existing Twp Rd 503B/Rge Rd 84 intersection is located approximately 27m south of the railway and may not meet the current standard. As well, the existing spacing to Highway 16 may not be sufficient to accommodate modifications to the intersection location prior to closure of the Highway 16/Rge Rd 84 intersection. While spacing may not be ideal, it is recommended that the Twp Rd 503B/Rge Rd 84 intersection be maintained in the plan to provide secondary emergency access to developable lands located south of the CNR between Rge Rd 85 and Rge Rd 84. A more detailed review of Rge Rd 84 between Highway 16 and the CNR should be completed prior to development east of Rge Rd 85 to determine if the intersection can be shifted south to meet minimum spacing standards.

The existing railroad crossing controls in and adjacent to the study area may need to be upgraded as traffic volumes increase on the roadway network.

5.1.3 Roadway Alignment

Roadway alignment can impact sightlines at intersections. Rge Rd 85 and Rge Rd 84 are generally straight and do not include horizontal curves that could impact sightlines. Twp Rd 503B includes a curve east of Rge Rd 85; however, the radius appears to be generous enough such that sightlines may not be a significant concern.

Along Twp Rd 504, the roadway curves north to avoid a wetland area between Rge Rd 85 and Rge Rd 84. Although access may not be provided through the wetland area, if it is considered in the future, sightlines at potential intersection locations should be reviewed.

Consider sightlines at intersections east and west of Rge Rd 85 if Twp Rd 503B is realigned south to accommodate additional spacing from the CNR.

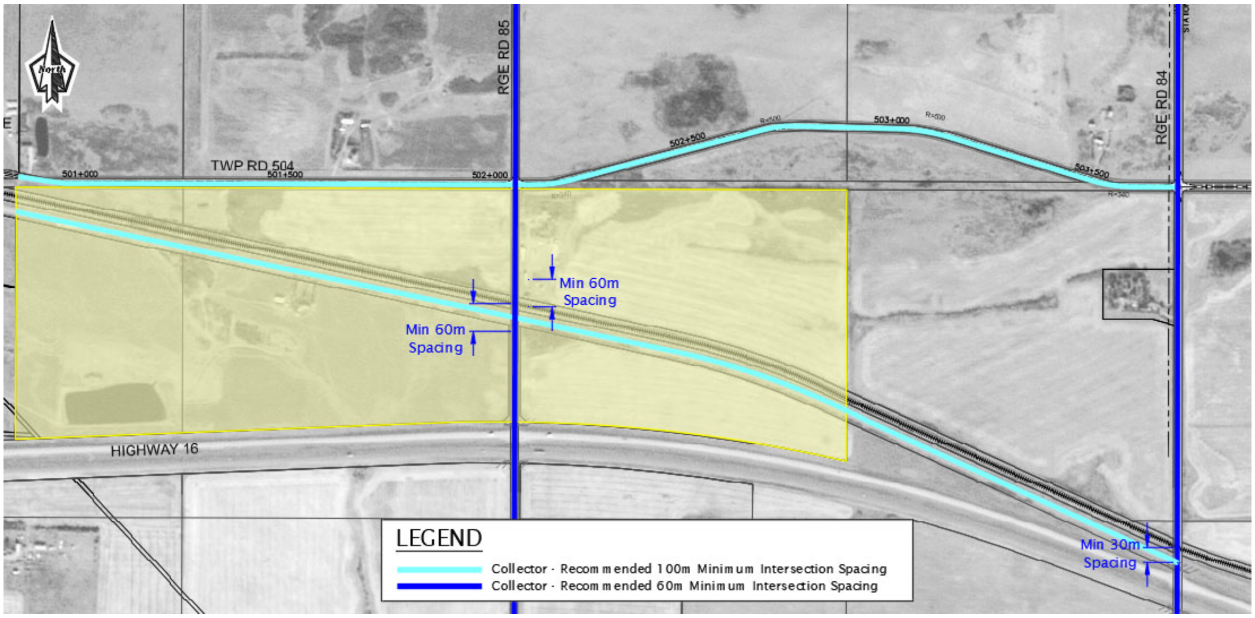
5.1.4 Highway 16 and Highway 881 Interchange

Details regarding the type of interchange that will ultimately be constructed at Highway 16 and Highway 881 were not provided as part of the access management study; however, the potential interchange footprint identifies land impacts to the existing industrial area in south Mannville. It was noted that the land adjacent to Mannville may be serviced through the existing industrial area in the village; however, the potential interchange construction should be considered when developing the access strategy for this area.

5.1.5 Recommended Access

Figure 2 illustrates the recommended minimum intersection spacing along the key study roadways. The posted speed limits along the collector roadways should be reviewed in the context of future development and ultimate access spacing.

Figure 2: Recommended Intersection Spacing



5.2 Truck Circulation

Highway 16 is an existing high load corridor adjacent to the study area, accommodating a maximum height of 12.8m and is anticipated to continue to be a high load connector route in the future. As well, Highway 16 can accommodate long combination vehicles up to 38m long.

As an industrial area, all roadways within the plan area should be designed to accommodate trucks; however, if end users that may require high load or long combination vehicles are considered within the plan area, additional design considerations will be required when establishing the roadway network.

5.3 Staging

Timing for the implementation of the Highway 16 access management plan is currently unknown; therefore, it is anticipated that development may proceed within the study area based on the existing roadway network. It is recommended that the internal roadway network be developed based on the ultimate plan. Specifically, access locations to Rge Rd 85 between Highway 16 and the CNR should be established early in the land development process to minimize disruptions in the future. It is also recommended that the future Highway 16 intersection closures be clearly communicated to future end users.

Traffic impact assessments (TIAs) will be required by Alberta Transportation for development within the study area. Intersection improvements may be required at intersections along Highway 16 under the existing at-grade configurations depending on projected site generated traffic volumes and design vehicle requirements.

6. CONCLUSIONS

It is anticipated that the above provides sufficient information to assist in the development of an internal roadway network as part of the overall planning process. Please contact the undersigned with any questions regarding our submission.

Yours truly,
Bunt & Associates

Catherine Oberg
Principal

This electronic document includes a certified digital signature and represents the original document retained on file. Any printed versions of this report are considered copies and can be confirmed by referring to the original electronic document.

This document entitled "Minburn Industrial ASP Transportation Review" was prepared by Bunt & Associates for the benefit of the County of Minburn and the Village of Mannville to provide transportation information for consideration in the planning of the Minburn Industrial ASP. The analysis and conclusions/recommendations in the report reflect Bunt & Associates' best professional judgment based on the knowledge and information available to Bunt & Associates at the time of preparation.

The County of Minburn and the Village of Mannville, including employees, members of Council, and Regulatory Board members shall be entitled to rely on this report for the specific purpose for which it was prepared. The County of Minburn and the Village of Mannville may also provide copies of the report to external governmental bodies having jurisdiction related to the project for which it was prepared.

Any use made of this report by a third party beyond those specifically noted here, or any reliance on or decisions based on it by any such third party, are the responsibility of such third parties. Bunt & Associates accepts no responsibility for damages, if any, suffered by such third parties as a result of decisions made or actions based on this report.

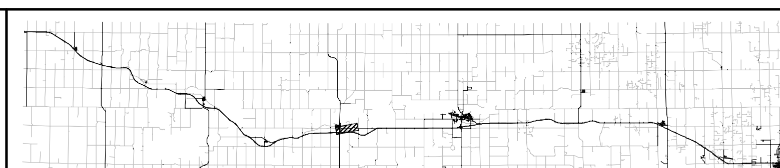
* ROADS CURRENTLY AT 20m RIGHT OF WAY WILL REQUIRE EXTRA RIGHT OF WAY TO MEET ALBERTA TRANSPORTATION STANDARDS. ANY LAND PURCHASE WILL BE LOOKED AT IN THE FUTURE AFTER DISCUSSIONS WITH MUNICIPALITIES.

Government of Alberta ■ Transportation

LEGEND:

- NEW CONSTRUCTION
- POTENTIAL ROAD UPGRADES
- UTILITY CORRIDOR
- CANADIAN NATIONAL RAILWAY
- PROPERTY LINE
- RIGHT-OF-WAY REQUIRED
- ROAD CLOSURES

KEYPLAN



CH2MHILL

50m 0 100m
HORIZONTAL

P-3355.17

HIGHWAY 16
ACCESS MANAGEMENT STUDY
RECOMMENDED PLAN
HIGHWAY 36 TO HIGHWAY 897
NORTH SIDE
SHEET 17 OF 39

DATE: 15/12/2009	REGION: CENTRAL	PROJECT No.:385113	C–400

NDM PROJECT: CGY / HIGHWAY16ACCESSMANAGMENT–385113 / HWY16ACCESSMAN / FUNCTIONAL STUDY DELIVERABLES / C–400.DWG NOV/13/2009 1:22 p.m. LAYOUT: C–400

E

Appendix E
Servicing Brief

Does not form part of this Bylaw.

Prepared by: BAR Engineering

January 19, 2023 | Project No.: 22MU-495300

Red Willow Planning
10617 – 98 Avenue
Morinville, AB
T8R 1E4

Attention: Vicki K. Dodge, RPP

Re: East Industrial Park Area Structure Plan – Servicing Brief
County of Minburn No. 27, AB

1.0 Introduction

Red Willow Planning, on behalf of the County of Minburn No. 27 (County), engaged BAR Engineering Co. Ltd. (BAR) to prepare a servicing brief associated with, and to complement, the preparation of the East Industrial Park Area Structure Plan (ASP) associated with the future development of the NW and NE ¼ Section 19-50-8-W4M and the NW ¼ Section 20-50-8-W4M. Servicing options and recommendations for the East Industrial Park water, wastewater, stormwater management, franchise utilities, and transportation network are provided in this servicing brief.

2.0 Background

The East Industrial Park is located directly east of the Village of Mannville (Mannville, or the Village), which encompasses the east half of the NW ¼ Section 19-50-8-W4M, the NE ¼ Section 19-50-8-W4M, and the NE ¼ Section 20-50-8-W4M. The subject ASP parcel is bounded by the Trans Canada Highway 16 to the south, the Village boundary to the west, Township Road 504 to the north and the east quarter section line of the NW ¼ Section 20-50-8-W4M. Canadian National Railway and Mannville Road (formerly Highway 2) bisect the parcel from the northwest corner to the southeast. Location of the subject ASP parcel is shown in Figure 2-1.

According to the County's Land Use Bylaw 1254-16, the existing ASP parcel districts are as follows:

- NW ¼ Section 19-50-8-W4M is zoned Direct Control,
- A small parcel in the southeast corner of the NE ¼ Section 19-50-8-W4M is zoned Rural Commercial District, and
- Remnant of the ASP area is zoned Agricultural.

Figure 2-2 illustrates the existing land use.

An Intermunicipal Development Plan (IDP) was adopted by the County and Village in 2015, which includes the ASP area. The IDP's purpose, as defined in the document, is to support ongoing cooperation between the two municipalities and to support the successful continuation of the Village as an incorporated municipality. Future land use for all areas of the subject ASP area is identified as Industrial/Commercial in the IDP.

The County of Minburn is proceeding with the ASP for the subject area resulting from the availability of funding and the IDP identifying the requirement for a joint ASP, and with the intent of the ASP area to be zoned, subdivided, and developed for the Rural Industrial land use. Large lot sizes are typical for rural industrial developments, which is consistent with the proposed lotting plan provided by Red Willow Planning. Proposed lot sizes range in size from roughly 1.00 acres to 9.97 acres as shown in Figure 2-3. It is important to note that the proposed lotting provided by Red Willow Planning is conceptual and will be refined during future development stages.

3.0 Servicing

3.1. Water

County of Minburn does not currently have an existing municipal water distribution system within the vicinity of the ASP lands to provide potable water to the development. As such, either private on-site potable water systems, such as wells or cisterns, will need to be utilized for the development or a connection to the Alberta Central East (ACE) Regional Water System will be required.

Two options for water servicing will be considered for the ASP:

- Rural Water Servicing Option, and
- Hybrid Water Servicing Option consisting of Municipal Water Services for the NW ¼ Section 19-50-8-W4M and Rural Wastewater Servicing for the remainder of the lands.

Rural water servicing consists of individual water wells. If water wells are utilized for the development, groundwater evaluations and/or hydrogeological assessments will be required prior to and as part of the subdivision process to obtain the required approvals and authorization from Alberta Environment and Parks and Sustainable Resource Development to divert and use groundwater.

Hybrid water servicing option consists of extending the existing water distribution from the Village of Mannville into the NW ¼ Section 19-50-8-W4M from the west. The Village is supplied with water from the ACE Waterline Corporation. The ACE Waterline Corporation is a regional entity that supplies high quality potable water to the municipalities in the County of Minburn, Two Hills and Vermilion River.

A watermain, owned and operated by the County, would be required from the connection points at 47A Avenue/45 Street and 45 Street and looped throughout the development to provide service to the Rural Industrial lots. It is important to note that ACE does not provide distribution pressures, so either the water supply would be through a trickle feed system to fill private on-site cisterns, or the County could construct a reservoir and pump station to provide adequate distribution pressures to the ASP lands. Figure 3-1 illustrates the location of the existing ACE Transmission Line and the possible connection point and watermain alignment to the north side of the ASP lands. Application to connect the ACE Transmission Line would be undertaken at future design stages of the development prior to subdivision.

3.2. Wastewater

Two options for wastewater servicing will be considered for the ASP:

- Rural Wastewater Servicing Option, and
- Hybrid Wastewater Servicing Option consisting of Municipal Wastewater Services for the NW ¼ Section 19-50-8-W4M and Rural Wastewater Servicing for the remainder of the lands.

Rural wastewater servicing consists of private on-site sewage disposal, which could include holding tanks with truck pump out or septic tanks discharging to treatment fields or mounds. Unlike municipal wastewater collection systems, on-site sewage systems include either collection of the wastewater and hauling offsite or collecting and treating the wastewater onsite prior to discharging to the environment. Implementation of private sewage systems shall be in accordance with the Alberta Private Sewage Systems current Standard of Practice at the subdivision stage.

Hybrid wastewater servicing option consists of extending the sanitary sewage collection system from the Village of Mannville into the NW ¼ Section 19-50-8-W4M from the west. Sewage for the Village is treated at the Village Lagoon located approximately a half mile northeast of the Village boundary with treated effluent being discharged into the Vermilion River. In 2009, BAR completed an assessment of the Village's Lagoon which determined that the existing lagoon had a facultative (aerobic) cell capacity for 515 people and storage cell capacity for 577 people. The IDP identified that the Village's population in 2011 was 803, meaning that the lagoon is undersized for the current population based on BAR's 2009 report and assuming that the Village has not undertaken any capacity improvements to their existing lagoon. A municipal wastewater collection system for the ASP lands could consist of a low-pressure sewage collection system, and/or gravity sanitary sewer mains in combination with lift stations. Figure 3-2 illustrates the location of the existing sanitary sewer system and lagoons within the Village of Mannville and the possible connection point and sanitary sewer alignment to the west side of the ASP lands.

Sanitary sewer design flows were calculated utilizing the City of Lloydminster Municipal Development Standards, October 2020 edition. The following parameters were used to determine the sanitary sewer flow rate:

- Equivalent Population = 48 persons/ha
- Minimum Average Contribution = 320 L/person/day
- C Peak Factor = $\frac{1+14}{(4+P^{1/2})}$

  Where P is the population in thousands
- Infiltration Rate = 0.28L/s/ha
- Manning's "n" value = 0.013

Based on the above parameters, the estimated total design peak flow rate for the site would be 10.3L/s.

The proposed sanitary sewer main was sized using the Manning's equation:

$$Q = \frac{AR^{0.667}S^{0.5}}{n}$$

Where: Q = Design flow in m^3/s
A = Cross sectional area in m^2
R = Hydraulic radius (area/wetted perimeter) in m
S = Slope of hydraulic grade line (m/m)
n = Roughness coefficient

According to the City of Lloydminster Municipal Development Standards, October 2020 edition, the minimum required sanitary sewer pipe size for a commercial/residential area is 250mm diameter at a minimum 0.28% grade. The velocity within the pipe must be between 0.6m/s to 3.0m/s. According to BAR's calculations, a 250mm sanitary sewer pipe at 0.28% grade will provide sufficient capacity for the development and the velocity within the pipe within the tolerable range.

3.3. Stormwater Management

The ASP lands is split into two drainage basins with the drainage divide approximately located along Range Road 85. The NW and NE 19-50-8-W4 generally drain from the north to the south and ultimately discharge via a culvert crossing under Highway 16. Land within NW 20-50-8-W4 slopes away from Highway 16 north towards Township Road 504.

For flexibility of development, two stormwater management scenarios have been analyzed for the ASP as follows:

- SWM Scenario 1 – County stormwater management system for the entire developed area consisting of two stormwater management facilities to collect runoff and discharge at a controlled release rate to a downstream drainage path.
- SWM Scenario 2 – County stormwater management system for the lots proposed within the NW19-50-8-W4 and provision for private on-site stormwater management for the remaining proposed lots.

In both scenarios, a series of drainage ditches, including roadside ditches, and stormwater management facilities (SWMF) will be utilized to convey and control stormwater runoff from the proposed development. The following sections provide an overview of the proposed stormwater management measures for each scenario with further detail provided in the attached Stormwater Management Plan.

3.3.1. SWM Scenario 1

The Canadian National Railway (CN Rail), bisecting the subject lands, will divide the proposed drainage into a north and south catchment. Surface runoff within the north parcel of the NE 19-50-8-W4 will be collected and conveyed via roadside ditches to a proposed dry stormwater management facility located in the northwest corner of the quarter section. The parcel of lands south of the CN Rail will also drain via roadside ditches to a proposed wet stormwater management facility located along the west side of the NE 19-50-8-W4 extending into the southeast corner of the NW 19-50-8-W4. Overland flow is designed to run off from the industrial lots to the roadside ditches with minimum 2% lot grades and minimum roadside ditch grades of 0.2%. Two stormwater management facility locations have been identified as shown in Figure 3-3, however, phasing of the development could result in additional interconnected stormwater management facilities in locations best suited to the phasing and development.

3.3.2. SWM Scenario 2

SWM Scenario 2 consists of similar overall drainage conveyance and patterns as Scenario 1 with runoff flowing overland from lots with a minimum 2% grade to roadside ditches at minimum grade of 0.2%. A dedicated wet stormwater management facility is proposed to collect runoff from the smaller lots along the west boundary of the ASP lands within the NW19-50-8-W4. Stormwater management for the remaining larger proposed Rural Industrial lots includes provision for on-site private stormwater storage. Stormwater from the NW and NE 19-50-8-W4 will be conveyed to the natural drainage run within the SE19-50-8-W4, south of Highway 16. Private on-site stormwater systems from the proposed lots in the NW20-50-8-W4 will discharge north across Township Road 503B and the CN Rail to the natural discharge point in the northeast corner of the quarter section. Figure 3-4 illustrates the stormwater management measures for Scenario 2.

3.4. Franchise Utilities

Power, natural gas, and communication services are all located within the vicinity of the ASP lands and will be extended from the nearest connection location for the planned subdivision. Application to the utility provider for connection and/or extension of service to the proposed development will be required at the subdivision stage.

3.5. Transportation Network

Access to the ASP area is currently provided via 46 Street, 47A Avenue, Township Road 504, Township Road 503B, and Range Road 85. 46 Street and 47A Avenue provides access from the Village on the west side of the development. Range Road 85 connects Highway 16 to the south, Township Road 503B and Township Road 504 to the north. Existing roadways are shown in Figure 2-1. The road allowance widths are as follows:

- 46 Street and 47A Avenue are 25m
- Township Road 504 is 20m

- Township Road 503B is 40m
- Range Road 85 from Highway 16 to Township Road 503B is 30m
- Range Road 85 from Township Road 503B to Township Road 504 is 20m

Transportation networks typically consist of three classifications of roadways: arterial, collector, and local. Roadway classification is determined based on connectivity of the transportation network and traffic volumes. In general, arterial roadways have higher traffic volumes and connect to collector roadways, while collector roadways connect to local roads with the least traffic volume. Direct access to private development is permitted on local and collector road classifications, but not arterial. The proposed transportation network, including roadway classifications, is shown in Figure 3-5.

All proposed roadways within the ASP development will be rural cross section roads with roadside ditches to provide drainage and convey stormwater runoff as noted in Section 3.3 and will be developed to the current County of Minburn Road Standards at time of development. The following recommendations are provided for the ASP transportation network at future development stages:

- Undertake a traffic impact assessment prior to subdivision to determine if intersection upgrades or controls are required as a result of development.
- Complete a geotechnical investigation to confirm soil stratigraphy, suitability of existing soil for construction, and recommended road pavement structures based on soils and vehicular loading.
- Construct roadways to accommodate a minimum 9m finished top width for truck traffic.
- Widen Township Road 504 road allowance to 30m for construction of the proposed rural road cross section.

4.0 Closure

If you have any questions or require any clarifications regarding this servicing brief, please do not hesitate to contact me at (780) 875-1683 or via email at caitlin.atkins@bareng.ca.

Yours truly,
BAR Engineering Co. Ltd.

Caitlin Atkins

Caitlin Atkins, P. Eng.
Intermediate Engineer
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Reviewed By,
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Manager
Municipal Division

Attachments: East Industrial Park Stormwater Management Plan Report, January 18, 2023

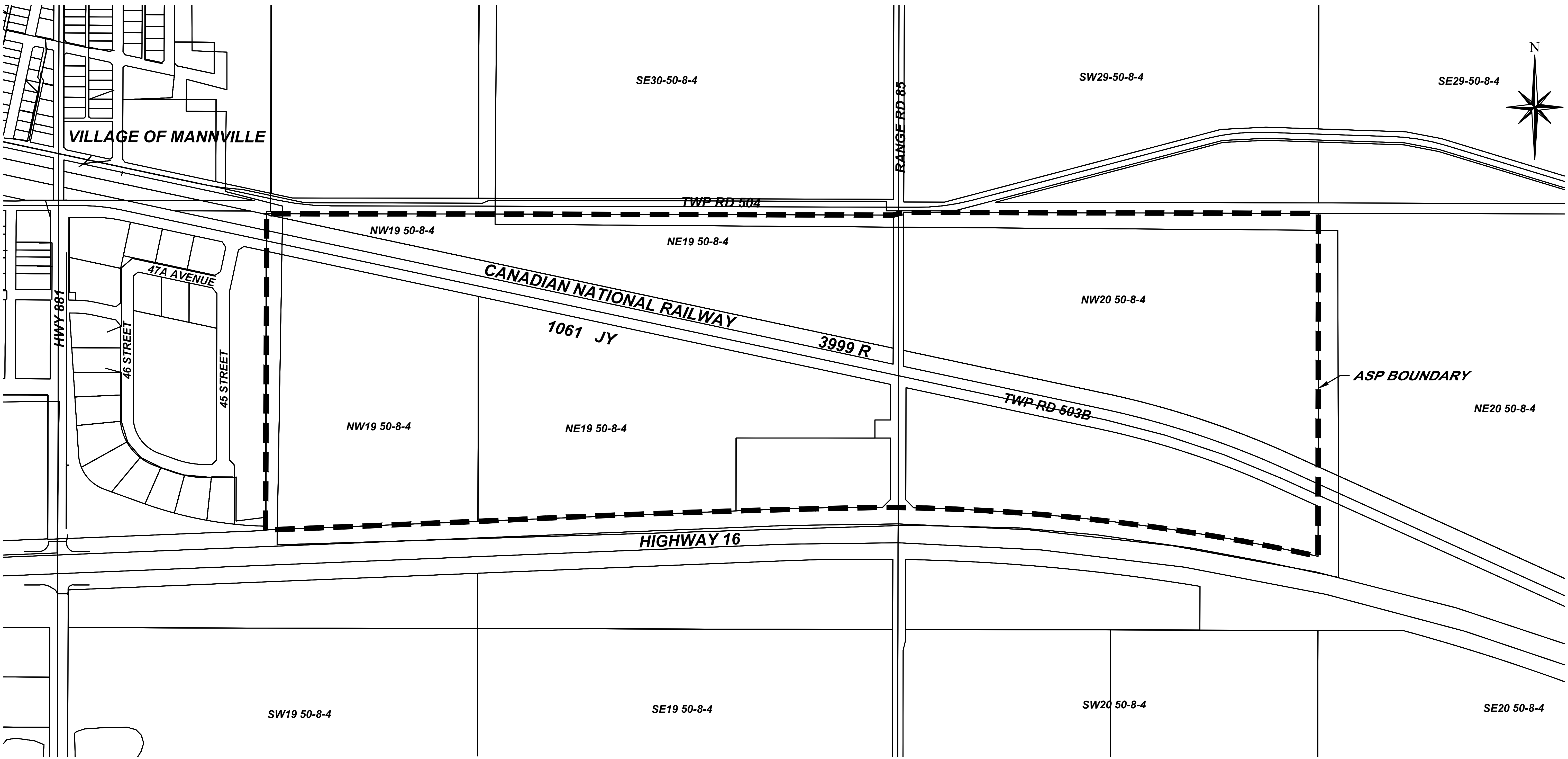

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FIGURE 2-1: LOCATION PLAN

SERVICING BRIEF

County of Minburn No. 27, Alberta

Drawn by:	DJB	Drawing #:	Figure 2-1
Approved by:	CMA	Scale:	1:7500
Date:	01/19/2023	Revision:	0

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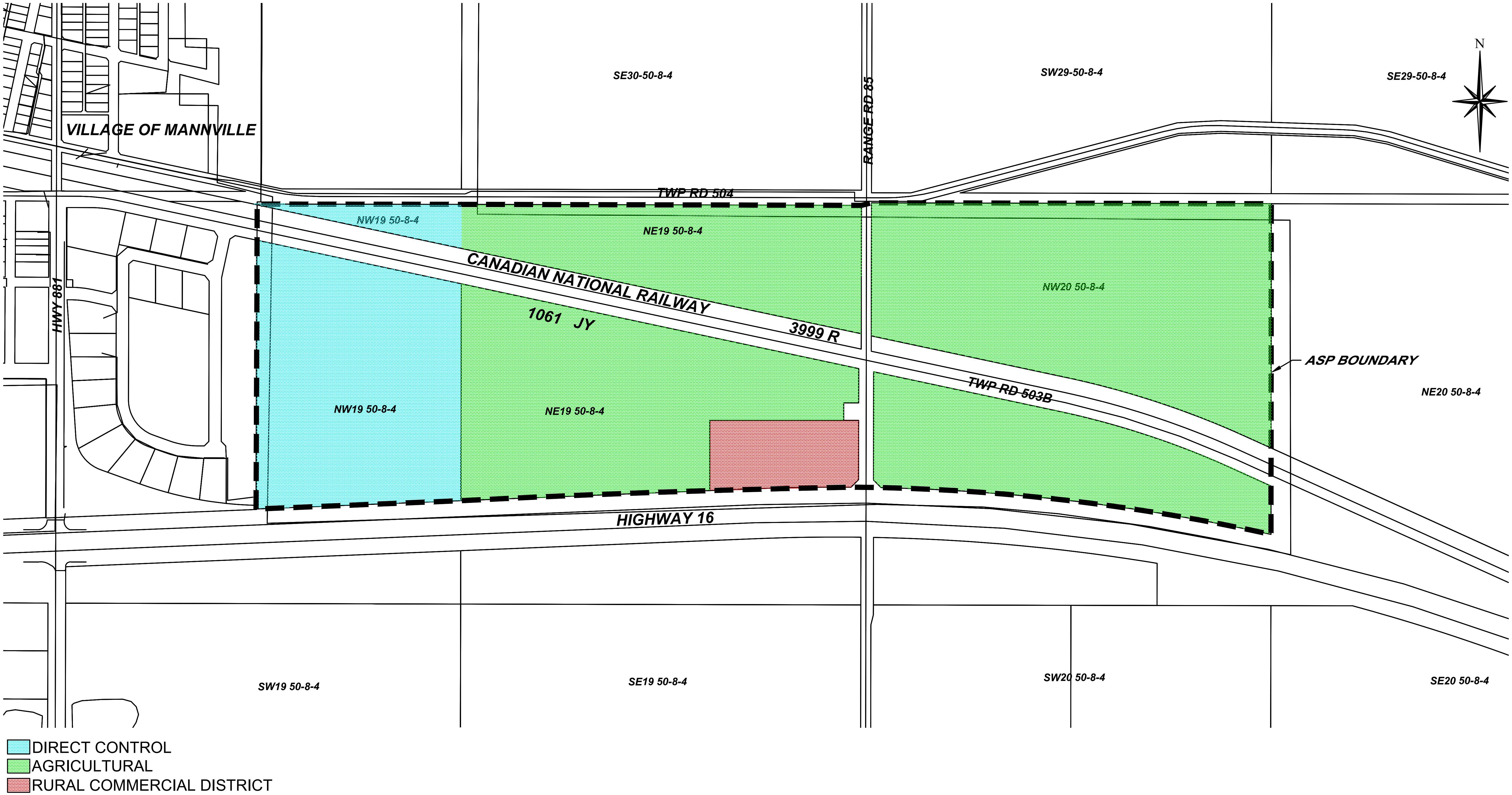

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FIGURE 2-2: EXISTING LAND USE

SERVICING BRIEF

County of Minburn No. 27, Alberta

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Date: 01/19/2023	Revision: 0

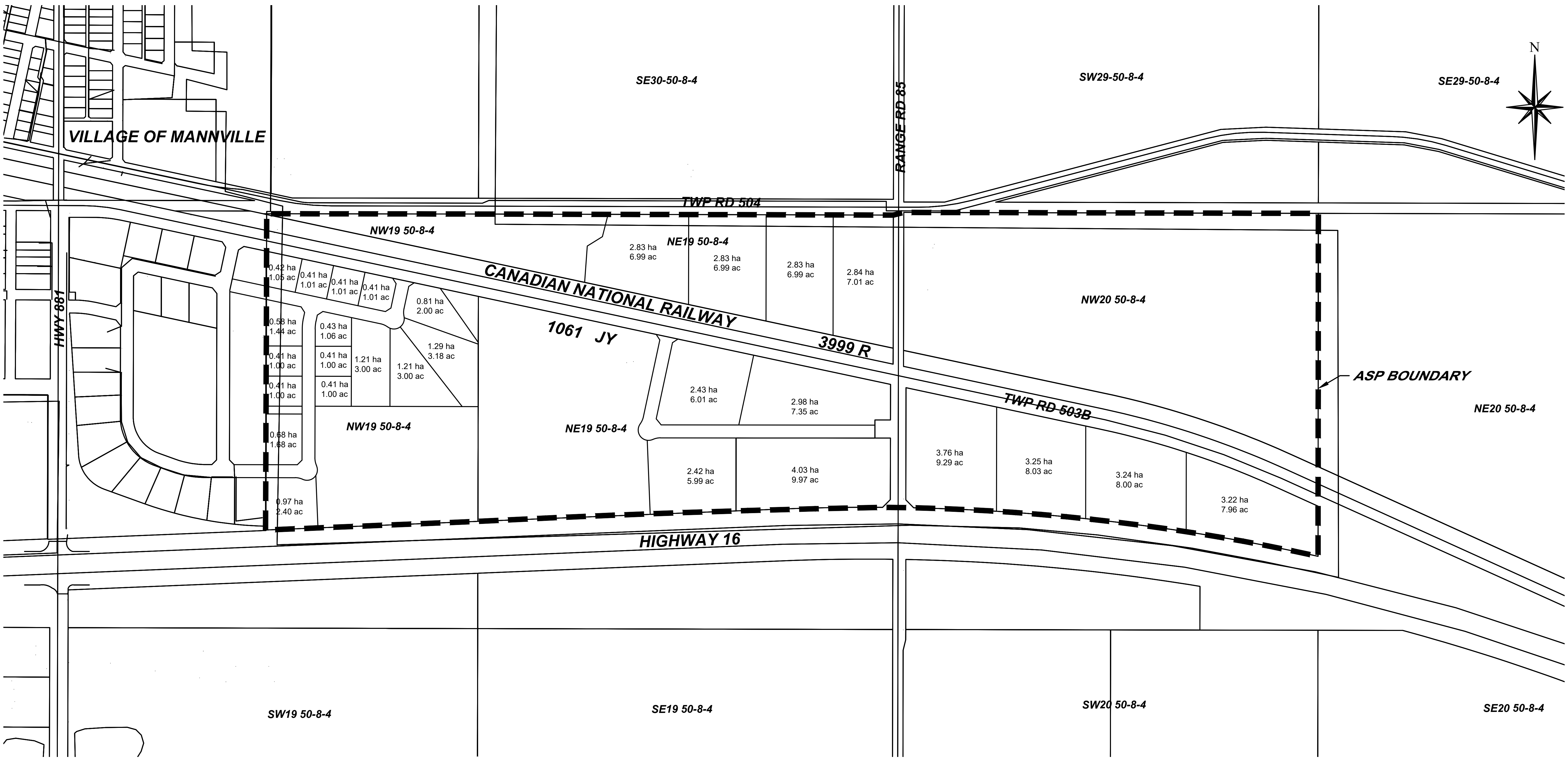

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FIGURE 2-3: DEVELOPMENT PLAN

SERVICING BRIEF

County of Minburn No. 27, Alberta

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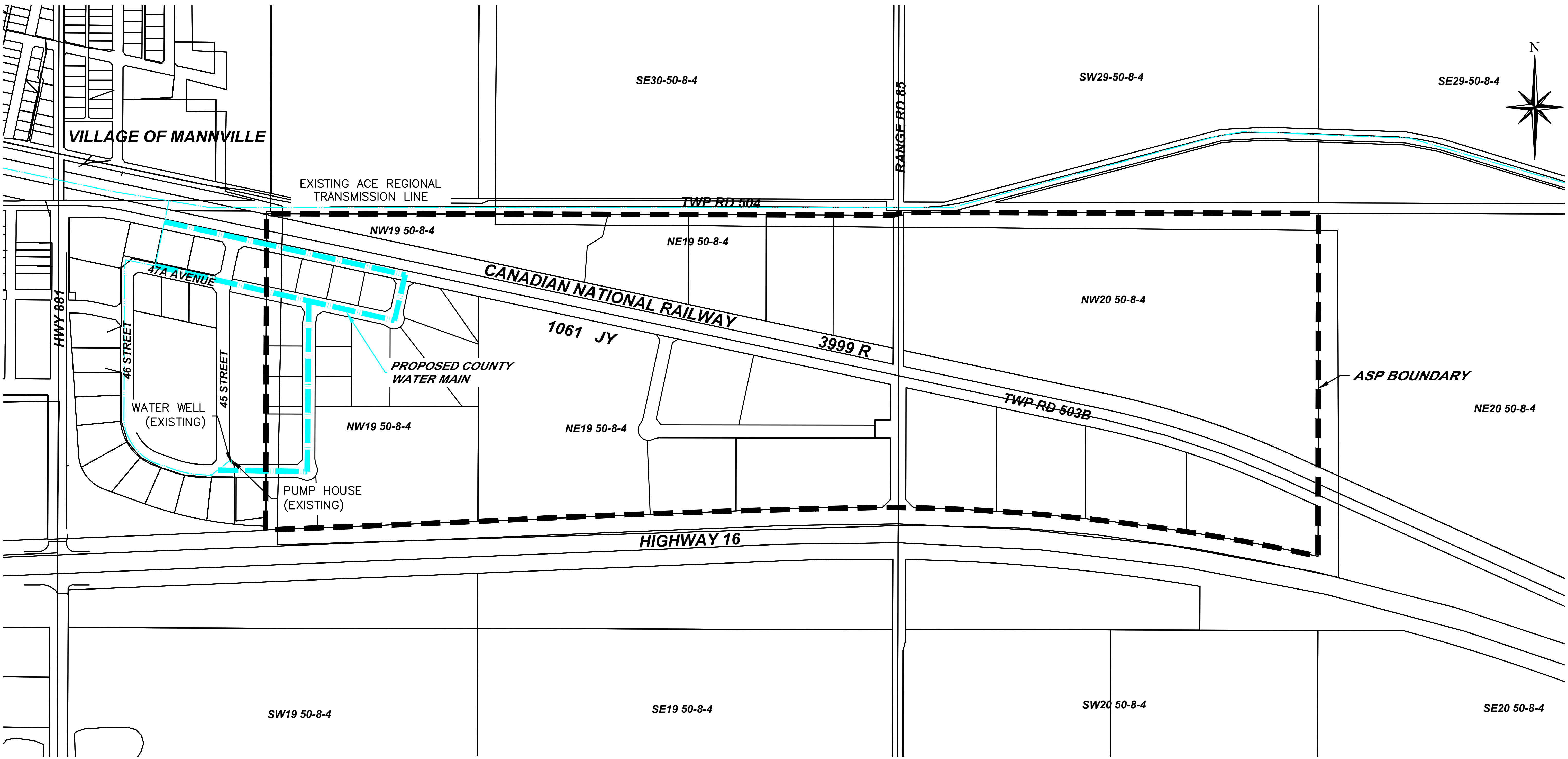

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FIGURE 3-1: ACE WATER CONNECTION

SERVICING BRIEF

County of Minburn No. 27, Alberta

Drawn by:	DJB	Drawing #:	Figure 3-1
Approved by:	CMA	Scale:	1:7500
Date:	01/19/2023	Revision:	0

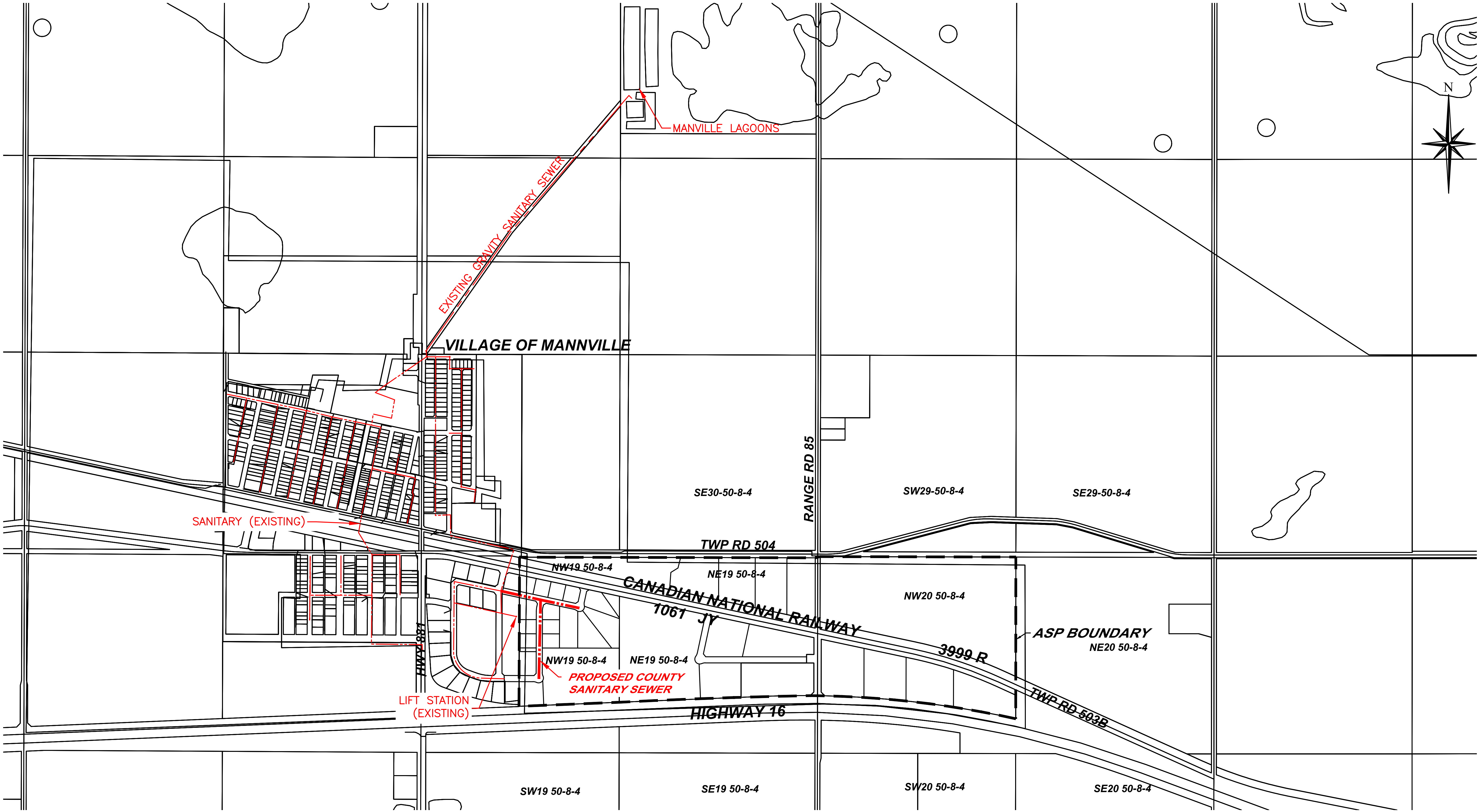

FIGURE 3-2: SANITARY SEWER CONNECTION

SERVICING BRIEF

County of Minburn No. 27, Alberta

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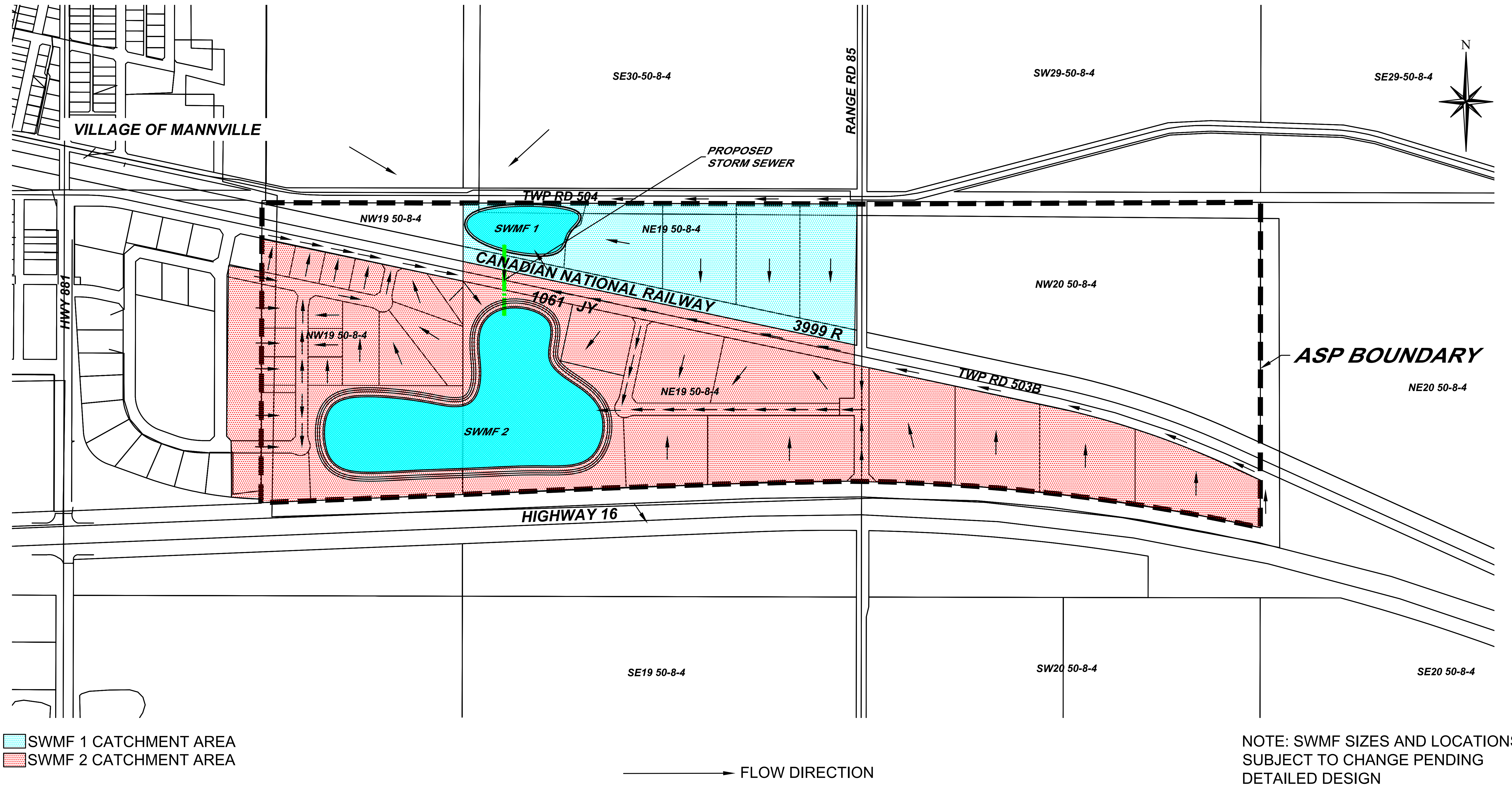

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FIGURE 3-3: POST DEVELOPMENT SWMP - SCENARIO 1

SERVICING BRIEF

County of Minburn No. 27, Alberta

Drawn by:	CMA	Drawing #:	Figure 3-3
Approved by:	SWS	Scale:	1:7500
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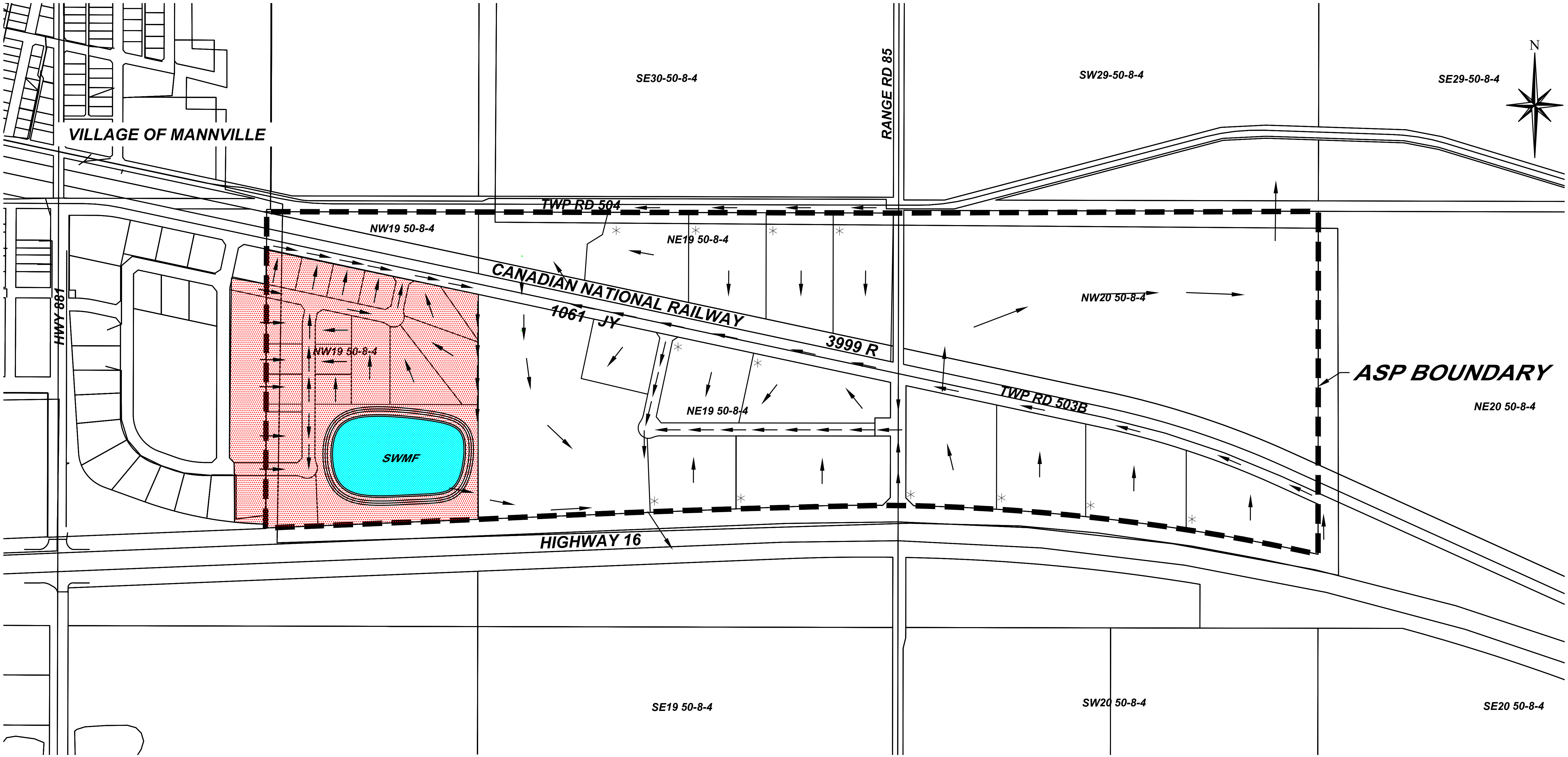

SWMF CATCHMENT AREA

*PRIVATE ON-SITE STORMWATER MANAGEMENT REQUIRED

NOTE: SWMF SIZES AND LOCATIONS SUBJECT TO CHANGE PENDING DETAILED DESIGN

FLOW DIRECTION

BAR ENGINEERING

FIGURE 3-4: POST DEVELOPMENT SWMP - SCENARIO 2

SERVICING BRIEF

County of Minburn No. 27, Alberta

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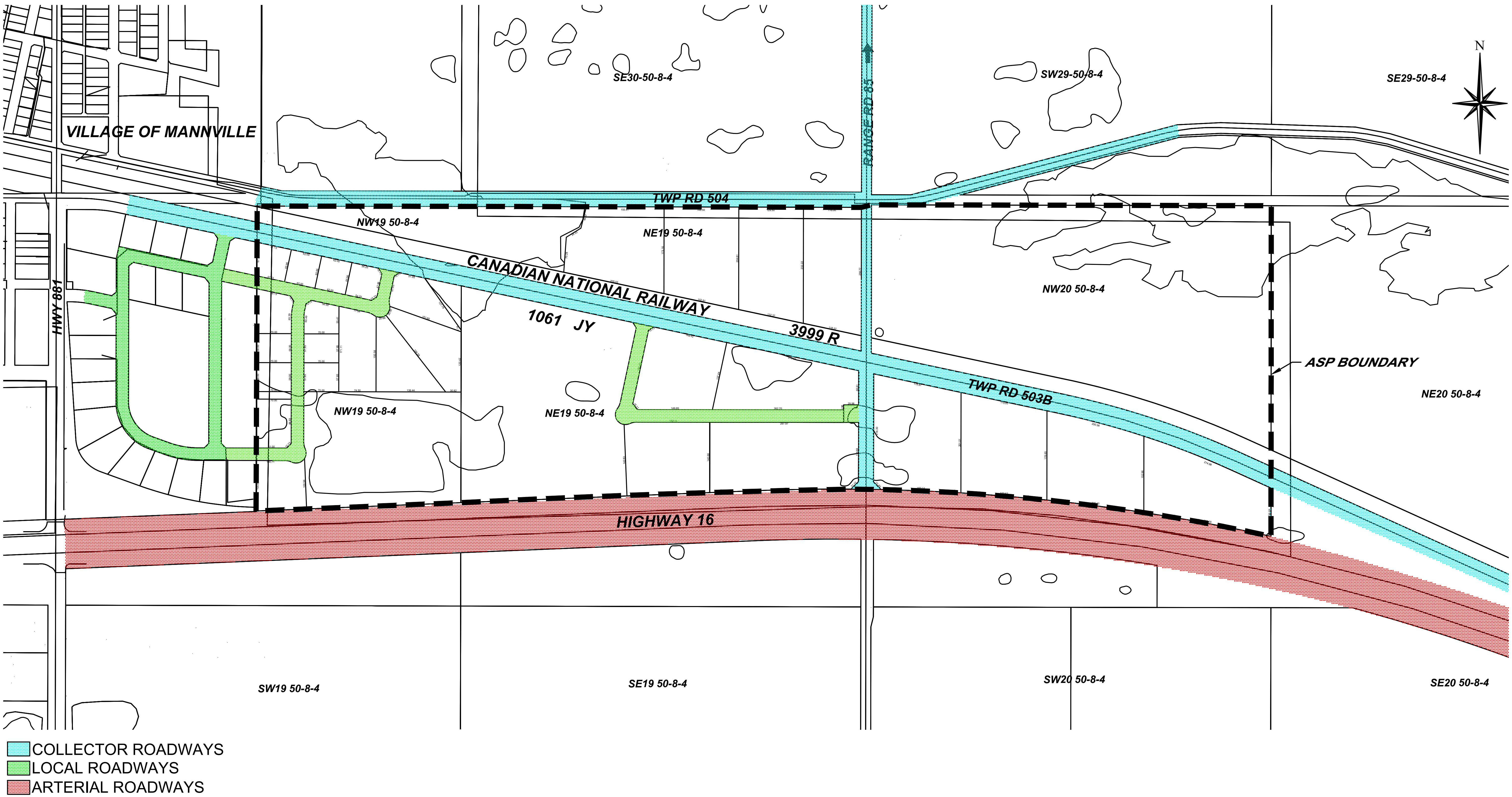

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FIGURE 3-5: TRANSPORTATION NETWORK

SERVICING BRIEF

County of Minburn No. 27, Alberta

Drawn by:	DJB	Drawing #:	Figure 3-5
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Date:	01/19/2023	Revision:	0

East Industrial Park Area Structure Plan (ASP) Stormwater Management Plan

County of Minburn No. 27

January 18, 2023 | BAR Project No.: 22MU-495300

FINAL REPORT

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5237 – 70 Avenue Lloydminster, AB T9V 3N6

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Figure 3-1: Post Development SWMP – Scenario 1
Figure 3-2: Post Development SWMP – Scenario 2

1.0 INTRODUCTION

1.1 Background

Red Willow Planning, on behalf of the County of Minburn No. 27 (County), retained BAR Engineering Co. Ltd. (BAR) to prepare a stormwater management plan (SWMP) to supplement the Area Structure Plan (ASP) for the East Industrial Park. An ASP provides the framework for decision-making regarding future subdivision of the lands, which is utilized by the Municipality and developers for development of the identified area. The SWMP outlines major overland drainage concepts, in context with the ASP and in accordance with applicable design standards and guidelines, to facilitate development of the subject lands. Refinement of the presented stormwater management concepts will occur prior to subdivision of the lands as part of the subdivision phase.

1.2 Pre-development Site Description

The East Industrial Park is located along the east boundary of the Village of Mannville (Mannville, or the Village), which encompasses the east half of the NW ¼ Section 19-50-8-W4M, the NE ¼ Section 19-50-8-W4M, and the NE ¼ Section 20-50-8-W4M. The subject ASP parcel is bounded by the Trans Canada Highway 16 to the south, the Village boundary to the west, Township Road 504 to the north and the east quarter section line of the NW ¼ Section 20-50-8-W4M. Canadian National Railway and Mannville Road (formerly Highway 2) bisect the parcel from the northwest corner to the southeast. Figure 1-1 shows the location of the ASP lands.

According to the County's Land Use Bylaw 1254-16, the existing ASP parcel districts are as follows:

- NW ¼ Section 19-50-8-W4M is zoned Direct Control,
- A small parcel in the southeast corner of the NE ¼ Section 19-50-8-W4M is zoned Rural Commercial District, and
- Remnant of the ASP area is zoned Agricultural.

LiDAR survey data, provided by the County, shows that the subject lands is split into two drainage basins with the drainage divide approximately located along Range Road 85. The NW and NE 19-50-8-W4 generally drain from the north to the south and ultimately discharge via a culvert crossing under Highway 16. Land within the NW20-50-8-W4 slopes from Highway 16 north towards Township Road 504. Figure 1-2 shows the original ground contours and general flow direction within the property.

1.3 Post Development Description

The ASP development area will be redistricted and subdivided for Rural Industrial land use. Large lot sizes are typical for rural industrial developments, which is consistent with the proposed lotting plan provided by Red Willow Planning. Proposed lot sizes range from roughly 1.00 acres to 9.97 acres as shown in Figure 1-3.

Access to the proposed Rural Industrial lots will be provided via 46 Street, 47A Avenue, Township Road 504, Township Road 503B, and Range Road 85. Local rural cross section industrial lots will be constructed within the proposed development to provide access to the internal lots.

Phasing of the ASP lands has not been identified at this time, although phasing of the development should consider logical implementation and sequencing of the overall drainage and stormwater management system. Further review and refinement of the stormwater management plan will be required at the subdivision stage once phasing has been confirmed as the development phasing may impact proposed stormwater management facility (SWMF) locations.

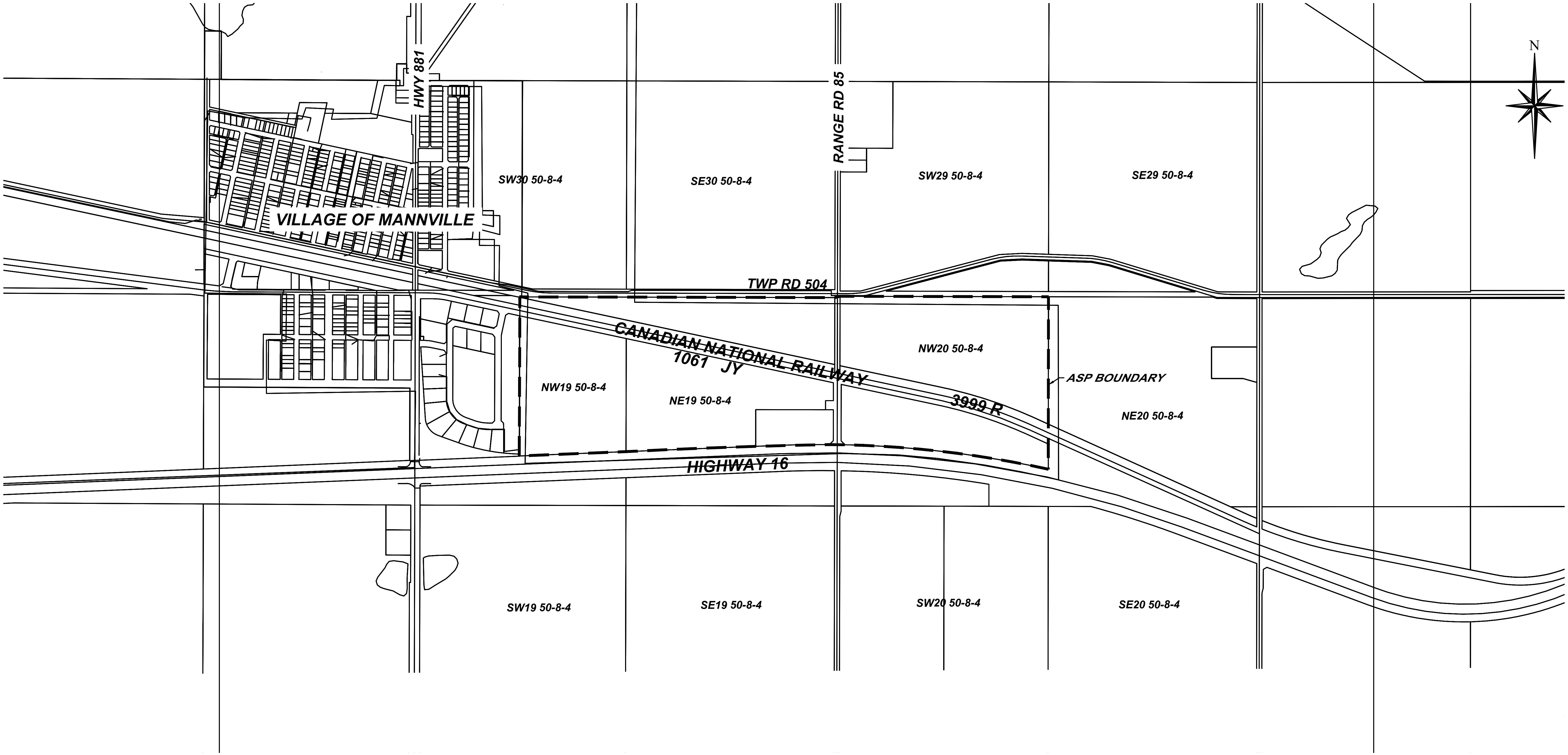

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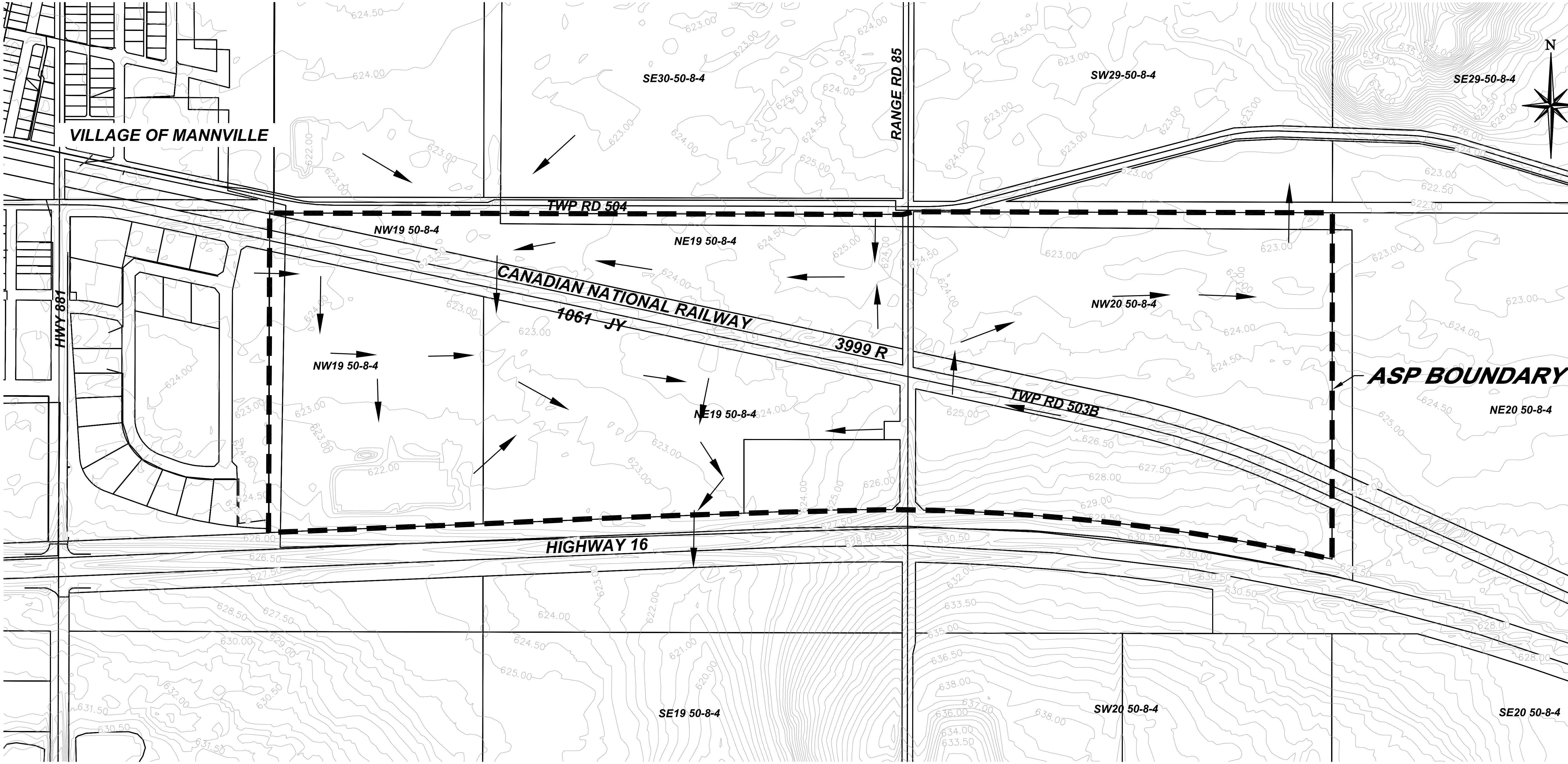
FIGURE 1-1: LOCATION PLAN

STORMWATER MANAGEMENT PLAN

County of Minburn No. 27, Alberta

Drawn by:	DJB	Drawing #:	Figure 1-1
Approved by:	CMA	Scale:	1:15000
Date:	01/16/2023	Revision:	1



FLOW DIRECTION

BAR ENGINEERING

FIGURE 1-2: PRE DEVELOPMENT DRAINAGE

STORMWATER MANAGEMENT PLAN

County of Minburn No. 27, Alberta

Drawn by: CMA	Drawing #: Figure 1-2
Approved by: SWS	Scale: 1:7500
Date: 01/16/2023	Revision: 1

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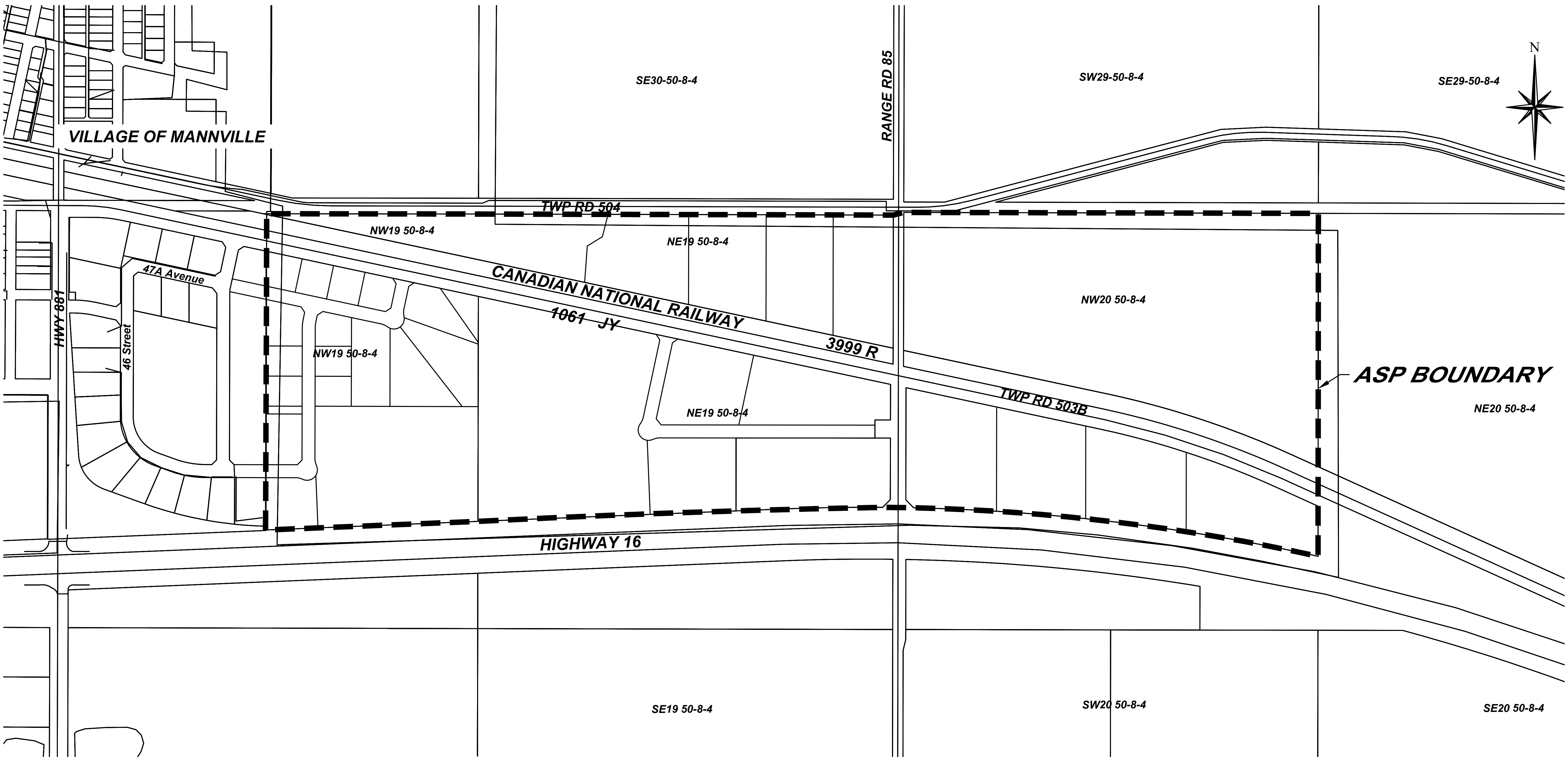

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FIGURE 1-3: DEVELOPMENT PLAN
STORMWATER MANAGEMENT PLAN
County of Minburn No. 27, Alberta

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Approved by: SWS	Scale: 1:7500
Date: 01/16/2023	Revision: 1

2.0 DESIGN CRITERIA AND METHODOLOGY

2.1 Design Standards and Assumptions

Stormwater management regulations and engineering standards have evolved over the past several decades. An approved stormwater management plan (SWMP) must address both stormwater quality and quantity aspects under today's regulations. The following design guidelines and standards were used in the development of the present stormwater management plan:

- Alberta Environment Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems, Part 5 Stormwater Management Guidelines, March 2013;

- Alberta Environment's Stormwater Management Drainage Systems Design Guidelines, January 1999; and,

- City of Edmonton Design and Construction Standards, Volume 3 Drainage, February 2022.

- Alberta Transportation Roadside Development Permits

Stormwater runoff volume and discharge rate increase with development of land due to an increase in impervious area from roads, buildings, parking lots, etc. and altering of drainage paths. Stormwater management facilities (SWMFs) are used as a best management practice (BMP) within developments for flood control by temporarily storing and restricting the release rate of stormwater runoff and to provide water quality enhancement prior to discharging to downstream water bodies and watercourses. Wet ponds are commonly used SWMFs as they provide water quality enhancement through settling of runoff pollutants within the permanent pool (dead storage) and stormwater runoff during rain events is temporarily stored above the permanent pool (live or active storage) and released downstream at a restricted rate. Alberta Environment guidelines do not specifically dictate the stormwater quantity requirements; however, they provide the following design parameters:

- 1 in 100 year storm stored within 2m above the permanent pool (alternatively, the 2m can be used to store the 1 in 25 year storm. In such cases an emergency overflow drainage system should be constructed with the capacity to carry storm runoff from the 1 in 100 year storm event to receiving streams or downstream stormwater management facilities); and,

- Detention time of 24 hours.

The 1 in 100 year 24 hour storm design parameter will be adopted for the purposes of quantity control for this SWMP.

Generally, the release rate of a SWMF is restricted to the pre development runoff rate for a parcel of land and is commonly determined using known flow data of downstream watercourses. Matching post development stormwater runoff rate to pre development will mitigate impact on downstream watercourses caused by development. Further analysis of the pre development rate will be required during future subdivision stages and prior to Water Act Application. For the purposes of this SWMP, the following typical release rates have been considered for preliminary SWMF sizing:

- 1 L/s/ha;
- 2.5 L/s/ha;

- 4 L/s/ha;
- 24-hour drawdown providing available SWMF storage equivalent to runoff from 1:5 year storm;
- 48-hour drawdown providing available SWMF storage equivalent to runoff from 1:25 year storm; and
- 96-hour drawdown providing available SWMF storage equivalent to 90% of total storage volume.

All development adjacent to Alberta Transportation highways require a minimum setback of 70m from the highway centre-line or 40m from the highway right-of-way boundary. The developer will be required to submit a Roadside Development Permit application to Alberta Transportation for the construction of all stormwater management facilities and infrastructure within 800m of the Highway 16 centerline prior to development.

2.2 Rainfall Models

The City of Edmonton Intensity, Duration and Frequency Curves (IDF Curves) were used to develop the storm events to determine the required storage of the SWMF(s). Specifically, required storage was determined using the City of Edmonton's 1:100 year 24 hour Huff distribution.

2.3 Horton's Infiltration Method

The infiltration method used in this study was the Horton Infiltration Method, which determines the rate that water seeps through the soil during a storm. This method is based on empirical data that shows that infiltration starts at an initial maximum rate and decreases exponentially to a minimum rate over the course of the rainfall event, which implies that the rate of infiltration decreases as the soil becomes saturated. The infiltration method is described by the following equation:

$$f_p = f_c + (f_o - f_c)e^{-kt}$$

Where: f_p = infiltration rate at time t (mm/hr)

k = decay rate (1/hr)

f_c = minimum equilibrium infiltration rate (mm/hr)

f_o = maximum infiltration rate (mm/hr)

The above parameters are based on soil properties and vegetation cover for any basin. For the purposes of this SWMP, it has been assumed that the soil in the study area is comprised of clay loam, lightly vegetated, and moist soil conditions.

2.4 Computer Analysis

To assist in determining runoff rates and design of the Stormwater Management Facilities, a computer model was produced. This model was created using USEPA SWMM 5.0, a dynamic rainfall-runoff simulation model developed by the U.S. Environmental Protection Agency. City of Edmonton rainfall distributions were utilized in the model as previously noted.

The post development basin parameters that were used in the computer model are provided in Table 2-1. Post development basins used a combined imperviousness of 72% for the rural industrial lots and subdivision roads, and 100% imperviousness for stormwater management facilities. The impervious area Manning's 'n' of 0.015 is typical for concrete, asphalt, or gravel surfaces and the Manning's 'n' value for pervious areas of 0.10 is typical for short natural grass. Depression storage is the depth of stormwater that is trapped in the basin due to small storage depressions. Impervious areas provide little depression storage, typically ranging in depth from 1.0 to 2.50mm. Pervious areas, like pasture and landscaping, have a much greater potential for depression storage. The Horton Infiltration parameters for the post development basins are described in Section 2.3.

Table 2-1: Basin Parameters

Parameter	Post Development
Hydraulically Connected Impervious Area: • **Rural Industrial Lots** • **Stormwater Management Facilities**	 72% 100%
Impervious Area Manning's 'n'	0.015
Pervious Area Manning's 'n'	0.10
Impervious Area Depression Storage	2.0 mm
Pervious Area Depression Storage	5.0 mm
Initial Infiltration Rate, f_o	25 mm/hr
Final Infiltration Rate, f_c	1.52 mm/hr
Decay Rate of Infiltration	4 /hr

3.0 STORMWATER MANAGEMENT

Two stormwater management scenarios have been analyzed for the ASP lands to provide flexibility for development. Scenario 1 includes an overall stormwater management system consisting of interconnected stormwater management facilities for all proposed Rural Industrial lots. The second scenario, Scenario 2, consists of a dedicated stormwater management facility for the smaller Rural Industrial lots located within the NW19-50-5-W4 along the west portion of the East Industrial Park and provision for the remaining larger Rural Industrial lots to provide on-site stormwater management storage. Further description and discussion of these two scenarios is provided in the following sections.

3.1 SWM Scenario 1

3.1.1 Post Development Drainage Patterns

The Canadian National Railway (CN Rail), bisecting the subject lands, will divide the proposed drainage into a north and south catchment. Surface runoff within the north parcel of the NE 19-50-8-W4 will be collected and conveyed via roadside ditches to a proposed dry stormwater management facility located in the northwest corner of the quarter section. The parcel of lands south of the CN Rail will also drain via roadside ditches to a proposed wet stormwater management facility located along the west side of the NE 19-50-8-W4 extending into the southeast corner of the NW19-50-8-W4. Overland flow is designed to run off from the industrial lots to the roadside ditches with minimum 2% lot grades and minimum roadside ditch grades of 0.2%. Two stormwater management facility locations have been identified as shown in Figure 3-1, however, phasing of the development could result in additional interconnected stormwater management facilities in locations best suited to the phasing of the development. It should be noted that excavated earth from the proposed stormwater management facilities would be used as engineered fill (if suitable) to construct the roadways and proposed lots.

3.1.2 Proposed Stormwater Management Facilities

A dry stormwater management facility (SWMF) has been proposed within the northwest corner of the NE19-50-8-W4 and a wet retention pond has been proposed south of the CN Rail. The dry SWMF has been proposed due to the proximity to the CN Rail, however, a wet SWMF could be accommodated pending permitting and approval by CN. Both SWMF's have been designed in accordance with Alberta Environment guidelines. The following parameters have been utilized in the SWMF design:

Dry Pond (SWMF 1)

- Interior Side Slopes: 4:1 (H:V)
- Maximum Active Storage Depth: 0.9m
- Freeboard Depth: 0.3m

Wet Pond (SWMF 2)

- Interior Side Slopes:
  - 7:1 (H:V) from 1m below normal water level (NWL) to the high water level (HWL)
  - 3:1 (H:V) side slopes from the pond bottom to 1m below NWL.
- Maximum Active Storage Depth: 0.6m
- Freeboard Depth: 0.6m

Maximum Release Rates

- 83.2 L/s (1 L/s/ha for the 83.2 ha development area)
- 208 L/s (2.5 L/s/ha for the 83.2 ha development area)

- 332.8 L/s (4 L/s/ha for the 83.2 ha development area)
- 409 L/s (96-hour drawdown providing SWMF storage equivalent to 90% of total volume)
- 508 L/s (48-hour drawdown providing SWMF storage equivalent to the 1:25 year runoff)
- 436 L/s (24-hour drawdown providing SWMF storage equivalent to the 1:5 year runoff)

The SWMF dead storage within a wet retention pond is the volume of water that is permanently stored in the pond and is the storage depth measured from the NWL to the pond bottom. Alberta Environment guidelines require a minimum dead storage depth of 2.0m to mitigate vegetation growth in the pond bottom. Dead storage provides the water quality enhancement of the BMP as previously noted by allowing sediments and pollutants to settle out prior to discharging.

Proposed SWMF 1 has a catchment area of 15.7 ha, as shown in the blue hatch in Figure 3-1. Stormwater from SWMF 1 will be discharged directly to SWMF 2 via a pipe connection. It is important to note that SWMF 1 will be hydraulically connected to SWMF 2 via the pipe connection essentially creating one stormwater management facility. Table 3-1 below provides the surface area and storage volume at the pond bottom, HWL, and freeboard elevations.

Table 3-1: SWMF 1 – Design Parameters

Elevation (m)	Surface Area (m^2)	Volume (m^3)	Notes
622.30	16,900.4	0.0	Bottom
623.20	18,879.0	16,059.9	HWL
623.50	19,495.8	21,792.6	Freeboard

Stormwater runoff from an area of 67.5 ha, shown in the red hatch in Figure 3-1, will drain via roadside ditches to SWMF 2 proposed along the west side of the NE ¼ Section 19-50-8-W4M extending into the NW19-50-8-W4. The entire ASP lands will drain through SWMF 2 across Highway 16 via a stormwater control structure to the natural drainage path in the SE19-50-8-W4M at a controlled release rate providing a hydraulically connected stormwater management system for the entire East Industrial Park development. With SWMF 1 hydraulically connected to SWMF 2, the total catchment area of SWMF 2 is 83.2 ha. Table 3-2 below provides the surface area and storage volume at the pond bottom, NWL, HWL, and freeboard elevations

Table 3-2: SWMF 2 – Design Parameters

Elevation (m)	Surface Area (m^2)	Volume (m^3)	Notes
620.30	103,938.0	0.0	Bottom
622.30	120,158.0	220,775.2	NWL
622.90	127,158.0	294,971.3	HWL
623.50	134,269.0	373,342.8	Freeboard

3.1.3 SWMF Modeling Results

Computer model simulations were completed for the 100-year rainfall event at the maximum discharge rates identified in Section 3.1.2. Table 3-3 and Table 3-4 summarize the results of the simulation and includes water depth, volume, and outlet discharge as well as the orifice size determined from the computer analysis for the proposed stormwater management facilities.

Table 3-3: SWMF 1 – 24 Hour Rainfall Simulation Results

SWMF	Design Parameter	Elevation (m)	Pond Volume (m^3)	Notes
1	Freeboard	623.50	21,792.6	Varying Discharge Rates does not impact SWMF1 Storage as a result of the interconnecting pipe with SWMF2
	HWL	623.20	16,059.9	
	1:100	623.00	12,424.3	
	Pond Bottom	622.30	0	

Table 3-4: SWMF 2 – 24 Hour Rainfall Simulation Results

SWMF	Design Parameter	Elevation (m)	Pond Volume (m^3)	Peak Discharge Rate (L/s/ha)	Outlet Peak Discharge (L/s)	Orifice Size (mm)
2	Freeboard	623.50	373,342.8	N/A	N/A	N/A
	1:100	622.92	297,861.3	1	83.2	224
	HWL	622.90	294,971.3	N/A	N/A	N/A
	1:100	**622.84**	**287,984.3**	**2.5**	**208**	**366**
	1:100	622.79	280,426.3	4	332.8	480
	1:100	622.76	277,730.1	4.9	409	530
	1:100	622.76	276,721.5	5.24	436	550
	1:100	622.74	274,280.0	6.1	508	600
	NWL	622.30	220,775.2	N/A	N/A	N/A
	Pond Bottom	620.30	0	N/A	N/A	N/A

3.1.4 SWMF Drawdown

The ability of a SWMF to drawdown in a reasonable amount of time after a storm event has past is an important consideration in design to allow for available capacity within the SWMF for subsequent rainfall events. Alberta Environment does not stipulate drawdown requirements within their guidelines, however, City of Edmonton Design and Construction Standards provide the following parameters:

Time after commencing drawdown from design full level	Available volume between high water level (HWL) and NWL
24 hours	Volume equivalent to runoff from 1 in 5 year storm
48 hours	Volume equivalent to runoff from 1 in 25 year storm
96 hours	90% of total storage volume above NWL

Using a maximum release rate of 2.5 L/s/ha, the above City of Edmonton parameters are not achievable in SWMF 2. Water elevations and volumes at various times after pond drawdown has commenced are provided in Table 3-5, and Table 3-6 for the proposed SWMFs at a maximum release rate of 2.5 L/s/ha. The SWMF volumes at time 0 represents the dead storage capacity or permanent pool volume for the facility.

SWMF 1 would reach a maximum volume of 12,424.3 m^3 in 14.0 hours. At 24 hours after pond drawdown has commenced, the live storage is at 53% of maximum capacity. The pond is 90% drained 54 hours after pond drawdown has commenced.

Table 3-5: SWMF 1 Drawdown – 1:100 Year 24-Hour Storm Simulation

Time (hours)	Elevation (m)	Pond Volume (m^3)	% of Maximum Live Storage
0	622.3	0	0
14.0	623.00	12,424.3	100
38.0	622.68	6,603.7	53
68.0	622.37	1,242.4	10

SWMF 2 would reach a maximum volume of 287,984.3m^3 in 23.2 hours. At 24 hours after pond drawdown has commenced, the live storage is at 87% of maximum capacity. The pond is 90% drained 158.8 hours after pond drawdown has commenced.

Table 3-6: SWMF 2 Drawdown – 1:100 Year 24-Hour Storm Simulation

Time (hours)	Elevation (m)	Pond Volume (m^3)	% of Maximum Live Storage
0	622.3	220,775.2	0
23.2	622.84	287,984.3	100
47.2	622.77	279,123.7	87
182.0	622.35	227,139.4	10

3.1.5 Stormwater Quality

Wet retention ponds are one of Alberta Environment's best management practices for removing sediments and pollutants from stormwater runoff. Alberta Environment design criteria for stormwater quality control consider storing the volume of runoff from a 25mm 24 hour storm within the dead storage of a wet pond. This provides adequate volume for the removal of sedimentation and pollutants.

A peak elevation of 620.43m was found in SWMF 2 through computer simulation of a 25mm 24-hour storm event. This equates to a depth of 0.13m in the facility with a runoff volume of 13,242m^3, which is 6.0% of the dead storage capacity.

3.2 SWM Scenario 2

3.2.1 Post Development Drainage Patterns and Proposed SWMF

Overall drainage patterns for SWM Scenario 2 is similar to Scenario 1 with the main difference being a dedicated stormwater management facility for the smaller lots along the west boundary of the ASP lands and provision for private on-site stormwater management for the larger Rural Industrial lots as shown in Figure 3-2. In addition, stormwater from the proposed lots in the NW20-50-8-W4 will discharge north across Township Road 503B and the CN Rail to the natural discharge point in the northeast corner of the quarter section.

The proposed stormwater management facility is a wet retention pond in the NE19-50-8-W4 and has been designed in accordance with Alberta Environment guidelines. The following parameters have been utilized in the SWMF design:

Wet Pond (SWM Scenario 2 SWMF)

- Interior Side Slopes:
    - 7:1 (H:V) from 1m below normal water level (NWL) to the high water level (HWL)
    - 3:1 (H:V) side slopes from the pond bottom to 1m below NWL.
- Maximum Active Storage Depth: 0.6m
- Freeboard Depth: 0.6m
- Dead Storage Depth: 2.0m

Maximum Release Rates

- 23.1 L/s (1 L/s/ha for the 23.1 ha development area)
- 57.6 L/s (2.5 L/s/ha for the 23.1 ha development area)
- 92.4 L/s (4 L/s/ha for the 23.1 ha development area)
- 92.4 L/s (96-hour drawdown providing SWMF storage equivalent to 90% of total volume)
- 100 L/s (48-hour drawdown providing SWMF storage equivalent to the 1:25 year runoff)
- 104 L/s (24-hour drawdown providing SWMF storage equivalent to the 1:5 year runoff)

Stormwater runoff from an area of 23.1 ha, shown in the red hatch in Figure 3-2, will drain via roadside ditches to the proposed SWMF in the NW19-50-8-W4. The SWMF, and the proposed lots within the NE19-50-8-W4, will drain across Highway 16 to the natural drainage path in the SE19-50-8-W4M. Discharge from the SWMF will be controlled via a control structure at the peak release rate previously noted. Table 3-7 below provides the surface area and storage volume at the pond bottom, NWL, HWL, and freeboard elevations.

Table 3-7: SWM Scenario 2 SWMF – Design Parameters

Elevation (m)	Surface Area (m^2)	Volume (m^3)	Notes
620.30	34,177.0	0.0	Bottom
622.30	41,453.0	74,080.3	NWL
622.90	44,696.0	99,920.0	HWL
623.50	48,050.0	127,738.0	Freeboard

3.2.2 SWMF Modeling Results

Computer model simulations were completed for the 100-year rainfall event at the maximum discharge rates identified in Section 3.2.1. Table 3-8 summarize the results of the simulation and includes water depth, volume, and outlet discharge as well as the orifice size determined from the computer analysis for the proposed stormwater management facility.

Table 3-8: SWM Scenario 2 SWMF – 24 Hour Rainfall Simulation Results

Design Parameter	Elevation (m)	Pond Volume (m^3)	Peak Discharge Rate (L/s/ha)	Outlet Peak Discharge (L/s)	Orifice Size (mm)
Freeboard	623.50	127,738.0	N/A	N/A	N/A
HWL	622.90	99,920.0	N/A	N/A	N/A
1:100	622.89	99,422.0	1.0	23.1	120
1:100	**622.84**	**97,315.4**	**2.5**	**57.6**	**185**
1:100	622.79	95,024.4	4.0	92.2	250
1:100	622.78	94,712.2	4.33	100	260
1:100	622.78	94,562.3	4.51	104	265
NWL	622.30	74,080.3	N/A	N/A	N/A
Pond Bottom	620.30	0	N/A	N/A	N/A

3.2.3 SWMF Drawdown

Using a maximum release rate of 2.5 L/s/ha, the City of Edmonton SWMF drawdown parameters are not achievable for Scenario 2. Water elevations and volumes at various times after pond drawdown has commenced are provided in Table 3-9 for the proposed SWMF at a maximum release rate of 2.5 L/s/ha. The SWMF volume at time 0 represents the dead storage capacity or permanent pool volume for the facility.

The SWMF would reach a maximum volume of 97,315.4 m^3 in 22.0 hours. At 24 hours after pond drawdown has commenced, the live storage is at 83% of maximum capacity. The pond is 90% drained 166 hours after pond drawdown has commenced.

Table 3-9: SWM Scenario 2 SWMF Drawdown – 1:100 Year 24-Hour Storm Simulation

Time (hours)	Elevation (m)	Pond Volume (m^3)	% of Maximum Live Storage
0	622.30	74,080.3	0
22.0	622.84	97,315.4	100
46.0	622.75	93,316.0	83
188.0	622.36	76,403.8	10

3.2.4 Stormwater Quality

Wet retention ponds are one of Alberta Environment's best management practices for removing sediments and pollutants from stormwater runoff. Alberta Environment design criteria for stormwater quality control consider storing the volume of runoff from a 25mm 24 hour storm within the dead storage of a wet pond. This provides adequate volume for the removal of sedimentation and pollutants.

A peak elevation of 620.43m was found in the SWMF through computer simulation of a 25mm 24-hour storm event. This equates to a depth of 0.13m in the facility with a runoff volume of 4,372m^3, which is 5.9% of the dead storage capacity.

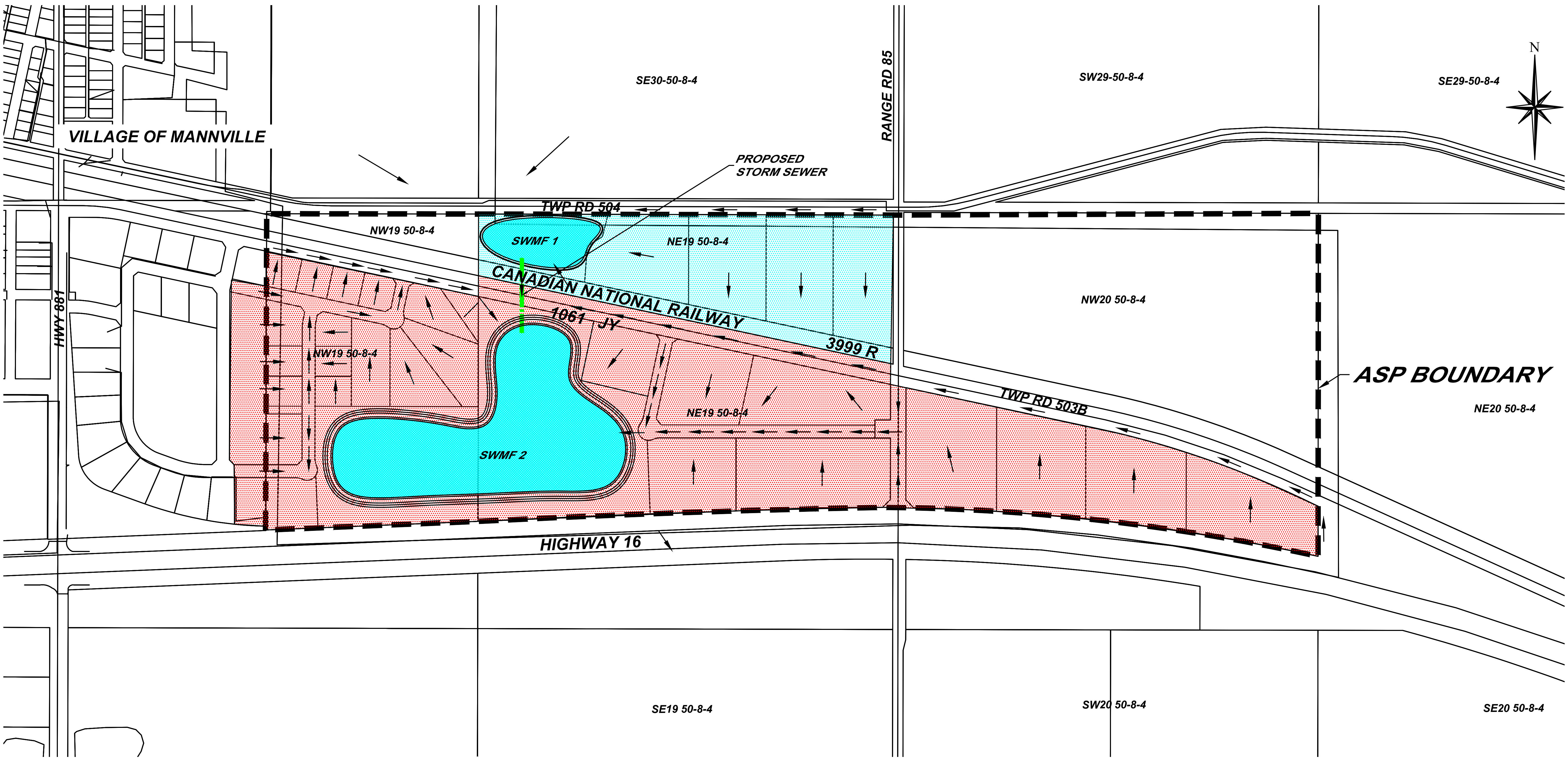
3.2.5 Private On-site Stormwater Management

Private on-site stormwater storage will be required for all Rural Industrial lots not included within the SWMF catchment area for Scenario 2 in lieu of provision of an overall SWMF to collect and control stormwater runoff. For the purposes of this SWMP, sizing of the individual lot stormwater storage requirements provided in Table 3-10 below is based on a cubic meter per acre volume using the modified Rational Method for the City of Edmonton 24 hour 1:100 year Huff storm and discharge rates of 1 L/s/ha, 2.5 L/s/ha, and 4 L/s/ha.

Table 3-10: SWM Scenario 2 – Private On-site Stormwater Management Storage

Discharge Rate (L/s/ha)	Required Storage (m^3/acre)
1.0	420
2.5	370
4.0	326

It should be noted that these storage volumes are provided for information and planning purposes only. Detailed analysis will be required to size private on-site stormwater management facilities at subdivision and Development Permit stages.



SWMF 1 CATCHMENT AREA
SWMF 2 CATCHMENT AREA

FLOW DIRECTION

NOTE: SWMF SIZES AND LOCATIONS SUBJECT TO CHANGE PENDING DETAILED DESIGN

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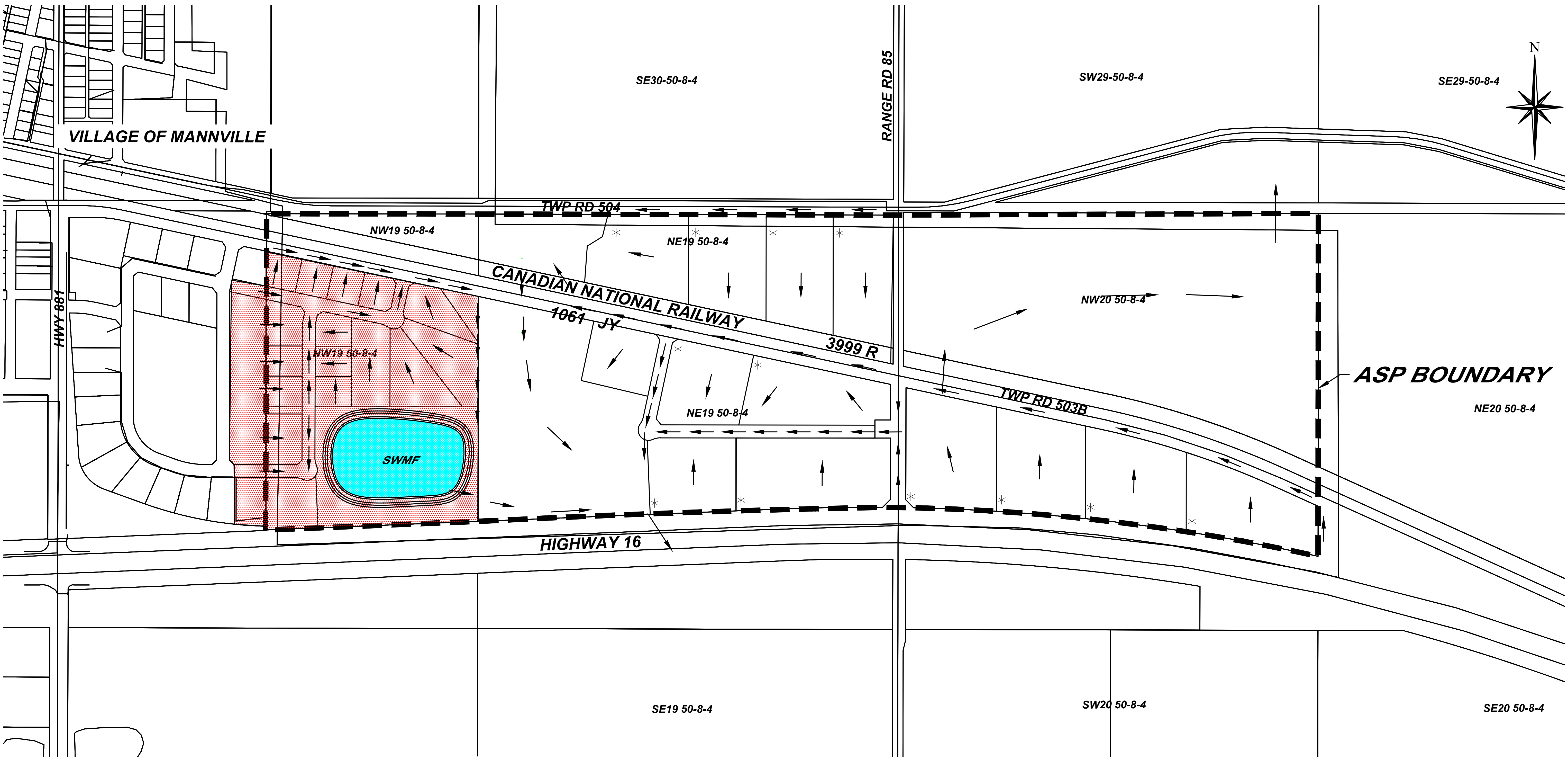
FIGURE 3-1: POST DEVELOPMENT SWMP - SCENARIO 1
SERVICING BRIEF
County of Minburn No. 27, Alberta

Drawn by:	CMA	Drawing #:	Figure 3-1
Approved by:	SWS	Scale:	1:7500
Date:	01/16/2023	Revision:	1



SWMF CATCHMENT AREA

FLOW DIRECTION

* PRIVATE ON-SITE STORMWATER MANAGEMENT REQUIRED

NOTE: SWMF SIZES AND LOCATIONS SUBJECT TO CHANGE PENDING DETAILED DESIGN

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FIGURE 3-2: POST DEVELOPMENT SWMP - SCENARIO 2

SERVICING BRIEF

County of Minburn No. 27, Alberta

Drawn by:	CMA	Drawing #:	Figure 3-2
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Drawing path: P:\Municipal\22MU-495300 RWP County of Minburn ASP\400-Drawings\Figures\SWMF\22MU-495300 - Figure 3-2 Post Development SWMP - SCENARIO 2.dwg Layout: Figure 3-3 Servicing Brief Last Saved: Jan 18, 2023 - 9:58 AM Plotted: January 18, 2023 10:01

4.0 CONCLUSIONS AND RECOMMENDATIONS

The East Industrial Park ASP area, located in the County of Minburn No. 27, consists of approximately 83.2 ha of rural industrial development. Two stormwater management scenarios have been considered for the ASP lands to provide flexibility in phasing the development. Both scenarios include ditch conveyance and stormwater management facilities to capture stormwater runoff for water quality and quantity control prior to discharging downstream to a natural drainage path. Scenario 1 consists of two SWMFs that collect stormwater runoff from all proposed Rural Industrial lots as where Scenario 2 includes one SWMF to collect runoff from the smaller Rural Industrial lots located in the NW19-50-8-W4 and provision of private on-site stormwater management for all other large Rural Industrial lots.

Consideration was given to various discharge rates in sizing of the proposed SWMFs. Further analysis of the pre-development release rate should be completed at future subdivision stages during detailed stormwater management design. Stormwater runoff simulations were undertaken for various rain events and the stormwater management facilities were sized to accommodate stormwater runoff for the 1:100 year 24-hour City of Edmonton Huff distribution.

In SWM Scenario 1, a dry stormwater management facility has been proposed within the NE19-50-8-W4M due to the proximity to the CN Rail and a wet retention pond has been designed south of the CN Rail with permanent water for enhancement of water quality by allowing sediments and pollutants to settle out in the pond prior to discharging to the downstream watercourse. Configuration of the dry stormwater management facility include 4:1 (H:V) side slopes and 0.3m freeboard depth. The wet retention pond has been designed with 7:1 (H:V) side slopes from 1m below the NWL to freeboard elevation, 3:1 (H:V) side slopes from pond bottom to NWL, minimum 0.6m freeboard depth, and 2.0m permanent pool depth.

A wet retention pond in SWM Scenario 2 has been designed south of the CN Rail within the NW19-50-8-W4. Similar to Scenario 1, configuration of the wet retention pond has been designed with 7:1 (H:V) side slopes from 1m below the NWL to freeboard elevation, 3:1 (H:V) side slopes from pond bottom to NWL, minimum 0.6m freeboard depth, and 2.0m permanent pool depth. Private on-site stormwater management storage volumes has been provided for various release rates on a per acre basis. Confirmation of sizing will be required during future subdivision and development permit stages.

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F

Appendix F

Stormwater Management Plan

Does not form part of this Bylaw.

Prepared by: BAR Engineering

East Industrial Park
Area Structure Plan (ASP)
Stormwater Management Plan

County of Minburn No. 27

January 18, 2023 | BAR Project No.: 22MU-495300

FINAL REPORT

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TABLE OF

CONTENTS

Figures

1.0 INTRODUCTION

1.1 Background

Red Willow Planning, on behalf of the County of Minburn No. 27 (County), retained BAR Engineering Co. Ltd. (BAR) to prepare a stormwater management plan (SWMP) to supplement the Area Structure Plan (ASP) for the East Industrial Park. An ASP provides the framework for decision-making regarding future subdivision of the lands, which is utilized by the Municipality and developers for development of the identified area. The SWMP outlines major overland drainage concepts, in context with the ASP and in accordance with applicable design standards and guidelines, to facilitate development of the subject lands. Refinement of the presented stormwater management concepts will occur prior to subdivision of the lands as part of the subdivision phase.

1.2 Pre-development Site Description

The East Industrial Park is located along the east boundary of the Village of Mannville (Mannville, or the Village), which encompasses the east half of the NW ¼ Section 19-50-8-W4M, the NE ¼ Section 19-50-8-W4M, and the NE ¼ Section 20-50-8-W4M. The subject ASP parcel is bounded by the Trans Canada Highway 16 to the south, the Village boundary to the west, Township Road 504 to the north and the east quarter section line of the NW ¼ Section 20-50-8-W4M. Canadian National Railway and Mannville Road (formerly Highway 2) bisect the parcel from the northwest corner to the southeast. Figure 1-1 shows the location of the ASP lands.

According to the County's Land Use Bylaw 1254-16, the existing ASP parcel districts are as follows:

- NW ¼ Section 19-50-8-W4M is zoned Direct Control,
- A small parcel in the southeast corner of the NE ¼ Section 19-50-8-W4M is zoned Rural Commercial District, and
- Remnant of the ASP area is zoned Agricultural.

LiDAR survey data, provided by the County, shows that the subject lands is split into two drainage basins with the drainage divide approximately located along Range Road 85. The NW and NE 19-50-8-W4 generally drain from the north to the south and ultimately discharge via a culvert crossing under Highway 16. Land within the NW20-50-8-W4 slopes from Highway 16 north towards Township Road 504. Figure 1-2 shows the original ground contours and general flow direction within the property.

1.3 Post Development Description

The ASP development area will be redistricted and subdivided for Rural Industrial land use. Large lot sizes are typical for rural industrial developments, which is consistent with the proposed lotting plan provided by Red Willow Planning. Proposed lot sizes range from roughly 1.00 acres to 9.97 acres as shown in Figure 1-3.

Access to the proposed Rural Industrial lots will be provided via 46 Street, 47A Avenue, Township Road 504, Township Road 503B, and Range Road 85. Local rural cross section industrial lots will be constructed within the proposed development to provide access to the internal lots.

Phasing of the ASP lands has not been identified at this time, although phasing of the development should consider logical implementation and sequencing of the overall drainage and stormwater management system. Further review and refinement of the stormwater management plan will be required at the subdivision stage once phasing has been confirmed as the development phasing may impact proposed stormwater management facility (SWMF) locations.

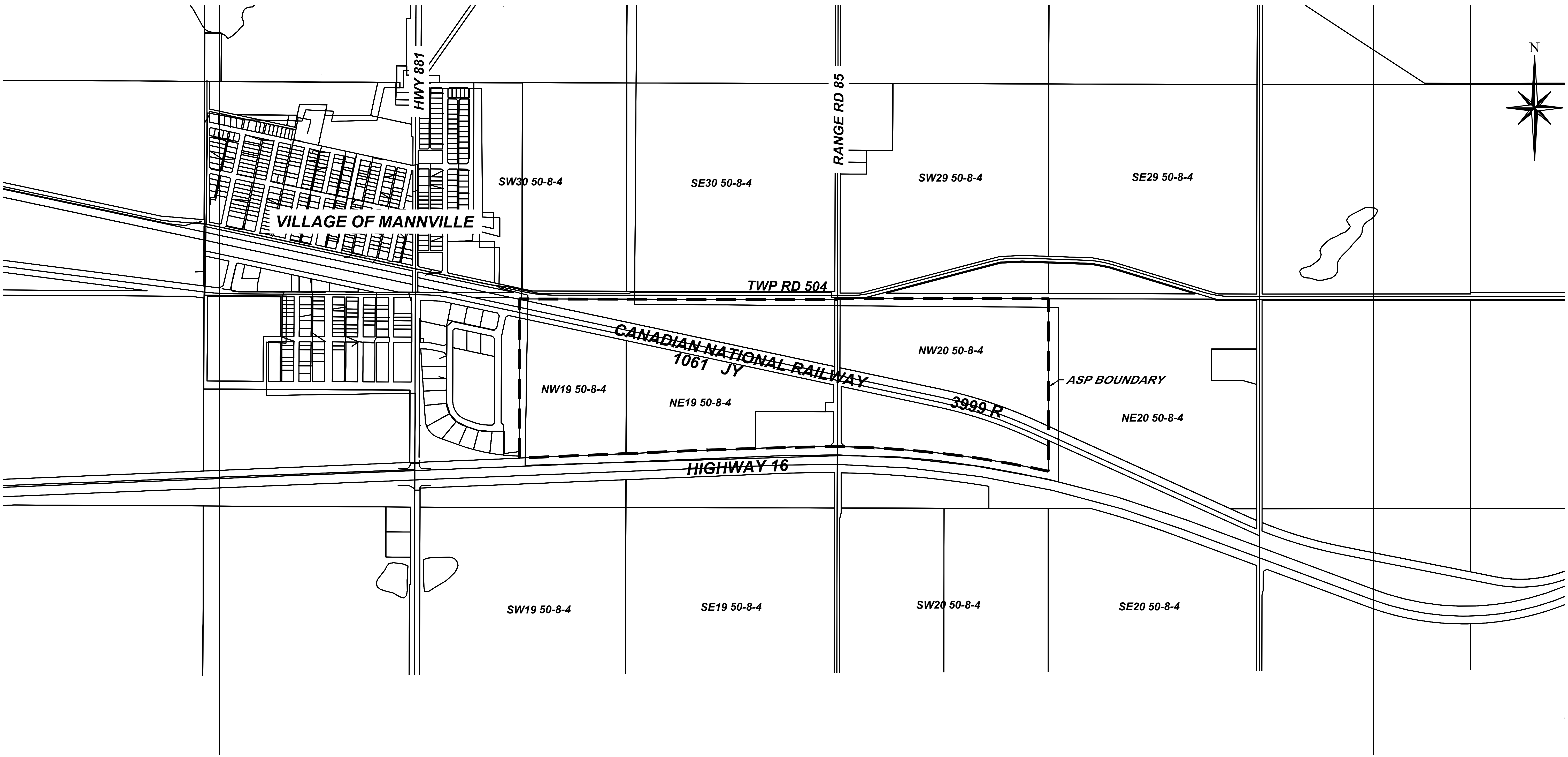

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FIGURE 1-1: LOCATION PLAN

STORMWATER MANAGEMENT PLAN

County of Minburn No. 27, Alberta

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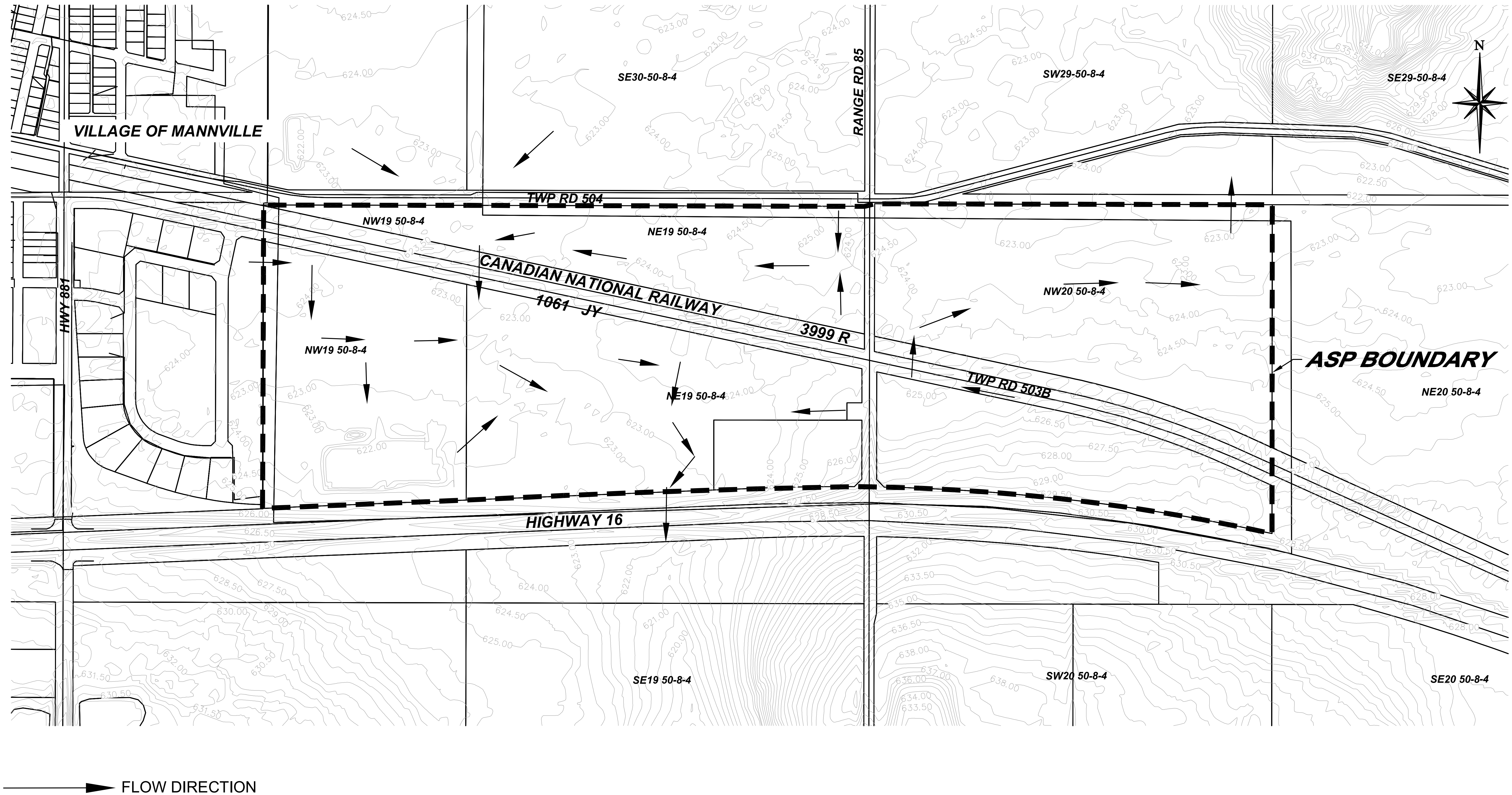

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FIGURE 1-2: PRE DEVELOPMENT DRAINAGE

STORMWATER MANAGEMENT PLAN

County of Minburn No. 27, Alberta

Drawn by:	CMA	Drawing #:	Figure 1-2
Approved by:	SWS	Scale:	1:7500
Date:	01/16/2023	Revision:	1

Drawing path: P:\Municipal\22MU-495300 RWP County of Minburn ASP\400-Drawings\Figures\SWMF\22MU-495300 - Figure 1-3 Development Drainage.dwg Layout: Figure 1-3 Last Saved: Jan 18, 2023 - 9:37 AM Plotted: January 18, 2023 10:01:51 AM

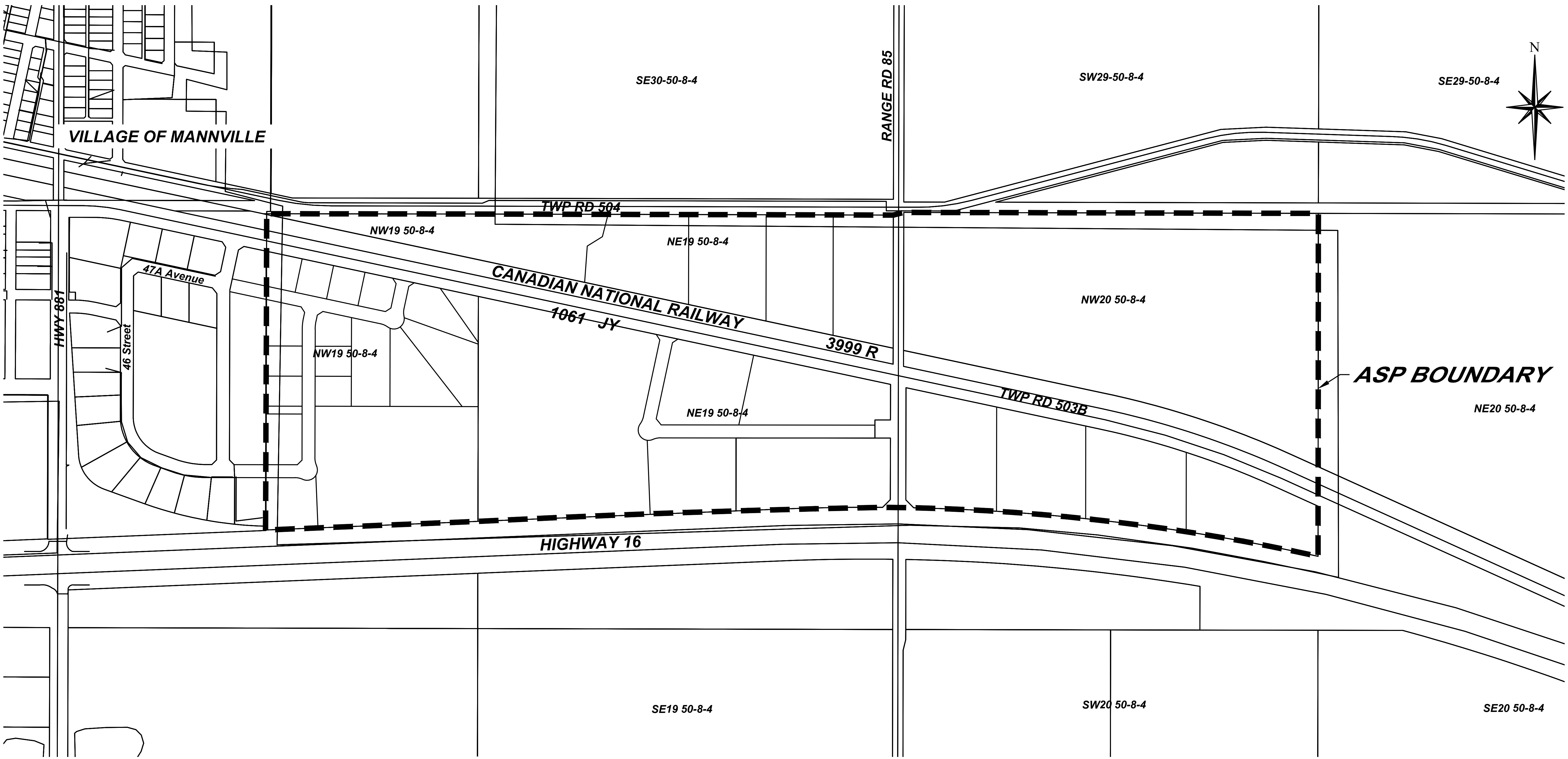

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FIGURE 1-3: DEVELOPMENT PLAN
STORMWATER MANAGEMENT PLAN
County of Minburn No. 27, Alberta

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2.0 DESIGN CRITERIA AND METHODOLOGY

2.1 Design Standards and Assumptions

Stormwater management regulations and engineering standards have evolved over the past several decades. An approved stormwater management plan (SWMP) must address both stormwater quality and quantity aspects under today's regulations. The following design guidelines and standards were used in the development of the present stormwater management plan:

- Alberta Environment Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems, Part 5 Stormwater Management Guidelines, March 2013;

- Alberta Environment's Stormwater Management Drainage Systems Design Guidelines, January 1999; and,

- City of Edmonton Design and Construction Standards, Volume 3 Drainage, February 2022.

- Alberta Transportation Roadside Development Permits

Stormwater runoff volume and discharge rate increase with development of land due to an increase in impervious area from roads, buildings, parking lots, etc. and altering of drainage paths. Stormwater management facilities (SWMFs) are used as a best management practice (BMP) within developments for flood control by temporarily storing and restricting the release rate of stormwater runoff and to provide water quality enhancement prior to discharging to downstream water bodies and watercourses. Wet ponds are commonly used SWMFs as they provide water quality enhancement through settling of runoff pollutants within the permanent pool (dead storage) and stormwater runoff during rain events is temporarily stored above the permanent pool (live or active storage) and released downstream at a restricted rate. Alberta Environment guidelines do not specifically dictate the stormwater quantity requirements; however, they provide the following design parameters:

- 1 in 100 year storm stored within 2m above the permanent pool (alternatively, the 2m can be used to store the 1 in 25 year storm. In such cases an emergency overflow drainage system should be constructed with the capacity to carry storm runoff from the 1 in 100 year storm event to receiving streams or downstream stormwater management facilities); and,

- Detention time of 24 hours.

The 1 in 100 year 24 hour storm design parameter will be adopted for the purposes of quantity control for this SWMP.

Generally, the release rate of a SWMF is restricted to the pre development runoff rate for a parcel of land and is commonly determined using known flow data of downstream watercourses. Matching post development stormwater runoff rate to pre development will mitigate impact on downstream watercourses caused by development. Further analysis of the pre development rate will be required during future subdivision stages and prior to Water Act Application. For the purposes of this SWMP, the following typical release rates have been considered for preliminary SWMF sizing:

- 1 L/s/ha;
- 2.5 L/s/ha;

- 4 L/s/ha;
- 24-hour drawdown providing available SWMF storage equivalent to runoff from 1:5 year storm;
- 48-hour drawdown providing available SWMF storage equivalent to runoff from 1:25 year storm; and
- 96-hour drawdown providing available SWMF storage equivalent to 90% of total storage volume.

All development adjacent to Alberta Transportation highways require a minimum setback of 70m from the highway centre-line or 40m from the highway right-of-way boundary. The developer will be required to submit a Roadside Development Permit application to Alberta Transportation for the construction of all stormwater management facilities and infrastructure within 800m of the Highway 16 centerline prior to development.

2.2 Rainfall Models

The City of Edmonton Intensity, Duration and Frequency Curves (IDF Curves) were used to develop the storm events to determine the required storage of the SWMF(s). Specifically, required storage was determined using the City of Edmonton's 1:100 year 24 hour Huff distribution.

2.3 Horton's Infiltration Method

The infiltration method used in this study was the Horton Infiltration Method, which determines the rate that water seeps through the soil during a storm. This method is based on empirical data that shows that infiltration starts at an initial maximum rate and decreases exponentially to a minimum rate over the course of the rainfall event, which implies that the rate of infiltration decreases as the soil becomes saturated. The infiltration method is described by the following equation:

$$f_p = f_c + (f_o - f_c)e^{-kt}$$

Where: f_p = infiltration rate at time t (mm/hr)

k = decay rate (1/hr)

f_c = minimum equilibrium infiltration rate (mm/hr)

f_o = maximum infiltration rate (mm/hr)

The above parameters are based on soil properties and vegetation cover for any basin. For the purposes of this SWMP, it has been assumed that the soil in the study area is comprised of clay loam, lightly vegetated, and moist soil conditions.

2.4 Computer Analysis

To assist in determining runoff rates and design of the Stormwater Management Facilities, a computer model was produced. This model was created using USEPA SWMM 5.0, a dynamic rainfall-runoff simulation model developed by the U.S. Environmental Protection Agency. City of Edmonton rainfall distributions were utilized in the model as previously noted.

The post development basin parameters that were used in the computer model are provided in Table 2-1. Post development basins used a combined imperviousness of 72% for the rural industrial lots and subdivision roads, and 100% imperviousness for stormwater management facilities. The impervious area Manning's 'n' of 0.015 is typical for concrete, asphalt, or gravel surfaces and the Manning's 'n' value for pervious areas of 0.10 is typical for short natural grass. Depression storage is the depth of stormwater that is trapped in the basin due to small storage depressions. Impervious areas provide little depression storage, typically ranging in depth from 1.0 to 2.50mm. Pervious areas, like pasture and landscaping, have a much greater potential for depression storage. The Horton Infiltration parameters for the post development basins are described in Section 2.3.

Table 2-1: Basin Parameters

Parameter	Post Development
Hydraulically Connected Impervious Area: • **Rural Industrial Lots** • **Stormwater Management Facilities**	 72% 100%
Impervious Area Manning's 'n'	0.015
Pervious Area Manning's 'n'	0.10
Impervious Area Depression Storage	2.0 mm
Pervious Area Depression Storage	5.0 mm
Initial Infiltration Rate, f_o	25 mm/hr
Final Infiltration Rate, f_c	1.52 mm/hr
Decay Rate of Infiltration	4 /hr

3.0 STORMWATER MANAGEMENT

Two stormwater management scenarios have been analyzed for the ASP lands to provide flexibility for development. Scenario 1 includes an overall stormwater management system consisting of interconnected stormwater management facilities for all proposed Rural Industrial lots. The second scenario, Scenario 2, consists of a dedicated stormwater management facility for the smaller Rural Industrial lots located within the NW19-50-5-W4 along the west portion of the East Industrial Park and provision for the remaining larger Rural Industrial lots to provide on-site stormwater management storage. Further description and discussion of these two scenarios is provided in the following sections.

3.1 SWM Scenario 1

3.1.1 Post Development Drainage Patterns

The Canadian National Railway (CN Rail), bisecting the subject lands, will divide the proposed drainage into a north and south catchment. Surface runoff within the north parcel of the NE 19-50-8-W4 will be collected and conveyed via roadside ditches to a proposed dry stormwater management facility located in the northwest corner of the quarter section. The parcel of lands south of the CN Rail will also drain via roadside ditches to a proposed wet stormwater management facility located along the west side of the NE 19-50-8-W4 extending into the southeast corner of the NW19-50-8-W4. Overland flow is designed to run off from the industrial lots to the roadside ditches with minimum 2% lot grades and minimum roadside ditch grades of 0.2%. Two stormwater management facility locations have been identified as shown in Figure 3-1, however, phasing of the development could result in additional interconnected stormwater management facilities in locations best suited to the phasing of the development. It should be noted that excavated earth from the proposed stormwater management facilities would be used as engineered fill (if suitable) to construct the roadways and proposed lots.

3.1.2 Proposed Stormwater Management Facilities

A dry stormwater management facility (SWMF) has been proposed within the northwest corner of the NE19-50-8-W4 and a wet retention pond has been proposed south of the CN Rail. The dry SWMF has been proposed due to the proximity to the CN Rail, however, a wet SWMF could be accommodated pending permitting and approval by CN. Both SWMF's have been designed in accordance with Alberta Environment guidelines. The following parameters have been utilized in the SWMF design:

Dry Pond (SWMF 1)

- Interior Side Slopes: 4:1 (H:V)
- Maximum Active Storage Depth: 0.9m
- Freeboard Depth: 0.3m

Wet Pond (SWMF 2)

- Interior Side Slopes:
    - 7:1 (H:V) from 1m below normal water level (NWL) to the high water level (HWL)
    - 3:1 (H:V) side slopes from the pond bottom to 1m below NWL.
- Maximum Active Storage Depth: 0.6m
- Freeboard Depth: 0.6m

Maximum Release Rates

- 83.2 L/s (1 L/s/ha for the 83.2 ha development area)
- 208 L/s (2.5 L/s/ha for the 83.2 ha development area)

- 332.8 L/s (4 L/s/ha for the 83.2 ha development area)
- 409 L/s (96-hour drawdown providing SWMF storage equivalent to 90% of total volume)
- 508 L/s (48-hour drawdown providing SWMF storage equivalent to the 1:25 year runoff)
- 436 L/s (24-hour drawdown providing SWMF storage equivalent to the 1:5 year runoff)

The SWMF dead storage within a wet retention pond is the volume of water that is permanently stored in the pond and is the storage depth measured from the NWL to the pond bottom. Alberta Environment guidelines require a minimum dead storage depth of 2.0m to mitigate vegetation growth in the pond bottom. Dead storage provides the water quality enhancement of the BMP as previously noted by allowing sediments and pollutants to settle out prior to discharging.

Proposed SWMF 1 has a catchment area of 15.7 ha, as shown in the blue hatch in Figure 3-1. Stormwater from SWMF 1 will be discharged directly to SWMF 2 via a pipe connection. It is important to note that SWMF 1 will be hydraulically connected to SWMF 2 via the pipe connection essentially creating one stormwater management facility. Table 3-1 below provides the surface area and storage volume at the pond bottom, HWL, and freeboard elevations.

Table 3-1: SWMF 1 – Design Parameters

Elevation (m)	Surface Area (m^2)	Volume (m^3)	Notes
622.30	16,900.4	0.0	Bottom
623.20	18,879.0	16,059.9	HWL
623.50	19,495.8	21,792.6	Freeboard

Stormwater runoff from an area of 67.5 ha, shown in the red hatch in Figure 3-1, will drain via roadside ditches to SWMF 2 proposed along the west side of the NE ¼ Section 19-50-8-W4M extending into the NW19-50-8-W4. The entire ASP lands will drain through SWMF 2 across Highway 16 via a stormwater control structure to the natural drainage path in the SE19-50-8-W4M at a controlled release rate providing a hydraulically connected stormwater management system for the entire East Industrial Park development. With SWMF 1 hydraulically connected to SWMF 2, the total catchment area of SWMF 2 is 83.2 ha. Table 3-2 below provides the surface area and storage volume at the pond bottom, NWL, HWL, and freeboard elevations

Table 3-2: SWMF 2 – Design Parameters

Elevation (m)	Surface Area (m^2)	Volume (m^3)	Notes
620.30	103,938.0	0.0	Bottom
622.30	120,158.0	220,775.2	NWL
622.90	127,158.0	294,971.3	HWL
623.50	134,269.0	373,342.8	Freeboard

3.1.3 SWMF Modeling Results

Computer model simulations were completed for the 100-year rainfall event at the maximum discharge rates identified in Section 3.1.2. Table 3-3 and Table 3-4 summarize the results of the simulation and includes water depth, volume, and outlet discharge as well as the orifice size determined from the computer analysis for the proposed stormwater management facilities.

Table 3-3: SWMF 1 – 24 Hour Rainfall Simulation Results

SWMF	Design Parameter	Elevation (m)	Pond Volume (m^3)	Notes
1	Freeboard	623.50	21,792.6	Varying Discharge Rates does not impact SWMF1 Storage as a result of the interconnecting pipe with SWMF2
	HWL	623.20	16,059.9	
	1:100	623.00	12,424.3	
	Pond Bottom	622.30	0	

Table 3-4: SWMF 2 – 24 Hour Rainfall Simulation Results

SWMF	Design Parameter	Elevation (m)	Pond Volume (m^3)	Peak Discharge Rate (L/s/ha)	Outlet Peak Discharge (L/s)	Orifice Size (mm)
2	Freeboard	623.50	373,342.8	N/A	N/A	N/A
	1:100	622.92	297,861.3	1	83.2	224
	HWL	622.90	294,971.3	N/A	N/A	N/A
	1:100	**622.84**	**287,984.3**	**2.5**	**208**	**366**
	1:100	622.79	280,426.3	4	332.8	480
	1:100	622.76	277,730.1	4.9	409	530
	1:100	622.76	276,721.5	5.24	436	550
	1:100	622.74	274,280.0	6.1	508	600
	NWL	622.30	220,775.2	N/A	N/A	N/A
	Pond Bottom	620.30	0	N/A	N/A	N/A

3.1.4 SWMF Drawdown

The ability of a SWMF to drawdown in a reasonable amount of time after a storm event has past is an important consideration in design to allow for available capacity within the SWMF for subsequent rainfall events. Alberta Environment does not stipulate drawdown requirements within their guidelines, however, City of Edmonton Design and Construction Standards provide the following parameters:

Time after commencing drawdown from design full level	Available volume between high water level (HWL) and NWL
24 hours	Volume equivalent to runoff from 1 in 5 year storm
48 hours	Volume equivalent to runoff from 1 in 25 year storm
96 hours	90% of total storage volume above NWL

Using a maximum release rate of 2.5 L/s/ha, the above City of Edmonton parameters are not achievable in SWMF 2. Water elevations and volumes at various times after pond drawdown has commenced are provided in Table 3-5, and Table 3-6 for the proposed SWMFs at a maximum release rate of 2.5 L/s/ha. The SWMF volumes at time 0 represents the dead storage capacity or permanent pool volume for the facility.

SWMF 1 would reach a maximum volume of 12,424.3 m^3 in 14.0 hours. At 24 hours after pond drawdown has commenced, the live storage is at 53% of maximum capacity. The pond is 90% drained 54 hours after pond drawdown has commenced.

Table 3-5: SWMF 1 Drawdown – 1:100 Year 24-Hour Storm Simulation

Time (hours)	Elevation (m)	Pond Volume (m^3)	% of Maximum Live Storage
0	622.3	0	0
14.0	623.00	12,424.3	100
38.0	622.68	6,603.7	53
68.0	622.37	1,242.4	10

SWMF 2 would reach a maximum volume of 287,984.3m^3 in 23.2 hours. At 24 hours after pond drawdown has commenced, the live storage is at 87% of maximum capacity. The pond is 90% drained 158.8 hours after pond drawdown has commenced.

Table 3-6: SWMF 2 Drawdown – 1:100 Year 24-Hour Storm Simulation

Time (hours)	Elevation (m)	Pond Volume (m^3)	% of Maximum Live Storage
0	622.3	220,775.2	0
23.2	622.84	287,984.3	100
47.2	622.77	279,123.7	87
182.0	622.35	227,139.4	10

3.1.5 Stormwater Quality

Wet retention ponds are one of Alberta Environment's best management practices for removing sediments and pollutants from stormwater runoff. Alberta Environment design criteria for stormwater quality control consider storing the volume of runoff from a 25mm 24 hour storm within the dead storage of a wet pond. This provides adequate volume for the removal of sedimentation and pollutants.

A peak elevation of 620.43m was found in SWMF 2 through computer simulation of a 25mm 24-hour storm event. This equates to a depth of 0.13m in the facility with a runoff volume of 13,242m^3, which is 6.0% of the dead storage capacity.

3.2 SWM Scenario 2

3.2.1 Post Development Drainage Patterns and Proposed SWMF

Overall drainage patterns for SWM Scenario 2 is similar to Scenario 1 with the main difference being a dedicated stormwater management facility for the smaller lots along the west boundary of the ASP lands and provision for private on-site stormwater management for the larger Rural Industrial lots as shown in Figure 3-2. In addition, stormwater from the proposed lots in the NW20-50-8-W4 will discharge north across Township Road 503B and the CN Rail to the natural discharge point in the northeast corner of the quarter section.

The proposed stormwater management facility is a wet retention pond in the NE19-50-8-W4 and has been designed in accordance with Alberta Environment guidelines. The following parameters have been utilized in the SWMF design:

Wet Pond (SWM Scenario 2 SWMF)

- Interior Side Slopes:
  - 7:1 (H:V) from 1m below normal water level (NWL) to the high water level (HWL)
  - 3:1 (H:V) side slopes from the pond bottom to 1m below NWL.
- Maximum Active Storage Depth: 0.6m
- Freeboard Depth: 0.6m
- Dead Storage Depth: 2.0m

Maximum Release Rates

- 23.1 L/s (1 L/s/ha for the 23.1 ha development area)
- 57.6 L/s (2.5 L/s/ha for the 23.1 ha development area)
- 92.4 L/s (4 L/s/ha for the 23.1 ha development area)
- 92.4 L/s (96-hour drawdown providing SWMF storage equivalent to 90% of total volume)
- 100 L/s (48-hour drawdown providing SWMF storage equivalent to the 1:25 year runoff)
- 104 L/s (24-hour drawdown providing SWMF storage equivalent to the 1:5 year runoff)

Stormwater runoff from an area of 23.1 ha, shown in the red hatch in Figure 3-2, will drain via roadside ditches to the proposed SWMF in the NW19-50-8-W4. The SWMF, and the proposed lots within the NE19-50-8-W4, will drain across Highway 16 to the natural drainage path in the SE19-50-8-W4M. Discharge from the SWMF will be controlled via a control structure at the peak release rate previously noted. Table 3-7 below provides the surface area and storage volume at the pond bottom, NWL, HWL, and freeboard elevations.

Table 3-7: SWM Scenario 2 SWMF – Design Parameters

Elevation (m)	Surface Area (m^2)	Volume (m^3)	Notes
620.30	34,177.0	0.0	Bottom
622.30	41,453.0	74,080.3	NWL
622.90	44,696.0	99,920.0	HWL
623.50	48,050.0	127,738.0	Freeboard

3.2.2 SWMF Modeling Results

Computer model simulations were completed for the 100-year rainfall event at the maximum discharge rates identified in Section 3.2.1. Table 3-8 summarize the results of the simulation and includes water depth, volume, and outlet discharge as well as the orifice size determined from the computer analysis for the proposed stormwater management facility.

Table 3-8: SWM Scenario 2 SWMF – 24 Hour Rainfall Simulation Results

Design Parameter	Elevation (m)	Pond Volume (m^3)	Peak Discharge Rate (L/s/ha)	Outlet Peak Discharge (L/s)	Orifice Size (mm)
Freeboard	623.50	127,738.0	N/A	N/A	N/A
HWL	622.90	99,920.0	N/A	N/A	N/A
1:100	622.89	99,422.0	1.0	23.1	120
1:100	**622.84**	**97,315.4**	**2.5**	**57.6**	**185**
1:100	622.79	95,024.4	4.0	92.2	250
1:100	622.78	94,712.2	4.33	100	260
1:100	622.78	94,562.3	4.51	104	265
NWL	622.30	74,080.3	N/A	N/A	N/A
Pond Bottom	620.30	0	N/A	N/A	N/A

3.2.3 SWMF Drawdown

Using a maximum release rate of 2.5 L/s/ha, the City of Edmonton SWMF drawdown parameters are not achievable for Scenario 2. Water elevations and volumes at various times after pond drawdown has commenced are provided in Table 3-9 for the proposed SWMF at a maximum release rate of 2.5 L/s/ha. The SWMF volume at time 0 represents the dead storage capacity or permanent pool volume for the facility.

The SWMF would reach a maximum volume of 97,315.4 m^3 in 22.0 hours. At 24 hours after pond drawdown has commenced, the live storage is at 83% of maximum capacity. The pond is 90% drained 166 hours after pond drawdown has commenced.

Table 3-9: SWM Scenario 2 SWMF Drawdown – 1:100 Year 24-Hour Storm Simulation

Time (hours)	Elevation (m)	Pond Volume (m^3)	% of Maximum Live Storage
0	622.30	74,080.3	0
22.0	622.84	97,315.4	100
46.0	622.75	93,316.0	83
188.0	622.36	76,403.8	10

3.2.4 Stormwater Quality

Wet retention ponds are one of Alberta Environment's best management practices for removing sediments and pollutants from stormwater runoff. Alberta Environment design criteria for stormwater quality control consider storing the volume of runoff from a 25mm 24 hour storm within the dead storage of a wet pond. This provides adequate volume for the removal of sedimentation and pollutants.

A peak elevation of 620.43m was found in the SWMF through computer simulation of a 25mm 24-hour storm event. This equates to a depth of 0.13m in the facility with a runoff volume of 4,372m^3, which is 5.9% of the dead storage capacity.

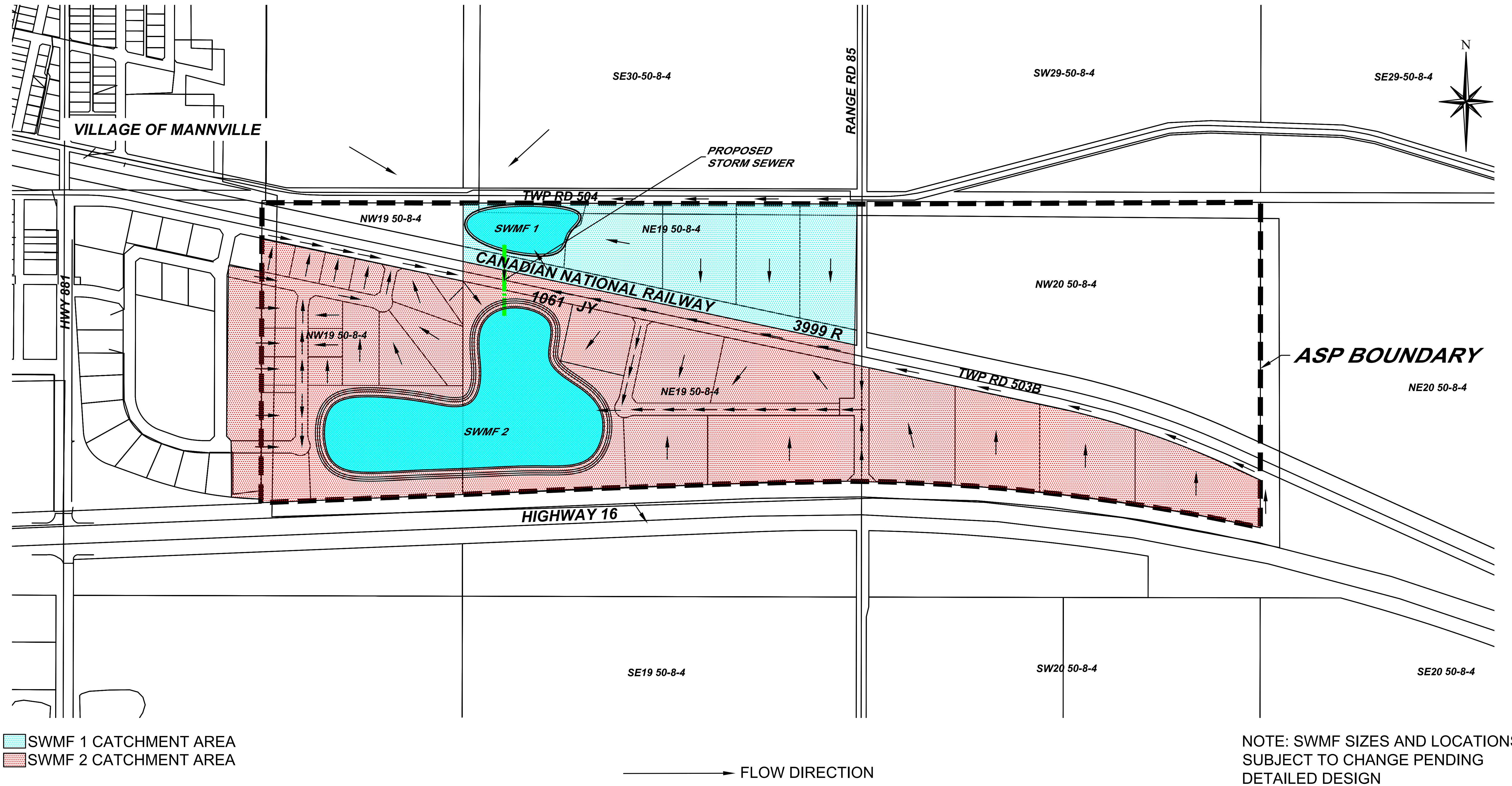
3.2.5 Private On-site Stormwater Management

Private on-site stormwater storage will be required for all Rural Industrial lots not included within the SWMF catchment area for Scenario 2 in lieu of provision of an overall SWMF to collect and control stormwater runoff. For the purposes of this SWMP, sizing of the individual lot stormwater storage requirements provided in Table 3-10 below is based on a cubic meter per acre volume using the modified Rational Method for the City of Edmonton 24 hour 1:100 year Huff storm and discharge rates of 1 L/s/ha, 2.5 L/s/ha, and 4 L/s/ha.

Table 3-10: SWM Scenario 2 – Private On-site Stormwater Management Storage

Discharge Rate (L/s/ha)	Required Storage (m^3/acre)
1.0	420
2.5	370
4.0	326

It should be noted that these storage volumes are provided for information and planning purposes only. Detailed analysis will be required to size private on-site stormwater management facilities at subdivision and Development Permit stages.



NOTE: SWMF SIZES AND LOCATIONS SUBJECT TO CHANGE PENDING DETAILED DESIGN

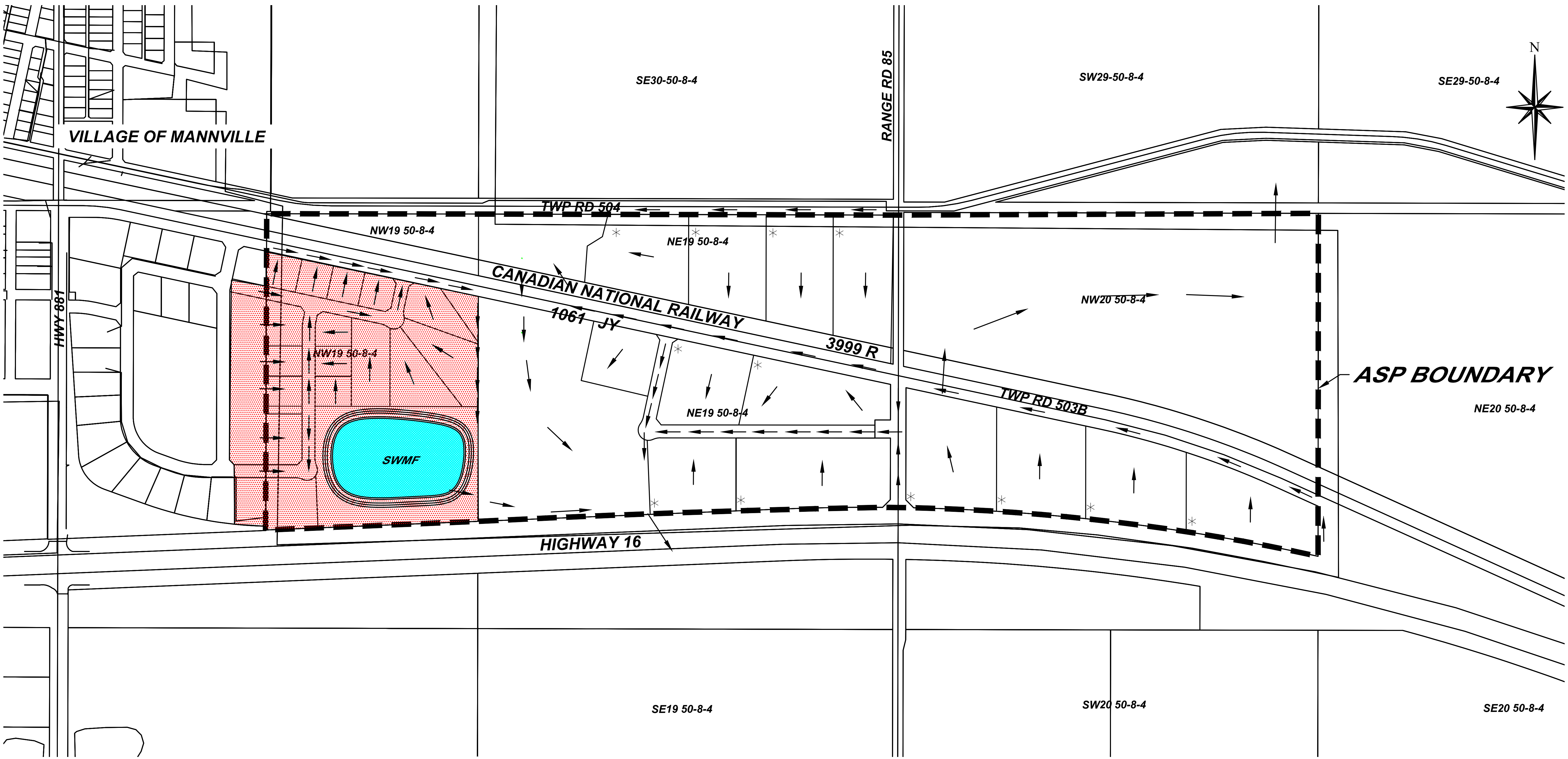
BAR ENGINEERING

FIGURE 3-1: POST DEVELOPMENT SWMP - SCENARIO 1

SERVICING BRIEF

County of Minburn No. 27, Alberta

Drawn by:	CMA	Drawing #:	Figure 3-1
Approved by:	SWS	Scale:	1:7500
Date:	01/16/2023	Revision:	1



SWMF CATCHMENT AREA

FLOW DIRECTION

* PRIVATE ON-SITE STORMWATER MANAGEMENT REQUIRED

NOTE: SWMF SIZES AND LOCATIONS SUBJECT TO CHANGE PENDING DETAILED DESIGN

BAR ENGINEERING

FIGURE 3-2: POST DEVELOPMENT SWMP - SCENARIO 2

SERVICING BRIEF

County of Minburn No. 27, Alberta

Drawn by:	CMA	Drawing #:	Figure 3-2
Approved by:	SWS	Scale:	1:7500
Date:	01/16/2023	Revision:	1

Drawing path: P:\Municipal\22MU-495300 RWP County of Minburn ASP\400-Drawings\Figures\SWMF\22MU-495300 - Figure 3-2 Post Development SWMP - SCENARIO 2.dwg Layout: Figure 3-3 Servicing Brief Last Saved: Jan 18, 2023 - 9:58 AM Plotted: January 18, 2023 10:01

4.0 CONCLUSIONS AND RECOMMENDATIONS

The East Industrial Park ASP area, located in the County of Minburn No. 27, consists of approximately 83.2 ha of rural industrial development. Two stormwater management scenarios have been considered for the ASP lands to provide flexibility in phasing the development. Both scenarios include ditch conveyance and stormwater management facilities to capture stormwater runoff for water quality and quantity control prior to discharging downstream to a natural drainage path. Scenario 1 consists of two SWMFs that collect stormwater runoff from all proposed Rural Industrial lots as where Scenario 2 includes one SWMF to collect runoff from the smaller Rural Industrial lots located in the NW19-50-8-W4 and provision of private on-site stormwater management for all other large Rural Industrial lots.

Consideration was given to various discharge rates in sizing of the proposed SWMFs. Further analysis of the pre-development release rate should be completed at future subdivision stages during detailed stormwater management design. Stormwater runoff simulations were undertaken for various rain events and the stormwater management facilities were sized to accommodate stormwater runoff for the 1:100 year 24-hour City of Edmonton Huff distribution.

In SWM Scenario 1, a dry stormwater management facility has been proposed within the NE19-50-8-W4M due to the proximity to the CN Rail and a wet retention pond has been designed south of the CN Rail with permanent water for enhancement of water quality by allowing sediments and pollutants to settle out in the pond prior to discharging to the downstream watercourse. Configuration of the dry stormwater management facility include 4:1 (H:V) side slopes and 0.3m freeboard depth. The wet retention pond has been designed with 7:1 (H:V) side slopes from 1m below the NWL to freeboard elevation, 3:1 (H:V) side slopes from pond bottom to NWL, minimum 0.6m freeboard depth, and 2.0m permanent pool depth.

A wet retention pond in SWM Scenario 2 has been designed south of the CN Rail within the NW19-50-8-W4. Similar to Scenario 1, configuration of the wet retention pond has been designed with 7:1 (H:V) side slopes from 1m below the NWL to freeboard elevation, 3:1 (H:V) side slopes from pond bottom to NWL, minimum 0.6m freeboard depth, and 2.0m permanent pool depth. Private on-site stormwater management storage volumes has been provided for various release rates on a per acre basis. Confirmation of sizing will be required during future subdivision and development permit stages.

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Reviewed By,

Caitlin Atkins, P. Eng.
Intermediate Engineer
Municipal Division

BAR ENGINEERING

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Lloydminster, AB/SK
T9V 3N6

G

Appendix G
Certificates of Title (redacted)

Does not form part of this Bylaw.

LAND TITLE CERTIFICATE

S

LINC	SHORT LEGAL	TITLE NUMBER
0035 392 456	4;8;50;19;NW,NE	132 151 036

LEGAL DESCRIPTION

MERIDIAN 4 RANGE 8 TOWNSHIP 50
SECTION 19
ALL THAT PORTION OF THE NORTH HALF
WHICH LIES NORTH EAST OF RAILWAY RIGHT OF WAY PLAN 3999R
CONTAINING 16.08 HECTARES (39.74 ACRES) MORE OR LESS
EXCEPTING THEREOUT:

		HECTARES	(ACRES)	MORE OR LESS
A) PLAN 1223892	ROAD	0.222	0.55	(N.W. 1/4)
		0.415	1.03	(N.E. 1/4)

EXCEPTING THEREOUT ALL MINES AND MINERALS
AND THE RIGHT TO WORK THE SAME

ESTATE: FEE SIMPLE

MUNICIPALITY: COUNTY OF MINBURN NO. 27

REFERENCE NUMBER: 122 322 418

REGISTERED OWNER(S)

REGISTRATION	DATE(DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
132 151 036	28/05/2013	TRANSFER OF LAND	$80,000	$80,000

OWNERS

[redacted]

AND
[redacted]
BOTH OF:
[redacted]
MANNVILLE
ALBERTA [redacted]
AS JOINT TENANTS

(CONTINUED)

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
862 005 167	09/01/1986	UTILITY RIGHT OF WAY GRANTEE - ALBERTA GOVERNMENT TELEPHONES. "N.W. PART AS DESCRIBED"
862 005 168	09/01/1986	UTILITY RIGHT OF WAY GRANTEE - ALBERTA GOVERNMENT TELEPHONES. "N.E. PART AS DESCRIBED"
902 243 518	17/08/1990	UTILITY RIGHT OF WAY GRANTEE - MINCO GAS CO-OP LTD. AS TO NE

TOTAL INSTRUMENTS: 003

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 13 DAY OF JUNE, 2023 AT 01:12 P.M.

ORDER NUMBER: 47502069

CUSTOMER FILE NUMBER:

END OF CERTIFICATE

LAND TITLE CERTIFICATE

S

LINC	SHORT LEGAL	TITLE NUMBER
0013 955 829	4;8;50;20;NW	902 244 497

LEGAL DESCRIPTION

ALL THAT PORTION OF THE NORTH WEST QUARTER OF SECTION
TWENTY (20)
TOWNSHIP FIFTY (50)
RANGE EIGHT (8)
WEST OF THE FOURTH MERIDIAN
LYING NORTH OF THE NORTH BOUNDARY OF A RAILROAD AS SHOWN
ON PLAN OF SURVEY 3999R CONTAINING 29 HECTARES
(72 ACRES) MORE OR LESS
EXCEPTING THEREOUT ALL MINES AND MINERALS

ESTATE: FEE SIMPLE

MUNICIPALITY: COUNTY OF MINBURN NO. 27

REFERENCE NUMBER: 812 191 843

REGISTERED OWNER(S)

REGISTRATION	DATE(DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
902 244 497	17/08/1990	TRANSFER OF LAND	$30,000	$1

OWNERS

[redacted]

AND

[redacted]

BOTH OF:

[redacted] [redacted]

MANNVILLE

ALBERTA [redacted]

[redacted]

(CONTINUED)

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
802 019 983	29/01/1980	CAVEAT CAVEATOR - PARAMOUNT ENERGY OPERATING CORP. ATTN: LAND MANAGER BOX 2776, STATION M CALGARY ALBERTA T2P3C2 (DATA UPDATED BY: TRANSFER OF CAVEAT 932102705) (DATA UPDATED BY: TRANSFER OF CAVEAT 932237464) (DATA UPDATED BY: CHANGE OF NAME 062264351) (DATA UPDATED BY: TRANSFER OF CAVEAT 072573424) (DATA UPDATED BY: CHANGE OF ADDRESS 082117367)
862 006 623	13/01/1986	UTILITY RIGHT OF WAY GRANTEE - ALBERTA GOVERNMENT TELEPHONES. "PART"
902 232 387	07/08/1990	UTILITY RIGHT OF WAY GRANTEE - MINCO GAS CO-OP LTD.

TOTAL INSTRUMENTS: 003

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 13 DAY OF JUNE, 2023 AT 01:14 P.M.

ORDER NUMBER: 47502101

CUSTOMER FILE NUMBER:

END OF CERTIFICATE

LAND TITLE CERTIFICATE

S

LINC	SHORT LEGAL	TITLE NUMBER
0032 011 950	0626818;1;1	082 185 488 +1

LEGAL DESCRIPTION

DESCRIPTIVE PLAN 0626818
BLOCK 1
LOT 1
EXCEPTING THEREOUT ALL MINES AND MINERALS
AREA: 13.5 HECTARES (33.36 ACRES) MORE OR LESS

ATS REFERENCE: 4;8;50;20;NW
ESTATE: FEE SIMPLE

MUNICIPALITY: COUNTY OF MINBURN NO. 27

REFERENCE NUMBER: 062 501 667

REGISTERED OWNER(S)

REGISTRATION	DATE(DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
082 185 488	02/05/2008	TRANSFER OF LAND		SEE INSTRUMENT

OWNERS

[redacted]
OF [redacted]
MANNVILLE
ALBERTA [redacted]

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
2162NI	24/05/1963	UTILITY RIGHT OF WAY GRANTEE - ALBERTA POWER LIMITED. "DATA UPDATED BY TRANSFER OF UTRW NO. 6699SQ PART"
062 501 666	02/11/2006	CAVEAT RE : ACQUISITION OF LAND CAVEATOR - THE COUNTY OF MINBURN NO. 27.

(CONTINUED)

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
		P.O. BOX 550 VEGREVILLE ALBERTA T9C1R6
062 501 668	02/11/2006	CAVEAT RE : DEFERRED RESERVE CAVEATOR - THE COUNTY OF MINBURN NO. 27. BOX 550, 4909-50 ST VEGREVILLE ALBERTA T9C1R6
082 185 489	02/05/2008	MORTGAGE MORTGAGEE - CANADIAN IMPERIAL BANK OF COMMERCE. 4940-50 AVE VERMILION ALBERTA T9X1A4 ORIGINAL PRINCIPAL AMOUNT: $140,000

TOTAL INSTRUMENTS: 004

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 13 DAY OF JUNE, 2023 AT 01:14 P.M.

ORDER NUMBER: 47502108

CUSTOMER FILE NUMBER:

END OF CERTIFICATE

LAND TITLE CERTIFICATE

S

LINC	SHORT LEGAL	TITLE NUMBER
0038 962 536	2122252;1;1	212 218 373

LEGAL DESCRIPTION
PLAN 2122252
BLOCK 1
LOT 1
EXCEPTING THEREOUT ALL MINES AND MINERALS
AREA: 4.047 HECTARES (10 ACRES) MORE OR LESS

ESTATE: FEE SIMPLE
ATS REFERENCE: 4;8;50;19;NE

MUNICIPALITY: COUNTY OF MINBURN NO. 27

REFERENCE NUMBER: 072 513 616 +1

REGISTERED OWNER(S)

REGISTRATION	DATE(DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
212 218 373	06/10/2021	SUBDIVISION PLAN		

OWNERS

[redacted]

AND

[redacted]
BOTH OF:
[redacted]
MANNVILLE
ALBERTA [redacted]
AS JOINT TENANTS

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
892 028 071	06/02/1989	UTILITY RIGHT OF WAY GRANTEE - MINCO GAS CO-OP LTD.

(CONTINUED)

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
122 419 438	20/12/2012	MORTGAGE MORTGAGEE - THE TORONTO DOMINION BANK. 500 EDMONTON CITY CENTER EAST, 10205-101 STREET, 5TH FLOOR EDMONTON ALBERTA T5J5E8 ORIGINAL PRINCIPAL AMOUNT: $410,500
162 337 294	29/11/2016	MORTGAGE MORTGAGEE - THE TORONTO DOMINION BANK. 500 EDMONTON CITY CENTRE EAST 10205- 101ST STREET, 5TH FLOOR EDMONTON ALBERTA T5J5E8 ORIGINAL PRINCIPAL AMOUNT: $410,500

TOTAL INSTRUMENTS: 003

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 13 DAY OF JUNE, 2023 AT 01:11 P.M.

ORDER NUMBER: 47502027

CUSTOMER FILE NUMBER:

END OF CERTIFICATE

LAND TITLE CERTIFICATE

S

LINC	SHORT LEGAL	TITLE NUMBER
0018 183 178	4;8;50;19;NW	072 513 616

LEGAL DESCRIPTION

ALL THAT PORTION OF THE NORTH WEST QUARTER OF SECTION NINETEEN (19)
TOWNSHIP FIFTY (50)
RANGE EIGHT (8)
WEST OF THE FOURTH MERIDIAN
WHICH LIES NORTH OF ROAD PLAN 8420925, EAST OF SUBDIVISION PLAN 8520860
AND SOUTH OF ROAD PLAN 1061JY CONTAINING 19.9 HECTARES (49.27 ACRES)
MORE OR LESS
EXCEPTING THEREOUT ALL MINES AND MINERALS
AND THE RIGHT TO WORK THE SAME

ESTATE: FEE SIMPLE

MUNICIPALITY: COUNTY OF MINBURN NO. 27

REFERENCE NUMBER: 012 072 384

REGISTERED OWNER(S)

REGISTRATION	DATE(DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
072 513 616	25/08/2007	TRANSFER OF LAND		SEE INSTRUMENT

OWNERS

[redacted]

AND

[redacted]

BOTH OF:

[redacted]

MANNVILLE

ALBERTA [redacted]

AS JOINT TENANTS

(CONTINUED)

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
390JU	20/08/1954	UTILITY RIGHT OF WAY GRANTEE - ATCO GAS AND PIPELINES LTD. 10035-105 ST EDMONTON ALBERTA T5J2V6 AS TO PORTION OR PLAN:5943HW (DATA UPDATED BY: TRANSFER OF UTILITY RIGHT OF WAY 012026215)
7748LI	20/07/1959	UTILITY RIGHT OF WAY GRANTEE - ALBERTA POWER LIMITED. AS TO PORTION OR PLAN:5943HW "DATA UPDATED BY: TRANSFER OF UTILITY RIGHT OF WAY #6699SQ"
792 136 874	15/06/1979	UTILITY RIGHT OF WAY GRANTEE - ALBERTA POWER LIMITED.
872 122 589	02/06/1987	UTILITY RIGHT OF WAY GRANTEE - THE VILLAGE OF MANNVILLE. AS TO PORTION OR PLAN:8721438
882 076 453	14/04/1988	UTILITY RIGHT OF WAY GRANTEE - ATCO GAS AND PIPELINES LTD. 10035-105 ST EDMONTON ALBERTA T5J2V6 (DATA UPDATED BY: TRANSFER OF UTILITY RIGHT OF WAY 012019921)
142 098 440	03/04/2014	DISCHARGE OF UTILITY RIGHT OF WAY 882076453 PARTIAL EXCEPT PLAN/PORTION: 8721438

TOTAL INSTRUMENTS: 006

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 13 DAY OF JUNE, 2023 AT 01:09 P.M.

ORDER NUMBER: 47501988

CUSTOMER FILE NUMBER:

END OF CERTIFICATE

(CONTINUED)

LAND TITLE CERTIFICATE

S

LINC	SHORT LEGAL	TITLE NUMBER
0038 962 544	4;8;50;19;NE	212 218 378

LEGAL DESCRIPTION

MERIDIAN 4 RANGE 8 TOWNSHIP 50
SECTION 19
ALL THAT PORTION OF THE NORTH EAST QUARTER
WHICH LIES TO THE SOUTH OF ROAD PLAN 1061JY AND NORTH OF ROAD PLAN 8420925
CONTAINING 26.6 HECTARES (65.85 ACRES) MORE OR LESS
EXCEPTING THEREOUT:

		HECTARES	(ACRES) MORE OR LESS
A) PLAN 9420258	ROAD	0.130	0.32
B) PLAN 2122252	SUBDIVISION	4.047	10.00
C) PLAN 2122253	ROAD	0.105	0.26

EXCEPTING THEREOUT ALL MINES AND MINERALS
AND THE RIGHT TO WORK THE SAME

ESTATE: FEE SIMPLE

MUNICIPALITY: COUNTY OF MINBURN NO. 27

REFERENCE NUMBER: 212 218 373 +1

REGISTERED OWNER(S)

REGISTRATION	DATE(DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
212 218 378	06/10/2021	ROAD PLAN		

OWNERS

[redacted]

AND
[redacted]
BOTH OF:
[redacted]
MANNVILLE
ALBERTA [redacted]
AS JOINT TENANTS

(CONTINUED)

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
892 028 071	06/02/1989	UTILITY RIGHT OF WAY GRANTEE - MINCO GAS CO-OP LTD.
122 419 438	20/12/2012	MORTGAGE MORTGAGEE - THE TORONTO DOMINION BANK. 500 EDMONTON CITY CENTER EAST, 10205-101 STREET, 5TH FLOOR EDMONTON ALBERTA T5J5E8 ORIGINAL PRINCIPAL AMOUNT: $410,500
162 337 294	29/11/2016	MORTGAGE MORTGAGEE - THE TORONTO DOMINION BANK. 500 EDMONTON CITY CENTRE EAST 10205- 101ST STREET, 5TH FLOOR EDMONTON ALBERTA T5J5E8 ORIGINAL PRINCIPAL AMOUNT: $410,500

TOTAL INSTRUMENTS: 003

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 13 DAY OF JUNE, 2023 AT 01:10 P.M.

ORDER NUMBER: 47502019

CUSTOMER FILE NUMBER:

END OF CERTIFICATE

LAND TITLE CERTIFICATE

S

LINC	SHORT LEGAL	TITLE NUMBER
0011 057 213	8520860;A	852 128 361

LEGAL DESCRIPTION

PLAN 8520860
BLOCK (A)
CONTAINING 22.26 HECTARES (55.01 ACRES) MORE OR LESS
EXCEPTING THEREOUT: 18.7 HECTARES (46.21 ACRES) MORE OR
LESS SUBDIVIDED UNDER PLAN 8720202
EXCEPTING THEREOUT ALL MINES AND MINERALS

ATS REFERENCE: 4;8;50;19;NW
ESTATE: FEE SIMPLE

MUNICIPALITY: VILLAGE OF MANNVILLE

REGISTERED OWNER(S)

REGISTRATION	DATE(DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
852 128 361	24/06/1985			$89,000

OWNERS

[redacted].
[redacted]

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
7748LI	20/07/1959	UTILITY RIGHT OF WAY GRANTEE - ALBERTA POWER LIMITED. "DATA UPDATED BY TRANSFER OF UTRW 6699SQ; REGISTRATION NUMBER CORRECTED" (DATA UPDATED BY: 062550759)
792 136 874	15/06/1979	UTILITY RIGHT OF WAY GRANTEE - ALBERTA POWER LIMITED.

(CONTINUED)

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
872 122 591	02/06/1987	UTILITY RIGHT OF WAY GRANTEE - THE VILLAGE OF MANNVILLE. AS TO PORTION OR PLAN:8721438
882 057 506	21/03/1988	UTILITY RIGHT OF WAY GRANTEE - ATCO GAS AND PIPELINES LTD. 10035-105 ST EDMONTON ALBERTA T5J2V6 (DATA UPDATED BY: TRANSFER OF UTILITY RIGHT OF WAY 012019911)
972 297 573	30/09/1997	CAVEAT RE : RIGHT OF WAY AGREEMENT CAVEATOR - ALBERTA POWER LIMITED. ATTENTION: LAND & PROPERTIES 10035-105 STREET EDMONTON ALBERTA T5J2V6 AGENT - LORRIE SAWCHUK
142 098 441	03/04/2014	DISCHARGE OF UTILITY RIGHT OF WAY 882057506 PARTIAL EXCEPT PLAN/PORTION: 8721438

TOTAL INSTRUMENTS: 006

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 13 DAY OF JUNE, 2023 AT 01:17 P.M.

ORDER NUMBER: 47502166

CUSTOMER FILE NUMBER:

END OF CERTIFICATE

County of Minburn No. 27

Village of Mannville

East Industrial Park
Area Structure Plan

Prepared by Red Willow Planning
All photos by Davin Gegolick