Corman Corner Agribusiness Centre

CDR APPLICATION

PREPARED FOR:
Rural Municipality of Corman Park
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1 PURPOSE

This Comprehensive Development Review (CDR) report and the supporting documentation for this proposed 77.54-acre parcel, Rural Industrial development in the Rural Municipality of Corman Park (RM) is submitted in accordance with the RM's requirements (refer to Appendix A, *Figure 1 – Area Map and Figure 2 – Legal Plan*). It provides a compilation of information relevant to the subdivision and development of a Rural Commercial/Industrial subdivision on LS.9, LS.10, LS.15 & LS.16 NE 1/4 SEC.3 - TWP.38 - RGE.6 - W3M as it pertains to social, environmental, health and economic issues. In addition, this CDR outlines the design rationale and development objectives to ensure a high-quality development.

2 PROPOSED LAND USE

The subject property, which comprises 77.54 total acres (31.38 ha), is located on the west corner of the intersection of Highways 16 and 684 (refer to *Figures 1 and 2*). The Developer is seeking approval to subdivide the property and to establish a multi-lot Rural Industrial development. The intent is to create a subdivision that fits the need for agribusiness in the area and blends in with the current agriculturally based land use. Our client, the developer of the Phase 1 portion of the development (4.50 acres of the 77.54 acres) is UFA Cooperative Ltd (UFA). UFA is a producer-owned agribusiness cooperative that serves 125,000 members across Western Canada. This approximately 4.5-acre portion will be used for the development of a site for fuel distribution, including bulk, cardlock and lubricant products. These products will be an important offering for local farmers, businesses, and residents.

The remaining lots will be sold to third party businesses and developed further by those entities.

The property is currently zoned Agricultural 1, and a rezoning will be required for the intended use (refer to *Figure 2 – Legal Plan* and *Figure 4 – Existing Land Use Plan*); under the current land use bylaw. The lands are designated as Rural Commercial/Industrial in the Partnership for Growth Official Community Plan (P4G OCP). We are making subdivision application for Phase 1 and rezoning application from D-Agricultural 1 District (DAG1) to the D-Light Industrial 1 District (DM1) for Phase 1 and DM1 (h) holding provision for the future phase(s) under the P4G Zoning Bylaw. The development will consist of 10-13 serviced lots accessed from a single road that connects to Grid Road 684, utilizing the existing approach (refer to *Figure 5 – Proposed Lot Layout*). Allowable land uses are identified in the P4G land use bylaw. Links to the P4G OCP and Zoning Bylaw are shown below:

P4G-District-Official-Community-Plan-Approved-September-24-2020_compressed.pdf (partnershipforgrowth.ca)

https://www.rmcormanpark.ca/DocumentCenter/View/3468/Draft-District-Zoning-Bylaw?bidId=

In order to demonstrate that this land use is appropriate for this location, on behalf of our client, the Developer, Hasegawa Engineering has completed code reviews, numerous analyses, and evaluation of the site for suitability for this application. These analyses are summarized in this CDR document. It provides a compilation of information relevant to the subdivision and development of a Rural Commercial/Industrial subdivision.

3 PROPOSED LAYOUT

It is proposed that the property be subdivided into 10-13 lots. The parcel is to be approximately 77.54 acres (31.38 ha). The proposed layout of these parcels is shown in *Figure 5*. This layout is the result of in-depth analysis to confirm site-specific feasibility and integration into the existing environment.

4 SUMMARY OF DEVELOPMENT

The Developer has selected this location to provide a visible, accessible, and convenient access to customers, who are drawn from throughout the region. The location is centered in an agricultural area. The lot layout is tentative and may be modified depending on market needs. The Developer will be using the site for a cardlock and bulk fuel business. Development will be serviced by a single internal roadway, to access all future parcels. The road alignment will not change and has been designed to allow for large tractor trailer trucks to be able to navigate the looped road system. There is also an easement provided to access the lands to the west in the event of additional development on those properties. Lots located in the eastern part of the development will have limited building area due to the construction restrictions from the Department of Transportation.

This CDR is submitted in conjunction with the application for discretionary use and provides the background information in support of the development proposal. A site zoning map taken from the P4G document shows the approved land uses for the site and surrounding area. *Figure 4* provides an indication of the subject property in relation to other surrounding land uses.

The development will be phased allow for access to Lot 1 as part of Phase 1 and the remainder of the lots as part of Phase 2.

5 LAND USE CONTEXT

5.1 LOCATION AND AREA

The property is located in the Corman Park – P4G District Plan Area, within the RM. It is a triangular shaped property, bounded on the northeast by Highway 16 (Yellowhead Highway), on the east by Beam Road, on the west by Highway 684, and legally described as the NE quarter section of 3-38-6-W3. It is currently comprised of cultivated farmland with pockets of treed areas. There are no buildings or building remnants on the property.

5.2 LOCATION RATIONALE

The Developer has identified this site as being conducive to local agribusiness needs and the local needs of the community. Criteria included:

- Rural location close to Saskatoon
- Adjacent to Highway 16
- Easy access to agribusiness surrounding Saskatoon
- Amenities to allow for site development

The proposed development is situated within an area that provides ready access to the provincial highway network as well as to the City of Saskatoon and will be compatible with existing land uses in the area. Based on discussions with other local businesses and realtors there is a market and need for serviced light industrial parcels in the area.

5.3 EXISTING LAND USES WITHIN THE VICINITY

This area is designated as Light Industrial or Commercial in the P4G planning document. The property is in an area that is almost entirely agricultural in nature. There are agribusinesses across Highway 16 and to the south. Other adjacent land uses include agricultural lands, a small shop to the east and a few homesteads within 1 km (refer to *Figure 4*).

5.4 LEGAL DESCRIPTION

The legal parcel description below provides the legal description that comprises the area proposed for development. Eldon Fortnum currently owns all of the land.

Table 1. Legal Parcel Description

LS 9, LS 10, LS 15 & LS 16
NE1/4 SEC 3 – TWP 38 – RGE 6 – W3M
IN RM of CORMAN PARK, No. 344

6 POLICY CONTEXT

6.1 P4G OFFICIAL COMMUNITY PLAN COMPLIANCE

The Saskatoon North Partnership for Growth ("P4G") is a regional collaboration of five partnering municipalities: the Rural Municipality of Corman Park No. 344 ("Corman Park"), the Cities of Martensville, Saskatoon and Warman, and the Town of Osler. Given the rapid growth of the region, the P4G municipalities recognized that a comprehensive approach to regional planning and servicing was needed to sustain economic prosperity, support a high quality of life, and protect the region's natural beauty, ecology, and heritage. *The Planning and Development Act, 2007* (the "Act") provides that municipalities may agree to establish a planning district which must adopt an official community plan. The P4G municipalities have agreed to form a planning district and to adopt an official community plan to address future land use development and servicing within the Rural Municipality and to provide a coordinated approach among all P4G municipalities. This document is the Official Community Plan for the Saskatoon North Partnership for Growth Planning District (the "Plan").

Table 2. P4G Official Community Plan Compliance

Item	Response
Adopted by the province in January 2022	The plan has been reviewed and the CDR has been designed to comply with these regulations
Section 4 – Economic Development	This plan meets the Economic Development objectives by a) Supporting and encouraging regional economic prosperity and entrepreneurship; b) Supporting initiatives to strengthen and diversify the regional economic base;

Item	Response
	c) Supporting efforts by the P4G municipalities, First Nations and Métis communities and economic development organizations in increasing economic opportunities in the region; and d) Enhancing the competitiveness of this undeveloped area
Proposed location designated for Rural Commercial/Industrial (light industrial DM1)	Refer to Schedule B in the P4G Official Community Plan
Public Consultation	A public notice was sent to all landowners within a 1.6 km radius and a public meeting was held on December 15th. Meeting minutes, written feedback from landowners and responses, as well as feedback from the public meeting for this process were compiled (attached in **Appendix F)**.
The following items refer to Section 14 of the Land Use Bylaw	
Item	**Response**
Section 14.3.9 – Agricultural Subdivisions in Rural Industrial Areas	As a result of this subdivision, the parcel east of Highway 16 and the residual tied parcels south of Highway 16 are considered the two building sites per quarter section.
Promote well-planned and managed industrial growth through a range of land use options.	Meets P4G projected land use and is compatible with the surrounding agricultural uses.
Promote economic development for Rural Industrial development based on industry needs, servicing availability and locational factors	The area being developed by UFA will provide a valuable service to the local community, including cardlock and bulk fuel for local famers and businesses. This service is not currently available in the general area. In addition, there will be 9 additional rural industrial lots in this development to allow for additional business growth.
Encourage Rural Industrial development to cluster in industrial parks to provide for the efficient development of rural infrastructure and community services.	This 10-13 lot development is clustered in a way to encourage efficient development.
Minimize conflicts between Rural Industrial development and other regional land uses.	The location of this site at the corner of Highway 684 and Highway 16 creates great access to the community and buffers the site from surrounding agricultural uses.
The carrying capacity of the lands proposed for development and the surrounding area based on site conditions, environmental considerations, potential impacts, and other factors that may warrant consideration in the design of the proposal are addressed.	As shown in this document, impacts to the site and environmental considerations have been evaluated. This report includes historical resource evaluation, environmental impact screening, and intrusive soil testing to evaluate conditions.
Impacts on regional drainage patterns and other regional ecological systems are minimized.	Drainage analysis has been conducted and the Water Security Agency has been consulted. No issues have been identified.
The suitability and availability of municipal and other services and infrastructure necessary to support the proposal are considered.	As described in this document, servicing for rural water, septic fields, electric, and tele-communications are available to the site.

Item	Response
The design is compatible with that of the surrounding area.	The surrounding land use has been considered in preparing this development. Public notification will also be taken to confirm compatibility.
Existing roads and infrastructure are sufficient to support the development while impacts to existing roadways and additional costs of maintenance are minimized.	Ministry of Highways has been consulted and a TIA completed. Access will not adversely affect existing infrastructure.
Nodal development is planned where key intersections of provincial highways, municipal roadways, and the Saskatoon Freeway can support access.	Ministry of Highways has been consulted and a Traffic Impact Assessment (TIA) completed. Access will not adversely affect existing infrastructure or future development of the intersection.
Lands are not prone to natural hazards.	Based on consultation with Water Security Agency, this site is not prone to flooding. The site will be designed to resist impact from other natural sources.
Lands do not have unique historical or archaeological features.	A historical or archaeological features screen for this site was conducted by the County of Corman Park. No issues were observed.
Lands do not have significant wildlife habitat.	An Environmental Impact Assessment (EIA) screening analysis was conducted, and no issues were identified.
Lands do not have high quality recreational resources;	These lands are cultivated farmland with no unique recreational features.
Surface and groundwater resources will not be impacted	Groundwater depth was assessed as part of the geotechnical analysis and is analyzed in Section 7.3
Any other costs to Corman Park associated with the development are minimized.	The Developer will be responsible for providing all improvements to facilitate this development.

6.2 P4G ZONING BYLAW COMPLIANCE: RURAL INDUSTRIAL DEVELOPMENT

Rural industrial development shall be located in areas designated as Rural Commercial/Industrial on Schedule B – District Land Use Map, and in areas that have been identified as suitable for Rural/Light (DM1) Industrial development through the detailed planning referenced in Section 14.3.1 of the Land Use Bylaw. Section 6.13 of the P4G District Zoning Bylaw sets forth the planning requirements for this land use. Section 3 General Requirements and Section 4.8 Bulk Fuel, Gas Bars, Service Stations, & Vehicle/Equipment Wash compliance have also been reviewed and compliance to these bylaws will also be met.

Section 3 consists of 31 sub-sections that address key requirements governing development in the Municipality. The CDR application has been designed to address these issues, and as further design occurs, compliance to this section will be maintained. UFA has reviewed all these requirements and this development will comply with Section 3 of the zoning bylaw. A summary of key sections that potentially apply to this site are included in Table 3. Sections that do not apply have not been included in this table.

Section 4.8 consists of 12 sub-sections and mostly focuses on building code and fire code compliance. The setback compliance to municipal and provincial standards has been addressed in this document. Specific site design to comply with this section will be performed during development permit and detailed design processes. The CDR application has been designed to address these issues and, as further design occurs, compliance to this section will be maintained. A summary of key sections that potentially apply to this site are included in Table 3. Sections that do not apply have not been included in this table.

These items are listed and addressed in Table 3 below.

Table 3. P4G Planning District Zoning Bylaw Compliance

Provision	Compliance
3.4 Clear Site Triangle	UFA has worked with Public Works and Ministry of Highways to comply with the site triangle requirements.
3.8 Design Standards	UFA will comply with these requirements.
3.10 Drainage	Refer to Section 7.7 for additional detail on the drainage analysis.
3.11 Environmental Features	The site is not adjacent to any waterways.
3.12 Fences	The only fence will be around the tank farm, and it will comply with the 2.44 m (8 ft) max height for industrial zoning districts
3.13 Hazardous Uses and Substances	UFA will comply with this section. Additional details will be provided at development permit and detailed design processes.
3.14 Landscaping	UFA will comply with these requirements.
3.15 Lighting	UFA will comply with these requirements.
3.17 Number of Principal Buildings and Uses on a Site	UFA will comply with these requirements.
3.18 Outdoor Storage	UFA will comply with these requirements.
3.19 Parking and Loading	UFA will comply with these requirements.
3.20 Projections into Required Yards	UFA will comply with these requirements.
3.21 Property Approaches	UFA will comply with these requirements.
3.22 Public Roadways	UFA will comply with these requirements.
3.23 Relocated Buildings or Structures	UFA will comply with these requirements.
3.25 Separation Distances	UFA will comply with these requirements.
3.27 Site Maintenance and Waste Disposal	UFA will comply with these requirements.
3.28 Utility Services	UFA will comply with these requirements.
3.29 Vehicle Storage	UFA will comply with these requirements.
3.30 Wastewater Treatment Systems	Refer to Section 7.6 for additional detail on the wastewater management.
3.31 Water Supply	Refer to Section 7.5 for additional detail on water supply.
4.8 Bulk Fuel, Gas Bars, Service Stations, & Vehicle/Equipment	UFA will comply with these requirements.
6.13.2 Permitted Uses Gas Bar, Service Station Warehouse Sales, Warehousing	Proposed land use complies with permitted uses.

6.13.3 Discretionary Uses Bulk Fuel Storage and Distribution	A discretionary use application will be made for Bulk fuel storage and distribution
6.13.5 Site Development Regulations a) Site area 2 acres b) Minimum frontage 20 m c) Minimum frontage setback from highway – 45 m and 20 m for local road d) Minimum side yard setback 8 m e) Minimum rear yard setback 8 m f) Maximum building height 17 m g) Maximum building/structure site coverage 60%	All lots in the development will comply with this section.
6.13.6 Supplementary Development Standards a) All waste materials or unsightly elements shall be enclosed by buildings, or screened by landscape feature, fences, or a combination thereof b) Outdoor storage of unfinished or raw materials must be screened from view from adjacent municipal roadways and public lands	All lots in the development will comply with this section.
6.13.7 Landscaping Development Standards a) A landscape buffer of not less than 4.5 m (14.8 ft) in depth throughout lying parallel to and abutting the front site line shall be provided on every site and shall be used for no purpose except landscaping and necessary driveway access to the site b) On corner lots, in addition to the landscaping required in the front yard, a landscape strip of not less than 3 m (9.8 ft) in depth throughout, which shall not be used for any purpose except landscaping.	All lots in the development will comply with this section.

6.3 SITE SPECIFIC FEASIBILITY ANALYSIS

On behalf of the Developer, Hasegawa Engineering has undertaken an in-depth analysis of existing information and materials and has conducted additional surveys, research, and analysis to compile the detailed information necessary for submission of this document. This work has included:

- Preparation of base mapping.
- Topographical survey of site.
- Geotechnical investigation (**Appendix B**).
- Environmental Impact Assessment screening analysis (**Appendix C**).
- Review of existing documents and reports, and the RM Official Community Plan and Zoning Bylaw.
- Preparation of topographic, aerial, drainage, and concept plans.

- Provision of overall servicing concept.
- Preparation of a drainage and grading plan.
- Preparation of a Traffic Impact Assessment.
- Meetings/contact with reviewing agencies, including the RM Administration and Public Works departments, Ministry of Highways and Infrastructure, SaskHealth Authority, SaskPower, SaskEnergy, SaskTel, Intervalley Water Utility, Fire Department, and licensed private sewage hauling company.

The information and findings are presented in this CDR and accompanying appendices.

7 LAND USE DESCRIPTION AND ANALYSIS

7.1 EXISTING LAND USE

7.1.1 Land Area and Use

The total land area intended for development is 77.54 acres (31.38 hectares). The current principal use of the land is cultivated agricultural land.

7.1.2 General Topography

The property proposed for development is located on lands that are characterized as level topography underlain first by 300 mm of topsoil and then clay till. The land is currently cultivated agricultural land.

The site topography is shown in *Figure 3 – Topography-Existing Conditions*. Overall runoff from the site goes from west to east. Two storm water ditches along the Highways 16 and 684 collect most of the runoff from the site. Some of the northwest of the property does flow to the east. Overall, the site is quite flat with only the northwest and western portions of the development flowing to the west.

The concept plan for this development has been developed to create a subdivision plan that is appropriate to the topography and natural features of the site. The development meets all requirements of the P4G OCP and Zoning Bylaw, as well as the provincial acts and regulations including the Planning and Development Act and Subdivision Regulations.

7.1.3 Utility Systems

The property is currently unserviced; however, the Intervalley Water Utility and, SaskPower have accessible services within 500 m of the site (refer to *Figure 7 – Proposed Servicing Plan*). SaskEnergy and SaskPower both have existing lines to the south of the property. SaskTel also has existing infrastructure located to the east of the property. Section 7.8.1 provides an overview of proposed utility servicing. Sewer services are not available at this time, but geotechnical analysis has indicated that onsite septic treatment is feasible.

7.2 DESCRIPTION OF PROPOSED DEVELOPMENT

The site plan is shown in *Figure 5*. The proposed development is described in the following sections. This design is tentative, and the lot layout could be revised depending on the market needs at the time of subdivision.

7.2.1 Lot Development and Phasing

A Plan of Proposed Subdivision (PPS) and phasing plan is attached and shown in *Figure 5*. Phase 1 will involve the subdivision of Lot 1 which is intended to be a cardlock and bulk fuel facility. It is anticipated that service for water, electrical and telecommunications will be brought to the development at the time of Phase 1 development. The remainder of the development will be completed as part of Phase 2. A breakdown of the development areas and square footage is shown in Table 4.

Table 4. Land Use Predictions

	Hectares (Acres)	**Percent of Gross Area**
Gross Total Area	31.38 ha (77.54 ac)	100%
Gross Developable Area		
Roads	5.25 ha (13.05 ac)	17%
Municipal Utility Lots	6.73 ha (16.63 ac)	21%
Developable Lots	19.37 ha (47.86 ac)	62%
Gross Protected Area		
Dalmeny Interchange Protected Area	7.07 ha (17.47 ac)	22%
Net Developable Area		
Roads	4.78 ha (11.8 ac)	15%
Municipal Utility Lots	6.73 ha 16.63 ac)	21%
Developable Lots	12.8 ha (31.6 ac)	42%
Total	**24.3 ha (60 ac)**	**78%**

An internal roadway through the subdivision will access the existing frontage road to Highway 684. In addition, a no-build buffer has been established based on setback requirements from the Ministry of Highways. This has been in conjunction with discussions with Highways to allow for future interchange development.

Due to the development being bordered by cultivated agricultural land to the west and highway corridors to the east and north, with minimal land use conflict potential, it is not anticipated that additional buffering will be necessary. There are no proposed public facilities requiring management structures, operations, maintenance, or insurance as part of this development.

7.3 GEOTECHNICAL ANALYSIS

A geotechnical investigation was undertaken on the site by ParklandGEO and is attached as **Appendix B**. The site lithology consists of 300 mm of topsoil underlain by silty sandy clay till in some areas and alternating till and sand in others. Groundwater depth is between 2.5 and 3.6 m below ground surface.

The investigation concluded that this area is generally considered suitable for the proposed development. Requirements for building foundations and flexible pavement design are consistent with industry standards in the area. The recommendations of the geotechnical report will be used for the site development, including roadways, buildings, and other structures.

The analysis also indicated that the site is suitable for onsite sewage infiltration galleries or mounds. The effluent load rate on the soil infiltrative surface was estimated using the soil texture classification method. The upper 4 m of the subsoil profile consisted of medium sandy loam, clay loam and loam with an assumed moderate shape, blocky structure. The estimated effluent loading rate will be between 13.2 to 19.5 L/day/m^2 with a specified effluent quality of 30 – 150 mg/L. For secondary treated effluent with a specified effluent quality of less than 30 mg/L, the load rate is between 30.8 and 36.6 L/day/m^2. Hydraulic linear load rates for these soils range from 43.3 – 64.1 L/day/m based on a slope of land of between 0 – 4 percent. The hydraulic loading rates and linear loading rates referenced are based on Table 13-2 and Table 13-4 from the Saskatchewan Onsite Wastewater Treatment Guide.

Any soil-based treatment requires the following:

- A minimum vertical separation of 1.5 m between the soil infiltration surface and a restricting layer for primary treated effluent.
- A minimum vertical separation of 0.9 m when receiving secondary treated effluent through a pressurized lateral distribution system.
- Adequate soil depth to achieve a 7-day effluent travel time to 2.4 m beneath the infiltration surface, or a restrictive layer, whichever is less.

Each site will require a site-specific design of the septic system if they choose to install one.

An additional geotechnical investigation will be completed and submitted for review prior to initiating Phase 2 to confirm soil characteristics in that area as well.

7.4 TRANSPORTATION

7.4.1 Access/Egress

Due to the location of this property adjacent to a major intersection, the Saskatchewan Ministry of Highways was consulted to confirm setback requirements and access points that will allow for the future development of an interchange. There have been suggestions that the Dalmeny Road and Hwy 16 intersection will be closed by a median and that traffic will only be allowed a right in/right out of the development when heading South bound into Saskatoon. Any traffic heading north out of the development and wanting to continue on Hwy 16 westbound will have to travel east past the median and U-turn before becoming westbound. We have consulted with Transportation and are aware of the new intersection improvements. The resulting design incorporates transportation requirements and recommendations.

Access to the property is proposed from the existing access to the frontage road on the west side of Highway 684. There will only be one access point to the development.

7.4.2 Internal Road Network

The concept plan was established with one internal, public roadway. The design of the roadway meets the municipality design standards and widths (refer to *Figure 5*). The roadway will utilize ditches and culverts to convey storm water to the existing ditch system along Highways 684 and 16. Roadway traffic expected to and from the location will consist of a combination of light automobiles and trucks, as well as highway tractor-trailer units. The road construction will follow the Corman Park standards as shown in *Figure 8 – Road Sections*. A road surfacing design will be completed as part of the detailed design.

7.4.3 Traffic and Roadway Condition Assessment

<u>Traffic Impact Analysis Summary</u>

The Ministry of Highways requested that all study area intersections be analyzed for warranted improvements including auxiliary lanes and lighting. WSP Engineering completed a traffic impact assessment study to meet these requirements. The Ministry confirmed that WSP does not need to investigate improvements for Highway 16 and Dalmeny Access intersection, as shown in *Figure 5*. The Ministry indicated that the intersection is not currently considered for upgrade to an interchange, staged ramps or separated right turn roadways. The RM and Ministry did not identify any other major issues or concerns.

The scope of work for the TIA included assessment of current traffic and prediction of future traffic to determine the volume of traffic generated by the site. This information was then used to confirm the adequacy of the road design.

The assessment focused on the intersection where Grid Road 684 meets Highway 16 and the intersection where Grid Road 684 meets the site access road, as these locations will experience higher traffic demand due to the development and may require remedial measures (i.e., left-turn or right-turn lanes, etc.). Highway 16 is a divided national highway running northwest southeast. Grid Road 684 is a paved Grid Road that was previously realigned to intersect Highway 16 at right angles. The Access Road includes site access to the current field to the west and a service road station to rural developments to the east. Highway 16 is a paved highway with a posted speed of 110 km/h. The posted limit on Grid Road 684 is 90 km/h. All study intersections are two-way stop controlled.

The results of this analysis indicate that roadside lighting may be required at the intersection of Grid Road 684 and the approach to the development. For additional details, refer to the attached TIA (**Appendix D**).

Based on the results of the TIA it appears the current roads are in good condition and able to meet the added traffic from the development. As indicated above, a road surfacing design will be completed as part of the detailed design. Another TIA will be completed for Phase 2. The timing of this is to be determined. It depends on a number of factors, such as approval of the CDR Application.

As required in Roadside Development Permit application process, Saskatchewan Ministry of Highways requested, and was provided with a copy of the Traffic Impact Assessment which was completed by WSP (**Appendix D**). Pursuant to reviewing the TIA and other documentation required in the application, the Roadside Development Permit was approved and issued thereafter. Saskatchewan Ministry of Highways Roadside Development Permit RSD00004007 (refer to **Appendix G**).

The Ministry of Highways will also be implementing new improvements to the existing intersection of the Yellowhead Highway and Highway 684 within the next year. We have integrated the proposed changes into this plan.

7.5 WATER SUPPLY

Water for the site will come from the Intervalley Water Utility line. The conditions of access limit water usage to 1 gpm through a 2” line. The proposed service to the site is shown on *Figure 7*. As such, businesses will create their own storage onsite to accommodate their business needs. Businesses to be located in the development will be limited to those that can subsist on the allowable flow rate. The Intervalley Water Utility will also maintain the piping infrastructure.

Fire flows will not be provided as part of the baseline development. If fire protection through a water supply is needed for a particular site, the developer of that lot will provide that service.

Since there is limited water supply for irrigation to the sites, landscaping will be done using dryscapes or through utilization of native grasses or vegetation that can survive using the natural rainfall in the area.

The above information was determined through communications with Heather Veitch from the Intervalley Water Coop (refer to correspondence in **Appendix G**). It was also stated that water will be provided via specific allocations which will be approved based on availability at the time of application. Each allocation will include a waterline to the edge of the property, and lot owners will be responsible for providing the required line extensions and holding tank complete with pumping system to service their specific lot. The supply will be on a drip system which requires 0.5 gpm (0.031 5L/s) flow restriction. Each allocation will require a dedicated curb-stop, and the water supply flow is guaranteed at 20 psi (138kPa). Heather’s contact information is as follows:

Intervalley Water Coop Representative:
Heather Veitch
306-242-6663
iwi1@sasktel.net

7.6 WASTEWATER COLLECTION

Wastewater will be managed through on-site holding tanks. According to the geotechnical analysis, septic systems are also feasible (refer to the attached geotechnical report, **Appendix B**). Each developer will either provide for a tank which will be pumped out by a commercial liquid waste hauler and taken to the City of Saskatoon’s wastewater treatment plant or provide a tank and septic system. The individual landowners will be responsible to provide a site-specific design for that particular site and use. Hasegawa Engineering reached out to a sewage disposal company who provided a letter stating that they are able to provide services that meet the requirements and will get the necessary approvals for dumping. The letter is attached in **Appendix G**.

Brent Latimer with the Saskatchewan Health Authority was also contacted with respect to the feasibility of the septic field use. He indicated that if the geotechnical assessment had indicated that soil was suitable and the design guidance document was followed, there was no reason why septic fields could not be used on these sites. A site-specific design of the septic system will be required on each lot prior to Development Permit approval.

7.7 DRAINAGE

Hasegawa Engineering (HE) has completed a hydrological analysis of the proposed development site located within NE 3-38-6-W3 (refer to *Figure 6 – Grading/Drainage Plan*). The hydrological analysis includes the following major aspects:

1. Existing topography and conditions

2. Runoff analysis based on a 100yr / 24-hour design storm
3. Retention storage size calculations

The analysis is detailed in the attached drainage report (see **Appendix E**) and is based on a proposed development of the 77.54-acre (31.38 ha) site into approximately 10-13 commercial lots. The purpose of the study was to model existing pre-development runoff from the site during a design storm event, and then model the site as developed property during the same storm event. The post development model is used to size storm water retention facilities so that post development runoff rates at downstream infrastructure is kept to pre-development levels. At this time, 10-13 lots are proposed along with a service road. At this stage, the modeling is not meant to provide design detail, but to provide guidelines for overall development.

The resulting detention strategy involved the use of the ditch systems along the road and north and west boundaries to create the required amount of storage (refer to *Figure 6*). Site topography was used to establish existing drainage paths on the proposed development. From this, catchment areas, average flow lengths, and drainage slopes were determined in order to model pre-development runoff from the site using a 100-year/24-hour synthetic design storm event. Results show the two main outflows and estimate the peak runoff rates flowing in them under pre-development conditions. The proposed development was then modeled and a system of lot-level runoff retention, drainage ditches, swales and weirs included so that runoff rates at the outfalls remain at pre-development levels. Conceptual site grading, drainage pathways and storm water retention is illustrated in *Figure 6*. This plan allows for adequate retention to maintain runoff rates offsite to pre-development runoff rates. Additional details and analysis are shown in **Appendix E**. A detailed design of the retention systems will be provided as part of the final design and submitted as part of the subdivision application.

The analysis was sent to Spencer McNie and Jessica Phelps with the Water Security Agency for review. They sent an email approving of the overall drainage concept (refer to **Appendix G**).

7.8 GENERAL SERVICING

A servicing review is included in Table 5 below and a proposed layout in *Figure 7*. Further details describing services are provided in this section, and the completed Summary of Property Servicing Form is included.

Table 5. Servicing Summary

Service	Source	Description
Potable Water	Intervalley Water Utility Co-op	Located approximately 500 m to the east. 2” line for drip system to provide 1 gpm per site
Fire water	N/A	The building code governs fire flow requirements for buildings and the NFPA 30 for the storage and distribution of petroleum hydrocarbons. Fire flow is not required on this site due to the small size of the buildings and the quantity of petroleum hydrocarbons on site (does not meet threshold values)
Sanitary sewage	Private Septic	Onsite septic system
Electric service	SaskPower	Sourced from existing 25 kV overhead powerline located approximately 1km south along Township Rd. 380. Install 25 kV overhead power line along HWY 684 north up to proposed site

Service	Source	Description
Gas service	SaskEnergy	Sourced from existing natural gas line located approximately 1 km south along Township Rd. 380. Install 4” line to service proposed site.
Telecommunications	SaskTel	Located approximately 500 m to the east. Extend copper line to proposed site.

7.8.1 Infrastructure and Utilities

7.8.1.1 Buildings

There are no buildings currently on the site. Plans for individual site development including onsite buildings will be submitted as part of the development permit process.

7.8.1.2 SaskTel

A cursory review by SaskTel identified that copper and fibre optic cables can be provided to the proposed site. The current proposed option is to tie into the existing copper infrastructure, located north of the site running parallel to Hwy 16, and run a new line along the west side of Hwy 684 down to the proposed development. The proposed line will be buried/directionally, drilled and daylighted at a new demarcation. Account executive Ken Yick approved the proposed option (refer to documentation in **Appendix G**), and can be contacted at:

SaskTel Representative:
Ken Yick (Account Executive)
306-931-5351
ken.yick@sasktel.com

7.8.1.3 SaskEnergy

There are a few existing SaskEnergy lines located in the general region of the proposed development. SaskEnergy proposed tying into an existing line that runs east to west along Township Road 380 located to the south of the proposed development (refer to **Appendix G** for correspondence). From here, they will run approximately 2315 m of new 4.5” (114 mm) natural gas line directly north along the west property line up to the proposed development. This new line will be stubbed near the development entrance where future lot owners will be able to tie in for individual service connections as needed. Application has been made to SaskEnergy for servicing, and the representative with whom we have been communicating is shown below:

SaskEnergy Representative:
Corey Snider (Customer Connect Technician)
306-920-7143
customerconnect4@saskenergy.com

7.8.1.4 SaskPower

SaskPower has an existing overhead three phase 25 kV distribution power line located approximately 1km directly to the south along Township Road 380 (refer to *Figure 7*). In servicing this site, SaskPower has proposed extending this line to the proposed site (refer to correspondence in **Appendix G**). This will include running a new overhead distribution line north along the west side of Hwy 684 up to the proposed development. Each lot owner will be responsible to apply for an electrical service connection, which will include an underground service conductor running from the overhead lines to an appropriately sized transformer as needed. Preliminary calculations suggest providing a 150 kVA pad-mount transformer. This will allow for a 400 A 120/208 VAC three-phase service for the development, which will be an underground service conductor trenched into the site. The representative from SaskPower who suggested this data and intent is Ian Waldner, and his contact information is below. Application has been made to SaskPower for this servicing.

SaskPower Representative:
Ian Waldner (Quote Expeditor)
360-934-7760
iwaldner@saskpower.com

7.8.1.5 Fire and Protective Services

Fire and protective services are available for the proposed subdivision. The RM of Corman Park has entered into agreements with seven urban municipalities for their fire departments to extend coverage into the rural areas. The proposed site lies within the protection area of The North Corman Fire Chiefs' Association which includes the Towns of Martensville, Warman, Osler, Dalmeny, and Langham.

The National Building Code governs fire flow requirements for buildings and the NFPA 30 governs requirements for the storage and distribution of petroleum hydrocarbons. Fire flow is not required on this site due to the small size of the buildings and the quantity of petroleum hydrocarbons on site (does not meet threshold values).

The Dalmeny Fire Chief confirmed that given the remoteness of the site, in the event of a fire and without a retention pond, water would need to be hauled to the site. He estimated that it would take 12-15 min. for a truck to respond to the fire, and given that the Fire Hall is not constantly staffed, this time could be up to 30 min. He did mention that installing a type of sprinkler system in the building would be the most ideal way to fight a fire. A sprinkler system is not required by code and there are no requirements for a hydrant from the local municipalities or the fire code. UFA does have a "let it burn policy" so that in the event of a fire the main goal is to contain the impact to the structure on fire.

Corman Park Police Services provide and deal with both provincial law and RM bylaws. In addition, policing services are provided by the Royal Canadian Mounted Police who are typically responsible for matters pertaining to the criminal code and provincial laws.

7.8.1.6 Sustainable Development Features

The storm water detention areas throughout the ditch system will form habitat for terrestrial and aquatic flora and fauna. Also, where possible, green spaces identified in *Figure 2* will be maintained as natural areas; the road alignment does intrude on these areas in a few locations. The use of sustainable energy such as solar power and wind to supplement traditional power sources will also be encouraged in the development. Finally, all buildings will be subject to meeting the energy code requirements.

7.8.1.7 Landscape Plan

Landscaping will be developed in such a manner as to screen exterior storage areas and to provide an aesthetically pleasing frontage for that portion of the site facing Highways 16 and 684. A detailed landscape plan will be submitted to the RM at the Development Permit submittal for each lot.

7.8.1.8 Solid Waste Management

Disposal of solid waste will be managed through use of a waste bin for standard landfill disposal. Maintenance and costs will be borne by each lot owner/developer and disposal pick-up will be scheduled as needed.

7.8.1.9 Public Amenities

There are no proposed public amenities requiring management structures, operations, maintenance, or insurance as part of this development.

7.9 NATURAL AND HERITAGE RESOURCES

7.9.1 Environment

Trace Environmental Services conducted an Environmental Impact Assessment screening using the project screening report from HabiSask (attached as **Appendix C**) and looked through the available aerial photographs. Based the technical proposal guidelines, it is unlikely that an EIA will be required. Although there is an endangered species record in the project area, the little brown bat, the summer habitat for this species is primarily in buildings (though sometimes in hollow trees). There are no buildings currently on the site, but there may be some deciduous trees. The site is primarily cultivated land; however, there are a couple of wetlands present which may require permits to disturb (https://www.wsask.ca/water-programs/aquatic-habitat-protection/). These areas will not be disturbed until additional analysis is conducted. The site is in the RM of Corman Park and, according to their website, a Natural Area Screening (NAS) may be needed. (https://www.rmcormanpark.ca/296/Natural-Area-Screening-Studies).

Phase 1 will only impact cultivated areas and will not encroach on any potentially sensitive areas. The Ministry of Environment requires a pre-construction wildlife sweep in undisturbed areas (see attached comments in **Appendix G**).

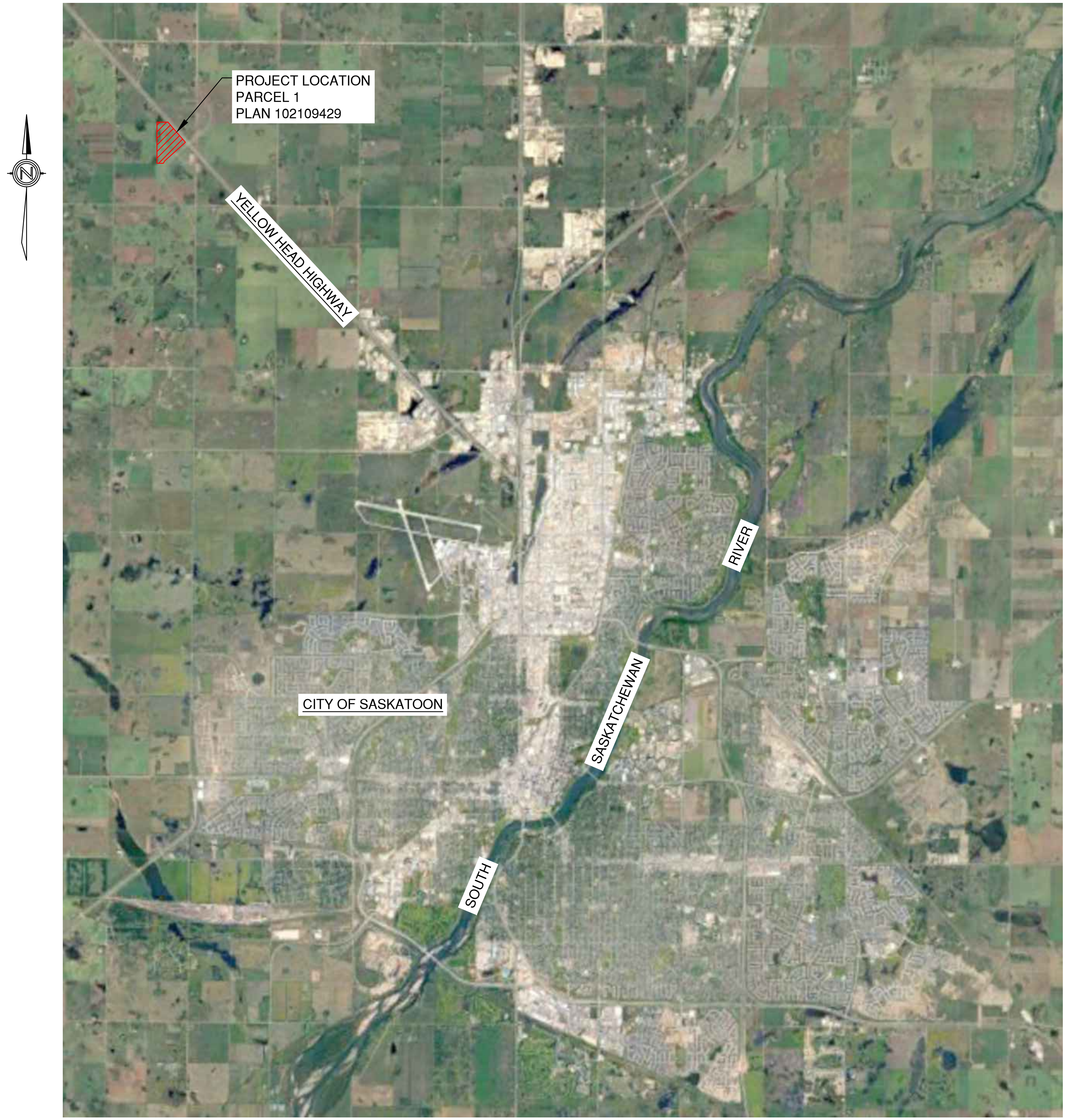
Also, where possible, green spaces identified in *Figure 2* will be maintained as natural areas; the road alignment in Phase 2 could intrude on some of these areas in a few locations and the protocol mentioned above will be followed prior to any work.

7.9.2 Heritage Resources

The property is cultivated farmland and therefore unlikely to contain artifacts that have not already been disturbed. The Province of Saskatchewan's online screening tool was accessed to determine if there are known heritage resources on the property. This screening indicated there were no sensitive historical resources on this site.

Appendix A

FIGURES



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ISSUE	DRAWING STATUS / REVISION	DATE (YY/MM/DD)	BY
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B	FOR APPROVAL	22/06/01	DPB/MO

DESIGNED	DRAWN	CHECKED	APPROVED	SCALE AND SHEET SIZE
MAH	DPB/MO	HE	MAH	AS SHOWN

HASEGAWA
CONSULTING PROFESSIONAL ENGINEERS
330, 3120 - 32nd Street South, Lethbridge, Alberta T1K 7B4
P: 403-328-2686 F: 403-328-2728 E: office@hasegawa.ca

NOTES

 Contractor to check and verify all dimensions before construction, any errors and omissions shall be reported to the engineer immediately. Drawing shall not be used for construction until approved for construction by engineer. Do not scale the drawing. All construction shall be in accordance with latest codes, may it be construction, mechanical, etc

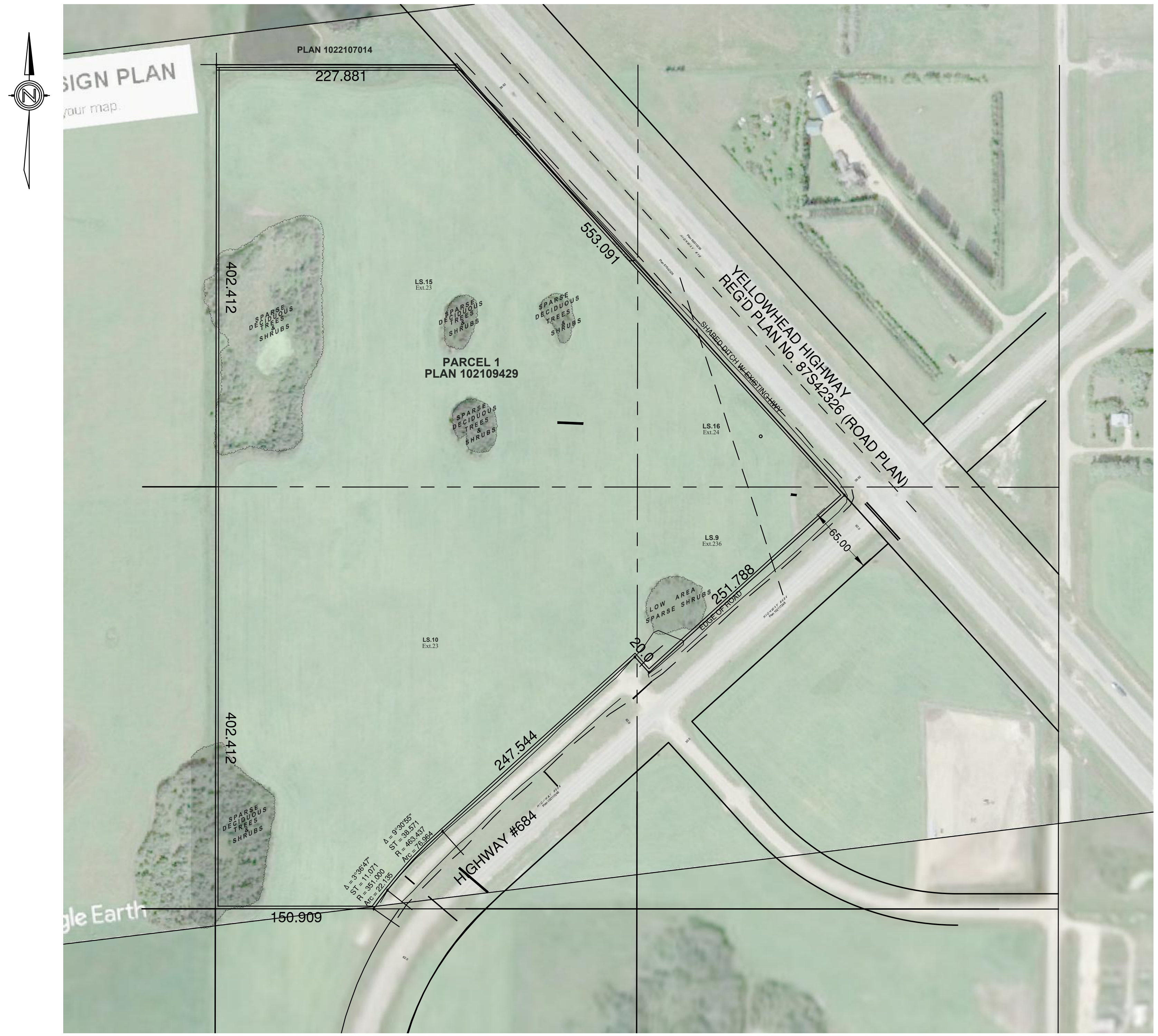
CLIENT
HASEGAWA ENGINEERING

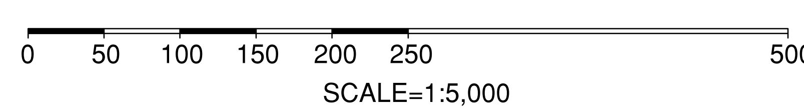
PROJECT
CORMAN 78ac.
DEVELOPMENT

DRAWING
AREA MAP

PROJECT NUMBER
21-050

SHEET NUMBER
FIGURE 1





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B	FOR APPROVAL	22/06/01	DPB/MO

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NOTES

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PROJECT
CORMAN 78ac. DEVELOPMENT

DRAWING
LEGAL PLAN

PROJECT NUMBER
21-050

SHEET NUMBER
FIGURE 2

ISSUE	DRAWING STATUS / REVISION	DATE (YY/MM/DD)	BY
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B	FOR APPROVAL	22/06/01	DPB/MO

DESIGNED	DRAWN	CHECKED	APPROVED	SCALE AND SHEET SIZE
MAH	DPB/MO	HE	MAH	AS SHOWN

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NOTES

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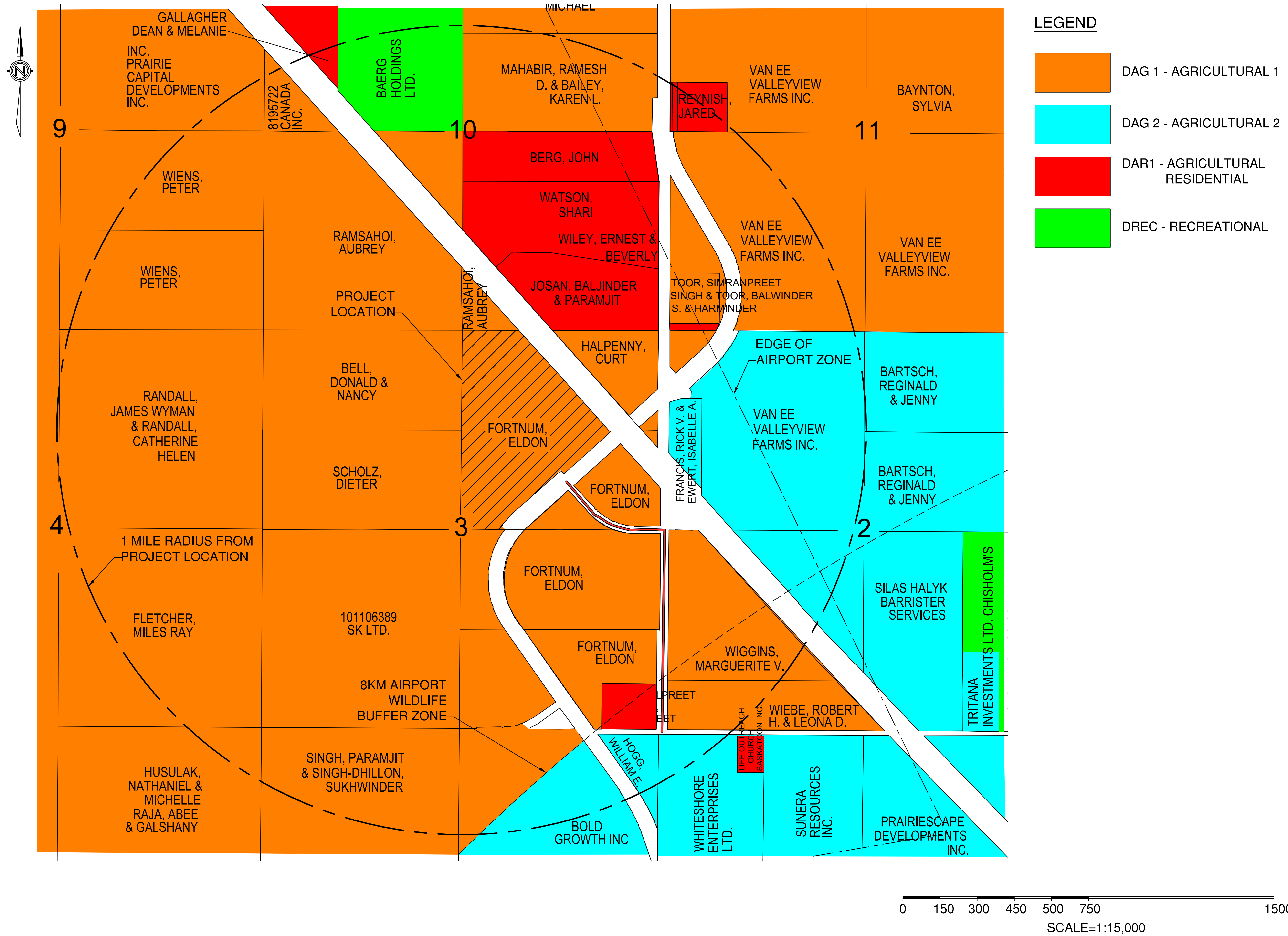
PROJECT
CORMAN 78ac. DEVELOPMENT

DRAWING
TOPOGRAPHY EXISTING CONDTIONS

PROJECT NUMBER
21-050

SHEET NUMBER
FIGURE 3



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B	FOR APPROVAL	22/06/01	DPB/MO

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DRAWING
EXISTING LANDUSE PLAN

PROJECT NUMBER
21-050

SHEET NUMBER
FIGURE 4

ISSUE	DRAWING STATUS / REVISION	DATE (YY/MM/DD)	BY
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B	FOR APPROVAL	22/06/01	DPB/MO
C	FOR APPROVAL	22/07/11	MO

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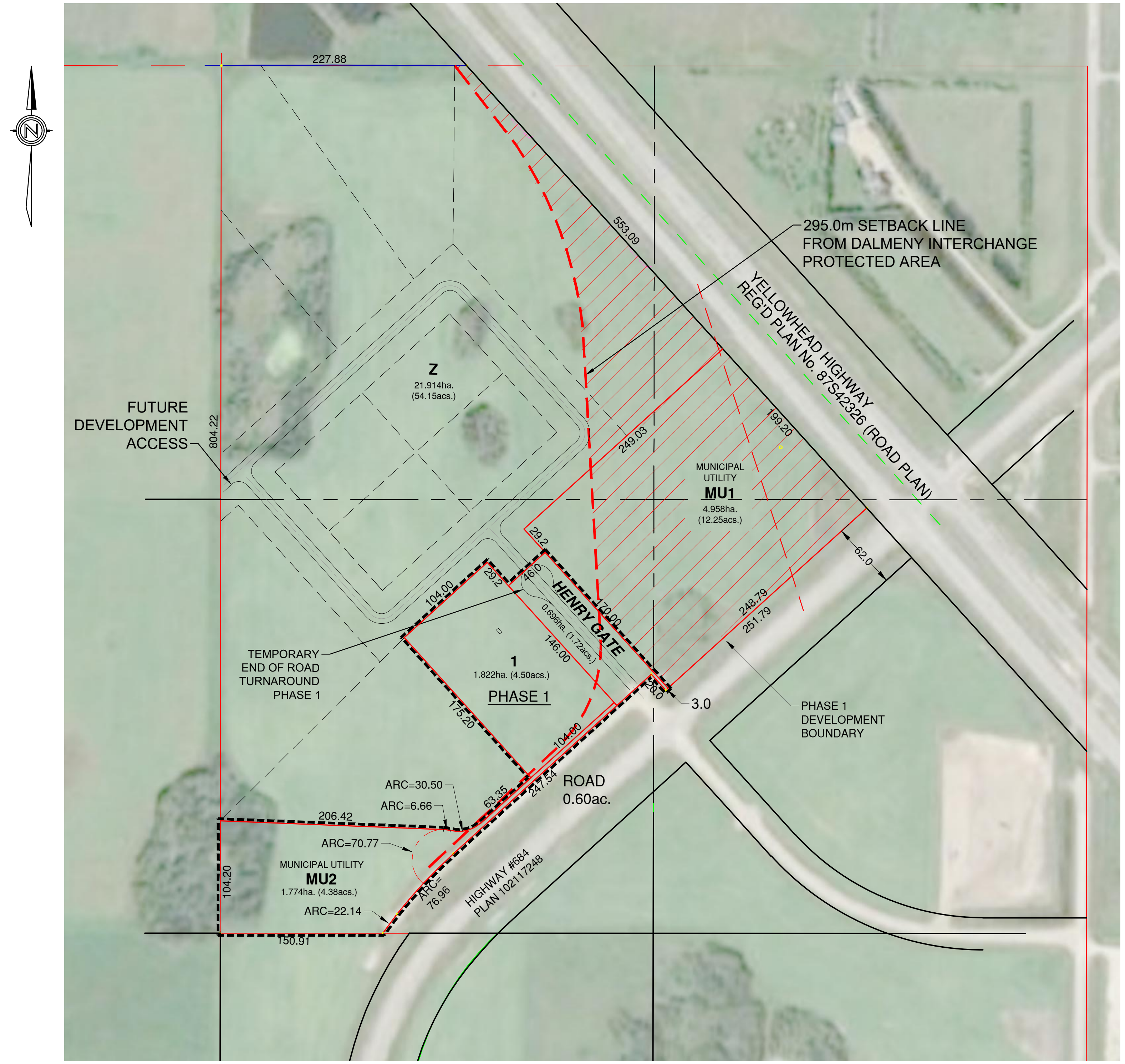
MAH	DPB/MO	HE	MAH	AS SHOWN



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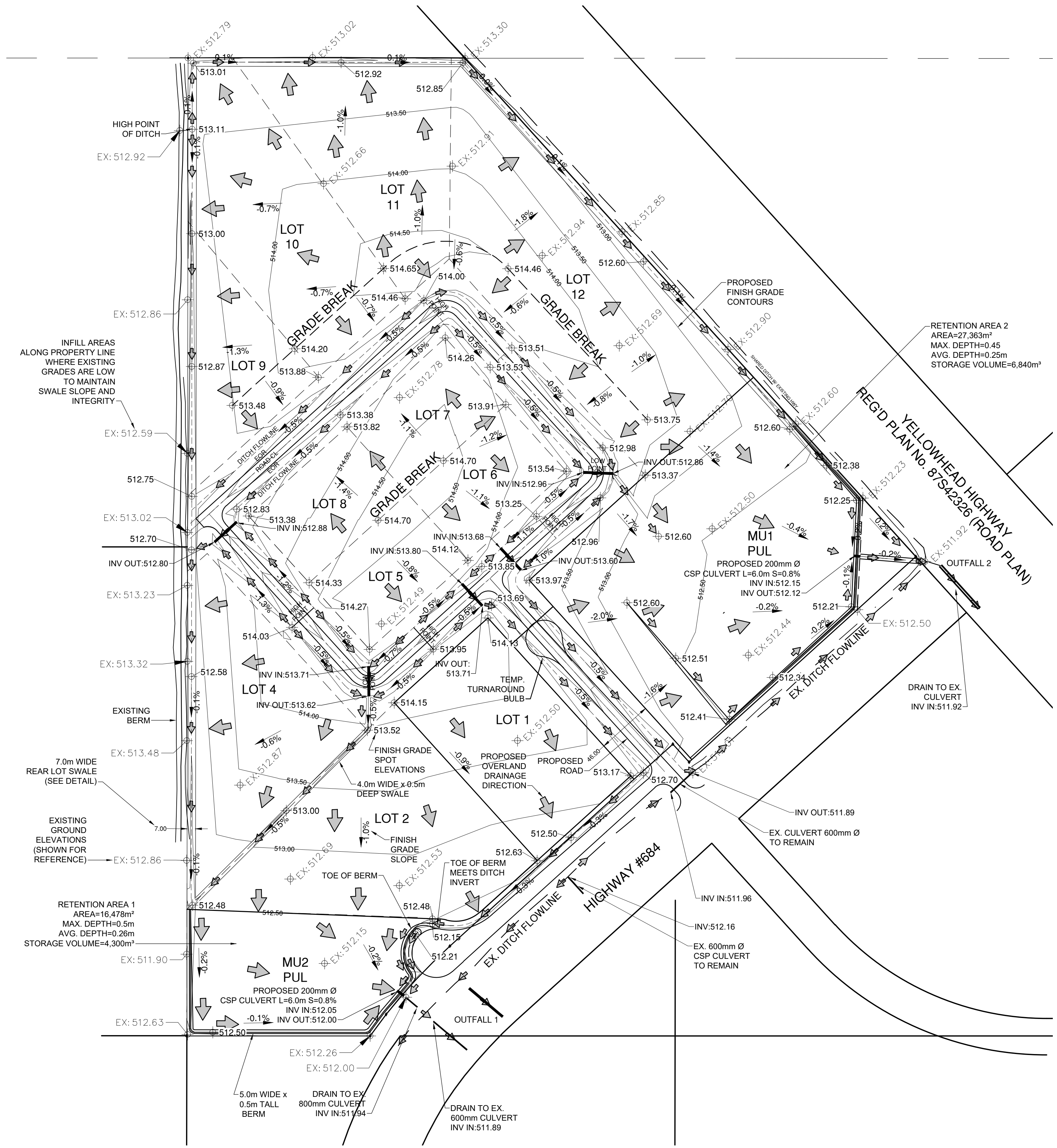
PROJECT
CORMAN 78ac. DEVELOPMENT

DRAWING
PROPOSED LOT LAYOUT

PROJECT NUMBER
21-050

SHEET NUMBER
FIGURE 5



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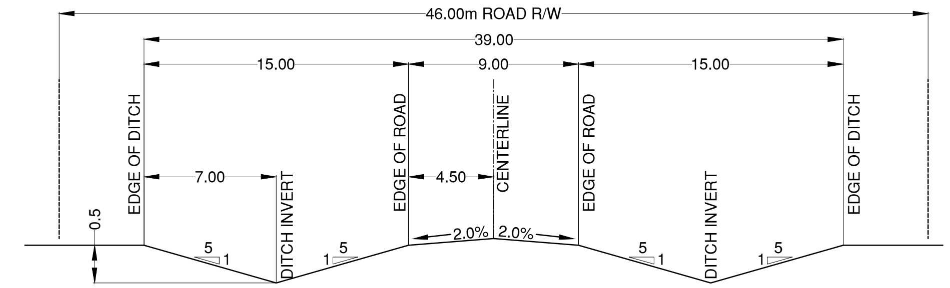
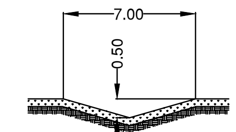
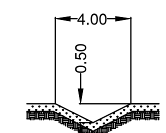
GRADING & DRAINAGE PLAN
SCALE: 1:4,000



PROPOSED ROAD - CROSS SECTION -TYPICAL
SCALE: NTS



7.0m WIDE REAR LOT SWALE -TYPICAL
SCALE: NTS



4.0m WIDE SWALE -TYPICAL
SCALE: NTS

NOTES:
- SWALES AND DITCHES TO BE GRASS SEEDED FOR EROSION CONTROL
- 4;1 MAX SIDE SLOPES ON ALL DITCHES AND SWALES

ISSUE	DRAWING STATUS / REVISION	DATE (YY/MM/DD)	BY
A	FOR REVIEW	22/07/04	MDO
B	FOR APPROVAL	22/06/01	DPB/MO
C	FOR APPROVAL	22/07/11	MO

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HASEGAWA ENGINEERING

PROJECT
CORMAN 78ac. DEVELOPMENT

DRAWING
SITE GRADING & DRAINAGE PLAN

PROJECT NUMBER
21-050

SHEET NUMBER
FIGURE 6

ISSUE	DRAWING STATUS / REVISION	DATE (YY/MM/DD)	BY
A	FOR APPROVAL	22/04/14	DPB
B	FOR APPROVAL	22/06/01	DPB/MO

DESIGNED	DRAWN	CHECKED	APPROVED	SCALE AND SHEET SIZE
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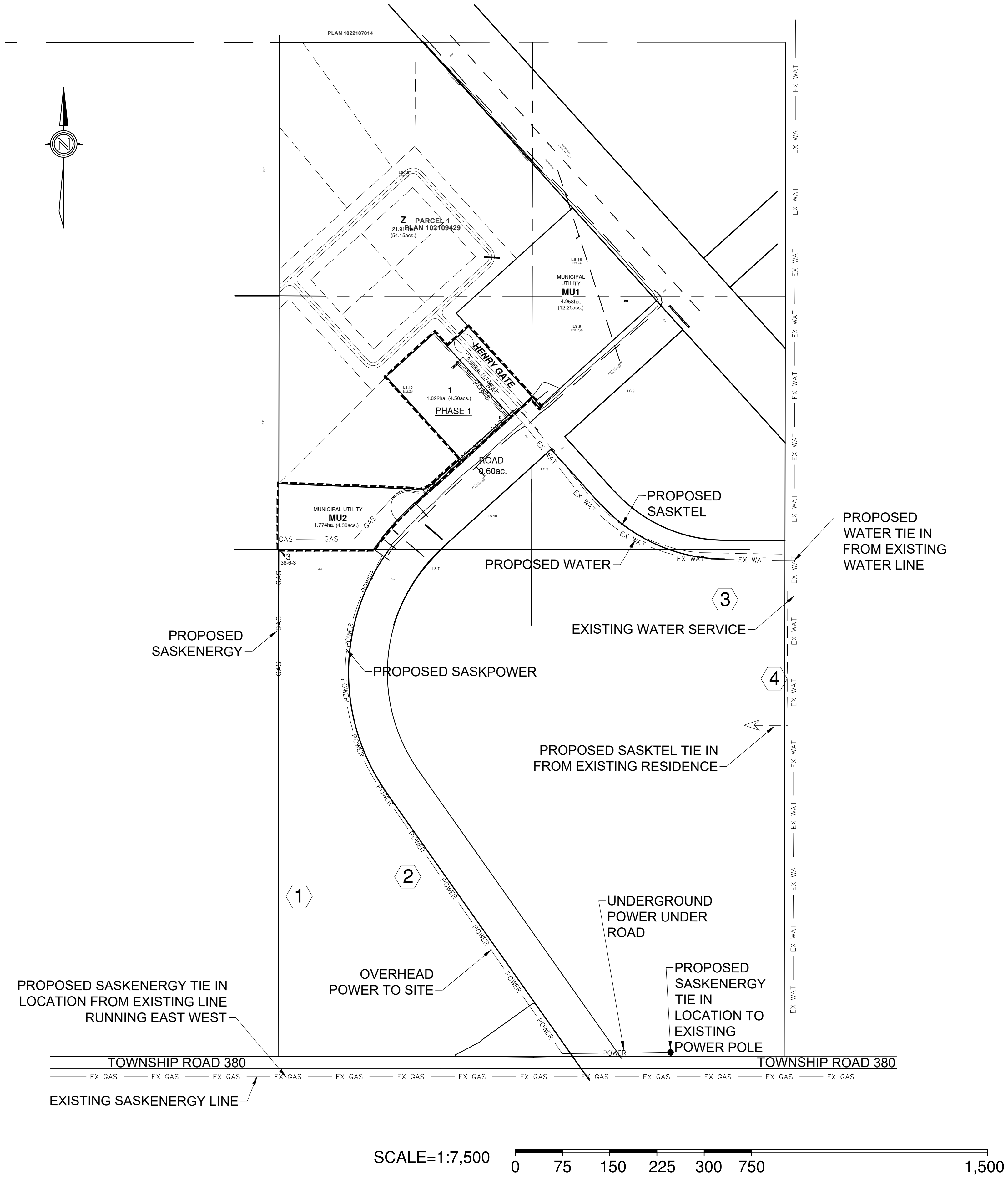

NOTES:

1 UTILITY INFORMATION CONTAINED ON THIS SHEET REPRESENTS CONCEPTS PROVIDED BY LOCAL UTILITY SERVICE PROVIDERS. THIS INFORMATION IS DIAGRAMMATIC AND SUBJECT TO CHANGE BASED ON INDIVIDUAL UTILITY SERVICE PROVIDER DESIGN CHANGES.

KEY NOTES:

1. PROPOSED SASKENERGY NATURAL GAS LINE SOURCED FROM EXISTING LINE ALONG TWP RD 380 APPROXIMATELY 1,000m SOUTH.
2. PROPOSED SASKPOWER 25KV OVERHEAD LINE SOURCED FROM EXISTING LINE ALONG TWP RD 380 APPROXIMATELY 1,000m SOUTH.
3. PROPOSED WATER LINE EXTENSION SOURCED FROM WATER CO-OP EXISTING INFRASTRUCTURE APPROXIMATELY 600m EAST.
4. PROPOSED TELECOMMUNICATIONS EXTENSION SOURCED FROM EXISTING INFRASTRUCTURE APPROXIMATELY 600m EAST.

LEGEND:

— — — — — —	SASKTEL TELECOMMUNICATIONS
— POWER — POWER —	PROPOSED SASKPOWER
— EX GAS — EX GAS —	EXSTING SASKENERGY
— GAS — GAS —	PROPOSED SASKENERGY
— EX WAT — EX WAT —	EXISTING WATER LINE
— WAT — WAT —	PROPOSED WATER LINE

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330, 3120 - 32nd Street South, Lethbridge, Alberta T1K 7B4
P: 403-328-2686 F: 403-328-2728 E: office@hasegawa.ca

NOTES

CLIENT: HASEGAWA ENGINEERING

PROJECT: CORMAN 78ac. DEVELOPMENT

DRAWING: PROPOSED SERVICING PLAN

PROJECT NUMBER: 21-050

SHEET NUMBER: FIGURE 7

ISSUE	DRAWING STATUS / REVISION	DATE (YY/MM/DD)	BY
A	FOR APPROVAL	22/04/14	DPB
B	FOR APPROVAL	22/06/01	DPB/MO

DESIGNED	DRAWN	CHECKED	APPROVED	SCALE AND SHEET SIZE
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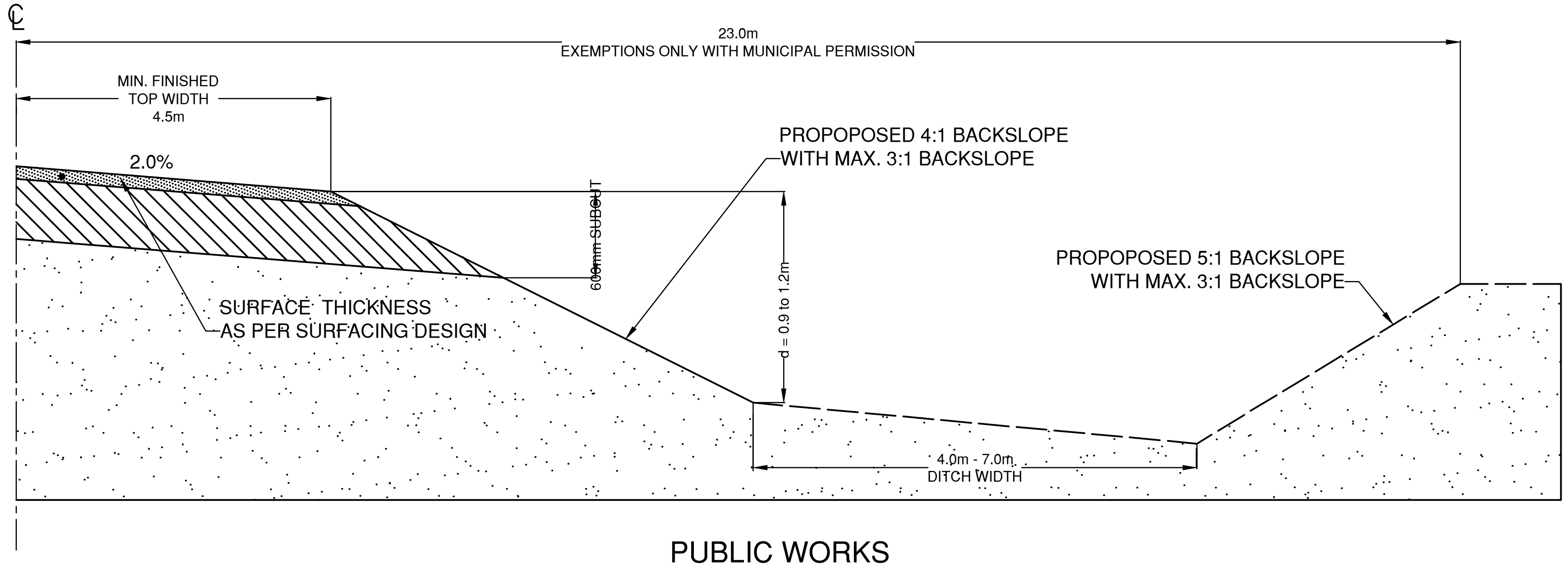
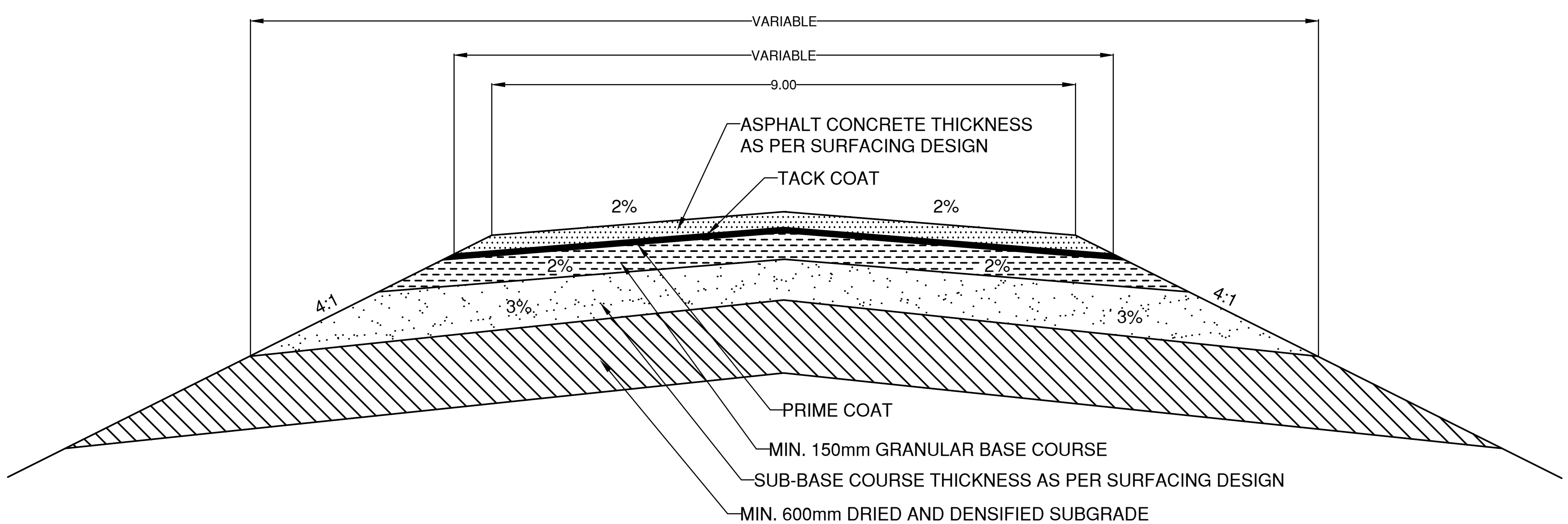


PUBLIC WORKS
INDUSTRIAL PAVED - TYPICAL CROSS SECTION
SUBGRADE



PUBLIC WORKS
INDUSTRIAL PAVED - TYPICAL SURFACING STRUCTURE
ASPHALT CONCRETE

HASEGAWA
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PROJECT
CORMAN 78ac.
DEVELOPMENT

DRAWING
ROAD SECTIONS

PROJECT NUMBER
21-050

SHEET NUMBER
FIGURE 8

Appendix B

GEOTECHNICAL INVESTIGATION

GEOTECHNICAL INVESTIGATION REPORT

CORMAN CORNER COMMERCIAL / LIGHT-INDUSTRIAL DEVELOPMENT
HIGHWAY NO. 16 AND HIGHWAY NO. 684
CORMAN PARK, SASKATCHEWAN

PREPARED FOR

HASEGAWA ENGINEERING
LETHBRIDGE, ALBERTA

HASEGAWA
CONSULTING PROFESSIONAL ENGINEERS

PREPARED BY

PARKLAND GEOTECHNICAL CONSULTING LTD.
REGINA, SASKATCHEWAN

ParklandGEO

PROJECT NO. SK0387
NOVEMBER 12, 2021
REVISION 1

Geotechnical, Environmental and Materials Engineering

Red Deer · Sherwood Park · Grande Prairie · Calgary · Fort McMurray
Peace River · Medicine Hat · Lethbridge · Fort St. John · Estevan · Regina

TABLE OF CONTENTS

TABLES

APPENDICES

1.0 INTRODUCTION

Hasegawa Engineering is proposing a commercial / light-industrial development in Corman Park, Saskatchewan. Parkland Geotechnical Consulting Ltd. (ParklandGEO) was commissioned to carry out a geotechnical investigation for the proposed site. This report summarizes results of the field and laboratory testing programs and presents geotechnical recommendations for general site preparation, excavations, and foundations.

The scope of work for this investigation was outlined in ParklandGEO's proposal dated September 20, 2021 (PRO9389). Authorization to proceed with this investigation was given by Mr. Jordan Michel of Hasegawa Engineering.

2.0 PROJECT INFORMATION

2.1 SITE DESCRIPTION

The site was located at the southwest corner of the intersection of Highway 16 and Highway 684 within LSD 10-3-38-6 W3, Corman Park, Saskatchewan as shown on the Key Plan, Figure 1. The planned site layout is shown on the Site Plan, Figure 2. The site was accessed from Highway 684 to the southeast. The subject site and surrounding lands were primarily agricultural land. At the time of drilling the site had been harvested and cleared of vegitation. Site conditions are shown on the arial plan and site photographs, Figures 3 and 4. The topography was relatively level. Surface elevations at the borehole locations ranged between 512.06 m and 512.97 m across the proposed area to be developed.

2.2 PROJECT DESCRIPTION

The proposed site development covers an area of approximately 75 acres and includes provisions for 10 lots. One of the lots has been selected as a potential site for a cardlock facility to provide fuel and petroleum-based products to the nearby agricultural community.

3.0 FIELD AND LABORATORY PROGRAMS

3.1 DRILLING PROGRAM

On October 4, 2021, eight boreholes were drilled at the site to depths between 5.0 and 12.0 m below grade. The locations and elevations of the boreholes are shown on the Site Plan, Figure 2. The following sampling and testing procedures were followed during the field investigation:

1. Prior to mobilizing the drilling rig, ParklandGEO personnel completed a Sask 1st Call and arranged for a professional private locator to verify the drill sites were clear of underground utilities.

2. The boreholes were drilled using a truck mounted drilling rig using 150 mm diameter solid stem augers. The drill rig was owned and operated by Mobile Auger and Reaserch LTD. of Saskatoon, Saskatchewan.

3. Drilling operations were monitored by members of ParklandGEO's geotechnical staff. The soil encountered was visually examined during drilling and logged according to the Modified Unified Soil Classification System.

4. Disturbed soil samples were obtained from auger cuttings at 1.0 m intervals in order to determine the soil/moisture profile and from other selected depths for other testing. Disturbed soil samples were also observed from standard penetration tests (SPT's), which were preformed at selected depth intervals.

5. Soil samples were field screened for hydrocarbon vapours using a RKI Eagle Portable Gas Detector calibrated with hexane to a known standard. Select samples were chosen for laboratory analyses of petroleum hydrocarbon parameters to identify if potential environmental concerns were present.

6. At the completion of drilling, 50 mm slotted PVC standpipes were installed in Boreholes 1, 3, 5 and 6 and backfilled with filter sand and bentonite chips. The remaining boreholes were backfilled with auger cuttings and bentonite chips. Excess auger cuttings were Removed from site. Groundwater levels and depths where seepage zones were encountered were noted during drilling. Groundwater measurements were recorded on October 14, 2021 and the water was purged.

7. Groundwater samples were retrieved on October 15, 2021 after recharging from purging. Samples were retrieved using sterile dedicated bailers from each well and were placed into the appropriate lab-provided containers for petroleum hydrocarbon analyses.

8. The ground surface locations and elevations of the completed boreholes were surveyed by ParklandGEO and referenced to a geodetic datum. UTM coordinates and geodetic elevations are provided in the borehole logs in Appendix A.

3.2 LABORATORY PROGRAM

Soil samples were returned to ParklandGEO's Calgary laboratory for selected soil testing to determine soil properties. The laboratory program consisted of moisture contents, Atterberg Limits, hydrometer particle size analysis and water-soluble sulphate tests. The results of all laboratory testing are shown on the borehole logs in Appendix A, and individual test results are presented in Appendix B.

The soil and groundwater samples analyzed for petroleum hydrocarbon parameters were undertaken by ALS Global Laboratories of Regina, Saskatchewan. All laboratory technical reports including quality assurance data and the preparation and quantification methods are presented on the analytical laboratory sheets attached to this report.

4.0 SUBSURFACE CONDITIONS

The generalized subsurface soil profile encountered at the borehole locations consisted of, in descending order: topsoil, sand and clay till. Detailed soil conditions encountered at each of the borehole locations are described on the borehole logs in Appendix A. Definitions of the terminology and symbols used on the borehole logs are provided on the Explanation sheets also in Appendix A. The following is a brief description of the soil types encountered.

4.1 TOPSOIL

Surficial topsoil 300 mm thick was encountered at the borehole locations. The topsoil was sandy, moderately organic, brown to black, contained rootlets and dry to damp. This topsoil is considered to be weak and compressible under load.

4.2 SAND

Deposits of sand were encountered below the topsoil in Boreholes 4, 7 and 8. Sand seams were encountered in borehole 3 between the clay till layers. The sand extended to depths of 1.2 to 2.4 m below grade. The sand contained trace to little silt, trace to little clay and was characterized as fine grained, poorly graded with a compact relative density. Cobble and hard drilling conditions were encountered. Moisture contents ranged from 4 to 17 percent.

4.3 CLAY TILL

Glacial clay (till) was encountered beneath the topsoil in Boreholes 1 to 3 and 5 to 6 and below the sand in the remaining boreholes. This till consisted of a homogeneous mixture of clay, some silt, some sand and trace gravel. The till was low to medium plastic. The deposit was noted to contain occasional rust stains, water bearing sand lenses and cobble. Standard Penetration Test (SPT) 'N' values ranged from 12 to 37 blows with an average of 25 denoting a very stiff consistency. Moisture contents ranged from 9 to 12 percent with an average of 10 percent which is considered to be below the estimated Optimum Moisture Content (OMC).

4.4 FIELD VAPOUR SCREENING

Eighty soil samples were field screened for hydrocarbon vapours to assist with selection for laboratory analyses. The results ranged from 5 to 630 parts per million by volume (ppmv). The highest concentration was measured in Borehole 6 at a depth of 2.0 m. The results of the field screening are shown on Table 1 in Appendix B.

4.5 LABORATORY SOIL TEST SUMMARY

4.5.1 Sulphate Results

Soil samples were taken for water soluble sulphate concentration testing. The concentration of sulphates is expressed as a percentage of the dry mass of soil. The concentration of water-soluble sulphates were 0.220% percent, which indicates a “severe potential for sulphate attack on buried concrete in direct contact with soil.” (CAN/CSA A23.1-14)

4.5.2 Routine Soil Classification

The following table provides a summary of laboratory test results and soil classification after the modified unified soil classification system.

TABLE 1
LABORATORY CLASSIFICATION TEST SUMMARY

BH#	Depth / Elev (m)	Grain Size Distribution (%)				Plasticity (%)			Soil Type	Symbol*
		Gravel	Sand	Silt	Clay	PL	LL	PI		
5	0.8	8.4	27.3	44.5	19.8	10	28	18	Sandy Low Plastic Clay	CL
5	6.8	-	-	-	-	11	28	17	-	CL
7	3.8	0	40.8	31.3	27.8	11	32	21	Sandy Medium Plastic Clay	CI
8	0.8	9.1	69.0	10.2	11.7	-	-	-	Silty Sand	SM

PL = Plastic Limit; LL = Liquid Limit; PI = Plastic Index
*Modified Unified Soil Classification System (ASTM D2487)

4.6 PETROLEUM HYDROCARBON RESULTS

Six soil samples were chosen for laboratory analyses of benzene, toluene, ethylbenzene, xylenes (BTEX) and petroleum hydrocarbon (PHC) Fractions F1 to F4. The results were below the applicable Saskatchewan Environmental Quality Guideline criteria, as shown on Tables 2 and 3 in Appendix B. The applicable criteria chosen for this site were for agricultural land use and both fine and coarse-grained soils.

5.0 GROUNDWATER CONDITIONS

5.1 GENERAL OBSERVATIONS

Sloughing and seepage conditions were observed during drilling and accumulation of free water was observed after drilling. Groundwater conditions were assessed by observations during drilling and soil moisture contents. The groundwater levels observed during drilling and measured on October 14, 2021, about 10 days after drilling, are summarized in the following table.

TABLE 2
GROUNDWATER MEASUREMENTS

Borehole No.	Ground Elevation (m)	At Completion	Measurements on October 14, 2021	
		Groundwater Level (mbg)	Groundwater Level (mbg)	Groundwater Elevation (mbg)
1	512.97	Dry	3.60	509.37
3	512.67	Dry	2.46	510.21
5	512.06	Wet	3.30	508.76
6	512.57	Dry	3.36	509.21

The groundwater levels observed are considered to be typical in this area and are considered to be near the seasonal average. The observed groundwater levels ranged from 2.46 to 3.6 m, which corresponds to an elevation of about 509 to 510.5 m. Groundwater levels are expected to be dependent on infiltration for recharge. Groundwater elevations are expected to fluctuate upwards on a seasonal basis and will be highest after periods of heavy or prolonged precipitation and snow-melt. For shallow excavations, groundwater seepage is expected to be manageable using conventional dewatering techniques. Significant groundwater seepage is expected for deeper excavations extending below the groundwater table. The volumes of groundwater encountered will be dependent on seasonal conditions and the permeability of the soils within the profile.

5.2 GROUNDWATER LABORATORY RESULTS

Four groundwater samples were retrieved from the monitoring wells installed in Boreholes 1, 3, 5 and 6, and were analysed for petroleum hydrocarbon parameters. The results for BTEX and PHC Fractions F1 to F2 were all non detectable concentrations.

6.0 DISCUSSION AND RECOMMENDATIONS

6.1 GEOTECHNICAL EVALUATION

The soil profile at the site includes topsoil, sand and clay till which is considered suitable for the proposed development. The foundation conditions are suited to deep foundation options such as driven steel piles. Bored cast-in-place (CIP) concrete piles are considered to be less feasible due to the presence of unsuitable wet sloughing conditions and cobble which will require extensive use of steel casing. Strip or spread footings are considered to be suitable for supporting light loads and structures that can tolerate some vertical displacement over time due to consolidation of existing clay layers. Foundation parameters are provided for bored CIP concrete piles, driven steel piles, footings and mat foundations. Recommendations for other foundation options can be provided upon request.

Other geotechnical design issues for the proposed development include:

1. The average seasonal depth of frost is expected to be 2.5 m below grade in exposed areas. The fine-grained clay till is considered to be moderately to highly frost susceptible. Maintaining subgrade uniformity (soil type, moisture content, and density) is important to minimize the potential for significant differential frost heave. The surficial soils will be susceptible to frost if they are given access to free water or groundwater within the zone of seasonal frost. In general, the depth to the local water table for much of the site is relatively shallow and within the potential depth of frost, so potential for ice lensing will be significant.

2. Groundwater seepage is not expected in shallow excavations to depths within 2 m below the existing grade. Groundwater seepage in deeper excavation should be expected. If groundwater is encountered during construction, measures such as conventional pumping may be required and are expected to be effective. The volumes of groundwater seepage will depend on seasonal conditions.

3. Frost action will have an impact on foundations, especially lightly loaded foundations in unheated environments such as the double pylon sign. The pile shaft embedded within the frost zone will be affected by an adfreeze force which will result in uplift. Uplift will also act on pile caps and grade beams bearing on the subgrade.

4. Traffic around the facility will include passenger vehicles and heavy trucks, but heavy traffic is expected to be restricted to specific access ways around the site. Gravel pavements can tolerate more movement than a paved asphalt or concrete surface, because the surface can be regraded during periodic maintenance.

5. The surficial clay till will provide a low level of subgrade support for pavement areas. The subgrade will be stable if not excessively disturbed. Due to the sensitive, fine grained nature of the surficial soils, subgrade conditions may be adversely impacted by wet weather and seasonal high groundwater levels including perched groundwater conditions. These materials may become disturbed during placement and compaction of surface fill

or backfill materials. Repetitive construction traffic may result in a significant weakening/failure of the subgrade. Site preparation measures will be significantly impacted by wet weather. The use of a geotextile as a separation barrier between the pavement gravel and the fine grained subgrade is suggested to minimize the migration of gravel into the clay till subgrade. Depending on the conditions encountered during construction, additional subgrade improvement such as extra gravel or geogrid may be required for critical traffic areas such as site accesses.

6. Subgrade beside buildings areas may be subject to initial post construction settlement and on going frost action. The issue of settlement around the exterior of the building should be a concern, especially in the building transition areas which are usually covered by a perimeter apron of concrete sidewalks and concrete flat work. When the only issue is frost, the general recommendation is to use grade supported flatwork protected by rigid insulation which tapers out into the surrounding area. Some allowances should be made in terms of pavement to sidewalks transitions (i.e. bond breaks and ramps).

7. Service trenches at the site will likely be excavated into and backfilled with firm to stiff clay. To minimize potential trench settlement, these soils must be backfilled and compacted in thin lifts. Backfilling stiff clay soils in thicker lifts is not appropriate and may lead to significant differential settlement due to potential bridging within the backfill. The clay soils generally have good soil moisture and textural characteristics, so they are suitable for use as backfill in thin lifts. If the existing till is proposed for use as trench backfill, it will need to be moisture conditioned (i.e. dried) in order to achieve the specified levels of compaction.

6.2 SITE PREPARATION

The present site is relatively level so it is anticipated that only minor cuts and fills will be required for the full-service island concrete pad. There is less than 1.5 m of relief across the site to maintain drainage. Surficial topsoil, organics, non-engineered fill, or unsuitable soils should be stripped from the development area.

6.2.1 General Subgrade Preparation

Following removal of any undesirable soils, all exposed subgrade soils in and around buildings and other facilities to be occupied by a slab-on-grade structures should be scarified to a depth of 150 to 200 mm and recompacted uniformly to a minimum of 98 percent of SPMDD. In building areas, the till surface should be moisture adjusted prior to compaction to a moisture content at least 5 percent above the OMC. Site preparation measures should be monitored by qualified and experienced geotechnical personnel to identify potential soft areas. The exposed subgrade should be proof rolled to identify wet and/or weak soils.

Ideally, site preparation operations should be carried out under dry weather conditions to minimize the risk of disturbance and softening. If adverse weather or groundwater conditions are observed during construction, these recommendations should be reviewed in order to avoid subgrade failure. Uniformity of compaction is of most importance to minimize potential for differential settlement under new loads. Over compaction and wetting should be avoided.

The final compacted subgrade should then be proof-rolled and monitored by a geotechnical engineer to identify non-uniformity and weak/soft areas. Soft areas should be sub-cut and replaced with a suitable fill material to a depth sufficient to support construction traffic. Soft areas should be expected along the majority of the roads and parking areas. Methods to avoid subgrade failure of soft subgrades may include: limiting construction traffic, modification of site preparation procedures (scarification, recompaction, etc.) and sub-cut and replacement with a suitable engineered fill material.

6.2.2 Temporary Excavations

Temporary excavations will likely be required for the foundation and possible underground utility installations. The latest edition of the Construction Safety Regulations of the Occupational Health and Safety Act of Saskatchewan should be followed. Excavation side slopes are not expected to be able to stand near vertical for extended periods of time. For excavations in cohesionless soils (sand) up to 3 m deep, side slopes should be cut back to 1H:1V from the toe. Vertical cuts can be used for excavations in cohesive soils (clay) up to 1.5 m deep. Unsupported excavations up to 3.0 m must be sloped at 1H:1V above a maximum 1.5 m deep vertical cut.

Flatter side-slopes may be required for excavations into the fill, sand lenses or groundwater table. Some sloughing and caving must be anticipated, particularly where a vertical cut is used. Excavation stability should be reviewed for deeper excavation or excavations that will remain open for longer than 4 weeks. Excavations result in a stress release which may induce a non-linear settlement on adjacent foundations. Therefore, the presence of nearby structures and the affect of the excavation should be considered when planning excavations.

For excavations through clay till, sand lenses or into the static or seasonal perched groundwater table, flatter side-slopes may be required. All temporary surcharge loads should be kept back from the excavated faces a distance of at least one-half the depth of the excavation. All vehicles delivering materials to the site should be kept back from excavated faces at least 1.0 m. Fill materials used to bring the site to grade after excavation may consist of low to medium plastic clay or an approved granular fill. If space does not permit the slopes to be cut back, some form of temporary shoring must be installed to protect workers in the trench.

6.2.3 Fill/ Backfill Materials

Fill required to bring the site up to grade should be low to medium plastic clay, well graded select granular material such as well graded sand or gravel, or select pit-run gravel having a maximum particle size of 80 mm. Fill soils must be free of any organic materials, contamination, deleterious construction debris and stones greater than 80 mm in diameter. Uniformly graded sand or silt should be avoided since these materials require strict moisture control to achieve required compaction standards. Sand which is uniformly graded, or which contains more than 10 percent passing the 0.080 mm sieve, should not be used for engineered subgrade fill. The native clay till is considered suitable as fill materials provided they receive moisture conditioning in order to achieve proper compaction. Like most clays, these materials will encounter some problems if backfill or deep grading fills are placed during periods of extended wet weather. All fill materials should be approved by the geotechnical engineer prior to being brought to or used at site.

6.2.4 Fill/ Backfill Placement and Compaction

Fill material should be placed uniformly to the following compaction specifications.

TABLE 3
RECOMMENDED COMPACTION LEVELS

Fill Location	Minimum Compaction (% SPMDD)	Moisture Content (% OMC)
Building Areas		
New fill greater than 0.6 m thickness (including trenches)	100%	±2%
New fill less than 0.6 m thick (including trenches)	98%	±2%
Under structural slabs	95%	±3%
Other Development Areas		
Subgrade preparation	97%	±2%
Under paved or concrete areas, access roads	98%	±2%
Exterior building area outside of pavement structures	95%	As Required

SPMDD = Standard Proctor Maximum Dry Density and OMC = Optimum Moisture Content as per ASTM D698.

The lift thicknesses should be governed by the ability of the selected compaction equipment to uniformly achieve the recommended density. However, it is generally recommended to use lifts with a maximum compacted thickness of 200 mm for granular fill and 150 mm for clay fill. Uniformity is of most importance. Granular fill is best compacted with large smooth drum vibratory rollers while clay fill is best compacted with large vibratory "padfoot" or "sheepsfoot" rollers. Over compaction and excessive use of vibration to achieve density should be avoided to minimize risk of failing the subgrade. In areas which require higher compaction, it is recommended that granular fill be placed at moisture contents 0 to 2 percent below the OMC and that clay fill be placed at moisture contents about 0 to 2 percent above the OMC. This will help reduce compactive effort and potential risk of subgrade disturbance needed to achieve maximum density.

Fill placement and compaction during the winter months in southern Saskatchewan is challenging due to the difficulty in moisture conditioning fill soils and obtaining high compaction levels. Materials and methodology should be reviewed prior to construction if cold weather compaction of clay fills is proposed. High compaction levels can only be achieved using fill soils that are unfrozen provided the compaction area is heated and hoarded to prevent freezing during placement and compaction.

6.2.5 Cold Weather Fill Placement

Special considerations are required for placement of engineered clay fill under winter conditions. As a general guideline reasonable compaction levels can be achieved with select clay fill at air temperatures above -7°C. With lower temperatures, achieving high levels of compaction will become increasingly more difficult. Below -12°C to -15°C it is exceedingly difficult to compact clay fill and it is very crucial to follow construction practices to prevent freezing of the material before it is compacted.

1. The operation requires that the fill is excavated, hauled, placed and compacted before it freezes. This usually requires a continuous excavation and placement operation. Exposed areas of the borrow site and the fill site may need to be protected with insulated tarps. Under extreme conditions the borrow site might need to be heated and hoarded. If heating is undertaken, care should be made to ensure the fill material does not become overly dried.

2. Material selection is particularly important because the soil requires strict moisture content control, because the material has to be compacted without moisture conditioning. The local clay has a moisture content that is close to OMC which will allow for higher levels of compaction with minimal compaction effort while in an unfrozen condition.

3. For higher levels of compaction, thinner lifts in the order of 150 mm are recommended. The maximum lift thickness should be governed by the ability of the equipment to break down the fill and achieve uniform compaction. More compactive effort may be required to achieve density if thicker lifts are used since less time is available for compaction. Uncompacted lifts greater than 300 mm thick should not be used.

4. The fill should not be placed on frozen fill. Unless approved by the design engineer any fill that freezes prior to being compacted should be removed and wasted. In the case of shallow frost penetration, it may be possible to re-compact the fill material if it thaws. Similarly, any exposed soil at the borrow site should be excavated and wasted.

5. Snow and ice should not be left in place or incorporated into the engineered fill.

6. Where compaction standards are not being achieved the options are to modify compaction effort with more stringent placement controls, relax specification only upon review and approval from the design engineer; or suspend operations.

6.2.6 Site Drainage

Surface water should be drained away from the site as quickly as possible, both during and after construction. Site drainage should be directed away from the foundation walls. A minimum grade of 3 percent (to reduce the time water is on the subgrade) is recommended to promote surface runoff and minimize potential saturation and degradation of the parking area subgrade. It is recommended to provide a 5 percent back slope from buildings for a distance of at least 5 m. Roof and other drains should discharge well clear of buildings.

Compliance with the recommendation for compaction of fill in exterior areas is important because poorly compacted backfill adjacent to foundation structures will settle, which may lead to ponding of surface water against foundation walls or grade beams. The slope of exterior backfill should be checked periodically to verify water is shed away from buildings. If the backfill settles causing water to pond against foundation walls, the surface should be re-graded. Water should not be allowed to pond adjacent to buildings, equipment, or pavement areas.

6.3 BUILDING CODE REQUIREMENTS

Saskatchewan follows the National Building Code of Canada (NBCC) as the minimum standard for the construction and renovation of buildings throughout the province. In accordance with the most recent versions of the NBCC, the use of Limit States Design (LSD) is required for the design of buildings and their structural components including foundations. The limit states of LSD design are classified into two groups; the Ultimate Limit States (ULS) and the Serviceability Limit States (SLS).

6.3.1 Ultimate Limit States (ULS)

The ULS case is primarily concerned with safety and the levels of load and resistance at the point of collapse or structural failure. The geotechnical value for this case is the ultimate resistance. For foundation design this ultimate resistance value is reduced using a Geotechnical Resistance Factor (GRF) which is based on the reliability index of the geotechnical data used to determine the ultimate resistance for the foundation loading case. As per the NBCC the following GRF values should be used for foundation design for deep and shallow foundations:

TABLE 4
LSD GEOTECHNICAL RESISTANCE FACTORS

Geotechnical Case	Resistance Factors
DEEP FOUNDATIONS (PILES)	
Vertical resistance by semi-empirical analysis and in-situ test data	0.4
Vertical resistance from analysis of dynamic monitoring results	0.5
Vertical resistance from analysis of static load test results	0.6
SHALLOW FOUNDATIONS (FOOTINGS AND MATS)	
Vertical resistance by semi-empirical analysis and in-situ test data	0.5

6.3.2 Serviceability Limit States (SLS)

The SLS case occurs when the foundation loads cause movements or vibrations that are greater than are tolerable for the intended use of the structure. The SLS case is addressed by determining the maximum available resistance to keep the foundation deformation within tolerable limits under service loads (i.e. settlement, lateral deflection, etc.). Typically, the foundation loads, configurations and serviceability tolerances have to be known to properly determine geotechnical SLS resistance values. In some foundation cases such as smaller footings, basic assumptions can be used to provide preliminary SLS resistance values under specific stated conditions. The settlement potential of the proposed foundations may be checked once foundation design and loading conditions are finalized.

For axial loading conditions the SLS resistance is addressed by determining the limiting load to keep foundation settlements within tolerable limits. Tolerable total and differential settlements should be verified by the structural engineer, but for normal buildings the tolerable limit of total settlement for foundations is typically about 25 mm. The settlement expected to be required to mobilize the ultimate resistance for piles on this project is expected to be less than 25 mm. Therefore, the serviceability limit states are not expected to govern for pile foundations unless very strict settlement tolerances are required or very large diameter piles are considered. The settlement potential of the proposed foundation may be checked once pile design and loading conditions are finalized.

6.3.3 Seismic Classification

The National Building Code of Canada (2019) requires buildings to be designed to resist a minimum earthquake force. The formula for obtaining minimum earthquake force is dependent on several factors including Foundation Factors (F_a and F_v) which should be determined using a Site Class of “D” for this site (Table 4.1.8.4.A). The subgrade soil is topsoil, sand, stiff clay till, and very stiff clay overlying bedrock estimated at 100 – 150 m deep.

6.4 FOOTINGS AND MATS

The soil conditions are considered suitable for conventional strip and spread footings bearing on native clay till. Strip or spread footings founded on native till within 3.0 m of grade may be designed based on ultimate and serviceability limit states using the bearing resistance values given in the following table:

TABLE 5
BEARING RESISTANCE FOR FOOTINGS

Soil Type	Depth (m)	ULS (kPa)		SLS (kPa)
		Ultimate	Factored	
Strip	< 3.0	450	225	150
Spread	< 3.0	540	270	180

The “factored” resistance in this table is calculated by multiplying the unfactored value by a geotechnical resistance factor of 0.5, in accordance with the building code as summarized in Section 6.3.1. The serviceability bearing resistance value given above is based on limiting the settlement to less than 25 mm and is applicable to footings to a maximum dimension of 1.2 m wide or 1.5 x 1.5 m^2. If very strict settlement tolerances are required or if larger footings are proposed, the footing sizes and settlement potential should be reviewed. If weak soils are encountered during the excavations for the footings an alternative configuration is to replace the weak soils with lean mix concrete or a mat of compacted gravel.

Additional design and construction recommendations for footings include:

1. Footings should bear on the native clay till, or approved engineered fill free from loosened material. Excavation of the footing trenches should be undertaken in a manner to minimize disturbance to the bearing surface. The use of backhoe or grade-all equipment is strongly recommended over loader or dozer equipment.

2. For protection against frost action, exterior footings in continuously heated structures should be provided with a minimum depth of ground cover of 1.5 m. Interior footings in heated buildings require a minimum of 0.5 m of ground cover. Isolated footings and exterior footings in unheated structures will require at least 2.5 m of ground cover. Artificial insulation may be used to prevent frost penetration where adequate depths of ground cover cannot be economically provided. Insulation should be placed exterior to the footing wall.

3. Footings and foundation walls should be reinforced to span localized soft spots.

4. The footing trenches should be protected against surface water run-off and seepage water through the use of conventional sumps and ditches, if required. Footing bases should not be allowed to dry out excessively during construction. Foundation soils must not be allowed to freeze at any time prior to, during, or after construction.

5. If footings are placed on a gravel mat:

   - The thickness for a gravel mat will be governed by the required soil resistance. The typical thickness should be at least 150 mm. It may be necessary to increase the design thickness of the gravel mat at the time of construction if localized soft or wet areas are present. An observational approach during construction should be adopted.

   - The gravel mat must extend beyond all sides of footings an equal distance to the gravel thickness.

   - Gravel should consist of select, well graded coarse gravel with a maximum particle size of 50 mm and less than 10 percent fines passing the 0.080 mm sieve.

   - The gravel should be compacted to at least 100 percent Standard Proctor Maximum Dry Density (SPMDD) below the base of the footing. Over-compaction of the footing should be avoided.

   - A geotextile should be placed over the full base and sides of the excavation prior to backfilling.

6. Preparation of the bearing surfaces should be monitored by a qualified geotechnical engineer prior to placement of footings to verify that design criteria are met.

6.5 DRIVEN STEEL PILES – ULS DESIGN

Driven steel piles are considered to be well suited for foundations at this site. Either steel "H" piles or open-ended steel pipe piles may be considered. Closed-end piles displace more soil and may induce greater resistance with depth resulting in early refusal. Driven steel piles that encounter early refusal may need to be removed and then pre-drilled.

6.5.1 Axial Compression

Driven steel piles may be designed for ultimate limit states using the ultimate resistance values for skin friction and end bearing provided in the following table.

TABLE 6
DRIVEN STEEL PILES – ULTIMATE RESISTANCE

Soil Type	Depth (m)	Ultimate Resistance (kPa)		Factored ULS (kPa) GRF, Φ = 0.4	
		Skin Friction	End Bearing	Skin Friction	End Bearing
Frost Zone	0 – 2.5	0	---	0	---
Clay Till	2.5 – 6.0	40	875	16	350
Clay Till	> 6.0	55	1350	22	540

The ultimate resistance values in this table are based on semi-empirical data, therefore the factored ULS values are calculated by multiplying the ultimate values above by a geotechnical resistance factor (GRF) of 0.4, in accordance with the building code. The GRF for resistance to axial compression may be increased if the pile capacities are verified by a dynamic monitoring method or by a static load test.

A Pile Driving Analyzer (PDA) test program should be considered to verify the ultimate pile resistance for this site. For resistance values verified by this dynamic monitoring method the GRF used to calculate the factored resistance may be increased to 0.5, resulting in a 25 percent increase in pile capacity for the ultimate limit states. Given the expected size of this project, a static load test may not be a cost effective option to significantly reduce driven steel pile costs.

6.5.2 Driven Steel Piles – Design Recommendations

1. The factored ULS capacity of driven steel piles is determined by multiplying the factored ULS skin friction resistances from Table 6 by the exterior surface area of the pipe pile or the surface area of the web and outside face of the flanges for H-piles. For unheated structures, the upper 2.5 m of pile shaft of the length of pile shaft in new fill, whichever is greater, should be assumed to carry no load. This depth can be reduced to 1.5 m for heated structures.

2. An end bearing contribution acting on the gross area of the pile tip may be added to the pile capacity for H-piles, closed ended pile, and open ended piles. For open ended pipe piles with diameter of less than 350 mm, the gross area may be used. For pipes between 350 and 425 mm or H-piles with webs larger than 400 mm, only 67 percent of the gross area should be used. For piles up to 610 mm in diameter only 50 percent of the gross area should be used. If larger piles are proposed, the potential for tip resistance in the pile design should be reviewed. The pile capacity should not exceed the structural capacity for the steel section of the pile.

3. For preliminary purposes, a minimum depth of embedment of 6.5 m is required for heated buildings and 8.5 m is required for unheated structures. Once structural loads are known, these embedment depths can be checked using the method described in Section 6.7.2 - Frost Design Considerations for Piles. These values assume pre-drill holes less than 90% of pile size.

4. For steel pipe piles driven to practical refusal into hard till prior to achieving design depths, but beyond the required minimum embedment depth, the ultimate load capacity may be determined by multiplying the cross-sectional area of steel at the tip by 0.80 f_y where f_y is yield strength of steel (normally 240 to 310 MPa). This ultimate resistance will need to be factored by the GRF to determine the factored ULS resistance. The maximum permissible value of f_y should be supplied by the manufacturer.

5. The minimum allowable pile spacing should be taken as three pile diameters. If groups of piles are installed at pile spacing less than the minimum, a group reduction factor must be applied to the ultimate bearing capacity of each pile.

6.5.3 Driven Steel Pile Construction Recommendations

1. The recommended optimal and maximum driving energies should be determined by wave equation analysis based on the selected type of hammer and pile configuration. As a preliminary guide, steel piles installed using a drop or diesel hammer should be driven using hammer energy no greater than 600 J per square centimeter of pile cross section. Lower energies in the order of 400 to 450 J per square centimeter of pile cross section should be considered for hydraulic hammers. Piles driven by high efficiency hydraulic hammers will require a lower maximum hammer energy.

2. Soil conditions can vary across a site and piles designed based on the skin friction and end bearing may not need to achieve refusal to achieve the required pile capacities. For steel piles driven to design depth, it is recommended to verify the piles have the required capacities by comparing the final driving set against the minimum termination set. The termination criteria for design loads and full refusal criteria should be verified by WEAP analysis once the proposed hammer energies and final pile details are known.

3. If a pilot hole is required (i.e. through frost or due to hard driving conditions) the pre-drilling methodology should be verified in the field at the time of construction. For preliminary purposes, the pre-drilled hole should be less than 90 percent of the diameter of the pile

section. Piles driven into a pre-drilled hole must be driven past the pre-drill depth. It is possible that some piles may get hung up above the depth of the pre-drill. In these cases, the pile should be removed and reinstalled; or the open space below the pile tip should be filled with lean mix concrete.

4. In order to prevent possible damage, steel piles should not be driven beyond practical refusal to avoid overstressing the steel section. Since a wide range of heavy walled sections may be used, the practical refusal criteria should be determined prior to piling once hammer energies and pile details are known. For preliminary purposes, the practical refusal criteria may be taken as 8 to 12 blows per each 25 mm interval for the last 250 mm of pile penetration; with the provision to stop driving if the pile is reaching sudden refusal with a blow count of over 15 blows over 25 mm (1 inch) or less. The hammer type and energy should be matched to the piles to achieve this termination set at refusal to avoid potential overdriving which may be harmful to driving equipment. Refusal conditions and criteria may be verified by additional dynamic monitoring (PDA) during construction.

5. Where groups of piles are to be installed, the piles should be installed starting at the center with outer piles installed last. The elevations of the tops of piles already installed should be monitored as adjacent piles are driven in order to determine if heaving of the piles has occurred. Piles that have heaved must be re-driven. If groups of piles are installed at pile spacing less than the minimum, a group reduction factor must be applied to the ultimate bearing capacity of each pile.

6. If steel pipe piles are used, it is suggested to fill the unplugged space inside the piles with concrete after installation, especially if open ended piles are used. Concrete filling of the pipe will add strength to the section and reduce the corrosion potential inside the pipe. Corrosion of the pipe in a partially saturated medium must be considered in selecting pipe wall thickness. If the concrete is not required for structural purposes (pile cap connections or improving rigidity), the use of lean mix concrete or low strength grout would be acceptable. Filling the shaft is not required to maintain the geotechnical pile design capacities of Table 6.

7. The steel piles should be inspected prior to installation to confirm that the appropriate material specifications are satisfied; and to check that there are no protrusions on the shaft or at the tip which could result in voids along the shaft as the pile is driven.

8. Monitoring of pile installation by experienced geotechnical personnel is recommended to confirm that the piles are installed in accordance with design assumptions and that the driving criteria are satisfied. A complete driving record of blows per 300 mm of penetration for each pile should be obtained and reviewed by the pile designer.

6.6 BORED CIP CONCRETE PILES

Bored cast-in-place (CIP) concrete piles are installed by drilling with a large auger piling rig. Ideally the pile excavation is drilled with an open hole. If the soil conditions are wet or sensitive a steel casing will be used to keep the hole open. Concrete placement using tremie methods is used in cases where the hole fills with water.

6.6.1 Axial Compression – ULS Design

The foundation conditions are poorly suited for straight shaft bored CIP concrete friction piles and end-bearing piles including belled piles. The depths and installation configurations will be restricted due to expected seepage and sloughing conditions. Casing should be made available on site and used as required during the installations. Straight shaft end bearing piles are not recommended for this site unless a clean base can be prepared within the lower clay till. Belled or expanded base piles are feasible in the clay till, but difficulties may occur if sand layers are present. Equipment should be suitably sized to handle the expected drilling conditions including possible boulders. If CIP piles are proposed, a trial pile is recommended to test the feasibility of this pile option and casing must be available and used as required.

Bored cast-in-place concrete piles at the site may be designed based on the ultimate resistance values provided in the following table.

TABLE 7
BORED CIP CONCRETE PILES - ULS DESIGN RESISTANCE

Soil Type	Depth (m)	Ultimate Resistance (kPa)		Factored ULS (Φ = 0.4) (kPa)	
		Skin Friction	End Bearing	Skin Friction	End Bearing
Frost Zone	0 to 2.5	---	---	---	---
Clay Till	2.5 – 6.0	45	875	23	350
	> 6.0	65	1350	26	540

The ultimate resistance values (ULS) in this table are based on semi-empirical data, therefore the “factored” ULS resistance have been calculated by multiplying the ultimate values above by a geotechnical resistance factor of 0.4. A static load test program could also be considered to increase the factored resistance for concrete piles using GRF of 0.6. This would only be cost effective if a large number of bored CIP concrete piles were proposed for this project.

6.6.2 ULS Design for Uplift Resistance on Concrete Friction Piles

For ULS design purposes, the uplift resistance of piles subject to static tension loads may be based on the ultimate skin friction values given in Table 7 of Subsections 6.6.1. Since the values in this table are based on semi-empirical data, the "factored" resistance should be calculated by reducing the ultimate resistance by the GRF of 0.3 for the ULS analysis. The GRF can be increased to 0.4 if a static load test program is completed. Pile foundations which are required to resist uplift forces should be checked for both resistance to pullout and to their structural ability to carry tensile stresses. Uplift loads due to frost and wind loads would not be additive since the two load mechanisms are vastly different.

6.6.3 CIP Pile Design Recommendations

1. Due to expected sloughing conditions, it is recommended to minimize drill depths of bored CIP piles by using larger diameter shafts.

2. For preliminary purposes, a minimum depth of embedment of 5.0 m is required for heated buildings and 6.5 m is required for unheated structures.

3. Neglect the upper 1.5 m of skin friction for heated structures and upper 2.5 m for unheated structures, or the length of shaft embedded in fill, whichever is greater.

4. Straight shaft piles bearing should be designed based on shaft friction. The end bearing contribution should be ignored.

5. Belled piles bearing on till should be designed on end bearing resistance only. Frictional resistance on the shaft should be ignored.

6. If belled CIP concrete piles are used:

   - The bell diameter should not exceed the shaft diameter by more than a factor of 2.5.

   - The minimum distance from the underside of any sand layer to the roof of the bell should be 1.5 m.

   - Bells should not be placed within sand lenses or sand/gravel layers.

   - The roof the bell should be constructed a minimum of 45^{o} from the base.

7. Steel reinforcement should extend to the minimum embedment depth or into the pile bell if belled piles are used. The minimum recommended pile diameter is 400 mm.

6.6.4 CIP Pile Construction Recommendations

1. Hard drilling conditions are possible in the clay till with possible boulders. The proposed piling equipment should be suitably sided to handle drilling in these conditions.

2. Steel casing must be available on site during construction and should be used to prevent sloughing and groundwater seepage into the drill-hole.

3. Pile excavations should be filled with concrete immediately upon completing the pile excavation. Concrete should be placed in a manner to minimize potential segregation of aggregates. If excessive seepage is encountered the concrete may need to be placed by tremie method to displace the water in the pile excavation.

4. All CIP pile installations should be inspected by a qualified geotechnical engineer or technician to verify that design criteria are met or exceeded. Pile Integrity Testing (PIT) should be considered to ensure continuity along the concrete pile shafts.

6.7 GENERAL PILE RECOMMENDATIONS

6.7.1 Down Drag on Piles

Minor fills may be required for final site grading. Piles driven or installed through clay fill should be assumed to have a negative skin friction (down-drag) of 15 kPa acting on the section of pile shaft within the full depth of the new fill. Down-drag will diminish over time and will be eliminated when the fill is fully settled. Down drag is not used in ULS design of piles, unless the potential downdrag loads exceed the governing structural live loads. Down-drag is an ultimate service load which may increase the amount of settlement acting on a pile. It should be checked as part of SLS analysis for settlement sensitive structures where the pile capacity is not governed by the ULS case. Down-drag is also applied in the structural ULS check on the pile section. A load factor of 1.25 should be applied for the structural check.

6.7.2 Frost Design Considerations for Piles

Piles shafts will be subject to adfreezing stresses which can cause pile jacking within the depth of frost. For frost design, the depth of frost may be taken as 1.5 m for heated buildings and 2.5 m for unheated buildings in the clay till at this site. Minimum pile depths for heated and unheated structures have been provided in Section 6.5 and 6.6 for driven steel piles and concrete piles. These depths are conservative since they don't factor in the dead load component of resistance. Adfreeze pressures acting on the pile shaft within the design frost depth of frost penetration should be assumed to average 65 kPa for concrete piles and 100 kPa for steel piles as per the Canadian Foundation Engineering Manual (CFEM). This adfreeze force is an ultimate load. In the case of friction piles, resistance to adfreeze uplift forces will be provided by the dead load acting on the pile, the weight of the pile and the frictional resistance of soil on the shaft below the frost zone. Therefore, lightly loaded piles will be subjected to worse frost uplift conditions. The unfactored ultimate shaft friction values for soil below the depth of frost may be used to determine the required pile embedment to resist frost forces. Uplift forces due to frost and uplift due to wind loads are not additive.

Frost heave forces will also act on the underside of pile caps and grade beams with upward heaving pressure in the order of 1000 kPa or greater. The potential of frost heaving forces can be greatly reduced by the placement of a compressible material or by providing a void of at least 75 mm between the underside of the concrete cap or grade beam and soil. A product such as Voidform or an equivalent is recommended. If a compressible material is used as an alternative to the Voidform, the uplift pressure acting on the underside of the concrete may be taken as the crushing strength of the compressible medium. The finished grade adjacent to foundation walls should be sloped away so the surface runoff is not allowed to infiltrate and collect in the void space or in the compressible medium. If water is allowed to accumulate in the void space or the compressible medium becomes saturated, the beneficial effect will be negated and frost heaving pressures will occur.

6.8 GRADE SUPPORTED SLABS

Grade supported floor slabs, supported by the native soil or a fill subgrade prepared as described in section 6.2 are expected to perform adequately at the site. The magnitude of the expected vertical slab movements is considered to be within acceptable design tolerance. If proposed, grade supported floor slabs in continuously heated buildings may be designed based on a modulus of subgrade reaction (Ks) of 30,000 kN/m^3 for slabs placed on a mud slab or at least 150 mm of compacted gravel base ontop of the native clay till. The following recommendations should be followed:

1. Lightly loaded (live load typically less than 10 kPa) grade supported concrete slabs should be placed on 150 mm thick well graded crushed gravel (SMHI Type 32 or 33) over reworked subgrade. The gravel base should be free draining, compacted to 100 percent of SPMDD with a subgrade reaction of 30,000 kN/m^3.

2. Moderately loaded (live load typically greater than 10 kPa) grade supported concrete slabs should be placed on minimum 300 mm of well graded free draining crushed gravel (SMHI Type 32 or 33) over reworked subgrade. The gravel base should be compacted uniformly to 100 percent SPMDD with a subgrade reaction of 35,000 kN/m^3.

3. The gravel used should be well graded, free draining, granular base with a maximum aggregate size of 50 mm and less than 10 percent passing the 0.080 mm sieve. If required, the gravel gradation can be specified to meet the requirements of a soil gas venting (radon) system design. The proposed gradation should be reviewed by a qualified geotechnical engineer.

4. Slabs may be constructed independently of all walls, columns and grade beams. Slab on grade floors should be tied into the grade beam with dowels at doorways. Alternatively, the slab may be tied to grade beams if a construction joint is placed parallel to the wall at a distance of about 2.0 m.

5. Concrete flatwork will experience shrinkage cracking and must be placed with a high level of workmanship. Slabs should be provided with construction joints or saw cuts in accordance with local practice. The concrete slab should be reinforced with steel bars and dimensioned in accordance with the structural engineer's requirements. The

reinforcing bars can be carried through the construction joints. As a minimum, the recommended option for reinforcing steel to keep shrinkage cracks together is properly chaired 10M steel bar on 300 to 450 mm centers. The use of equivalent wire mesh is not recommended. Large slab areas should be saw-cut within 24 to 48 hours of placement to train cracks into planned locations. The maximum panel dimension between saw-cuts and/or joints should be 4.0 to 4.5 m.

6. Non-load bearing partitions should be designed to accommodate slight vertical movements of at least 50 mm. Service connections should be flexible enough to allow for small differential movements.

7. For all transitions between the fine grained subgrade and course gravel pad, a non-woven geotextile is recommended to prevent the migration of the gravel down into the subgrade

8. In unheated structures, frost heaving is a common cause of differential slab movement and cracking. Increasing the depth of granular, thickness of slab and amount of reinforcing steel could be utilized to minimize floor slab distress. If strict vertical movement tolerances are required, particularly for unheated slab areas, including the proposed slab area, consideration should be given to use rigid styrofoam insulations below the slab, the styrofoam insulation should be extended horizontally beyond the edges of the slab to provide sufficient protection against frost penetration below the slab. ParklandGEO can provide insulation details for frost protection upon request.

9. Piping and electrical conduit connections should be laid out to permit some flexibility, as vertical movement of such equipment as water meters, furnaces and electrical equipment may cause distress in the pipes. This provision is particularly important where there are short pipe runs between mechanical equipment and points where piping passes through the walls. Forced air ducts beneath the floor must not be allowed.

6.9 PRIVATE SEWAGE DISPOSAL SYSTEMS

The final layout and location of each proposed treatment area was not determined at the time of this study. Therefore, the recommendations given in this section are considered preliminary and are only provided for the purposes of describing general feasibility for PSDS and allowing preliminary sizing to assess possible treatment options at this site. It is expected that a detailed PSDS assessment will be required as a condition for the final subdivision approval in accordance with the "*Saskatchewan Onsite Wastewater Disposal Guide (Third Edition – November 2018)* Based on the area of the property the subdivision would be classified as a low density area. A detailed assessment for the parcel is not within the scope of this assessment. Some of the information in this report can be used for the detailed assessment.

6.9.1 Soil Classification

To make effective use of the Wastewater Disposal Guide, the description of the soil must use terms that are set out in the Canadian System of Soil Classification (CSSC) as effluent loading rates and available vertical separations is determined by these characteristics. The upper soils encountered were categorized by the (CSCC) and are summarized on the Soil Triangle in

Appendix B. The results of all grain size tests are appended and the results from three hydrometer test within the upper 7 m are summarized in the following table.

TABLE 8
SOIL CLASSIFICATION FOR PSDS

Borehole	Depth (m)	Gravel Content (% by wt.)	Sand Content (% by wt.)	Silt Content (% by wt.)	Clay Content (% by wt.)	SCC Soil Texture Classification
5	0.8	11.0	37.5	31.7	19.8	Loam (L)
7	3.8	0.0	43.4	28.8	27.8	Clay Loam (CL)
8	0.8	12.9	66.7	8.8	11.7	Medium Sandy Loam (MSL)

*The structure of the soil is assumed and should be verified prior to construction of the PSDS.

6.9.2 Soil Suitability

As discussed in Section 3.0, eight boreholes were drilled at the site to depths from 5.0 to 12.0 m below grade to classify the soil texture. Soil based treatment systems are also dependent on soil structure which is most easily identified in test pits or undisturbed sampling (ie. direct-push drilling). Soil structure is very important for wastewater treatment and can have great impact on treatment options. The effluent load rate on the soil infiltrative surface was estimated using the soil texture classification method. The upper 4 m of the subsoil profile consisted of Medium Sandy Loam, Clay Loam and Loam with an assumed moderate shape, blocky structure. The estimated effluent loading rate will be between 13.2 to 19.5L/day/m^2 with a specified effluent quality of 30 – 150 mg/L. For secondary treated effluent with a specified effluent quality of less than 30 mg/L the load rate is between 30.8 and 36.6L/day/m^2. Hydraulic linear load rates for these soils range from 43.3 to 64.1 L/day/m based on a slope of land of between 0 - 4 percent. The hydraulic loading rates and linear loading rates referenced are based on Table 13-2 and Table 13-4 from the Saskatchewan Onsite Wastewater Treatment Guide.

6.9.3 Sewage Disposal System Requirements

Any soil-based treatment requires the following:

- a minimum vertical separation of 1.5 m between the soil infiltration surface and a restricting layer for primary treated effluent.
- A minimum vertical separation of 0.9 m is required when receiving secondary treated effluent through a pressurized lateral distribution system.
- Adequate soil depth to achieve a 7-day effluent travel time to 2.4 m beneath the infiltration surface or a restrictive layer whichever is less.

Based on the borehole logs, the restricting layer on this site is expected to be caused by the shallow groundwater table. Groundwater was measured between 2.46 to 3.6 m below grade, however mottling (i.e. rust inclusions) above this depth indicates seasonally saturated conditions may be much shallower. For areas where seasonally saturated soils exist closer than 0.9 m from the surface, construction of a Type II mound may be required. For a more detailed outline of all the effluent loading rates and separation distances required by each of the treatment systems mentioned in this report, please refer to the Saskatchewan Onsite Wastewater Disposal Guide.

The expected sewage volumes required for design of the system should be based off Annex 1 in the Guide, which indicates 90 L/day per employee for industrial and commercial buildings with showers; or 50 L/day per employee if no showers are present. Design volumes may be increased, depending on the services offered and anticipated water usage.

The working capacity for primary treatment (septic tanks) is required to include an additional capacity to accommodate sludge and scum accumulation. Septic tank access openings should not be buried and should be located at a height above the surrounding landscape that ensures surface water will drain away from the access opening. Access openings should be equipped with a secure, air-tight lid or cover. A secondary treatment component shall include sampling ports or a suitable location to obtain wastewater and effluent samples to confirm treatment performance and assess operation of the component.

Additional requirements for private sewage disposal systems (PSDS):

1. The septic tank shall have adequate earth cover or other means to protect it from freezing while in operation and during periods of non-use. A septic tank that has less than 1.2 m of earth cover to protect it from freezing conditions shall be insulated to provide the equivalent of an R-8 insulation value over the top and sides of the tank to a minimum depth of 1.2 m below grade or insulated in some other acceptable manner to achieve a level of protection from freezing that equivalent to tank that has a minimum 1.2 m cover of the in situ soil.

2. The PSDS shall be designed to meet the separation requirements and to not exceed the effluent loading rate. The treatment system should be constructed in accordance with applicable regulations and should be properly sized and installed by a licensed contractor based on normal testing and verification of actual field conditions.

6.9.4 Treatment Mounds

If a treatment mound is proposed for private sewage disposal at the parcel, the mound should be constructed with imported materials that meet the required infiltration rate requirements. The onsite wastewater disposal guide also outlines the particle distribution of suitable medium density sand. In addition, the concrete sand specification or provincial CAN/CSA-A23.1 or ASTM-C33 may also be used. The mound berm fill material to form the berm of the overall mound covering the soil infiltration area (sand layer) is also outlined in the guide.
A treatment mound is required to meet the following setback requirements:

- 15 from a water source or water well;
- 15 m from a water course;
- 3 m from a property line;
- 3 m from septic tank;
- 9 m from a building with or without a basement, cellar or crawl space; and

6.9.5 Site Feasibility

Based on the preliminary results obtained by this geotechnical investigation, no discernable evidence was found that would indicate that the property would not be suitable for on-site wastewater treatment, however some areas of the site may be limited by shallow, seasonally saturated layers. Suitable waste water treatment systems include standard septic tank and fields, mounds and package treatment plants. Additional test pits should be conducted once the proposed PSDS area has been chosen to check for restrictive layers and soil structure.

6.10 ABOVE GROUND STORAGE TANKS (AST)

A maximum of 6 tanks are proposed for this site. The vertical tanks are expected to have a diameter of 4 m, a height of 10.7 m and will have a capacity of 125kL. The typical foundation for the ASTs is a concrete mat, although a thick gravel base supported on the native subgrade would also be considered suitable. Based on the borehole logs, the foundation soils for the tanks will likely be clay till.

6.10.1 General

The factors that must be considered in tank foundation design are bearing capacity of the soil, settlement potential below the tanks, spacing of the tanks to avoid overlapping influences, edge effect around the perimeter of the tank due to seasonal frost, and the operating temperature of the tank. The settlement potential is likely to govern due to the relatively large diameter of the tanks. Settlement of tanks over fill layers will also be dependent on the level of compaction achieved during placement.

The typical tank foundation is a gravel mat at least 0.8 m thick, thickened to 1.0 m under the edges of the tank. From a geotechnical perspective, a properly installed gravel mat will meet the requirements for these AST's. Other options to support large diameter AST's include the use of a perimeter foundation and in cases of very poor subgrade support or in areas of thick fills, a piled foundation can be used. Recommendations for these options may be provided upon request.

6.10.2 Bearing Pressure

The subgrade for the tank farm area will be native clay till. If fill should be required, engineered fill can be constructed to provide similar levels of subgrade performance to the native soil. The subgrade will be moderately susceptible to softening and heave due to frost action.

It is anticipated that the maximum height of the tanks will be about 10.7 m. Therefore, the highest bearing pressure applied by a fully loaded tank on the top of the gravel foundation is expected to be 100 kPa. The load along the edge of the tank might be as high as 115 kPa, including snow and wind loads on the steel tank structure. This load will be reduced slightly as it is spread down to subgrade through the gravel base layer.

The ultimate bearing capacity of the clay till subgrade for a circular load in this location is 540 kPa. The applied load below the tank is within the capacity of the subgrade to carry the load without experiencing a bearing failure, so the tank foundation design at this site will be governed by settlement and frost concerns.

6.10.3 Gravel Mat Foundation

The existing clay till subgrade is considered to have a moderate potential for vertical movement due to frost heaving and settlement. Provided that some small amount of seasonal heaving (estimated at about 50 to 75 mm) can be tolerated, gravel mat foundations may be suitable for the tank foundations. It is recommended to place a gravel mat at least 0.8 m thick on the clay till subgrade thickening to 1.0 m under the edges of the tank. The following general recommendations are provided for the construction of a gravel pad foundations.

1. All topsoil and/or fill soils must be cleanly removed down to firm undisturbed native material or engineered fill placed to specifications given in Section 6.2. All exposed native soil should be inspected to identify any weak subgrade soils. Weak soils should be sub-cut and replaced with engineered fill. All fills should be placed and compacted to at least 100 percent of SPMDD.

2. The pad foundation should consist of 0.8 m of compacted sand and gravel, thickened to 1.0 m under the edges of the tank. This material should be placed in no more than 150 mm thick layers with each layer compacted to at least 100 percent of SPMDD.

3. The upper 150 mm gravel layer should be comprised of 20 mm crushed granular base course material, with the lower gravel having a maximum particle size of 80 mm. The thickened edges should have a maximum particle size of 40 mm.

4. A sand bedding course for geomembrane liner and tank bedding directly below the tank would be acceptable and would be considered part of the granular structure. The thickness of the levelling layer should be at least 50 mm or as specified by the tank supplier. The leveling surface should be compacted to 100 percent of SPMDD.

5. The top edge of the tank pad should extend out at least 1. 5 m beyond the edge of the tank, or a distance equal to the thickness of the pad.

6. The exposed native soil surface should be crowned and surrounding area should be graded away from the bearing area, to provide proper drainage out from the centre of the tank farm area.

7. Material used for this base should be well graded, select gravel with a maximum particle size of 80 mm. It is suggested to place a 150 mm levelling surface of select sand or 20 mm crushed gravel (specifications below) over the gravel mat. The levelling surface should be compacted to 100 percent of SPMDD. A specification for the crushed gravel is given below.

TABLE 9
RECOMMENDED 20 MM GRAVEL GRADATION

Sieve Size (mm)	Percent Passing by Weight
	20 mm Crush Base
20	100
10	63 – 86
5	40 – 67
1.25	20 – 43
0.315	9 - 26
0.08	2 - 10

8. For any portion of the gravel mat above grade, the gravel should be confined by a perimeter foundation wall. Alternatively, the stability of the edge of the gravel mat may be achieved by extending the mat horizontally above grade past the edge of the equipment block, a distance of at least three (3) times the thickness of the gravel above grade, before sloping the mat down to the surrounding grade. The side slopes should be 2.5H:1V or less, and the gravel mat should extend a minimum distance of 0.5 m above the ground surface.

9. Gravel should be placed in layers no more than 150 mm thick, with each layer compacted to at least 100 percent of the Standard Proctor Maximum Dry Density (SPMDD) until the total thickness is achieved.

6.10.4 Settlement of Tanks Supported on Gravel Mats

AST base and edge settlement is a significant issue for owners of facilities with large tanks. The weights of tanks and associated gravel embankment and concrete ring wall will introduce a surcharge pressure to the subgrade soils. This surcharge pressure will cause both immediate and consolidation settlements. Tank contents produce a uniform load beneath the tank, however the tank edge carries an increase load from the shell and roof. Tanks are flexible structures that tolerate a large amount of settlement without signs of distress. However, tank settlement can result in inoperative floating roofs, shell roof buckling damage, stress corrosion, and leaks. Most settlement problems occur under the outside edge of the tank, however interior settling can also result in failures.

The magnitude of settlement will vary depending on, but not limited to, the thickness of the varying subgrade soils, composition of the soil (i.e. moisture content, void ratio, etc.), thickness and density of engineered fills, groundwater level and type of loading.

Settlement estimates for the tanks have been calculated based on conservative soil properties derived from classification test results and local experience. The settlement magnitude at the center of the 4 m diameter tanks in this area is estimated to range up to 0.10 m under full loading conditions. This estimation is based on this assumption that the tanks have a maximum height of 10.7 m, the clay till is about 25 m thick and a bearing pressure of 100kPa. Differential settlement between the centre and the edge of the tank perimeter is expected to be less than half of the estimated settlement at the centre. If any tanks are proposed in areas of fill, the type of fill and placement will have a large impact on the rate of settlement. Sand and gravel fills will experience almost immediate settlement; clay fills will experience longer consolidation settlement over an expected period of 6 to 18 months.

The proposed spacing between tanks is expected to produce minimal overlapping influences or settlement. The area between the two larger tanks may experience a minor heave (less than 10 to 15 mm). If tanks are spaced too closely together, the influence of adjacent tanks can overlap and cause differential settlement, resulting in tanks leaning towards each other. Differential settlement of this nature can result in floating roofs to jam, loss of tank capacity, and buckling of the tank shell. This may require a reduction in ultimate bearing capacity due to overstressed soil zones. Any tanks closely spaced at less than 2D to 3D center-to-center (or spacing less than 1.0 to 2.0 times the tank diameter) may need to be revaluated. The settlement performance for these proposed tanks is expected to be within the normally accepted range for cylindrical storage tanks, but this should be verified by the manufacturer. If stricter tolerances are required, it is recommended to either undertake detailed consolidation testing and settlement analysis to determine if modifications to the foundation system are required, or else support the tanks on a pile foundation.

It should be understood that settlement estimating for large ASTs is not an exact science, even when more test data is available. It is difficult to accurately apply information from small discrete test samples to models for large scale load applications in the field. For large industrial sties, it is recommended to measure and keep records of settlement performance for AST bases to calibrate and aid in design of future AST installation and tank repair programs. Settlement and bearing capacity for foundations on sandy soils are checked using the weight of water since settlement under this condition occurs very rapidly and should be essential complete of the hydrotest (i.e. first loading). Foundations on clay are checked using the weight of the commodity (i.e. long-term loading) since clay settles more evenly and slowly due to consolidation.

Sand drains or wicks can be used accelerate foundation drainage and consolidation and increase the strength of the foundation. If slow loading is possible, foundation stability can be improved very significantly by consolidation of the foundation during the first loading. Settlement problems are addressed by taking elevation readings at the base of the tank. Correcting excessive settlement can be done by releveling the tank using several common procedures such as shell jacking, under-the-shell releveling, or pressure grouting. The effect of detrimental settlement can be minimized by designing the tanks to allow for jacking and re-leveling as consolidation settlement occur, using flexible connection between mechanical and structural elements, and delaying connection as long as possible to reduce the magnitude of consolidation settlement after the tank is put into service.

6.10.5 Frost Effects on ASTs

Above-ground Storage Tanks are exposed structures which will experience frost penetration beneath the edges of the tank. This will cause some seasonal heave due to frost penetration beneath the perimeter edges during the winter; followed by subsidence upon thawing in the spring. The repetitive seasonal heave and subsidence can lead to subgrade softening, which can result in extra settlement over time. The perimeter edge of a tank is stressed higher than the base from carrying the dead and live load of the tank structure including the roof. Over time, these seasonal movements combined with “edge softening” of the subgrade can lead to excessive deformation and fatigue in the tank base.

Experience in Saskatchewan has shown that this has not been problematic for storage tanks founded on sufficient gravel foundations with adequate bearing support, so provision of additional foundation systems is not the normal design practice for tank farms. As a result, insulation of tank farms is not a conventional practice. The design of the thickened edges for gravel pad from 0.8 m to 1.0 m has evolved as a way to reduce the edge softening effect and achieve better support under the edge of larger tanks.

6.10.6 Containment Area for Aboveground Storage Tanks

The Saskatchewan Environment Ministry regulations dictate that tank storage areas need secondary containment. The tank area will need to be underlain by a compacted clay and/or synthetic liner. A synthetic liner will be used for this project.

Geo-membranes in conjunction with underlying subgrade layer that is not quite suitable as a standalone liner (i.e. a composite liner) will provide excellent containment protection. One advantage of geo-membrane liners is that installation of the liner will be less weather dependent. The selected membrane should be chemically resistant to the fluids stored at the tank farm and should be suitable to a range of operating temperatures. The liners should be incorporated below the tank foundation across the whole tank farm area and should extend up the berms. Geo-membranes should be installed and protected in accordance with the manufacturer’s specifications.

The following recommendations for containment areas should be followed:

1. The subgrade in the tank compound should be graded to provide drainage away from the tank pads. The ground surface of the area around the tank should be graded to a single collection point for removal of surface runoff.

2. Containment dykes should be constructed with native low to medium plastic clay fill. Grading and drainage are important considerations to minimize frost action and softening. The dykes should be provided with side slopes no steeper than 3H:1V, and should be have sufficient height to contain the design spill volume. The clay fill for the dykes should be placed in uniform thin lifts. The lift thickness should be governed by the ability of the selected equipment to uniformly achieve the recommended density of at least 95 percent of SPMDD, but no greater than 200 mm thick after compaction. Proper moisture conditioning will help remould the clay and reduce compaction effort needed to achieve maximum density (i.e. minimizing the potential risk of subgrade disturbance). Each successive lift should be scarified approximately 25 mm to allow the clay layers to bond.

3. A leak detection system should be placed above the liner and monitored. This system should consist of a minimum 150 mm thick layer of free draining gravel (i.e. washed) with less than 5 percent material passing the 0.080 mm sieve by weight. The entire bottom surface of this layer should be graded to a sump to allow for collection of runoff and possible leakage. Drainage is important for both soil stability and bottom corrosion.

6.11 PAVEMENTS

It is expected that the area around the proposed building site for the parking areas and roadways will be constructed with either a granular or ACP surface.

6.11.1 Subgrade Assumptions

Gravel pavement will be able to tolerate more deflection than ACP surfaced pavement and will be subject to periodic maintenance and gravel replenishment as required. The proposed pavement sections are based on the assumption that the subgrade will be constructed on a stable, suitably prepared stable subgrade with a California Bearing Ratio of at least 3.0. This is indicative of a low level of subgrade support as expected during spring thaw when the subgrade soils will exist in a weakened condition. If soft subgrade conditions are encountered, it is assumed that the subgrade will be improved with select clay fill or coarse gravel to support construction traffic and paving activities. Additional localized thickening of the gravel layers may be required depending on conditions at the time of construction. If required, the subgrade improvement gravel and the sub-base layer are typically placed together, effectively increasing the thickness of the sub-base layer.

6.11.2 Gravel Pavement

The proposed new pavement design sections are based on a 20 year design life. The heavy duty condition assumes about 50 heavy truck loadings per day over a twenty year design period (1.0×10^6 ESALs). The following gravel pavement sections are suggested in the following table.

TABLE 8
GRAVEL PAVEMENT STRUCTURES

Pavement Material	Thickness (mm)			
	Light Traffic		Heavy Traffic	
Base Course Gravel (Type 33*)	400	200	550	200
Sub-base Course Gravel (Type 8*)	-	250	-	490
Woven Geotextile	Yes	Yes	Yes	Yes
150 mm Subgrade Preparation	Yes	Yes	Yes	Yes

*Saskatchewan Ministry of Highways and Infrastructure (SMHI)

6.11.3 Flexible Asphalt Pavement (ACP)

Consideration may be given to paving this site. The suggested ACP pavement structure for this site is provided in the following table.

TABLE 9
FLEXABLE PAVEMENT STRUCTURES

Pavement Material	Thickness (mm)			
	Light Traffic		Heavy Traffic	
Asphalt Concrete Pavement	75	75	100	100
Base Course Gravel (Type 33*)	300	150	450	200
Sub-base Course Gravel (Type 8*)	-	250	-	300
Woven Geotextile	Yes	Yes	Yes	Yes
150 mm Subgrade Preparation	Yes	Yes	Yes	Yes

*Saskatchewan Ministry of Highways and Infrastructure (SMHI)

6.11.4 Materials and Placement

The performance of the proposed pavement design sections will be, in part, dependent on achieving an adequate level of compaction in subgrade and pavement materials. The recommended levels of compaction for the granular materials in the pavement section should be a minimum of 98 percent of SPMDD. The asphalt concrete should be compacted to a minimum of 93 percent of Maximum Theoretical Density (MTD).

Aggregate materials for base and subbase gravel should be composed of sound, hard, durable particles free from organics and other foreign material. It is recommended to use aggregates conforming to SMHI specification. A driving surface aggregate should be considered for the top lift of gravel pavement.

6.11.5 Rigid Concrete Pavements (RCP)

For this development, heavy truck and equipment is expected to cross across or be parked on asphalt areas, which may cause pavement distress to pavements founded the clay till subgrade. The use of rigid pavement (concrete) at curb crossings and main drive aisles where heavy trucks will drive and especially turn or break, with or without an asphalt topping, will provide better long-term performance with less operational and maintenance costs compared with asphalt pavement. Rigid concrete pavement may be considered for other areas of the site which will be subjected to heavy truck traffic and high static loads (loading areas, truck turning areas). Under these conditions, rigid pavement sections will provide longer life with expected lower maintenance compared to flexible asphalt pavements on the present low support subgrade. Details for RCP can be provided upon request.

6.11.6 Geosynthetics

Filter fabric is commonly placed as a separation barrier between fine grained subgrade soils and subsurface gravel features such as: base and subbase gravel layers in roads, gravel drainage blankets and gravel drains. In conventional road applications woven filter cloth is recommended unless the fabric is used in conjunction with a geo-grid. As a general rule, if the subgrade is too soft or sensitive to undertake a conventional subgrade preparation, then the use of filter fabric should be considered. Since areas of the site have sensitive subgrade soils, the use of geotextile is required to act as a separation barrier between the subgrade and the gravel base. A geotextile filter fabric works as a separation barrier between the pavement gravel and the clay subgrade to minimize the movement of fines into the gravel base course. As a minimum, it should be used for critical areas such as site accesses and loading areas. The suggested geotextile specification is:

TABLE 10
WOVEN FILTER CLOTH SPECIFICATION

Parameter	Specification	Test Method
Minimum Grab Tensile Strength	800 N	ASTM D4632
Minimum Grab Elongation at Failure	15%	ASTM D4632
Minimum Puncture Strength	300 N	ASTM D4833
Minimum Sewn Seam Strength	720 N	ASTM D3786
Minimum Tear Strength	250 N	ASTM D4533
Maximum Apparent Opening Size	0.6 mm	ASTM D4751

* or equivalent SMHI Standard Medium Weight Woven Filter Cloth

The addition of a geotextile at the subgrade surface on this type of subgrade material would not reduce the granular thickness requirements significantly since the subgrade would have to deform (rut) in order for the strength of the geotextile to be developed. Woven fabrics typically have more favourable stress/strain characteristics (30% elongation at failure) than non-woven filter fabrics (100% elongation at failure). Therefore, the woven fabric will mobilize more strength as the subgrade deflects under traffic loads. Proposed geosynthetic filter fabrics should be reviewed based on their proposed end use. A slightly less robust geotextile could be given consideration if initial field performance ratings dictate.

The selective use of geo-grid reinforcement may be prudent for critical traffic areas at this site. The need for extra pavement reinforcement measures should be reviewed based on conditions in the field at the time of construction.

6.11.7 Grading and Drainage

All pavement area surface and subgrade should be sloped and graded to effectively remove all surface and subsurface water as rapidly as possible. It is recommended to provide adequate surface drainage with cross slope crowns of at least 3 percent on regularly maintained gravel surfaces. Yard areas should be sloped and graded to effectively remove all surface water as rapidly as possible. To minimize the occurrence of surface water ponding in the yard, surface grades of at least 3 percent are recommended. Allowing water to pond on the surface will lead to infiltration of the water into the subgrade which could result in weakening of the subgrade soils and may lead to distress/failure of the overlying pavement. For large yard areas, additional grade may be needed to shed water from the surface

6.12 FOUNDATION CONCRETE

Water soluble sulphate concentration results indicates a very severe potential for sulphate attack of subsurface concrete. Therefore it is recommended that an S-2 classification be applied to all concrete exposed to soils, as per the CAN/CSA-A23.1-19 standards. High Sulphate Resistant (Type HS) hydraulic cement may be used for concrete placed in contact with native soil. The minimum 56 day compressive strength is 32 MPa with a maximum water to cement ratio of 0.45. All concrete exposed to a freezing environment either during or after construction should be air entrained. Concrete should be placed in accordance with CSA Standard CAN3-A23.1-19. Calcium chloride used as accelerating admixture or any admixture formulation containing chloride should not be used in the subsurface concrete, since they may increase the severity of sulphate attack.

6.13 INSPECTION

It is recommended that on-site inspection and testing be performed to verify that actual site conditions are consistent with assumed conditions which meet or exceed design criteria. The recommendations provided within this report are dependent on proper quality control of fill placement. Initial site stripping and excavation activities should be monitored by experienced and qualified geotechnical personnel. The placement of an engineered fill should be monitored and tested by a qualified soils technician to verify adequate levels of compaction and design standards are achieved. Based on the National Building Code, adequate levels of inspection are considered to be: proof roll of prepared subgrade, full time inspection during construction of deep foundations, monitoring and compaction testing of engineered fill, and review of all completed bearing surfaces for footings and full-time inspection during construction of deep foundations.

6.14 ENVIRONMENTAL EVALUATION

The results of the petroleum hydrocarbon laboratory analyses did not identify impacts within the select soil and groundwater samples analyzed for BTEX and PHC Fractions F1 to F4. No additional environmental investigation is recommended at this time in relation to the proposed development.

7.0 LIMITATIONS

Geological conditions are variable. At the time this report was prepared, information on the subsurface conditions was available only at the borehole locations. Therefore, it was necessary to make certain assumptions concerning conditions between the borehole locations. The recommendations presented in this report, and any subsequent correspondence, are based on an evaluation of information derived from eight boreholes, and additional sources of information referenced in this report. The conditions described are believed to be reasonably representative of the site. If conditions are noted during construction which are believed to be at variance with the conditions described in this report, this office should be contacted immediately.

This report has been prepared for the exclusive use of **Hasegawa Engineering,** and their approved agents, for the specified application of the Proposed Corman Corner Commercial/ Light -Industrial Development in Corman Park, Saskatchewan. It has been prepared in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made. Use of the report is subject to acceptance of the General Terms and Conditions provided in Limitation Appendix of this report.

We trust that this report meets with your current requirements. If there are any questions, please contact the undersigned.

Respectfully Submitted,
PARKLAND GEOTECHNICAL CONSULTING LTD.

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Geo-Materials Technician

Roldane Senior, P.Eng.
APEGS Permit to Practice No. P – 27603

Reviewed by:
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Senior Associate, Geotechnical Engineer

Mark Brotherton, P.Eng.
Principal Geotechnical Engineer
Responsible member

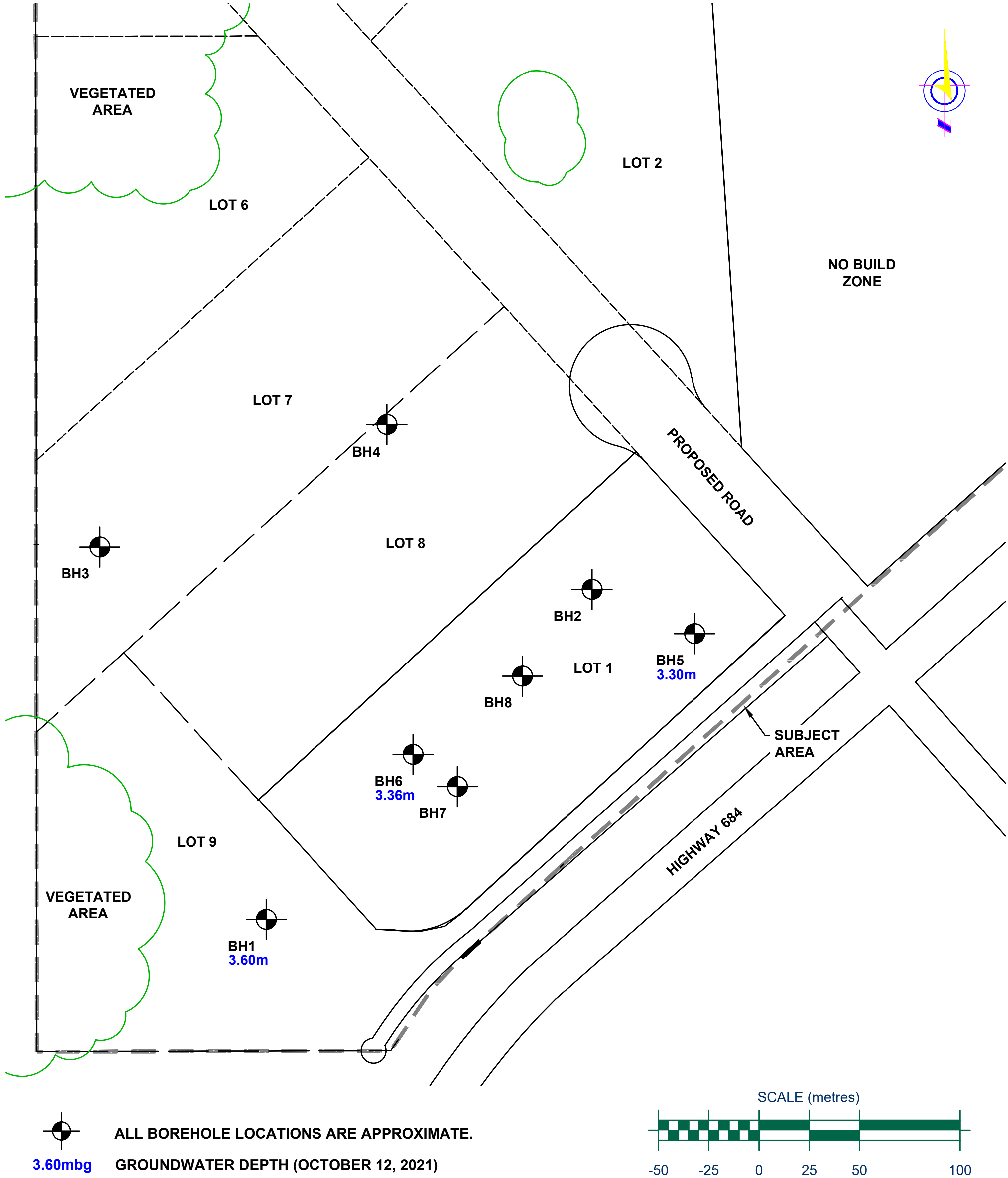
FIGURES

ParklandGEO	CLIENT: HASEGAWA CONSULTING PROFESSIONAL ENGINEERS	**KEY PLAN**

PROPOSED CORMAN CORNER DEVELOPMENT
HIGHWAY 16 & HIGHWAY 684, CORMAN PARK, SK

DRAWN:	CHK'D.:	REV #:	DATE:
NC	RS	0	OCTOBER 2021

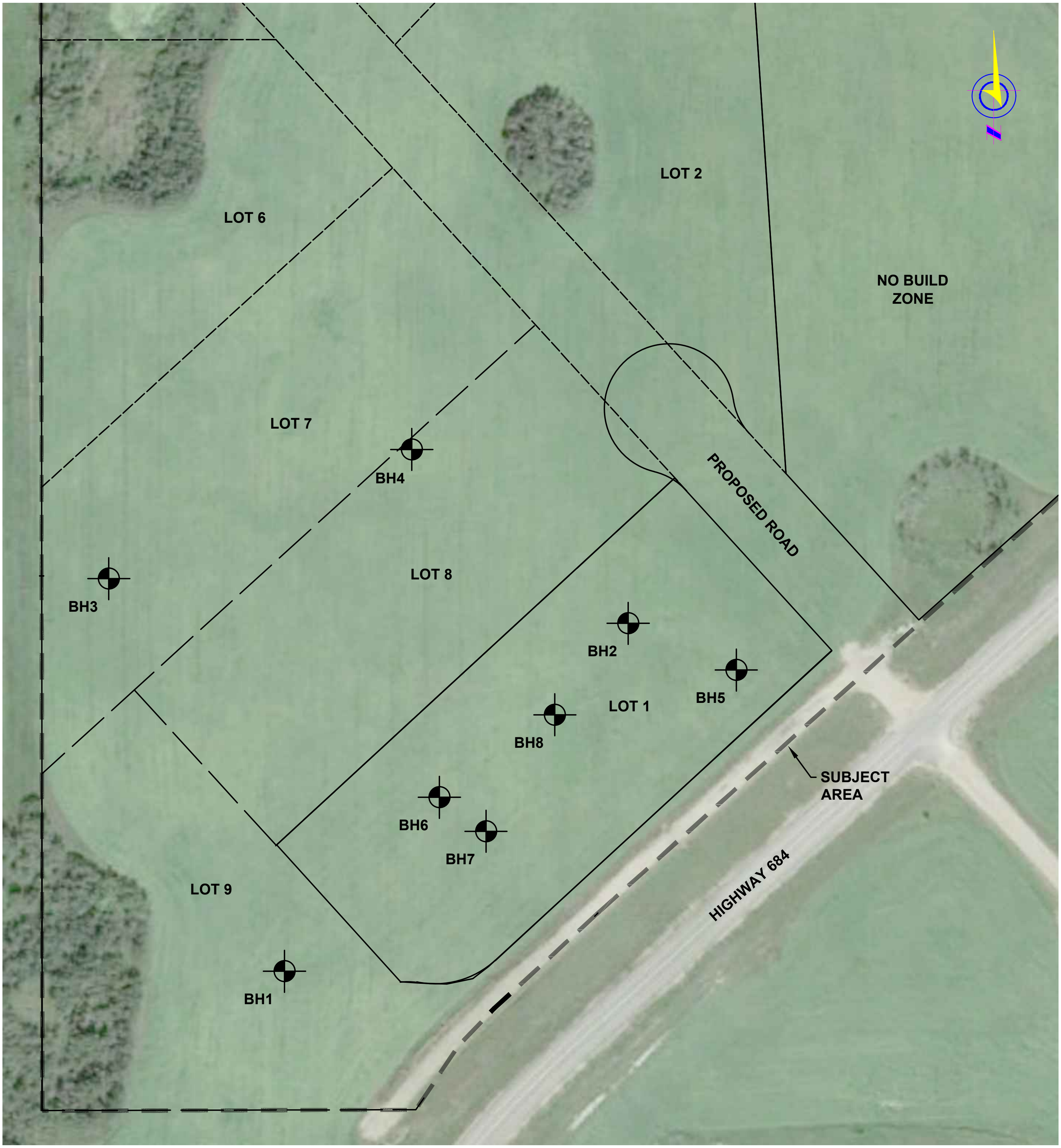
SCALE:	JOB NO.	DRAWING NO.
NTS	SK0387	FIGURE 1



ALL BOREHOLE LOCATIONS ARE APPROXIMATE.

3.60mbg GROUNDWATER DEPTH (OCTOBER 12, 2021)

ParklandGEO	CLIENT: HASEGAWA CONSULTING PROFESSIONAL ENGINEERS	SITE PLAN
		PROPOSED CORMAN CORNER DEVELOPMENT HIGHWAY 16 & HIGHWAY 684, CORMAN PARK, SK
		DRAWN: NC / CHK'D.: RS / REV #: 0 / DATE: OCTOBER 2021
		SCALE: 1:2500 / JOB NO. SK0387 / DRAWING NO. FIGURE 2



NOTE: AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH, DATED AUGUST 23, 2015.

ALL BOREHOLE LOCATIONS ARE APPROXIMATE.

SCALE (metres)

-50 -25 0 25 50 100

ParklandGEO

CLIENT: HASEGAWA CONSULTING PROFESSIONAL ENGINEERS

AERIAL PLAN

PROPOSED CORMAN CORNER DEVELOPMENT
HIGHWAY 16 & HIGHWAY 684, CORMAN PARK, SK

DRAWN:	CHK'D.:	REV #:	DATE:
NC	RS	0	OCTOBER 2021

SCALE:	JOB NO.	DRAWING NO.
1:2500	SK0387	FIGURE 3

PHOTOGRAPH 1: SHOWS BH1

PHOTOGRAPH 2: SHOWS BH2, FACING SOUTH

PHOTOGRAPH 3: SHOWS BH3, FACING WEST

PHOTOGRAPH 4: SHOWS 7, FACING SOUTHWEST

Parkland GEO

CLIENT:

HASEGAWA CONSULTING PROFESSIONAL ENGINEERS

SITE PHOTOGRAPHS

PROPOSED CORMAN CORNER DEVELOPMENT
HIGHWAY 16 & HIGHWAY 684, CORMAN PARK, SK

DRAWN:	CHK'D.:	REV #:	DATE:
NC	RS	0	OCTOBER 2021
SCALE: NTS	JOB NO. SK0387		DRAWING NO. FIGURE 4

APPENDIX A

Borehole Logs (8)
Explanation of Terms and Symbols

ParklandGEO

CLIENT: Hasegawa Engineering
SITE: Corman Corner Development
NOTES:

BOREHOLE NO.: 01

PROJECT NO.: SK0387
BH LOCATION: 10-3-38-6 W3

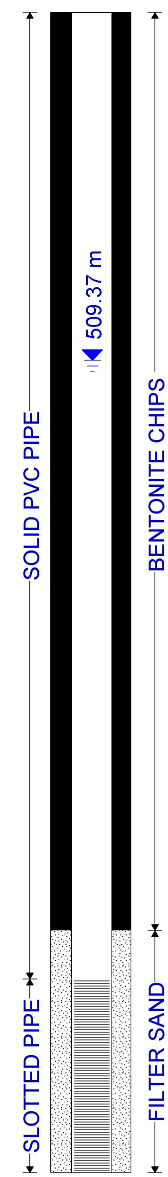
SUBSURFACE PROFILE

GROUND SURFACE (Elevation 512.97 m)

Depth (m)	Description	Moisture (Wp |-----X-----| Wl)	Type	Sample No	SPT (N)	Elevation (m)
0 – 0.3	***Topsoil (300 mm)*** Organic, sandy, brown to black, trace rootlets, dry to damp.					512.97 / 512.67
0.3 – 12.0	***Till*** Clay, some silt, some sand, trace gravel, very stiff, low to medium plastic, brown / tan, damp. -Rust inclusions at 2.0 m. -Grey at 7.5 m.					
0.8		9	G	1G1		
1.8		10				
2.3			G	1G2		
2.8		11				
3.8		9	G	1G3		
4.8		9	D	1D1	22	
5.3			G	1G4		
5.8		10				
6.3			D	1D2	30	
6.8		11	G	1G5		
7.8		11				
8.3			G	1G6		
8.8		10				
9.3			D	1D3	26	
9.8		10	G	1G7		
10.8		8	D	1D4	34	
11.3			G	1G8		
11.8		11				
12.0	End of hole at 12.0 m. 50 mm PVC standpipe installed. Backfilled with bentonite chips and filter sand. Dry upon completion. Water at 3.6 m on October 14, 2021.					500.97

Comments:

Well Completion Details



LOGGED BY: NH
CONTRACTOR: Mobile Augers and Research Ltd.
RIG/METHOD: Truck Mounted / 150 mm SSA
DATE: October 4, 2021
CALIBRATION:

GROUND ELEVATION: 512.97 m
NORTHING: 5789139 N
EASTING: 378768 E

ParklandGEO

CLIENT: Hasegawa Engineering
SITE: Corman Corner Development
NOTES:

BOREHOLE NO.: 02
PROJECT NO.: SK0387
BH LOCATION: 10-3-38-6 W3

SUBSURFACE PROFILE

Depth (m)	Description	Moisture (Wp |-----X-----| Wl)	Type	Sample No	SPT (N)	Comments	Well Completion Details	Elevation (m)
0	GROUND SURFACE							512.38
0–0.3	***Topsoil (300 mm)*** Organic, sandy, brown to black, trace rootlets, dry to damp.							512.08
0.3–9.0	***Till*** Clay,some silt, some sand, trace gravel, very stiff, low to medium plastic, brown / tan, rust inclusions, damp.							
1.0		11	G	2G1				
2.0		10						
2.5			G	2G2				
3.0		12						
3.3			SPT	2D1	19			
4.0		10	G	2G3				
4.8			SPT	2D2	28			
5.0		9						
5.5			G	2G4				
6.0		10						
7.0		10	G	2G5				
7.5	-Grey at 7.5 m.							
7.8			SPT	2D3	37			
8.0		9						
8.5			G	2G6				
9.0	End of hole at 9.0 m. Backfilled with auger cuttings. Dry upon completion.	10						503.38

LOGGED BY: NH
CONTRACTOR: Mobile Augers and Research Ltd.
RIG/METHOD: Truck Mounted / 150 mm SSA
DATE: October 4, 2021
CALIBRATION:

GROUND ELEVATION: 512.38 m
NORTHING: 5789303 N
EASTING: 378930 E

BOREHOLE NO.: 03

ParklandGEO

CLIENT: Hasegawa Engineering
SITE: Corman Corner Development
NOTES:

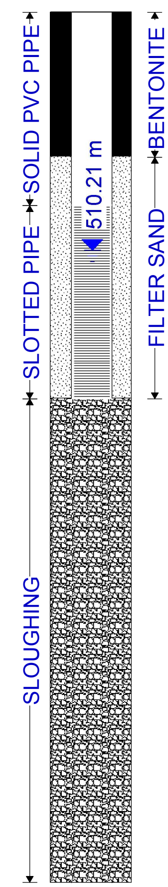
PROJECT NO.: SK0387
BH LOCATION: 10-3-38-6 W3

SUBSURFACE PROFILE

Depth (m)	Description	Moisture (Wp |-----X-----| Wl)
0	GROUND SURFACE	
0 – 0.3	***Topsoil (300 mm)*** Organic, sandy, brown to black, trace rootlets, dry to damp.	
0.3 – 2.6	***Till*** Clay, little silt, little sand, trace gravel, very stiff, low to medium plastic, brown / tan, damp.	12 (1.0 m); 12 (2.0 m)
2.6 – 4.0	***Sand*** Trace clay, trace silt, very dense, brown, saturated. -Water at 2.6 m.	17 (3.0 m); 14 (4.0 m)
4.0 – 9.0	***Till*** Clay, some silt, some sand, trace gravel, very stiff, low to medium plastic, brown / tan, damp.	12 (5.0 m); 10 (6.0 m); 11 (7.0 m); 11 (8.0 m); 11 (9.0 m)
9.0	End of hole at 9.0 m. Sloughed to 4.0 m upon completion. 50 mm PVC standpipe installed. Backfilled with bentonite chips and filter sand. Dry upon completion. Water at 2.46 m on October 14, 2021.	

Type	Sample No	SPT (N)	Comments
G	3G1		
D	3D1	17	
G	3G2		
G	3G3		
D	3D2	-	- 50 blows for 200 mm
G	3G4		
G	3G5		
G	3G6		

Well Completion Details



Elevation (m)
512.67
512.37
510.07
508.67
503.67

LOGGED BY: NH
CONTRACTOR: Mobile Augers and Research Ltd.
RIG/METHOD: Truck Mounted / 150 mm SSA
DATE: October 4, 2021
CALIBRATION:

GROUND ELEVATION: 512.67 m
NORTHING: 5791207 N
EASTING: 378074 E

BOREHOLE NO.: 04

Parkland GEO

CLIENT: Hasegawa Engineering
SITE: Corman Corner Development
NOTES:

PROJECT NO.: SK0387
BH LOCATION: 10-3-38-6 W3

SUBSURFACE PROFILE

Depth (m)	Description	Symbol	Moisture (Wp |-----X-----| Wl) 25 50 75	Type	Sample No	SPT (N)	Comments	Well Completion Details	Elevation (m)
	GROUND SURFACE								512.98
0	***Topsoil (300 mm)*** Organic, sandy, brown to black, trace rootlets, dry to damp.								512.68
1	***Sand*** Trace clay, trace silt, trace gravel, trace cobble, dense, brown, rust inclusions, damp.		4	G	4G1				511.48
2	***Till*** Clay, some silt, some sand, trace gravel, very stiff, low to medium plastic, brown / tan, damp.		10						
2.5				G	4G2				
3			11						
3.5				SPT	4D1	29			
4			9	G	4G3				
4.5				SPT	4D2	36			
5	End of hole at 5.0 m. Backfilled with auger cuttings Dry upon completion.								507.98

LOGGED BY: NH
CONTRACTOR: Mobile Augers and Research Ltd.
RIG/METHOD: Truck Mounted / 150 mm SSA
DATE: October 4, 2021
CALIBRATION:

GROUND ELEVATION: 512.98 m
NORTHING: 5789385 N
EASTING: 378828 E

BOREHOLE NO.: 05

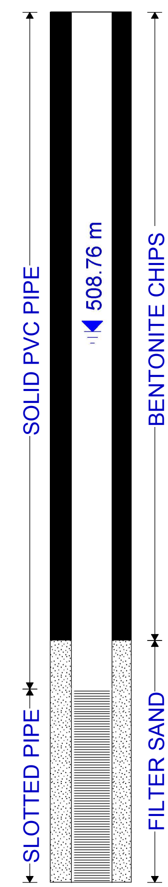
CLIENT: Hasegawa Engineering
SITE: Corman Corner Development
NOTES:

PROJECT NO.: SK0387
BH LOCATION: 10-3-38-6 W3

SUBSURFACE PROFILE

Depth (m)	Description	Moisture (Wp |-----X-----| Wl)	Type	Sample No	SPT (N)	Comments	Elevation (m)
	GROUND SURFACE						512.06
0	***Topsoil (300 mm)*** Organic, sandy, brown to black, trace rootlets, dry to damp.						511.76
1	***Till*** Clay, and silt, some sand, trace gravel, very stiff, low plastic, brown / tan, damp. -Cobble at 0.5 m.	8	G	5G1		**Grain Size Analysis** Gravel - 8.4 % Sand - 27.3 % Silt - 44.5 % Clay - 19.8 %	
2		10					
			G	5G2			
3		10	D	5D1	23		
4		9	G	5G3			
4.5	-Hard at 4.5 m.						
5		10	D	5D2	38		
			G	5G4			
6	- Grey at 6.0 m.	10					
7		10	G	5G5			
7.5	-Water seepage at 7.5 m.						
8		10	D	5D3	30		
			G	5G6			
9	End of hole at 9.0 m. 50 mm PVC standpipe installed. Backfilled with bentonite chips and filter sand. Wer upon completion. Water at 3.3 m on October 14, 2021.	9					503.06

Well Completion Details



LOGGED BY: NH
CONTRACTOR: Mobile Augers and Research Ltd.
RIG/METHOD: Truck Mounted / 150 mm SSA
DATE: October 4, 2021
CALIBRATION:

GROUND ELEVATION: 512.06 m
NORTHING: 5789281 N
EASTING: 378981 E

ParklandGEO

CLIENT: Hasegawa Engineering
SITE: Corman Corner Development
NOTES:

BOREHOLE NO.: 06
PROJECT NO.: SK0387
BH LOCATION: 10-3-38-6 W3

SUBSURFACE PROFILE

Depth (m)	Description	Moisture (Wp |-----X-----| Wl)	Type	Sample No	SPT (N)	Comments	Well Completion Details	Elevation (m)
	GROUND SURFACE							512.57
0	***Topsoil (300 mm)*** Organic, sandy, brown to black, trace rootlets, dry to damp.						SOLID PVC PIPE; BENTONITE CHIPS	512.27
1	***Till*** Clay, and silt, some sand, trace gravel, very stiff, low plastic, brown / tan, damp.	11	G	6G1				
2		10	D	6D1	15			
2.5			G	6G2				
3		11					509.21 m	
4		9	G	6G3				
5		10						
5.5			G	6G4				
6		11	D	6D2	27			
7		10	G	6G5			FILTER SAND	
7.2	- Grey at 7.2 m.						SLOTTED PIPE	
8		10						
8.5			G	6G6				
9		10	D	6D3	29			503.07
9.5	End of hole at 9.5 m. 50 mm PVC standpipe installed. Backfilled with bentonite chips and filter sand. Dry upon completion. Water at 3.36 m on October 14, 2021.							

LOGGED BY: NH
CONTRACTOR: Mobile Augers and Research Ltd.
RIG/METHOD: Truck Mounted / 150 mm SSA
DATE: October 4, 2021
CALIBRATION:

GROUND ELEVATION: 512.57 m
NORTHING: 5789221 N
EASTING: 378841 E

ParklandGEO

CLIENT: Hasegawa Engineering
SITE: Corman Corner Development
NOTES:

BOREHOLE NO.: 07

PROJECT NO.: SK0387
BH LOCATION: 10-3-38-6 W3

SUBSURFACE PROFILE

Depth (m)	Description	Symbol	Moisture (Wp |-----X-----| Wl) 25 50 75	Type	Sample No	SPT (N)	Comments	Well Completion Details	Elevation (m)
0	GROUND SURFACE								512.67
0–0.3	***Topsoil (300 mm)*** Organic, sandy, brown to black, trace rootlets, dry to damp.								512.37
0.3–1.2	***Sand*** Trace silt, trace clay, trace gravel, compact, low plastic, brown, moist.		10	G	7G1		SO_4 - 0.220 %		511.47
1.2–6.5	***Till*** Clay, and sand, some silt, very stiff, medium plastic, brown / tan, rust inclusions, damp.		8	D	7D1	15			
				G	7G2				
	- Cobble at 2.8 m.		9	D	7D2	16			
			11	G	7G3		**Grain Size Analysis** Gravel - 0.0 % Sand - 40.8 % Silt - 31.3 % Clay - 27.8 %		
	- Grey at 5.2 m.		9	G	7G4				
	- Hard at 6.0 m.		9	D	7D3	33			506.17
6.5	End of hole at 6.5 m. Backfilled with auger cuttings. Dry upon completion.								

LOGGED BY: NH
CONTRACTOR: Mobile Augers and Research Ltd.
RIG/METHOD: Truck Mounted / 150 mm SSA
DATE: October 4, 2021
CALIBRATION:

GROUND ELEVATION: 512.67 m
NORTHING: 5789205 N
EASTING: 378863 E

ParklandGEO

CLIENT: Hasegawa Engineering
SITE: Corman Corner Development
NOTES:

BOREHOLE NO.: 08

PROJECT NO.: SK0387
BH LOCATION: 10-3-38-6 W3

SUBSURFACE PROFILE

Depth (m)	Description	Moisture (Wp |-----X-----| Wl)	Type	Sample No	SPT (N)	Comments	Well Completion Details	Elevation (m)
	GROUND SURFACE							512.67
0	***Topsoil (300 mm)*** Organic, sandy, brown to black, trace rootlets, dry to damp.							512.37
0.3	***Sand*** Fine grained, trace silt, little clay, trace gravel, trace cobble, compact, low plastic, brown, moist. - Medium to coarse grained at 1.5 m.	10 (1 m); 8 (2 m)	G; D	8G1; 8D1	15	**Grain Size Analysis** Gravel - 9.1 % Sand - 69 % Silt - 10.2 % Clay - 11.7 %		510.27
2.4	***Till*** Clay, some silt, some sand, trace gravel, very stiff, low to medium plastic, brown / tan, rust inclusions, damp. - Sand lense and Water at 4.5 m.	9 (3 m); 11 (4 m); 9 (5 m); 9 (6 m)	G; D; G; D; G	8G2; 8D2; 8G3; 8D3; 8G4	19; 20			506.67
6.0	End of hole at 6.0 m. Backfilled with auger cuttings. Dry upon completion.							

LOGGED BY: NH
CONTRACTOR: Mobile Augers and Research Ltd.
RIG/METHOD: Truck Mounted / 150 mm SSA
DATE: October 4, 2021
CALIBRATION:

GROUND ELEVATION: 512.67 m
NORTHING: 5789229 N
EASTING: 378944 E

THE PARKLANDGEO CONSULTING GROUP
EXPLANATION OF TERMS AND SYMBOLS

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

The borehole logs are a graphical representation summarizing the soil profile as determined during site specific field investigation. The materials, boundaries, and conditions have been established only at the borehole location at the time of drilling. The soil conditions shown on the borehole logs are not necessarily representative of the subsurface conditions elsewhere across the site. The transitions in soil profile can have gradual rather than distinct boundaries.

1. **PRINCIPAL SOIL TYPE** – The major soil type by weight of material or by behaviour.

Material	Grain Size
Boulders	Larger than 300 mm
Cobbles	75 mm to 300 mm
Coarse Gravel	19 mm to 75 mm
Fine Gravel	5 mm to 19 mm
Coarse Sand	2 mm to 5 mm
Medium Sand	0.425 mm to 2 mm
Fine Sand	0.075 mm to 0.425 mm
Silt	0.020 to 0.075 mm
Clay	Smaller than 0.020 mm

2. **DESCRIPTION OF MINOR SOIL TYPE** – Minor soil types are identified by weight of minor component.

Descriptor	Percent
and	35 to 50
some	20 to 35
little	10 to 20
trace	1 to 10

3. **CONSISTENCY OF FINE GRAINED SOILS** – The following terms are used relative to undrained shear strength and Standard Penetration Test (SPT), N value, for blows per 300 mm penetration (ASTM D1586).

Description	Undrained Shear Strength, C_u (kPa)	SPT N Value
Very Soft	Less than 12	Less than 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 150	15 to 30
Hard	Over 150	Over 30

4. **RELATIVE DENSITY OF COARSE GRAINED SOIL** – The following terms are used relative to Standard Penetration Test (SPT), N value, for blows per 300 mm penetration (ASTM D1586).

Description	SPT N Value
Very Loose	Less than 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	Over 50

5. **TYPICAL SEDIMENTARY BEDROCK TYPES AND CLASSIFICATION** – The following terms are based on visual inspection and field/laboratory identification tests.

Characteristic	Sandstone	Mudrocks			
		Siltstone	Mudstone	Clayshale	Claystone
Composition	>50% Sand $CaCO_3$ or silica binder. Use weak acid to test for $CaCO_3$.	>50% Silt	33% to 66% Silt & 33% to 66% Clay	>50% Clay & <33% Silt	
Bedding	Banding possible Non- Fissile Wackes – dirty sandstone matrix (>15% clay)	Non-Fissile & Non-laminated	Non-Fissile & Non-laminated	Fissile	Non-Fissile

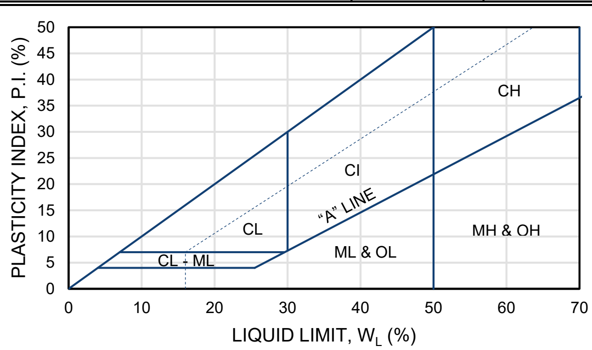
Definitions

Fissile	Breaks apart on bedding planes, not fractures.
Shale	Only used to describe a fissile clay mudrock.
Slate	Hard mudstone exposed to high pressure and temperature.
Limestone	Sedimentary rock (i.e. particles) formed from calcium carbonate minerals from skeletal fragments of marine organisms such as coral. Particles generally too small to see with eye.

THE PARKLANDGEO CONSULTING GROUP
EXPLANATION OF TERMS AND SYMBOLS

MODIFIED UNIFIED CLASSIFICATION SYSTEM FOR SOILS

MAJOR DIVISION			GROUP SYMBOL	GRAPH SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA	
COARSE GRAINED SOILS (MORE THAN HALF BY WEIGHT LARGER THAN NO. 200 SIEVE)	**GRAVELS** MORE THAN HALF COARSE GRAINS LARGER THAN NO. 4 SIEVE	**CLEAN GRAVELS** (LITTLE OR NO FINES)	GW		WELL GRADED GRAVELS, GRAVEL-SAND MIXTURE, LITTLE OR NO FINES	$C_U = \frac{D_{60}}{D_{10}} \geq 4$ AND $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1$ to 3	
			GP		POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS	
		DIRTY GRAVELS (WITH SOME FINES)	GM		SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES	CONTENT OF FINES EXCEEDS 12%	ATTERBERG LIMITS BELOW "A" LINE OR P.I. LESS THAN 4
			GC		CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES		ATTERBERG LIMITS ABOVE "A" LINE AND P.I. GREATER THAN 7
	SANDS MORE THAN HALF FINE GRAINS SMALLER THAN NO. 4 SIEVE	**CLEAN SANDS** (LITTLE OR NO FINES)	SW		WELL GRADED SANDS, GRAVELLY SANDS WITH LITTLE OR NO FINES	$C_U = \frac{D_{60}}{D_{10}} \geq 6$ AND $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1$ to 3	
			SP		POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS	
		DIRTY SANDS (WITH SOME FINES)	SM		SILTY SANDS, SAND-SILT MIXTURES	CONTENT OF FINES EXCEEDS 12%	ATTERBERG LIMITS BELOW "A" LINE OR P.I. LESS THAN 4
			SC		CLAYEY SANDS, SAND-CLAY MIXTURES		ATTERBERG LIMITS ABOVE "A" LINE AND P.I. GREATER THAN 7
FINE-GRAINED SOILS (MORE THAN HALF BY WEIGHT PASSES NO. 200 SIEVE)	**SILTS** BELOW "A" LINE NEGLIGIBLE ORGANIC CONTENT	**$W_L < 50\%$**	ML		INORGANIC SILTS & VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH 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 SOILS		
		$30\% < W_L < 50\%$	CI		INORGANIC CLAYS OF MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, 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 AND MEDIUM PLASTICITY		
		$W_L > 50\%$	OH		ORGANIC CLAYS OF HIGH PLASTICITY, ORGANIC SILTS		
HIGHLY ORGANIC SOILS			Pt		PEAT AND OTHER HIGHLY ORGANIC SOILS	STRONG COLOR OR ODOR, AND OFTEN FIBROUS TEXTURE	



NOTES ON SOIL CLASSIFICATION AND DESCRIPTION:

1. Soil are classified and described according to their engineering properties and behaviour.
2. Boundary classification for soil with characteristics of two groups are given combined group symbols (e.g. GW-GC is a well graded gravel sand mixture with clay binder between 5 and 12%).
3. Soil classification is in accordance with the Unified Soil Classification System (ASTM D2487) with the exception that an inorganic clay of medium plasticity (CI) is recognized.
4. The use of modifying adjectives may be employed to define the estimated percentage range of minor components.

APPENDIX B

Soil Test Results

Table 1: Soil Analyses- BTEX and Petroleum Hydrocarbon

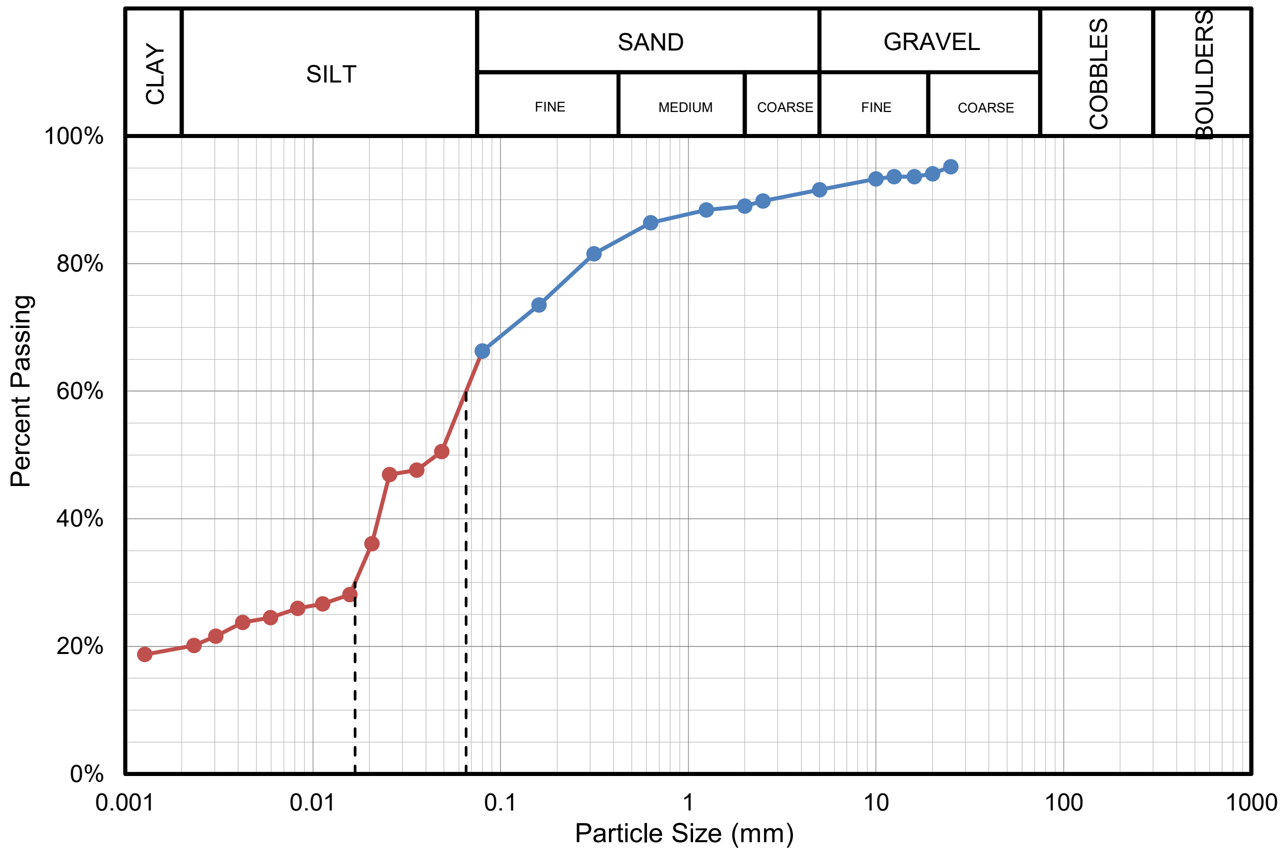
Table 2: Ground Water Analyses- BTEX and Petroleum Hydrocarbon

PARTICLE-SIZE ANALYSIS, LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY

ASTM D422 & ASTM D4318

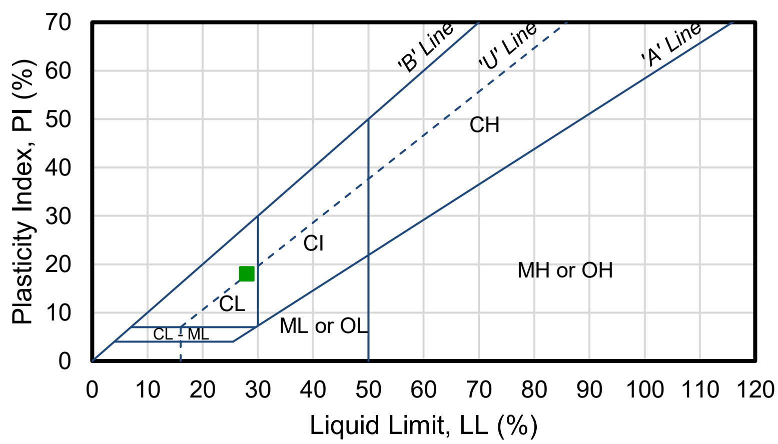
PROJECT: Corman Corner Development
PROJECT#: SK0387
CLIENT: Hasegawa Engineering
SOIL DESCRIPTION: silt, some sand, little clay, trace gravel

SAMPLE DATE: October 4, 2021
TEST DATE: October 13, 2021
SAMPLE ID: 5G1
DEPTH: 0.8 m



PARTICLE-SIZE ANALYSIS	Gravel	8.4%
	Sand	27.3%
	Silt	44.5%
	Clay	19.8%
	D_{10}	0** mm
	D_{30}	0.0168** mm
	D_{60}	0.0655** mm
	C_U	1968.2
	C_C	129.1
LIMITS	PL	10
	LL	28
	PI	18

*Interpolated value *Extrapolated value



Modified Unified Soil Classification	Group Symbol
Sandy low plastic clay	CL

TECH: DS
CHECKED: BH

V15.42 U20201106
T:\SK0350-SK0399\SK0387 - Corman Park Development GEO\06_Labs\[Hydrometer Limit_5G1.xlsx]Lab Worksheet

LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY

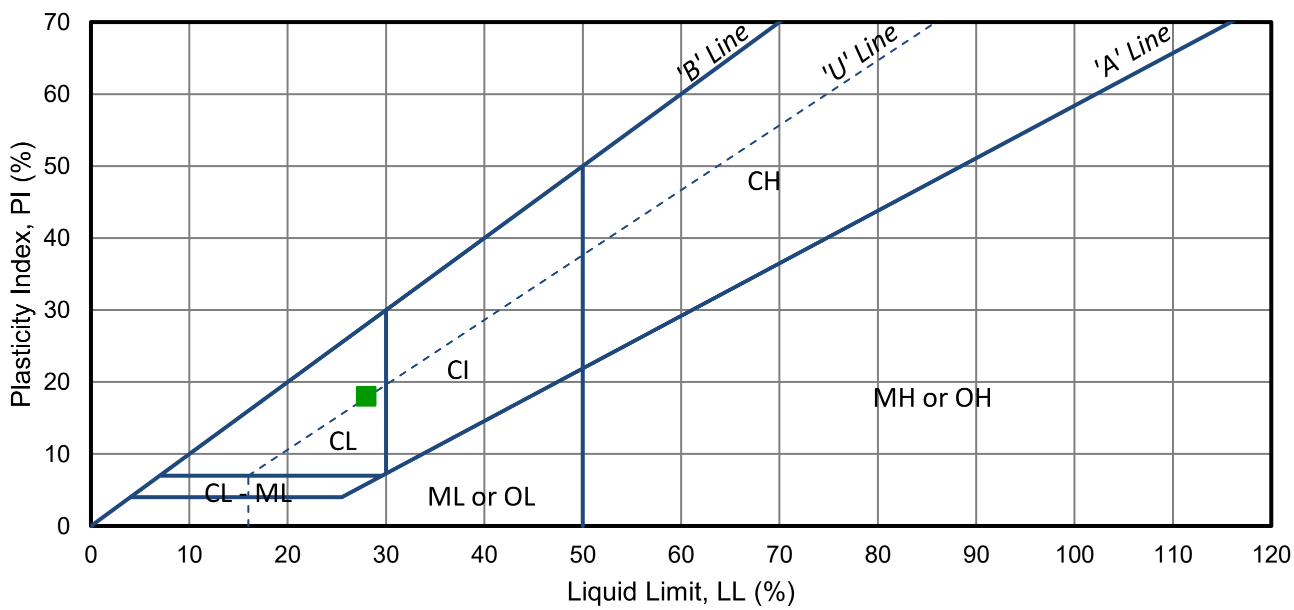
ASTM D4318 - Method B: One-Point

PROJECT: Corman Corner Development
PROJECT#: SK0387
CLIENT: Hasegawa Engineering
SOIL DESCRIPTION: silt, some sand, little clay, trace gravel

SAMPLE DATE: October 4, 2021
TEST DATE: October 13, 2021
SAMPLE ID: 5G1
DEPTH: 0.8 m

PROCEDURE USED: Dry Preparation - Method B: One-Point

	AS RECEIVED	PLASTIC LIMIT				LIQUID LIMIT	
		1	2	3	4	1	2
Number of blows, N						24	25
Container Number	A	7	10	K		B	AA
Tare Container, M_C (g)	392.000	7.200	7.230	7.120		14.585	14.745
Wet Sample + Tare, M_{CMS} (g)	2619.300	8.550	8.640	8.170		35.530	40.975
Dry Sample + Tare, M_{CDS} (g)	2424.800	8.420	8.505	8.075		31.005	35.185
Dry Sample, M_S (g)	2032.800	1.220	1.275	0.955		16.420	20.440
Water, M_W (g)	194.500	0.130	0.135	0.095		4.525	5.790
Moisture Content, w (%)	9.6	10.7	10.6	9.9		27.6	28.3
One point liquid limit for given trial, $LL^n = w^n \cdot (N/25)^{0.121}$ (%)						27.4	28.3



Plastic Limit, PL or w_P (%)	10
Liquid Limit, LL or w_L (%)	28
Plasticity Index, PI (%)	18
Modified USCS Classification	CL

TECH: DS
CHECKED: BH

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LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX

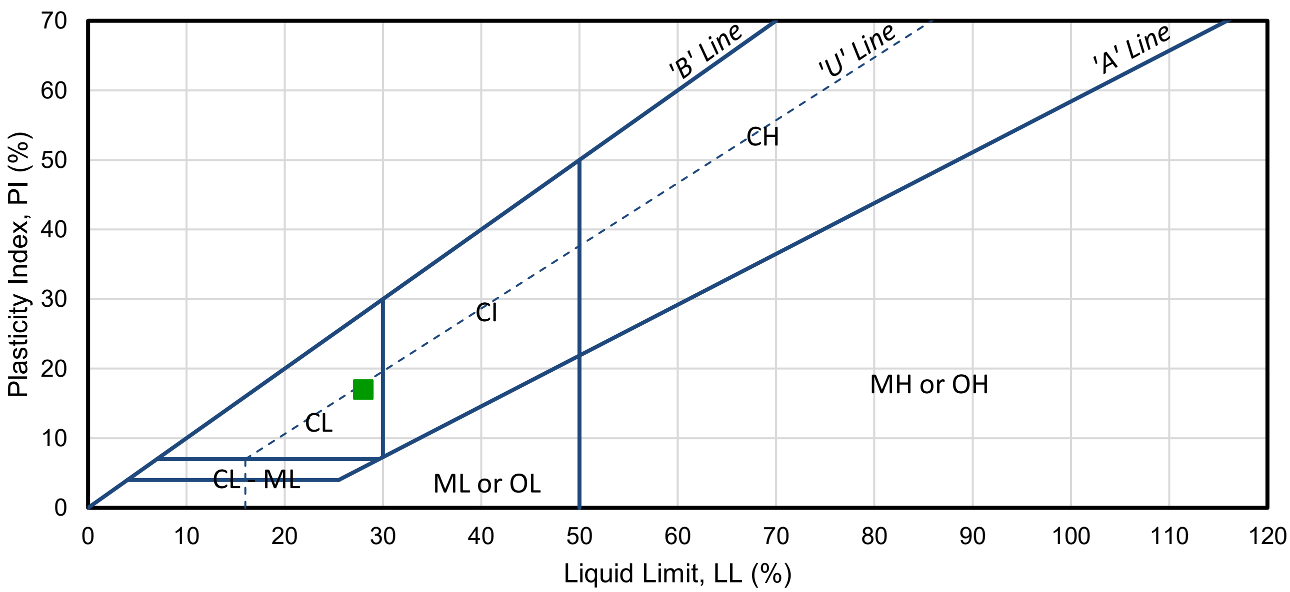
ASTM D4318 - Method B: One-Point

PROJECT: Corman Corner Development
PROJECT#: SK0387
CLIENT: Hasegawa Engineering
SOIL DESCRIPTION:

SAMPLE DATE: October 6, 2021
TEST DATE: October 6, 2021
SAMPLE ID: 5G5
DEPTH: 6.8 m

PROCEDURE USED: Wet Preparation - Method B: One-Point

	AS RECEIVED	PLASTIC LIMIT				LIQUID LIMIT	
		1	2	3	4	1	2
Number of blows, N						26	27
Container Number	F	9	A	Q		PP	T
Tare Container, M_C (g)	1077.8	7.270	7.185	7.175		14.205	14.015
Wet Sample + Tare, M_{CMS} (g)	3282.1	8.265	8.210	8.080		42.730	38.320
Dry Sample + Tare, M_{CDS} (g)	3083.5	8.170	8.115	7.990		36.467	32.980
Dry Sample, M_S (g)	2005.7	0.900	0.930	0.815		22.262	18.965
Water, M_W (g)	198.600	0.095	0.095	0.090		6.263	5.340
Moisture Content, w (%)	9.9	10.6	10.2	11.0		28.1	28.2
One point liquid limit for given trial, $LL^n = w^n \cdot (N/25)^{0.121}$ (%)						28.3	28.4



Plastic Limit, PL or w_P (%)	11
Liquid Limit, LL or w_L (%)	28
Plasticity Index, PI (%)	17
Modified USCS Classification	CL

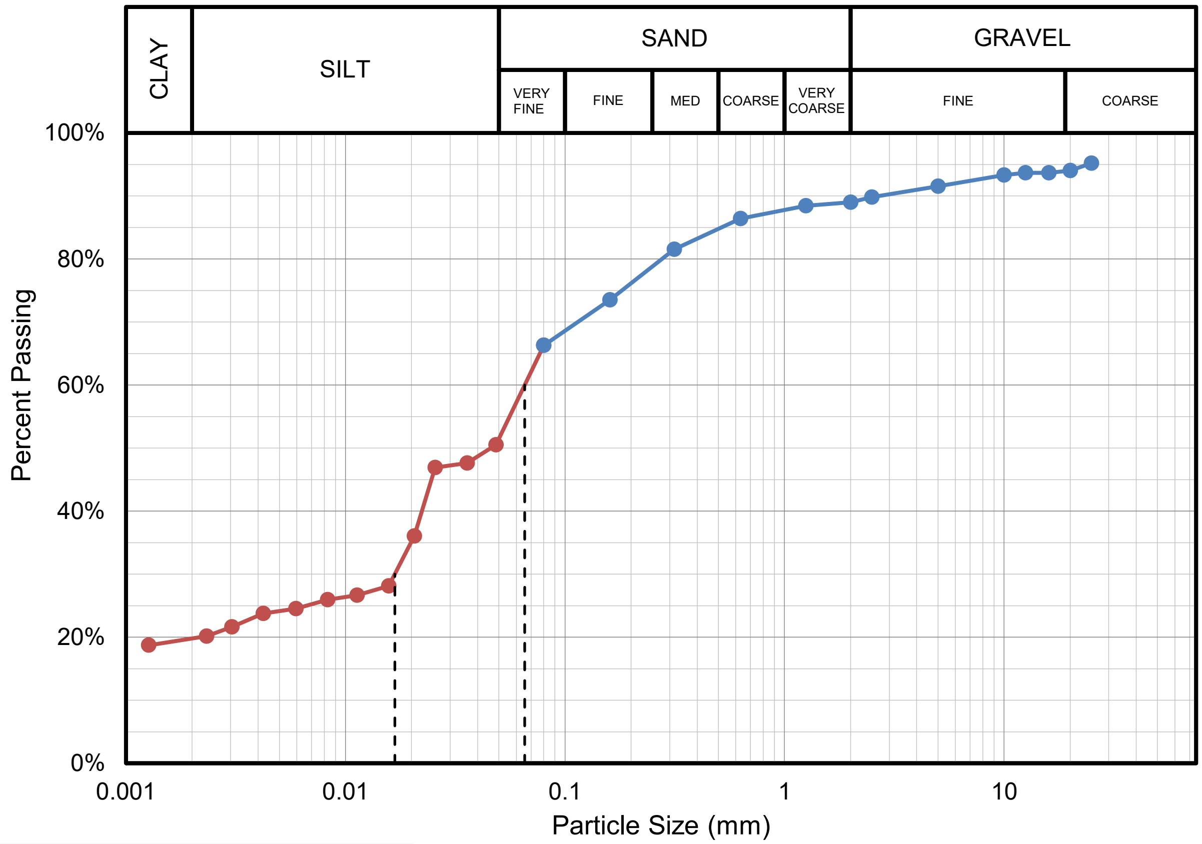
TECH: DS
CHECKED: BH

PARTICLE-SIZE ANALYSIS AND SOIL TEXTURE CLASSIFICATION

ASTM D422

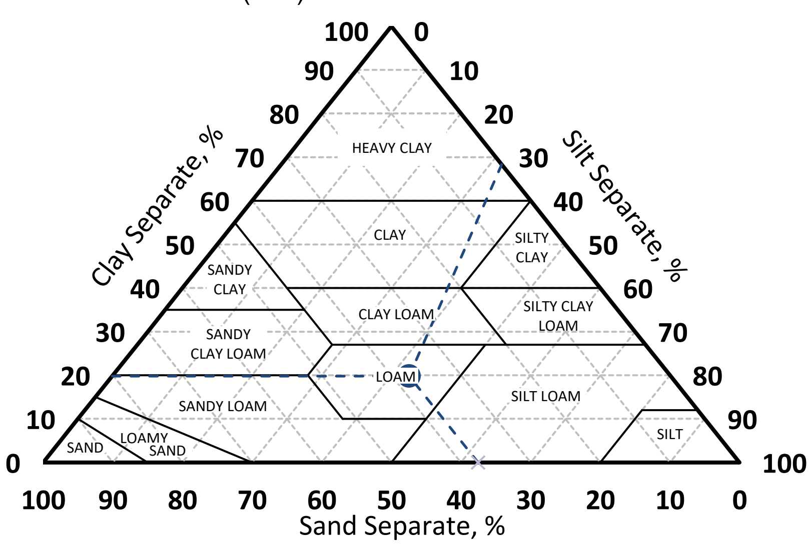
PROJECT: Corman Corner Development
PROJECT#: SK0387
CLIENT: Hasegawa Engineering
SOIL DESC.: silt, some sand, little clay, trace gravel

SAMPLE DATE: October 4, 2021
TEST DATE: October 13, 2021
SAMPLE ID: 5G1
DEPTH: 0.8 m



PARTICLE-SIZE ANALYSIS	Gravel	11.0%
	Sand	37.5%
	Silt	31.7%
	Clay	19.8%
	D_{10}	0** mm
	D_{30}	0.0168** mm
	D_{60}	0.0655** mm
	C_U	1968.2
	C_C	129.1
LIMITS	PL	10
	LL	28
	PI	18

*Interpolated value *Extrapolated value



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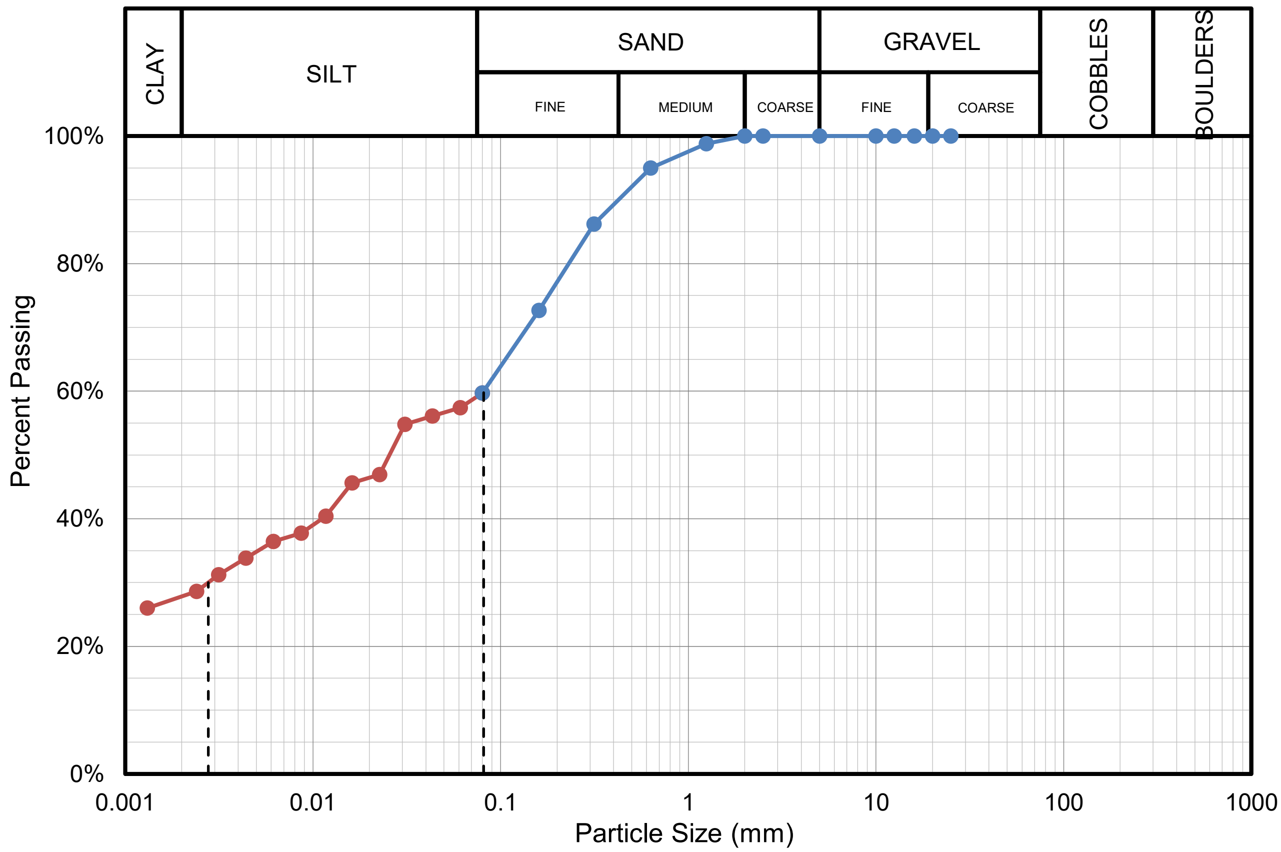
TECH: DS
CHECKED: BH

PARTICLE-SIZE ANALYSIS, LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY

ASTM D422 & ASTM D4318

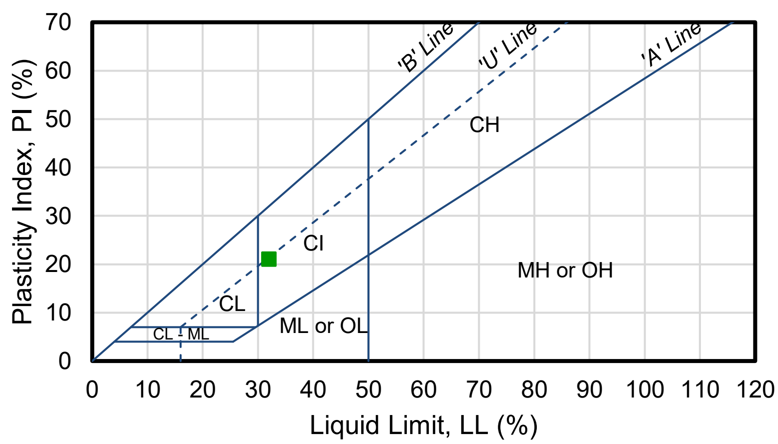
PROJECT: Corman Corner Development
PROJECT#: SK0387
CLIENT: Hasegawa Engineering
SOIL DESCRIPTION: sand, some silt, some clay

SAMPLE DATE: October 4, 2021
TEST DATE: October 13, 2021
SAMPLE ID: 7G3
DEPTH: 3.8 m



PARTICLE-SIZE ANALYSIS		
	Gravel	0.0%
	Sand	40.8%
	Silt	31.3%
	Clay	27.8%
	D_{10}	0** mm
	D_{30}	0.0028** mm
	D_{60}	0.0813** mm
	C_U	2507.0
	C_C	2.9
LIMITS	PL	11
	LL	32
	PI	21

*Interpolated value *Extrapolated value



Modified Unified Soil Classification	Group Symbol
Sandy medium plastic clay	CI

TECH: DS
CHECKED: BH

LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY

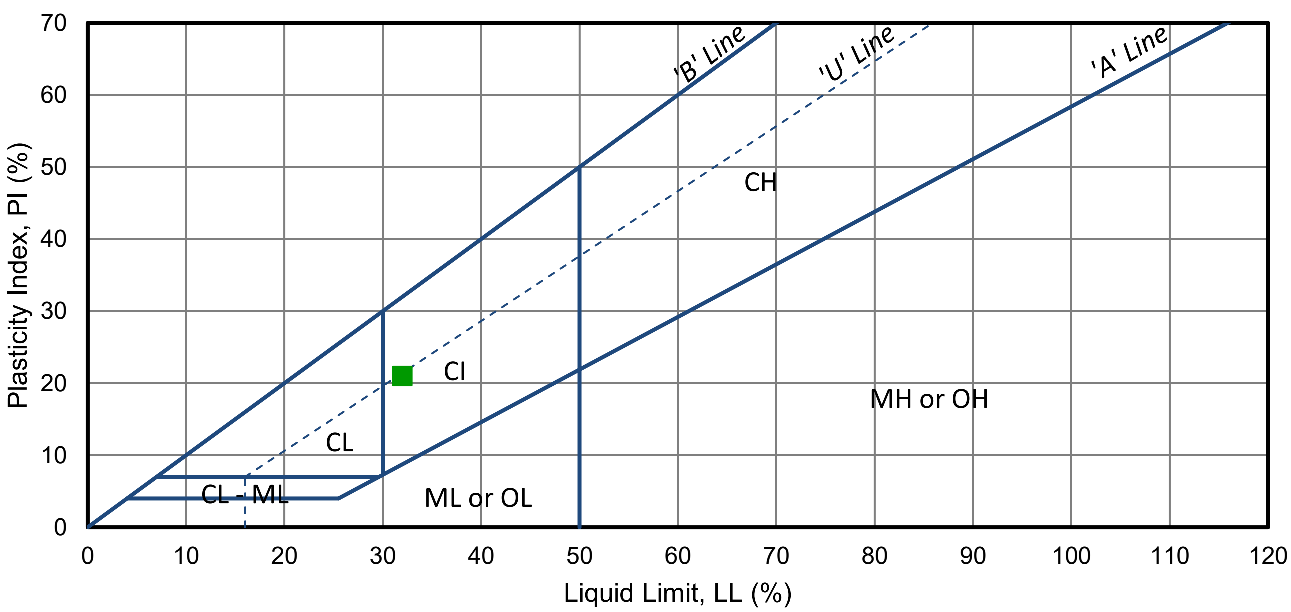
ASTM D4318 - Method B: One-Point

PROJECT: Corman Corner Development
PROJECT#: SK0387
CLIENT: Hasegawa Engineering
SOIL DESCRIPTION: sand, some silt, some clay

SAMPLE DATE: October 4, 2021
TEST DATE: October 13, 2021
SAMPLE ID: 7G3
DEPTH: 3.8 m

PROCEDURE USED: Dry Preparation - Method B: One-Point

	AS RECEIVED	PLASTIC LIMIT				LIQUID LIMIT	
		1	2	3	4	1	2
Number of blows, N						28	29
Container Number	BB	X	AA	VV		DD	A
Tare Container, M_C (g)	1077.700	7.300	7.330	7.185		14.490	14.755
Wet Sample + Tare, M_{CMS} (g)	4090.300	8.455	8.420	8.525		35.350	45.735
Dry Sample + Tare, M_{CDS} (g)	3785.700	8.342	8.312	8.390		30.430	38.370
Dry Sample, M_S (g)	2708.000	1.042	0.982	1.205		15.940	23.615
Water, M_W (g)	304.600	0.113	0.108	0.135		4.920	7.365
Moisture Content, w (%)	11.2	10.8	11.0	11.2		30.9	31.2
One point liquid limit for given trial, $LL^n = w^n \cdot (N/25)^{0.121}$ (%)						31.3	31.8



Plastic Limit, PL or w_P (%)	11
Liquid Limit, LL or w_L (%)	32
Plasticity Index, PI (%)	21
Modified USCS Classification	CI

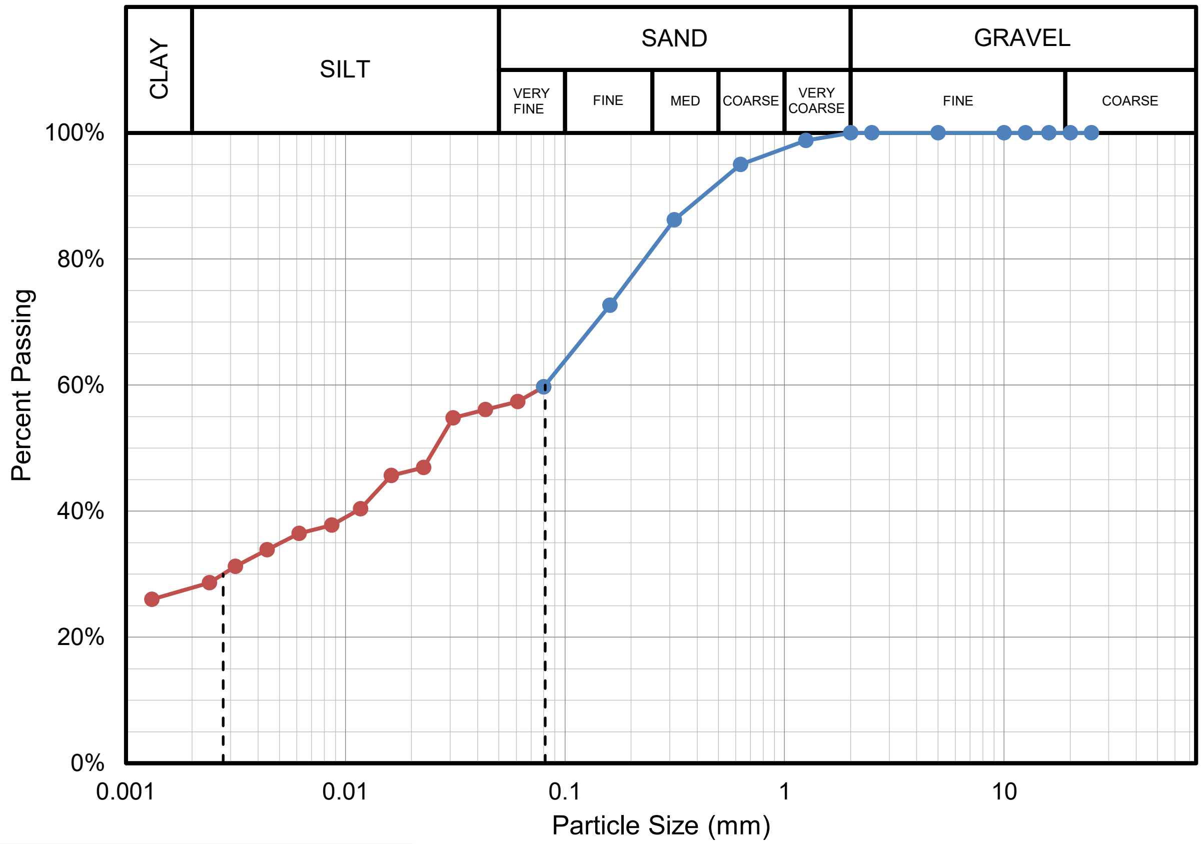
TECH: DS
CHECKED: BH

PARTICLE-SIZE ANALYSIS AND SOIL TEXTURE CLASSIFICATION

ASTM D422

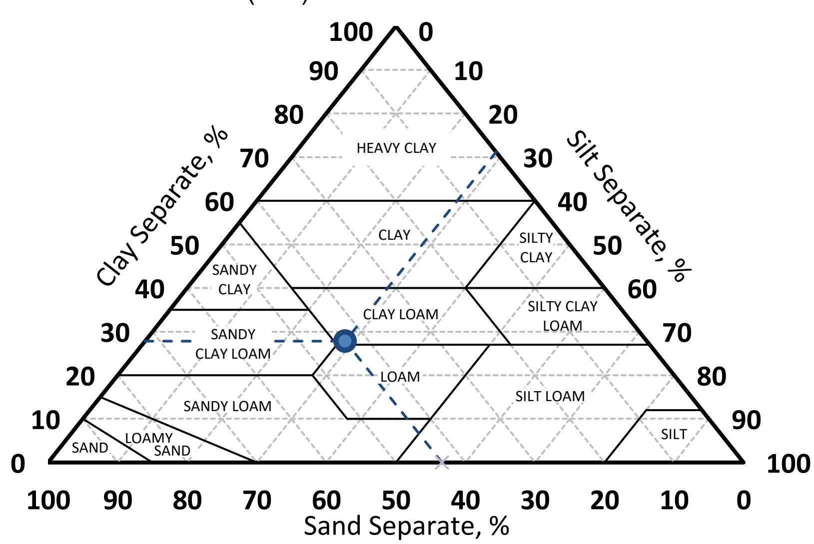
PROJECT: Corman Corner Development
PROJECT#: SK0387
CLIENT: Hasegawa Engineering
SOIL DESC.: sand, some silt, some clay

SAMPLE DATE: October 4, 2021
TEST DATE: October 13, 2021
SAMPLE ID: 7G3
DEPTH: 3.8 m



PARTICLE-SIZE ANALYSIS	Gravel	0.0%
	Sand	43.4%
	Silt	28.8%
	Clay	27.8%
	D_{10}	0** mm
	D_{30}	0.0028** mm
	D_{60}	0.0813** mm
	C_U	2507.0
	C_C	2.9
LIMITS	PL	11
	LL	32
	PI	21

*Interpolated value *Extrapolated value

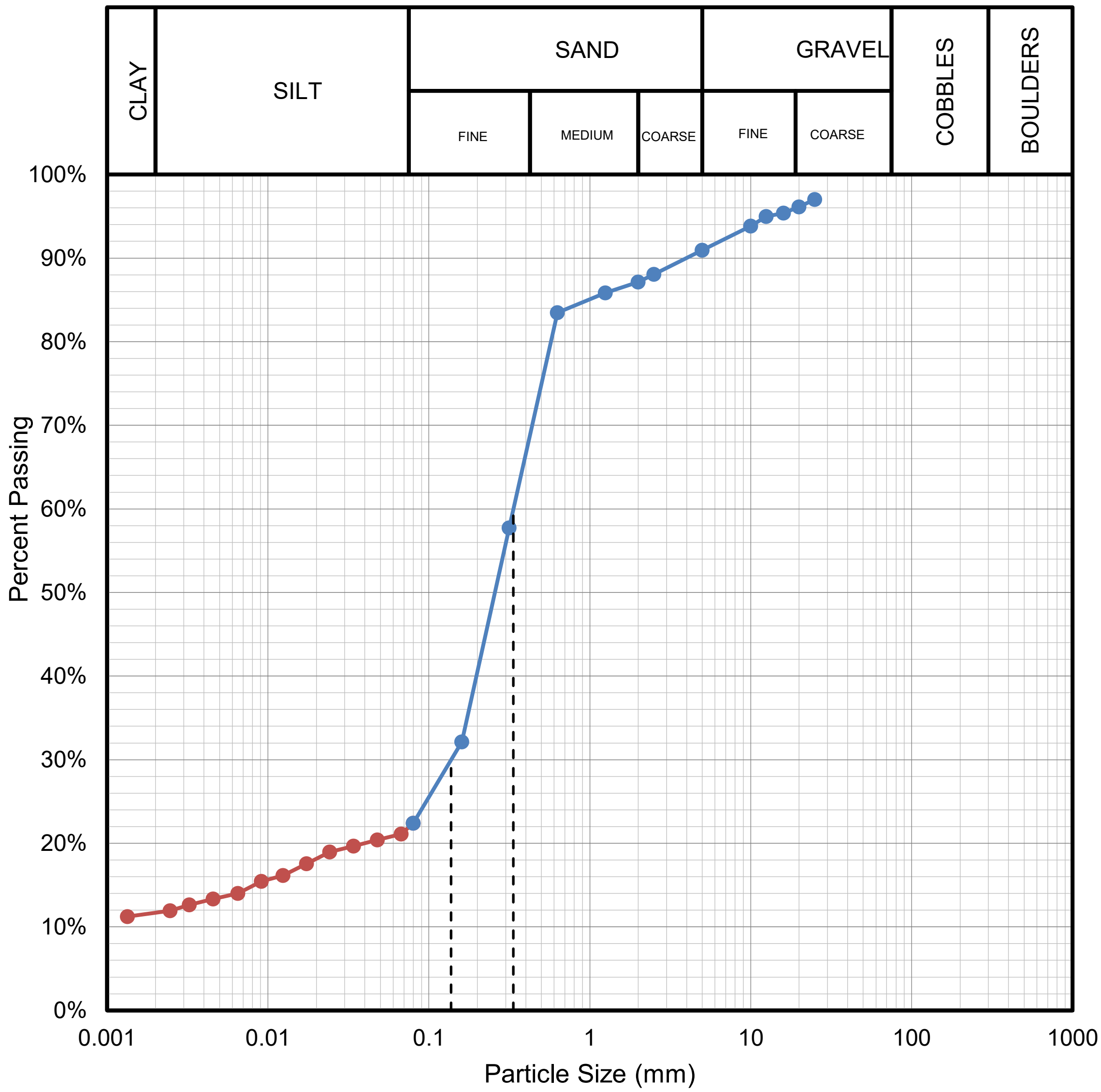


PARTICLE-SIZE ANALYSIS

ASTM D422

PROJECT: Corman Corner Development
PROJECT#: SK0387
CLIENT: Hasegawa Engineering
SOIL DESCRIPTION: sand, little clay, little silt, trace gravel

SAMPLE DATE: October 4, 2021
TEST DATE: October 13, 2021
SAMPLE ID: 8G1
DEPTH: 0.8 m



SUMMARY OF RESULTS		
	Gravel	9.1%
	Sand	69.0%
	Silt	10.2%
	Clay	11.7%

GRAIN SIZE		
	D_{10}	0.0005** mm
	D_{30}	0.1374** mm
	D_{60}	0.3347** mm

*Interpolated value **Extrapolated value

COEFFICIENTS		
	Coefficient of Uniformity, C_U	724.8
	Coefficient of Curvature, C_C	122.0

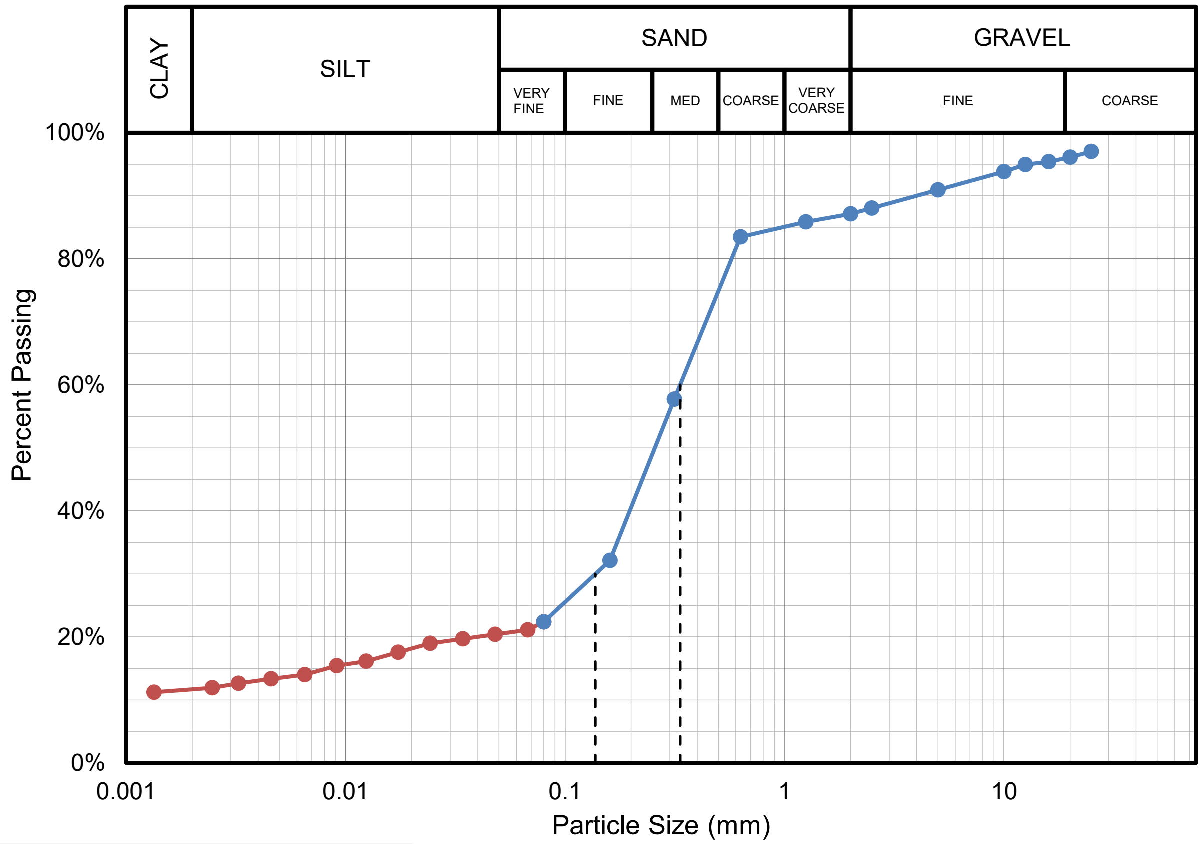
TECH: DS
CHECKED: BH

PARTICLE-SIZE ANALYSIS AND SOIL TEXTURE CLASSIFICATION

ASTM D422

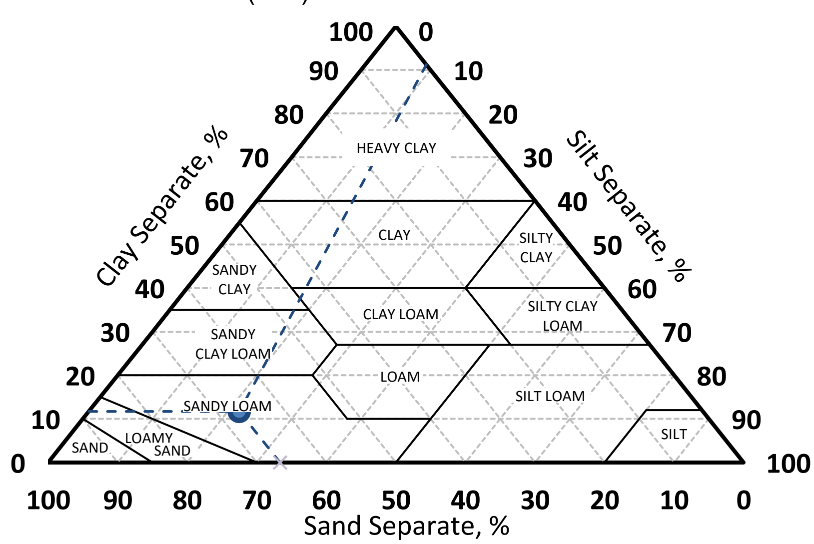
PROJECT: Corman Corner Development
PROJECT#: SK0387
CLIENT: Hasegawa Engineering
SOIL DESC.: sand, little clay, little silt, trace gravel

SAMPLE DATE: October 4, 2021
TEST DATE: October 13, 2021
SAMPLE ID: 8G1
DEPTH: 0.8 m



PARTICLE-SIZE ANALYSIS		
	Gravel	12.9%
	Sand	66.7%
	Silt	8.8%
	Clay	11.7%
	D_{10}	0.0005** mm
	D_{30}	0.1374** mm
	D_{60}	0.3347** mm
	C_U	724.8
	C_C	122.0
LIMITS	PL	---
	LL	---
	PI	---

*Interpolated value *Extrapolated value



TECH: DS
CHECKED: BH

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WATER-SOLUBLE SULPHATE IN SOIL

PROJECT: Corman Corner Development
PROJECT#: SK0387
CLIENT: Hasegawa Engineering

SAMPLE DATE:
TEST DATE: October 9, 2021

Sample #:	7G1	Sample #:	
Borehole:	7	Borehole:	
Depth:	0.8 m	Depth:	
Result:	0.220%	Result:	
Sample #:		Sample #:	
Borehole:		Borehole:	
Depth:		Depth:	
Result:		Result:	
Sample #:		Sample #:	
Borehole:		Borehole:	
Depth:		Depth:	
Result:		Result:	
Sample #:		Sample #:	
Borehole:		Borehole:	
Depth:		Depth:	
Result:		Result:	
Sample #:		Sample #:	
Borehole:		Borehole:	
Depth:		Depth:	
Result:		Result:	
Sample #:		Sample #:	
Borehole:		Borehole:	
Depth:		Depth:	
Result:		Result:	

Comments: Range of 0.22 to 0.22 percent. Sulphate Exposure Classification S-2, Severe

REQUIREMENTS FOR CONCRETE SUBJECTED TO SULPHATE ATTACK (CAN/CSA-A23.1-14)

EXPOSURE CLASSIFICATION	DEGREE OF EXPOSURE	WATER-SOLUBLE SULFATE (SO_4) IN SOIL SAMPLE, %	SULFATE (SO_4) IN GROUNDWATER SAMPLES, mg/L	MINIMUM SPECIFIED 56-DAY COMPRESSIVE STRENGTH, MPa	MAXIMUM WATER-CEMENTING MATERIAL RATIO	PORTLAND CEMENT TO BE USED
S-1	Very Severe	over 2.0	over 10,000	35	0.40	HS
S-2	Severe	0.20 to 2.0	1,500 to 10,000	32	0.45	HS
S-3	Moderate	0.1 to 0.2	150 to 1,500	30	0.50	MS or HS

TECH: DS
CHECKED: BH

TABLE: 1
TITLE: **SOIL ANALYSES - FIELD HYDROCARBON VAPOURS**

PROJECT#: SK0387
CLIENT: Hasegawa Engineering
PROJECT: Geotechnical Investigation
SITE: Corman Development
LOCATION: Highway 16 and Higway 684, Corman Park, Saskatchewan

All concentrations in parts per million by volume (ppmv)
ND = Non-detectable (< 5 ppmv)
= Submitted for Laboratory Analysis for Hydrocarbons

Depth (m)	BOREHOLE							
	BH1	BH2	BH3	BH4	BH5	BH6	BH7	BH8
0.00	ND	5	ND	ND	ND	5	5	ND
0.50	ND	35	ND	5	110	5	20	ND
1.00	10	150	45	20	280	80	40	ND
2.00	110	60	110	130	60	630	55	30
3.00	130	35	70	100	ND	85	90	60
4.00	150	140	130	350	450	260	410	85
5.00	340	410	90	-	170	50	130	45
6.00	560	220	75	-	160	110	65	50
7.00	180	25	75	-	20	180	-	-
8.00	60	ND	170	-	75	80	-	-
9.00	30	5	60	-	60	40	-	-
10.00	35	-	-	-	-	-	-	-
11.00	20	-	-	-	-	-	-	-
12.00	5	-	-	-	-	-	-	-

Sample Dates
October 4, 2021

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TABLE: 2
TITLE: SOIL ANALYSES - BTEX AND PETROLEUM HYDROCARBON (PHC) FRACTIONS; SURFACE

PROJECT#: SK0387
CLIENT: Hasegawa Engineering
PROJECT: Geotechnical Investigation
SITE: Corman Development
LOCATION: Highway 16 and Higway 684, Corman Park, Saskatchewan

CRITERIA: Saskatchewan Environmental Quality Guidelines (as ammended)

Surface Guidelines for BTEX and F1-F4 must be applied to a depth of 1.5 m within 5 m setback from a wellhead OR to a depth of 3 m at any other site.

LAND USE	
Natural Area	NO
Agricultural	YES
Residential	NO
Commercial	NO
Industrial	NO

SOIL TYPE	
Fine	YES
Coarse	YES

NGR = No Guideline Required
BDL = Below Detection Limit
HVC = Hydrocarbon Vapour Concentration (in parts per million per volume (ppmv))
PHC = Petroleum Hydrocarbon Fraction; F1 = C6-C10 (minus BTEX); F2 = C10-C16; F3 = C16-C34; F4 = C34-C50
RES = Residual PHC Formation. Calculated value exceeds 30,000 mg/kg and solubility limit for PHC Fraction

All concentrations in mg/kg unless otherwise noted
Bold = Exceeds Criteria
NO = Does not meet QA/QC for Laboratory

PATHWAY	APPLICABLE	MOST STRINGENT CRITERIA FOR LAND USE AND SOIL TYPE							
		Benzene	Toluene	Ethylbenzene	Xylenes	PHC F1	PHC F2	PHC F3	PHC F4
Human Exposure Pathways									
Soil Ingestion	YES	110	22,000	10,000	150,000	12,000	6,800	15,000	21,000
Direct Soil Contact	YES	78	640	1,700	480	12,000	6,800	15,000	21,000
Vapour Inhalation (basement)	YES	0.1	130	60	16	40	190	-	-
Vapour Inhalation (slab-on-grade)	YES	0.073	95	44	12	30	150	-	-
Protection of Domestic Use Aquifer*	YES	0.046	0.52	0.073	0.99	970	380	-	-
Off-Site Migration by Wind or Water Erosion	YES								
Ecological Exposure Pathways									
Direct Soil Contact	YES	31	75	55	230	210	150	300	2,800
Nutrient/Energy Cycling	YES								
Livestock Ingestion	YES								
Wildlife Ingestion	YES								
Freshwater Aquatic Life*	YES	0.17	0.12	540	41	970	380	-	-
Livestock Watering*	YES	0.2	26	36	160	4200	14,000	-	-
Wildlife Watering*	YES								
Irrigation Watering*	YES								
Off-Site Migration by Wind or Water Erosion	YES								
Other Pathways									
Management Limit	YES	-	-	-	-	800	1,000	2,500	10,000

SAMPLE				MOST STRINGENT CRITERIA FOR APPLICABLE PATHWAY(S)								QA/QC		
				Benzene	Toluene	Ethylbenzene	Xylenes	PHC F1	PHC F2	PHC F3	PHC F4	Hold Times Met	Acceptable Limits Met	Notes
Sample ID	**Depth (m)**	**Sample Date**	**Lab ID**	**0.046**	**0.12**	**0.073**	**0.99**	**30**	**150**	**300**	**2800**			
1E (BH1)	2.00	4-Oct-21	RG2100636-001	<0.0050	<0.015	<0.050	<0.075	<5.0	<25	<50	<50	YES	YES	
3E (BH3)	3.00		RG2100636-002	<0.0050	<0.015	<0.050	<0.075	<5.0	<25	<50	<50	YES	YES	
6E (BH6)	2.00		RG2100636-005	<0.0050	<0.015	<0.050	<0.075	<5.0	<25	<50	<50	YES	YES	
8E (BH8)	3.00		RG2100636-006	<0.0050	<0.015	<0.050	<0.075	<5.0	<25	<50	<50	YES	YES	

TABLE: 3

TITLE: SOIL ANALYSES - BTEX AND PETROLEUM HYDROCARBON (PHC) FRACTIONS; SUBSOIL

PROJECT#: SK0387
CLIENT: Hasegawa Engineering
PROJECT: Geotechnical Investigation
SITE: Corman Development
LOCATION: Highway 16 and Higway 684, Corman Park, Saskatchewan

CRITERIA: Saskatchewan Environmental Quality Guidelines (as ammended)

Subsurface Guidelines may be used as follows:
(a) Below 1.5 m in depth within a 5 m setback from an oilfield wellhead
(b) Below 3 m in depth at any site; or
(c) Below 1.5 m at remoted forested sites in Green Zone with fine-texture soil regardless of distance to wellhead
Exclusion of the ecological direct soil contact pathway is permissible for petroleum hydrocarbon fractions F1 to F4 only.

LAND USE	
Natural Area	NO
Agricultural	YES
Residential	NO
Commercial	NO
Industrial	NO

SOIL TYPE	
Fine	YES
Coarse	YES

NGR = No Guideline Required
BDL = Below Detection Limit
HVC = Hydrocarbon Vapour Concentration (in parts per million per volume (ppmv))
PHC = Petroleum Hydrocarbon Fraction; F1 = C6-C10 (minus BTEX); F2 = C10-C16; F3 = C16-C34; F4 = C34-C50
NC = Not calculated. Insufficient data to allow derivation.

All concentrations in mg/kg unless otherwise noted
Bold = Exceeds Criteria
NO = Does not meet QA/QC for Laboratory

PATHWAY	APPLICABLE	MOST STRINGENT CRITERIA FOR LAND USE AND SOIL TYPE							
		Benzene	Toluene	Ethylbenzene	Xylenes	PHC F1	PHC F2	PHC F3	PHC F4
Human Exposure Pathways									
Direct Soil Contact	YES	NC	NC	1700	480	12000	6800	15,000	21,000
Vapour Inhalation (basement)	YES	0.1	130	60	16	30	190	-	-
Vapour Inhalation (slab-on-grade)	YES	0.14	180	86	23	55	150	-	-
Protection of Domestic Use Aquifer*	YES	0.046	0.52	0.073	0.99	170	320	-	-
Off-Site Migration by Wind or Water Erosion	YES	-	-	-	-	-	-	-	-
Ecological Exposure Pathways									
Direct Soil Contact	YES	78	150	110	130	420	300	600	5,600
Nutrient/Energy Cycling	YES	-	-	-	-	-	-	-	-
Livestock Ingestion	YES	-	-	-	-	-	-	-	-
Wildlife Ingestion	YES	-	-	-	-	-	-	-	-
Freshwater Aquatic Life*	YES	0.17	0.12	540	41	970	380	-	-
Livestock Watering*	YES	0.2	26	36	160	4,200	10,000	-	-
Wildlife Watering*	YES	-	-	-	-	-	-	-	-
Irrigation Watering*	YES	-	-	-	-	-	-	-	-
Off-Site Migration by Wind or Water Erosion	YES	-	-	-	-	-	-	-	-
Other Pathways									
Management Limit	YES	-	-	-	-	700	1,000	2,500	10,000

SAMPLE				MOST STRINGENT CRITERIA FOR APPLICABLE PATHWAY(S)								QA/QC		
				Benzene	Toluene	Ethylbenzene	Xylenes	PHC F1	PHC F2	PHC F3	PHC F4	Hold Times Met	Acceptable Limits Met	Notes
Sample ID	Depth (m)	Sample Date	Lab ID	0.046	0.12	0.073	0.99	30	150	600	5600			
4E (BH4)	4.00	4-Oct-21	RG2100636-003	<0.0050	<0.050	<0.015	<0.075	<5.0	<25	<50	<50	YES	YES	
5E (BH5)	4.00		RG2100636-004	<0.0050	<0.050	<0.015	<0.075	<5.0	<25	<50	<50	YES	YES	

Parkland GEO

TABLE: 4
TITLE: GROUNDWATER ANALYSES - BTEX AND PETROLEUM HYDROCARBON (PHC) FRACTIONS

PROJECT#: SK0387
CLIENT: Hasegawa Engineering
PROJECT: Geotechnical Investigation
SITE: Corman Development
LOCATION: Highway 16 and Higway 684, Corman Park, Saskatchewan

CRITERIA: Saskatchewan Environmental Quality Guidelines (as ammended)

LAND USE	
Natural Area	NO
Agricultural	YES
Residential	NO
Commercial	NO
Industrial	NO

SOIL TYPE	
Fine	YES
Coarse	YES

NGR = No Guideline Required
BDL = Below Detection Limit
PHC = Petroleum Hydrocarbon Fraction; F1 = C6-C10 (minus BTEX); F2 = C10-C16
HVC = Hydrocarbon Vapour Concentration

All concentrations in mg/L
Bold = Exceeds Criteria
NO = Does not meet QA/QC

PATHWAY	APPLICABLE	MOST STRINGENT CRITERIA FOR LAND USE AND SOIL TYPE					
		Benzene	Toluene	Ethylbenzene	Xylenes	PHC F1	PHC F2
Human Exposure Pathways							
Direct Soil Contact	YES	-	-	-	-	-	-
Vapour Inhalation (basement)	YES	0.14	74	16	3.9	0.81	1.5
Vapour Inhalation (slab-on-grade)	YES	0.14	74	16	3.9	0.81	1.5
Protection of Domestic Use Aquifer*	YES	0.005	0.06	0.14	0.09	2.2	1.1
Off-Site Migration by Wind or Water Erosion	YES	-	-	-	-	-	-
Ecological Exposure Pathways							
Direct Soil Contact	YES	61	59	20	21	6.5	1.8
Nutrient/Energy Cycling	YES	-	-	-	-	-	-
Livestock Ingestion	YES	-	-	-	-	-	-
Wildlife Ingestion	YES	-	-	-	-	-	-
Freshwater Aquatic Life*	YES	0.074	0.021	41	2.9	9.8	1.3
Livestock Watering*	YES	0.088	4.9	3.2	13	53	-
Wildlife Watering*	YES	0.14	180	-	-	-	-
Irrigation Watering*	YES	-	-	-	-	-	-
Off-Site Migration by Wind or Water Erosion	YES	-	-	-	-	-	-
Other Pathways							
Management Limit	YES	-	-	-	-	-	-

SAMPLE				MOST STRINGENT CRITERIA FOR APPLICABLE PATHWAY(S)						QA/QC		
				Benzene	Toluene	Ethylbenzene	Xylenes	PHC F1	PHC F2	Hold Times Met	Acceptable Limits Met	Notes
Sample ID	Sample Date		Lab ID	0.005	0.021	0.14	0.09	0.81	1.1			
BH1	15-Oct-2021		RG2100709-001	<0.0005	<0.0005	<0.0005	<0.0005	<0.1	<0.1	YES	YES	
BH3			RG2100709-002	<0.0005	<0.0005	<0.0005	<0.0005	<0.1	<0.1	YES	YES	
BH5			RG2100709-003	<0.0005	<0.0005	<0.0005	<0.0005	<0.1	<0.1	YES	YES	
BH6			RG2100709-004	<0.0005	<0.0005	<0.0005	<0.0005	<0.1	<0.1	YES	YES	

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **RG2100636**	Page	: 1 of 4
Client	: **ParklandGeo Consulting Group**	Laboratory	: Regina - Environmental
Contact	: Monica gaudet	Account Manager	: Brian Morgan
Address	: #102 4756 Riverside Drive Red Deer AB Canada T4N 2N7	Address	: 1119 Osler Street Regina SK Canada S4R 8N5
Telephone	: ----	Telephone	: 1 306 221 7147
Project	: SK0387	Date Samples Received	: 05-Oct-2021 16:50
PO	: ----	Date Analysis Commenced	: 08-Oct-2021
C-O-C number	: ----	Issue Date	: 13-Oct-2021 15:49
Sampler	: ----		
Site	: ----		
Quote number	: ----		
No. of samples received	: 6		
No. of samples analysed	: 6		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Jeanie Mark	Laboratory Analyst	Organics, Calgary, Alberta
Joshua Stessun	Laboratory Analyst	Organics, Calgary, Alberta
Marsha Calero	Laboratory Assistant	Organics, Calgary, Alberta
Sorina Motea	Laboratory Analyst	Organics, Calgary, Alberta

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
%	percent
mg/kg	milligrams per kilogram

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical Results

Sub-Matrix: **Soil**

(Matrix: **Soil/Solid)**

				Client sample ID	1E2	3E3	4E4	5E4	6E2
				Client sampling date / time	04-Oct-2021 11:30	04-Oct-2021 11:30	04-Oct-2021 11:30	04-Oct-2021 11:30	04-Oct-2021 11:30
Analyte	CAS Number	Method	LOR	Unit	RG2100636-001	RG2100636-002	RG2100636-003	RG2100636-004	RG2100636-005
					Result	Result	Result	Result	Result
Physical Tests									
moisture	----	E144	0.25	%	10.6	14.7	10.0	10.3	10.4
Volatile Organic Compounds [BTEXS+MTBE]									
benzene	71-43-2	E611A	0.0050	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
ethylbenzene	100-41-4	E611A	0.015	mg/kg	<0.015	<0.015	<0.015	<0.015	<0.015
toluene	108-88-3	E611A	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
xylene, m+p-	179601-23-1	E611A	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
xylene, o-	95-47-6	E611A	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
xylenes, total	1330-20-7	E611A	0.075	mg/kg	<0.075	<0.075	<0.075	<0.075	<0.075
BTEX, total	----	E611A	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
Volatile Organic Compounds Surrogates									
bromofluorobenzene, 4-	460-00-4	E611A	0.10	%	84.6	94.0	118	86.9	83.3
difluorobenzene, 1,4-	540-36-3	E611A	0.10	%	79.4	88.5	116	81.8	82.3
Hydrocarbons									
F1 (C6-C10)	----	E581.F1	5.0	mg/kg	<5.0	<5.0	<5.0	<5.0	<5.0
F1-BTEX	----	EC580	5.0	mg/kg	<5.0	<5.0	<5.0	<5.0	<5.0
F2 (C10-C16)	----	E601.SG	25	mg/kg	<25	<25	<25	<25	<25
F3 (C16-C34)	----	E601.SG	50	mg/kg	<50	<50	<50	<50	<50
F4 (C34-C50)	----	E601.SG	50	mg/kg	<50	<50	<50	<50	<50
chromatogram to baseline at nC50	----	E601.SG	-	-	YES	YES	YES	YES	YES
hydrocarbons, total (C6-C50)	----	EC581	80	mg/kg	<80	<80	<80	<80	<80
Hydrocarbons Surrogates									
bromobenzotrifluoride, 2- (F2-F4 surr)	392-83-6	E601.SG	1.0	%	97.1	94.9	96.3	92.6	96.2
dichlorotoluene, 3,4-	97-75-0	E581.F1	1.0	%	76.1	100	123	81.0	77.0

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	8E3	----	----	----	----
				Client sampling date / time	04-Oct-2021 11:30	----	----	----	----
					RG2100636-006	--------	--------	--------	--------
					Result	----	----	----	----
Physical Tests									
moisture	----	E144	0.25	%	10.4	----	----	----	----
Volatile Organic Compounds [BTEXS+MTBE]									
benzene	71-43-2	E611A	0.0050	mg/kg	<0.0050	----	----	----	----
ethylbenzene	100-41-4	E611A	0.015	mg/kg	<0.015	----	----	----	----
toluene	108-88-3	E611A	0.050	mg/kg	<0.050	----	----	----	----
xylene, m+p-	179601-23-1	E611A	0.050	mg/kg	<0.050	----	----	----	----
xylene, o-	95-47-6	E611A	0.050	mg/kg	<0.050	----	----	----	----
xylenes, total	1330-20-7	E611A	0.075	mg/kg	<0.075	----	----	----	----
BTEX, total	----	E611A	0.10	mg/kg	<0.10	----	----	----	----
Volatile Organic Compounds Surrogates									
bromofluorobenzene, 4-	460-00-4	E611A	0.10	%	80.6	----	----	----	----
difluorobenzene, 1,4-	540-36-3	E611A	0.10	%	74.0	----	----	----	----
Hydrocarbons									
F1 (C6-C10)	----	E581.F1	5.0	mg/kg	<5.0	----	----	----	----
F1-BTEX	----	EC580	5.0	mg/kg	<5.0	----	----	----	----
F2 (C10-C16)	----	E601.SG	25	mg/kg	<25	----	----	----	----
F3 (C16-C34)	----	E601.SG	50	mg/kg	<50	----	----	----	----
F4 (C34-C50)	----	E601.SG	50	mg/kg	<50	----	----	----	----
chromatogram to baseline at nC50	----	E601.SG	-	-	YES	----	----	----	----
hydrocarbons, total (C6-C50)	----	EC581	80	mg/kg	<80	----	----	----	----
Hydrocarbons Surrogates									
bromobenzotrifluoride, 2- (F2-F4 surr)	392-83-6	E601.SG	1.0	%	93.2	----	----	----	----
dichlorotoluene, 3,4-	97-75-0	E581.F1	1.0	%	77.2	----	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

CERTIFICATE OF ANALYSIS

Work Order	: **RG2100709**	Page	: 1 of 3
Client	: **ParklandGeo Consulting Group**	Laboratory	: Regina - Environmental
Contact	: Monica gaudet	Account Manager	: Brian Morgan
Address	: #102 4756 Riverside Drive Red Deer AB Canada T4N 2N7	Address	: 1119 Osler Street Regina SK Canada S4R 8N5
Telephone	: ----	Telephone	: 1 306 221 7147
Project	: SK0387	Date Samples Received	: 15-Oct-2021 15:56
PO	: ----	Date Analysis Commenced	: 20-Oct-2021
C-O-C number	: ----	Issue Date	: 22-Oct-2021 15:22
Sampler	: ----		
Site	: ----		
Quote number	: ----		
No. of samples received	: 4		
No. of samples analysed	: 4		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Cynthia Bauer	Organic Supervisor	Organics, Calgary, Alberta
Jeanie Mark	Laboratory Analyst	Organics, Calgary, Alberta
Maqsood Ul Hassan	Laboratory Analyst	Organics, Calgary, Alberta

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
µg/L	micrograms per litre

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	BH1	BH3	BH5	BH6	----
				Client sample ID	BH1	BH3	BH5	BH6	----
				Client sampling date / time	15-Oct-2021 12:00	15-Oct-2021 12:00	15-Oct-2021 12:00	15-Oct-2021 12:00	----
					RG2100709-001	RG2100709-002	RG2100709-003	RG2100709-004	--------
					Result	Result	Result	Result	----
Volatile Organic Compounds									
benzene	71-43-2	E611A	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	----
ethylbenzene	100-41-4	E611A	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	----
toluene	108-88-3	E611A	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	----
xylene, m+p-	179601-23-1	E611A	0.40	µg/L	<0.40	<0.40	<0.40	<0.40	----
xylene, o-	95-47-6	E611A	0.30	µg/L	<0.30	<0.30	<0.30	<0.30	----
xylenes, total	1330-20-7	E611A	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	----
Volatile Organic Compounds Surrogates									
bromofluorobenzene, 4-	460-00-4	E611A	1.0	%	95.6	92.5	90.6	90.1	----
difluorobenzene, 1,4-	540-36-3	E611A	1.0	%	104	106	103	102	----
Hydrocarbons									
F1 (C6-C10)	----	E581.F1	100	µg/L	<100	<100	<100	<100	----
F1-BTEX	----	EC580	100	µg/L	<100	<100	<100	<100	----
F2 (C10-C16)	----	E601	100	µg/L	<100	<100	<100	<100	----
Hydrocarbons Surrogates									
bromobenzotrifluoride, 2- (F2-F4 surr)	392-83-6	E601	1.0	%	94.7	97.5	97.4	96.7	----
dichlorotoluene, 3,4-	97-75-0	E581.F1	1.0	%	118	121	124	104	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

LIMITATIONS

General Terms and Conditions

The use of this attached report is subject to the following general terms and conditions.

1. STANDARD OF CARE - In the performance of professional services, ParklandGEO used the degree of care and skill ordinarily exercised under similar circumstances by reputable members of its profession practicing in the same or similar localities. No other warranty expressed or implied is made in any manner.

2. INTERPRETATION OF THE REPORT - The CLIENT recognizes that subsurface conditions will vary from those encountered at the location where borings, surveys, or explorations are made and that the data, interpretations and recommendation of ParklandGEO are based solely on the information available to him. Classification and identification of soils, rocks, geological units, contaminated materials and contaminant quantities will be based on commonly accepted practices in geotechnical or environmental consulting practice in this area. ParklandGEO will not be responsible for the interpretation by others of the information developed.

3. SITE INFORMATION - The CLIENT has agreed to provide all information with respect to the past, present and proposed conditions and use of the Site, whether specifically requested or not. The CLIENT acknowledged that in order for ParklandGEO to properly advise and assist the CLIENT, ParklandGEO has relied on full disclosure by the CLIENT of all matters pertinent to the Site investigation.

4. COMPLETE REPORT - The Report is of a summary nature and is not intended to stand alone without reference to the instructions given to ParklandGEO by the CLIENT, communications between ParklandGEO and the CLIENT, and to any other reports, writings or documents prepared by ParklandGEO for the CLIENT relative to the specific Site, all of which constitute the Report. The word "Report" shall refer to any and all of the documents referred to herein. In order to properly understand the suggestions, recommendations and opinions expressed by ParklandGEO, reference must be made to the whole of the Report. ParklandGEO cannot be responsible for use of any part or portions of the report without reference to the whole report. The CLIENT has agreed that "This report has been prepared for the exclusive use of the named CLIENT. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. ParklandGEO accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report."

   The CLIENT has agreed that in the event that any such report is released to a third party, the above disclaimer shall not be obliterated or altered in any manner. The CLIENT further agrees that all such reports shall be used solely for the purposes of the CLIENT and shall not be released or used by others without the prior written permission of ParklandGEO.

5. LIMITATIONS ON SCOPE OF INVESTIGATION AND WARRANTY DISCLAIMER
   There is no warranty, expressed or implied, by ParklandGEO that:
   a) the investigation uncovered all potential geo-hazards, contaminants or environmental liabilities on the Site; or
   b) the Site is entirely free of all geo-hazards or contaminants as a result of any investigation or cleanup work undertaken on the Site, since it is not possible, even with exhaustive sampling, testing and analysis, to document all potential geo-hazards or contaminants on the Site.

   The CLIENT acknowledged that:
   a) the investigation findings are based solely on the information generated as a result of the specific scope of the investigation authorized by the CLIENT;
   b) unless specifically stated in the agreed Scope of Work, the investigation will not, nor is it intended to assess or detect potential contaminants or environmental liabilities on the Site;
   c) any assessment regarding geological conditions on the Site is based on the interpretation of conditions determined at specific sampling locations and depths and that conditions may vary between sampling locations, hence there can be no assurance that undetected geological conditions, including soils or groundwater are not located on the Site;
   d) any assessment is also dependent on and limited by the accuracy of the analytical data generated by the sample analyses;
   e) any assessment is also limited by the scientific possibility of determining the presence of unsuitable geological conditions for which scientific analyses have been conducted; and
   f) the laboratory testing program and analytical parameters selected are limited to those outlined in the CLIENT's authorized scope of investigation; and
   g) there are risks associated with the discovery of hazardous materials in and upon the lands and premises which may inadvertently discovered as part of the investigation. The CLIENT acknowledges that it may have a responsibility in law to inform the owner of any affected property of the existence or suspected existence of hazardous materials and in some cases the discovery of hazardous conditions and materials will require that certain regulatory bodies be informed. The CLIENT further acknowledges that any such discovery may result in the fair market value of the lands and premises and of any other lands and premises adjacent thereto to be adversely affected in a material respect.

6. COST ESTIMATES - Estimates of remediation or construction costs can only be based on the specific information generated and the technical limitations of the investigation authorized by the CLIENT. Accordingly, estimated costs for construction or remediation are based on the known site conditions, which can vary as new information is discovered during construction. As some construction activities are an iterative exercise, ParklandGEO shall therefore not be liable for the accuracy of any estimates of remediation or construction costs provided.

7. LIMITATION OF LIABILITY - The CLIENT has agreed that to the fullest extent permitted by the law ParklandGEO's total liability to CLIENT for any and all injuries, claims, losses, expenses or damages whatsoever arising out of or in anyway relating to the Project is contractually limited, as outlined in ParklandGEO's standard Consulting Services Agreement. Further, the CLIENT has agreed that to the fullest extent permitted by law ParklandGEO is not liable to the CLIENT for any special, indirect or consequential damages whatsoever, regardless of cause.

8. INDEMNIFICATION - To the fullest extent permitted by law, the CLIENT has agreed to defend, indemnify and hold ParklandGEO, its directors, officers, employees, agents and subcontractors, harmless from and against any and all claims, defence costs, including legal fees on a full indemnity basis, damages, and other liabilities arising out of or in any way related to ParklandGEO's work, reports or recommendations.

Appendix C

ENVIRONMENTAL IMPACT ASSESSMENT SCREENING

Project Screening Report

Notes:

Report Generated
08/24/2021

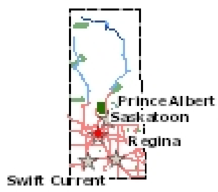
Map Information

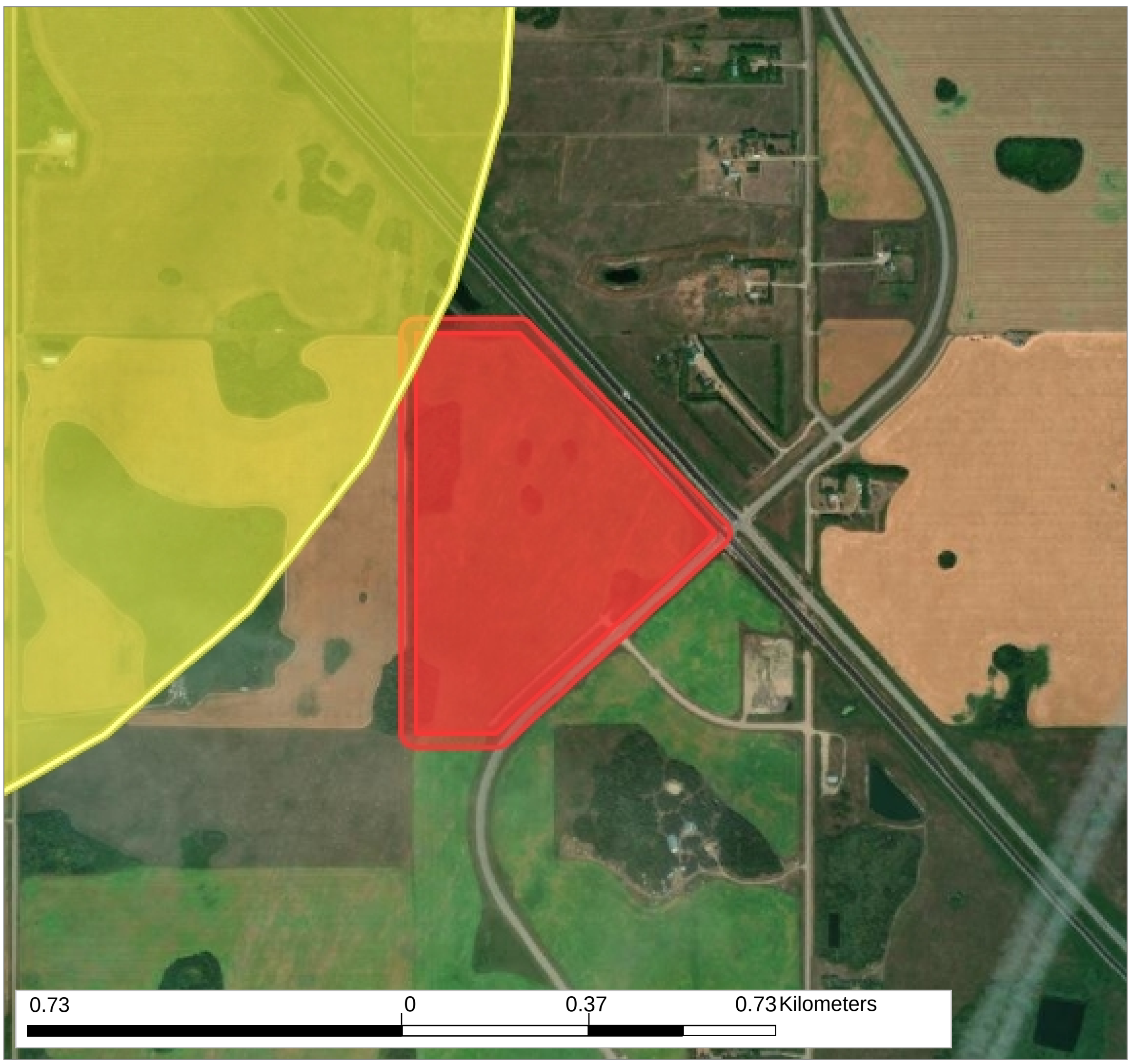
Buffer Size:

30 Meters

Coordinates:
Lat: 52.24221° N
Lon: -106.77393° W

Area of Interest





Screened Areas:

Ecological Management Specialist (EMS) District
Compliance & Field Service Area
Compliance & Field Service (CFS) Region
Area Fisheries Ecologists
Area Wildlife Ecologists
Rural Municipality
Indian Reserve
Rare and Endangered Species
Fish Species
Woodland Caribou Range
Species Predictive Models
Whooping Crane Corridor
Federal Critical Habitat
Emergency Protection Order
Wind Energy Avoidance Zones
Important Natural Areas
Provincial Parks
Recreation Sites
Game Preserves
National Wildlife Areas
Federal Pastures
Community Pastures
Wildlife Habitat Protection Act Lands
Fish & Wildlife Development Fund Lands
Migratory Bird Sanctuary
Wildlife Refuge
Conservation Easements
Crown Conservation Easements
Ecological Reserves
Ramsar Wetlands
Reservoir Development Areas
Representative Areas

Species Likely to be Present

Known Species

"Known" species are species that have known occurrences in the area from the Saskatchewan Conservation Data Centre's Rare and Endangered Species map layer. However, absence of species observation records does not preclude the existence of species in the area of interest. Observations may simply not have been recorded for the given area or may not have yet been entered into the ministry data holdings – new observation records are continuously being discovered. Information accessible through HABISask is not intended to be a definitive statement on the presence, absence or status of a species within a given area, nor as a substitute for onsite surveys.

Rare and Endangered Species

Category: Vertebrate Animal

Common Name	Scientific Name:	G Rank	N Rank	S Rank	COSEWIC	SARA Status	Wild Species at Risk Regulations
Little Brown Myotis	*Myotis lucifugus*	G3	N2N4B, NNRN, NNRM	S4B,S4N	Endangered	Endangered	

Fish Atlas

Common Name	Scientific Name:	G Rank	N Rank	S Rank	COSEWIC	SARA Status	Wild Species at Risk Regulations

Expected Species

"Expected" is based on a modelled prediction if a species might occur in areas based upon developed statistical relationships between local and landscape characteristics and species presence. Models utilized by this report have only been created in the prairie ecozone for a selection of species. The boreal plain, boreal shield and taiga shield will not return any expected species results. Models are not a substitute for on the ground surveys to determine species presence.

Species Predictive Models

Category: Invertebrate Animal

Common Name	Scientific Name:	G Rank	N Rank	S Rank	COSEWIC	SARA Status	Wild Species at Risk Regulations
Monarch	*Danaus plexippus plexippus*	G4T3	N3B,NNRM	S2B,SNRM	Endangered	Special Concern	

Category: Vertebrate Animal

Common Name	Scientific Name:	G Rank	N Rank	S Rank	COSEWIC	SARA Status	Wild Species at Risk Regulations
American Badger	*Taxidea taxus taxus*	G5T5	N4	S3	Special Concern	Special Concern	
Baird's Sparrow	*Centronyx bairdii*	G4	N4B,N4M	S4B	Special Concern	Special Concern	
Bobolink	*Dolichonyx oryzivorus*	G5	N5B, N4N5M	S4B,S4M	Threatened	Threatened	
Burrowing Owl	*Athene cunicularia*	G4	N1N2B, N1N2M	S2B,S2M	Endangered	Endangered	Endangered
Horned Grebe	*Podiceps auritus*	G5	N5B,N5N, N5M	S5B,S5M	Special Concern	Special Concern	
Northern Harrier	*Circus hudsonius*	G5	N5B,N4N	S4B,S4M	Not at Risk		
Sprague's Pipit	*Anthus spragueii*	G3G4	N3N4B, N3N4M	S3B,S3M	Threatened	Threatened	

Whooping Crane Corridor 50% Core Area

Whooping Crane Corridor 95% Core Area

Whooping Crane Corridor 75% Core Area

Woodland Caribou Habitat

Detailed information concerning woodland caribou habitat, administration units and Caribou Habitat Management areas is provided below.

Currently, information on woodland caribou habitat potential is not available in this report, but users are encouraged to view the dataset "Woodland Caribou Habitat Potential" to determine whether your project falls within high, moderate or low caribou habitat potential areas.

Caribou Conservation Unit(s): Nothing found

Caribou Administrative Unit(s): Nothing found

Caribou Habitat Management Area Tier category: Nothing found

Species with Critical Habitat Present

Project Screening Report

This dataset displays the geographic areas within which federal Critical Habitat for species at risk listed on Schedule 1 of the federal Species at Risk Act (SARA) occurs in Saskatchewan. Please be aware that not all of the area within these boundaries is necessarily Critical Habitat. To determine if a specific area is Critical Habitat and if your activity might be considered "destruction" of Critical Habitat, other information available in each individual species' Recovery documents (http://www.sararegistry.gc.ca) need to be considered, including biophysical attributes and activities likely to result in destruction of Critical Habitat.

Note that recovery documents (and therefore Critical Habitat) may be amended from time to time. Species are added as the data becomes ready, which may occur after the recovery document has been posted on the SAR Public Registry. Although HABISask will try to provide the latest data, the SAR Public Registry should always be considered as the official source for Critical Habitat information.

Common Name	Scientific Name:	G Rank	N Rank	S Rank	COSEWIC	SARA Status	Wild Species at Risk Regulations
No Critical Habitat found							

Emergency Protection Order

This dataset is comprised of areas under the federal Emergency Order for the Protection of the Greater Sage-Grouse in Canada. The exterior extent polygons are derived from the detailed dataset of the Government of Canada Emergency Order dataset. For specific information regarding the order and the prohibitions set out in the Emergency Order please consult the official documents on the Species at Risk Registry (sararegistry.gc.ca)

Common Name	Scientific Name
No species found	

Important Natural Areas

Important Natural Areas are sites in Saskatchewan that are considered to have conservation significance, but are not necessarily legally protected.

Name	Type
Nothing Found	

Wind Turbine Avoidance Zones Present

The Wind Energy Avoidance Zones were designed to enhance environmental protection and provide more certainty to future wind energy developments. These guidelines clearly identify environmentally sensitive areas that should be avoided for projects that include the siting of wind turbines but can be helpful in siting any development project. The complete report entitled, Wildlife Siting Guidelines for Saskatchewan Wind Energy Projects, can be found on the Government of Saskatchewan website or by selecting the following link: https://publications.saskatchewan.ca/#/categories/78

Land Type
No Zone Present

Managed Areas

Managed areas are a diverse collection of lands and waters on which the conservation of biodiversity and ecosystem function are among the goals of the land management programs. Each of the unique or sensitive landscapes, within the network of managed areas, have some level of protection or activity restrictions placed on them by legislation, agreement or policy. These lands include provincial and national parks, ecological reserves, wildlife lands, game preserves, conservation easements and other privately held stewardship lands.

Conservation Easement

Nothing Found

Crown Conservation Easement

Nothing Found

Ecological Reserve

Nothing Found

Fish & Wildlife Development Fund (FWDF)

Nothing Found

Former Federal Pasture

Nothing Found

Game Preserve

Nothing Found

Migratory Bird Sanctuary

Nothing Found

National Wildlife Area

Nothing Found

Provincial Park

Nothing Found

Provincial Pasture

Nothing Found

Ramsar Wetland

Nothing Found

Recreation Site

Nothing Found

Representative Area Ecological Reserve

Nothing Found

Reservoir Development Area

Nothing Found

Wildlife Habitat Protection Act (WHPA)

Nothing Found

Wildlife Refuge

Nothing Found

Project Screening Report

Rare and Endangered Species Occurrences

The absence of information provided by the Saskatchewan Conservation Data Centre (SKCDC) does not categorically mean the absence of sensitive species or features. The quantity and quality for data collected by the SKCDC are dependent on the research and observations of many individuals and organizations. SKCDC reports summarize the existing natural heritage information, known to the SKCDC, at the time of the request.

SKCDC data should never be regarded as final statements on the elements or areas being considered, nor should they be substituted for on-site surveys required for environmental assessments. The user therefore acknowledges that the absence of data may indicate that the project area has not been surveyed, rather than confirm that the area lacks natural heritage resources.

Occurrence ID:	9999101037	**First Observation:**	1980-09-02
Occurrence Class:	Vertebrate Animal	**Last Observation:**	1989-09-08
Scientific Name:	Myotis lucifugus		
Common Name:	Little Brown Myotis		
Occurrence Rank:			
General Description:	Species detected (1980, 1989)		
Occurrence Data:			
Directions:	CORMAN PARK		

Wild Species Research Permitting

A Research Permit is required to detect or observe plants or wildlife for commercial purposes, such as pre-screening surveys to collect baseline data or other activities, or to conduct academic research. Research Permits are not required if you are doing surveys for personal, recreational, educational or other non-commercial purposes. Revisions were made to Section 21 of The Wildlife Act in 2015 and to Section 6.2 of The Wildlife Regulations in 2016.

See the Government of Saskatchewan Wild Species Research Permitting page for more information.

All forms and related information pertaining to Research Permits can be found in the Publications Centre. Be sure to check out the Conservation Standards Terms and Conditions for Research Permits for general, wildlife and research-specific and information submission conditions that pertain to all research permits.

Subscribe to our Mail-out List Subscriptions for updates regarding Species Detection Permits, SKCDC Lists and Ranks, Legislation and Policy and HABISask.

Species Detection Survey Protocols

The Species Detection Survey Protocols are used to detect rare and sensitive species so Activity Restriction Guidelines can be applied. Their use is required by industry/ environmental consultants for proposed or existing commercial activities.

Activity Restriction Guidelines for Sensitive Species

The Activity Restriction Guidelines for Sensitive Species outline restricted activity periods and distance setbacks for rare and sensitive species to assist proponents in minimizing impacts to rare and sensitive species and habitats.

Administrative Areas

8	Ecological Management Specialist (EMS) District(s)
Saskatoon	Compliance and Field Services Area(s)
Saskatoon	Compliance and Field Services Region(s)
Saskatoon	Area Fisheries Ecologist Area(s)
YORKTON	Area Wildlife Ecologist(s)
344 - CORMAN PARK	Rural Municipality
Nothing Found	First Nation Reserve

Contact Us

For more information, please contact our Client Service Office:
Email: centre.inquiry@gov.sk.ca
Tel (toll free in North America): 1-800-567-4224
Tel (Regina): 306-787-2584

Appendix D

TRAFFIC IMPACT ASSESSMENT

HASEGAWA CONSULTING PROFESSIONAL ENGINEERS

DALMENY ACCESS/HIGHWAY NO. 16 DEVELOPMENT

TRAFFIC IMPACT ASSESSMENT

DALMENY ACCESS/ HIGHWAY NO. 16 DEVELOPMENT

TRAFFIC IMPACT ASSESSMENT

HASEGAWA CONSULTING PROFESSIONAL ENGINEERS

REPORT (DRAFT)

PROJECT NO.: 211-09885-00
DATE: OCTOBER 2021

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WSP.COM

October 8, 2021

Confidential

Hasegawa Consulting Professional Engineers
1220 31 Street North
Lethbridge, Alberta, Canada

Dear Mark,

RE: Dalmeny Access/Highway No. 16 Development Traffic Impact Assessment - Saskatoon, SK

As requested, WSP has prepared this Draft Report for the Traffic Impact Assessment (TIA) for a Cardlock Gas Station near Saskatoon, SK. This report summarizes our methodology, analysis, findings, and recommendations.

If you have any questions, please give me a call at (306) 518-0216.

Yours sincerely,

Sean Buchko,
Transportation Planning Engineer SK

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SIGNATURES

PREPARED BY

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REVIEWED BY

Sean Buchko, P.Eng.
Transportation Planning Engineer

This report was prepared by WSP for the account of Hasegawa Consulting Professional Engineers, in accordance with the professional services agreement. The disclosure of any information contained in this report is the sole responsibility of the intended recipient. The material in it reflects WSP's best judgement in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. WSP accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. This limitations statement is considered part of this report.

The original of the technology-based document sent herewith has been authenticated and will be retained by WSP for a minimum of ten years. Since the file transmitted is now out of WSP's control and its integrity can no longer be ensured, no guarantee may be given with regards to any modifications made to this document.

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APPENDICES

1 INTRODUCTION

WSP Canada Inc. (WSP) was commissioned by Hasegawa Consulting Professional Engineers (Hasegawa) to complete a Traffic Impact Assessment (TIA) for a proposed Gas Station (Cardlock) near Saskatoon, Saskatchewan. The intent of the TIA is to identify traffic generated by the proposed development, assess the current and future traffic conditions, and discuss potential mitigation measures if required.

1.1 BACKGROUND INFORMATION

WSP contacted both the RM of Corman Park (RM) and Saskatchewan Ministry of Highways (Ministry) to confirm the scope of the study as well as to identify any initial concerns the RM and Ministry may have regarding the proposed development. The Ministry requested that all study area intersections be analysed for warranted improvements including auxiliary lanes and lighting. The Ministry confirmed that WSP does not need to investigate improvements for the Highway No. 16 and Dalmeny Access intersection, as shown in **Figure 1.1**. The Ministry indicated that the intersection is not currently considered for upgrade to an interchange, staged ramps or separated right turn roadways. The RM and Ministry did not identify any other major issues or concerns.

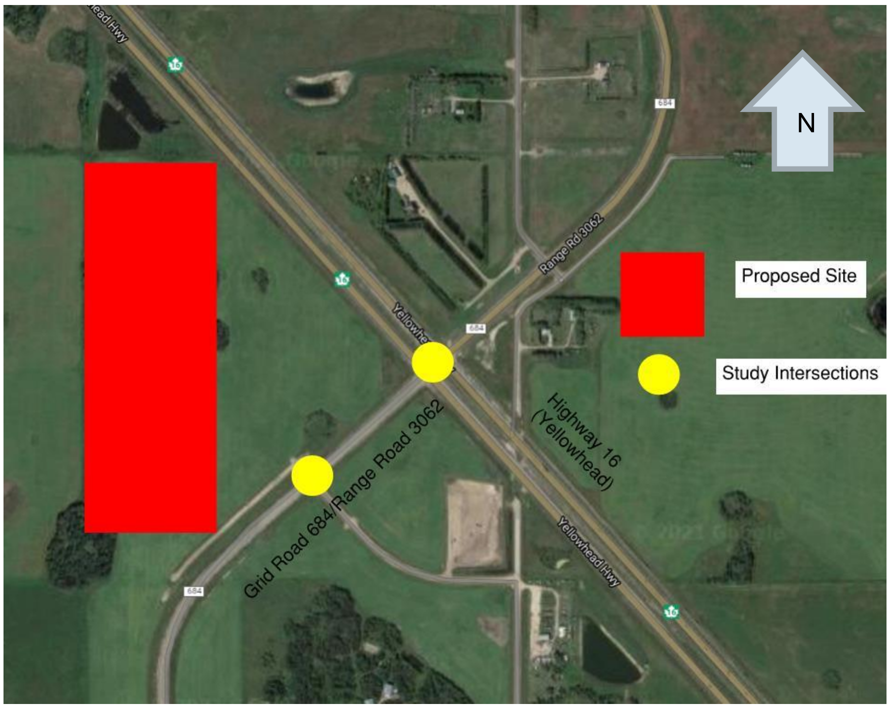

Figure 1-1 | Proposed Site Plan and Study Intersections

1.2 PROPOSED DEVELOPMENT

Located near Dalmeny, the proposed development will be located in the south-west quadrant of the Highway No. 16 and Grid 684/Dalmeny Access intersection, which is the main access to Dalmeny from Highway 16. The proposed development is a cardlock site for fuel products (Gas, Diesel, etc.), and will not include a convenience store. It is estimated that the proposed development will consist of approximately 10 filling positions and is assumed to be opened in 2023.

The Grid 684/Dalmeny Access and Cardlock Access intersection would serve as the key intersection for the proposed development. The Highway No. 16 and Grid 684/Dalmeny Access intersection will also be impacted by traffic utilizing the cardlock access.

2 EXISTING CONDITIONS

2.1 EXISTING ROAD NETWORK

The assessment will focus on the intersection where Grid Road 684 meets Highway No. 16 and the intersection where Gride Road 684 meets the site access road as these locations will experience higher traffic demand due to the development and may require remedial measures (i.e. left-turn or right-turn lanes, etc.).

Highway No. 16 is a divided national highway running northwest southeast. Grid Road 684 is a paved Grid Road that was previously realigned to intersect Highway No. 16 at right angles. The Access Road includes site access to the current field to the west and a service road station to rural developments to the east.

Highway No. 16 is a paved highway with a posted speed of 110 km/h. The posted limit on Grid Road 684 is 90 km/h. All study intersections are two-way stop controlled.

2.2 EXISTING TRAFFIC VOLUMES

WSP conducted a traffic count for the morning and afternoon peak hours on Tuesday, September 28, 2021 that captured all movements at the Access Road/Grid Road 684 intersection and any movements that used Grid Road 684 at the Highway No 16./Grid Road 684 intersection. The historical information available in the Ministry of Highway's 2018 Traffic Volume Map was used to determine the AADT and heavy vehicle percentage for the through movements on Highway No. 16. The turning movement count was conducted on September 28, 2021 during the morning (6:00 a.m. to 9:00 a.m.) and afternoon (4:00 p.m. to 7:00 p.m.) peak periods to capture commuter traffic at the following intersections:

— Highway No. 16 and Grid Road 684 | morning peak hour occurred between 7:15 a.m. and 8:15 a.m. | afternoon peak hour occurred between 4:15 p.m. and 5:15 p.m.
— Access Road and Grid Road 684 | morning peak hour occurred between 7:15 a.m. and 8:15 a.m. | afternoon peak hour occurred between 4:15 p.m. and 5:15 p.m.

A cardlock facility experiences higher truck traffic compared to a typical commercial gas station. In past studies, WSP has estimated the ratios of percent passenger cars to heavy vehicles utilizing a cardlock facility. WSP has identified that the percentage of truck traffic is approximately 30% in the morning and 20% in the afternoon peak hour for a typical cardlock facility.

Appendix A contains a summary illustration of the existing morning and afternoon peak hour traffic volumes, percent truck traffic, and peak hour factors. Traffic volumes between intersections were not balanced in this study.

3 TRIP GENERATION

There were two sources of information examined for estimating the traffic volumes generated by the proposed cardlock facility, including:

— A supplied estimate based on historical counts done on similar sites, provided by the client; and
— A conservatively high estimate assuming the cardlock fueling station would operate similar to a regular gas station using the ITE Trip Generation Manual.

The analysis conducted during this study was based on the client provided data as it is specific to a cardlock site and is therefore more representative of the proposed development.

3.1 HISTORICAL COUNTS ON SIMILAR SITES

Trip generation for a cardlock gas station is typically lower than a traditional gas station. In past studies, WSP has used annual sales figures and average fill per vehicle to determine the peak hour trips. WSP has determined a range of 20 to 40 new entering/exiting peak hour trips is typical of a cardlock. The client expects the trips will plateau after 3 years with 180 small vehicles per day (vpd) and 80 large vehicles per day utilizing the cardlock facility.

Due to the absence of hourly information for a cardlock facility, the typical average peak hour traffic demand, between 8% and 12% of the daily traffic, was used. Referencing the ITE Trip Generation Manual, 11th Edition Hourly Distribution tables a peak hour distribution of 8% was used for the morning and afternoon peak hour. The estimated peak hour volumes generated by the proposed site are therefore 21 vehicles in the 2033 horizon. These vehicles are anticipated to also exit the site within the hour; thus, a total of 42 trips are anticipated to enter and exit the site during each peak hour. The percent heavy traffic is estimated to be approximately 30% based on the clients supplied estimates.

Pass-by trips are made by traffic already using the adjacent roadway and entering the site as an intermediate stop on the way to another destination. These trips may not be directly generated by the proposed land use. Although there is a reduction in the total number of new trips on the adjacent network, pass-by trips are still included in the total number of vehicles entering or exiting the site. The ITE pass-by rates are 58% for the morning peak and 42% for the afternoon peak hour for a Gasoline Service Station. For this study, we assume there will be no diverted link trips. The pass-by trips are:

- Morning Peak Hour | a total of 24 pass-by trips with 12 vehicles entering and 12 exiting the site.
- Afternoon Peak Hour | a total of 18 pass-by trips with 9 vehicles entering and 9 exiting the site.

As such, the new trips generated by the proposed development to be added to the road networks are:

- Morning Peak Hour | a total of 18 new trips with 9 vehicles entering and 9 exiting the site.
- Afternoon Peak Hour | a total of 24 new trips with 12 vehicles entering and 12 exiting the site.

3.2 ITE TRIP GENERATION MANUAL

The anticipated traffic volumes generated by the proposed cardlock facility were estimated using the Gasoline / Service Station trip rates (ITE Code 944) based on 10 fueling positions. The weekday peak hour trip generation yields:

- Morning Peak Hour | a total of 103 new trips with 51 vehicles entering and 52 exiting the site.
- Afternoon Peak Hour | a total of 140 new trips with 70 vehicles entering and 70 exiting the site.

The ITE pass-by rates are 58% for the morning peak and 42% for the afternoon peak hour for a Gasoline Service Station. For this study, we assume there will be no diverted link trips. The pass-by trips are:

- Morning Peak Hour | a total of 60 pass-by trips with 30 vehicles entering and 30 exiting the site.
- Afternoon Peak Hour | a total of 60 pass-by trips with 30 vehicles entering and 30 exiting the site.

As such, the new trips generated by the proposed development to be added to the road networks are:

- Morning Peak Hour | a total of 43 new trips with 21 vehicles entering and 22 exiting the site.
- Afternoon Peak Hour | a total of 80 new trips with 40 vehicles entering and 40 exiting the site.

3.3 TRIP DISTRIBUTION AND ASSIGNMENT

The trip rates for the cardlock facility supplied by the client were used for the capacity analyses as they are based on historical counts at similar cardlock facilities and are therefore assumed to be more reasonable and accurate.

The anticipated site-generated traffic volumes were applied to the network based on an assessment of how customers would enter and exit the site. The new trips were distributed through the road network using existing traffic patterns obtained from turning movement count data, as well as engineering judgement. **Table 3-1** summarizes the existing and proposed study area trip distribution as an origin-destination trip table using PM traffic data.

Table 3-1 | Existing and Proposed Development Trip Distribution

Links	Incoming	Outgoing	Incoming %	Outgoing %	Used Incoming %	Used Outgoing %
Highway 16 W	544	552	39%	39%	40%	40%
Highway 16 E	622	533	44%	38%	45%	40%
Grid Road 684 N	70	214	5%	15%	5%	15%
Grid Road 684 S	168	104	12%	7%	10%	5%
Access Road W	1	1	0%	0%	0%	0%
Access Road E	1	1	0%	0%	0%	0%
Total	1406	1405	100%	100%	100%	100%

With the existing traffic patterns, it is anticipated that the majority of the site-generated traffic will access the site from the Highway No. 16 and Grid Road 684 intersection, using the southbound right turn to enter the site and the westbound left turn to exit the site. Based on the configuration of the proposed development, traffic generated by the cardlock site was assigned to the study area intersections. The assignment of trips was conducted using existing percentages of traffic flow within the area. Trends show that traffic generally moves towards Dalmeny in the PM Peak Hour.

Figures 3-1 summarizes the route assignment for each movement of the study intersections.

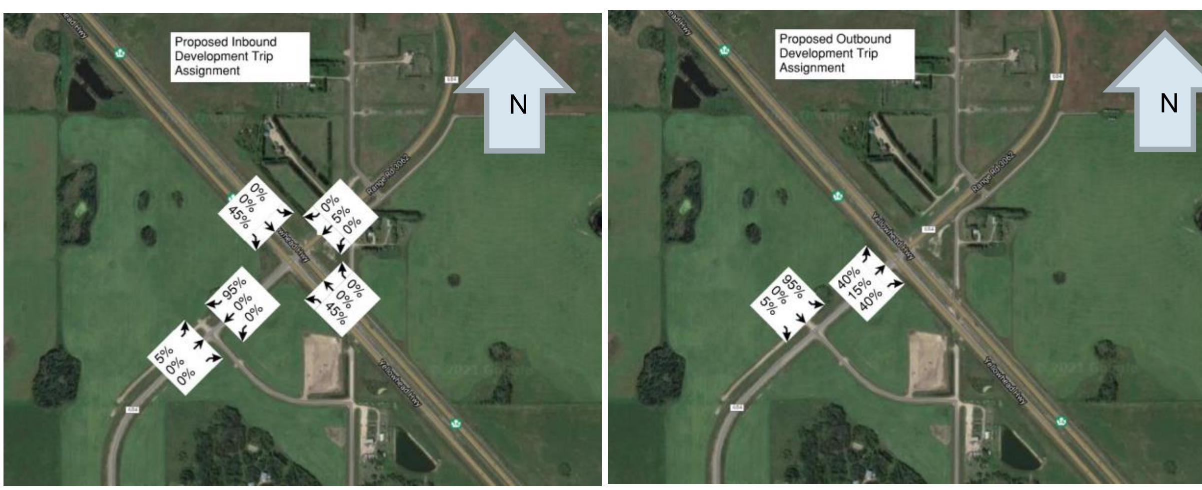

Figure 3-1 | Proposed Development Trip Assignment

Appendix B contains additional details on the assignment of development trips to the study area intersections in the morning and afternoon peak hours.

4 FUTURE TRAFFIC DEMAND

4.1.1 BACKGROUND FORECAST VOLUMES

Background forecast volumes are a projection of the traffic volumes anticipated without the impact of the proposed development. This analysis was conducted to determine how the network will operate in the future without the proposed development. Segments of Highway No. 16 near Lloydminster have a 15-year growth factor of 1.3. A slightly more conservative 15-year growth factor of 1.4 (growth of 40%) was used for Highway No. 16 and Grid Road 684, with no growth factor applied to the access road.

4.1.2 POST DEVELOPMENT VOLUMES

The total forecast volumes associated with the development are obtained by combining the background growth volumes with the new trips associated with the development. As noted in **Section 2.2**, the percentage of truck traffic utilizing a cardlock facility in the adjacent area was identified to be approximately 30% in the morning and 20% in the afternoon peak. This study assumed the percentage of trucks to be approximately 30% for the newly generated traffic, based on the clients supplied estimates.

Appendix B contains detailed calculations of the background and total forecast volumes during the morning and afternoon peak hours for the 2023 and 2033 horizons.

5 TRAFFIC OPERATIONS

Background and total forecast scenarios have been assessed using Synchro Suite 11.0 and SimTraffic (industry-standard traffic analysis software). The study intersections were assessed using the current configurations and conditions.

Level of service (LOS) analysis assesses the effectiveness of a transportation system alphabetically from A to F, with LOS A equating to the best-operating conditions and LOS F representing the failure of a movement or intersection. LOS E is typically considered the limit of acceptable operation for minor streets in order to provide additional capacity or maintain free-flow movement on the major street.

The volume-to-capacity (v/c) ratio is representative of congestion and available capacity, which may be used to identify a movement's ability to accommodate fluctuations in traffic flow. V/C values of 0.80 or greater typically indicate a system that has reached its limit of operational effectiveness. The 95th percentile queue length represents the maximum length of the queue a movement may experience with 95th percentile traffic volumes.

SimTraffic, a traffic simulation software program included in the Synchro Studio 11.0 suite, was used to perform the queuing analysis for the 2033 full build-out scenario. SimTraffic can be used to help predict the length of vehicle queues that will form at an intersection in order to determine if queued vehicles will cause blockages at adjacent intersections. The results of the SimTraffic analyses are based on the average of 10 simulation runs.

The Synchro and SimTraffic model outputs are included as **Appendix C**.

Figures 5-1 and 5-2 illustrate the change in LOS from the background and total forecast scenarios for commencement (2023) and 10 years from commencement (2033) during the afternoon peak hours.

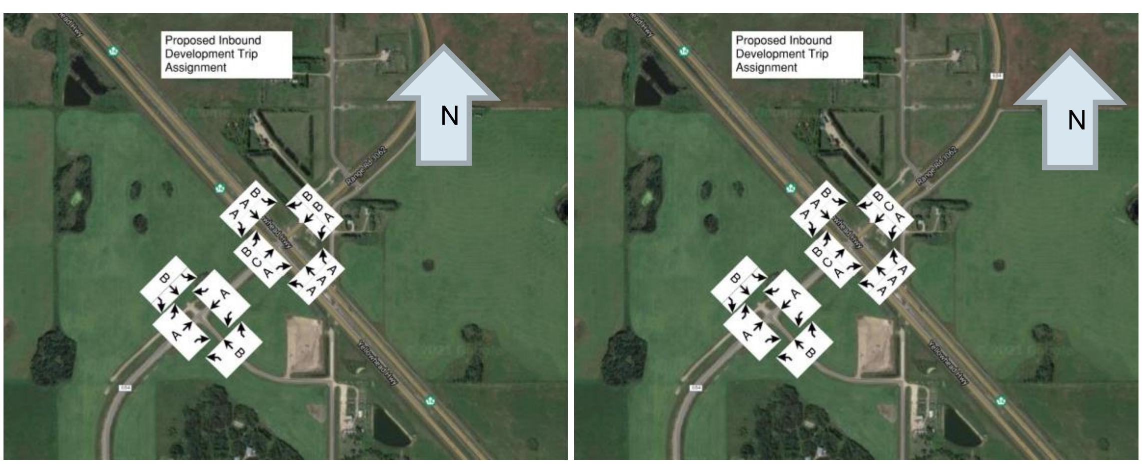

Figure 5-1 | LOS Afternoon Peak Commencement Background (Left) and Post Development (Right) 2023

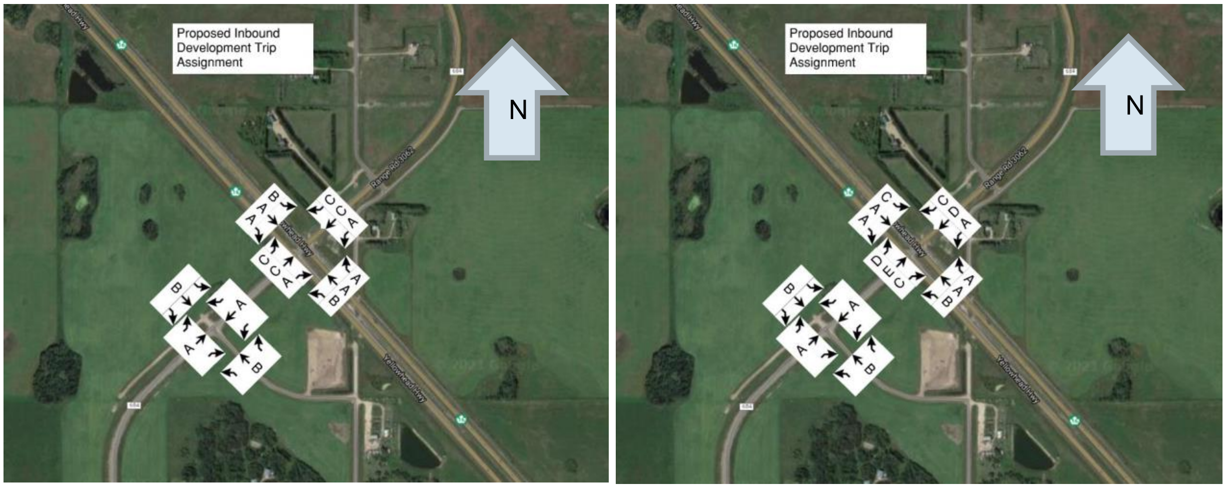

Figure 5-2 | LOS Afternoon Peak 10-year Forecast Background (Left) and Post Development (Right) 2033

HIGHWAY NO. 16 AND GRID ROAD 684 INTERSECTION

The Highway No. 16 and Grid Road 684 intersection is a four-leg intersection located within the RM of Corman Park. Highway No. 16 is a four-lane divided rural highway operating with free-flow conditions. Grid Road 684 is stop-controlled and provides access to Dalmeny to the north and access to Saskatoon to the south. The Highway No. 16 and Grid Road 684 intersection is the main access to Dalmeny coming from the east and south. There are currently right turn lanes for the west and eastbound right turns on Highway No. 16 and acceleration lanes for the north and southbound left turns from Grid Road 684 onto Highway No. 16. The posted speed limit on Highway No. 16 is 110 km/h while the posted limit on Grid Road 684 is 90 km/h.

— For the 2023 background forecast scenario, the northbound approach on Grid Road 684 is expected to operate at LOS C during the afternoon peak hour with a 26 m 95th percentile queue length. The southbound approach is expected to operate at LOS B during the afternoon peak hour with a 17 m 95th percentile queue length.

— With the development traffic, the 2023 total forecast scenario maintains the level of service at LOS C for the northbound approach while the southbound approach decreases to a LOS C with a 16.7 m 95th percentile queue length.

— For all the 2033 forecast scenarios, the northbound and southbound approaches are expected to operate at LOS C condition.

— For the 2033 total forecast scenario, the northbound approach is expected to operate at LOS E during the afternoon peak hour with a 53 m 95th percentile queue length. The southbound approach is expected to operate at LOS D during the afternoon peak hour with a 20 m 95th percentile queue length.

Grid Road 684 is expected to operate under congested constraints in the afternoon peak hour as a stop-controlled approach while Highway No. 16 continues to operate acceptably under free-flow conditions in the future forecast scenarios.

GRID ROAD 684 AND CARDLOCK ACCESS INTERSECTION

The Grid Road 684 and Cardlock access intersection is a stop-controlled four-leg intersection located within the RM of Corman Park. Grid Road 684 is a two-lane undivided rural highway operating with free-flow conditions. The cardlock access road provides access to rural developments to the east of the grid road and to a field to the west, intersecting Grid Road 684 perpendicularly. No auxiliary lanes are present. The posted limit for Grid Road 684 is 90 km/h while the access has an unposted limit of 80 km/h (standard rural speed limit in the RM).

— Overall, the intersection operates acceptably (LOS B) during both peak hours for the2023 background forecast and post-development volumes and the 2033 background and post-development volumes.

Table 5-1 summarizes the critical movements for the2023 commencement and 2033 horizon background and post-development scenarios for all study intersections during the afternoon peak hours, while **Table 5-2** outlines the LOS at Highway No. 16.

Table 5-1 | Capacity Analysis Results Summary – PM Peak Hour

Intersections	Scenarios	Afternoon Peak - Critical Movements					
		Overall LOS (Delay)	Movement	Delay (s)	LOS	V/C	95% Queue (m)
Grid Road 684 and Cardlock Access	Background 2023	B (0.1)	EB/WB L/T/R	10.9	B	0.002	0
	Post Development 2023	B (1)	EB L/T/R	11.2	B	0.050	1
	Background 2033	B (0.1)	EB/WB L/T/R	10.9	B	0.002	0
	Post Development 2033	B (0.8)	EB L/T/R	12.1	B	0.056	1
Hwy 16 and Grid Road 684	Background 2023	A (5.7)	NB T	17.8	C	0.307	26
	Post Development 2023	A (6.2)	NB T	19.2	C	0.359	28
	Background 2033	A (7.0)	NB T	22.1	C	0.451	31
	Post Development 2033	C (16.4)	NB T	42.2	E	0.496	53

Table 5-2 | Delay Calculations for Highway No. 16 and Grid Road 684 Intersection

PM Peak Hour		Eastbound			Westbound			Northbound			Southbound			Overall
Background 2023		L	T	R	L	T	R	L	T	R	L	T	R	
Node 6	Hwy 16 WB & Grid Road 684	7.5			2.6	1.2	0.8	3.6	7.5		9.0	9.0	5.3	2.5
Node 3	Hwy 16 EB & Grid Road 684	2.9	1.3	0.4	5.6			10.3	10.3	5.5	4.9	5.6		3.2
	Total	10.4	1.3	0.4	8.2	1.2	0.8	13.9	17.8	5.5	13.9	14.6	5.3	5.7
	LOS	B	A	A	A	A	A	B	C	A	B	B	A	A
	95% Queue (m)	1.1	0.7	1.0	1.5	0.9	3.3	25.6	25.6	25.6	17.0	17.0	17.0	

PM Peak Hour		Eastbound			Westbound			Northbound			Southbound			Overall
Post Development 2023		L	T	R	L	T	R	L	T	R	L	T	R	
Node 6	Hwy 16 WB & Grid Road 684	7.9			3.4	1.3	0.9	3.4	7.9		9.3	9.3	4.4	2.7
Node 3	Hwy 16 EB & Grid Road 684	4.1	1.2	0.5	6.3			11.3	11.3	6.4	3.0	6.3		3.5
	Total	12.0	1.2	0.5	9.7	1.3	0.9	14.7	19.2	6.4	12.3	15.6	4.4	6.2
	LOS	B	A	A	A	A	A	B	C	A	B	C	A	A
	95% Queue (m)	1.6	1.6	1.2	1.9	1.9	3.1	28.3	28.3	28.3	16.7	16.7	16.7	

PM Peak Hour		Eastbound			Westbound			Northbound			Southbound			Overall
Background 2033		L	T	R	L	T	R	L	T	R	L	T	R	
Node 6	Hwy 16 WB & Grid Road 684	8.9			3.6	1.5	1.1	4.3	8.9		11.6	11.6	6.5	3.1
Node 3	Hwy 16 EB & Grid Road 684	3.9	1.4	0.6	7.7			13.2	13.2	7.6	3.9	7.7		3.9
	Total	12.8	1.4	0.6	11.3	1.5	1.1	17.5	22.1	7.6	15.5	19.3	6.5	7.0
	LOS	B	A	A	B	A	A	C	C	A	C	C	A	A
	95% Queue (m)	2.7	2.7	1.6	2.8	1.1	4.2	31.4	31.4	31.4	20.8	20.8	20.8	

PM Peak Hour		Eastbound			Westbound			Northbound			Southbound			
Post Development 2033		L	T	R	L	T	R	L	T	R	L	T	R	
Node 6	Hwy 16 WB & Grid Road 684	13.8			1.8	5.4	1.2	5.2	13.8		19.2	19.2	7.2	6.6
Node 3	Hwy 16 EB & Grid Road 684	2.0	5.1	0.4	10.6			28.4	28.4	20.6	4.1	10.6		9.8
	Total	15.8	5.1	0.4	12.4	5.4	1.2	33.6	42.2	20.6	23.3	29.8	7.2	16.4
	LOS	C	A	A	B	A	A	D	E	C	C	D	A	C
	95% Queue (m)	2.5	0.6	0.6	3.8	0.9	4.1	53.1	53.1	53.1	20.1	20.1	20.1	

6 FUTURE MODIFICATIONS

TURNING LANE WARRANTS

Spot Improvement Warrants

Spot warrants are reactive and are assessed using current traffic volumes at existing locations and are partly based on past collision occurrences. There have been multiple collisions and fatalities at the Highway No. 16 and Grid Road 684 Intersection. The Ministry is currently preparing a safety study on this specific intersection, so an in-depth review of collision data was not preformed. For the Grid Road 684 and Cardlock Access intersection the traffic volumes are so low that it is assumed that limited preventable collisions have occurred. For the lower volume intersection, a brief review of MoH Standard Plan 20615 for spot improvement warrants indicated that no improvements were warranted at current traffic volumes and past collisions occurrences.

System Improvement Warrants

System warrants for existing highway locations are predictive and warrant improvements at locations that will undergo re-construction or are adjacent to future major projects. System warrant analyses were carried out to determine if additional lanes are required at all highway intersections affected by the development. The warrant analyses were conducted using the existing intersection configuration and 10-year forecasted post-development volumes. For this study, MoH Standard Plan 20610, 20611, 20612, 20613, and 20614 were used to assess the left-turn, channelization, bypass, flare, and right turn lane requirement along Grid Road 684. Additionally, MoH Standard Plan 20610 and 20614 were used to assess the requirement for a right turn lane turning onto Highway No. 16 and a left turn lane turning off of Highway No. 16. For this study, the MoH Supplement to the TAC Geometric Design Guide 2.3.5-F was used to assess the acceleration lane requirements.

The Annual Average Daily Traffic (AADT) volumes used in the analysis were estimated from the afternoon peak hour, assuming the afternoon peak hour traffic volume represents 8% of daily traffic.

ILLUMINATION WARRANTS

Intersection area lighting includes illumination of the intersection and at the adjacent approaches while the delineation lighting only provides partial lighting at the intersections. Intersection area lighting warrant and delineation lighting analyses were conducted at all intersection legs affected by the development.

Intersection Area Lighting

Traffic volume warrants were used for the intersection area lighting assessment, as per MoH Intersection Area Lighting (DM 2621-2). There are three warrants for intersection area lighting, including:

- Traffic Volume Warrant
- Raised Channelized / Median Curbing Warrant
- Traffic Accident Rate Warrant

Delineation Lighting

According to DM 2621-1, Delineation lighting is warranted when a provincial highway intersects with a grid road that has an AADT greater than 150 on that leg. However, if there is urban lighting within 25 metres of the intersection, it is not needed.

Turning Lane and Illumination Warrants can be found in **Appendix D**.

6.1 HIGHWAY NO. 16 AND GRID ROAD 684 INTERSECTION

At this intersection, Highway No. 16 travels in a southeast to northwest orientation, which can result in intersections intersecting at less than 90 degrees. However, the Grid Road 684 accesses were previously realigned to create a perpendicular intersection at Highway No 16. The north leg of Grid Road 684 has a posted limit of 100 km/h while the posted limit of the south leg is 90 km/h. The current intersection configuration operates reasonably well under the current traffic conditions based solely on the capacity analysis results. On-site observations during the movement count identified phases of heavy queueing on the northbound and southbound legs of the intersection, along with heavy use of the median storage to complete movements. This intersection also includes important intersection ahead signs with flashing lights in both directions on Highway 16.

TURNING LANE WARRANTS

The current intersection configuration features dedicated right turn lanes for the eastbound and westbound Highway No. 16 traffic along with left turn acceleration lanes for the traffic turning onto Highway No. 16. Using Standard Plan 21610 and 21604, a right turn lane is warranted under background conditions for northbound traffic turning right onto Highway No. 16 under existing conditions. The critical movement for this lane is the northbound through traffic, with the right turn reaching a LOS C in the worst-case scenario. Additionally, it was observed that the shoulder provided sufficient room for vehicles to make a right turn beside the queue for the through and left turn movements. While the high collision rate at the intersection necessitates further analysis.

The southbound right turn lane and the eastbound and westbound left turn lanes were not warranted in all scenarios.

ILLUMINATION WARRANTS

Currently, this intersection has area and delineation lighting on Grid Road 684 and area lighting on Highway No. 16. No further warrants were assessed.

6.2 GRID ROAD 684 AND CARDLOCK ACCESS ROAD

The speed limit on Grid Road is 90 km/h south of Highway No. 16 in both northeast and southwest directions. The Access Road is a northwest-southeast gravel road with an unposted speed limit of 80 km/h. The intersection is located approximately 300 m south of the Highway No. 16 and Grid Road 684 intersection, with a horizontal curve on Grid Road 684 approximately 300 m further south. Currently, there is no posted transition zone for the speed limit heading into the Highway No. 16 intersection, although the horizontal curve helps lower northbound speeds while southbound traffic is still accelerating up to the posted limit after leaving the Highway No. 16 intersection.

TURNING LANE WARRANTS

Currently, there are no separate turning lanes or shoulder extensions at this intersection. Using Ministry Standard Plans for warrants, there is one intersection improvement that could be warranted at the horizon year with the development: a right turn lane for southbound traffic on Grid Road 684. However, with most of the southbound traffic on Grid Road 684 free flowing and the reduced actual travel speed due to the nearby intersection and curve there will be minimal increase in delay compared to background traffic conditions. A possible solution would be to create a reduced speed transition zone from the Highway No. 16 intersection past the access road.

ILLUMINATION WARRANTS

Currently, this intersection does not have area or delineation lighting on either Grid Road 684 or the Access Road. Reviewing the three area lighting warrants, it was concluded that the intersection does not warrant area lighting upgrades. However, with the construction of the development to the north of the intersection, the west leg of the intersection would warrant delineation lighting.

7 SUMMARY OF RECOMMENDATIONS

WSP was commissioned by Hasegawa to complete a Traffic Impact Assessment (TIA) for the proposed cardlock facility near Saskatoon. **Figure 6-1** illustrates the recommendations that have resulted from the completion of the TIA.

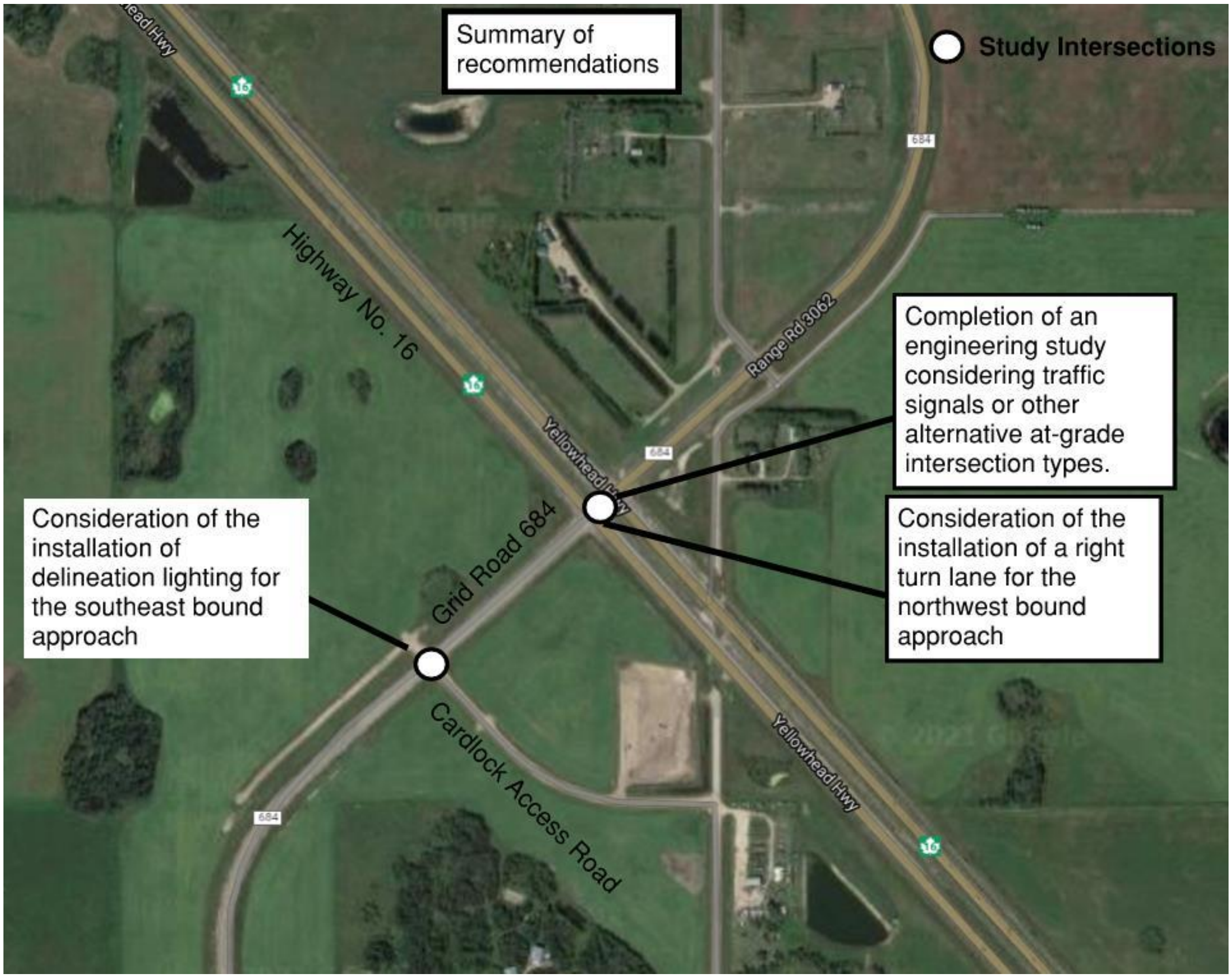

Figure 7-1 | Summary of Recommendations

APPENDIX

A

TURNING MOVEMENT COUNT SUMMARIES

Turning Movement Count Summary - Total Traffic
Grid Road 684 & Highway 16 - Dalmeny, SK

Dalmeny Access/Highway No. 16 Development
Project Number: 211-11128-00

Morning Peak Period

Date: 09/28/21

Start Time	Grid Road 684 NORTHBOUND LT	TH	RT	Total	Grid Road 684 SOUTHBOUND LT	TH	RT	Total	Highway 16 EASTBOUND LT	TH	RT	Total	Highway 16 WESTBOUND LT	TH	RT	Total	Overall
06:00	1	2	1	4	11	3	0	14	0	0	5	5	0	0	3	3	26
06:15	5	2	1	8	10	15	2	27	0	0	12	12	0	0	3	3	50
06:30	5	9	1	15	26	20	0	46	0	0	6	6	1	0	1	2	69
06:45	4	4	1	9	27	15	1	43	0	0	7	7	3	0	4	7	66
07:00	4	0	1	5	23	8	0	31	0	0	10	10	6	0	1	7	53
07:15	11	8	0	19	27	18	1	46	0	0	11	11	0	0	2	2	78
07:30	5	4	3	12	52	14	0	66	0	0	21	21	2	0	1	3	102
07:45	8	8	2	18	34	19	0	53	4	0	5	9	4	0	1	5	85
08:00	5	9	3	17	17	16	1	34	0	0	18	18	0	0	4	4	73
08:15	6	18	1	25	13	7	1	21	2	0	9	11	1	0	4	5	62
08:30	8	5	2	15	16	5	2	23	0	0	3	3	1	0	8	9	50
08:45	8	6	4	18	16	14	1	31	1	0	5	6	0	0	4	4	59
	70	75	20	165	272	154	9	435	7	0	112	119	18	0	36	54	773
Morning Peak Hour 7:15 AM - 8:15 AM	29	29	8	66	130	67	2	199	4	0	55	59	6	0	8	14	338
15 Minute Max	11	9	3	19	52	19	1	66	4	0	21	21	4	0	4	5	102
Peak Hour Factor	0.66	0.81	0.67	0.87	0.63	0.88	0.50	0.75	0.25		0.65	0.70	0.38		0.50	0.70	0.83

Afternoon Peak Period

Date: 09/28/21

Start Time	Grid Road 684 NORTHBOUND LT	TH	RT	Total	Grid Road 684 SOUTHBOUND LT	TH	RT	Total	Highway 16 EASTBOUND LT	TH	RT	Total	Highway 16 WESTBOUND LT	TH	RT	Total	Overall
16:00	16	12	5	33	2	4	1	7	0	0	9	9	2	0	16	18	67
16:15	13	12	4	29	8	14	0	22	0	0	15	15	1	0	40	41	107
16:30	17	17	9	43	4	12	1	17	0	0	15	15	1	0	23	24	99
16:45	10	27	7	44	6	7	1	14	1	0	9	10	5	0	29	34	102
17:00	20	32	0	52	6	10	1	17	2	0	13	15	3	0	31	34	118
17:15	13	13	3	29	6	9	0	15	0	0	6	6	2	0	41	43	93
17:30	22	26	7	55	12	9	0	21	0	0	14	14	1	0	22	23	113
17:45	11	21	4	36	7	5	0	12	0	0	10	10	3	0	15	18	76
18:00	14	10	3	27	6	3	2	11	0	0	6	6	1	0	11	12	56
18:15	14	14	1	29	5	7	0	12	0	0	4	4	3	0	12	15	60
18:30	5	6	4	15	7	9	0	16	0	0	9	9	2	0	11	13	53
18:45	9	8	2	19	7	9	0	16	0	0	6	6	2	0	15	17	58
	164	198	49	411	76	98	6	180	3	0	116	119	26	0	266	292	1,002
Afternoon Peak Hour 4:15 PM - 5:15 PM	60	88	20	168	24	43	3	70	3	0	52	55	10	0	123	133	426
15 Minute Max	20	32	9	52	8	14	1	22	2	0	15	15	5	0	40	41	118
Peak Hour Factor	0.75	0.69	0.56	0.81	0.75	0.77	0.75	0.80	0.38		0.87	0.92	0.50		0.77	0.81	0.90

Turning Movement Count Summary - Total Traffic
Grid Road 684 & Access Road - Dalmeny, SK

Dalmeny Access/Highway No. 16 Development
Project Number: 211-11128-00

Morning Peak Period

Date: 09/28/21

Start Time	Grid Road 684 NORTHBOUND				Grid Road 684 SOUTHBOUND				Access Road EASTBOUND				Access Road WESTBOUND				Overall
	LT	TH	RT	Total	LT	TH	RT	Total	LT	TH	RT	Total	LT	TH	RT	Total	
06:00	0	4	0	4	0	8	0	8	0	0	0	0	0	0	0	0	12
06:15	0	8	0	8	0	27	0	27	0	0	0	0	0	0	0	0	35
06:30	0	15	0	15	0	27	0	27	0	0	0	0	0	0	0	0	42
06:45	0	9	0	9	0	25	0	25	0	0	0	0	0	0	0	0	34
07:00	0	5	0	5	0	24	0	24	0	0	0	0	0	0	0	0	29
07:15	0	19	0	19	0	29	0	29	0	0	0	0	0	0	0	0	48
07:30	0	12	0	12	1	35	1	37	0	0	0	0	1	0	0	1	50
07:45	0	18	0	18	0	28	0	28	0	0	0	0	0	0	0	0	46
08:00	0	17	0	17	0	34	0	34	0	0	0	0	0	0	0	0	51
08:15	0	25	0	25	0	17	0	17	0	0	0	0	0	0	0	0	42
08:30	0	15	0	15	0	9	0	9	0	0	0	0	0	0	0	0	24
08:45	0	18	0	18	0	19	0	19	0	0	0	0	0	0	0	0	37
	0	165	0	165	1	282	1	284	0	0	0	0	1	0	0	1	450
Morning Peak Hour																	
7:15 AM - 8:15 AM	0	66	0	66	1	126	1	128	0	0	0	0	1	0	0	1	195
15 Minute Max	0	19	0	19	1	35	1	37	0	0	0	0	1	0	0	1	51
Peak Hour Factor		0.87		0.87	0.25	0.90	0.25	0.86					0.25			0.25	0.96

Afternoon Peak Period

Date: 09/28/21

Start Time	Grid Road 684 NORTHBOUND				Grid Road 684 SOUTHBOUND				Access Road EASTBOUND				Access Road WESTBOUND				Overall
	LT	TH	RT	Total	LT	TH	RT	Total	LT	TH	RT	Total	LT	TH	RT	Total	
16:00	0	33	0	33	0	15	0	15	0	0	0	0	0	0	0	0	48
16:15	0	29	0	29	0	29	1	30	1	0	0	1	1	0	0	1	61
16:30	0	43	0	43	0	28	0	28	0	0	0	0	0	0	0	0	71
16:45	0	44	0	44	1	20	0	21	0	0	0	0	0	0	0	0	65
17:00	0	52	0	52	0	26	0	26	0	0	0	0	0	0	0	0	78
17:15	0	29	0	29	0	17	0	17	0	0	0	0	0	0	0	0	46
17:30	0	55	1	56	0	24	0	24	0	0	0	0	0	0	1	1	81
17:45	0	36	0	36	0	18	0	18	0	0	0	0	0	0	0	0	54
18:00	0	27	0	27	0	10	0	10	0	0	0	0	0	0	0	0	37
18:15	0	29	0	29	0	14	0	14	0	0	0	0	0	0	0	0	43
18:30	0	15	0	15	0	20	0	20	0	0	0	0	0	0	0	0	35
18:45	0	19	3	22	0	17	0	17	0	0	0	0	0	0	0	0	39
	0	411	4	415	1	238	1	240	1	0	0	1	1	0	1	2	658
Afternoon Peak Hour																	
4:15 PM - 5:15 PM	0	168	0	168	1	103	1	105	1	0	0	1	1	0	0	1	275
15 Minute Max	0	52	0	52	1	29	1	30	1	0	0	1	1	0	0	1	78
Peak Hour Factor		0.81		0.81	0.25	0.89	0.25	0.88	0.25			0.25	0.25			0.25	0.88

APPENDIX

B TRIP ASSIGNMENT AND FORECASTING CALCULATIONS

Access-Grid Road 684														
Directions			Grid Road 684 NB			Grid Road 684 SB			Access EB			Access WB		
			L	TH	R	L	TH	R	L	TH	R	L	TH	R
2021	Traffic Count	AM Peak Hour (vph) 7:15-8:15	0	66	0	1	126	1	0	0	0	1	0	0
		AM Heavy Vehicles (%)	2%	9%	2%	2%	4%	2%	2%	2%	2%	2%	2%	2%
		AM 15 m Peak	0	19	0	1	35	1	0	0	0	1	0	0
		AM Peak Hour Factor	0.96											
		PM Peak Hour (vph) 4:15-5:15	0	168	0	1	103	1	1	0	0	1	0	0
		PM Heavy Vehicles (%)	2%	6%	2%	2%	7%	2%	2%	2%	2%	2%	2%	2%
		PM 15 m Peak	0	52	0	1	29	1	1	0	0	1	0	0
		PM Peak Hour Factor	0.88											
		AADT (vpd) (8% of Peak)	0	1680	0	10	1260	10	10	0	0	10	0	0
		Growth Factor (15-year)	1.4	1.4	1.4	1.4	1.4	1.4	1.0	1.0	1.0	1.0	1.0	1.0
	Development/ Pass-by Volumes	Inbound Trips	21			PM Peak			21			AM Peak		
		Outbound Trips	21						21					
		Heavy Vehicles (%)	31%						31%					
		Development Pass by Trip %	42%						58%					
		Movement Pass by %	10%	-10%			-5%	90%	95%		5%			
		Development Inbound %	10%					90%						
		Development Outbound %							95%		5%			
2023	Commencement Day	AM Peak Hour Traffic Volume (vph)	0	70	0	1	133	1	0	0	0	1	0	0
		PM Peak Hour Traffic Volume (vph)	0	177	0	1	108	1	1	0	0	1	0	0
		AM Peak Hour Traffic Volume (pce vph)	0	74	0	1	136	1	0	0	0	1	0	0
		PM Peak Hour Traffic Volume (pce vph)	0	184	0	1	114	1	1	0	0	1	0	0
		AM Development Volume (vph)	3	-2	0	0	-1	19	20	0	2	0	0	0
		PM Development Volume (vph)	3	-1	0	0	-1	19	20	0	2	0	0	0
		AM Combined Volume (vph)	3	68	0	1	132	20	20	0	2	1	0	0
		PM Combined Volume (vph)	3	176	0	1	107	20	21	0	2	1	0	0
		AM Heavy Vehicles (%)	31%	8%	0%	2%	4%	29%	31%	0%	31%	2%	0%	0%
		PM Heavy Vehicles (%)	31%	6%	0%	2%	7%	29%	29%	0%	31%	2%	0%	0%
		AM Combined Volume (pce vph)	4	72	0	1	135	24	24	0	2	1	0	0
		PM Combined Volume (pce vph)	4	183	0	1	112	24	25	0	2	1	0	0
		AADT Combined (8% of Peak)	46	2290	0	13	1690	302	316	0	30	13	0	0
2033	10-year Horizon	AM Peak Hour Traffic Volume (vph)	0	87	0	1	166	1	0	0	0	1	0	0
		PM Peak Hour Traffic Volume (vph)	0	222	0	1	136	1	1	0	0	1	0	0
		AM Peak Hour Traffic Volume (pce vph)	0	93	0	1	171	1	0	0	0	1	0	0
		PM Peak Hour Traffic Volume (pce vph)	0	231	0	1	142	1	1	0	0	1	0	0
		AM Development Volume (vph)	3	-2	0	0	-1	19	20	0	2	0	0	0
		PM Development Volume (vph)	3	-1	0	0	-1	19	20	0	2	0	0	0
		AM Combined Volume (vph)	3	85	0	1	165	20	20	0	2	1	0	0
		PM Combined Volume (vph)	3.0	221	0	1	135	20	21	0	2	1	0	0
		AM Heavy Vehicles (%)	31%	9%	0%	2%	4%	29%	31%	0%	31%	2%	0%	0%
		PM Heavy Vehicles (%)	31%	6%	0%	2%	7%	29%	29%	0%	31%	2%	0%	0%
		AM Combined Volume (pce vph)	4	91	0	1	170	24	24	0	2	1	0	0
		PM Combined Volume (pce vph)	4	230	0	1	142	24	25	0	2	1	0	0
		AADT Combined (8% of Peak)	36	2878	0	17	2124	305	316	0	30	13	0	0

HWY 16-Grid Road 684														
Directions			Grid Road 684 NB			Grid Road 684 SB			Hwy 16 EB			Hwy 16 WB		
			L	TH	R	L	TH	R	L	TH	R	L	TH	R
2021	Traffic Count	AM Peak Hour (vph) 7:15-8:15	29	29	8	130	67	2	4	489	55	6	489	8
		AM Heavy Vehicles (%)	3%	17%	2%	2%	2%	2%	50%	22%	9%	2%	21%	13%
		AM 15 m Peak	11	9	3	52	19	1	4	N/A	21	4	N/A	4
		AM Peak Hour Factor	0.83											
		PM Peak Hour (vph) 4:15-5:15	60	88	20	24	43	3	3	489	52	10	489	123
		PM Heavy Vehicles (%)	7%	2%	25%	2%	7%	2%	2%	22%	8%	2%	21%	2%
		PM 15 m Peak	20	32	9	8	14	1	2	0	15	5	0	40
		PM Peak Hour Factor	0.90											
		AADT (vpd) (8% of Peak Hour)	600	880	200	1300	670	30	40	4890	550	100	4890	1230
		Growth Factor (15-year)	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
	Development/ Pass-by Volumes	Inbound Trips	21			PM Peak			21			AM Peak		
		Outbound Trips	21						21					
		Heavy Vehicles (%)	31%						31%					
		Development Pass by Trip %	42%						58%					
		Movement Pass by %	40%		45%					-45%	45%	40%	-40%	
		Development Inbound %					5%				45%	40%		
		Development Outbound %	40%	15%	40%									
2023	Commencement Day	AM Peak Hour Traffic Volume (vph)	31	31	8	137	71	2	4	554	58	6	554	8
		PM Peak Hour Traffic Volume (vph)	63	93	21	25	45	3	3	554	55	11	554	130
		AM Peak Hour Traffic Volume (pce vph)	32	31	10	139	74	2	4	639	61	6	636	9
		PM Peak Hour Traffic Volume (pce vph)	66	94	25	26	48	3	3	639	58	11	636	131
		AM Development Volume (vph)	9	2	10	0	1	0	0	-6	10	9	-5	0
		PM Development Volume (vph)	9	2	9	0	1	0	0	-4	10	9	-4	0
		AM Combined Volume (vph)	40	33	18	137	72	2	4	548	68	15	549	8
		PM Combined Volume (vph)	72	95	30	25	46	3	3	550	65	20	550	130
		AM Heavy Vehicles (%)	10%	18%	18%	2%	2%	2%	50%	22%	12%	19%	21%	13%
		PM Heavy Vehicles (%)	10%	3%	27%	2%	8%	2%	2%	22%	11%	15%	21%	2%
		AM Combined Volume (pce vph)	42	33	22	139	75	2	4	632	73	17	630	9
		PM Combined Volume (pce vph)	77	96	36	26	49	3	3	634	70	22	631	131
		AADT Combined (8% of Peak)	964	1205	446	1736	942	40	53	7925	916	270	7892	1642
2033	10-year Horizon	AM Peak Hour Traffic Volume (vph)	38	38	11	172	88	3	5	685	73	8	685	11
		PM Peak Hour Traffic Volume (vph)	79	116	26	32	57	4	4	685	69	13	685	162
		AM Peak Hour Traffic Volume (pce vph)	39	43	11	174	90	3	7	789	77	8	786	11
		PM Peak Hour Traffic Volume (pce vph)	83	118	31	32	60	4	4	789	72	13	786	165
		AM Development Volume (vph)	9	2	10	0	1	0	0	-6	10	9	-5	0
		PM Development Volume (vph)	9	2	9	0	1	0	0	-4	10	9	-4	0
		AM Combined Volume (vph)	47	40	21	172	89	3	5	679	83	17	680	11
		PM Combined Volume (vph)	88	118	35	32	58	4	4	681	79	22	681	162
		AM Heavy Vehicles (%)	9%	18%	16%	2%	2%	2%	50%	22%	12%	17%	21%	13%
		PM Heavy Vehicles (%)	9%	2%	26%	2%	7%	2%	2%	22%	11%	14%	21%	2%
		AM Combined Volume (pce vph)	50	45	23	174	91	3	7	782	89	19	780	11
		PM Combined Volume (pce vph)	94	120	42	32	61	4	4	784	84	24	781	165
		AADT (vpd) (8% of Peak Hour)	1173	1503	524	2175	1136	50	89	9804	1117	304	9763	2058

APPENDIX

C SYNCRO HCM OUTPUTS

Summary of All Intervals

Run Number	1	2	3	4	5	6	7
Start Time	6:57	6:57	6:57	6:57	6:57	6:57	6:57
End Time	8:07	8:07	8:07	8:07	8:07	8:07	8:07
Total Time (min)	70	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1	1
Vehs Entered	1740	1806	1738	1718	1661	1724	1815
Vehs Exited	1725	1798	1735	1713	1660	1729	1816
Starting Vehs	46	43	37	33	42	46	45
Ending Vehs	61	51	40	38	43	41	44
Travel Distance (km)	2145	2218	2146	2121	2056	2139	2243
Travel Time (hr)	46.5	48.0	46.3	45.7	44.4	46.3	48.4
Total Delay (hr)	2.6	2.9	2.6	2.4	2.3	2.6	2.6
Total Stops	407	445	358	357	334	361	382
Fuel Used (l)	149.4	154.4	148.7	146.1	141.5	149.0	155.9

Summary of All Intervals

Run Number	8	9	10	Avg
Start Time	6:57	6:57	6:57	6:57
End Time	8:07	8:07	8:07	8:07
Total Time (min)	70	70	70	70
Time Recorded (min)	60	60	60	60
# of Intervals	2	2	2	2
# of Recorded Intervals	1	1	1	1
Vehs Entered	1815	1700	1732	1745
Vehs Exited	1810	1724	1714	1742
Starting Vehs	40	61	36	41
Ending Vehs	45	37	54	44
Travel Distance (km)	2231	2104	2132	2154
Travel Time (hr)	48.2	45.3	45.8	46.5
Total Delay (hr)	2.8	2.4	2.4	2.5
Total Stops	424	353	382	382
Fuel Used (l)	154.7	145.6	147.3	149.3

Interval #0 Information Seeding

Start Time	6:57
End Time	7:07
Total Time (min)	10

Volumes adjusted by Growth Factors.

No data recorded this interval.

Interval #1 Information Recording

Start Time	7:07
End Time	8:07
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	1740	1806	1738	1718	1661	1724	1815
Vehs Exited	1725	1798	1735	1713	1660	1729	1816
Starting Vehs	46	43	37	33	42	46	45
Ending Vehs	61	51	40	38	43	41	44
Travel Distance (km)	2145	2218	2146	2121	2056	2139	2243
Travel Time (hr)	46.5	48.0	46.3	45.7	44.4	46.3	48.4
Total Delay (hr)	2.6	2.9	2.6	2.4	2.3	2.6	2.6
Total Stops	407	445	358	357	334	361	382
Fuel Used (l)	149.4	154.4	148.7	146.1	141.5	149.0	155.9

Interval #1 Information Recording

Start Time	7:07
End Time	8:07
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	1815	1700	1732	1745
Vehs Exited	1810	1724	1714	1742
Starting Vehs	40	61	36	41
Ending Vehs	45	37	54	44
Travel Distance (km)	2231	2104	2132	2154
Travel Time (hr)	48.2	45.3	45.8	46.5
Total Delay (hr)	2.8	2.4	2.4	2.5
Total Stops	424	353	382	382
Fuel Used (l)	154.7	145.6	147.3	149.3

Grid Road 684/Highway No. 16 S: Performance by movement

Movement	SEL	SET	SER	NET	NER	SWL	SWT	All
Denied Del/Veh (s)	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.1
Total Del/Veh (s)	2.9	1.3	0.4	10.3	5.5	3.2	6.5	3.2

Grid Road 684/Highway No. 16 N: Performance by movement

Movement	NWL	NWT	NWR	NEL	NET	SWT	SWR	All
Denied Del/Veh (s)	0.2	0.1	0.1	0.0	0.0	0.1	0.2	0.1
Total Del/Veh (s)	2.6	1.2	0.8	3.6	7.5	9.0	5.3	2.5

Grid Road 684/Cardlock Access Road: Performance by movement

Movement	SEL	NWL	NET	SWL	SWT	SWR	All
Denied Del/Veh (s)	0.1	0.1	0.2	0.0	0.0	0.0	0.1
Total Del/Veh (s)	3.3	4.1	0.3	2.4	1.1	1.1	0.6

Total Network Performance

Denied Del/Veh (s)	0.1
Total Del/Veh (s)	5.0

Intersection: Grid Road 684/Highway No. 16 S:

Movement	SE	SE	SE	NE	SW
Directions Served	LT	T	R	TR	LT
Maximum Queue (m)	1.6	0.7	1.4	29.2	16.6
Average Queue (m)	0.1	0.0	0.0	15.9	7.3
95th Queue (m)	1.1	0.7	1.0	25.6	15.0
Link Distance (m)	624.1	624.1	624.1	280.9	19.2
Upstream Blk Time (%)					0
Queuing Penalty (veh)					0
Storage Bay Dist (m)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: Grid Road 684/Highway No. 16 N:

Movement	NW	NW	NW	NE	SW
Directions Served	LT	T	R	LT	TR
Maximum Queue (m)	2.6	0.6	6.4	22.1	19.2
Average Queue (m)	0.1	0.0	0.5	10.4	9.8
95th Queue (m)	1.5	0.9	3.3	19.9	17.0
Link Distance (m)	626.0	626.0	626.0	19.2	434.3
Upstream Blk Time (%)				1	
Queuing Penalty (veh)				1	
Storage Bay Dist (m)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: Grid Road 684/Cardlock Access Road:

Movement	SE	NW
Directions Served	LTR	LTR
Maximum Queue (m)	5.3	6.4
Average Queue (m)	0.2	0.5
95th Queue (m)	2.4	3.8
Link Distance (m)	33.2	156.4
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 1

Summary of All Intervals

Run Number	1	2	3	4	5	6	7
Start Time	6:57	6:57	6:57	6:57	6:57	6:57	6:57
End Time	8:07	8:07	8:07	8:07	8:07	8:07	8:07
Total Time (min)	70	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1	1
Vehs Entered	1769	1844	1777	1776	1745	1756	1832
Vehs Exited	1767	1861	1767	1776	1730	1747	1835
Starting Vehs	42	69	44	37	38	38	58
Ending Vehs	44	52	54	37	53	47	55
Travel Distance (km)	2169	2270	2166	2176	2132	2152	2247
Travel Time (hr)	47.1	49.4	46.9	47.2	46.3	46.9	48.7
Total Delay (hr)	2.6	3.0	2.8	2.8	2.6	2.8	2.8
Total Stops	412	470	452	458	419	429	428
Fuel Used (l)	150.5	159.3	150.6	152.6	148.1	149.6	156.3

Summary of All Intervals

Run Number	8	9	10	Avg
Start Time	6:57	6:57	6:57	6:57
End Time	8:07	8:07	8:07	8:07
Total Time (min)	70	70	70	70
Time Recorded (min)	60	60	60	60
# of Intervals	2	2	2	2
# of Recorded Intervals	1	1	1	1
Vehs Entered	1890	1772	1769	1793
Vehs Exited	1885	1786	1769	1792
Starting Vehs	43	58	49	46
Ending Vehs	48	44	49	48
Travel Distance (km)	2316	2175	2166	2197
Travel Time (hr)	50.7	46.9	47.0	47.7
Total Delay (hr)	3.2	2.5	2.8	2.8
Total Stops	470	406	444	438
Fuel Used (l)	160.8	151.6	151.1	153.1

Interval #0 Information Seeding

Start Time	6:57
End Time	7:07
Total Time (min)	10

Volumes adjusted by Growth Factors.

No data recorded this interval.

Interval #1 Information Recording

Start Time	7:07
End Time	8:07
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	1769	1844	1777	1776	1745	1756	1832
Vehs Exited	1767	1861	1767	1776	1730	1747	1835
Starting Vehs	42	69	44	37	38	38	58
Ending Vehs	44	52	54	37	53	47	55
Travel Distance (km)	2169	2270	2166	2176	2132	2152	2247
Travel Time (hr)	47.1	49.4	46.9	47.2	46.3	46.9	48.7
Total Delay (hr)	2.6	3.0	2.8	2.8	2.6	2.8	2.8
Total Stops	412	470	452	458	419	429	428
Fuel Used (l)	150.5	159.3	150.6	152.6	148.1	149.6	156.3

Interval #1 Information Recording

Start Time	7:07
End Time	8:07
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	1890	1772	1769	1793
Vehs Exited	1885	1786	1769	1792
Starting Vehs	43	58	49	46
Ending Vehs	48	44	49	48
Travel Distance (km)	2316	2175	2166	2197
Travel Time (hr)	50.7	46.9	47.0	47.7
Total Delay (hr)	3.2	2.5	2.8	2.8
Total Stops	470	406	444	438
Fuel Used (l)	160.8	151.6	151.1	153.1

Grid Road 684/Highway No. 16 S: Performance by movement

Movement	SEL	SET	SER	NET	NER	SWL	SWT	All
Denied Del/Veh (s)	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.1
Total Del/Veh (s)	4.1	1.2	0.5	11.3	6.4	3.0	6.3	3.5

Grid Road 684/Highway No. 16 N: Performance by movement

Movement	NWL	NWT	NWR	NEL	NET	SWT	SWR	All
Denied Del/Veh (s)	0.2	0.1	0.1	0.0	0.0	0.1	0.2	0.1
Total Del/Veh (s)	3.4	1.3	0.9	3.4	7.9	9.3	4.4	2.7

Grid Road 684/Cardlock Access Road: Performance by movement

Movement	SEL	SER	NWL	NEL	NET	SWL	SWT	SWR	All
Denied Del/Veh (s)	0.1	0.1	0.1	0.1	0.2	0.0	0.0	0.0	0.1
Total Del/Veh (s)	4.8	2.0	6.8	2.2	0.3	1.9	1.3	1.3	1.1

Total Network Performance

Denied Del/Veh (s)	0.1
Total Del/Veh (s)	5.3

Intersection: Grid Road 684/Highway No. 16 S:

Movement	SE	SE	NE	SW
Directions Served	LT	R	TR	LT
Maximum Queue (m)	3.1	2.0	36.1	19.3
Average Queue (m)	0.1	0.1	16.8	8.1
95th Queue (m)	1.6	1.2	28.3	16.4
Link Distance (m)	624.1	624.1	280.9	19.2
Upstream Blk Time (%)				0
Queuing Penalty (veh)				0
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: Grid Road 684/Highway No. 16 N:

Movement	NW	NW	NE	SW
Directions Served	LT	R	LT	TR
Maximum Queue (m)	3.3	6.0	21.3	19.3
Average Queue (m)	0.2	0.4	10.6	10.4
95th Queue (m)	1.9	3.1	19.7	16.7
Link Distance (m)	626.0	626.0	19.2	434.3
Upstream Blk Time (%)			1	
Queuing Penalty (veh)			1	
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: Grid Road 684/Cardlock Access Road:

Movement	SE	NW	NE	SW
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (m)	13.6	8.0	4.4	0.7
Average Queue (m)	5.3	0.4	0.2	0.0
95th Queue (m)	13.1	3.2	2.7	0.7
Link Distance (m)	33.2	156.4	283.9	280.9
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 1

Summary of All Intervals

Run Number	1	2	3	4	5	6	7
Start Time	6:57	6:57	6:57	6:57	6:57	6:57	6:57
End Time	8:07	8:07	8:07	8:07	8:07	8:07	8:07
Total Time (min)	70	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1	1
Vehs Entered	2139	2236	2140	2094	2070	2088	2286
Vehs Exited	2138	2223	2131	2081	2082	2096	2275
Starting Vehs	69	49	56	52	56	59	59
Ending Vehs	70	62	65	65	44	51	70
Travel Distance (km)	2641	2749	2636	2573	2571	2584	2824
Travel Time (hr)	57.7	60.0	57.4	56.1	56.1	56.7	61.7
Total Delay (hr)	3.8	4.1	3.7	3.7	3.4	3.9	4.2
Total Stops	481	547	499	467	462	502	512
Fuel Used (l)	184.9	193.0	182.7	179.2	177.9	181.6	196.9

Summary of All Intervals

Run Number	8	9	10	Avg
Start Time	6:57	6:57	6:57	6:57
End Time	8:07	8:07	8:07	8:07
Total Time (min)	70	70	70	70
Time Recorded (min)	60	60	60	60
# of Intervals	2	2	2	2
# of Recorded Intervals	1	1	1	1
Vehs Entered	2182	2184	2127	2155
Vehs Exited	2183	2192	2123	2151
Starting Vehs	55	65	51	57
Ending Vehs	54	57	55	59
Travel Distance (km)	2698	2698	2625	2660
Travel Time (hr)	58.6	58.7	57.2	58.0
Total Delay (hr)	3.7	3.7	3.5	3.8
Total Stops	501	474	456	488
Fuel Used (l)	187.0	188.8	182.6	185.5

Interval #0 Information Seeding

Start Time	6:57
End Time	7:07
Total Time (min)	10

Volumes adjusted by Growth Factors.

No data recorded this interval.

Interval #1 Information Recording

Start Time	7:07
End Time	8:07
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	2139	2236	2140	2094	2070	2088	2286
Vehs Exited	2138	2223	2131	2081	2082	2096	2275
Starting Vehs	69	49	56	52	56	59	59
Ending Vehs	70	62	65	65	44	51	70
Travel Distance (km)	2641	2749	2636	2573	2571	2584	2824
Travel Time (hr)	57.7	60.0	57.4	56.1	56.1	56.7	61.7
Total Delay (hr)	3.8	4.1	3.7	3.7	3.4	3.9	4.2
Total Stops	481	547	499	467	462	502	512
Fuel Used (l)	184.9	193.0	182.7	179.2	177.9	181.6	196.9

Interval #1 Information Recording

Start Time	7:07
End Time	8:07
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	2182	2184	2127	2155
Vehs Exited	2183	2192	2123	2151
Starting Vehs	55	65	51	57
Ending Vehs	54	57	55	59
Travel Distance (km)	2698	2698	2625	2660
Travel Time (hr)	58.6	58.7	57.2	58.0
Total Delay (hr)	3.7	3.7	3.5	3.8
Total Stops	501	474	456	488
Fuel Used (l)	187.0	188.8	182.6	185.5

Grid Road 684/Highway No. 16 S: Performance by movement

Movement	SEL	SET	SER	NET	NER	SWL	SWT	All
Denied Del/Veh (s)	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.1
Total Del/Veh (s)	3.9	1.4	0.6	13.2	7.6	3.9	7.7	3.9

Grid Road 684/Highway No. 16 N: Performance by movement

Movement	NWL	NWT	NWR	NEL	NET	SWT	SWR	All
Denied Del/Veh (s)	0.2	0.1	0.1	0.0	0.0	0.2	0.1	0.1
Total Del/Veh (s)	3.6	1.5	1.1	4.3	8.9	11.6	6.5	3.1

Grid Road 684/Cardlock Access Road: Performance by movement

Movement	SEL	NWL	NET	SWL	SWT	SWR	All
Denied Del/Veh (s)		0.1	0.2		0.0	0.0	0.1
Total Del/Veh (s)		8.2	0.3		1.3	1.0	0.7

Total Network Performance

Denied Del/Veh (s)	0.1
Total Del/Veh (s)	6.0

Intersection: Grid Road 684/Highway No. 16 S:

Movement	SE	SE	NE	SW
Directions Served	LT	R	TR	LT
Maximum Queue (m)	5.5	2.6	39.7	19.6
Average Queue (m)	0.2	0.1	19.2	8.7
95th Queue (m)	2.7	1.5	31.4	17.2
Link Distance (m)	624.1	624.1	280.9	19.2
Upstream Blk Time (%)				0
Queuing Penalty (veh)				0
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: Grid Road 684/Highway No. 16 N:

Movement	NW	NW	NW	NE	SW
Directions Served	LT	T	R	LT	TR
Maximum Queue (m)	5.6	1.3	7.6	22.2	26.8
Average Queue (m)	0.3	0.1	0.6	13.3	11.7
95th Queue (m)	2.8	1.1	4.2	21.8	20.8
Link Distance (m)	626.0	626.0	626.0	19.2	434.3
Upstream Blk Time (%)				2	
Queuing Penalty (veh)				3	
Storage Bay Dist (m)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: Grid Road 684/Cardlock Access Road:

Movement	SE	NW
Directions Served	LTR	LTR
Maximum Queue (m)	1.8	6.4
Average Queue (m)	0.1	0.3
95th Queue (m)	1.5	3.1
Link Distance (m)	33.2	156.4
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 4

SimTraffic Simulation Summary

10-06-2021

Summary of All Intervals

Run Number	1	2	3	4	5	6	7
Start Time	6:57	6:57	6:57	6:57	6:57	6:57	6:57
End Time	8:07	8:07	8:07	8:07	8:07	8:07	8:07
Total Time (min)	70	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1	1
Vehs Entered	2174	2247	2247	2166	2219	2258	2239
Vehs Exited	2207	2235	2260	2156	2212	2251	2251
Starting Vehs	61	41	51	45	42	44	61
Ending Vehs	28	53	38	55	49	51	49
Travel Distance (km)	2656	2722	2723	2629	2693	2713	2733
Travel Time (hr)	46.8	47.8	47.2	45.3	46.7	47.4	47.4
Total Delay (hr)	6.9	7.0	6.7	6.1	6.4	6.6	6.6
Total Stops	577	663	602	591	591	590	506
Fuel Used (l)	178.7	184.4	181.0	176.5	180.3	182.3	182.7

Summary of All Intervals

Run Number	8	9	10	Avg
Start Time	6:57	6:57	6:57	6:57
End Time	8:07	8:07	8:07	8:07
Total Time (min)	70	70	70	70
Time Recorded (min)	60	60	60	60
# of Intervals	2	2	2	2
# of Recorded Intervals	1	1	1	1
Vehs Entered	2253	2248	2169	2222
Vehs Exited	2242	2246	2181	2222
Starting Vehs	38	41	58	46
Ending Vehs	49	43	46	42
Travel Distance (km)	2724	2733	2634	2696
Travel Time (hr)	48.3	48.8	46.0	47.2
Total Delay (hr)	7.7	7.9	6.6	6.8
Total Stops	568	574	590	584
Fuel Used (l)	182.6	183.0	177.1	180.8

Interval #0 Information Seeding

Start Time	6:57
End Time	7:07
Total Time (min)	10

Volumes adjusted by Growth Factors.

No data recorded this interval.

Interval #1 Information Recording

Start Time	7:07
End Time	8:07
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	2174	2247	2247	2166	2219	2258	2239
Vehs Exited	2207	2235	2260	2156	2212	2251	2251
Starting Vehs	61	41	51	45	42	44	61
Ending Vehs	28	53	38	55	49	51	49
Travel Distance (km)	2656	2722	2723	2629	2693	2713	2733
Travel Time (hr)	46.8	47.8	47.2	45.3	46.7	47.4	47.4
Total Delay (hr)	6.9	7.0	6.7	6.1	6.4	6.6	6.6
Total Stops	577	663	602	591	591	590	506
Fuel Used (l)	178.7	184.4	181.0	176.5	180.3	182.3	182.7

Interval #1 Information Recording

Start Time	7:07
End Time	8:07
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	2253	2248	2169	2222
Vehs Exited	2242	2246	2181	2222
Starting Vehs	38	41	58	46
Ending Vehs	49	43	46	42
Travel Distance (km)	2724	2733	2634	2696
Travel Time (hr)	48.3	48.8	46.0	47.2
Total Delay (hr)	7.7	7.9	6.6	6.8
Total Stops	568	574	590	584
Fuel Used (l)	182.6	183.0	177.1	180.8

Grid Road 684/Highway No. 16 S: Performance by movement

Movement	SEL	SET	SER	NET	NER	SWL	SWT	All
Denied Del/Veh (s)	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.1
Total Del/Veh (s)	2.0	5.1	0.4	28.4	20.6	4.1	10.6	9.8

Grid Road 684/Highway No. 16 N: Performance by movement

Movement	NWL	NWT	NWR	NEL	NET	SWT	SWR	All
Denied Del/Veh (s)	0.4	0.1	0.2	0.0	0.0	0.1	0.1	0.1
Total Del/Veh (s)	1.8	5.4	1.2	5.2	13.8	19.2	7.2	6.6

Grid Road 684/Cardlock Access Road: Performance by movement

Movement	SEL	SER	NWL	NEL	NET	SWL	SWT	SWR	All
Denied Del/Veh (s)	0.1	0.1	0.1	0.2	0.2		0.0	0.0	0.1
Total Del/Veh (s)	5.5	2.9	4.9	0.7	0.5		4.0	2.3	2.1

Total Network Performance

Denied Del/Veh (s)	0.1
Total Del/Veh (s)	10.7

Intersection: Grid Road 684/Highway No. 16 S:

Movement	SE	SE	SE	NE	SW
Directions Served	LT	T	R	TR	LT
Maximum Queue (m)	3.6	0.6	0.6	62.0	20.3
Average Queue (m)	0.1	0.0	0.0	26.8	10.4
95th Queue (m)	2.5	0.6	0.6	53.1	18.5
Link Distance (m)	624.1	624.1	624.1	280.9	19.2
Upstream Blk Time (%)					1
Queuing Penalty (veh)					1
Storage Bay Dist (m)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: Grid Road 684/Highway No. 16 N:

Movement	NW	NW	NW	NE	SW
Directions Served	LT	T	R	LT	TR
Maximum Queue (m)	7.5	1.3	7.2	22.4	24.8
Average Queue (m)	0.3	0.0	0.6	15.0	11.9
95th Queue (m)	3.8	0.9	4.1	24.3	20.1
Link Distance (m)	626.0	626.0	626.0	19.2	434.3
Upstream Blk Time (%)				4	
Queuing Penalty (veh)				8	
Storage Bay Dist (m)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: Grid Road 684/Cardlock Access Road:

Movement	SE	NW	NE	SW
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (m)	19.4	4.6	3.7	1.4
Average Queue (m)	5.9	0.2	0.1	0.0
95th Queue (m)	15.3	2.3	2.0	1.0
Link Distance (m)	33.2	156.4	283.9	280.9
Upstream Blk Time (%)	0			
Queuing Penalty (veh)	0			
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 9

Intersection	
Int Delay, s/veh	0.1

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Vol, veh/h	1	0	0	1	0	0	0	184	0	1	114	1
Future Vol, veh/h	1	0	0	1	0	0	0	184	0	1	114	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	88	88	88	88	88	88	88	88	88
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	1	0	0	1	0	0	0	209	0	1	130	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	342	342	131	342	342	209	131	0	0	209	0	0
Stage 1	133	133	-	209	209	-	-	-	-	-	-	-
Stage 2	209	209	-	133	133	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	616	583	924	616	583	836	1467	-	-	1374	-	-
Stage 1	875	790	-	798	733	-	-	-	-	-	-	-
Stage 2	798	733	-	875	790	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	615	582	924	615	582	836	1467	-	-	1374	-	-
Mov Cap-2 Maneuver	615	582	-	615	582	-	-	-	-	-	-	-
Stage 1	875	789	-	798	733	-	-	-	-	-	-	-
Stage 2	798	733	-	874	789	-	-	-	-	-	-	-

Approach	SE	NW	NE	SW
HCM Control Delay, s	10.9	10.9	0	0.1
HCM LOS	B	B		

Minor Lane/Major Mvmt	NEL	NET	NER	NWLn1	SELn1	SWL	SWT	SWR
Capacity (veh/h)	1467	-	-	615	615	1374	-	-
HCM Lane V/C Ratio	-	-	-	0.002	0.002	0.001	-	-
HCM Control Delay (s)	0	-	-	10.9	10.9	7.6	0	-
HCM Lane LOS	A	-	-	B	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0	0	-	-

Intersection	
Int Delay, s/veh	1

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Vol, veh/h	25	0	2	1	0	0	4	183	0	1	112	24
Future Vol, veh/h	25	0	2	1	0	0	4	183	0	1	112	24
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	88	88	88	88	88	88	88	88	88
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	28	0	2	1	0	0	5	208	0	1	127	27

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	361	361	141	362	374	208	154	0	0	208	0	0
Stage 1	143	143	-	218	218	-	-	-	-	-	-	-
Stage 2	218	218	-	144	156	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	598	569	912	598	560	837	1439	-	-	1375	-	-
Stage 1	865	782	-	789	726	-	-	-	-	-	-	-
Stage 2	789	726	-	864	772	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	596	566	912	594	557	837	1439	-	-	1375	-	-
Mov Cap-2 Maneuver	596	566	-	594	557	-	-	-	-	-	-	-
Stage 1	862	781	-	786	723	-	-	-	-	-	-	-
Stage 2	786	723	-	861	771	-	-	-	-	-	-	-

Approach	SE	NW	NE	SW
HCM Control Delay, s	11.2	11.1	0.2	0.1
HCM LOS	B	B		

Minor Lane/Major Mvmt	NEL	NET	NER	NWLn1	SELn1	SWL	SWT	SWR
Capacity (veh/h)	1439	-	-	594	612	1375	-	-
HCM Lane V/C Ratio	0.003	-	-	0.002	0.05	0.001	-	-
HCM Control Delay (s)	7.5	0	-	11.1	11.2	7.6	0	-
HCM Lane LOS	A	A	-	B	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0.2	0	-	-

Intersection	
Int Delay, s/veh	0.1

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Vol, veh/h	1	0	0	1	0	0	0	231	0	1	142	1
Future Vol, veh/h	1	0	0	1	0	0	0	231	0	1	142	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	88	88	88	88	88	88	88	88	88
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	1	0	0	1	0	0	0	263	0	1	161	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	427	427	162	427	427	263	162	0	0	263	0	0
Stage 1	164	164	-	263	263	-	-	-	-	-	-	-
Stage 2	263	263	-	164	164	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	541	523	888	541	523	781	1429	-	-	1313	-	-
Stage 1	843	766	-	747	694	-	-	-	-	-	-	-
Stage 2	747	694	-	843	766	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	540	522	888	540	522	781	1429	-	-	1313	-	-
Mov Cap-2 Maneuver	540	522	-	540	522	-	-	-	-	-	-	-
Stage 1	843	765	-	747	694	-	-	-	-	-	-	-
Stage 2	747	694	-	842	765	-	-	-	-	-	-	-

Approach	SE	NW	NE	SW
HCM Control Delay, s	11.7	11.7	0	0.1
HCM LOS	B	B		

Minor Lane/Major Mvmt	NEL	NET	NER	NWLn1	SELn1	SWL	SWT	SWR
Capacity (veh/h)	1429	-	-	540	540	1313	-	-
HCM Lane V/C Ratio	-	-	-	0.002	0.002	0.001	-	-
HCM Control Delay (s)	0	-	-	11.7	11.7	7.7	0	-
HCM Lane LOS	A	-	-	B	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0	0	-	-

Intersection	
Int Delay, s/veh	0.8

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Vol, veh/h	25	0	2	1	0	0	4	230	0	1	142	24
Future Vol, veh/h	25	0	2	1	0	0	4	230	0	1	142	24
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	6	6	6	6	6	6	6	6	6	6	6	6
Mvmt Flow	28	0	2	1	0	0	4	256	0	1	158	27

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	438	438	172	439	451	256	185	0	0	256	0	0
Stage 1	174	174	-	264	264	-	-	-	-	-	-	-
Stage 2	264	264	-	175	187	-	-	-	-	-	-	-
Critical Hdwy	7.16	6.56	6.26	7.16	6.56	6.26	4.16	-	-	4.16	-	-
Critical Hdwy Stg 1	6.16	5.56	-	6.16	5.56	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.16	5.56	-	6.16	5.56	-	-	-	-	-	-	-
Follow-up Hdwy	3.554	4.054	3.354	3.554	4.054	3.354	2.254	-	-	2.254	-	-
Pot Cap-1 Maneuver	522	506	861	521	498	773	1366	-	-	1286	-	-
Stage 1	819	747	-	732	683	-	-	-	-	-	-	-
Stage 2	732	683	-	818	738	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	520	504	861	518	496	773	1366	-	-	1286	-	-
Mov Cap-2 Maneuver	520	504	-	518	496	-	-	-	-	-	-	-
Stage 1	817	746	-	730	681	-	-	-	-	-	-	-
Stage 2	730	681	-	815	737	-	-	-	-	-	-	-

Approach	SE	NW	NE	SW
HCM Control Delay, s	12.1	12	0.1	0
HCM LOS	B	B		

Minor Lane/Major Mvmt	NEL	NET	NER	NWLn1	SELn1	SWL	SWT	SWR
Capacity (veh/h)	1366	-	-	518	536	1286	-	-
HCM Lane V/C Ratio	0.003	-	-	0.002	0.056	0.001	-	-
HCM Control Delay (s)	7.6	0	-	12	12.1	7.8	0	-
HCM Lane LOS	A	A	-	B	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0.2	0	-	-

APPENDIX

D

MINISTRY OF HIGHWAYS WARRANT ANALYSIS

Intersection Area Lighting Warrant (DM 2621-2)					
Grid Road 684-Access West Leg			Input		Warranted
1. Traffic Volume Warrant (2023)	1.1 Through Highway	Leg 1 AADT	2305		
		Leg 2 AADT	1447	1876	TRUE
	1.2 Intersecting Roadway	Leg 1 AADT	13		
		Leg 2 AADT	13	26	FALSE
	Warrant				NOT WARRANTED
1. Traffic Volume Warrant (2023 w/ Dev)	1.1 Through Highway	Leg 1 AADT	2320		
		Leg 2 AADT	1736	2028	TRUE
	1.2 Intersecting Roadway	Leg 1 AADT	347		
		Leg 2 AADT	13	360	FALSE
	Warrant				NOT WARRANTED
1. Traffic Volume Warrant (2033)	1.1 Through Highway	Leg 1 AADT	2888		
		Leg 2 AADT	1814	2351	TRUE
	1.2 Intersecting Roadway	Leg 1 AADT	13		
		Leg 2 AADT	13	26	FALSE
	Warrant				NOT WARRANTED
1. Traffic Volume Warrant (2033 w/ Dev)	1.1 Through Highway	Leg 1 AADT	2909		
		Leg 2 AADT	2106	2507.5	TRUE
	1.2 Intersecting Roadway	Leg 1 AADT	347		
		Leg 2 AADT	13	360	FALSE
	Warrant				NOT WARRANTED
2. Raised Channelization/Median Curbing Warrant	2.1 Traffic Speed	Posted Limit	80		
		Actual 85th percentile speed			TRUE
	2.2 Traffic Engineering Assessment				
	Traffic engineering assessment supports retention of the raised islands/median and the provision of area lighting				FALSE
	Warrant				NOT WARRANTED
3. Traffic Accident Rate Warrant	3.1 Traffic Volume	Through Highway Traffic Volume (AADT)	3752		TRUE
	3.2 Accident Rate				
	The intersection accident rate is >= 1.5 accidents/MEV/yr. The ratio of the last three year average night to day accident rate is > 1.5. A Traffic engineering study supports area lighting is an acceptable expenditure			0	FALSE
	Warrant				NOT WARRANTED

Intersection Delineation Lighting Warrant (DM 2621-1)						
Grid Road 684-Access West Leg			Input	Points	Max Points	Points Carried
1. Highway Classification Arterial = 5 Collector = 3 Local = 1				3		3
2. AADT on Through Highway Points = 0.01*AADT		Commencement	3752	37.52	25	25
		Commencement with Development	4056	40.56	25	25
		Horizon	4702	47.02	25	25
		Horizon with Development	4960	49.6	25	25
3. AADT on Intersecting Roadway Points = 0.05*AADT		Commencement	13	0.65		1
		Commencement with Development	347	17.35		17
		Horizon	13	0.65		1
		Horizon with Development	347	17.35		17
4. Average Annual Number of Accidents Average annual number of night accidents last 3 years * 10			0	0	30	0
5. Geometric Features	5.1 Through Highway	5.1.1 Channelized intersection treatment			5	0
		5.1.2 Divided Highway			5	0
		5.1.3 Intersection on horizontal curve			2	0
		5.1.4 Intersection off curve but within 100 m of curve (ST or TS)		1	1	1
		5.1.5 Intersection road surface visible: i) less than 180 m=2 ii) less than 370 m=1			2	0
		5.1.6 Obstructed Sight Triangle in advance of intersection: i) one sight triangle obstructed=2 ii) both sight triangles obstructed=3			3	0
		5.1.7 Intersection angle less than 70 or more than 110 degrees			2	0
	5.2 Intersecting Roadway	5.2.1 Intersection road surface visible from less than 180 m			2	0
		5.2.2 Horizontal curve ending less than 60m from the intersection			1	0
		5.2.3 Channelized intersection or divided roadway			5	0
		5.2.4 Signed Hospital access route			5	0
6. Environmental Factors	6.1 Rural development with lighting (within 150 m of intersecting leg)	i) in four quadrants			8	0
		ii) in three quadrants			6	0
		iii) in two quadrants			4	0
		iv) in one quadrant			1	0
	OR					
	6.2 Urban Built up area	i) highway commerical			8	0
		ii) residential			4	0
		iii) industrial with lighting			3	0
Total Priority Ranking Points		Commencement				30
		Commencement with Development				46
		Horizon				30
		Horizon with Development				46
Intersecting Roadway AADT		Commencement	13		150	NOT WARRANTED
		Commencement with Development	347		150	WARRANTED
		Horizon	13		150	NOT WARRANTED
		Horizon with Development	347		150	WARRANTED

Left-turn Lane Warrants: Std plan #20610

Dalmeny Access

Grid Road 684 & Access Road - Dalmeny, SK

Project Number: 211-11128

Northbound	Existing	Forecast	Southbound	Existing	Forecast
1: Intersecting Rd - North Leg	Grid Road 684		1: Intersecting Rd - South Leg	Grid Road 684	
Provincial Highway:	n	n	Provincial Highway:	n	n
Industrial Access Road:	n	n	Industrial Access Road:	n	n
Provincial Campground / Picnic Site:	n	n	Provincial Campground / Picnic Site:	n	n
2: Peak Hour Volume			2: Peak Hour Volume		
V_A =	231	233	V_A =	145	169
Vo =	145	169	Vo =	231	233
V_L =	0	4	V_L =	1	1
3: Divided Highway:	n	n	3: Divided Highway:	n	n
4: Right of Curve:	n	n	4: Right of Curve:	n	n
Warranted :	Not Warranted	Not Warranted	Warranted :	Not Warranted	Not Warranted

Right-turn Lane Warrants: Std plan #20614

Dalmeny Access

Grid Road 684 & Access Road - Dalmeny, SK

Project Number: 211-11128

Northbound	Existing	Forecast	Southbound	Existing	Forecast
1: Intersecting Rd - South Leg	Existing		1: Intersecting Rd - North Leg	Existing	
Provincial Highway:	n	n	Provincial Highway:	n	n
Industrial Access Road:	n	n	Industrial Access Road:	n	n
Provincial Campground / Picnic Site:	n	n	Provincial Campground / Picnic Site:	n	n
2: Divided Highway:	n	n	3: Divided Highway:	n	n
3: Peak Hour Volume			2: Peak Hour Volume		
V_A =	231	233	V_A =	145	169
V_R =	0	0	V_R =	1	24
$R = V_R / V_A$	0.00	0.00	$R = V_R / V_A$	0.01	0.14
4: Right of Curve:	n	n	4: Right of Curve:	n	y
Warranted :	Not Warranted	Not Warranted	Warranted :	Not Warranted	Warranted

Bypass Lane Warrants: Std plan #20612

Dalmeny Access

Grid Road 684 & Access Road - Dalmeny, SK

Project Number: 211-11128

Northbound	Existing	Forecast	Southbound	AM	PM
Highway:	0		Highway:	0	
2: Peak Hour Volume			2: Peak Hour Volume		
V_A =	231	233	V_A =	145	169
V_O =	145	169	V_O =	231	233
V_L =	0	4	V_L =	1	1
$L = V_L / V_A$	0.00	0.02	$L = V_L / V_A$	0.01	0.01
4: Right of Curve:	n	n	4: Right of Curve:	n	n
Warranted :	Not Warranted	Not Warranted	Warranted :	Not Warranted	Not Warranted

Channelized Lane Warrants: Std plan #20611

Dalmeny Access

Grid Road 684 & Access Road - Dalmeny, SK

Project Number: 211-11128

Northbound	AM	PM	Southbound	AM	PM
Highway:	0		Highway:	0	
2: Peak Hour Volume			2: Peak Hour Volume		
V_A =	231	233	V_A =	145	169
V_O =	145	169	V_O =	231	233
V_L =	0	4	V_L =	1	1
$L = V_L / V_A$	0.00	0.02	$L = V_L / V_A$	0.01	0.01
4: Right of Curve:	n	n	4: Right of Curve:	n	n
Warranted :	Not Warranted	Not Warranted	Warranted :	Not Warranted	Not Warranted

Flared Intersection Warrants: Std plan #20613

Dalmeny Access

Grid Road 684 & Access Road - Dalmeny, SK

Project Number: 211-11128

Northbound	Existing	Forecast	Southbound	Existing	Forecast
	0			0	
1: Intersecting Rd - West Leg	0		1: Intersecting Rd - East Leg	0	
Provincial Highway:	n	n	Provincial Highway:	n	n
2: Access to Town / Village:			2: Access to Town / Village:		
Highway Classification Arterial & Population > 500:	n	n	Highway Classification Arterial & Population > 500:	n	n
Highway Classification Collector & Population >700:	n	n	Highway Classification Collector & Population >700:	n	n
2: Access to Parks, Campsites, Provincial Picnic Sites:			2: Access to Parks, Campsites, Provincial Picnic Sites:		
Highway Classification Major / Minor Arterial:	n	n	Highway Classification Major / Minor Arterial:	n	n
Highway Classification Local/Collector & AADT > 600 & Left-turn AADT > 50:	n	n	Highway Classification Local/Collector & AADT > 600 & Left-turn AADT > 50:	n	n
3: Industrial Access Roads			3: Industrial Access Roads		
Highway AADT > 500 & Left-turn AADT > 25	n	n	Highway AADT > 500 & Left-turn AADT > 25	n	n
5: All other Intersections:			5: All other Intersections:		
Highway AADT > 600 & Highway Left-turn AADT > 50	n	n	Highway AADT > 600 & Highway Left-turn AADT > 50	n	n
Warranted :	Not Warranted	Not Warranted	Warranted :	Not Warranted	Not Warranted

Left-turn Lane Warrants: Std plan #20610 Dalmeny Access TIA
Grid Road 684 & Access Road - Dalmeny, SK Project Number: 211-11128-00

	Northbound			Southbound	
Analysis Year	Existing	Forecast	Analysis Year	Existing	Forecast
1: Intersecting Rd - North Leg	0		1: Intersecting Rd - South Leg	0	
Provinicial Highway:	n	n	Provinicial Highway:	n	n
Industrial Access Road:	n	n	Industrial Access Road:	n	n
Provinicial Campground / Picnic Site:	n	n	Provinicial Campground / Picnic Site:	n	n
2: Peak Hour Volume			2: Peak Hour Volume		
V_A =	399	396	V_A =	145	169
Vo =	964	970	Vo =	231	233
V_L =	4	4	V_L =	1	1
3: Divided Highway:	n	n	3: Divided Highway:	n	n
4: Right of Curve:	n	n	4: Right of Curve:	n	n
Warranted :	Not Warranted	Not Warranted	Warranted :	Not Warranted	Not Warranted

Right-turn Lane Warrants: Std plan #20614 Dalmeny Access TIA
Grid Road 684 & Access Road - Dalmeny, SK Project Number: 211-11128-00

	Northbound			Southbound	
Analysis Year	Existing	Forecast	Analysis Year	Existing	Forecast
1: Intersecting Rd - South Leg	Northbound		1: Intersecting Rd - North Leg	Northbound	
Provinicial Highway:	n	n	Provinicial Highway:	n	n
Industrial Access Road:	n	n	Industrial Access Road:	n	n
Provinicial Campground / Picnic Site:	n	n	Provinicial Campground / Picnic Site:	n	n
2: Divided Highway:	n	n	3: Divided Highway:	n	n
3: Peak Hour Volume			2: Peak Hour Volume		
V_A =	232	256	V_A =	96	97
V_R =	31	42	V_R =	4	4
$R = V_R / V_A$	0.13	0.16	$R = V_R / V_A$	0.04	0.04
4: Right of Curve:	n	n	4: Right of Curve:	n	n
Warranted :	Not Warranted	Not Warranted	Warranted :	Not Warranted	Not Warranted

Note:
For 4-lane highways, the advancing volume should be based on 50% of the total directional volume (vph) ro 25% of the total volume (where directional split is not a factor), which no further reduction for left turn vehicles

Appendix E

SITE DRAINAGE ANALYSIS

SITE DRAINAGE ANALYSIS

Corman Park Development
Located Within NE 3-38-6-W3
North of Saskatoon, SK
Intersection of Highway 684 and Yellowhead Highway 16

HASEGAWA
CONSULTING PROFESSIONAL ENGINEERS

PREPARED FOR:
Rural Municipality of Corman Park
111 Pinehouse Drive
Saskatoon, SK S7K 5W1

PREPARED BY:
Hasegawa Engineering
1220 – 31st Street North
Lethbridge, Alberta T1H 5J8

Issue/Revision Log

Issue/Revision #	Issued By	Date	Issue / Revision Description
1	M. Hasegawa	2021-12-23	Corman Park Drainage Analysis
2	M. Hasegawa	2022-06-22	Corman Park Drainage Analysis-r2
3	M. Hasegawa	2022-07-12	Corman Park Drainage Analysis-r3

Report Authors

Report Prepared By:

Dave Chalmers, CET.
Hasegawa Engineering

PROFESSIONAL ENGINEER
SASKATCHEWAN
2022 07-12
YR. MM. DAY

Report Reviewed and Approved By:

Mark Hasegawa, P.Eng.
Hasegawa Engineering
Certificate of Authorization No. 30099

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1.0 Introduction

Hasegawa Engineering (HE) has completed a hydrological analysis of the proposed development site located within NE 3-37-6-W3 (Appendix A - Figure 1). The hydrological analysis includes the following major aspects:

1. Existing topography and conditions
2. Runoff analysis based on a 100yr/24-hour design storm
3. Retention storage size calculations

The analysis is detailed below and is based on a proposed development of the 77-acre (31 ha) site into 13 commercial lots. The purpose of the study was to model existing pre-development runoff from the site during a design storm event, and then model the site as developed property during the same storm event. The post development model is used to size storm water retention facilities so that post-development runoff rates at downstream infrastructure are kept to pre-development levels. At this time, 13 lots are proposed along with a service road. At this stage, the modeling is not meant to provide design detail, but to provide guidelines for overall development.

2.0 Site Conditions

Figure 1 shows the existing surface which varies about 1.5 meters in elevation with several low spots scattered throughout the site. Pronounced low spots, such as the seven areas indicated in Figure 1, act as natural retention areas and trap significant volumes of runoff. Existing contours suggest several established runoff flow paths, most of which pass through at least one of these low spots. These runoff paths lead to five possible outflow locations which are shown as outfalls in the pre-development model. Outfalls 1 and 2 at the south side of the development lead to existing culverts, but Outfalls 3 to 5 on the west and north sides are low spots where it is assumed runoff will flow out onto neighboring property. However, the surrounding topography is not mapped and so this is only an assumption – runoff from adjacent property may actually flow onto the site at these three locations. Likewise, the assumption was that these are all discrete outflow locations when they may actually flow around and join Outfalls 1 and 2. Flow at outfalls is discussed further in the section on surface runoff results.

The south edge of the property is generally fairly low and the existing private road there is built up about 1 meter above – i.e., there is no true ditch to contain any significant storm flows to this area and the area would likely be prone to flooding as the storm water flowing south backs up against the elevated road.

The topo map identifies several culverts along or near the south end of the property. As mentioned, two of these form the outfalls at the south side of the property for storm water flowing away from the property. As the total offsite area contributing additional runoff to these same outfall culverts is unknown, the model cannot account for all flow into these culverts. The goal is to model pre-development runoff from the property into these culverts and then limit post-development peak runoff flow leaving the property to this estimated pre-development level. The attenuated flows as property is developed will be achieved by creating runoff storage on Lots 3 and 13 and restricting release from these areas to estimated pre-development levels. This will help keep flood risk at the culverts to pre-development conditions

3.0 Runoff Design Criteria

3.1 Pre-Development

The pre-development model divided the existing site into catchments based on the flow paths mentioned above but also incorporated the initial proposed lot boundaries as catchments to allow for flexibility in designing lot-level retention if required. Figure 2 (Appendix A) shows the pre-development model with catchments and with outflow locations as determined from existing site topography. The larger natural low spots were modeled as storage areas with storage volumes obtained from the contours. Slopes and catchment areas were also obtained from the contours with existing cultivated farmland modeled as 100% pervious surface. The blue conduits shown in Figure 2 are modeled as wide overland flow channels except for the conduits which are modeled using culvert information obtained from the topo map. It was assumed that only the south outflows flow to these culverts while the remaining outflows flow onto the adjacent property and then into different drainage paths.

Modeling used SWMM, a storm runoff software program developed by the United States Environmental Protection Agency and widely accepted for runoff analysis. The storm event used in the model is a 100-year/24-hour Modified Chicago method synthetic storm using rainfall for Diefenbaker International Airport in the City of Saskatoon obtained from the Meteorological Service of Canada on the Environment Canada website. The 24-hour rainfall for a 100-year return period storm at this location is 96.5mm which was used to develop a synthetic Modified Chicago storm producing a peak intensity of 41mm/hour and 96mm of total rainfall (see Figure 4). The cultivated farmland was modeled with 2.5mm depression storage assumed for pervious surfaces, and infiltration was modeled using Green-Ampt methodology using a suction head of 253 mm, conductivity of 3.5 mm/hour and an initial deficit of 0.15 for soil moisture.

3.2 Post-Development

Post-development modeling assumes that all site drainage will need to flow to the existing culverts on the south side of the property. Therefore, the site will need to be graded, thus filling in natural low spots and eliminating natural storm water retention areas. The post-development model therefore has a continuous swale along the back of the perimeter lots draining from a high point at the rear of Lot 10 and flowing in both directions to retention areas near the south outfalls. This swale is 7m wide at the top with sides sloping at 5:1 to a depth of 0.5m (2m across at the bottom). The road right-of-way throughout the development is modeled with a 15m wide ditch 0.5m deep on either side of the road graded at 0.5 percent. With the generally flat ground, the 0.5 percent slope is achieved through a series of local high and low spots – the low spots on the outer road ditches drain either to the perimeter swale or through 4m wide by 05m deep v-swales leading directly to the retention areas. The interior road ditches drain to the outer road ditches through 0.3m culverts.

It is necessary to build up the south portion of the development adjacent to Highway 684 to an elevation of about 512.5m as there is no defined ditch. Building up the lot elevations here would allow for a 0.5m deep ditch alongside the south property line adjoining the main roads. Without the ditch, storm water would back up into the lots as it backs up at the culverts along Highway 684. The low-lying areas of Lots 3 and 13 can be designated for storm storage and left 0.5m lower but with a 0.5m berm along the south defining the retention area separate from the existing culverts under Highway 684. Each retention area has an outlet through this berm releasing to the nearby culvert. As modeled, these outlets are 300mm culverts that restrict peak outflows to pre development rates. All ditches are modeled with 4h:1v to 5h:1v side slopes.

A plan view of the post-development model is included as Figure 3 in Appendix A. Model inputs are updated to reflect commercial development. Each catchment was estimated to average 70% impervious surface using an assumed building size (at 100% impervious surface) and also assuming areas of asphalt and graveled surface (at 70-100% impervious surface). Post-development modelling used the same design storm as in pre-development modelling; depression storage for pervious surface remained at 5mm; and depression storage for impervious surfaces was set at 2.5mm in anticipation of both smooth and graveled surfaces.

4.0 Surface Runoff Results

The pre-development model using the synthetic100-year design storm calculates peak flows of 0.097 and 0.117 m^3/sec at the Outfall 1 and 2 culverts respectively, and a system-wide peak outflow of 0.260 m^3/sec – this has been used as an allowable release for post-development modeling. Although much of the offsite topography is unknown, we do know that grade from the west property line to outlet 1 and 2 is less than 0.1% grade with several high points in between. There is also a low spot on the south side of the property to the west that gathers most of the drainage. Finally, the distribution of the offsite drainage (grade break on the west and north side follows the current grade break to Outfall 1 and 2. As such, the distribution of flow to each outfall will be unchanged. As a safety precaution, Lot 13 has been over-designed to accommodate an additional 1200 m^3 of runoff. It was found in pre-development and post-development modeling that this is a non-issue since the two low spots at Outfalls 4 and 5 on the west side do not fill enough for storm water to flow off of the property at those locations. At the same time, Outfall 3 on the north side of the property has a peak outflow rate of 0.052 m^3/sec, but the volume of runoff is relatively minor at 264 m^3. The retention area in Lot 13 has been designed to retain this flow. As such, the post-development flow at Outfall 2 remains below the predevelopment runoff value.

Post-development modeling indicates that the system of swales and ditches routes the storm water as intended as shown in Table 1 below. Post development peak flows at outfall culverts 1 and 2 are 0.099 and 0.117 m^3/sec respectively, with a system-wide peak flow of 0.181 m^3/sec. There is minor flooding at four nodes in the model, most of which occurs at the Lot 3 retention pond – this may change as the retention area and flow path to it are finalized when soil cuts and fills are balanced. Balancing soil cuts and fills may also change the shape of the retention area and affect flow paths. Drain-down times of the retention areas are shown in Figure 4.

Table 1: Outfall and Retention Summary

Node	Pre-development Peak Outflow m^3/sec	Post-Development Peak Outflow m^3/sec	Retention Area Active Depth/Peak Volume/% Full
Outfall 1	0.097	0.099	N/A
Outfall 2	0.117	0.083	N/A
Lot 3 Retention	N/A	0.99	0.52m / 6550 m^3 / 100% - 88 m^3 flooding
Lot 13 Retention	N/A	0.82	0.42m / 5580 m^3 / 82%
System	0.260	0.181	N/A

The runoff status details for pre- and post-development models are included in Appendix B and give a summary of modelling results. Appendix B also contains detail reports showing the inputs used in each storm model.

5.0 Conclusion

Site topography was used to establish existing drainage paths on the proposed development. From this, catchment areas, average flow lengths and drainage slopes were determined in order to model pre-development runoff from the site using a 100-year/24-hour synthetic design storm event. Results indicate that there are two main outflows with existing culverts located at the south boundary and peak runoff rates flowing at these outflows under pre-development conditions were estimated. The proposed development was then modeled, and a system of drainage ditches, swales and retention areas included so that combined runoff rates at the outfalls remain at or below estimated pre-development levels. Site topography may dictate that the lots and perimeter ditches be graded with shallow slopes; interior ditches along road right of ways are graded at 0.5% slope. The system may need minor adjustments when final soil volumes are established.

APPENDICES

APPENDIX A-FIGURES

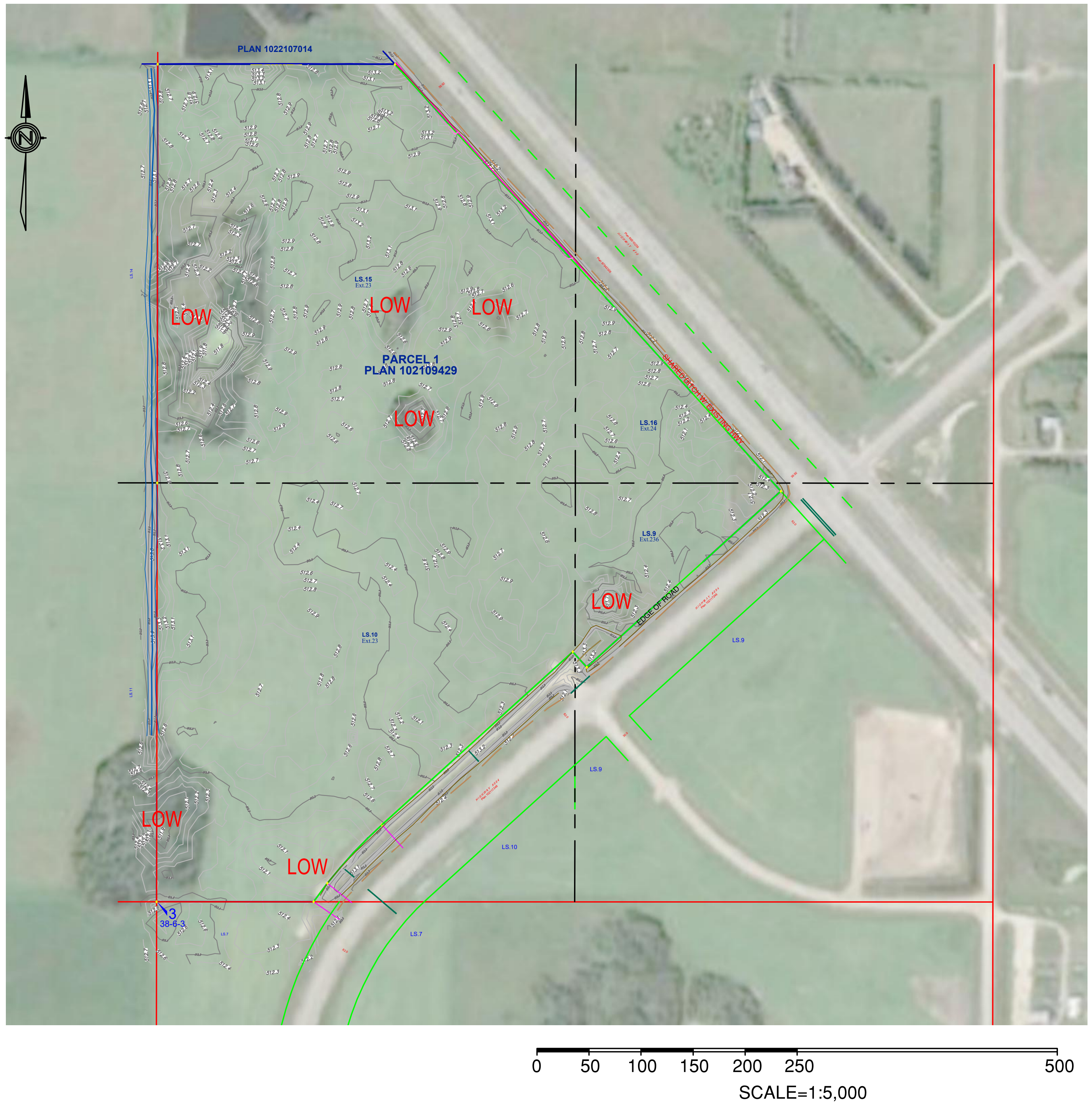


FIGURE 1 -
DEVELOPMENT SITE
AND
EXISTING TOPOGRAPHY

Figure 2 Predevelopment Runoff Model

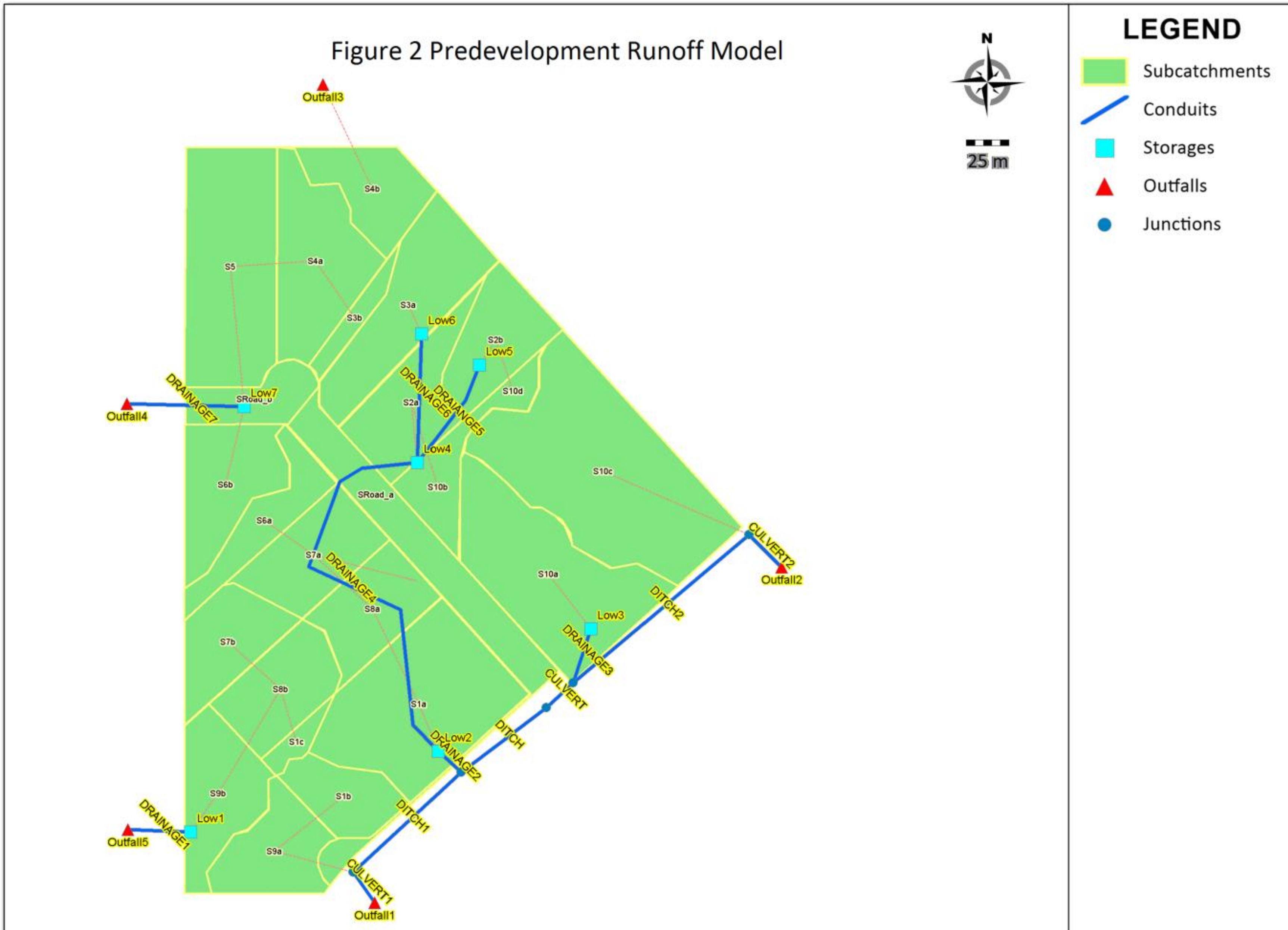
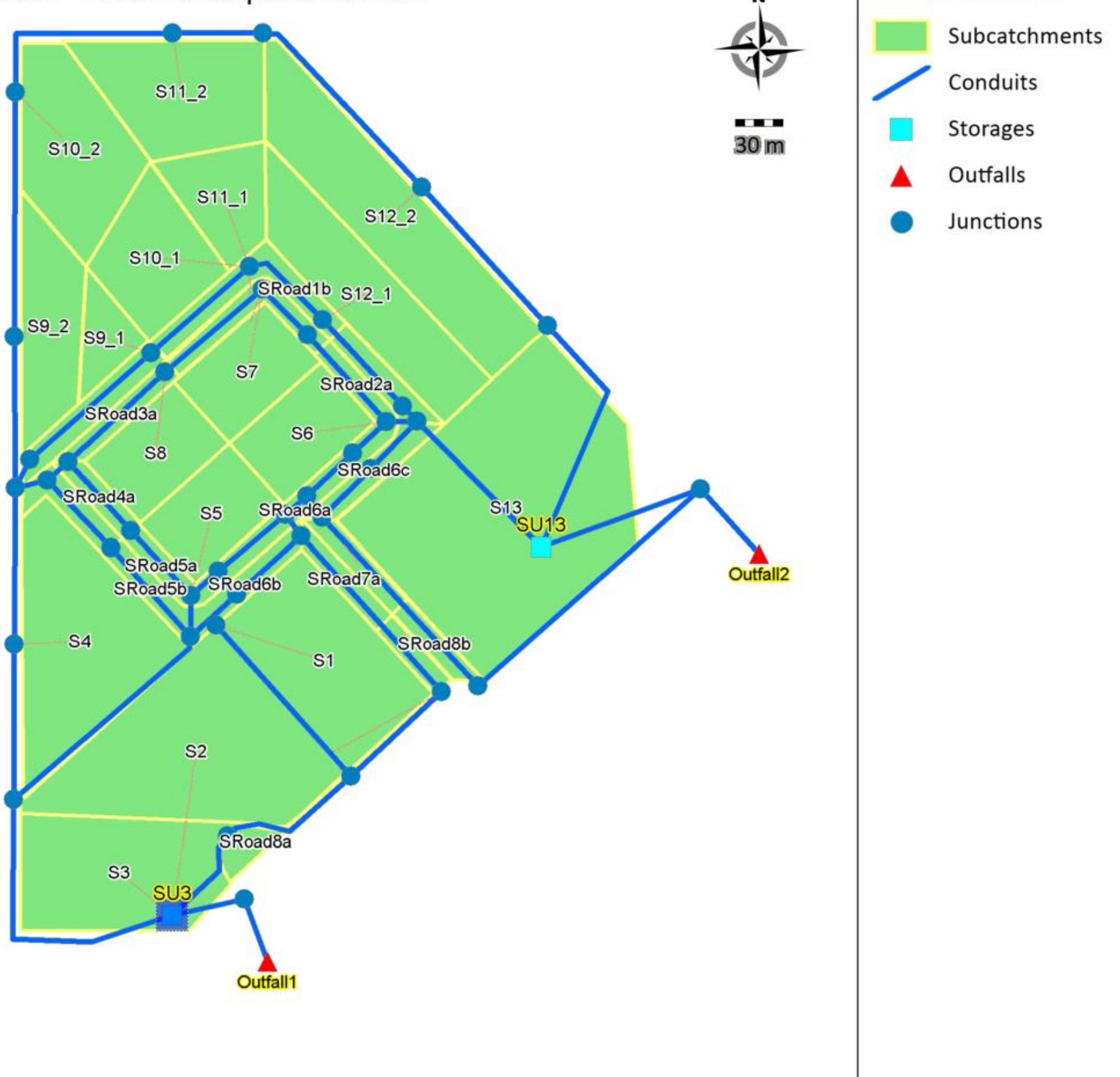


Figure 3 - Post Development Model



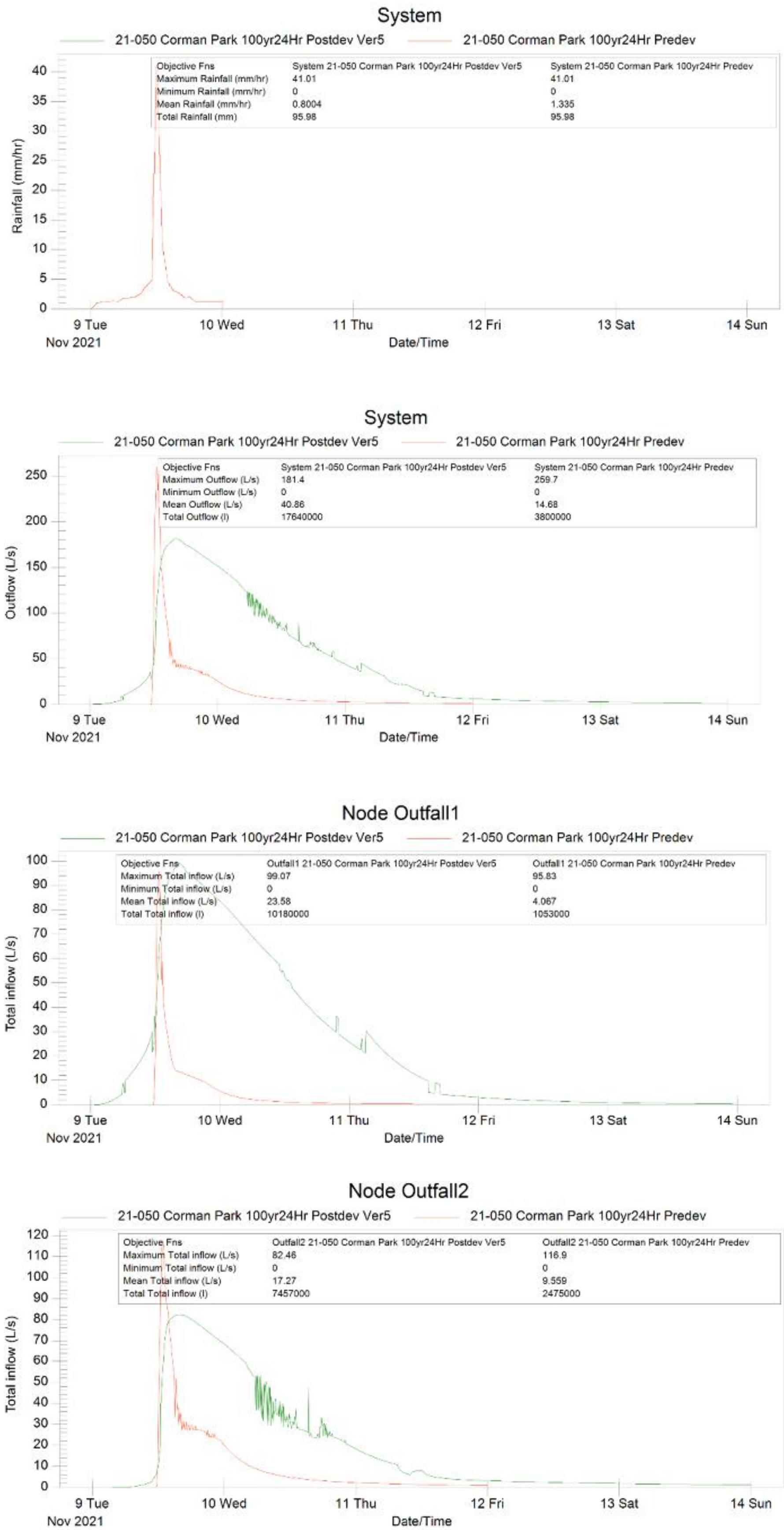


Figure 4 Design Storm Rainfall & Comparison of Runoff Rates

APPENDIX B-SWMM SUMMARIES

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.0 (Build 5.0.021)
--------------------------------------------------------------

21-050 Corman Park Post Dev Status Report

*********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*********************************************************

****************
Analysis Options
****************
Flow Units ............... LPS
Process Models:
  Rainfall/Runoff ........ YES
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ YES
  Water Quality .......... NO
Infiltration Method ...... GREEN_AMPT
Flow Routing Method ...... DYNWAVE
Starting Date ............ NOV-09-2021 00:00:00
Ending Date .............. NOV-14-2021 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:05:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 1.00 sec

WARNING 02: maximum depth increased for Node J14

**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         2.827        95.935
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         1.006        34.143
Surface Runoff ...........         1.816        61.621
Final Surface Storage ....         0.006         0.192
Continuity Error (%) .....        -0.022
```

```
*************************        Volume       Volume
Flow Routing Continuity       hectare-m      10^6 ltr
*************************     ---------     ---------
Dry Weather Inflow .......        0.000         0.000
Wet Weather Inflow .......        1.816        18.165
Groundwater Inflow .......        0.000         0.000
RDII Inflow ..............        0.000         0.000
External Inflow ..........        0.000         0.000
External Outflow .........        1.765        17.655
Internal Outflow .........        0.004         0.042
Storage Losses ...........        0.000         0.000
Initial Stored Volume ....        0.000         0.000
Final Stored Volume ......        0.046         0.464
Continuity Error (%) .....        0.021


*************************
Highest Continuity Errors
*************************
Node J33 (7.80%)
Node J25 (-3.67%)
Node J27 (-2.06%)
Node J28 (1.75%)
Node J30 (1.61%)


***************************
Time-Step Critical Elements
***************************
None


********************************
Highest Flow Instability Indexes
********************************
Link C12 (4)
Link C53 (3)
Link C52 (3)
Link C26 (1)


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :     0.53 sec
Average Time Step           :     1.00 sec
```

```
Maximum Time Step           :     1.00 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     2.00
```

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff LPS	Runoff Coeff
S12_1	95.94	0.00	0.00	19.63	76.06	0.49	66.19	0.793
S11_1	95.94	0.00	0.00	19.77	75.92	0.11	13.75	0.791
S9_1	95.94	0.00	0.00	19.58	76.12	0.18	24.00	0.793
S10_1	95.94	0.00	0.00	19.77	75.92	0.22	29.40	0.791
S7	95.94	0.00	0.00	19.61	76.09	0.62	83.71	0.793
S8	95.94	0.00	0.00	19.59	76.11	0.62	84.15	0.793
S5	95.94	0.00	0.00	19.64	76.05	0.62	83.02	0.793
SRoad1b	95.94	0.00	0.00	52.98	42.90	0.20	37.01	0.447
SRoad8a	95.94	0.00	0.00	46.24	49.61	0.10	16.85	0.517
S13	95.94	0.00	0.00	75.30	20.65	0.71	93.67	0.215
S12_2	95.94	0.00	0.00	19.56	76.14	2.79	382.99	0.794
S11_2	95.94	0.00	0.00	19.69	76.00	1.47	196.54	0.792
S10_2	95.94	0.00	0.00	19.88	75.81	1.57	199.93	0.790
S9_2	95.94	0.00	0.00	19.55	76.15	0.75	103.41	0.794
S1	95.94	0.00	0.00	17.75	77.93	1.42	184.86	0.812
S6	95.94	0.00	0.00	19.61	76.09	0.62	83.71	0.793
S4	95.94	0.00	0.00	19.67	76.03	1.70	228.24	0.792
SRoad6a	95.94	0.00	0.00	50.28	45.59	0.22	38.04	0.475
S2	95.94	0.00	0.00	21.43	74.26	2.04	264.74	0.774
S3	95.94	0.00	0.00	71.02	24.93	0.41	91.04	0.260
SRoad8b	95.94	0.00	0.00	56.05	39.83	0.07	13.38	0.415
SRoad7b	95.94	0.00	0.00	53.85	42.02	0.08	14.31	0.438
SRoad5a	95.94	0.00	0.00	54.58	41.29	0.07	11.98	0.430
SRoad3a	95.94	0.00	0.00	54.58	41.29	0.11	18.78	0.430
SRoad3b	95.94	0.00	0.00	55.32	40.56	0.13	23.93	0.423
SRoad4a	95.94	0.00	0.00	53.85	42.02	0.07	12.26	0.438
SRoad4b	95.94	0.00	0.00	53.85	42.02	0.10	17.80	0.438
SRosd1a	95.94	0.00	0.00	54.58	41.29	0.16	27.62	0.430
SRoad6b	95.94	0.00	0.00	56.05	39.83	0.11	19.15	0.415
SRoad7a	95.94	0.00	0.00	53.85	42.02	0.08	14.29	0.438
SRoad6c	95.94	0.00	0.00	56.05	39.83	0.10	18.21	0.415
SRoad5b	95.94	0.00	0.00	57.52	38.36	0.08	14.73	0.400

SRoad2a	95.94	0.00	0.00	54.58	41.29	0.07	12.17	0.430
SRoad2b	95.94	0.00	0.00	56.78	39.11	0.08	17.10	0.408

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days	hr:min
J1	JUNCTION	0.02	0.21	513.72	0	12:20
J3	JUNCTION	0.02	0.20	513.91	0	12:26
J4	JUNCTION	0.00	0.14	512.85	0	12:45
J6	JUNCTION	0.02	0.40	513.20	0	12:59
J9	JUNCTION	0.02	0.45	513.33	0	12:57
J11	JUNCTION	0.13	0.50	512.57	0	16:22
J12	JUNCTION	0.07	0.16	512.16	0	15:50
J13	JUNCTION	0.02	0.28	512.68	0	12:27
J7	JUNCTION	0.02	0.44	513.04	0	12:20
J15	JUNCTION	0.02	0.41	513.33	0	12:26
J16	JUNCTION	0.01	0.27	513.38	0	12:24
J17	JUNCTION	0.02	0.36	513.23	0	12:48
J18	JUNCTION	0.04	0.50	513.08	0	12:50
J14	JUNCTION	0.05	0.12	512.12	0	16:21
J21	JUNCTION	0.01	0.15	514.15	0	12:17
J8	JUNCTION	0.03	0.50	512.95	0	12:10
J25	JUNCTION	0.01	0.10	513.70	0	12:17
J27	JUNCTION	0.01	0.17	513.57	0	12:28
J28	JUNCTION	0.02	0.40	513.20	0	12:59
J29	JUNCTION	0.01	0.13	513.75	0	12:28
J31	JUNCTION	0.01	0.17	513.03	0	12:30
J23	JUNCTION	0.03	0.50	513.20	0	12:59
J5	JUNCTION	0.00	0.08	513.76	0	12:03
J24	JUNCTION	0.01	0.16	514.32	0	12:06
J35	JUNCTION	0.02	0.23	513.61	0	12:18
J36	JUNCTION	0.01	0.16	514.14	0	12:10
J37	JUNCTION	0.01	0.17	513.70	0	12:23
J38	JUNCTION	0.02	0.48	513.44	0	12:52
J22	JUNCTION	0.02	0.39	513.24	0	12:37
J10	JUNCTION	0.03	0.40	512.83	0	12:40
J41	JUNCTION	0.01	0.13	513.93	0	12:16
J43	JUNCTION	0.02	0.34	514.05	0	12:30
J45	JUNCTION	0.00	0.06	514.09	0	12:28

J47	JUNCTION	0.01	0.08	514.11	0	12:24
J19	JUNCTION	0.02	0.24	513.22	0	12:24
J20	JUNCTION	0.00	0.00	514.05	0	12:29
J26	JUNCTION	0.00	0.00	513.95	0	00:00
J30	JUNCTION	0.01	0.19	513.44	0	12:52
J32	JUNCTION	0.01	0.12	513.32	0	12:28
J33	JUNCTION	0.06	0.15	512.16	0	15:52
Outfall1	OUTFALL	0.05	0.13	511.98	0	16:21
Outfall2	OUTFALL	0.05	0.14	512.04	0	15:50
SU3	STORAGE	0.15	0.52	512.57	0	16:21
SU13	STORAGE	0.12	0.42	512.57	0	15:30

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days	hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr
J1	JUNCTION	66.18	101.15	0	12:12	0.490	0.757
J3	JUNCTION	33.42	53.91	0	12:17	0.188	0.318
J4	JUNCTION	16.84	66.33	0	12:31	0.100	0.421
J6	JUNCTION	0.00	107.18	0	12:19	0.000	1.245
J9	JUNCTION	31.04	157.27	0	12:18	0.177	1.196
J11	JUNCTION	0.00	199.45	0	12:27	0.000	1.848
J12	JUNCTION	0.00	82.49	0	15:39	0.000	7.499
J13	JUNCTION	0.00	211.25	0	12:12	0.000	1.840
J7	JUNCTION	382.97	514.45	0	12:12	2.792	4.956
J15	JUNCTION	196.53	257.12	0	12:12	1.475	2.174
J16	JUNCTION	199.93	199.93	0	12:06	1.571	1.571
J17	JUNCTION	103.41	192.15	0	12:13	0.752	1.630
J18	JUNCTION	228.23	379.23	0	12:36	1.703	5.141
J14	JUNCTION	0.00	99.07	0	16:21	0.000	10.181
J21	JUNCTION	79.42	79.42	0	12:12	0.532	0.532
J8	JUNCTION	0.00	509.84	0	12:20	0.000	4.965
J25	JUNCTION	32.51	40.22	0	12:10	0.183	0.218
J27	JUNCTION	24.00	60.39	0	12:12	0.176	0.442
J28	JUNCTION	23.93	76.03	0	12:24	0.134	0.586
J29	JUNCTION	14.73	86.38	0	12:24	0.080	0.763
J31	JUNCTION	0.00	213.60	0	12:29	0.000	2.129
J23	JUNCTION	0.00	277.28	0	12:42	0.000	3.447
J5	JUNCTION	0.00	16.87	0	12:16	0.000	0.086

J24	JUNCTION	184.85	184.85	0	12:06	1.421	1.421
J35	JUNCTION	84.15	130.31	0	12:06	0.616	0.965
J36	JUNCTION	109.69	109.69	0	12:06	0.773	0.773
J37	JUNCTION	0.00	60.07	0	12:10	0.000	0.426
J38	JUNCTION	95.16	144.71	0	12:09	0.685	1.171
J22	JUNCTION	0.00	232.10	0	12:20	0.000	2.176
J10	JUNCTION	0.00	449.10	0	12:45	0.000	5.911
J41	JUNCTION	38.04	38.04	0	12:12	0.215	0.215
J43	JUNCTION	83.01	85.70	0	12:06	0.616	0.643
J45	JUNCTION	11.97	11.97	0	12:12	0.068	0.068
J47	JUNCTION	17.80	17.80	0	12:12	0.102	0.102
J19	JUNCTION	17.09	111.51	0	12:18	0.084	0.841
J20	JUNCTION	0.00	1.80	0	12:24	0.000	0.000
J26	JUNCTION	0.00	0.00	0	00:00	0.000	0.000
J30	JUNCTION	0.00	18.23	0	12:11	0.000	0.055
J32	JUNCTION	0.00	21.38	0	12:17	0.000	0.128
J33	JUNCTION	13.38	31.29	0	12:19	0.074	0.183
Outfall1	OUTFALL	0.00	99.07	0	16:21	0.000	10.180
Outfall2	OUTFALL	0.00	82.46	0	15:50	0.000	7.474
SU3	STORAGE	337.91	894.78	0	12:31	2.449	10.205
SU13	STORAGE	93.67	797.59	0	12:34	0.709	7.772

****
Node Surcharge Summary
****

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters
J11	JUNCTION	0.01	0.002	0.000
J18	JUNCTION	0.01	0.000	0.000
J8	JUNCTION	0.33	0.000	0.000
SU3	STORAGE	0.01	0.022	0.000

****
Node Flooding Summary
****

Flooding refers to all water that overflows a node, whether it ponds or not.

Total Maximum

Node	Hours Flooded	Maximum Rate LPS	Time of Max Occurrence days hr:min	Flood Volume 10^6 ltr	Ponded Depth Meters
J11	0.84	3.70	0 15:58	0.002	0.50
J18	0.14	4.90	0 12:46	0.001	0.50
J8	0.33	51.85	0 12:15	0.042	0.50
SU3	2.55	62.80	0 15:17	0.088	0.52

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	E&I Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow LPS
SU3	1.365	21	0	6.552	100	0 15:17	102.46
SU13	1.441	21	0	5.579	82	0 15:30	81.74

****
Outfall Loading Summary
****

Outfall Node	Flow Freq. Pcnt.	Avg. Flow LPS	Max. Flow LPS	Total Volume 10^6 ltr
Outfall1	99.01	23.80	99.07	10.180
Outfall2	95.12	18.19	82.46	7.474
System	97.06	41.99	181.40	17.655

****
Link Flow Summary
****

Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth

C7	CHANNEL	184.08	0	12:06	1.35	0.05	0.43
C45	CHANNEL	95.58	0	12:20	0.14	0.10	0.45
C1	CHANNEL	10.42	0	12:24	0.03	0.01	0.47
C19	CHANNEL	102.31	0	13:12	0.08	0.10	0.90
C4	CHANNEL	460.52	0	12:51	0.34	0.55	0.76
C2	CHANNEL	47.74	0	12:10	0.09	0.05	0.39
C8	CHANNEL	60.00	0	12:45	0.08	0.09	0.41
C11	CONDUIT	99.07	0	16:21	2.05	0.06	0.17
C12	CONDUIT	82.46	0	15:50	0.89	0.24	0.33
C13	CHANNEL	266.03	0	13:02	0.12	1.00	1.00
C14	CHANNEL	369.10	0	12:46	0.20	1.03	0.89
C15	CONDUIT	99.07	0	16:21	1.85	0.93	0.71
C17	CHANNEL	70.90	0	12:23	0.06	0.22	0.68
C18	CHANNEL	211.82	0	12:37	0.13	0.60	0.82
C20	CHANNEL	498.88	0	12:33	0.31	0.73	0.73
C21	CONDUIT	81.74	0	15:30	1.40	0.38	0.77
C25	CHANNEL	109.82	0	12:25	0.19	0.11	0.40
C42	CHANNEL	52.90	0	12:34	0.14	0.05	0.33
C28	CHANNEL	85.89	0	12:28	0.77	0.03	0.53
C44	CHANNEL	38.36	0	12:17	0.11	0.04	0.32
C41	CHANNEL	0.00	0	00:00	0.00	0.00	0.20
C5	CHANNEL	103.79	0	12:24	0.10	0.28	0.62
C6	CHANNEL	53.75	0	12:28	0.08	0.06	0.56
C29	CHANNEL	120.30	0	12:18	0.13	0.13	0.66
C32	CHANNEL	6.56	0	12:28	0.01	0.00	0.51
C33	CHANNEL	4.19	0	12:28	0.01	0.00	0.41
C34	CHANNEL	6.36	0	12:24	0.04	0.01	0.21
C35	CHANNEL	0.00	0	12:29	0.00	0.00	0.13
C36	CONDUIT	20.57	0	12:16	0.54	0.27	0.54
C37	CHANNEL	55.06	0	12:23	0.05	0.06	0.63
C38	CHANNEL	10.53	0	12:13	0.12	0.01	0.26
C39	CHANNEL	21.38	0	12:17	0.14	0.02	0.22
C40	CHANNEL	18.05	0	12:19	0.12	0.02	0.23
C47	CHANNEL	509.84	0	12:20	0.25	0.69	0.94
C27	CHANNEL	38.38	0	12:17	0.09	0.04	0.36
C54	CHANNEL	161.26	0	12:23	0.12	0.39	0.86
C53	CONDUIT	96.93	0	12:19	1.37	1.35	1.00
C55	CHANNEL	50.42	0	13:00	0.06	0.04	0.90
C16	CHANNEL	11.60	0	13:20	0.01	0.01	0.66
C3	CHANNEL	60.07	0	12:10	0.17	0.05	0.33
C52	CONDUIT	90.88	0	12:52	1.57	1.13	0.78
C22	CHANNEL	20.07	0	12:28	0.07	0.02	0.29
C50	CHANNEL	213.47	0	12:31	1.89	0.05	0.42
C9	CONDUIT	8.32	0	12:08	0.49	0.12	0.30
C48	CHANNEL	232.10	0	12:20	0.16	0.76	0.80

C7_1	CHANNEL	199.45	0	12:27	0.16	0.33	0.67
C7_2	CHANNEL	187.77	0	12:30	0.16	0.68	1.00
C23	CHANNEL	1.80	0	12:24	0.00	0.00	0.35
C24	CHANNEL	0.00	0	00:00	0.00	0.00	0.13
C26	CONDUIT	66.25	0	12:30	1.21	0.87	0.72
C30	CHANNEL	10.13	0	12:51	0.02	0.13	0.31
C31	CHANNEL	16.87	0	12:16	0.11	0.02	0.21

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	--- Fraction of Time in Flow Class ---- Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Avg. Froude Number	Avg. Flow Change
C7	1.00	0.00	0.00	0.00	0.81	0.19	0.00	0.00	0.49	0.0000
C45	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.11	0.0000
C1	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.01	0.0000
C19	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.13	0.0000
C4	1.00	0.00	0.01	0.00	0.99	0.00	0.00	0.00	0.02	0.0000
C2	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.02	0.0000
C8	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.02	0.0000
C11	1.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00	1.98	0.0000
C12	1.00	0.02	0.00	0.00	0.97	0.01	0.00	0.00	0.64	0.0009
C13	1.00	0.00	0.01	0.00	0.99	0.00	0.00	0.00	0.02	0.0000
C14	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.05	0.0000
C15	1.00	0.00	0.00	0.00	0.62	0.38	0.00	0.00	0.99	0.0000
C17	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.02	0.0000
C18	1.00	0.00	0.01	0.00	0.99	0.00	0.00	0.00	0.04	0.0000
C20	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.02	0.0000
C21	1.00	0.01	0.00	0.00	0.94	0.05	0.00	0.00	0.75	0.0000
C25	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.10	0.0000
C42	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.14	0.0000
C28	1.00	0.00	0.00	0.00	0.93	0.06	0.00	0.00	0.24	0.0000
C44	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.07	0.0000
C41	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
C5	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.02	0.0000
C6	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.08	0.0000
C29	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.13	0.0000
C32	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.06	0.0000
C33	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.02	0.0000
C34	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.05	0.0000
C35	1.00	0.00	0.10	0.00	0.90	0.00	0.00	0.00	0.00	0.0000

C36	1.00	0.00	0.70	0.00	0.30	0.00	0.00	0.00	0.04	0.0000
C37	1.00	0.00	0.01	0.00	0.99	0.00	0.00	0.00	0.13	0.0000
C38	1.00	0.01	0.76	0.00	0.23	0.00	0.00	0.00	0.02	0.0000
C39	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.13	0.0000
C40	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.01	0.0000
C47	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.08	0.0000
C27	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.07	0.0000
C54	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.02	0.0000
C53	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.15	0.0003
C55	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.14	0.0000
C16	1.00	0.00	0.02	0.00	0.98	0.00	0.00	0.00	0.05	0.0000
C3	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.04	0.0000
C52	1.00	0.00	0.02	0.00	0.96	0.02	0.00	0.00	0.21	0.0003
C22	1.00	0.00	0.01	0.00	0.99	0.00	0.00	0.00	0.08	0.0000
C50	1.00	0.00	0.00	0.00	0.31	0.01	0.00	0.68	1.25	0.0000
C9	1.00	0.00	0.77	0.00	0.23	0.00	0.00	0.00	0.04	0.0000
C48	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.03	0.0000
C7_1	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.01	0.0000
C7_2	1.00	0.00	0.01	0.00	0.99	0.00	0.00	0.00	0.00	0.0000
C23	1.00	0.00	0.10	0.00	0.90	0.00	0.00	0.00	0.01	0.0000
C24	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
C26	1.00	0.00	0.45	0.00	0.54	0.01	0.00	0.00	0.17	0.0001
C30	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.0000
C31	1.00	0.70	0.00	0.00	0.30	0.00	0.00	0.00	0.02	0.0000

****
Conduit Surcharge Summary
****

Conduit	--------- Hours Full -------- Both Ends	Upstream	Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
C13	0.01	0.01	0.01	0.09	0.01
C14	0.01	0.01	0.01	0.42	0.01
C53	1.77	1.77	1.77	1.54	1.54
C52	0.01	0.01	0.01	1.13	0.01
C7_2	0.84	0.84	0.84	0.01	0.01

Analysis begun on: Thu Jun 02 23:05:54 2022
Analysis ended on: Thu Jun 02 23:06:26 2022
Total elapsed time: 00:00:32

```
[TITLE]
21-050 Corman Park Post Dev Input Details Report


[OPTIONS]
FLOW_UNITS           LPS
INFILTRATION         GREEN_AMPT
FLOW_ROUTING         DYNWAVE
START_DATE           11/09/2021
START_TIME           00:00:00
REPORT_START_DATE    11/09/2021
REPORT_START_TIME    00:00:00
END_DATE             11/14/2021
END_TIME             00:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          0:05:00
WET_STEP             0:05:00
DRY_STEP             0:05:00
ROUTING_STEP         1
ALLOW_PONDING        YES
INERTIAL_DAMPING     PARTIAL
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         0
NORMAL_FLOW_LIMITED  BOTH
SKIP_STEADY_STATE    NO
FORCE_MAIN_EQUATION  H-W
LINK_OFFSETS         DEPTH
MIN_SLOPE            0

[EVAPORATION]
;;Type          Parameters
;;------------- ----------
CONSTANT     0.0
DRY_ONLY     NO

[RAINGAGES]
;;                Rain      Time   Snow   Data
;;Name            Type      Intrvl Catch  Source
;;-------------- --------- ------ ------ ----------
SK_University    INTENSITY 0:05   1.0    TIMESERIES SK_University
SK_Airport       INTENSITY 0:06   1.0    TIMESERIES SK_Airport

[SUBCATCHMENTS]
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;;                                                       Total    Pcnt.             Pcnt.    Curb     Snow
;;Name           Raingage         Outlet           Area     Imperv   Width    Slope    Length   Pack
;;-------------- ---------------- ---------------- -------- -------- -------- -------- -------- --------
S12_1            SK_Airport       J1               0.6437   70       105.525  0.6      0
S11_1            SK_Airport       J21              0.1386   70       13.723   0.6      0
S9_1             SK_Airport       J27              0.2307   70       39.776   0.9      0
S10_1            SK_Airport       J21              0.2962   70       27.174   0.7      0
S7               SK_Airport       J36              0.8096   70       109.405  1.1      0
S8               SK_Airport       j35              0.8096   70       109.405  1.4      0
S5               SK_Airport       J43              0.8096   70       109.405  0.8      0
SRoad1b          SK_Airport       J21              0.4713   20       235.65   0.1      0
SRoad8a          SK_Airport       J4               0.2014   30       100.7    0.1      0
S13              SK_Airport       SU13             3.4313   0        171.565  0.1      0
S12_2            SK_Airport       J7               3.6666   70       564.092  1.4      0
S11_2            SK_Airport       J15              1.9397   70       193.97   1        0
S10_2            SK_Airport       J16              2.0715   70       142.862  0.7      0
S9_2             SK_Airport       J17              0.9875   70       170.259  1.3      0
S1               SK_Airport       J24              1.8231   73       177      0.7      0
S6               SK_Airport       J38              0.8096   70       109.405  1.1      0
S4               SK_Airport       J18              2.2396   70       315.437  0.6      0
SRoad6a          SK_Airport       J41              0.4718   24       235.9    0.1      0
S2               SK_Airport       SU3              2.7439   70       238.6    0.9      0
S3               SK_Airport       SU3              1.6478   0        329.56   0.2      0
SRoad8b          SK_Airport       j33              0.1867   22       93.35    0.1      0
SRoad7b          SK_Airport       j25              0.1947   25       97.35    0.1      0
SRoad5a          SK_Airport       j45              0.1643   24       82.15    0.1      0
SRoad3a          SK_Airport       j9               0.2577   24       128.85   0.1      0
SRoad3b          SK_Airport       J28              0.3312   23       165.6    0.1      0
SRoad4a          SK_Airport       j9               0.16675  25       83.375   0.1      0
SRoad4b          SK_Airport       J47              0.2421   25       121.05   0.1      0
SRosd1a          SK_Airport       J36              0.3789   24       189.45   0.1      0
SRoad6b          SK_Airport       J3               0.2672   22       133.6    0.1      0
SRoad7a          SK_Airport       j3               0.1944   25       97.2     0.1      0
SRoad6c          SK_Airport       j25              0.2542   22       127.1    0.1      0
SRoad5b          SK_Airport       J29              0.2083   20       104.15   0.1      0
SRoad2a          SK_Airport       j38              0.167    24       83.5     0.1      0
SRoad2b          SK_Airport       j19              0.2135   20       106.75   0.5      0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
S12_1            0.01       0.1        0.5        2.5        25         OUTLET
S11_1            0.01       0.1        0.5        2.5        25         OUTLET
S9_1             0.01       0.1        0.5        2.5        25         OUTLET
S10_1            0.01       0.1        0.5        2.5        25         OUTLET
S7               0.01       0.1        0.5        2.5        25         OUTLET
```

```
S8                0.01       0.1        0.5        2.5        25         OUTLET
S5                0.01       0.1        0.5        2.5        25         OUTLET
SRoad1b           0.01       0.1        0.5        2.5        25         OUTLET
SRoad8a           0.01       0.1        0.5        2.5        25         OUTLET
S13               0.01       0.1        0.5        2.5        25         OUTLET
S12_2             0.01       0.1        0.5        2.5        25         OUTLET
S11_2             0.01       0.1        0.5        2.5        25         OUTLET
S10_2             0.01       0.1        0.5        2.5        25         OUTLET
S9_2              0.01       0.1        0.5        2.5        25         OUTLET
S1                0.01       0.1        0.5        2.5        25         OUTLET
S6                0.01       0.1        0.5        2.5        25         OUTLET
S4                0.01       0.1        0.5        2.5        25         OUTLET
SRoad6a           0.01       0.1        0.5        2.5        25         OUTLET
S2                0.01       0.1        0.5        2.5        25         OUTLET
S3                0.01       0.1        0.5        2.51       25.1       OUTLET
SRoad8b           0.01       0.1        0.5        2.5        25         OUTLET
SRoad7b           0.01       0.1        0.5        2.5        25         OUTLET
SRoad5a           0.01       0.1        0.5        2.5        25         OUTLET
SRoad3a           0.01       0.1        0.5        2.5        25         OUTLET
SRoad3b           0.01       0.1        0.5        2.5        25         OUTLET
SRoad4a           0.01       0.1        0.5        2.5        25         OUTLET
SRoad4b           0.01       0.1        0.5        2.5        25         OUTLET
SRosd1a           0.01       0.1        0.5        2.5        25         OUTLET
SRoad6b           0.01       0.1        0.5        2.5        25         OUTLET
SRoad7a           0.01       0.1        0.5        2.5        25         OUTLET
SRoad6c           0.01       0.1        0.5        2.5        25         OUTLET
SRoad5b           0.01       0.1        0.5        2.5        25         OUTLET
SRoad2a           0.01       0.1        0.5        2.5        25         OUTLET
SRoad2b           0.01       0.1        0.5        2.5        25         OUTLET

[INFILTRATION]
;;Subcatchment   Suction    HydCon     IMDmax
;;-------------- ---------- ---------- ----------
S12_1             253        3.5        0.15
S11_1             253        3.5        0.15
S9_1              253        3.5        0.15
S10_1             253        3.5        0.15
S7                253        3.5        0.15
S8                253        3.5        0.15
S5                253        3.5        0.15
SRoad1b           253        3.5        0.15
SRoad8a           253        3.5        0.15
S13               253.1      3.5        0.15
S12_2             253        3.5        0.15
S11_2             253        3.5        0.15
S10_2             253        3.5        0.15
```

```
S9_2             253        3.5        0.15
S1               253        3.5        0.15
S6               253        3.5        0.15
S4               253        3.5        0.15
SRoad6a          253        3.5        0.15
S2               253        3.5        0.25
S3               253.7      3.51       0.2
SRoad8b          253        3.5        0.25
SRoad7b          253        3.5        0.25
SRoad5a          253        3.5        0.25
SRoad3a          253        3.5        0.25
SRoad3b          253        3.5        0.25
SRoad4a          253        3.5        0.25
SRoad4b          253        3.5        0.25
SRosd1a          253        3.5        0.25
SRoad6b          253        3.5        0.25
SRoad7a          253        3.5        0.25
SRoad6c          253        3.5        0.25
SRoad5b          253        3.5        0.25
SRoad2a          253        3.5        0.25
SRoad2b          253        3.5        0.25

[JUNCTIONS]
;;               Invert     Max.       Init.      Surcharge  Ponded
;;Name           Elev.      Depth      Depth      Depth      Area
;;-------------- ---------- ---------- ---------- ---------- ----------
J1               513.51     0.5        0          0          1000
J3               513.71     0.5        0          0          1000
J4               512.71     0.5        0          0          1000
J6               512.8      0.5        0          0          1000
J9               512.88     0.5        0          0          1000
J11              512.07     0.5        0          0          200
J12              512        0.5        0          0          1000
J13              512.4      0.5        0          0          1000
J7               512.6      0.5        0          0          1000
J15              512.92     0.5        0          0          1000
J16              513.11     0.5        0          0          1000
J17              512.87     0.5        0          0          1000
J18              512.58     0.5        0          0          1000
J14              512        0.5        0          0          0
J21              514        0.5        0          0          1000
J8               512.45     0.5        0          0          0
J25              513.6      0.5        0          0          1000
J27              513.4      0.5        0          0          1000
J28              512.8      0.5        0          0          1000
J29              513.62     0.5        0          0          1000
```

```
J31              512.86     0.5        0          0          1000
J23              512.7      0.5        0          0          0
J5               513.68     0.5        0          0          0
J24              514.16     0.5        0          0          0
J35              513.38     0.5        0          0          1000
J36              513.98     0.5        0          0          1000
J37              513.53     0.5        0          0          1000
J38              512.96     0.5        0          0          1000
J22              512.85     0.5        0          0          0
J10              512.43     0.5        0          0          1000
J41              513.8      0.5        0          0          1000
J43              513.71     0.5        0          0          1000
J45              514.03     0.5        0          0          1000
J47              514.03     0.5        0          0          1000
J19              512.98     0.5        0          0          0
J20              514.05     0.5        0          0          0
J26              513.95     0.5        0          0          0
J30              513.25     0.5        0          0          0
J32              513.2      0.5        0          0          0
J33              512.01     0.5        0          0          0

[OUTFALLS]
;;               Invert     Outfall    Stage/Table      Tide
;;Name           Elev.      Type       Time Series      Gate
;;-------------- ---------- ---------- ---------------- ----
Outfall1         511.85     FREE                         NO
Outfall2         511.9      FREE                         NO

[STORAGE]
;;               Invert   Max.     Init.    Storage    Curve                      Ponded   Evap.
;;Name           Elev.    Depth    Depth    Curve      Params                     Area     Frac.    Infiltration Parameters
;;-------------- -------- -------- -------- ---------- -------- -------- -------- -------- -------- -----------------------
SU3              512.05   0.5      0        TABULAR    Lot3Storage                3600     0
SU13             512.15   0.5      0        TABULAR    Lot13Storage               3600     0

[CONDUITS]
;;               Inlet            Outlet                      Manning    Inlet      Outlet     Init.      Max.
;;Name           Node             Node             Length     N          Offset     Offset     Flow       Flow
;;-------------- ---------------- ---------------- ---------- ---------- ---------- ---------- ---------- ----------
C7               J24              J13              175        0.01       0          0          0          0
C45              J1               J19              111        0.01       0          0          0          0
C1               J47              J6               95         0.01       0          0          0          0
C19              J6               J23              18         0.01       0          0          0          0
C4               J10              SU3              60         0.01       0          0          0          0
C2               J36              J35              114        0.01       0          0          0          0
C8               J4               J13              111        0.01       0          0          0          0
```

C11	J14	Outfall1	11.6	0.01	0	0	0	0
C12	J12	Outfall2	47	0.01	0	0	0	0
C13	J23	j18	185	0.01	0	0	0	0
C14	J18	J10	127	0.01	0	0	0	0
C15	SU3	J14	7	0.01	0	0	0	0
C17	J16	J15	206	0.01	0	0	0	0
C18	J22	J7	216	0.01	0	0	0	0
C20	J8	SU13	100	0.01	0	0	0	0
C21	SU13	J12	5	0.01	0	0	0	0
C25	J19	J31	23	0.01	0	0	0	0
C42	J3	J4	193	0.01	0	0	0	0
C28	J29	J10	205	0.01	0	0	0	0
C44	J21	J27	114	0.01	0	0	0	0
C41	J26	J3	53	0.01	0	0	0	0
C5	J16	J17	196	0.01	0	0	0	0
C6	J27	J28	143	0.01	0	0	0	0
C29	J35	J9	115	0.01	0	0	0	0
C32	J45	J9	95	0.01	0	0	0	0
C33	J45	J43	65	0.01	0	0	0	0
C34	J47	J29	85	0.01	0	0	0	0
C35	J20	J41	53	0.01	0	0	0	0
C36	J41	J3	24.5	0.01	0	0	0	0
C37	J37	J38	115	0.01	0	0	0	0
C38	J30	J5	39	0.01	0	0	0	0
C39	J32	J25	39	0.01	0	0	0	0
C40	J25	J33	216	0.01	0	0	0	0
C47	J7	J8	30	0.01	0	0	0	0
C27	J21	J1	93	0.01	0	0	0	0
C54	J17	J23	110	0.01	0	0	0	0
C53	J9	J6	24.5	0.01	0	0	0	0
C55	J28	J23	15	0.01	0	0	0	0
C16	J30	J38	52	0.01	0	0	0	0
C3	J36	J37	54	0.01	0	0	0	0
C52	J38	J31	24.5	0.01	0	0	0	0
C22	J32	J31	72	0.01	0	0	0	0
C50	J31	SU13	60	0.01	0	0.1	0	0
C9	J5	J25	24.5	0.01	0	0	0	0
C48	J15	J22	82	0.01	0	0	0	0
C7_1	J13	J11	140	0.01	0	0	0	0
C7_2	J11	SU3	40	0.01	0	0	0	0
C23	J20	J43	49	0.01	0	0	0	0
C24	J26	J29	64.5	0.01	0	0	0	0
C26	J43	J29	24.5	0.01	0	0	0	0
C30	J33	J12	265	0.01	0	0	0	0
C31	J41	J5	24.5	0.01	0	0	0	0

```
[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4      Barrels
;;-------------- ------------ ---------------- ---------- ---------- ---------- ----------
C7               IRREGULAR    4x0.5mSwale      0          0          0          1
C45              IRREGULAR    15m_ditch        0          0          0          1
C1               IRREGULAR    15m_ditch        0          0          0          1
C19              IRREGULAR    15m_ditch        0          0          0          1
C4               IRREGULAR    BackLotDitch     0          0          0          1
C2               IRREGULAR    15m_ditch        0          0          0          1
C8               IRREGULAR    7m_ditch         0          0          0          1
C11              CIRCULAR     0.75             0          0          0          1
C12              CIRCULAR     0.45             0          0          0          2          5
C13              IRREGULAR    BackLotDitch     0          0          0          1
C14              IRREGULAR    BackLotDitch     0          0          0          1
C15              CIRCULAR     0.3              0          0          0          1          5
C17              IRREGULAR    BackLotDitch     0          0          0          1
C18              IRREGULAR    BackLotDitch     0          0          0          1
C20              IRREGULAR    7m_ditch         0          0          0          1
C21              CIRCULAR     0.3              0          0          0          1          5
C25              IRREGULAR    15m_ditch        0          0          0          1
C42              IRREGULAR    15m_ditch        0          0          0          1
C28              IRREGULAR    4x0.5mSwale      0          0          0          1
C44              IRREGULAR    15m_ditch        0          0          0          1
C41              IRREGULAR    15m_ditch        0          0          0          1
C5               IRREGULAR    BackLotDitch     0          0          0          1
C6               IRREGULAR    15m_ditch        0          0          0          1
C29              IRREGULAR    15m_ditch        0          0          0          1
C32              IRREGULAR    15m_ditch        0          0          0          1
C33              IRREGULAR    15m_ditch        0          0          0          1
C34              IRREGULAR    15m_ditch        0          0          0          1
C35              IRREGULAR    15m_ditch        0          0          0          1
C36              CIRCULAR     0.3              0          0          0          1          5
C37              IRREGULAR    15m_ditch        0          0          0          1
C38              IRREGULAR    15m_ditch        0          0          0          1
C39              IRREGULAR    15m_ditch        0          0          0          1
C40              IRREGULAR    15m_ditch        0          0          0          1
C47              IRREGULAR    BackLotDitch     0          0          0          1
C27              IRREGULAR    15m_ditch        0          0          0          1
C54              IRREGULAR    BackLotDitch     0          0          0          1
C53              CIRCULAR     0.3              0          0          0          1          5
C55              IRREGULAR    15m_ditch        0          0          0          1
C16              IRREGULAR    15m_ditch        0          0          0          1
C3               IRREGULAR    15m_ditch        0          0          0          1
C52              CIRCULAR     0.3              0          0          0          1          5
C22              IRREGULAR    15m_ditch        0          0          0          1
C50              IRREGULAR    4x0.5mSwale      0          0          0          1
```

```
C9               CIRCULAR     0.3              0          0          0          1          5
C48              IRREGULAR    BackLotDitch     0          0          0          1
C7_1             IRREGULAR    7m_ditch         0          0          0          1
C7_2             IRREGULAR    7m_ditch         0          0          0          1
C23              IRREGULAR    15m_ditch        0          0          0          1
C24              IRREGULAR    15m_ditch        0          0          0          1
C26              CIRCULAR     0.3              0          0          0          1          5
C30              IRREGULAR    7m_ditch         0          0          0          1
C31              IRREGULAR    15m_ditch        0          0          0          1

[TRANSECTS]

NC 0.1      0.1      0.1
X1 overland_flow    3        0.0      0.0      0.0       0.0       0.0      0.0      0.0
GR 0.1      0        0        15       0.1      30

NC 0.1      0.1      0.1
X1 15m_ditch        3        0.0      0.0      0.0       0.0       0.0      0.0      0.0
GR 0.5      0        0        7        0.5      14

NC 0.1      0.1      0.1
X1 7m_ditch         4        0.0      0.0      0.0       0.0       0.0      0.0      0.0
GR 0.5      0        0        2        0        5         0.5      7

NC 0.1      0.1      0.1
X1 BackLotSwale     4        0.0      0.0      0.0       0.0       0.0      0.0      0.0
GR 0.25     0        0        1        0        4         0.25     5

NC 0.1      0.1      0.1
X1 BackLotDitch     4        0.0      0.0      0.0       0.0       0.0      0.0      0.0
GR 0.5      0        0        2.5      0        4.5       0.5      7

NC 0.1      0.1      0.1
X1 10mDitch         4        0.0      0.0      0.0       0.0       0.0      0.0      0.0
GR 0.35     0        0        1.4      0        8.6       0.35     10

NC 0.01     0.01     0.01
X1 4x0.5mSwale      3        0.0      0.0      0.0       0.0       0.0      0.0      0.0
GR 0.5      0        0        2        0.5      4

[LOSSES]
;;Link           Inlet      Outlet     Average    Flap Gate
;;-------------- ---------- ---------- ---------- ----------

[CURVES]
;;Name           Type       X-Value    Y-Value
```

```
;;-------------- ---------- ---------- ----------
Lot4Storage      Storage    0          5766
Lot4Storage                  .25        6329

Lot10Storage     Storage    0          3831
Lot10Storage                 .25        4234

Lot1Storage      Storage    0          3427
Lot1Storage                  .25        3780

Lot3Storage      Storage    0          0
Lot3Storage                  .1         8618
Lot3Storage                  .2         15950
Lot3Storage                  .3         16170
Lot3Storage                  .4         16478
Lot3Storage                  .5         16608

Lot9Storage      Storage    0          4660
Lot9Storage                  .25        5138

Lot12Storage     Storage    0          7982
Lot12Storage                 .25        8729

Lot2Storage      Storage    0          416
Lot2Storage                  .25        512

Lot11Storage     Storage    0          3802
Lot11Storage                 .25        4191

Lot13Storage     Storage    0          11450
Lot13Storage                 .5         15742

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
SK_University               0:00       0.00000
SK_University               0:05       0.07500
SK_University               0:10       0.15000
SK_University               0:15       0.22500
SK_University               0:20       0.30000
SK_University               0:25       0.37500
SK_University               0:30       0.45000
SK_University               0:35       0.52500
SK_University               0:40       0.60000
SK_University               0:45       0.67500
SK_University               0:50       0.75000
```

SK_University	0:55	0.82500
SK_University	1:00	0.90000
SK_University	1:05	0.91500
SK_University	1:10	0.93000
SK_University	1:15	0.94500
SK_University	1:20	0.96000
SK_University	1:25	0.97500
SK_University	1:30	0.99000
SK_University	1:35	1.00500
SK_University	1:40	1.02000
SK_University	1:45	1.03500
SK_University	1:50	1.05000
SK_University	1:55	1.06500
SK_University	2:00	1.08000
SK_University	2:05	1.08750
SK_University	2:10	1.09500
SK_University	2:15	1.10250
SK_University	2:20	1.11000
SK_University	2:25	1.11750
SK_University	2:30	1.12500
SK_University	2:35	1.13250
SK_University	2:40	1.14000
SK_University	2:45	1.14750
SK_University	2:50	1.15500
SK_University	2:55	1.16250
SK_University	3:00	1.17000
SK_University	3:05	1.17750
SK_University	3:10	1.18500
SK_University	3:15	1.19250
SK_University	3:20	1.20000
SK_University	3:25	1.20750
SK_University	3:30	1.21500
SK_University	3:35	1.22250
SK_University	3:40	1.23000
SK_University	3:45	1.23750
SK_University	3:50	1.24500
SK_University	3:55	1.25250
SK_University	4:00	1.26000
SK_University	4:05	1.25250
SK_University	4:10	1.24500
SK_University	4:15	1.23750
SK_University	4:20	1.23000
SK_University	4:25	1.22250
SK_University	4:30	1.21500
SK_University	4:35	1.20750
SK_University	4:40	1.20000

SK_University	4:45	1.19250
SK_University	4:50	1.18500
SK_University	4:55	1.17750
SK_University	5:00	1.17000
SK_University	5:05	1.21500
SK_University	5:10	1.26000
SK_University	5:15	1.30500
SK_University	5:20	1.35000
SK_University	5:25	1.39500
SK_University	5:30	1.44000
SK_University	5:35	1.48500
SK_University	5:40	1.53000
SK_University	5:45	1.57500
SK_University	5:50	1.62000
SK_University	5:55	1.66500
SK_University	6:00	1.71000
SK_University	6:05	1.71000
SK_University	6:10	1.71000
SK_University	6:15	1.71000
SK_University	6:20	1.71000
SK_University	6:25	1.71000
SK_University	6:30	1.71000
SK_University	6:35	1.71000
SK_University	6:40	1.71000
SK_University	6:45	1.71000
SK_University	6:50	1.71000
SK_University	6:55	1.71000
SK_University	7:00	1.71000
SK_University	7:05	1.72500
SK_University	7:10	1.74000
SK_University	7:15	1.75500
SK_University	7:20	1.77000
SK_University	7:25	1.78500
SK_University	7:30	1.80000
SK_University	7:35	1.81500
SK_University	7:40	1.83000
SK_University	7:45	1.84500
SK_University	7:50	1.86000
SK_University	7:55	1.87500
SK_University	8:00	1.89000
SK_University	8:05	1.92750
SK_University	8:10	1.96500
SK_University	8:15	2.00250
SK_University	8:20	2.04000
SK_University	8:25	2.07750
SK_University	8:30	2.11500

SK_University	8:35	2.15250
SK_University	8:40	2.19000
SK_University	8:45	2.22750
SK_University	8:50	2.26500
SK_University	8:55	2.30250
SK_University	9:00	2.34000
SK_University	9:05	2.43750
SK_University	9:10	2.53500
SK_University	9:15	2.63250
SK_University	9:20	2.73000
SK_University	9:25	2.82750
SK_University	9:30	2.92500
SK_University	9:35	3.02250
SK_University	9:40	3.12000
SK_University	9:45	3.21750
SK_University	9:50	3.31500
SK_University	9:55	3.41250
SK_University	10:00	3.51000
SK_University	10:05	3.58500
SK_University	10:10	3.66000
SK_University	10:15	3.73500
SK_University	10:20	3.81000
SK_University	10:25	3.88500
SK_University	10:30	3.96000
SK_University	10:35	4.03500
SK_University	10:40	4.11000
SK_University	10:45	4.18500
SK_University	10:50	4.26000
SK_University	10:55	4.33500
SK_University	11:00	4.41000
SK_University	11:05	7.23000
SK_University	11:10	10.05000
SK_University	11:15	12.87000
SK_University	11:20	15.69000
SK_University	11:25	18.51000
SK_University	11:30	21.33000
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[REPORT]
INPUT      NO
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS       0                0                10000            10000
UNITS            Meters

[COORDINATES]
;;Node           X-Coord          Y-Coord
;;-------------- ---------------- ----------------
J1               526.085          -253.708
J3               511.39           -398.865
J4               605.462          -503.466
J6               341.165          -361.411
J9               355.319          -349.19
J11              462.113          -600.448
J12              779.564          -367.343
J13              545.099          -560.263
J7               592.412          -164.659
J15              425.218          -61.157
J16              319.636          -100.723
J17              318.881          -265.167
J18              319.104          -471.641
J14              473.222          -642.721
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J21              477.01           -218.046
J8               677.001          -257.436
J25              525.668          -386.315
J27              410.666          -275.833
J28              329.43           -347.343
J29              437.341          -466.306
J31              589.347          -321.839
J23              319.629          -366.472
J5               515.21           -371.825
J24              454.316          -458.624
J35              420.266          -288.833
J36              485.35           -233.216
J37              515.672          -263.904
J38              568.69           -322.256
J22              486.037          -61.31
J10              318.72           -575.587
J41              501.005          -384.567
J43              437.576          -439.037
J45              397.314          -395.494
J47              383.982          -406.406
J19              579.644          -311.612
J20              455.944          -422.624
J26              468.46           -438.084
J30              546.048          -343.052
J32              558.318          -353.85
J33              630.1            -499.386
Outfall1         488.905          -684.756
Outfall2         818.633          -410.988
SU3              424.837          -653.706
SU13             672.691          -406.01

[VERTICES]
;;Link           X-Coord          Y-Coord
;;-------------- ---------------- ----------------
C4               317.641          -669.48
C4               371.195          -671.507
C17              319.974          -61.618
C18              496.041          -61.989
C20              717.399          -302.042
C28              436.319          -474.151
C27              488.582          -215.726
C7_1             503.618          -597.102
C7_1             482.986          -591.944
C7_1             468.086          -594.809
C7_2             456.05           -607.991
C7_2             456.739          -623.723
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[Polygons]
;;Subcatchment   X-Coord            Y-Coord
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S12_1            538.176            -186.717
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S12_1            607.529            -323.595
S12_1            507.204            -220.774
S12_1            488.069            -199.411
S12_1            487.017            -133.612
S12_1            538.176            -186.717
S11_1            488.041            -199.82
S11_1            463.345            -221.244
S11_1            410.395            -147.698
S11_1            486.836            -133.978
S11_1            488.041            -199.82
S9_1             409.812            -268.433
S9_1             362.227            -310.77
S9_1             367.127            -217.833
S9_1             409.812            -268.433
S10_1            463.102            -220.964
S10_1            409.725            -268.433
S10_1            367.127            -217.888
S10_1            410.174            -147.974
S10_1            463.102            -220.964
S7               463.368            -336.524
S7               426.021            -295.274
S7               487.533            -241.623
S7               525.153            -281.889
S7               463.368            -336.524
S8               463.33             -336.524
S8               402.239            -390.953
S8               364.835            -349.15
S8               426.021            -295.321
S8               463.33             -336.524
S5               498.882            -376.49
S5               440.502            -430.944
S5               402.483            -390.471
S5               463.368            -336.543
S5               498.882            -376.49
SRoad1b          530.468            -268.554
SRoad1b          491.218            -226.307
SRoad1b          485.48             -225.231
SRoad1b          479.341            -228.163
SRoad1b          421.829            -279.546
SRoad1b          408.931            -268.427
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SRoad1b	541.979	-255.546
SRoad1b	530.468	-268.554
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SRoad8a	457.811	-622.241
SRoad8a	456.08	-616.536
SRoad8a	455.876	-612.156
SRoad8a	457.608	-606.045
SRoad8a	462.293	-600.035
SRoad8a	466.538	-596.436
SRoad8a	471.054	-594.127
SRoad8a	476.249	-593.515
SRoad8a	481.24	-593.923
SRoad8a	488.37	-595.349
SRoad8a	495.297	-596.469
SRoad8a	500.779	-594.78
SRoad8a	600.264	-504.596
SRoad8a	600.834	-504.691
SRoad8a	561.337	-463.792
SRoad8a	571.905	-451.376
SRoad8a	612.132	-495.32
SRoad8a	463.618	-631.307
S13	607.551	-323.617
S13	607.564	-323.631
S13	664.977	-269.449
S13	674.3	-261.395
S13	730.627	-323.708
S13	737.469	-403.181
S13	633.948	-495.595
S13	542.879	-396.674
S13	535.399	-388.295
S13	607.551	-323.617
S12_2	639.556	-293.758
S12_2	487.278	-133.321
S12_2	486.519	-66.009
S12_2	495.629	-66.009
S12_2	674.812	-261.495
S12_2	639.556	-293.758
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S11_2	351.825	-66.788
S11_2	486.509	-65.76
S11_2	487.011	-133.967
S11_2	410.971	-147.386
S10_2	411.14	-147.911
S10_2	367.121	-217.919

S10_2	323.559	-166.546
S10_2	323.594	-68.372
S10_2	352.42	-67.838
S10_2	411.14	-147.911
S9_2	361.775	-310.99
S9_2	324.217	-345.506
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S9_2	367.091	-217.942
S9_2	361.775	-310.99
S1	543.603	-556.672
S1	453.655	-459.509
S1	511.717	-408.24
S1	600.06	-504.633
S1	543.603	-556.672
S6	463.294	-336.499
S6	524.899	-282.044
S6	561.224	-322.084
S6	499.597	-378.852
S6	463.294	-336.499
S4	323.501	-387.433
S4	332.598	-378.337
S4	339.931	-370.819
S4	437.443	-472.675
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S4	325.266	-574.671
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S2	323.453	-576.801
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S2	323.442	-585.021
S2	323.453	-576.801
S3	481.929	-591.656
S3	469.495	-594.601
S3	464.466	-597.772
S3	460.312	-602.582
S3	456.814	-607.173

S3	455.674	-610.43
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S3	323.307	-664.006
S3	322.678	-585.048
S3	481.929	-591.656
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SRoad7b	511.796	-387.179
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SRoad7b	572.431	-451.694
SRoad7b	511.634	-387.322
SRoad7b	511.796	-387.179
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[SYMBOLS]
;;Gage           X-Coord          Y-Coord
;;-------------- ---------------- ----------------
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Appendix F

PUBLIC CONSULTATION FEEDBACK

HASEGAWA
CONSULTING PROFESSIONAL ENGINEERS

1220 – 31 Street North
Lethbridge, AB T1H 5J8
Bus: 403-328-2686
Fax: 403-328-2728
E-mail: office@hasegawa.ca

November 19, 2021 **Our File: 21-050**

Re: **Corman Corner Agribusiness Centre**
Location: **NE ¼ 3-38-6-W3M, RM of Corman Park, Saskatchewan**

To Whom It May Concern:

Hasegawa Engineering, on behalf of one of their clients, is proposing a 78-acre parcel, Rural Industrial development in the R.M. of Corman Park (the RM) on LS.9, LS.10, LS.15 & LS.16 NE.1/4 SEC.3 - TWP.38 - RGE.6 - W3M as shown on **Figure 1 – Area Map** and **Figure 2 – Legal Plan**. Existing land use and ownership is shown on **Figure 3 – Existing Land Use Plan**. Current land use consists of Agricultural 1, 2 and Agricultural Residential.

The lands are designated as rural commercial/industrial in the new proposed Partnership for Growth Official Community Plan (P4G OCP). We are making subdivision application for Phase 1 and rezoning application from D-Agricultural 1 District (DAG1) to the D-Light Industrial 1 District (DM1) for Phase 1 and DM1 (h) holding provision for the future phase(s) under the new proposed P4G Zoning Bylaw. The development will consist of 10-13 serviced lots accessed from a single road that connects to Grid Road 684, utilizing the existing approach (refer to **Figure 4 – Proposed Lot Layout**). Allowable land uses are identified in the proposed P4G land use bylaw. Links to the new proposed P4G OCP and Zoning Bylaw are shown below:

https://partnershipforgrowth.ca/isl/uploads/2020/11/P4G-District-Official-Community-Plan-Approved-September-24-2020_compressed.pdf

https://www.rmcormanpark.ca/DocumentCenter/View/3468/Draft-District-Zoning-Bylaw?bidId=

In order to demonstrate that this land use is appropriate for this location, Hasegawa Engineering has completed code reviews, numerous analyses, and evaluation of the site for suitability for this application. These analyses are summarized in the Comprehensive Development Review (CDR) document. It provides a compilation of information relevant to the subdivision and development of a Rural Commercial/Industrial subdivision.

Additionally, please see the following summary of some key items relating to regulatory, social, environmental, health and economic issues that have been addressed by Hasegawa Engineering:

- Our proposal will conform to the existing and proposed Corman Park land use bylaws and planning documents, including the proposed P4G OCP.
- We have reviewed the Corman Park engineering requirements and will ensure compliance to these standards.
- We have ongoing coordination with the Ministry of Highways and will adhere to all requirements.
- Completion of a traffic impact analysis (TIA) has indicated that the development could proceed using the existing approach and comply with the no-build zone setback from the Ministry of Highways.
- We conducted an Environmental Impact Screening, which set forth the criteria on which this development could proceed.
- We completed a Historical Resources Impact Screening. This screening revealed no issues of concern.

- Drainage analysis has been conducted for the site to comply with Saskatchewan Water Security Agency rules and regulations. Each lot will be designed to limit runoff from the 100-year 24-hour storm to the pre-development flow rate thus not increasing runoff due to the development.
- As part of the geotechnical analysis, the site was tested for feasibility of onsite sewage infiltration mounds to allow for disposal of municipal wastewater. The result indicated that the soil and site conditions are amenable to this option. Each site will have a sewage tank that will either be pumped and trucked to a disposal facility or fed to a septic field mound located onsite. Each site will require a site-specific design for sewage treatment and disposal.
- Servicing analysis was completed for potable water, natural gas, telecommunications, and electricity (refer to **Figure 5 – Proposed Servicing Plan**).

Once the public notice period is complete a full regulatory review will be conducted through the Municipality's CDR approval process. This development will accommodate multiple businesses, including our client, and will be developed to serve your community. Our client is a well-regarded western Canadian company that has a strong reputation among its customers, suppliers, and the communities it serves.

Please respond in writing to the above address or by email (office@hasegawa.ca) by December 14th with questions or concerns. We will also be holding a GoToMeeting on December 15th at 2 p.m. Mountain Time to answer any additional questions. To join the meeting enter the following URL into your browser https://global.gotomeeting.com/join/317378045. You can also dial in using your phone. Canada: +1 (647) 497-9391 Access Code: 317-378-045.

Yours truly,

Mark Hasegawa

Mark Hasegawa, P.Eng.
HASEGAWA ENGINEERING
MH/cms

ISSUE	DRAWING STATUS / REVISION	DATE (YY/MM/DD)	BY
A	FOR APPROVAL	21/11/19	DPB

DESIGNED	DRAWN	CHECKED	APPROVED	SCALE AND SHEET SIZE
MAH	DPB	HE	MAH	AS SHOWN

HASEGAWA
CONSULTING PROFESSIONAL ENGINEERS
330, 3120 - 32nd Street South, Lethbridge, Alberta T1K 7B4
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NOTES

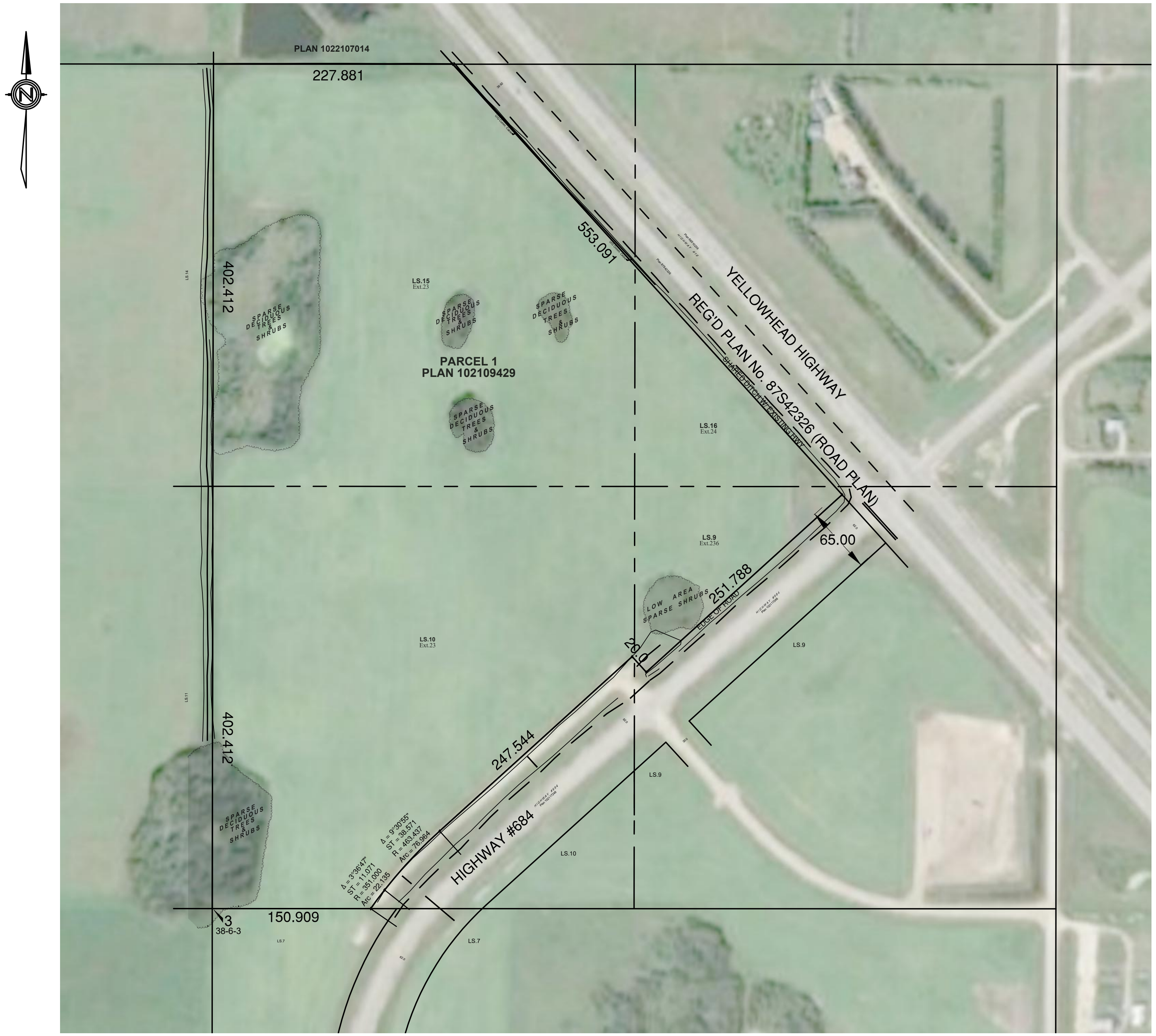
CLIENT
HASEGAWA ENGINEERING

PROJECT
CORMAN 78ac.
DEVELOPMENT

DRAWING
AREA MAP

PROJECT NUMBER
21-050

SHEET NUMBER
FIGURE 1



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ISSUE	DRAWING STATUS / REVISION	DATE (YY/MM/DD)	BY
A	FOR APPROVAL	21/11/19	DPB

DESIGNED	DRAWN	CHECKED	APPROVED	SCALE AND SHEET SIZE
MAH	DPB	HE	MAH	AS SHOWN

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NOTES

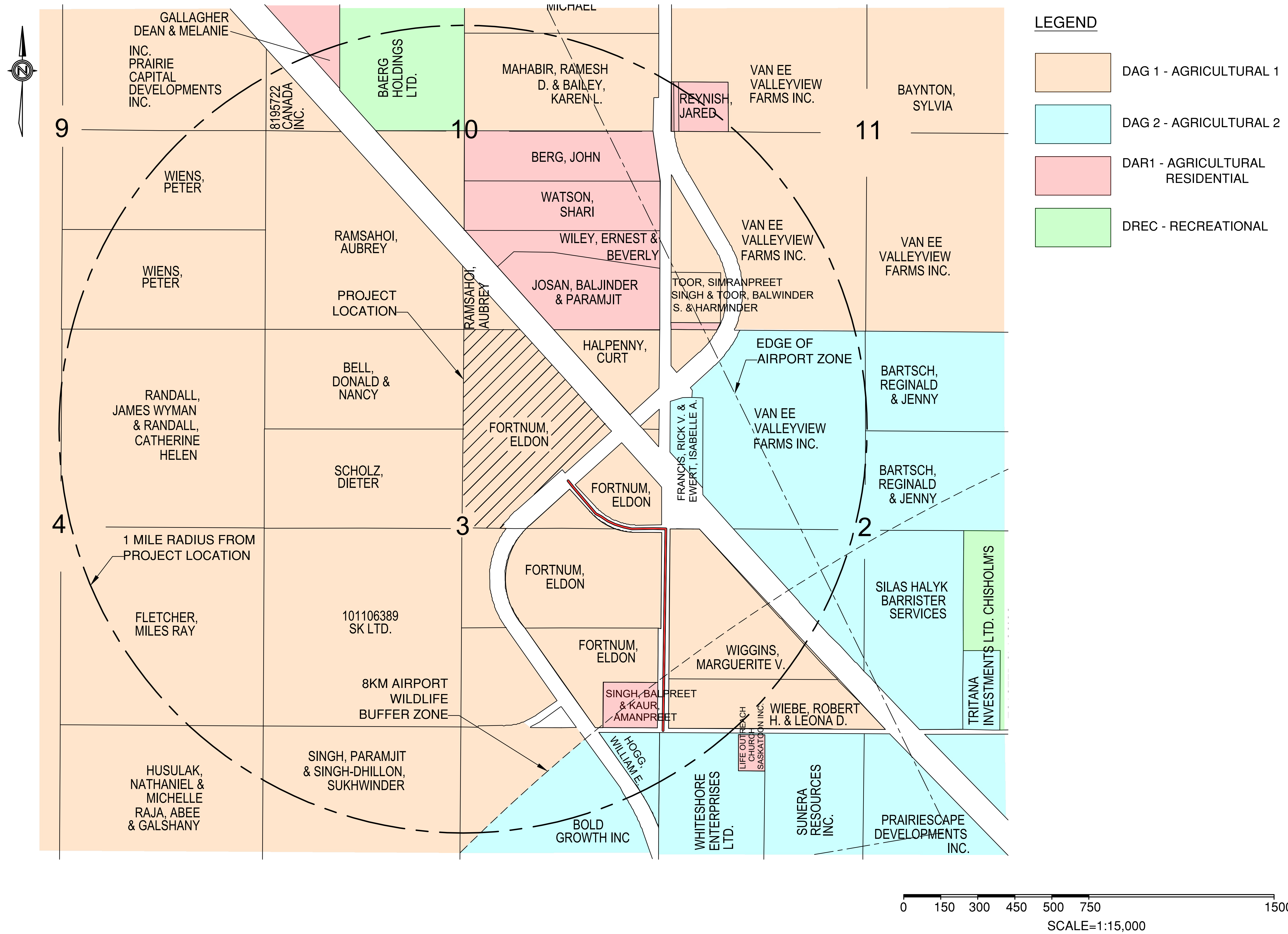
CLIENT
HASEGAWA ENGINEERING

PROJECT
CORMAN 78ac.
DEVELOPMENT

DRAWING
LEGAL PLAN

PROJECT NUMBER
21-050

SHEET NUMBER
FIGURE 2



ISSUE	DRAWING STATUS / REVISION	DATE (YY/MM/DD)	BY
A	FOR APPROVAL	21/11/19	DPB

DESIGNED	DRAWN	CHECKED	APPROVED	SCALE AND SHEET SIZE
MAH	DPB	HE	MAH	AS SHOWN

HASEGAWA
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NOTES

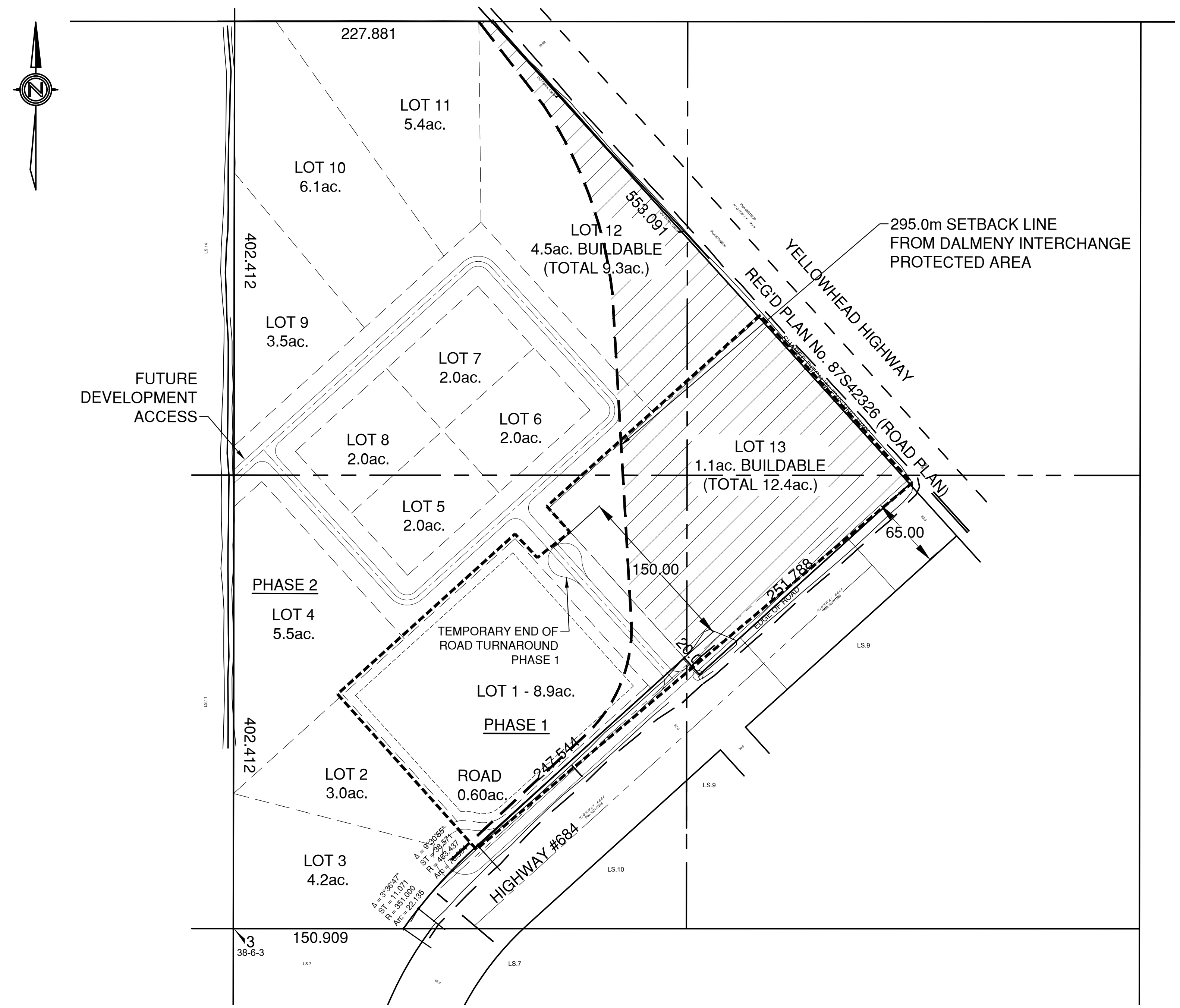
CLIENT
HASEGAWA ENGINEERING

PROJECT
CORMAN 78ac. DEVELOPMENT

DRAWING
EXISTING LANDUSE PLAN

PROJECT NUMBER
21-050

SHEET NUMBER
FIGURE 3



ISSUE	DRAWING STATUS / REVISION	DATE (YY/MM/DD)	BY
A	FOR APPROVAL	21/11/19	DPB

DESIGNED	DRAWN	CHECKED	APPROVED	SCALE AND SHEET SIZE
MAH	DPB	HE	MAH	AS SHOWN

0 50 100 150 200 250 500

SCALE=1:5,000

HASEGAWA
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NOTES

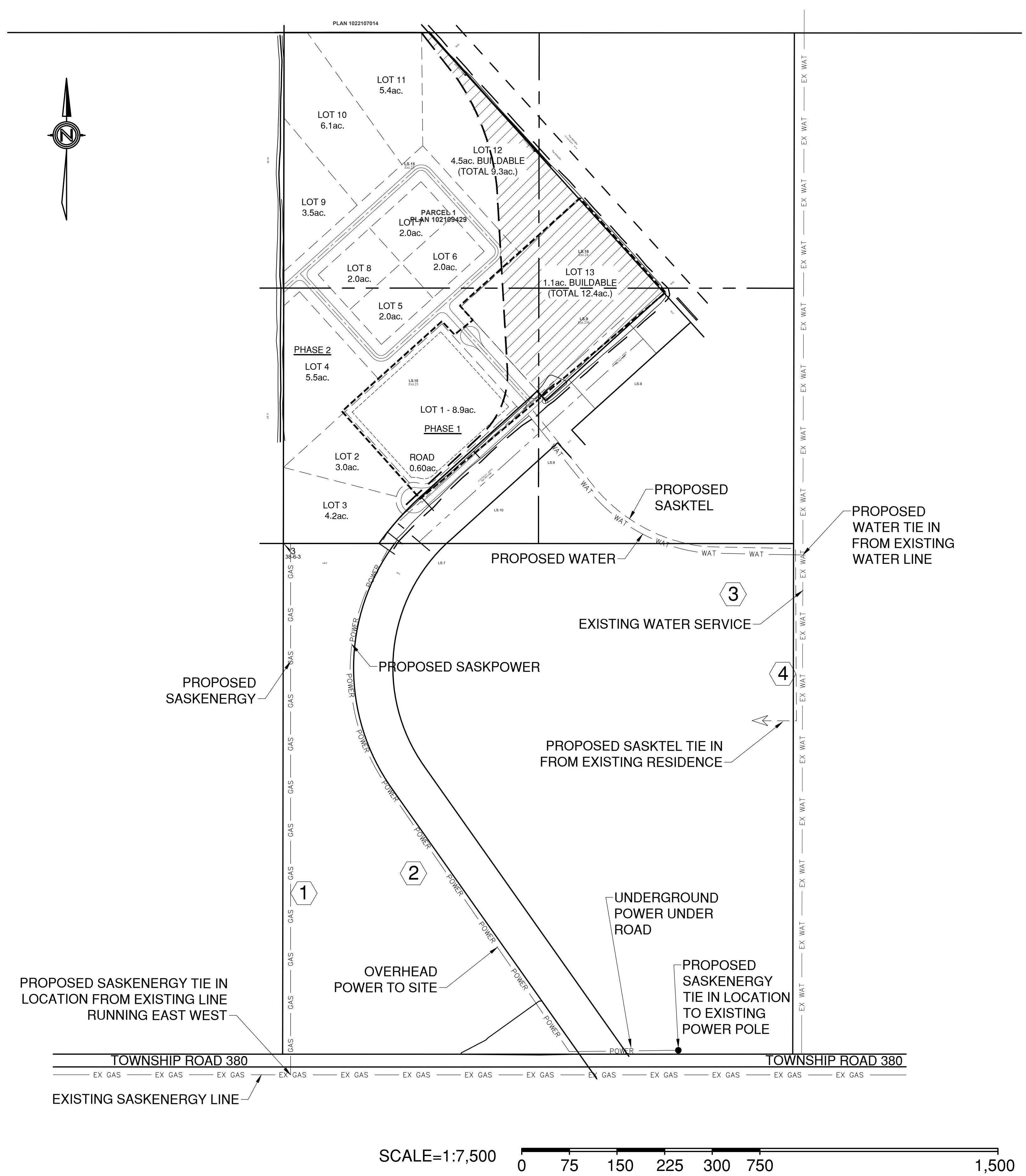
CLIENT
HASEGAWA ENGINEERING

PROJECT
CORMAN 78ac. DEVELOPMENT

DRAWING
PROPOSED LOT LAYOUT

PROJECT NUMBER
21-050

SHEET NUMBER
FIGURE 4



NOTES:

1 UTILITY INFORMATION CONTAINED ON THIS SHEET REPRESENTS CONCEPTS PROVIDED BY LOCAL UTILITY SERVICE PROVIDERS. THIS INFORMATION IS DIAGRAMMATIC AND SUBJECT TO CHANGE BASED ON INDIVIDUAL UTILITY SERVICE PROVIDER DESIGN CHANGES.

KEY NOTES:

1 PROPOSED SASKENERGY NATURAL GAS LINE SOURCED FROM EXISTING LINE ALONG TWP RD 380 APPROXIMATELY 1,000m SOUTH.

2 PROPOSED SASKPOWER 25KV OVERHEAD LINE SOURCED FROM EXISTING LINE ALONG TWP RD 380 APPROXIMATELY 1,000m SOUTH.

3 PROPOSED WATER LINE EXTENSION SOURCED FROM WATER CO-OP EXISTING INFRASTRUCTURE APPROXIMATELY 600m EAST.

4 PROPOSED TELECOMMUNICATIONS EXTENSION SOURCED FROM EXISTING INFRASTRUCTURE APPROXIMATELY 600m EAST.

LEGEND:

— — — — — —	SASKTEL TELECOMMUNICATIONS
— POWER — POWER —	PROPOSED SASKPOWER
— EX GAS — EX GAS —	EXSTING SASKENERGY
— GAS — GAS —	PROPOSED SASKENERGY
— EX WAT — EX WAT —	EXISTING WATER LINE
— WAT — WAT —	PROPOSED WATER LINE

ISSUE	DRAWING STATUS / REVISION	DATE (YY/MM/DD)	BY
A	FOR APPROVAL	21/11/19	DPB

DESIGNED	DRAWN	CHECKED	APPROVED	SCALE AND SHEET SIZE
MAH	DPB	HE	MAH	AS SHOWN

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CLIENT
HASEGAWA ENGINEERING

PROJECT
CORMAN 78ac. DEVELOPMENT

DRAWING
PROPOSED SERVICING PLAN

PROJECT NUMBER
21-050

SHEET NUMBER
FIGURE 5

Public Meeting - Corman Corner Proposed Development
December 15, 2021 2:00 p.m. MST

Meeting Notes

Attendees:
David Reifferscheid, UFA
Brendon Krueger, UFA
Liam Whitelaw, UFA
Tim Church, UFA
Mark Hasegawa, Hasegawa Engineering
Jordan Michel, Hasegawa Engineering
Carol Smith, Hasegawa Engineering
Curt Halpenny
Dorian Brown
Ramesh Mahabir
Karen Bailey

1. PowerPoint presentation given by Mark Hasegawa, Hasegawa Engineering, and Brendon Krueger, UFA

Mark described the proposed development and efforts made to make sure that all the proper steps and procedures, environmental concerns, traffic, etc. are being considered in the planning. When working with the client to select the site, the RM of Corman Park was consulted from the beginning to identify potential locations that the municipality would consider to be amenable to the development. The P4G plan was referenced and considered; this plan was developed by the local municipalities (Corman Park, Martensville, Osler, Saskatoon, and Warman) to develop a long-term regional plan for growth and development. The specific area proposed for the development is identified on the North Concept Plan map, which shows the various land uses and what is proposed for the different areas. The area chosen for the proposed development was created using the P4G plan as a guide:

- It coincides with the proposed Rural Commercial/Industrial land use designated in the P4G North Concept Plan.
- The land is currently cultivated, and environmental due diligence revealed no significant issues.
- Development will take place with a strong regard for the local greenspace.

The development will take place in two phases: Phase I – initial development of the UFA site; and Phase 2 – subsequent lots to be developed at a later date. Separate Development Permits will be required for each site.

Brendon provided general information about UFA:

- A 112-year-old agricultural producer-owned cooperative with approximately 140 locations servicing 125,000 members in three provinces.
- A progressive and diversified business that provides the products, services, and solutions our member/owners and other customers in rural communities require to successfully run their operations.
- UFA's members guide decision-making and are rooted in the heart of all we do.
- Operations include Farm and Ranch stores supplying farmers and ranchers with agriproducts and inputs.

- UFA also offers fuel and lubricant products from its network of cardlock and bulk sites throughout Alberta, Northeast BC, and Southwest Saskatchewan.
- A strong reputation in the communities we serve, we are committed to farmers, ranchers, and the well-being of rural communities with a commitment to environmental responsibility, community focus and patronage to our members.

UFA is looking to expand with a new site along the number 16 highway and will be the first developer in this subdivision.

The site will be an important new offering to this area:

- Will offer local producers a bulk fuel option, including UFA's premium diesel products.
- Will provide local traffic a cardlock service for their fueling needs.
- Will invest in the local community with employment, community investment and involvement.

2. Questions and Comments from Attendees

Curt Halpenney (CH):

Re: study on possibility of sewer mounds and traffic studies. What are the results? What issues were identified and how were they dealt with?

Mark Hasegawa (MH) reply:

Sewer: We consulted with Department of Health, and they provided some information from the area where mounds have been successful. Results of the geotechnical analysis indicated that mounds are feasible; but another option for managing such wastes is tanking the sewage and having it trucked offsite.

Traffic Impact Assessment (TIA): Highways is primarily interested in the increase in traffic at the intersection and access to the site. Traffic counts were done to determine the current traffic flow with Highways 16 and 684. The conclusion was that there must be a setback for a future interchange and that the current turnout across the road from Curt, just south, is an appropriate distance from the highway to gain access to the site (where the current approach is now).

CH: Have you identified what increased traffic counts the facility would generate and can you share it?

MH: Existing traffic is counted and then they do projections based on what the development would add (speed and volume are taken into account) to determine the need for additional controls such as signals, additional lanes, etc. Yes, the report can be shared.

CH: Is this out of your purview now and in the hands of Highways?

MH: Our purview is how our proposed development would impact the overall traffic flow. The overall traffic flow with respect to Highways 16 and 684 is a Ministry of Highways issue but adding the additional traffic at our intersection and determining how much more of a conflict that may create is the question we answer.

CH: This is a problem interchange. I have lived here for thirty years and sold land to the Department of Highways to make the current interchange safer because it was even worse before, but it is not much better now. Even though the alignment is better, and the sightlines are *supposed to be better, there are still fatal accidents there on a regular basis. I hear tractor trailers giving long airhorn blasts several times per day, which indicates to me that those are near misses of collisions. This is a potentially dangerous interchange and so the increased traffic is a concern.*

MH: We will share the report with Curt and discuss it further with him.

CH (comment): I have had conversations with the Ministry on what they are planning to do, but it is always a matter of priority. They get lots of requests for overpasses in many areas.

CH: Another concern is the increased danger in being in close proximity to residential properties. What about the chemicals and fuel that will be stored on the site? What is the advantage of having those kinds of products in close proximity to residential areas when there are other more industrial sites within the area?

MH: The current environment for petroleum products is that the secondary containment and the fuel handling and containment requirements are quite rigorous both through the Fire Code and provincial rules (21) on how to handle and maintain fuel facilities so that they don't impact neighbouring residents. You can see, for example, how retail facilities are nested close to higher density residential areas. The proposed site has been located quite a distance from any residences (at least a few hundred metres) and the highway is also a buffer. UFA is very conscious of being a good neighbour. First, from a liability perspective (cannot afford to lose any of that petroleum product into the ground), they put a great deal of due diligence into maintaining and monitoring and making sure those things are protected.

Brendon Krueger (BK), UFA: UFA takes environmental stewardship very seriously. Some of the things that have been put into place are:

- An array of sensors that are detecting product loss at any given time throughout various areas between the tanks and the dispensers.
- A bladder tank that surrounds the area where the tanks are, as well as containment walls to contain any breach (no known serious breaches of this nature to Brendon's knowledge)
- Oil/water separators – any of the runoff or excess fuel goes into a cistern that separates the chemical away from the water.

UFA takes every precaution to ensure that our environmental responsibilities are being met and also maintain an ARO (Asset Retention Obligation) where money is set aside for remediation of every single site in the event of any unfortunate accident. UFA recognizes that customers, members, and owners rely on the land to support their livelihoods so take great responsibility in ensuring that we do the same.

CH: Will there be any anhydrous ammonia stored on the site?

No anhydrous ammonia or fertilizer, only bulk fuel and lubricants will be stored on the site.

CH: My property asset is in residential and could be markedly impacted by this development with a loss of value.
BK: Were you given any opportunity to express these concerns when the P4G Plan was developed?
CH: Yes, but it was not heeded.

BK: All of this information will be going to the RM and likely to the P4G as well so there may be more visibility given to these concerns.

MH: we sometimes see benefits to land values when these developments happen because it creates amenities much closer. Many times, as long as it's not right in your back yard, there could be potential benefits.

BK When the CDR is submitted to the RM it will be posted on their website so the full report including the TIA and any environmental reports will be available to the public.

Ramesh Mahabir:
When will this development start and how long will it be in existence? Who will be responsible for cleaning up the site?

BK: Development Start: UFA has very ambitious goals for the site. However, there are significant processes for the RM and P4G, so we are not sure what timelines look like. We don't know when the P4G will receive final approval. Our ideal scenario would be to provide petroleum services to customers and members in the area for harvest time in 2022, but we are not sure about timelines.

Cleanup: UFA is responsible for that. The ARO fund is set up and additional funds are added each year. Sites are usually around for 20 to 40 years. We have sites that are quite old and get updated on a regular basis. The advantage right now is that the technologies involved in these types of facilities as far as the environmental stewardship and the containment go have increased by leaps and bounds in the last ten to twenty years. Sites today are far more secure from an environmental perspective than they were even a few years ago.

Karen Bailey:
UFA is doing Phase I. For Phase II who controls which business come in? Is the whole property owned by UFA and will they help with the development of Phase II or will someone else make decisions about what goes into the other lots?

BK: Those decisions will likely fall on others. UFA was in a position where it had to purchase all 78 acres but are only occupying the 8.9-acre parcel and only roughly 5 acres of that will likely be developed on our behalf. The remainder will be sold. There will be a few more restrictions that will be put on the site (e.g., restrictions on additional petroleum sales). Other than that, the likelihood is that it will be sold to a developer or UFA will put the subdivision to an end user; it would then have to go through the RM and P4G development process which would also have a consultation phase as well.

3. Concluding Remarks by Mark Hasegawa

Comments and questions provided in this public meeting and notes from this meeting will be part of the CDR submission as an Appendix, so the questions and comments will be documented and included in the approval process. It will be submitted to the Municipality which will initiate their review process. They will go through their stakeholder review which includes all the government agencies, both provincial and municipal and then they will make final decisions based on the information provided in the CDR and whether it fits with their planning designations.

PUBLIC CONSULTATION FEEDBACK

Compilation of Questions/Concerns and Responses

Ramesh Mahabir and Karen Bailey

1. *Wildlife and Wildlife Habitat: Although the area is zoned primarily as Agricultural, it does support some wildlife. What efforts will be taken to preserve these?*

   - During our evaluation we conducted an Environmental Impact assessment screening for the development. The screening did not find any significant impact on the local wildlife.
     - The development will have significant amounts of open space and green areas.
     - The only endangered species that was noted nearby was the little brown bat, the summer habitat for these species is primarily in buildings (and sometimes in hollow trees). There are no buildings and few large trees within the area proposed for development.
   - The development area is primarily cultivated land. There are a couple smaller areas of wetland present.
     - These wetlands may require permits to disturb in subsequent phases of development, and will be done in accordance with the regulations in the following (https://www.wsask.ca/water-programs/aquatic-habitat-protection/).
     - These areas will not be disturbed until additional analysis such as a Natural Area Screening (NAS), and (if required) any required permitting is in place. Please see the following link to the RM of Corman Park's NAS (https://www.rmcormanpark.ca/296/Natural-Area-Screening-Studies).
   - For further detail on the wildlife and habitat impact, please see the following attachments:
     - Trace Environmental Services conducted an Environmental Impact Assessment screening using the project screening report from HabiSask (attached as **Schedule A)** and looked through the available aerial photographs.
     - Assessed that no further environmental impact diligence was required at this time.

2. *Water: What will be a sufficient source of potable water to the development? And what treatment options exist for the wastewater(s) that will be generated?*

   Water for the site will come from the Intervalley Water Utility line. This water flow is accessible under the condition that it is limited to 1 gallon per minute (gpm) of flow from a second line.

   - The proposed service to the site is shown on Figure 7 of the CDR – Proposed Servicing Plan (attached as **Schedule C**).
   - The UFA site will be able to work with the limits as our water use will be for basic plumbing such as washrooms and drinking water.
   - For future developments on site, businesses located in the development will need to work within this constraint. For example, they may need to create their own cistern storage onsite to accommodate their business needs.

3. *Solid Waste: We also foresee the generation of solid waste in various forms. How will these be handled and/or disposed of?*

   Disposal of solid waste will be managed through use of a waste bin for standard landfill disposal. Maintenance and costs will be borne by each lot owner/developer and disposal pick-up will be scheduled as needed.

   For the UFA location, UFA takes great pride in the condition in which we keep our sites, free of litter and debris. We work hard and employ landscaping companies to ensure we keep our sites landscaped well and very clean.

4. *Smells: What odours might be created by the various industrial processes conducted in the area, who might be directly affected, and what technology might be employed to mitigate these?*

   For UFA as the Phase 1 and initial developer, we will have a bulk filling station for our delivery trucks and a cardlock fuel dispenser. These do not generate a significant odor or related issues.

   For future other developments on site, potential odors or smells will be a function of the businesses permitted.

   - Other specific uses are unknown at this time as these other lots have not been sold. Please note that uses allowed under the land use bylaw are detailed on: www.rmcormanpark.ca/DocumentCenter/View/183/RM-Zoning-Bylaw---Bylaw-No-0994-PDF?bidId=
   - Each new development on the broader site will need to have approval of their development and line of business. Odors or smells potentially emitted from any of these uses will be reviewed and approved through the Development permit or building permit approval process.

5. *Traffic: Is the existing road network capable of handling the increase in traffic safely and effectively?*

   We have had extensive discussions and interaction with the Ministry of Highways (The Ministry) regarding access and traffic.

   - The Ministry requested that area intersections be analyzed for warranted improvements including auxiliary lanes and lighting.
   - WSP Engineering (WSP) completed a traffic impact assessment (TIA, the Assessment) study to meet these requirements.
     - The assessment focused on the intersection where Grid Road 684 meets Highway No. 16 and the intersection where Grid Road 684 meets the site access road, as these locations will experience higher traffic demand due to the development and may require remedial measures (i.e., left-turn or right-turn lanes, etc.). Highway No. 16 is a divided national highway running northwest southeast. Grid Road 684 is a paved Grid Road that was previously realigned to intersect Highway No. 16 at right angles. The Access Road includes site access to the current field to the west and a service road station to rural developments to the east. Highway No. 16 is a paved highway with a posted speed of 110 km/h. The posted limit on Grid Road 684 is 90 km/h. All study intersections are two-way stop controlled.
     - The scope of work for the TIA included assessment of current traffic and prediction of future traffic to determine the volume of traffic generated by the site. This information was then used to confirm the adequacy of the road design.
     - Based on this TIA, The Ministry confirmed that WSP does not need to investigate improvements for Highway No. 16 and Dalmeny Access intersection.
   - The Ministry indicated that the intersection is not currently considered for upgrade to an interchange, staged ramps or separated right turn roadways. The RM and Ministry did not identify any other major issues or concerns.

6. *Noise: With an increase in traffic, there will be a corresponding increase in noise. Is there a plan in place to deal with this?*

   Due to the location of this development adjacent highway 16 and its distance from other uses including residents, it is not anticipated that noise will be an issue.

   - For the initial UFA Phase 1 development, we do not anticipate significant levels of noise coming from our operation.

- For future developments on the broader site, potential noise will be a function of the businesses permitted.
  - The Development will be limited to uses allowed under Light industrial in the land use bylaw
  - The distance of this development from any residences should mitigate any local concerns around noise.
  - Noise generated from any of these new users in subsequent development will be reviewed and approved through the Development permit or building permit approval process.

7. *We have no information regarding the nature of the businesses that might occupy the Business centre and what their abilities are, individually or collectively, to deal with problems that may arise. Therefore, given the many questions that are yet to be answered, we are not able to support this development at this time.*

   UFA considers it of the upmost importance to develop its sites with strong standards with respect to the environment and has a reputation as a good neighbor throughout its network.

8. *End of life cleanup: When will this development start and how long will it be in existence? Is there any planning for end of life clean up of the site once the business cycle has completed? For example, does the business have any plans to set aside funds for removal of contaminants remaining on the site after the business departs from this location.*

   Development Start: UFA has very ambitious goals for the site. However, there are significant processes for the RM and P4G, so we are not sure what timelines look like. We don't know when the P4G will receive final approval. Our ideal scenario would be to provide petroleum services to customers and members in the area for harvest time in 2022, but we are not sure about timelines

   Cleanup: UFA is responsible for cleanup. UFA takes every precaution to ensure that our environmental responsibilities are being met and also maintains an ARO (Asset Retention Obligation) where money is set aside for remediation of every single site. Additional funds are added each year. The advantage right now is that the technologies involved in these types of facilities as far as the environmental stewardship and the containment go have increased by leaps and bounds in the last ten to twenty years. Sites today are far more secure from an environmental perspective than they were even a few years ago.

9. *UFA is doing Phase I. For Phase II who controls which business come in? Is the whole property owned by UFA and will they help with the development of Phase II or will someone else make decisions about what goes into the other lots?*

   Those decisions will likely fall on others. UFA was in a position where it had to purchase all 78 acres but is only occupying the 8.9-acre parcel and only roughly 5 acres of that will likely be developed. The remainder will be sold. There will be a few more restrictions that will be put on the site (e.g., restrictions on additional petroleum sales). Other than that, the likelihood is that it will be sold to a developer or UFA will put the subdivision to an end user; it would then have to go through the RM and P4G development process which would also have a consultation phase as well.

Curt Halpenny

10. *Study on sewer mounds: What are the results? What issues were identified and how were they dealt with?*

    We consulted with the Department of Health, and they provided some information from the area where mounds have been successful. Results of the geotechnical analysis indicated that mounds are feasible; but another option for managing such wastes is tanking the sewage and having it trucked offsite.

11. *Property value: Concerns that increased noise, odour, traffic, etc. of a commercial venture would result in a decrease in property value.*

    All of this information will be going to the RM and likely to the P4G as well so there may be more visibility given to these concerns.

    Sometimes benefits are seen to land values when these developments happen because it creates amenities much closer. Many times, as long as it's not right in your back yard, there could be potential benefits.

    When the CDR is submitted to the RM it will be posted on their website so the full report including the TIA and any environmental reports will be available to the public.

12. *Dangerous highway interchange: The highway interchange is dangerous now. Have you identified what increased traffic counts the facility would generate and can you share it? Is this out of your purview now and in the hands of Highways? I previously sold land to the Ministry of Highways to make the current interchange safer because it was even worse before, but it is not much better now. Even though the alignment is better, and the sightlines are supposed to be better, there are still fatal accidents there on a regular basis. Tractor trailers are often heard giving long airhorn blasts several times per day, which indicates to me that those are near misses of collisions. This is a potentially dangerous interchange and so the increased traffic is a concern.*

    A Traffic Impact Assessment (TIA) was performed. The Ministry of Highways is primarily interested in the increase in traffic at the intersection and access to the site. Traffic counts were done to determine the current traffic flow with Highways 16 and 684. The conclusion was that there must be a setback for a future interchange and that the current turnout across the road from Curt, just south, is an appropriate distance from the highway to gain access to the site (where the current approach is now).

    Existing traffic is counted and then they do projections based on what the development would add (speed and volume are taken into account) to determine the need for additional controls such as signals, additional lanes, etc. Yes, the report can be shared.

    Our purview is how our proposed development would impact the overall traffic flow. The overall traffic flow with respect to Highways 16 and 684 is a Ministry of Highways issue but adding the additional traffic at our intersection and determining how much more of a conflict that may create is the question we answer.

13. *Increased danger in being in close proximity to residential properties. What about the chemicals and fuel that will be stored on the site? What is the advantage of having those kinds of products in close proximity to residential areas when there are other more industrial sites within the area?*

    The current environment for petroleum products is that the secondary containment and the fuel handling and containment requirements are quite rigorous both through the Fire Code and provincial rules (21) on how to handle and maintain fuel facilities so that they don't impact neighbouring residents. You can see, for example, how retail facilities are nested close to higher density residential areas. The proposed site has been located quite a distance from any residences (at least a few hundred metres) and the highway is also a buffer. UFA is very conscious of being a good neighbour. First, from a liability perspective (cannot afford to lose any of that petroleum product into the ground), they put a great deal of due diligence into maintaining and monitoring and making sure those things are protected.

    UFA takes environmental stewardship very seriously. Some of the things that have been put into place are:

    - An array of sensors that are detecting product loss at any given time throughout various areas between the tanks and the dispensers.

- A bladder tank that surrounds the area where the tanks are, as well as containment walls to contain any breach (no known serious breaches of this nature to Brendon's knowledge)
- Oil/water separators – any of the runoff or excess fuel goes into a cistern that separates the chemical away from the water.

Michelle Husulak

14. *Dangerous highway interchange: a turning lane needs to be created on Highway 16 prior to starting construction. There are currently right turning lanes on Highway 16 turning onto Highway 684, but there is no left turning lane when travelling northwest from Saskatoon and turning southwest onto Highway 684. This is a dangerous intersection. Drivers in the left lane are driving fast, looking to pass vehicles in the right lane and often not paying attention to vehicles slowing down to turn left at this intersection. To accommodate the increased volume of traffic turning left due to the construction site and future business centre, a left turning lane is crucial.*

    To address your question there have already been extensive discussions with the Ministry of Highways, and they will also be informed of the concerns regarding this intersection. A Traffic Impact Assessment (TIA) was also conducted, and the report and recommendations are attached as well for you to review. The TIA will be included as an Appendix to the development application (Comprehensive Development Review [CDR] application). The complete application and its appendices will be available on the Corman Park website once complete and submitted. Public feedback will be included as part of the approval process.

    The Ministry of Highways is primarily interested in the increase in traffic at the intersection and access to the site. Traffic counts were done to determine the current traffic flow with Highways 16 and 684. The conclusion was that there must be a setback for a future interchange and that the current turnout is an appropriate distance from the highway to gain access to the site (where the current approach is now).

Schedules A-C

HASEGAWA
CONSULTING PROFESSIONAL ENGINEERS

Schedule A: HabiSask Project Screening Assessment

Project Screening Report

Notes:

Report Generated
08/24/2021

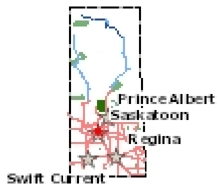
Map Information

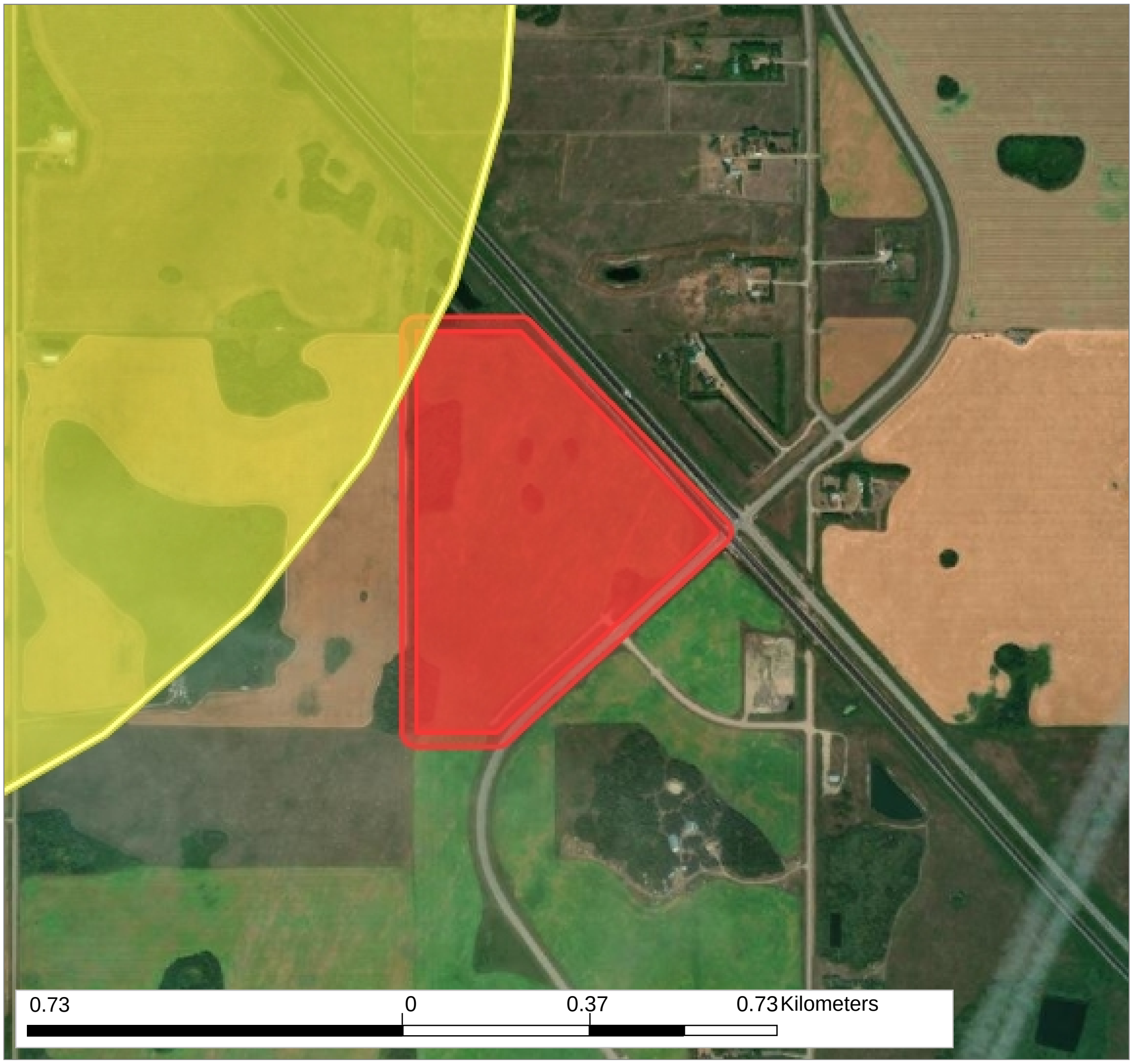
Buffer Size:

30 Meters

Coordinates:
Lat: 52.24221° N
Lon: -106.77393° W

Area of Interest





Screened Areas:

Ecological Management Specialist (EMS) District
Compliance & Field Service Area
Compliance & Field Service (CFS) Region
Area Fisheries Ecologists
Area Wildlife Ecologists
Rural Municipality
Indian Reserve
Rare and Endangered Species
Fish Species
Woodland Caribou Range
Species Predictive Models
Whooping Crane Corridor
Federal Critical Habitat
Emergency Protection Order
Wind Energy Avoidance Zones
Important Natural Areas
Provincial Parks
Recreation Sites
Game Preserves
National Wildlife Areas
Federal Pastures
Community Pastures
Wildlife Habitat Protection Act Lands
Fish & Wildlife Development Fund Lands
Migratory Bird Sanctuary
Wildlife Refuge
Conservation Easements
Crown Conservation Easements
Ecological Reserves
Ramsar Wetlands
Reservoir Development Areas
Representative Areas

Project Screening Report

Species Likely to be Present

Known Species

“Known” species are species that have known occurrences in the area from the Saskatchewan Conservation Data Centre’s Rare and Endangered Species map layer. However, absence of species observation records does not preclude the existence of species in the area of interest. Observations may simply not have been recorded for the given area or may not have yet been entered into the ministry data holdings – new observation records are continuously being discovered. Information accessible through HABISask is not intended to be a definitive statement on the presence, absence or status of a species within a given area, nor as a substitute for onsite surveys.

Rare and Endangered Species

Category: Vertebrate Animal

Common Name	Scientific Name:	G Rank	N Rank	S Rank	COSEWIC	SARA Status	Wild Species at Risk Regulations
Little Brown Myotis	*Myotis lucifugus*	G3	N2N4B, NNRN, NNRM	S4B,S4N	Endangered	Endangered	

Fish Atlas

Common Name	Scientific Name:	G Rank	N Rank	S Rank	COSEWIC	SARA Status	Wild Species at Risk Regulations

Expected Species

“Expected” is based on a modelled prediction if a species might occur in areas based upon developed statistical relationships between local and landscape characteristics and species presence. Models utilized by this report have only been created in the prairie ecozone for a selection of species. The boreal plain, boreal shield and taiga shield will not return any expected species results. Models are not a substitute for on the ground surveys to determine species presence.

Species Predictive Models

Category: Invertebrate Animal

Common Name	Scientific Name:	G Rank	N Rank	S Rank	COSEWIC	SARA Status	Wild Species at Risk Regulations
Monarch	*Danaus plexippus plexippus*	G4T3	N3B,NNRM	S2B,SNRM	Endangered	Special Concern	

Category: Vertebrate Animal

Common Name	Scientific Name:	G Rank	N Rank	S Rank	COSEWIC	SARA Status	Wild Species at Risk Regulations
American Badger	*Taxidea taxus taxus*	G5T5	N4	S3	Special Concern	Special Concern	
Baird's Sparrow	*Centronyx bairdii*	G4	N4B,N4M	S4B	Special Concern	Special Concern	
Bobolink	*Dolichonyx oryzivorus*	G5	N5B, N4N5M	S4B,S4M	Threatened	Threatened	
Burrowing Owl	*Athene cunicularia*	G4	N1N2B, N1N2M	S2B,S2M	Endangered	Endangered	Endangered
Horned Grebe	*Podiceps auritus*	G5	N5B,N5N, N5M	S5B,S5M	Special Concern	Special Concern	
Northern Harrier	*Circus hudsonius*	G5	N5B,N4N	S4B,S4M	Not at Risk		
Sprague's Pipit	*Anthus spragueii*	G3G4	N3N4B, N3N4M	S3B,S3M	Threatened	Threatened	

Whooping Crane Corridor 50% Core Area

Whooping Crane Corridor 95% Core Area

Whooping Crane Corridor 75% Core Area

Woodland Caribou Habitat

Detailed information concerning woodland caribou habitat, administration units and Caribou Habitat Management areas is provided below.

Currently, information on woodland caribou habitat potential is not available in this report, but users are encouraged to view the dataset “Woodland Caribou Habitat Potential” to determine whether your project falls within high, moderate or low caribou habitat potential areas.

Caribou Conservation Unit(s): Nothing found

Caribou Administrative Unit(s): Nothing found

Caribou Habitat Management Area Tier category: Nothing found

Species with Critical Habitat Present

Project Screening Report

This dataset displays the geographic areas within which federal Critical Habitat for species at risk listed on Schedule 1 of the federal Species at Risk Act (SARA) occurs in Saskatchewan. Please be aware that not all of the area within these boundaries is necessarily Critical Habitat. To determine if a specific area is Critical Habitat and if your activity might be considered "destruction" of Critical Habitat, other information available in each individual species' Recovery documents (http://www.sararegistry.gc.ca) need to be considered, including biophysical attributes and activities likely to result in destruction of Critical Habitat.

Note that recovery documents (and therefore Critical Habitat) may be amended from time to time. Species are added as the data becomes ready, which may occur after the recovery document has been posted on the SAR Public Registry. Although HABISask will try to provide the latest data, the SAR Public Registry should always be considered as the official source for Critical Habitat information.

Common Name	Scientific Name:	G Rank	N Rank	S Rank	COSEWIC	SARA Status	Wild Species at Risk Regulations
No Critical Habitat found							

Emergency Protection Order

This dataset is comprised of areas under the federal Emergency Order for the Protection of the Greater Sage-Grouse in Canada. The exterior extent polygons are derived from the detailed dataset of the Government of Canada Emergency Order dataset. For specific information regarding the order and the prohibitions set out in the Emergency Order please consult the official documents on the Species at Risk Registry (sararegistry.gc.ca)

Common Name	Scientific Name
No species found	

Important Natural Areas

Important Natural Areas are sites in Saskatchewan that are considered to have conservation significance, but are not necessarily legally protected.

Name	Type
Nothing Found	

Wind Turbine Avoidance Zones Present

The Wind Energy Avoidance Zones were designed to enhance environmental protection and provide more certainty to future wind energy developments. These guidelines clearly identify environmentally sensitive areas that should be avoided for projects that include the siting of wind turbines but can be helpful in siting any development project. The complete report entitled, Wildlife Siting Guidelines for Saskatchewan Wind Energy Projects, can be found on the Government of Saskatchewan website or by selecting the following link: https://publications.saskatchewan.ca/#/categories/78

Land Type
No Zone Present

Managed Areas

Managed areas are a diverse collection of lands and waters on which the conservation of biodiversity and ecosystem function are among the goals of the land management programs. Each of the unique or sensitive landscapes, within the network of managed areas, have some level of protection or activity restrictions placed on them by legislation, agreement or policy. These lands include provincial and national parks, ecological reserves, wildlife lands, game preserves, conservation easements and other privately held stewardship lands.

Conservation Easement

Nothing Found

Crown Conservation Easement

Nothing Found

Ecological Reserve

Nothing Found

Fish & Wildlife Development Fund (FWDF)

Nothing Found

Former Federal Pasture

Nothing Found

Game Preserve

Nothing Found

Migratory Bird Sanctuary

Nothing Found

National Wildlife Area

Nothing Found

Provincial Park

Nothing Found

Provincial Pasture

Nothing Found

Ramsar Wetland

Nothing Found

Recreation Site

Nothing Found

Representative Area Ecological Reserve

Nothing Found

Reservoir Development Area

Nothing Found

Wildlife Habitat Protection Act (WHPA)

Nothing Found

Wildlife Refuge

Nothing Found

Rare and Endangered Species Occurrences

The absence of information provided by the Saskatchewan Conservation Data Centre (SKCDC) does not categorically mean the absence of sensitive species or features. The quantity and quality for data collected by the SKCDC are dependent on the research and observations of many individuals and organizations. SKCDC reports summarize the existing natural heritage information, known to the SKCDC, at the time of the request.

SKCDC data should never be regarded as final statements on the elements or areas being considered, nor should they be substituted for on-site surveys required for environmental assessments. The user therefore acknowledges that the absence of data may indicate that the project area has not been surveyed, rather than confirm that the area lacks natural heritage resources.

Occurrence ID:	9999101037	**First Observation:**	1980-09-02
Occurrence Class:	Vertebrate Animal	**Last Observation:**	1989-09-08
Scientific Name:	Myotis lucifugus		
Common Name:	Little Brown Myotis		
Occurrence Rank:			
General Description:	Species detected (1980, 1989)		
Occurrence Data:			
Directions:	CORMAN PARK		

Wild Species Research Permitting

A Research Permit is required to detect or observe plants or wildlife for commercial purposes, such as pre-screening surveys to collect baseline data or other activities, or to conduct academic research. Research Permits are not required if you are doing surveys for personal, recreational, educational or other non-commercial purposes. Revisions were made to Section 21 of The Wildlife Act in 2015 and to Section 6.2 of The Wildlife Regulations in 2016.

See the Government of Saskatchewan Wild Species Research Permitting page for more information.

All forms and related information pertaining to Research Permits can be found in the Publications Centre. Be sure to check out the Conservation Standards Terms and Conditions for Research Permits for general, wildlife and research-specific and information submission conditions that pertain to all research permits.

Subscribe to our Mail-out List Subscriptions for updates regarding Species Detection Permits, SKCDC Lists and Ranks, Legislation and Policy and HABISask.

Species Detection Survey Protocols

The Species Detection Survey Protocols are used to detect rare and sensitive species so Activity Restriction Guidelines can be applied. Their use is required by industry/ environmental consultants for proposed or existing commercial activities.

Activity Restriction Guidelines for Sensitive Species

The Activity Restriction Guidelines for Sensitive Species outline restricted activity periods and distance setbacks for rare and sensitive species to assist proponents in minimizing impacts to rare and sensitive species and habitats.

Administrative Areas

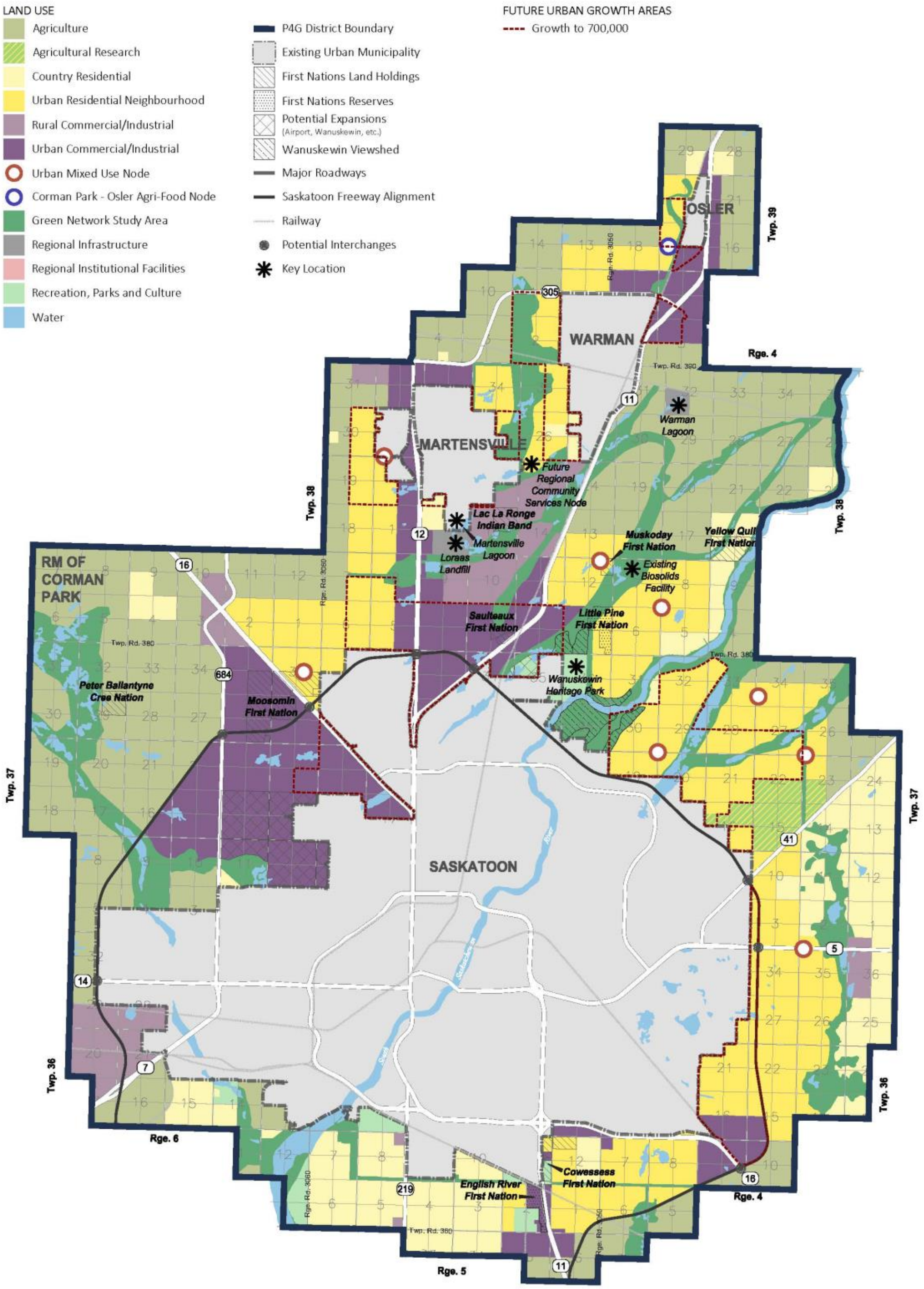
8	Ecological Management Specialist (EMS) District(s)
Saskatoon	Compliance and Field Services Area(s)
Saskatoon	Compliance and Field Services Region(s)
Saskatoon	Area Fisheries Ecologist Area(s)
YORKTON	Area Wildlife Ecologist(s)
344 - CORMAN PARK	Rural Municipality
Nothing Found	First Nation Reserve

Contact Us

For more information, please contact our Client Service Office:
Email: centre.inquiry@gov.sk.ca
Tel (toll free in North America): 1-800-567-4224
Tel (Regina): 306-787-2584

SASKATOON NORTH PARTNERSHIP FOR GROWTH

SCHEDULE B: DISTRICT LAND USE

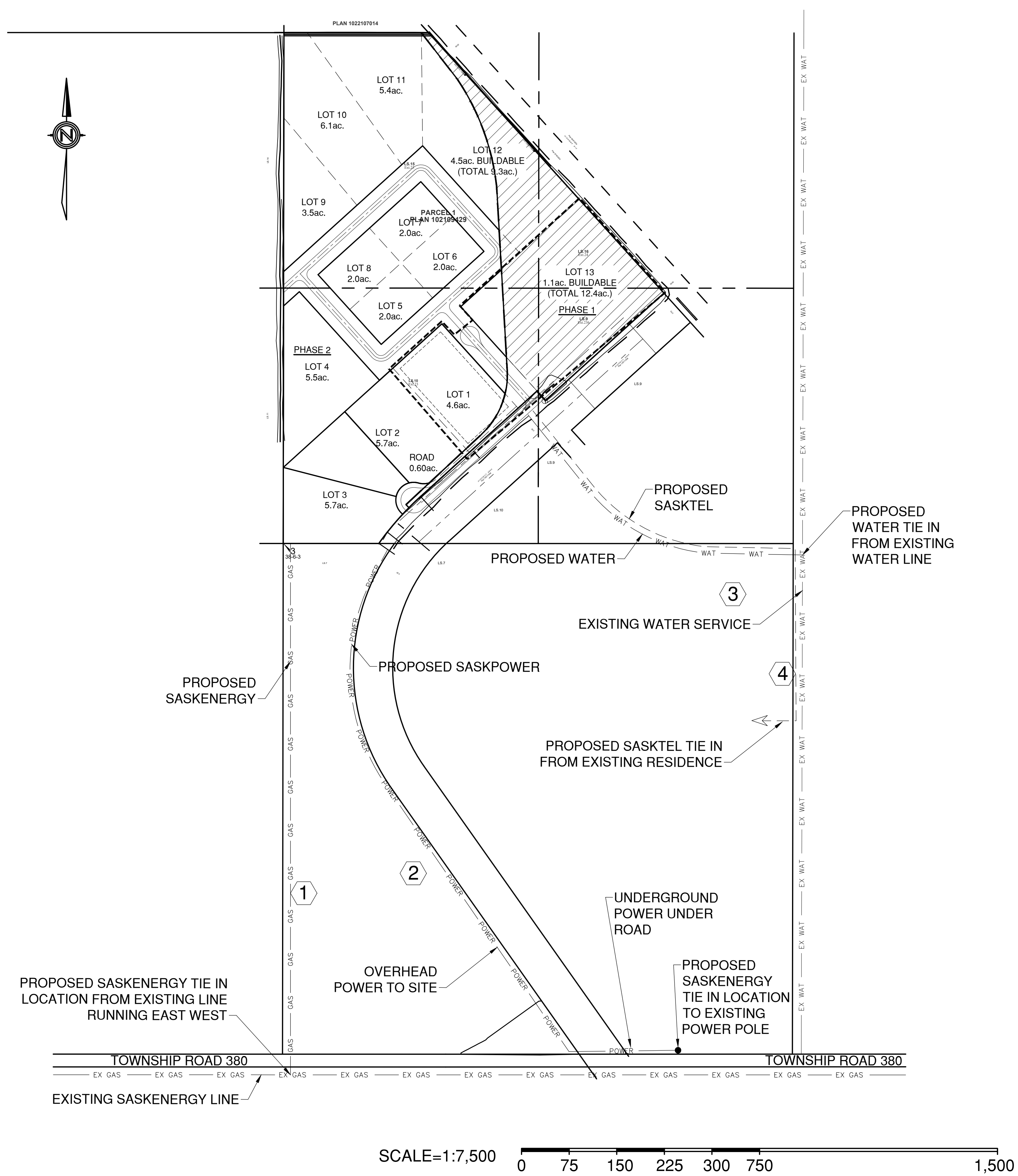


NOTE: The information contained on this map is for reference only and should not be used for legal purposes. All proposed line work is subject to change. This map may not be reproduced without the expressed written consent of the Saskatoon North Partnership for Growth.

DRAWING NOT TO BE SCALED
June 10, 2020

N:\Planning\MAPPING\Wall_Maps\P4G\District OCP\P4G_DISTRICT OCP.dwg (11x17)

Schedule C: CDR Figure 7. Proposed Servicing Plan



NOTES:

1 UTILITY INFORMATION CONTAINED ON THIS SHEET REPRESENTS CONCEPTS PROVIDED BY LOCAL UTILITY SERVICE PROVIDERS. THIS INFORMATION IS DIAGRAMMATIC AND SUBJECT TO CHANGE BASED ON INDIVIDUAL UTILITY SERVICE PROVIDER DESIGN CHANGES.

KEY NOTES:

1. PROPOSED SASKENERGY NATURAL GAS LINE SOURCED FROM EXISTING LINE ALONG TWP RD 380 APPROXIMATELY 1,000m SOUTH.
2. PROPOSED SASKPOWER 25KV OVERHEAD LINE SOURCED FROM EXISTING LINE ALONG TWP RD 380 APPROXIMATELY 1,000m SOUTH.
3. PROPOSED WATER LINE EXTENSION SOURCED FROM WATER CO-OP EXISTING INFRASTRUCTURE APPROXIMATELY 600m EAST.
4. PROPOSED TELECOMMUNICATIONS EXTENSION SOURCED FROM EXISTING INFRASTRUCTURE APPROXIMATELY 600m EAST.

LEGEND:

— — — — — — —	SASKTEL TELECOMMUNICATIONS
—— POWER —— POWER ——	PROPOSED SASKPOWER
—— EX GAS —— EX GAS ——	EXSTING SASKENERGY
—— GAS —— GAS ——	PROPOSED SASKENERGY
—— EX WAT —— EX WAT ——	EXISTING WATER LINE
—— WAT —— WAT ——	PROPOSED WATER LINE

ISSUE	DRAWING STATUS / REVISION	DATE (YY/MM/DD)	BY
A	FOR APPROVAL	21/11/19	DPB

DESIGNED	DRAWN	CHECKED	APPROVED	SCALE AND SHEET SIZE
MAH	DPB	HE	MAH	AS SHOWN

HASEGAWA
CONSULTING PROFESSIONAL ENGINEERS

330, 3120 - 32nd Street South, Lethbridge, Alberta T1K 7B4
P: 403-328-2686 F: 403-328-2728 E: office@hasegawa.ca

NOTES

CLIENT
HASEGAWA ENGINEERING

PROJECT
CORMAN 78ac. DEVELOPMENT

DRAWING
PROPOSED SERVICING PLAN

PROJECT NUMBER	SHEET NUMBER
21-050	FIGURE 7

HASEGAWA
CONSULTING PROFESSIONAL ENGINEERS

1220-31 Street North
Lethbridge, AB T1H 5J8
Bus: 403-328-2686
Fax: 403-328-2728
E-mail: office@hasegawa.ca

December 14, 2021 **Our File #: 21-050**

Ramesh Mahabir
Karen Bailey [redacted]

Re: Corman Corner Agribusiness Centre

Thank you for sharing your concerns and questions regarding the development of the Corman Corner Agribusiness Centre.

This development was initially driven by the RM of Corman Park's decision in 2010 to adopt the Saskatoon North Partnership for Growth (also known as the P4G). The proposed development for this area is for rural industrial/commercial use (refer to schedule B attached). Our plans have been put forward and are complemented by significant due diligence around the impact to the area, including Environmental Impact Screening, Historical Resources review, Geotechnical Analysis, Drainage Analysis, and Traffic Impact Assessment.

We believe that this is an ideal location for services and businesses that will bring additional opportunity, employment, and growth to this area in an environmentally and socially responsible manner.

Our client and the developer of the Phase 1 portion of the development (approximately 9 of the 78 acres) is UFA Cooperative Ltd (UFA). UFA is a producer-owned agribusiness cooperative that serves 125,000 members across Western Canada. This 9-acre portion will be used for the development of a site for fuel distribution, including bulk, cardlock and lubricant products. These products will be an important offering for local farmers, businesses, and residents.

As a community-focused cooperative UFA is committed to being a constructive partner in the communities it serves and to developing its sites in alignment with strong adherence to environmental and safety standards. Some key elements of the standards that will be in place at this site include.

1. Oil-water separators and electronic inventory control systems to ensure that there is no impact from our operations to local groundwater.
2. The latest in tank berms and safety equipment.
3. Operators that are held to the highest standards in our industry.

Please see the following responses to your questions. These responses are complemented by several detailed schedules (A-C) to provide additional colour. UFA will also follow up with you to ensure that your questions are appropriately and completely addressed.

Sincerely,

Mark Hasegawa

Mark Hasegawa, P.Eng., P.E.
HASEGAWA
CONSULTING PROFESSIONAL ENGINEERS

Reponses to questions:

1. Wildlife and Wildlife Habitat: *Although the area is zoned primarily as Agricultural, it does support some wildlife. What efforts will be taken to preserve these?*

- During our evaluation we conducted an Environmental Impact assessment screening for the development. The screening did not find any significant impact on the local wildlife.
  - The development will have significant amounts of open space and green areas.
  - The only endangered species that was noted nearby was the little brown bat, the summer habitat for these species is primarily in buildings (and sometimes in hollow trees). There are no buildings and few large trees within the area proposed for development.
- The development area is primarily cultivated land. There are a couple smaller areas of wetland present.
  - These wetlands may require permits to disturb in subsequent phases of development, and will be done in accordance with the regulations in the following (https://www.wsask.ca/water-programs/aquatic-habitat-protection/).
  - These areas will not be disturbed until additional analysis such as a Natural Area Screening (NAS), and (if required) any required permitting is in place. Please see the following link to the RM of Corman Park's NAS (https://www.rmcormanpark.ca/296/Natural-Area-Screening-Studies).
- For further detail on the wildlife and habitat impact, please see the following attachments:
  - Trace Environmental Services conducted an Environmental Impact assessment screening using the project screening report from HabiSask (attached as **Schedule A)** and looked through the available aerial photographs.
  - Assessed that no further environmental impact diligence was required at this time.

2. Water: *What will be a sufficient source of potable water to the development? And what treatment options exist for the wastewater(s) that will be generated?*

Water for the site will come from the Intervalley Water Utility line. This water flow is accessible under the condition that it is limited to 1 gallon per minute (gpm) of flow from a second line.

- The proposed service to the site is shown on Figure 7 of the CDR – Proposed Servicing Plan (attached as **Schedule C**).
- The UFA site will be able to work with the limits as our water use will be for basic plumbing such as washrooms and drinking water.
- For future developments on site, businesses located in the development will need to work within this constraint. For example, they may need to create their own cistern storage onsite to accommodate their business needs.

3. Solid Waste: We foresee also the generations of solid waste in various forms. How will these be handled and/or disposed of?

Disposal of solid waste will be managed through use of a waste bin for standard landfill disposal. Maintenance and costs will be borne by each lot owner/developer and disposal pick-up will be scheduled as needed.

For the UFA location, UFA takes great pride in the condition in which we keep our sites, free of litter and debris. We work hard and employ landscaping companies to ensure we keep our sites landscaped well and very clean.

4. *Smells: What odours might be created by the various industrial processes conducted in the area, who might be directly affected, and what technology might be employed to mitigate these?*

For UFA as the Phase 1 and initial developer, we will have a bulk filling station for our delivery trucks and a cardlock fuel dispenser. These do not generate a significant odor or related issues.

For future other developments on site, potential odors or smells will be a function of the businesses permitted.

- Other specific uses are unknown at this time as these other lots have not been sold. Please note that uses allowed under the land use bylaw are detailed on www.rmcormanpark.ca/DocumentCenter/View/183/RM-Zoning-Bylaw---Bylaw-No-0994-PDF?bidId=
- Each new development on the broader site will need to have approval of their development and line of business. Odors or smells potentially emitted from any of these uses will be reviewed and approved through the Development permit or building permit approval process.

5. *Traffic: Is the existing road network capable of handling the increase in traffic safely and effectively?*

   We have had extensive discussions and interaction with the Ministry of Highways (The Ministry) regarding access and traffic.

- The Ministry requested that area intersections be analyzed for warranted improvements including auxiliary lanes and lighting.
- WSP Engineering (WSP) completed a traffic impact assessment (TIA, the Assessment) study to meet these requirements.
  - The assessment focused on the intersection where Grid Road 684 meets Highway No. 16 and the intersection where Grid Road 684 meets the site access road, as these locations will experience higher traffic demand due to the development and may require remedial measures (i.e., left-turn or right-turn lanes, etc.). Highway No. 16 is a divided national highway running northwest southeast. Grid Road 684 is a paved Grid Road that was previously realigned to intersect Highway No. 16 at right angles. The Access Road includes site access to the current field to the west and a service road station to rural developments to the east. Highway No. 16 is a paved highway with a posted speed of 110 km/h. The posted limit on Grid Road 684 is 90 km/h. All study intersections are two-way stop controlled.
  - The scope of work for the TIA included assessment of current traffic and prediction of future traffic to determine the volume of traffic generated by the site. This information was then used to confirm the adequacy of the road design.
  - Based on this TIA, The Ministry confirmed that WSP does not need to investigate improvements for Highway No. 16 and Dalmeny Access intersection.
- The Ministry indicated that the intersection is not currently considered for upgrade to an interchange, staged ramps or separated right turn roadways. The RM and Ministry did not identify any other major issues or concerns.

6. *Noise: With an increase in traffic, there will be a corresponding increase in noise. Is there a plan in place to deal with this?*

   Due to the location of this development adjacent highway 16 and its distance from other uses including residents, it is not anticipated that noise will be an issue.

   - For the initial UFA phase 1 development, we do not anticipate significant levels of noise coming from our operation.

- For future developments on the broader site, potential noise will be a function of the businesses permitted.
    - The Development will be limited to uses allowed under Light industrial in the land use bylaw
    - The distance of this development from any residences should mitigate any local concerns around noise.
    - Noise generated from any of these new users in subsequent development will be reviewed and approved through the Development permit or building permit approval process.

7. *We have no information regarding the nature of the businesses that might occupy the Business centre and what their abilities are, individually or collectively, to deal with problems that may arise. Therefore, given the many questions that are yet to be answered, we are not in a position to support this development at this time.*

UFA considers it of the upmost importance to develop its sites with strong standards with respect to the environment and has a reputation as a good neighbor throughout its network.

We will strive to provide excellent service to this community and provide our customers with our products and services.

This development will create growth and opportunities in the region, and in conjunction with the plans already in place, will be done under the regulatory approval of the local government.

We look forward to future discussions and hope that we can gain your support for this important development.

Schedules A-C

Schedule A: HabiSask Project Screening Assessment

Project Screening Report

Notes:

Report Generated
08/24/2021

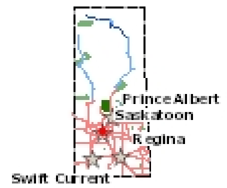
Map Information

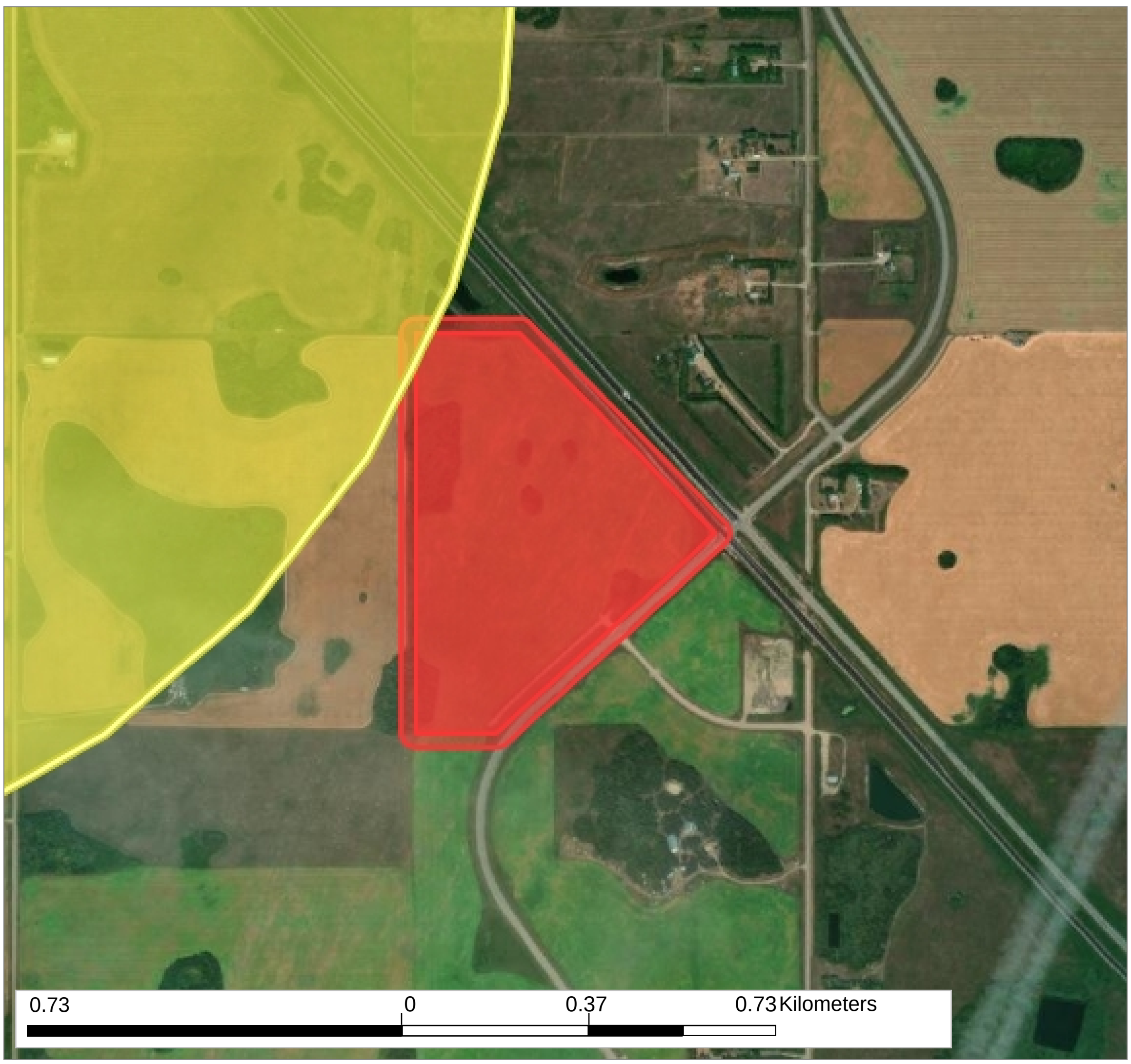
Buffer Size:

30 Meters

Coordinates:
Lat: 52.24221° N
Lon: -106.77393° W

Area of Interest





Screened Areas:

- Ecological Management Specialist (EMS) District
- Compliance & Field Service Area
- Compliance & Field Service (CFS) Region
- Area Fisheries Ecologists
- Area Wildlife Ecologists
- Rural Municipality
- Indian Reserve
- Rare and Endangered Species
- Fish Species
- Woodland Caribou Range
- Species Predictive Models
- Whooping Crane Corridor
- Federal Critical Habitat
- Emergency Protection Order
- Wind Energy Avoidance Zones
- Important Natural Areas
- Provincial Parks
- Recreation Sites
- Game Preserves
- National Wildlife Areas
- Federal Pastures
- Community Pastures
- Wildlife Habitat Protection Act Lands
- Fish & Wildlife Development Fund Lands
- Migratory Bird Sanctuary
- Wildlife Refuge
- Conservation Easements
- Crown Conservation Easements
- Ecological Reserves
- Ramsar Wetlands
- Reservoir Development Areas
- Representative Areas

Project Screening Report

Species Likely to be Present

Known Species

"Known" species are species that have known occurrences in the area from the Saskatchewan Conservation Data Centre's Rare and Endangered Species map layer. However, absence of species observation records does not preclude the existence of species in the area of interest. Observations may simply not have been recorded for the given area or may not have yet been entered into the ministry data holdings – new observation records are continuously being discovered. Information accessible through HABISask is not intended to be a definitive statement on the presence, absence or status of a species within a given area, nor as a substitute for onsite surveys.

Rare and Endangered Species

Category: Vertebrate Animal

Common Name	Scientific Name:	G Rank	N Rank	S Rank	COSEWIC	SARA Status	Wild Species at Risk Regulations
Little Brown Myotis	*Myotis lucifugus*	G3	N2N4B, NNRN, NNRM	S4B,S4N	Endangered	Endangered	

Fish Atlas

Common Name	Scientific Name:	G Rank	N Rank	S Rank	COSEWIC	SARA Status	Wild Species at Risk Regulations

Expected Species

"Expected" is based on a modelled prediction if a species might occur in areas based upon developed statistical relationships between local and landscape characteristics and species presence. Models utilized by this report have only been created in the prairie ecozone for a selection of species. The boreal plain, boreal shield and taiga shield will not return any expected species results. Models are not a substitute for on the ground surveys to determine species presence.

Species Predictive Models

Category: Invertebrate Animal

Common Name	Scientific Name:	G Rank	N Rank	S Rank	COSEWIC	SARA Status	Wild Species at Risk Regulations
Monarch	*Danaus plexippus plexippus*	G4T3	N3B,NNRM	S2B,SNRM	Endangered	Special Concern	

Category: Vertebrate Animal

Common Name	Scientific Name:	G Rank	N Rank	S Rank	COSEWIC	SARA Status	Wild Species at Risk Regulations
American Badger	*Taxidea taxus taxus*	G5T5	N4	S3	Special Concern	Special Concern	
Baird's Sparrow	*Centronyx bairdii*	G4	N4B,N4M	S4B	Special Concern	Special Concern	
Bobolink	*Dolichonyx oryzivorus*	G5	N5B, N4N5M	S4B,S4M	Threatened	Threatened	
Burrowing Owl	*Athene cunicularia*	G4	N1N2B, N1N2M	S2B,S2M	Endangered	Endangered	Endangered
Horned Grebe	*Podiceps auritus*	G5	N5B,N5N, N5M	S5B,S5M	Special Concern	Special Concern	
Northern Harrier	*Circus hudsonius*	G5	N5B,N4N	S4B,S4M	Not at Risk		
Sprague's Pipit	*Anthus spragueii*	G3G4	N3N4B, N3N4M	S3B,S3M	Threatened	Threatened	

Whooping Crane Corridor 50% Core Area

Whooping Crane Corridor 95% Core Area

Whooping Crane Corridor 75% Core Area

Woodland Caribou Habitat

Detailed information concerning woodland caribou habitat, administration units and Caribou Habitat Management areas is provided below.

Currently, information on woodland caribou habitat potential is not available in this report, but users are encouraged to view the dataset "Woodland Caribou Habitat Potential" to determine whether your project falls within high, moderate or low caribou habitat potential areas.

Caribou Conservation Unit(s): Nothing found

Caribou Administrative Unit(s): Nothing found

Caribou Habitat Management Area Tier category: Nothing found

Species with Critical Habitat Present

This dataset displays the geographic areas within which federal Critical Habitat for species at risk listed on Schedule 1 of the federal Species at Risk Act (SARA) occurs in Saskatchewan. Please be aware that not all of the area within these boundaries is necessarily Critical Habitat. To determine if a specific area is Critical Habitat and if your activity might be considered "destruction" of Critical Habitat, other information available in each individual species' Recovery documents (http://www.sararegistry.gc.ca) need to be considered, including biophysical attributes and activities likely to result in destruction of Critical Habitat.

Note that recovery documents (and therefore Critical Habitat) may be amended from time to time. Species are added as the data becomes ready, which may occur after the recovery document has been posted on the SAR Public Registry. Although HABISask will try to provide the latest data, the SAR Public Registry should always be considered as the official source for Critical Habitat information.

Common Name	Scientific Name:	G Rank	N Rank	S Rank	COSEWIC	SARA Status	Wild Species at Risk Regulations
No Critical Habitat found							

Emergency Protection Order

This dataset is comprised of areas under the federal Emergency Order for the Protection of the Greater Sage-Grouse in Canada. The exterior extent polygons are derived from the detailed dataset of the Government of Canada Emergency Order dataset. For specific information regarding the order and the prohibitions set out in the Emergency Order please consult the official documents on the Species at Risk Registry (sararegistry.gc.ca)

Common Name	Scientific Name
No species found	

Important Natural Areas

Important Natural Areas are sites in Saskatchewan that are considered to have conservation significance, but are not necessarily legally protected.

Name	Type
Nothing Found	

Wind Turbine Avoidance Zones Present

The Wind Energy Avoidance Zones were designed to enhance environmental protection and provide more certainty to future wind energy developments. These guidelines clearly identify environmentally sensitive areas that should be avoided for projects that include the siting of wind turbines but can be helpful in siting any development project. The complete report entitled, Wildlife Siting Guidelines for Saskatchewan Wind Energy Projects, can be found on the Government of Saskatchewan website or by selecting the following link: https://publications.saskatchewan.ca/#/categories/78

Land Type
No Zone Present

Managed Areas

Managed areas are a diverse collection of lands and waters on which the conservation of biodiversity and ecosystem function are among the goals of the land management programs. Each of the unique or sensitive landscapes, within the network of managed areas, have some level of protection or activity restrictions placed on them by legislation, agreement or policy. These lands include provincial and national parks, ecological reserves, wildlife lands, game preserves, conservation easements and other privately held stewardship lands.

Conservation Easement

Nothing Found

Crown Conservation Easement

Nothing Found

Ecological Reserve

Nothing Found

Fish & Wildlife Development Fund (FWDF)

Nothing Found

Former Federal Pasture

Nothing Found

Game Preserve

Nothing Found

Migratory Bird Sanctuary

Nothing Found

National Wildlife Area

Nothing Found

Provincial Park

Nothing Found

Provincial Pasture

Nothing Found

Ramsar Wetland

Nothing Found

Recreation Site

Nothing Found

Representative Area Ecological Reserve

Nothing Found

Reservoir Development Area

Nothing Found

Wildlife Habitat Protection Act (WHPA)

Nothing Found

Wildlife Refuge

Nothing Found

Project Screening Report

Rare and Endangered Species Occurrences

The absence of information provided by the Saskatchewan Conservation Data Centre (SKCDC) does not categorically mean the absence of sensitive species or features. The quantity and quality for data collected by the SKCDC are dependent on the research and observations of many individuals and organizations. SKCDC reports summarize the existing natural heritage information, known to the SKCDC, at the time of the request.

SKCDC data should never be regarded as final statements on the elements or areas being considered, nor should they be substituted for on-site surveys required for environmental assessments. The user therefore acknowledges that the absence of data may indicate that the project area has not been surveyed, rather than confirm that the area lacks natural heritage resources.

Occurrence ID:	9999101037	**First Observation:**	1980-09-02
Occurrence Class:	Vertebrate Animal	**Last Observation:**	1989-09-08
Scientific Name:	Myotis lucifugus		
Common Name:	Little Brown Myotis		
Occurrence Rank:			
General Description:	Species detected (1980, 1989)		
Occurrence Data:			
Directions:	CORMAN PARK		

Wild Species Research Permitting

A Research Permit is required to detect or observe plants or wildlife for commercial purposes, such as pre-screening surveys to collect baseline data or other activities, or to conduct academic research. Research Permits are not required if you are doing surveys for personal, recreational, educational or other non-commercial purposes. Revisions were made to Section 21 of The Wildlife Act in 2015 and to Section 6.2 of The Wildlife Regulations in 2016.

See the Government of Saskatchewan Wild Species Research Permitting page for more information.

All forms and related information pertaining to Research Permits can be found in the Publications Centre. Be sure to check out the Conservation Standards Terms and Conditions for Research Permits for general, wildlife and research-specific and information submission conditions that pertain to all research permits.

Subscribe to our Mail-out List Subscriptions for updates regarding Species Detection Permits, SKCDC Lists and Ranks, Legislation and Policy and HABISask.

Species Detection Survey Protocols

The Species Detection Survey Protocols are used to detect rare and sensitive species so Activity Restriction Guidelines can be applied. Their use is required by industry/ environmental consultants for proposed or existing commercial activities.

Activity Restriction Guidelines for Sensitive Species

The Activity Restriction Guidelines for Sensitive Species outline restricted activity periods and distance setbacks for rare and sensitive species to assist proponents in minimizing impacts to rare and sensitive species and habitats.

Administrative Areas

8	Ecological Management Specialist (EMS) District(s)
Saskatoon	Compliance and Field Services Area(s)
Saskatoon	Compliance and Field Services Region(s)
Saskatoon	Area Fisheries Ecologist Area(s)
YORKTON	Area Wildlife Ecologist(s)
344 - CORMAN PARK	Rural Municipality
Nothing Found	First Nation Reserve

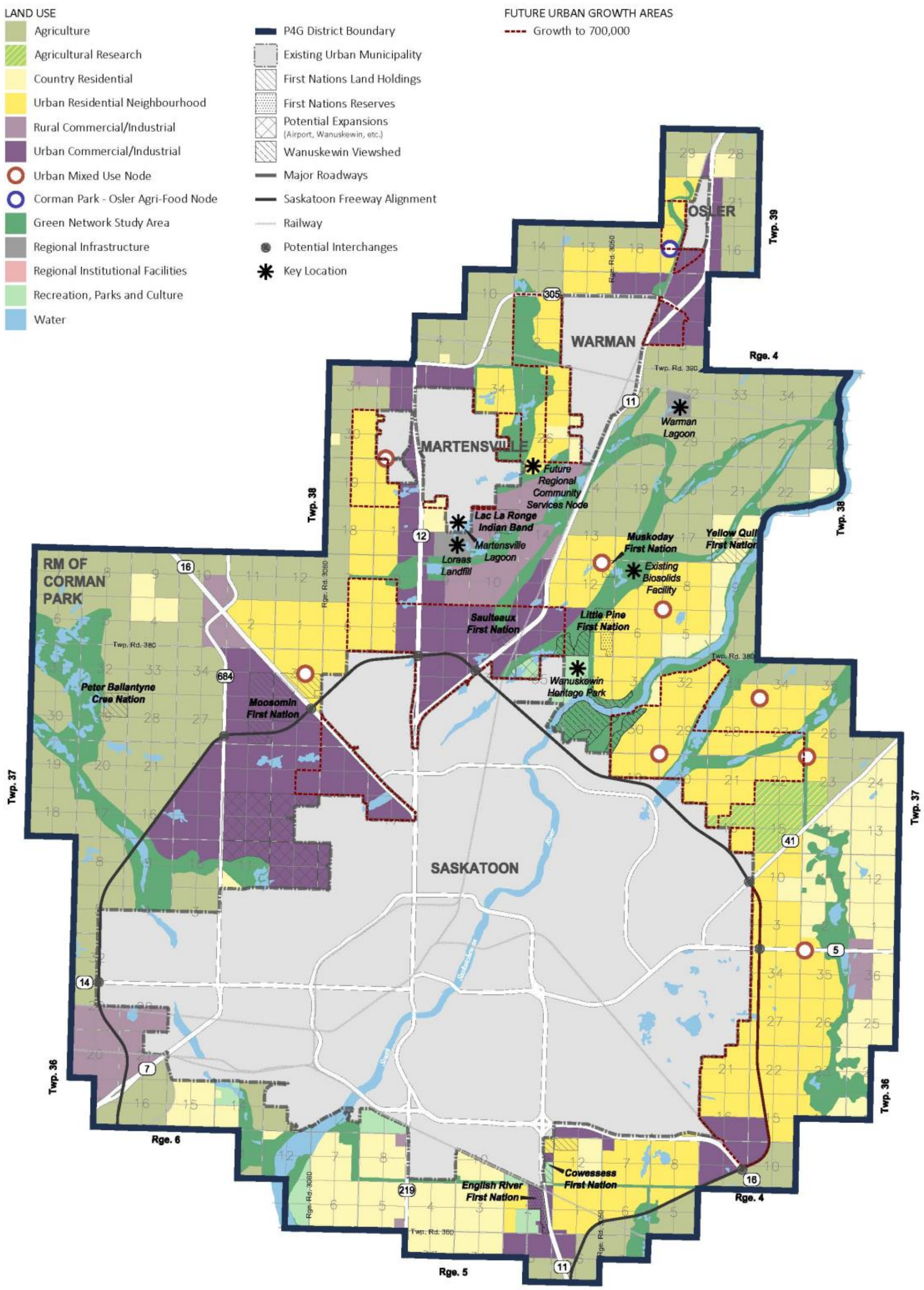
Contact Us

For more information, please contact our Client Service Office:
Email: centre.inquiry@gov.sk.ca
Tel (toll free in North America): 1-800-567-4224
Tel (Regina): 306-787-2584

HASEGAWA
CONSULTING PROFESSIONAL ENGINEERS

SASKATOON NORTH PARTNERSHIP FOR GROWTH

SCHEDULE B: DISTRICT LAND USE



NOTE: The information contained on this map is for reference only and should not be used for legal purposes. All proposed line work is subject to change. This map may not be reproduced without the expressed written consent of the Saskatoon North Partnership for Growth.

DRAWING NOT TO BE SCALED
June 10, 2020

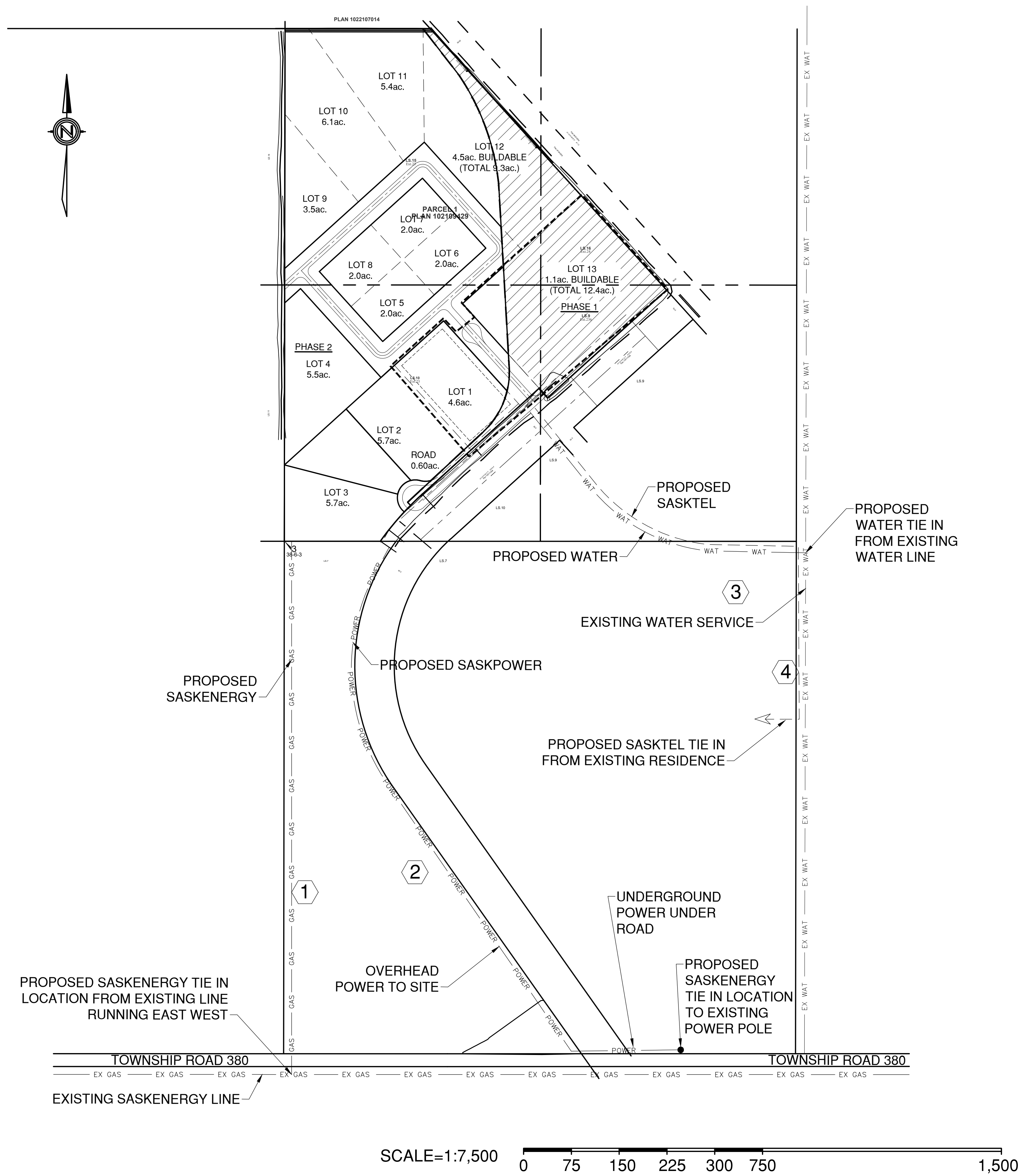
N:\Planning\MAPPING\Wall_Maps\P4G\District OCP\P4G_DISTRICT OCP.dwg (11x17)

HASEGAWA
CONSULTING PROFESSIONAL ENGINEERS

Schedule C: CDR Figure 7. Proposed Servicing Plan

ISSUE	DRAWING STATUS / REVISION	DATE (YY/MM/DD)	BY
A	FOR APPROVAL	21/11/19	DPB

DESIGNED	DRAWN	CHECKED	APPROVED	SCALE AND SHEET SIZE
MAH	DPB	HE	MAH	AS SHOWN



NOTES:

1 UTILITY INFORMATION CONTAINED ON THIS SHEET REPRESENTS CONCEPTS PROVIDED BY LOCAL UTILITY SERVICE PROVIDERS. THIS INFORMATION IS DIAGRAMMATIC AND SUBJECT TO CHANGE BASED ON INDIVIDUAL UTILITY SERVICE PROVIDER DESIGN CHANGES.

KEY NOTES:

1. PROPOSED SASKENERGY NATURAL GAS LINE SOURCED FROM EXISTING LINE ALONG TWP RD 380 APPROXIMATELY 1,000m SOUTH.
2. PROPOSED SASKPOWER 25KV OVERHEAD LINE SOURCED FROM EXISTING LINE ALONG TWP RD 380 APPROXIMATELY 1,000m SOUTH.
3. PROPOSED WATER LINE EXTENSION SOURCED FROM WATER CO-OP EXISTING INFRASTRUCTURE APPROXIMATELY 600m EAST.
4. PROPOSED TELECOMMUNICATIONS EXTENSION SOURCED FROM EXISTING INFRASTRUCTURE APPROXIMATELY 600m EAST.

LEGEND:

— — — — — —	SASKTEL TELECOMMUNICATIONS
—— POWER —— POWER ——	PROPOSED SASKPOWER
—— EX GAS —— EX GAS ——	EXSTING SASKENERGY
—— GAS —— GAS ——	PROPOSED SASKENERGY
—— EX WAT —— EX WAT ——	EXISTING WATER LINE
—— WAT —— WAT ——	PROPOSED WATER LINE

HASEGAWA
CONSULTING PROFESSIONAL ENGINEERS
330, 3120 - 32nd Street South, Lethbridge, Alberta T1K 7B4
P: 403-328-2686 F: 403-328-2728 E: office@hasegawa.ca

NOTES

CLIENT
HASEGAWA ENGINEERING

PROJECT
CORMAN 78ac. DEVELOPMENT

DRAWING
PROPOSED SERVICING PLAN

PROJECT NUMBER 21-050

SHEET NUMBER FIGURE 7

carol.s@hasegawa.ca

To:	michelle.husulak@gmail.com
Cc:	Mark Hasegawa; Liam Whitelaw; David Reifferscheid; Brendon Krueger; Steven Marshall; Jordan Michel; Dragan Karanovic; Mark Tse
Subject:	Response to Corman Corner Inquiry
Attachments:	PRESENTATION_2021-12-15_Public Consultation Corman Park.pptx; APP D-RPT - 211-09885-00 - Corman Park TIA.pdf; MIN_2021-12-15_Corman Corner Proposed Development-Minutes of Public Meeting.pdf

Hello Michelle,

Thank you for sharing your concerns regarding the development of the Corman Corner Agribusiness Centre. We have attached the minutes from the meeting to give you a chance to review questions and concerns that were brought up by your neighbours. One of the items discussed in the meeting was the traffic at the intersection with Highway 16.

To address your question there have already been extensive discussions with the Ministry of Highways, and they will also be informed of the concerns regarding this intersection. A Traffic Impact Assessment (TIA) was also conducted, and the report and recommendations are attached as well for you to review. The TIA will be included as an Appendix to the development application (Comprehensive Development Review [CDR] application). The complete application and its appendices will be available on the Corman Park website once complete and submitted. Public feedback will be included as part of the approval process.

The Ministry of Highways is primarily interested in the increase in traffic at the intersection and access to the site. Traffic counts were done to determine the current traffic flow with Highways 16 and 684. The conclusion was that there must be a setback for a future interchange and that the current turnout is an appropriate distance from the highway to gain access to the site (where the current approach is now).

If you have any other questions or concerns please reach out.

Carol Smith, BA
Administrative Support
Email: carol.s@hasegawa.ca
Phone: 403-328-2686
Fax: 403-328-2728
Direct: 403-330-3300

HASEGAWA
CONSULTING PROFESSIONAL ENGINEERS

PLEASE NOTE:
OUR LOCATION & MAILING ADDRESS HAVE CHANGED – PLEASE UPDATE YOUR RECORDS TO THE FOLLOWING:

1220 31st STREET NORTH
LETHBRIDGE, AB
T1H 5J8

APPENDIX G

CORRESPONDENCE WITH REGULATORS

Appendix G

CORRESPONDENCE WITH REGULATORS

carol.s@hasegawa.ca

From:	Mark Hasegawa <hasegawamark@gmail.com>
Sent:	May 5, 2022 8:39 AM
To:	Carol Smith
Subject:	Fwd: Corman Corner CDR application
Flag Status:	Flagged

From: **Latimer, Brent SHA** <Brent.Latimer@saskhealthauthority.ca>
Date: Mon, Apr 11, 2022 at 12:31 PM
Subject: RE: Corman Corner CDR application
To: Mark Hasegawa <hasegawamark@gmail.com>, Adam Toth <atoth@rmcormanpark.ca>, Liam Whitelaw <Liam.Whitelaw@ufa.com>, Jordan Michel <jordan.m@hasegawa.ca>

J From page 9 of the report geological should be changed to hydrogeotechnical assessment.

J The last sentence in the paragraph is not clear as to what is being stated. Is the intent to say that if type 2 mounds were used enviroseptic would at least be considered equivalent? Or that both type 2 mounts and enviroseptic have been sucessfully used in similar sites?

He indicated that if the geological assessment had indicated that soil was suitable and the design guidance document was followed, that they saw no reason why septic field could not be used on these sites. It was also indicated that if mounds were used, the Enviroseptic system had been used effectively in the area.

Brent Latimer, B.Sc, B.EH, CPHI(C)
Supervisor – Environmental Public Health Department
Idylwyld Centre - Saskatoon
Saskatchewan Health Authority | 306-291-8254

The Saskatchewan Health Authority works in the spirit of truth and reconciliation, acknowledging Saskatchewan as the traditional territory of First Nations and Métis People.

From: Mark Hasegawa [mailto:hasegawamark@gmail.com]
Sent: Sunday, April 10, 2022 8:11 PM
To: Latimer, Brent SHA <Brent.Latimer@saskhealthauthority.ca>; Adam Toth <atoth@rmcormanpark.ca>; Liam Whitelaw <Liam.Whitelaw@ufa.com>; Jordan Michel <jordan.m@hasegawa.ca>
Subject: Corman Corner CDR application

Hi Brent

You may remember we spoke in latre 2021. We prepared a CDR application for our client to develop land adjacent Highway 1 and Highway 684. At the time you provided feedback regarding the potential to utilize onsite septic treatment via mounds. I have summarized our conversation in the attached document. The Municipality of Corman Park asked us to send you the report to obtain feedback and confirm the document correctly reflects our conversation. Let me know if you have any questions or comments.

Cheers

Mark Hasegawa, P.Eng., P.E.

Office 403-328-2686
Cell 403-393-0878

carol.s@hasegawa.ca

From:	Mark Hasegawa <hasegawamark@gmail.com>
Sent:	May 5, 2022 8:38 AM
To:	Carol Smith
Subject:	Fwd: CDR Application in Corman Park
Flag Status:	Flagged

From: **District 7 Lands App ENV** <district7landsapp@gov.sk.ca>
Date: Tue, May 3, 2022 at 4:13 PM
Subject: RE: CDR Application in Corman Park
To: Mark Hasegawa <hasegawamark@gmail.com>

Hi Mark,

I reviewed the proposed subdivision in the RM of Corman Park. The quarter section appears to be privately owned previously disturbed habitat and wetland habitat. I reviewed the HABISask project screening included in the submission. The HABISask search for rare and sensitive species identifiedLittle Brown Myotis with the potential to occur in the proposed work area. To prevent potential impacts to sensitive species, it is recommended that ground disturbance activities within previously undisturbed habitat occurs outside of the growing season and ensuring ground disturbance activities comply with the Saskatchewan Activity Restriction Guidelines.

Please ensure that you contact Community Planning and the Water Security Agency for comments and/or permits prior to proceeding with construction.

Robert Read, PAg
Government of Saskatchewan
Ecological Management Specialist
Fish, Wildlife and Lands Branch, Ministry of Environment

102 – 112 Research Drive
Saskatoon, Canada S7N 3R3
Tel: 306-531-6752
Fax: 306-933-8442

Saskatchewan

From: Mark Hasegawa <hasegawamark@gmail.com>
Sent: Friday, April 8, 2022 9:36 AM
To: District 7 Lands App ENV <district7landsapp@gov.sk.ca>; Jordan Michel <jordan.m@hasegawa.ca>; Adam Toth <atoth@rmcormanpark.ca>
Subject: CDR Application in Corman Park

WARNING: This message originated from a source that is not managed by **SaskBuilds and Procurement, Information Technology Division**. Do not visit links or open attachments unless you trust the sender's email ID and ensure it is not a spam/phishing email.

Hi Robert

We prepared a CDR application for our client to develop land adjacent to Highway 1 and Highway 684. Trace Environmental conducted an Environmental Impact Assessment Screening for the project. We also sampled for petroleum hydrocarbons as part of our geotechnical analysis. I have attached a copy of the CDR which includes the environmental screening analysis for the site. The Municipality of Corman Park asked us to send you the report to obtain feedback. Let me know if you have any questions or comments.

Cheers

Mark Hasegawa, P.Eng., P.E.

Office 403-328-2686
Cell 403-393-0878

Saskatchewan

Ministry of Highways
Operation & Maintenance – Central
18, 3603 Millar Avenue
Saskatoon, Canada S7P 0B2

March 15, 2022

Our File: C.S. 16-23 Per
Your File: RSD0005116

UFA
c/o Hasegawa Engineering
1220 31st St. N
Lethbridge AB T1H 5J8

Attention: Jordan Michel

RE: Roadside Development Permit Adjacent to Highway No. 16 LSD 15-3-38-6 W3M

Permission is granted to construct a Pylon Sign adjacent to Provincial Highway No. **16** in **LSD 15-3-38-6 W3M**. This permit is issued subject to the following conditions:

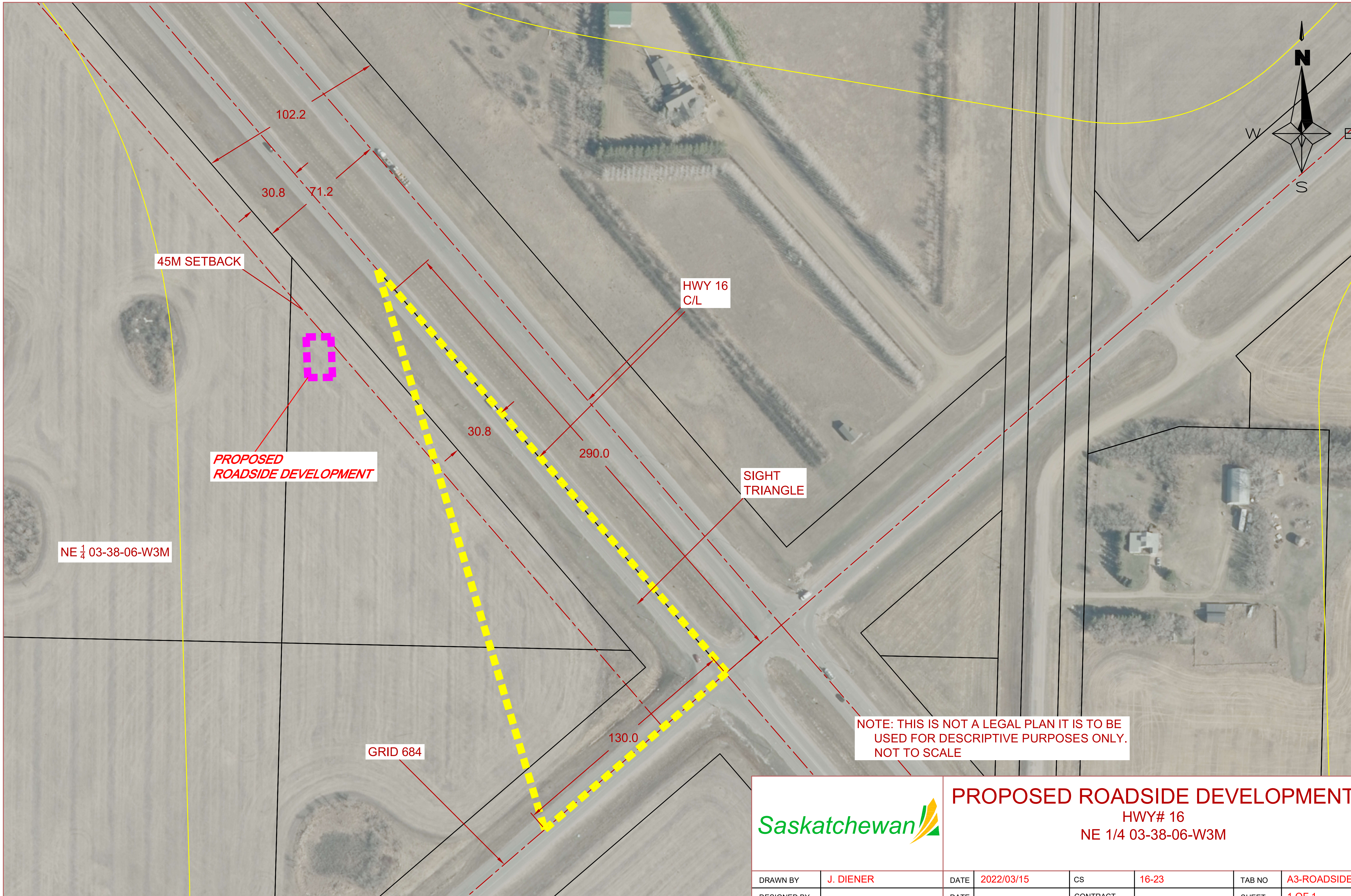
1. The development must be:
   a) At least 55 m from centreline of Highway No. **16**;
   b) Outside a triangle formed by measuring the following distances from the intersection of the roadway centrelines and joining the points so obtained;
      290 metres (951 feet) along the highway centreline.
      130 metres (427 feet) along the centreline of the intersecting paved road.
2. The Ministry assumes no responsibility for the diminution in property value, resulting to the remaining property, due to proximity to buildings and loss of utility to the remainder, except in such instances where right-of-way expansion for future highway widening is extended beyond the distance indicated in point 1(a).
3. The applicant will be responsible for any alteration of utilities required as a result of this development.
4. This development must commence within **one (1) calendar year** from the date of issue of this permit. If the development does not begin within this time period, application must be made for a new permit.
5. This permit does not eliminate the need to comply with the requirements of any other Government Ministry or authority concerned, or with local building and zoning bylaws. This permit does not constitute approval of any subdivision plan. If an approach is required to access this development from the highway a permit is required. You may obtain an application form for permission to construct an approach from the Ministry contact person shown below.

Authorized,

Jennifer Fertuck, P. Eng.
Director, Traffic Engineering and Development
Central Region

cc: Wayne Brown, Assistant District Operations Manager, Saskatoon
Laurence Knackstedt, Supervisor of Operations, Saskatoon West

Ministry Contact: Jackie Diener



NOTE: THIS IS NOT A LEGAL PLAN IT IS TO BE USED FOR DESCRIPTIVE PURPOSES ONLY. NOT TO SCALE

Saskatchewan

PROPOSED ROADSIDE DEVELOPMENT

HWY# 16

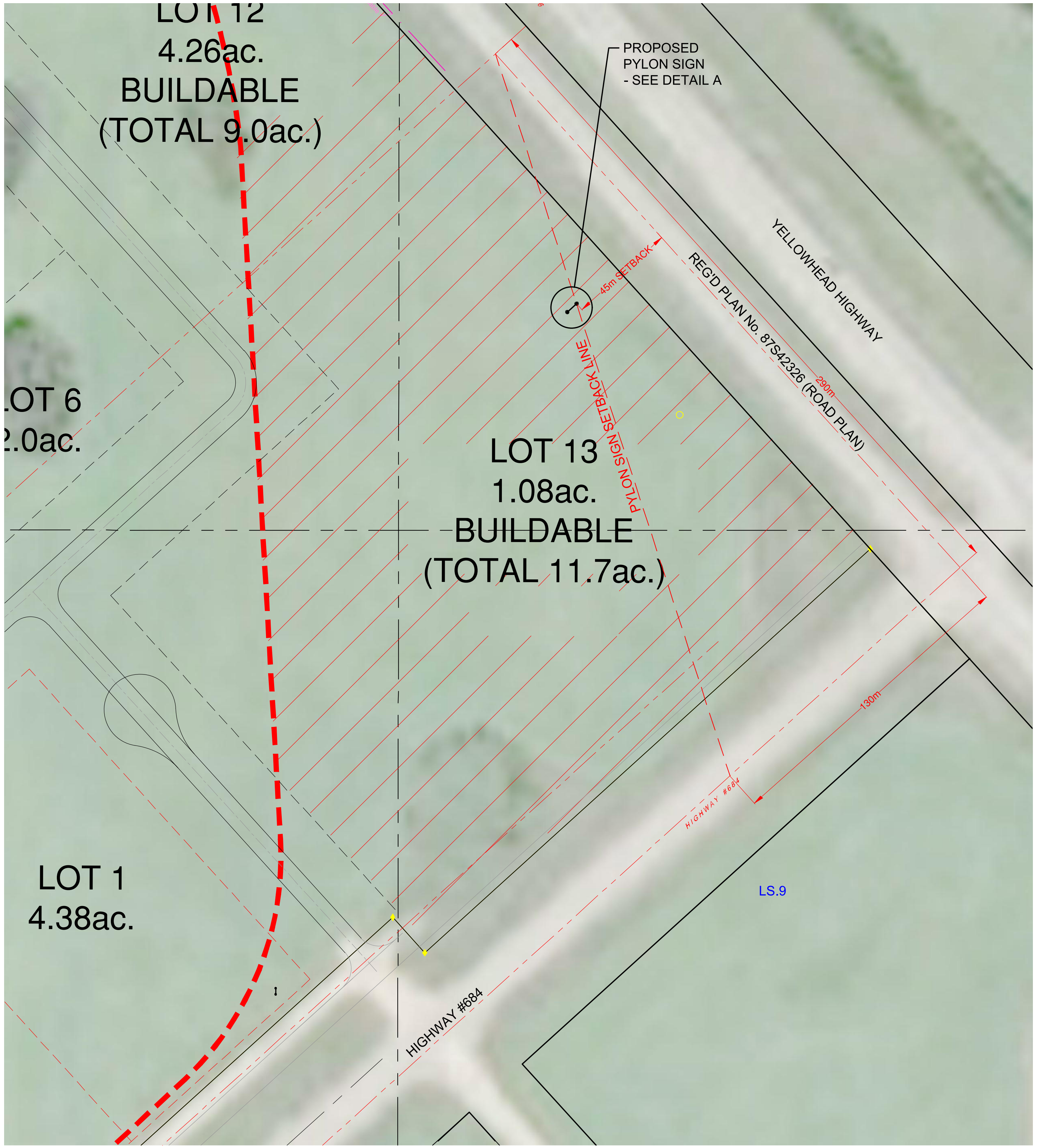
NE 1/4 03-38-06-W3M

DRAWN BY	J. DIENER	DATE	2022/03/15	CS	16-23	TAB NO	A3-ROADSIDE
DESIGNED BY		DATE		CONTRACT		SHEET	1 OF 1

ACAD DWG:
LAST REV DATE: YY/MM/DD

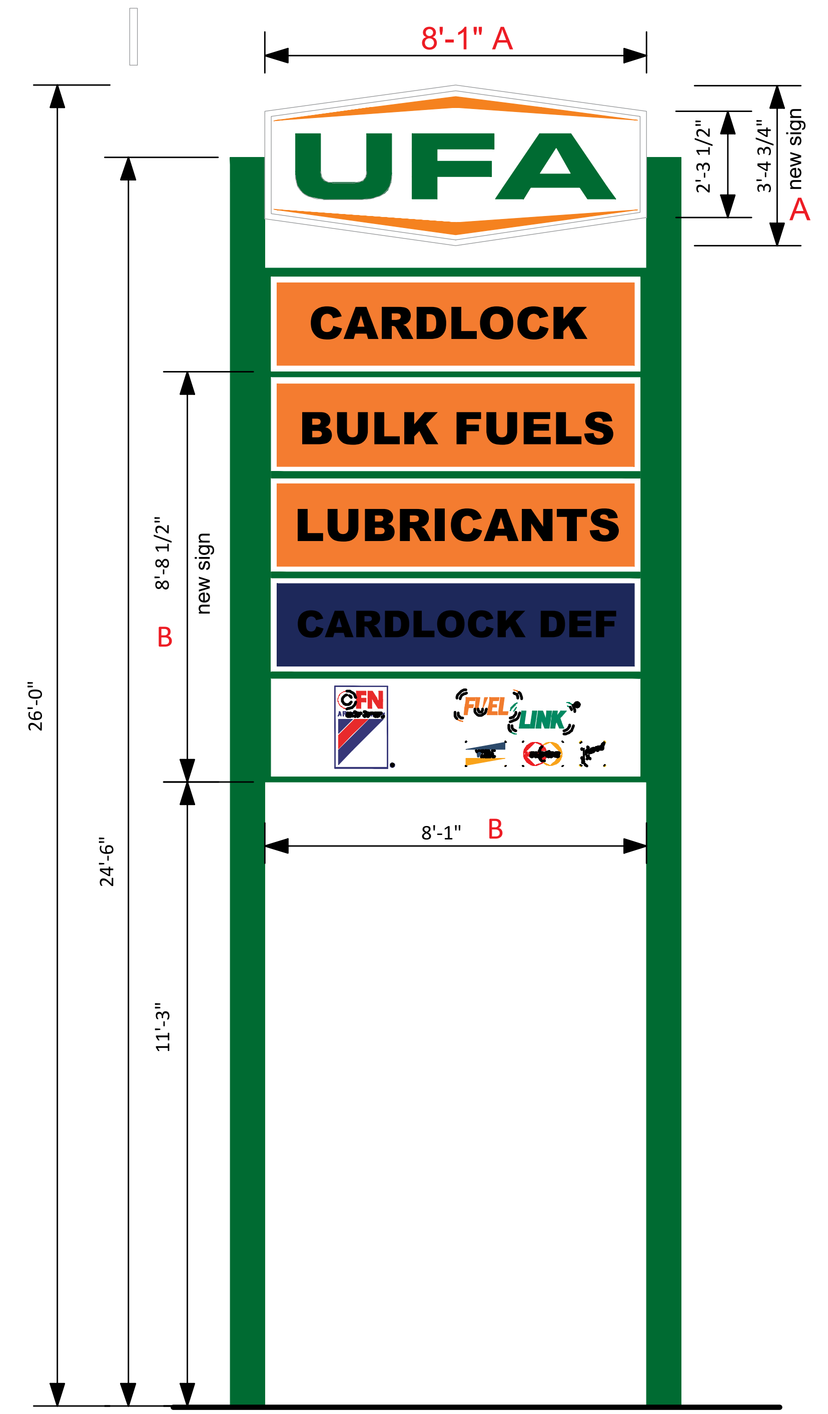
ISSUE	DRAWING STATUS / REVISION	DATE (YY/MM/DD)	BY
A	DEVELOPMENT PERMIT	22/03/09	MDO

DESIGNED	DRAWN	CHECKED	APPROVED	SCALE AND SHEET SIZE
MAH	MDO	HE	MAH	AS SHOWN



PYLON SIGN LOCATION PLAN
SCALE: 1:2,000

0 20 40 60 80 100 200
SCALE=1:2,000



DETAIL A - PYLON SIGN
SCALE: NTS

HASEGAWA
CONSULTING PROFESSIONAL ENGINEERS
330, 3120 - 32nd Street South, Lethbridge, Alberta T1K 7B4
P: 403-326-2686 F: 403-328-2728 E: office@hasegawa.ca

NOTES

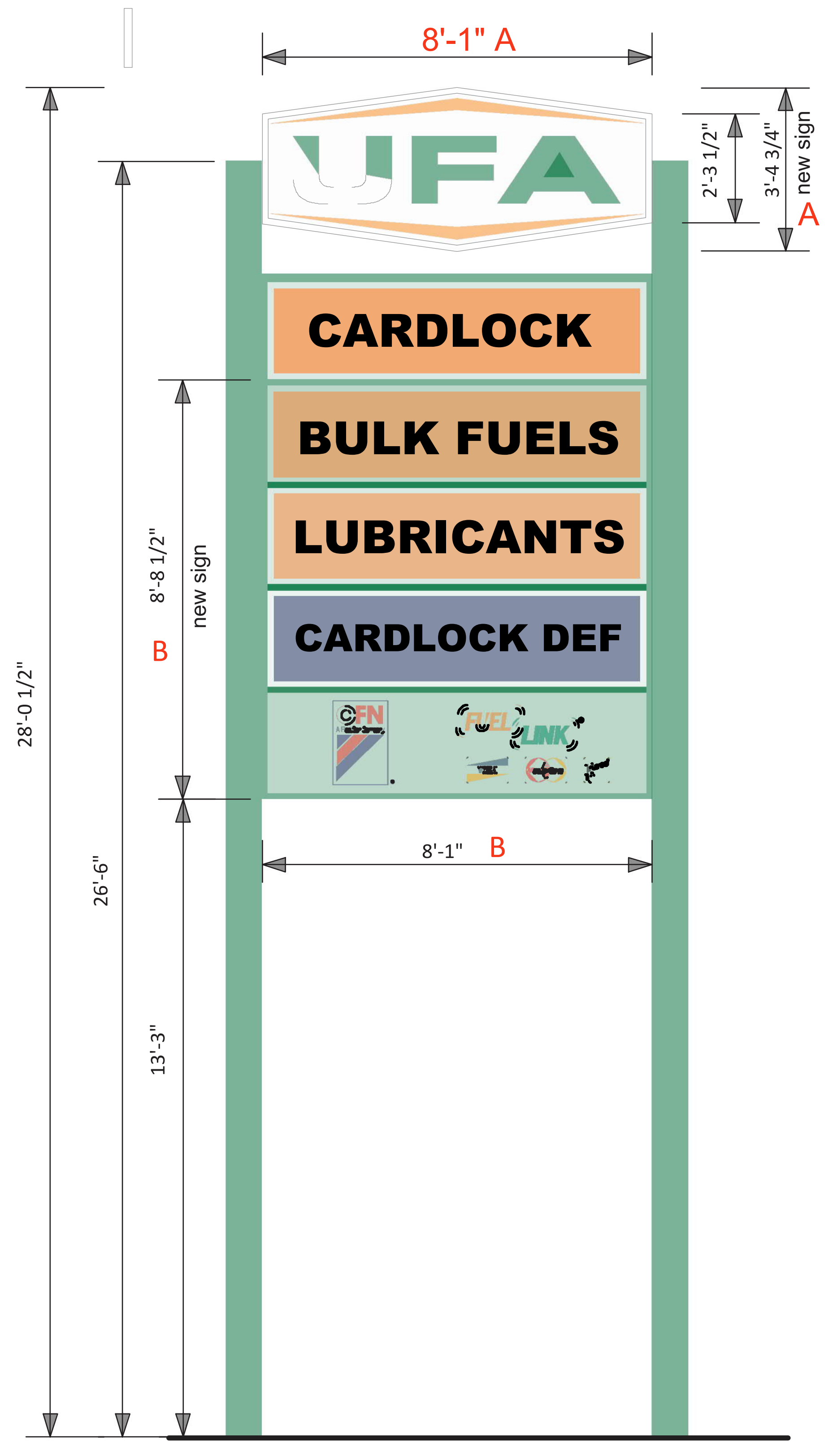
CLIENT
UFA

PROJECT
CORMAN PARK
PHASE 1 DEVELOPMENT

DRAWING
PROPOSED PYLON SIGN
LOCATION PLAN

PROJECT NUMBER
21-050

SHEET NUMBER
C4.0



Specifications

Supply & install:
One new shaped Flex face Cabinet &
One new Flex face cabinet
utilizing existing poles and bases

Construction A:
Substrate: White Flex Faces c/w 1st. surface vinyl.
Cabinet : painted white
Retainers: 1/2" flex retainers painted white
Illumination: White LED

Construction B:
Substrate: White Flex Faces c/w 1st. surface vinyl.
Cabinet : Painted green
Retainers: 1 1/2" flex retainers painted green
Illumination: white LED

Existing poles...repaint green

Colours

- 3M 3630-44 Orange Vinyl
- 3M 3630-126 Dark Emeral Green Vinyl / Paint to match
- 3M 3630-137 European Blue Vinyl (PMS 2757C)
- White Substrate

Fuel Link Colours:
Dark Emerald Green 3630-126
Orange 3630-44
Visa - Black outline
Blue 3630-36
Sunflower 3630-25
Mastercard - Black outline
Red 3630-33
Golden Yellow 3630-125
CFN - Red 3630-33
Royal Blue 3630-87
Interac Yellow - 3630-025

ISSUE	DRAWING STATUS / REVISION	DATE (YY/MM/DD)	BY
A	DEVELOPMENT PERMIT	21/08/11	DPB/MO

DESIGNED	DRAWN	CHECKED	APPROVED	SCALE AND SHEET SIZE
MH	DPB/MO	JM	MH	AS SHOWN - 11x17

SEE STD-AC-04 & STD-AC-06

HASEGAWA
CONSULTING PROFESSIONAL ENGINEERS
1220-31 St. N., Lethbridge, Alberta T1H 5J8
P: 403-328-2686 F: 403-328-2728 E: office@hasegawa.ca

NOTES
 Contractor to check and verify all dimensions before construction, any errors and omissions shall be reported to the engineer immediately. Drawing shall not be used for construction until approved for construction by engineer. Do not scale the drawing. All construction shall be in accordance with latest codes, may it be construction, mechanical, etc

CLIENT
UFA

PROJECT
STANDARD DRAWING

DRAWING
PYLON SIGN
DETAIL & NOTES

PROJECT NUMBER

SHEET NUMBER

LETTER OF AUTHORIZATION

TO: All municipal, provincial and federal authorities (collectively, the "**Authorities**")

FROM: Eldon Fortnum (the "**Owner**")

RE: The lands described in Schedule "A" attached hereto

(collectively, the "**Property**")

2335321 ALBERTA LTD., **UNITED FARMERS OF ALBERTA CO-OPERATIVE LIMITED** (collectively, "**UFA**") or their respective assignees, servants and agents, including but not limited to **HASEGAWA ENGINEERING** (collectively, "**UFA Agents**"), will be making applications for land use reclassification, subdivision, development permits, building permits, water permits and other development related issues (collectively the "**Development**") with respect to the Property.

Please consider this your irrevocable authority and direction from the Owner as owner of the Property, to:

(a) allow UFA and UFA Agents to enter into formal discussions with any of the mentioned Authorities in respect of the Development of the Property;

(b) allow UFA and UFA Agents, on behalf of the Owner, to make and sign any application or document that may be necessary, expedient or desirable for the Development of the Property; and

(c) release to UFA and UFA Agents all information you have on record with respect to the Owner in respect of the Property or which may affect the Owner's interest in the Property and to photocopy the material they deem necessary as to the Owner and the Property with respect to any of the mentioned Authorities.

This Letter of Authorization may be executed and delivered by fax or email and if so delivered shall be deemed to be an original.

Dated as of Nov 25, 2021.

Witness
Name: JUSTIN ZELOWSKY

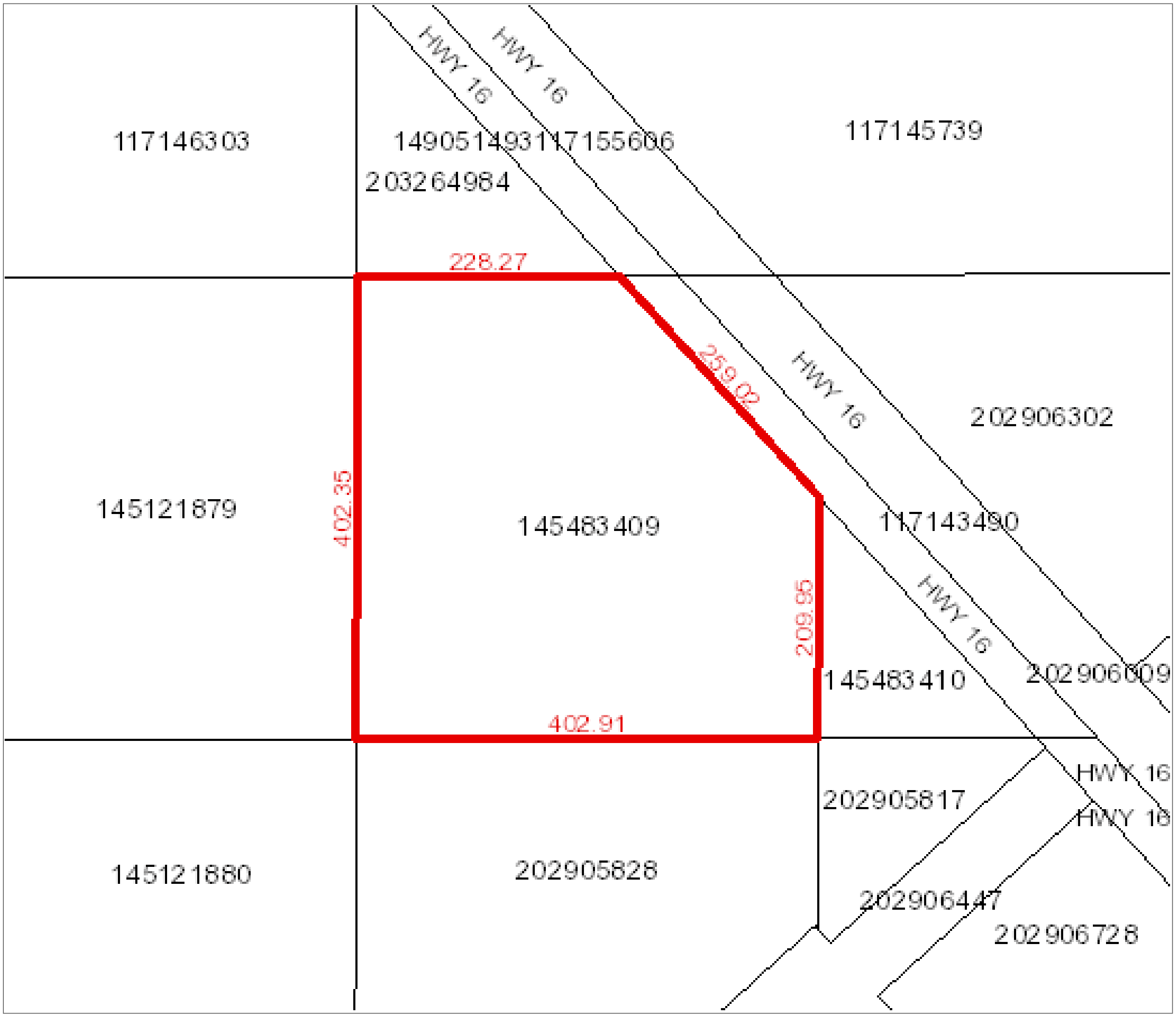
Eldon Fortnum
ELDON FORTNUM

SCHEDULE "A"
Property

Description of Property
SURFACE PARCEL # 202905817 LSD 9 - Sec 03 Twp 38 Rge 06 W3 Extension 236 SURFACE PARCEL #202905828 LSD 10 - Sec 03 Twp 38 Rge 06 W 3 Extension 23 SURFACE PARCEL # 145483409 LSD 15 – Sec 03 Twp 38 Rge 06 W3 Extension 23 As described on Certificate of Title 00SA08861, description 23 SURFACE PARCEL # 145483410 LSD 16 – Sec 03 Twp 38 Rge 06 W3 Extension 24 As described on Certificate of Title 00SA08861, description 24 SURFACE PARCEL # 202906717 LSD 10 Sec 03 Twp 38 Rge 06 W 3 Extension 24 SURFACE PARCEL # 202905806 LSD 9 - Sec 03 Twp 38 Rge 06 W 3 Extension 234 SURFACE PARCEL # 202906728 LSD 9 - Sec 03 Twp 38 Rge 06 W 3 Extension 235

Surface Parcel Number: 145483409

REQUEST DATE: Wed Feb 16 10:44:13 GMT-06:00 2022



Owner Name(s) : Fortnum, Eldon

Municipality : RM OF CORMAN PARK NO. 344

Area : 14.529 hectares (35.9 acres)

Title Number(s) : 129625353

Converted Title Number : 00SA08861

Parcel Class : Parcel (Generic)

Ownership Share : 1:1

Land Description : LSD 15- 03-38-06-3 Ext 23

Source Quarter Section : NE-03-38-06-3

Commodity/Unit : Not Applicable

Report Title:	Permit Application Details
Run Date and Time:	2022-03-10 11:29:57 Central Standard Time
Run by:	Jackie Diener
Table name:	x_smoit_hicsm_permit_application

Permit Application

Number:	RSD0005116	Needs attention:	true
Channel:	Web	Opened:	2022-02-15 11:57:42
Permit Type:	Roadside Development	Priority:	3 - Moderate
Category:		State:	Open
Other Category:		Approval:	Waiting on Info
Applicant:	Jordan Michel	Date Issued:	
Contact:		Assignment group:	CSM Central
Requester:	Jordan Michel	Assigned to:	Jackie Diener
Applicant Company Name:			
Contact Company:			
Owner:	Dragan Karanovic		
Owner Company Name:			
Owner Contact:			
Owner Contact Company:			

Short description:

RSD Permit Application Roadside Development for Jordan Michel

Control Section:		District:	
km (approx.):		R/L:	

Notes

Watch list:		Work notes list:	

Additional comments:

2022-03-10 10:02:05 - You (Additional comments)
Hi Jackie, See attached drawing of the proposed sign and location in accordance with the setback requirements that were provided. Please let me know of the expected timeline for approval. Thanks.

2022-03-02 13:55:14 - Jackie Diener (Additional comments)
Good afternoon Jordan,

As per Andrea Landell's email I am awaiting an updated drawing from you and a preferred location so that I can proceed with your permit.

Thank you
Jackie Diener

2022-02-16 11:43:00 - You (Additional comments)
We have been working with the current land owner, our client and the RM of Carmon Park (Adam Toth). Our client is purchasing this land from the current landowner, and we are going through land titles and changes to zoning for this land to be developed moving forward. We have already obtained a RSD (RSD0004007) for this development which included a TIA. I initiated this RSD Permit Application because a MoH Technician said it would be required to install a sign adjacent to HWY 16. He also said that the sign couldn't be within 500m of the HWY 16 & Dalmeny HWY intersection. I since wondered if the information he provided is not accurate, and I have reached out to Andrea Landell to sort this out. Basically, I saying that this RSD permit application may not be required since we have already obtained one for this site. Please provide insights if you have any. Thanks.

2022-02-16 11:16:13 - Jackie Diener (Additional comments)
Good morning Jordan,

Could you please send me the landowners approval for putting up your sign on their land?

Thank you
Jackie Diener

Work notes:

Resolution Information

Resolved by:		Resolved:	
Resolution code:			

Resolution notes:

Add resolution notes to comments:

false

Application Information

Technician Review

Highway No. (if applicable):	
Legal Land Description:	15-3-38-6 W3
GPS Coordinates:	52.244973, -106.773934

Please enter a description and additional details of the works:

Construction of a pylon sign to inform motorists of services provided

Commercial vs. Private Use:	Commercial/ Municipal	Anticipated Construction Start Date:	2022-08-01
Commodity (if applicable):		How long do you anticipate using this infrastructure?:	More than 1 year

Constructing a new approach:	false	Modifying an existing approach:	false
Utilizing an existing approach (without modifications):	false	Removing an existing approach:	false

First Name:		Last Name:	
Company Name (if applicable):		24-hour Phone Number:	

Attachments

Related List Title: Attachment List

Table name: sys_attachment

Query Condition: Table name = x_smoit_hicsm_permit_application AND Table sys ID = 30692fbf87a901d0309effb9cebb357d

Sort Order: Created in descending order

3 Attachments

File name	Content type	▼ Created	Created by
21-040 - CORMAN PARK 78ac DEVELOPMENT - Proposed Pylon Sign and Location Plan_3-9-22.pdf	application/pdf	2022-03-10 10:02:09	hiportal
Letter of Authorization.pdf	application/pdf	2022-02-15 11:57:07	hiportal
Pylon Sign.pdf	application/pdf	2022-02-15 11:57:02	hiportal

Related List Title: Email List

Table name: sys_email

Query Condition: Target table = x_smoit_hicsm_permit_application AND Target = 30692fbf87a901d0309effb9cebb357d

Sort Order: None

7 Emails

Created	Recipients	Subject	Type	Notification type	User ID
2022-02-16 11:16:15	jordan.m@hasegawa.ca	Application RSD0005116 has comments	sent	SMTP	
2022-02-15 14:37:37	jordan.m@hasegawa.ca	Application RSD0005116 has been assigned	sent	SMTP	
2022-03-10 10:02:18	Jackie.Diener@gov.sk.ca	RSD0005116 has new attachment	sent	SMTP	
2022-02-16 11:43:05	Jackie.Diener@gov.sk.ca	RSD0005116 has new comment	sent	SMTP	
2022-03-02 13:55:25	jordan.m@hasegawa.ca	Application RSD0005116 has comments	sent	SMTP	

Created	Recipients	Subject	Type	Notification type	User ID
2022-03-10 10:02:18	Jackie.Diener@gov.sk.ca	RSD0005116 has new comment	sent	SMTP	
2022-02-15 11:57:56	jordan.m@hasegawa.ca	Application RSD0005116 has been submitted.	sent	SMTP	

Related List Title: Phone Log List

Table name: sn_openframe_phone_log

Query Condition: Task = RSD0005116

Sort Order: None

Phone Logs

Saskatchewan

Ministry of Highways
Operation & Maintenance – Central
18, 3603 Millar Avenue
Saskatoon, Canada S7P 0B2

November 5, 2021

Regional File: C.S. 16-23-70
Service Now File: RSD0004007

Jordan Michel
Hasegawa Engineering
1220 31st St. N
Lethbridge, AB
T1H 5J8

RE: Request to install two approaches adjacent to Highway No. 684 (CS 16-23-70) , in the NE 1/4 03-38-06-W3M, as shown on the attached location plan.

Jordan Michel, hereinafter called the applicant, is granted consent to construct two approaches to the service road of Highway 684 CS (16-23-70) in the manner shown on the attached typical plans at the location described above, subject to the following conditions:

GENERAL CONDITIONS:

1. The applicant shall advise Wayne Brown, Ministry of Highways Assistant District Operations Manager in Saskatoon, at 306-933-5838, at least forty-eight (48) hours prior to beginning any works related to this approach and to arrange for final inspection and approval after construction is complete.
2. All construction and all costs of construction are the responsibility of the applicant. This includes all materials, equipment rentals or purchases and all labour or other costs that may be required to complete construction.
3. A copy of the permit shall stay on site during construction.
4. Material from the highway right-of-way shall not be used for construction of the approach.
5. All materials unloaded at the job site shall be immediately moved to the edge of the highway right-of-way.
6. Only equipment required to construct the approach shall be allowed on the shoulder and/or road surface and only when it is in use.
7. The approach and any sideslopes or ditch damage during construction shall be neatly trimmed. Any disturbed areas within the highway right-of-way shall be compacted, levelled smooth and reseeded to brome native grass.
8. The applicant shall be responsible to locate all existing utilities within the right-of-way and take whatever precautions are necessary to protect them.
9. This consent does not eliminate the need to comply with the requirements of any other government Ministry or authority, or with local building and zoning bylaws.

10. The highway must be signed in accordance with the attached Ministry Standard Plan. The specifications set forth in this permit regarding the number, location, size and any other matter respecting the signs authorized by this permit, are designed to protect the safety of persons using the public highway and any failure to comply with the terms of this permit is: (i) an offence under s. 59 of The Highways and Transportation Act, 1997; and (ii) could lead to civil liability if any one suffers loss or damage due to non-compliance with the terms of this permit.
11. All construction including final clean-up shall be complete within **ninety (90) days** of permit issue date. If final clean-up is not completed within that time, the Ministry may arrange to complete the clean- up with the entire cost being borne by the applicant. If extension is required, reapply for an approach permit at Sask.ca, Roadside Development Permits.
12. The approach may be removed or relocated by the Ministry at any time without compensation to the applicant. Indirect highway access may be provided by means of a service road or from the nearest municipal road. If future development leads to an increase in traffic volumes on this approach the Ministry must be notified and approve the utilization of the approach for the new development. Failure to do so could result in removal or relocation of the approach by the Ministry without compensation to the applicant.
13. The approaches are permitted for Type I use only. The approach is approved to provide access for primarily public use, including commercial, recreational, and higher traffic developments. More information about Type I and Type II approaches is attached to this permit.
14. The work site shall be signed in accordance with the attached Ministry sign plan(s), and at the advice and consent of the District Operations Manager:
    - If work will be conducted within ten (10) metres from the edge of the shoulder, then Sign Plan TCDMWZ C-1 shall be used;
    - If work will be conducted within two (2) metres of the driving lane or shoulder, then Sign Plan TCDMWZ D-3 shall be used.
15. The applicant shall indemnify the Government of Saskatchewan and its ministers, officers and employees from and against all proceedings or claims commenced by third parties for liabilities, losses, damages, costs (including legal fees) and expenses, whether for injury to or death of persons or loss or damage to land or property of any kind, that arise out of or result from any breach or failure to perform any condition of this Permit or from any other act or omission of the applicant or its contractors, officers, agents or employees.

SPECIAL CONDITIONS:

16. A culvert is required. Either a galvanized corrugated steel culvert of a minimum 500 mm diameter, and 1.6 mm wall thickness or a concrete equivalent as shown in the attached HM - 609-01 Table No. 609-01-4, shall be installed

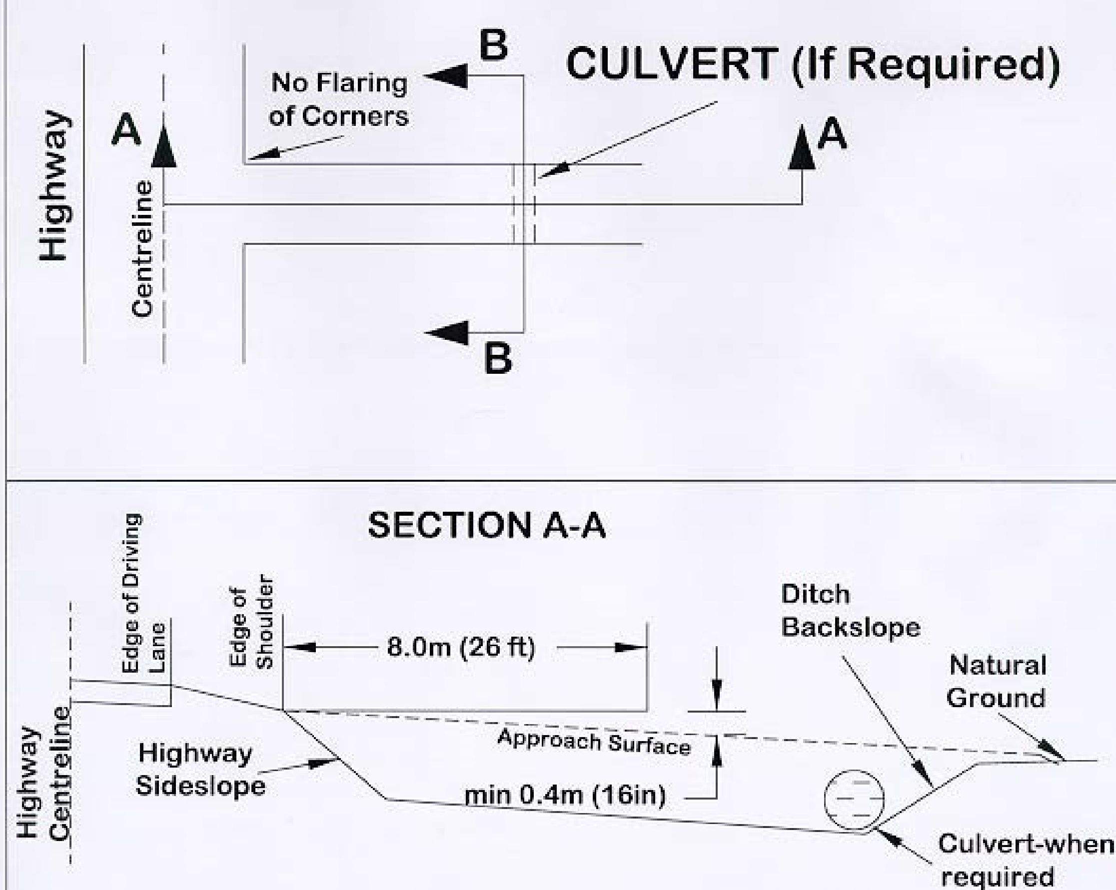
17. The approach shall be constructed, as shown in the attached figures 1 and 2.
    a. At 90 degrees to the highway centreline.
    b. With a top width of 8.0 metres (26.0 feet) to a maximum of 11.0 metres (36.0 feet).
    c. With side slopes of 6:1 with culvert, 10:1 without.
    d. To slope away from the highway so that the approach surface is at least 0.4 metres (16 inches) lower than the highway shoulder edge at a distance of 8 metres (26 feet) from the shoulder edge.

Andrea Landell

Andrea Landell, P. Eng.
Senior Project Manager, Traffic Engineering and Development
Central Region

cc: Wayne Brown, District Operations Manager, Saskatoon
Laurence Knackstedt, Supervisor of Operations, Saskatoon West

Ministry Contact: Ethan Eger



1. Approach must slope away from highway so that 8.0m from the highway shoulder edge the approach surface is a minimum of 0.4m below the shoulder edge.

2. Culvert must be located against the ditch backslope.

Figure 1

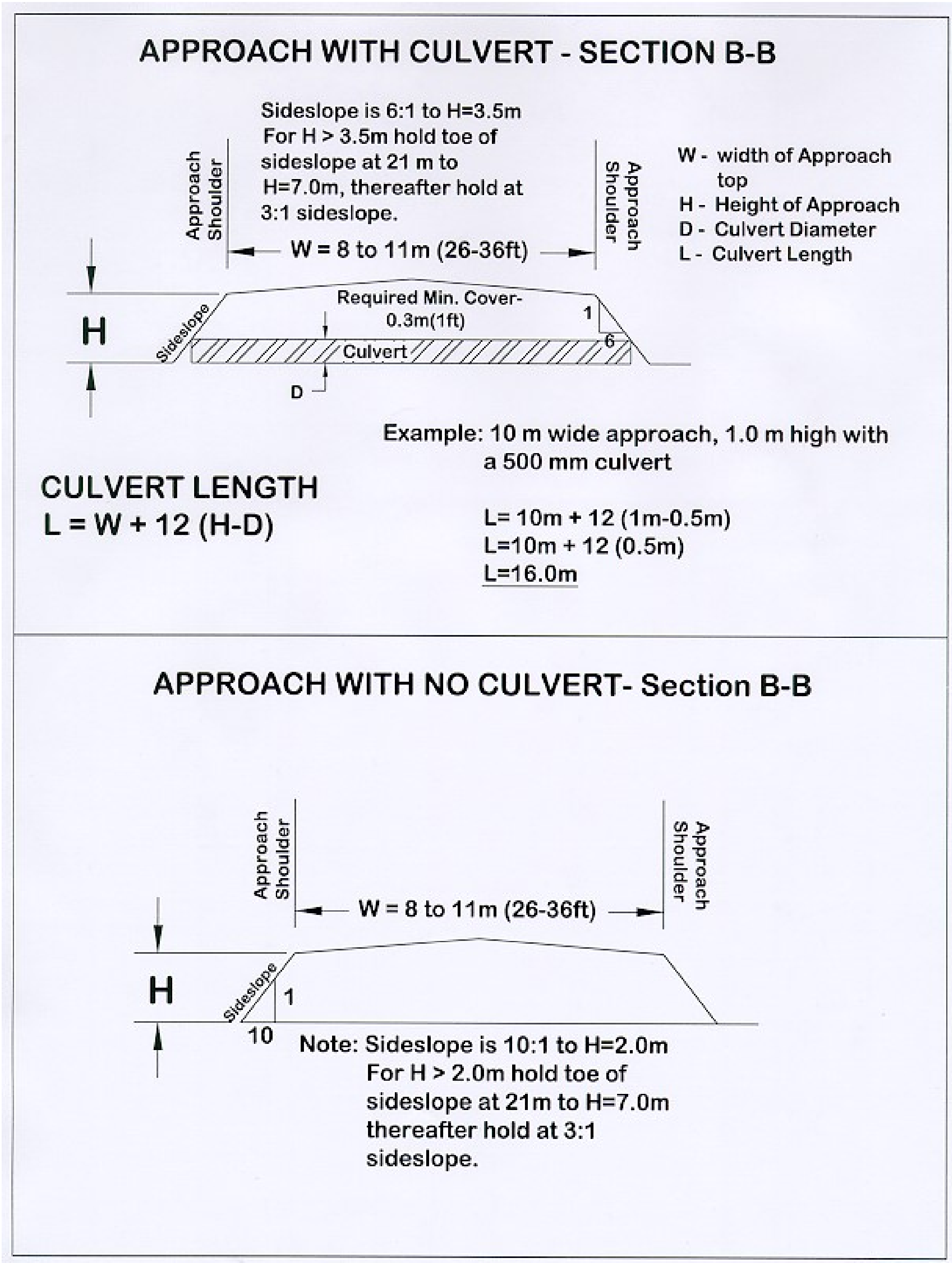
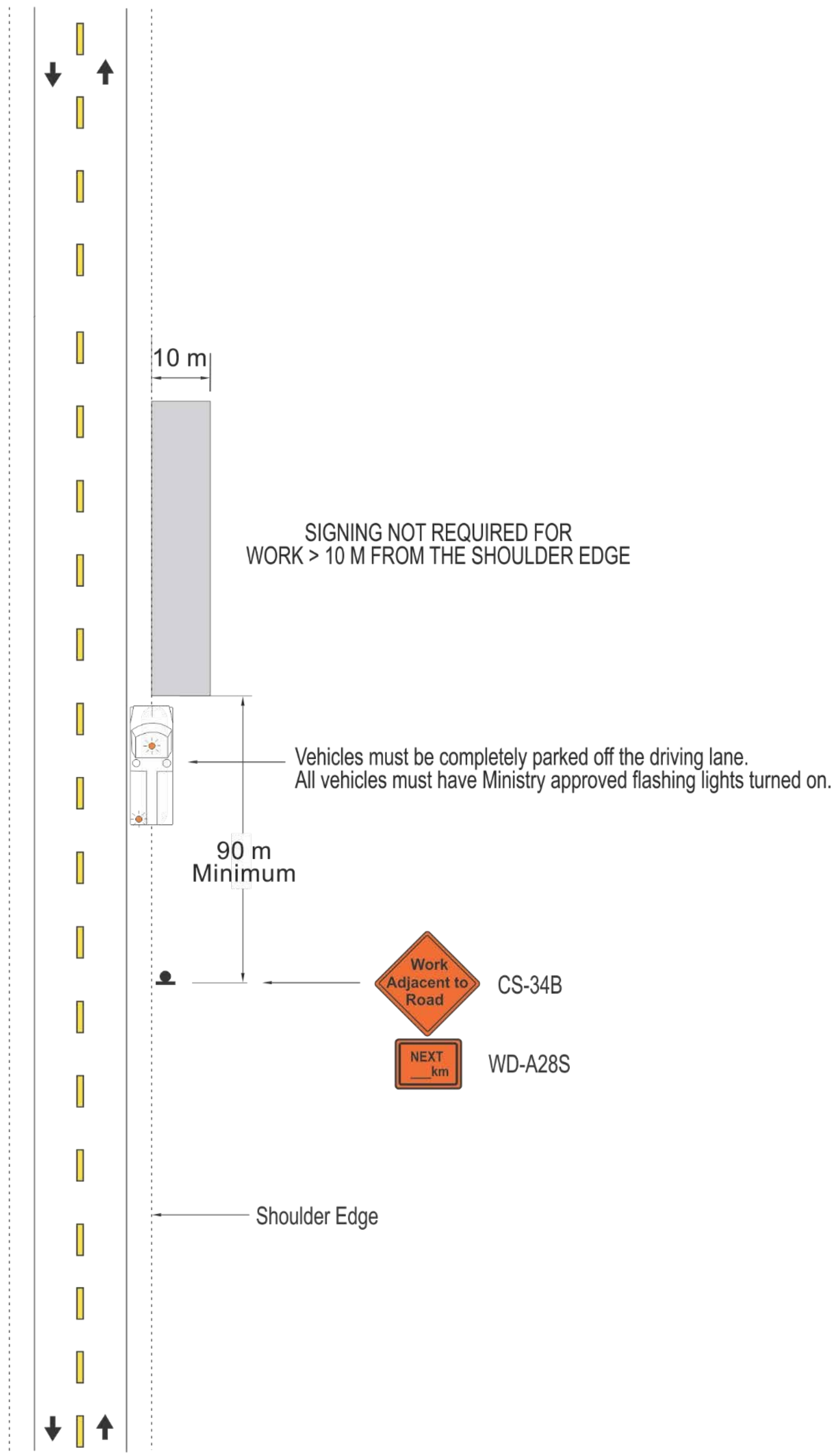

APPROACH WITH CULVERT - SECTION B-B
Sideslope is 6:1 to H=3.5m
For H > 3.5m hold toe of
sideslope at 21 m to
H=7.0m, thereafter hold at
3:1 sideslope.
Approach Shoulder
Approach Shoulder
W - width of Approach top
H - Height of Approach
D - Culvert Diameter
L - Culvert Length
W = 8 to 11m (26-36ft)
H
Sideslope
Required Min. Cover-
0.3m(1ft)
Culvert
1
6
D
Example: 10 m wide approach, 1.0 m high with
a 500 mm culvert
CULVERT LENGTH
L = W + 12 (H-D)
L= 10m + 12 (1m-0.5m)
L=10m + 12 (0.5m)
L=16.0m
APPROACH WITH NO CULVERT- Section B-B
Approach Shoulder
Approach Shoulder
W = 8 to 11m (26-36ft)
H
Sideslope
1
10
Note: Sideslope is 10:1 to H=2.0m
For H > 2.0m hold toe of
sideslope at 21m to H=7.0m
thereafter hold at 3:1
sideslope.

Figure 2

C. ROADSIDE PLANS

C.1 WORK ADJACENT TO ROADWAY - WITHOUT HAZARD

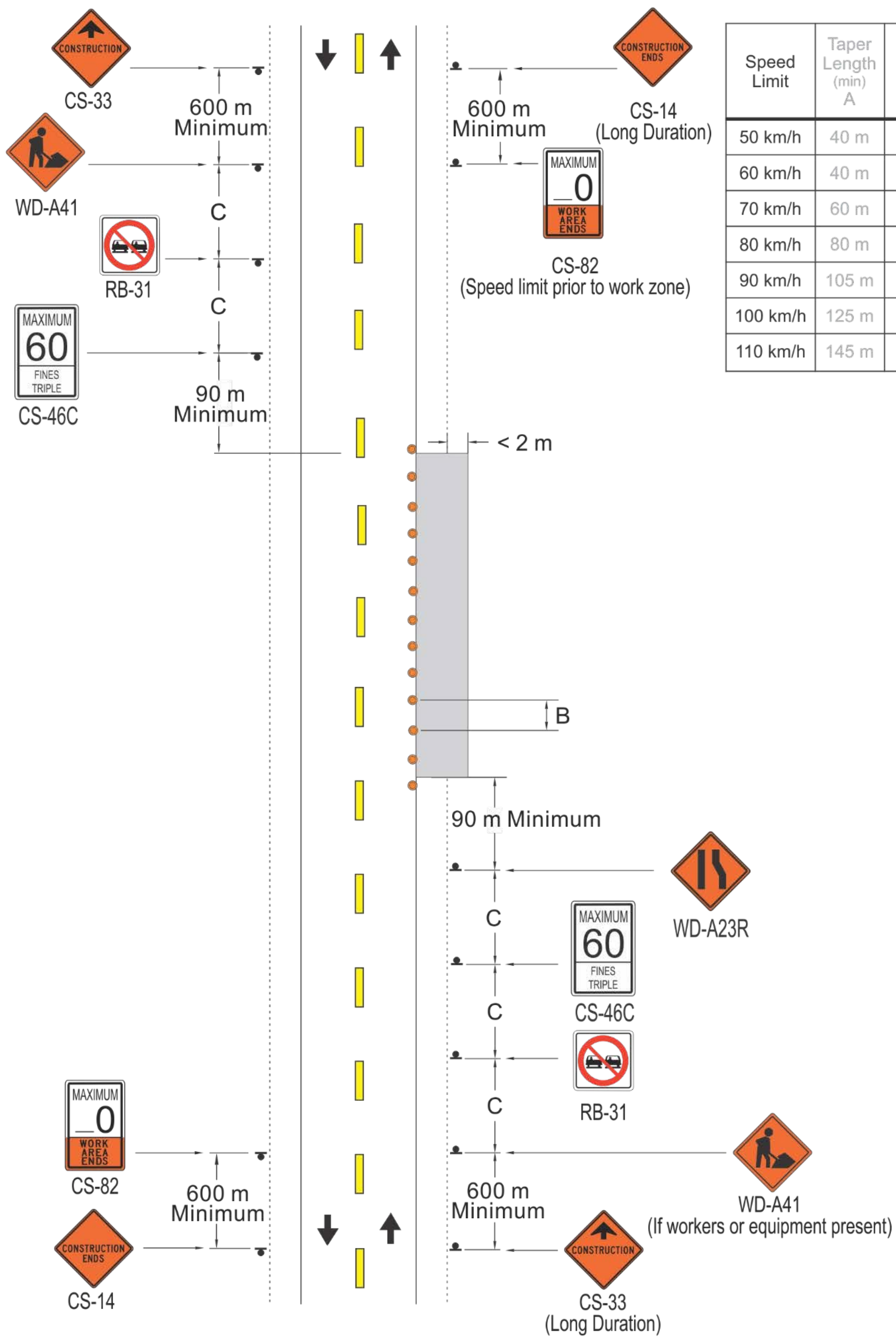
Effective: 2013-02-22



D. SHOULDER PLANS

D.3 WORK ON SHOULDER

Speed Limit	Taper Length (min) A	Distance Between Markers B	Distance Between Signs (min) C
50 km/h	40 m	10 m	50 m
60 km/h	40 m	10 m	60 m
70 km/h	60 m	15 m	70 m
80 km/h	80 m	15 m	100 m
90 km/h	105 m	20 m	100 m
100 km/h	125 m	20 m	100 m
110 km/h	145 m	20 m	100 m



Ministry of Highways
Operation & Maintenance – Central
18, 3603 Millar Avenue
Saskatoon, Canada S7P 0B2

November 5, 2021

Our File: C.S. 16-23-70 Per
Your File: RSD0004007

Jordan Michel
Hasegawa Engineering
1220 31st St. N
Lethbridge, AB
T1H 5J8

RE: Roadside Development Permit Adjacent to Grid Road 684 (C.S. 16-23-70) in NE 1/4 03-38-06-W3M

Permission is granted to construct gas station adjacent to Grid Road 684 (C.S. 16-23-70) in **NE 1/4 03-38-06-W3M**. This permit is issued subject to the following conditions:

1. The development must be:
    a) At least 4m from the property line of Highway No. **16-23-70**;
    b) Outside the control shape as outlined in the drawing below.

2. The Ministry assumes no responsibility for the diminution in property value, resulting to the remaining property, due to proximity to buildings and loss of utility to the remainder, except in such instances where right-of-way expansion for future highway widening is extended beyond the distance indicated in point 1(a).
3. The applicant will be responsible for any alteration of utilities required as a result of this development.
4. This development must commence within **one (1) calendar year** from the date of issue of this permit. If the development does not begin within this time period, application must be made for a new permit.
5. This permit does not eliminate the need to comply with the requirements of any other Government Ministry or authority concerned, or with local building and zoning bylaws. This permit does not constitute approval of any subdivision plan. If an approach is required to access this development from the highway a permit is required. You may obtain an application form for permission to construct an approach from the Ministry contact person shown below.
6. A Traffic Impact Assessment (TIA), as outline in the Ministry's Roadside Management Manual, shall be completed to address any issues the proposed development will have at the highway intersection. The applicant shall complete a TIA and submit it to the Ministry for approval prior to the approval of the subdivision. Submission of the TIA does not constitute the approval of the TIA. The proponent shall contact the Ministry for more details and to arrange a scope meeting with the Ministry. Any improvements from the Traffic Impact

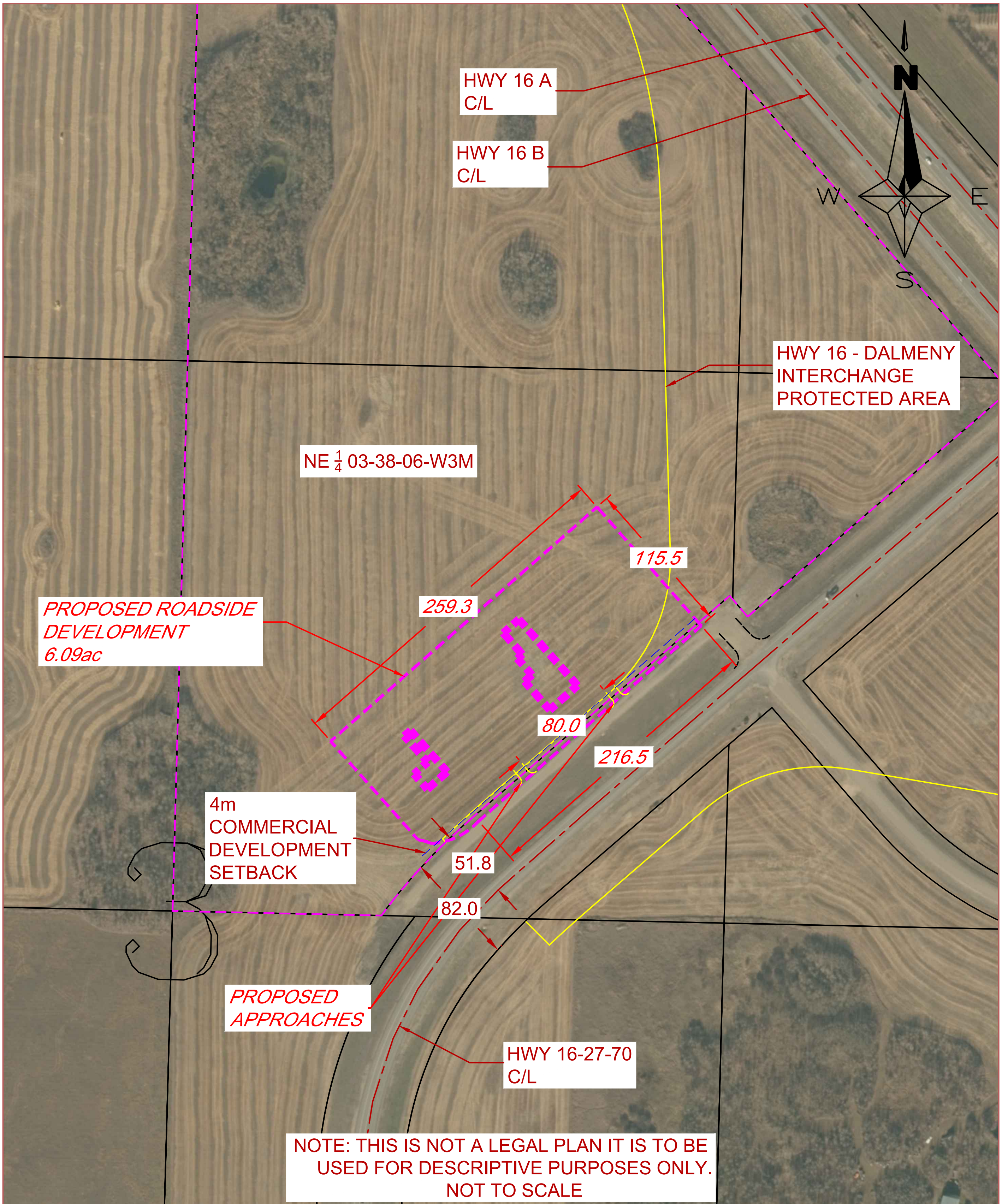
Assessment (TIA) approved by this Ministry are the responsibility of the applicant to implement. An agreement between the Ministry and the applicant for improvements identified in the TIA must be signed prior to the approval of the subdivision. Recommendations indicated by the TIA shall be dedicated on the proponent's plan of survey, which shall be submitted before the final approval of the permit.

Authorized,

Jennifer Fertuck, P. Eng.
Director, Traffic Engineering and Development
Central Region

cc: Wayne Brown, District Operations Manager, Saskatoon
Laurence Knackstedt, Supervisor of Operations, Saskatoon West

Ministry Contact: Ethan Eger



Saskatchewan

PROPOSED ROADSIDE DEVELOPMENT

HWY 16
NE 1/4 03-38-06-W3M

DRAWN BY	E.EGER	DATE	2021/08/18	CS	16-23	TAB NO	A4-ROADSIDE
DESIGNED BY		DATE		CONTRACT		SHEET	1 OF 1

ACAD DWG:
LAST REV DATE: 2021/10/13

ISSUE	DRAWING STATUS / REVISION	DATE (YY/MM/DD)	BY
A	FOR REVIEW	21/08/11	MDO
B	FOR REVIEW	21/09/28	DPB

DESIGNED	DRAWN	CHECKED	APPROVED	SCALE AND SHEET SIZE
MAH	MDO	MAH	MAH	AS SHOWN

LEGEND

PHASE 1

PHASE 2 (FUTURE)

HASEGAWA
CONSULTING PROFESSIONAL ENGINEERS
1220 - 31 Street North, Lethbridge, Alberta T1H 5J8
P: 403-328-2686 F: 403-328-2728 E: office@hasegawa.ca

NOTES

CLIENT

UFA

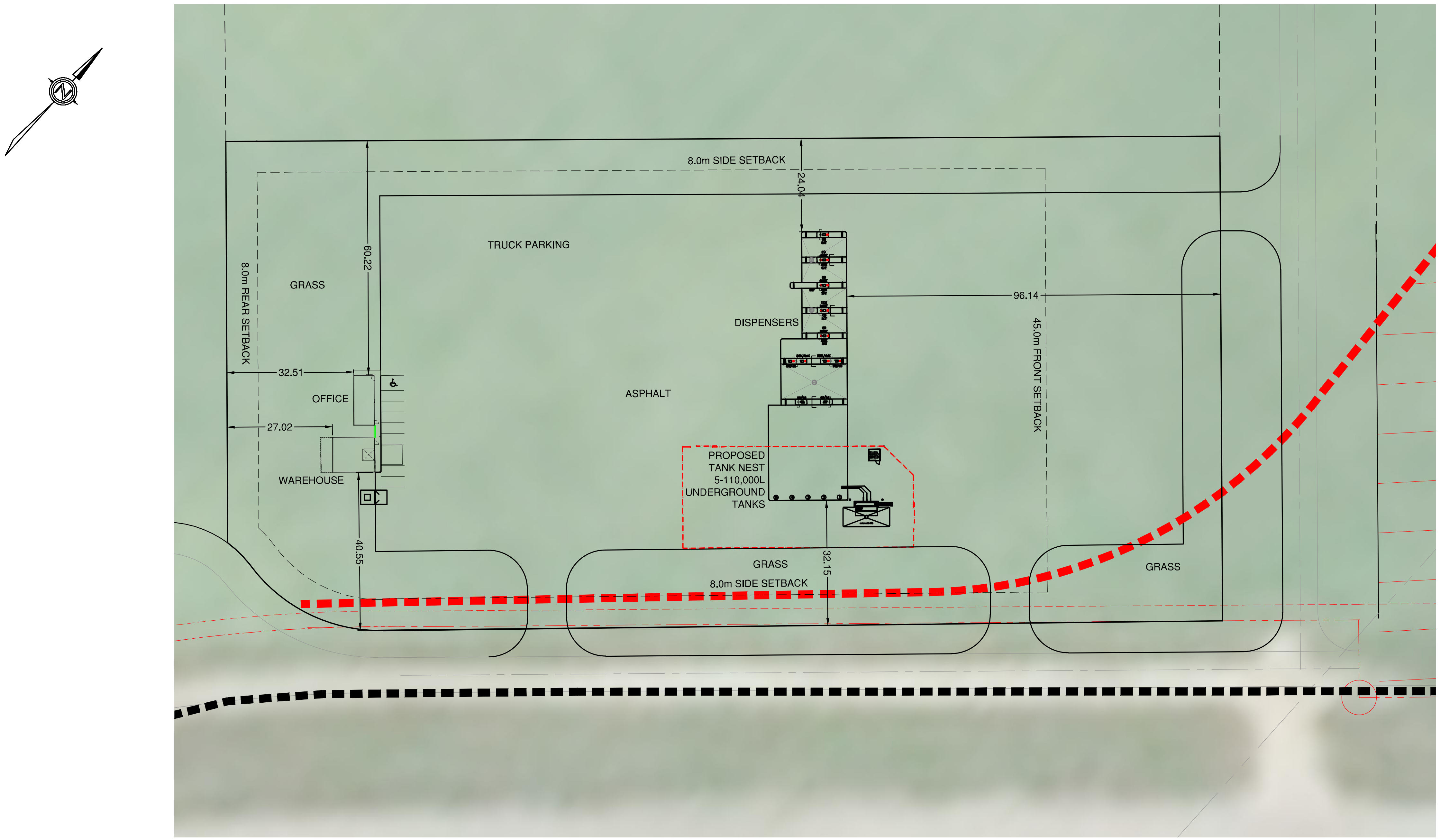
PROJECT

CORMAN 78ac.
DEVELOPMENT

DRAWING

PROPOSED PHASING
PLAN - OPTION 3

PROJECT NUMBER	SHEET NUMBER
21-050	C1.0



0 12.5 25 37.5 50 62.5 125

SCALE=1:1,250

ISSUE	DRAWING STATUS / REVISION	DATE (YY/MM/DD)	BY
A	FOR REVIEW	21/10/12	DPB

DESIGNED	DRAWN	CHECKED	APPROVED	SCALE AND SHEET SIZE
MAH	DPB	HE	MAH	AS SHOWN

HASEGAWA
CONSULTING PROFESSIONAL ENGINEERS
1220 - 31 Street North, Lethbridge, Alberta T1H 5J8
P: 403-328-2686 F: 403-328-2728 E: office@hasegawa.ca

NOTES

CLIENT
UFA

PROJECT
CORMAN 78ac.
DEVELOPMENT

DRAWING
SITE PLAN

PROJECT NUMBER
21-050

SHEET NUMBER
C1.0

Report Title:	Permit Application Details
Run Date and Time:	2021-10-14 09:27:03 Central Standard Time
Run by:	Ethan Eger
Table name:	x_smoit_hicsm_permit_application

Permit Application

Number:	RSD0004007	Needs attention:	false
Channel:	Web	Opened:	2021-08-13 15:21:40
Permit Type:	Roadside Development	Priority:	3 - Moderate
Category:		State:	Open
Other Category:		Approval:	Not Yet Requested
Applicant:	Jordan Michel	Date Issued:	
Contact:		Assignment group:	CSM Central
Requester:	Jordan Michel	Assigned to:	Ethan Eger
Applicant Company Name:			
Contact Company:			
Owner:	Dragan Karanovic		
Owner Company Name:			
Owner Contact:			
Owner Contact Company:			

Short description:

RSD Permit Application Roadside Development for Jordan Michel

Control Section:		District:	
km (approx.):		R/L:	

Notes

Watch list:		Work notes list:	

Additional comments:

2021-10-12 13:55:24 - You (Additional comments)
Lot 1 (see attached site plan) is our client's proposed lot. See attached proposed site plan, and standard lot layout drawings.

2021-10-12 13:54:36 - You (Additional comments)
Hi Ethan,

2021-09-28 15:59:41 - You (Additional comments)
A site plan showing building locations is forthcoming.

2021-09-28 15:58:09 - You (Additional comments)
Hi Ethan, For this project (Corman Park) construction is planned to occur within 12 months.

2021-09-28 15:42:51 - Ethan Eger (Additional comments)
Hi Jordan,

In our roadside development permits, we have a section that states that all work must be done within one year of the date on the approved permit. We also typically require the exact locations of the buildings within a certain development.

If you think the work will be started within the next year I can continue processing the permit. I will just require your updated plans.

If there won't be work happening for a while, I could close this application and you could reapply closer to the start of construction.

The same goes for RSD0003967.

Thanks

2021-09-27 15:29:48 - You (Additional comments)
Hi, Checking in on the status of this Application. Please provide an update. Thanks, Jordan Michel

Work notes:

Resolution Information

Resolved by:		Resolved:	
Resolution code:			

Resolution notes:

Add resolution notes to comments:

false

Application Information

Technician Review

Highway No. (if applicable):	16
Legal Land Description:	9-3-38-6 W3
GPS Coordinates:	52.241718, -106.770031

Please enter a description and additional details of the works:

Construction of a Bulk Fuel handling Facility, including underground Bulk Storage, Cardlock, Office and Warehouse.

Commercial vs. Private Use:	Commercial/ Municipal	Anticipated Construction Start Date:	
Commodity (if applicable):			

		How long do you anticipate using this infrastructure?:	More than 1 year
Constructing a new approach:	false	Modifying an existing approach:	false
Utilizing an existing approach (without modifications):	false	Removing an existing approach:	false
First Name:		Last Name:	
Company Name (if applicable):		24-hour Phone Number:	

Attachments

Related List Title: Attachment List
Table name: sys_attachment
Query Condition: Table name = x_smoit_hicsm_permit_application AND Table sys ID = 0b8f1e841b06fcd05161a60abc4bcbe8
Sort Order: Created in descending order

3 Attachments

File name	Content type	▼ Created	Created by
CORMAN 78ac DEVELOPMENT - SASKATOON_9-28-21.pdf	application/pdf	2021-10-12 13:55:32	hiportal
21-050 - Corman Park UFA - Preliminary Site Plan_10-12-21.pdf	application/pdf	2021-10-12 13:55:31	hiportal
21-XXX - UFA - CORMAN 78ac DEV - Saskatoon - OPTION 1 - FOR REVIEW - Aug 11 2021.pdf	application/pdf	2021-08-13 15:21:30	hiportal

Related List Title: Email List
Table name: sys_email
Query Condition: Target table = x_smoit_hicsm_permit_application AND Target = 0b8f1e841b06fcd05161a60abc4bcbe8
Sort Order: None

8 Emails

Created	Recipients	Subject	Type	Notification type	User ID
2021-08-17 10:10:52	jordan.m@hasegawa.ca	Application RSD0004007 has been assigned	sent	SMTP	
2021-08-13 15:21:54	jordan.m@hasegawa.ca	Application RSD0004007 has been submitted.	sent	SMTP	
2021-10-12 13:55:45	ethan.eger@gov.sk.ca	RSD0004007 has new comment	sent	SMTP	
2021-09-27 15:30:08	ethan.eger@gov.sk.ca	RSD0004007 has new comment	sent	SMTP	

Created	Recipients	Subject	Type	Notification type	User ID
2021-09-28 15:59:53	ethan.eger@gov.sk.ca	RSD0004007 has new comment	sent	SMTP	
2021-09-28 15:58:30	ethan.eger@gov.sk.ca	RSD0004007 has new comment	sent	SMTP	
2021-10-12 13:54:56	ethan.eger@gov.sk.ca	RSD0004007 has new comment	sent	SMTP	
2021-09-28 15:42:55	jordan.m@hasegawa.ca	Application RSD0004007 has comments	sent	SMTP	

Related List Title: Phone Log List

Table name: sn_openframe_phone_log

Query Condition: Task = RSD0004007

Sort Order: None

None

ECONO SEPTIC & SEWER SERVICES LTD.

May 6, 2022

Jordan Michel
RM Corman Park

Dear Mr. Michel:

In response to your request regarding your septic needs, Econo Septic and Sewer Services Ltd. Is a licensed sewage disposal company that can pump out your holding tanks. We are approved by Water Security Agency to haul our disposal to various rural municipalities. As a rule, we usually haul and dump the sewage at the Saskatoon Water Treatment Plant.

If you have or will have approval for dumping sewage at your facility, we will certainly meet those requirements. Once you have determined what site you would like to use and have approval from the rural municipality, we will get the necessary approval from the Agency.

Our contact information is as follows:

Phone 306-384-6662

Email: econoseptic@sasktel.net

Website: www.econoseptic.ca

Thank you for giving us this opportunity.

Yours Truly,

Ada Arlein
Business Manager
Econo Septic & Sewer Services Ltd.

carol.s@hasegawa.ca

From:	Ken Yick <ken.yick@sasktel.com>
Sent:	November 12, 2021 11:07 AM
To:	jordan.m@hasegawa.ca
Subject:	Corman Park - SaskTel
Attachments:	2021-13986 Proposed Pathway.pdf; REV 1_CORMAN 78ac DEVELOPMENT - SASKATOON - Sept 28 2021-OPTION 3 (002) (1).pdf

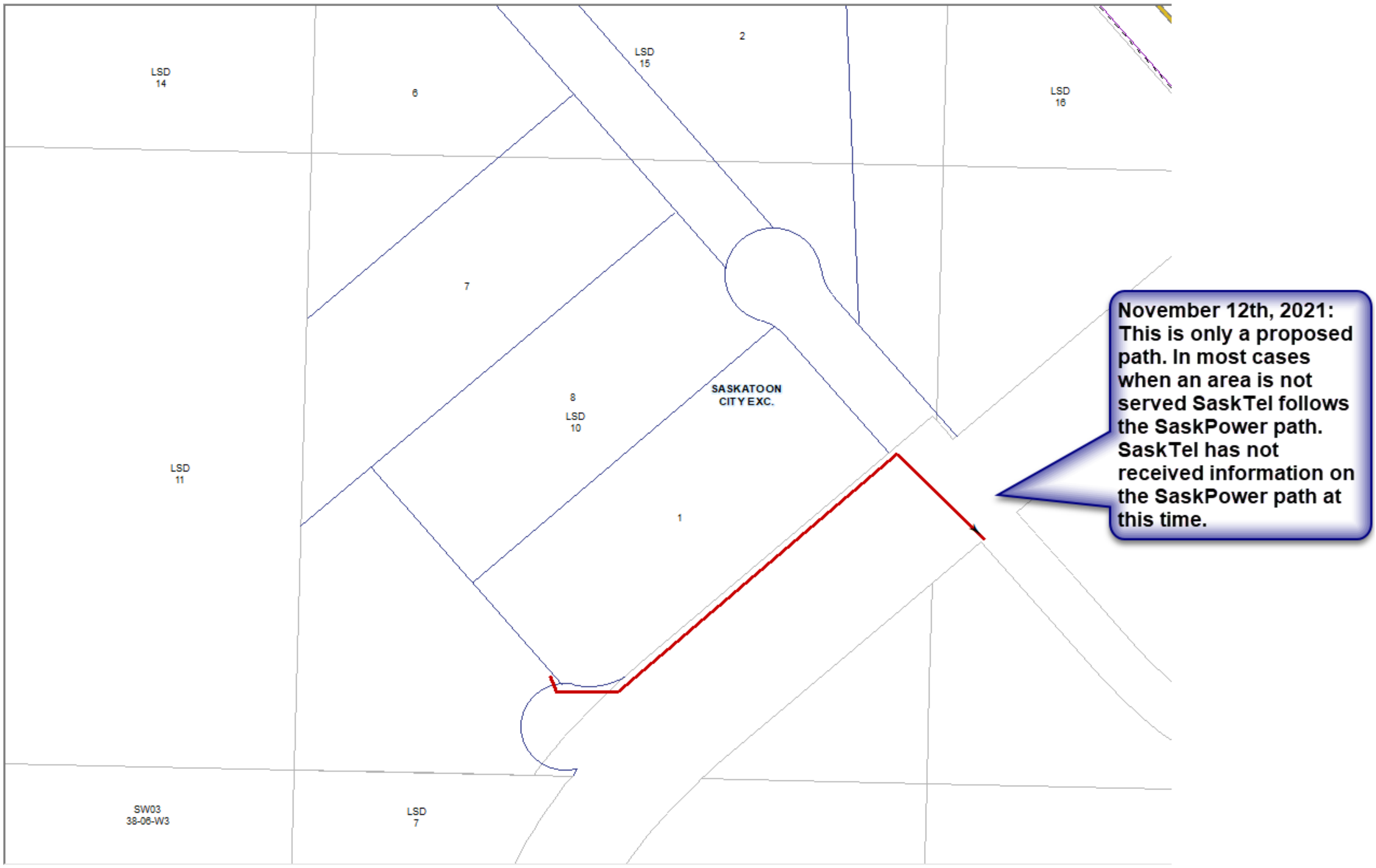
Hi Jordan:

Here's the tentative pathway drawing for your reference.

Thanks

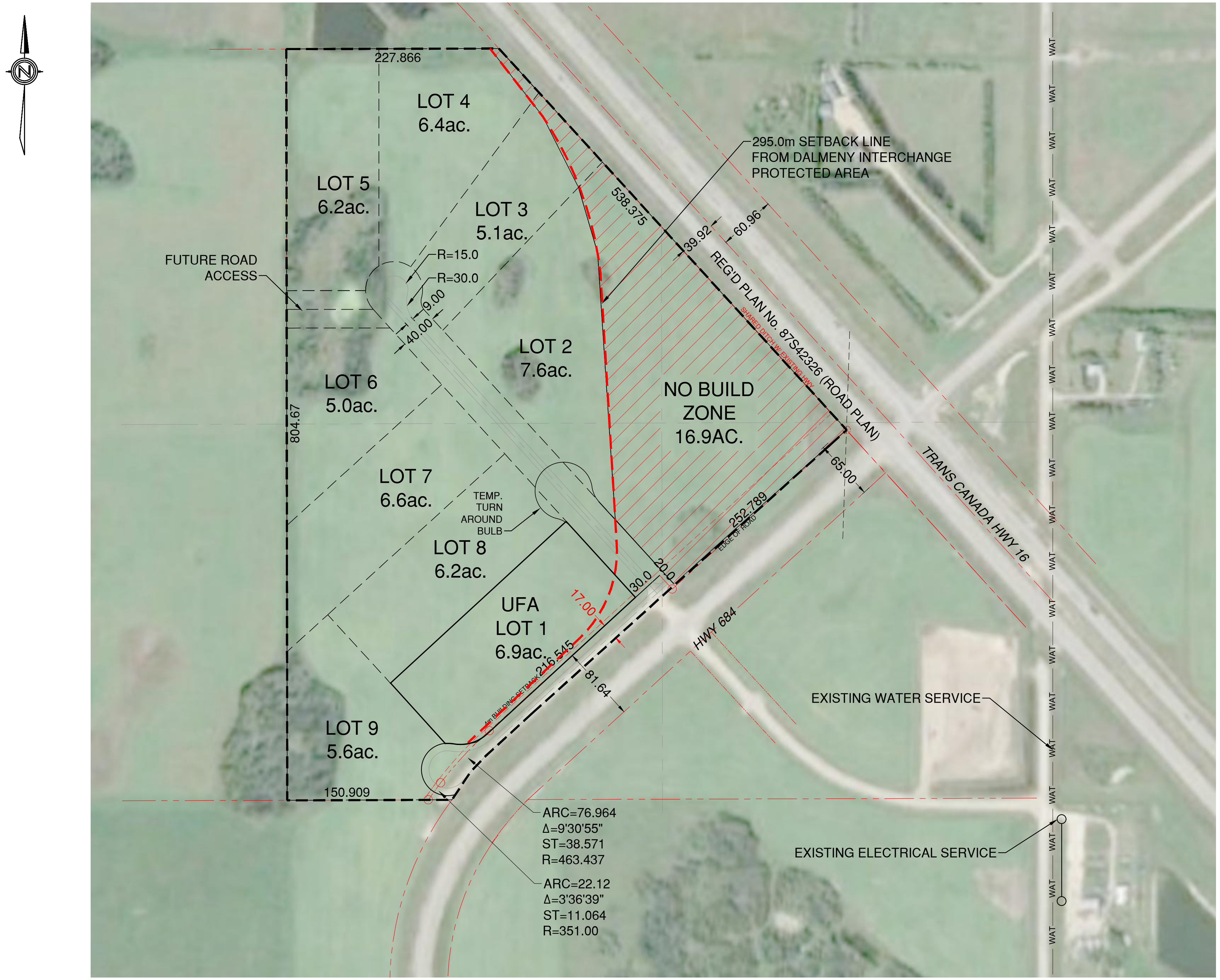
Ken Yick
Account Executive
Business Sales - SMB
e: ken.yick@sasktel.com
w: sasktel.com/business
d: 306.931.5351

SaskTel
Business Solutions


LSD
14
6
LSD
15
2
LSD
16
7
8
LSD
10
SASKATOON
CITY EXC.
LSD
11
1
SW03
38-06-W3
LSD
7
November 12th, 2021: This is only a proposed path. In most cases when an area is not served SaskTel follows the SaskPower path. SaskTel has not received information on the SaskPower path at this time.

ISSUE	DRAWING STATUS / REVISION	DATE (YY/MM/DD)	BY
A	FOR REVIEW	21/08/11	MDO
B	FOR REVIEW	21/09/28	DPB

DESIGNED	DRAWN	CHECKED	APPROVED	SCALE AND SHEET SIZE
MAH	MDO	MAH	MAH	AS SHOWN



0 50 100 150 200 250 500

SCALE=1:5,000

LEGEND

PHASE 1

PHASE 2 (FUTURE)

HASEGAWA
CONSULTING PROFESSIONAL ENGINEERS

1220 - 31 Street North, Lethbridge, Alberta T1H 5J8
P: 403-328-2686 F: 403-328-2728 E: office@hasegawa.ca

NOTES

CLIENT
UFA

PROJECT
CORMAN 78ac.
DEVELOPMENT

DRAWING
PROPOSED PHASING
PLAN - OPTION 3

PROJECT NUMBER
21-050

SHEET NUMBER
C1.0

carol.s@hasegawa.ca

From:	Ken Yick <ken.yick@sasktel.com>
Sent:	November 1, 2021 3:27 PM
To:	Jordan Michel
Subject:	SaskTel - Dalmeny

Good afternoon Jordan:

Here are the rates to bring telephone cable to your site:

Description

- Copper cable – 1st voice facility to new demarc
- Plowing and construction required

Cost

- $400.00
- If you wish to proceed with this work during the winter months, a winter surcharge of $3,177.00 would be applicable
- Building entry: $1,500.00 (from the property line to the building)

If you wish to have this work completed during the summer construction period: this work can be completed after June 30, 2022

Phone service: monthly rates and installation are not included in this quote.

Please let me know if I can be of any further assistance. Sorry that it took a while to get this request back from our engineering dept.

Thanks

Ken Yick

ACCOUNT EXECUTIVE

d: 306 931 5351
c: 306 221 3001
e: ken.yick@sasktel.com
w: sasktel.com/business

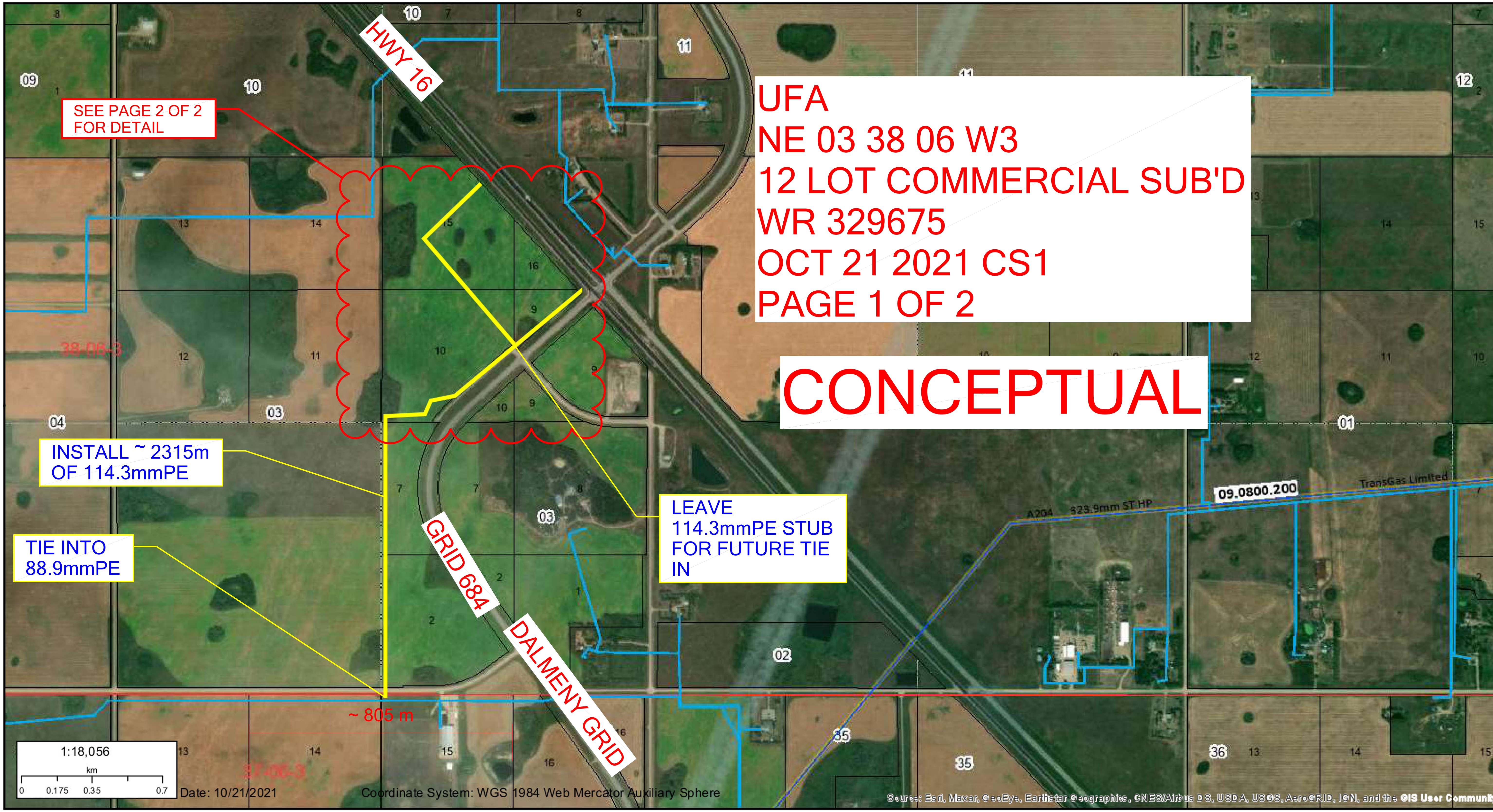
SaskTel
| Business Solutions |

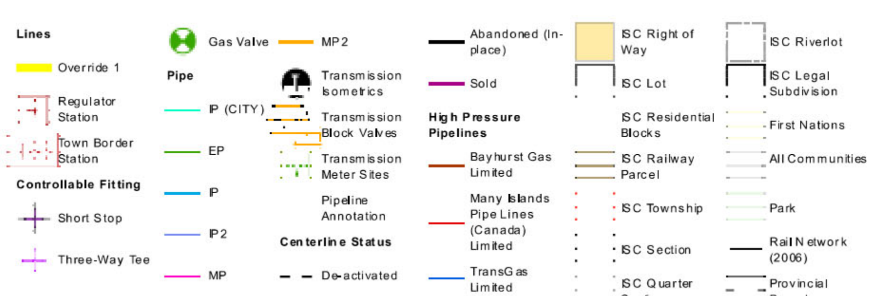
carol.s@hasegawa.ca

From:	Customer Connect 4 <CustomerConnect4@saskenergy.com>
Sent:	November 3, 2021 2:32 PM
To:	jordan.m@hasegawa.ca
Subject:	WR329625 Conceptual SaskEnergy Plan
Attachments:	WR 329675 CONCEPTUAL PAGE 1 OF 2 OCT 21 2021 CS1.pdf; WR 329675 CONCEPTUAL PAGE 2 OF 2 OCT 21 2021 CS1.pdf

Jordan here is a copy of the proposed Gas line to serve your proposed development in NE-03-38-06-W3 Corman Park. I have voided the DocuSign Document so it will stop appearing on your end. Let me know if you have any other questions. Thanks.

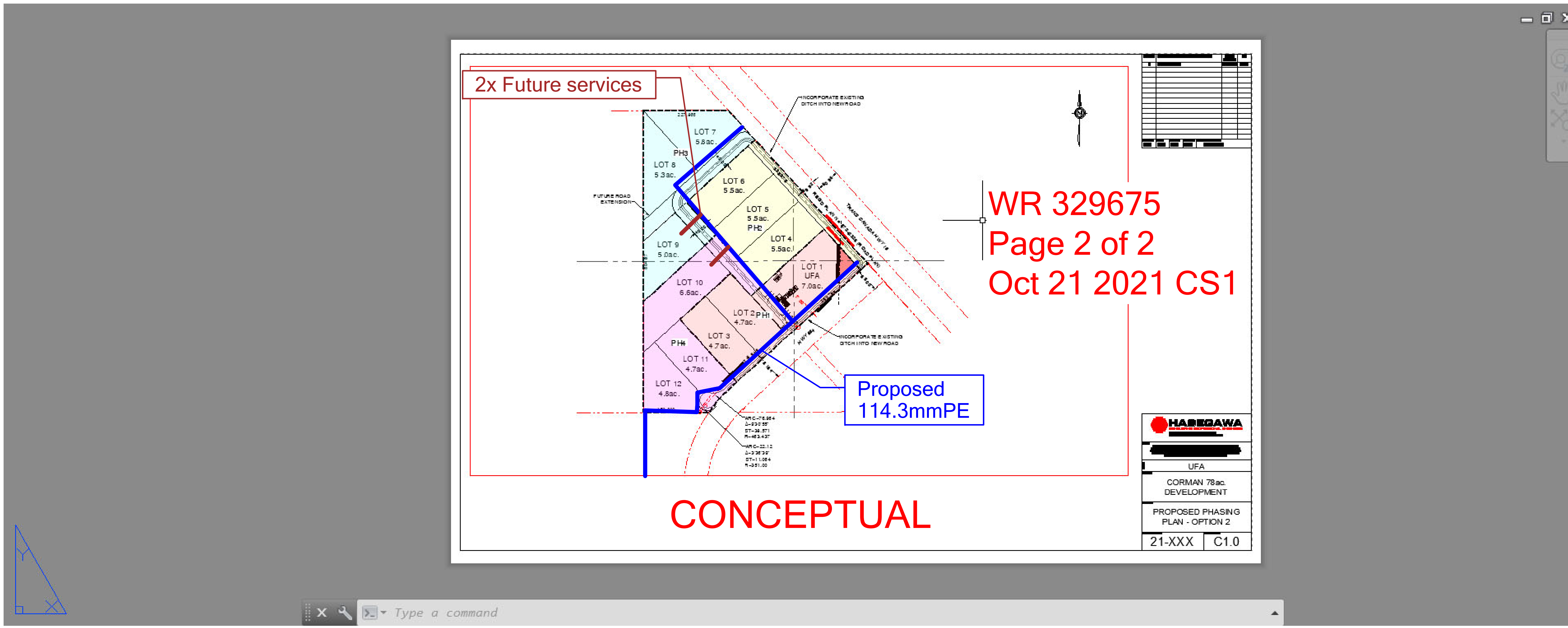
Corey Snider
Customer Connect Technician
SaskEnergy
PO Box 1056
North Battleford SK S9A 3E6
C. 306.920.7143
customerconnect4@saskenergy.com | saskenergy.com





Distribution Asset Viewer Map

SaskEnergy


2x Future services
WR 329675
Page 2 of 2
Oct 21 2021 CS1
Proposed
114.3mmPE
CONCEPTUAL
LOT 7
5.8ac.
LOT 8
5.3ac.
PH3
LOT 6
5.5ac.
LOT 5
5.5ac.
PH2
LOT 4
5.5ac.
LOT 9
5.0ac.
LOT 1
UFA
7.0ac.
LOT 10
6.6ac.
LOT 2
4.7ac.
PH1
LOT 3
4.7ac.
PH4
LOT 11
4.7ac.
LOT 12
4.8ac.
FUTURE ROAD EXTENSION
INCORPORATE EXISTING DITCH INTO NEW ROAD
HASEGAWA
[redacted]
UFA
CORMAN 78ac. DEVELOPMENT
PROPOSED PHASING PLAN - OPTION 2
21-XXX
C1.0
Type a command

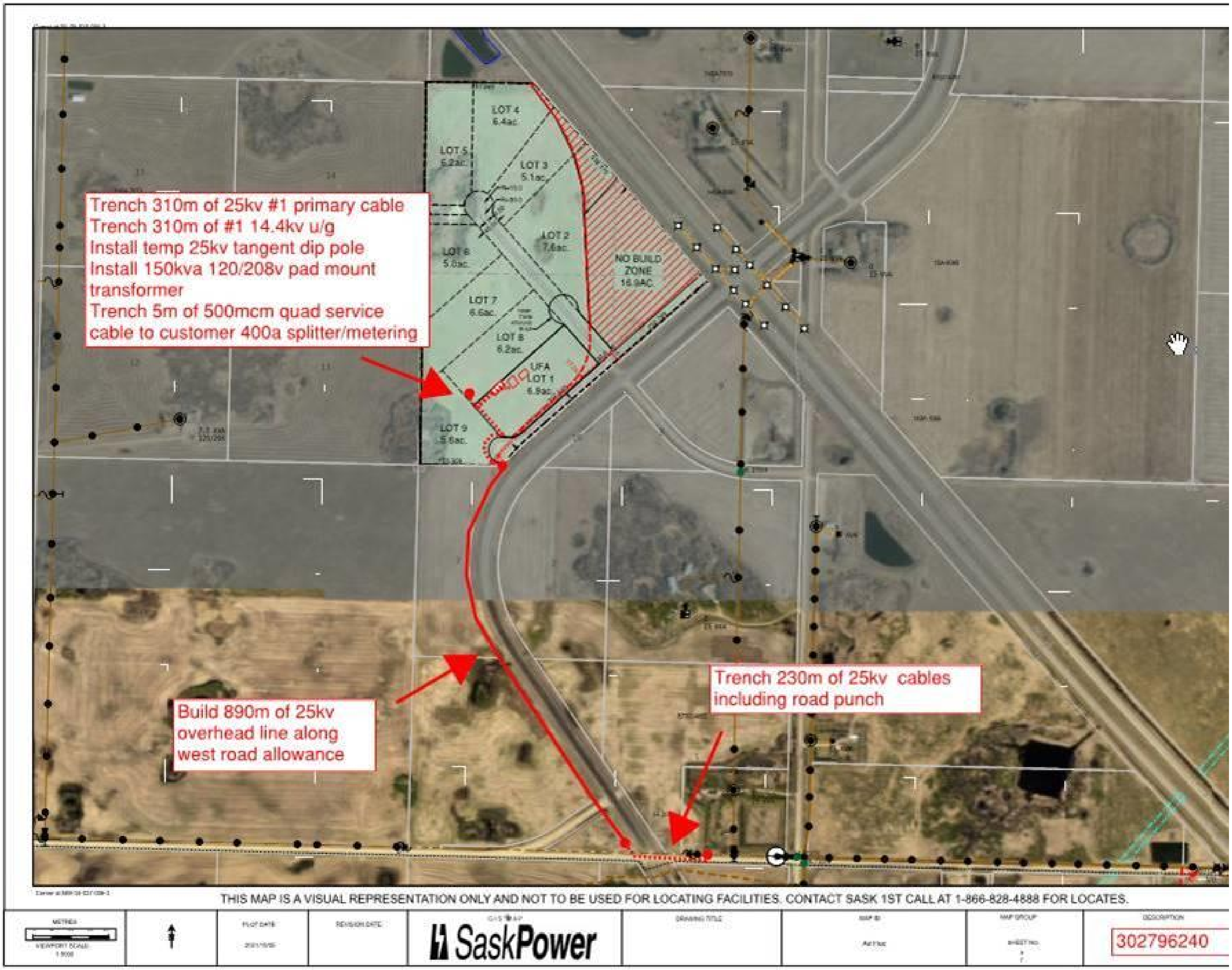
carol.s@hasegawa.ca

From:	Ian Waldner <iwaldner@saskpower.com>
Sent:	October 12, 2021 10:49 AM
To:	jordan.m@hasegawa.ca
Subject:	FW: EXTERNAL EMAIL: RE: 302796240

Jordon,
As per our phone conversation this morning, a ballpark cost to build overhead distribution line to subdivision and trench the underground 3ph 25kv #1Al primary cables to 150kva 120/208v transformer with 500mcm Quad service cable to customer 400a splitter/metering, about $100,000.00
Please call/email back if you would like to proceed.
Please allow at least 10 weeks for scheduling from when you call back to proceed.

Thanks

Ian Waldner
SaskPower |Quote Expeditor
p. 306-934-7760 | email (iwaldner@saskpower.com) | saskpower.com

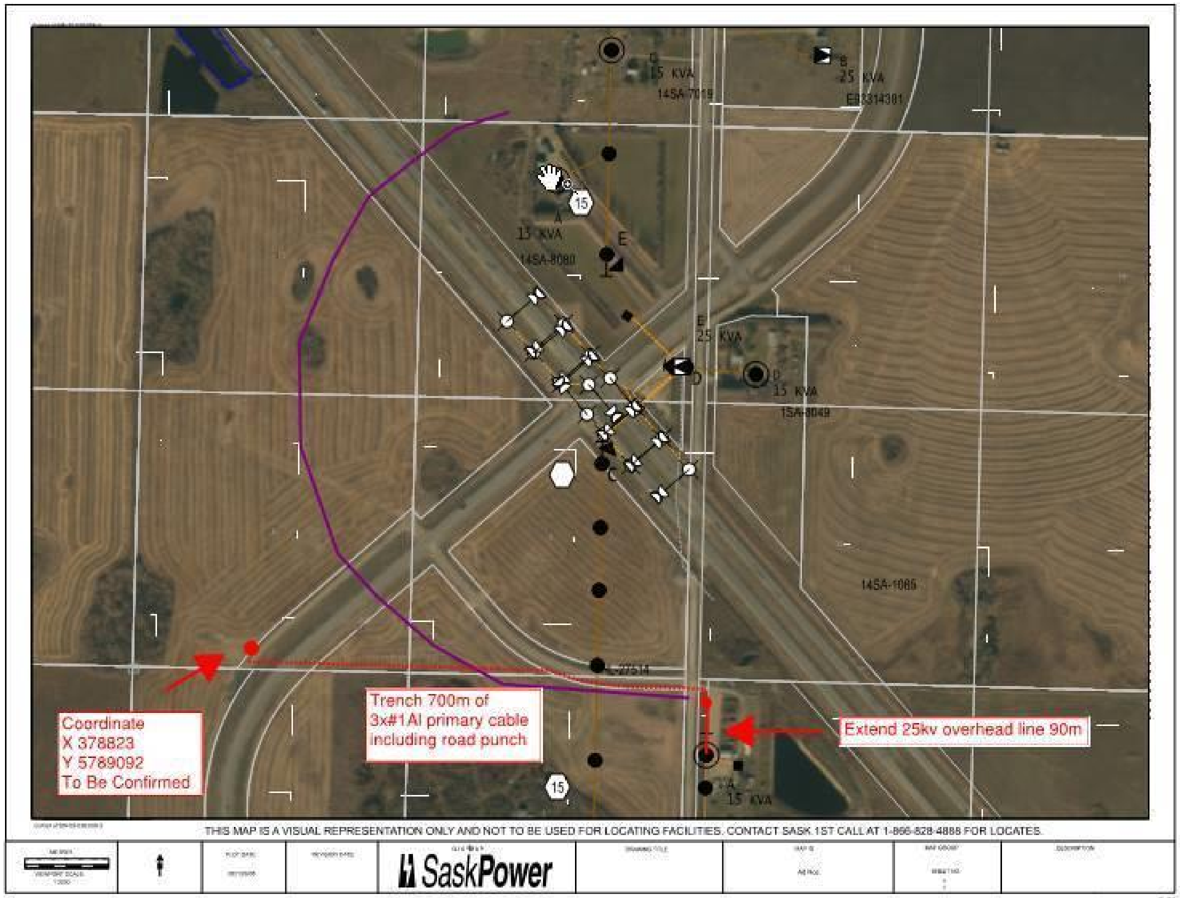


From: Ian Waldner
Sent: Friday, September 10, 2021 12:21 PM
To: 'jordan.m@hasegawa.ca' <jordan.m@hasegawa.ca>
Subject: RE: EXTERNAL EMAIL: RE: 302796240

Jordon,
I am unable to get you a cost until I get a lot(8) layout for this property.

Thanks

Ian Waldner
SaskPower |Quote Expeditor
p. 306-934-7760 | email (iwaldner@saskpower.com) | saskpower.com

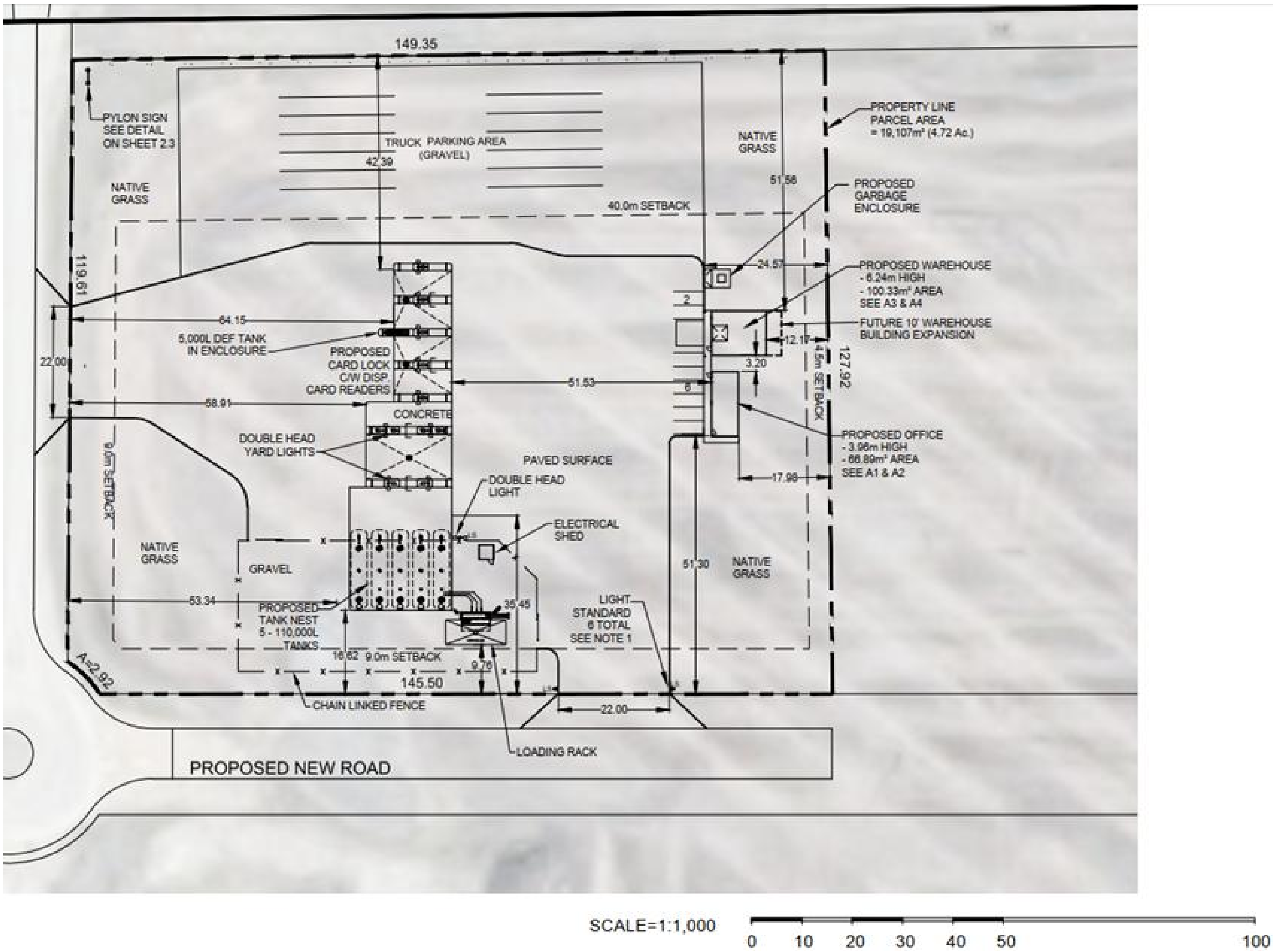


From: jordan.m@hasegawa.ca <jordan.m@hasegawa.ca>
Sent: Friday, September 10, 2021 10:04 AM
To: Ian Waldner <iwaldner@saskpower.com>
Subject: RE: EXTERNAL EMAIL: RE: 302796240

EXTERNAL EMAIL: Take extra caution when clicking links or opening files. Report any suspected phishing.

Hi Ian,

I don't have a proposed layout for this site, but it will be similar to the picture below:



Jordan Michel, P. Eng.
Project Engineer
1220 31st St N
Lethbridge, AB T1H 5J8
jordan.m@hasegawa.ca
office: 403-328-2686, Ext. 115
mobile: 403-915-4923
fax: 403-328-2728
HASEGAWA
CONSULTING PROFESSIONAL ENGINEERS

From: Ian Waldner <iwaldner@saskpower.com>
Sent: September 8, 2021 12:25 PM
To: jordan.m@hasegawa.ca
Subject: RE: EXTERNAL EMAIL: RE: 302796240

Joran,
Please plot the developer's building on the property for estimating purposes.

Thanks

Ian Waldner
SaskPower |Quote Expeditor
p. 306-934-7760 | email (iwaldner@saskpower.com) | saskpower.com

---

From: jordan.m@hasegawa.ca <jordan.m@hasegawa.ca>
Sent: Wednesday, September 8, 2021 10:35 AM
To: Ian Waldner <iwaldner@saskpower.com>
Subject: EXTERNAL EMAIL: RE: 302796240

Ian,

FYI: initial development will begin at the south of the proposed space.

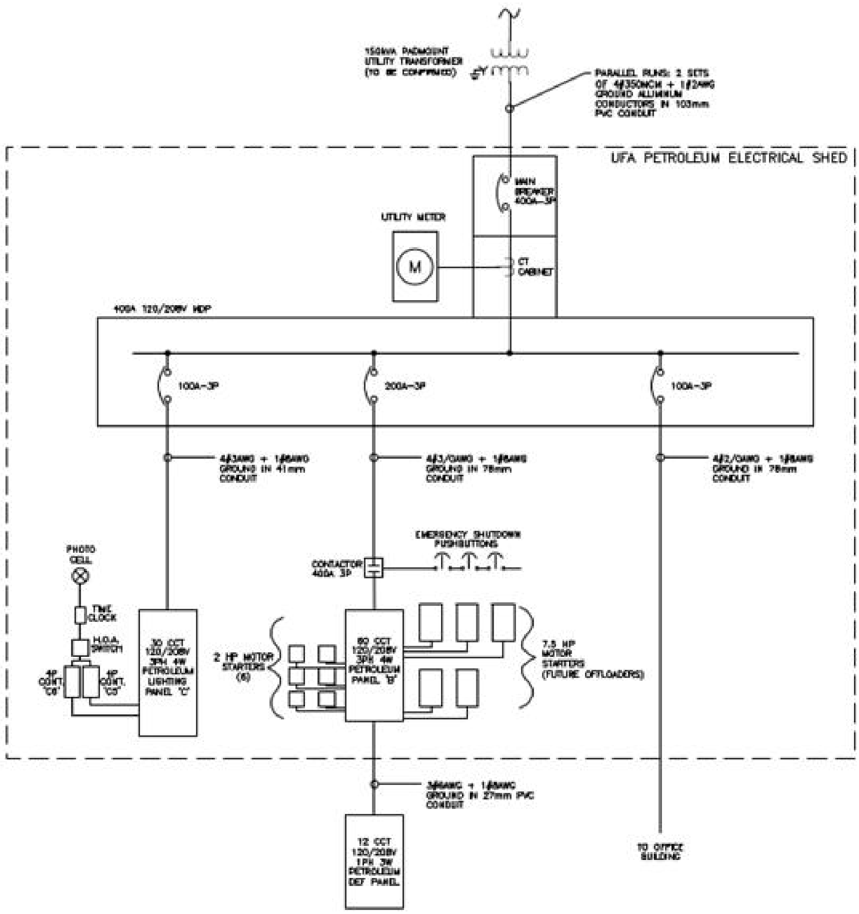
From: jordan.m@hasegawa.ca <jordan.m@hasegawa.ca>
Sent: September 8, 2021 10:10 AM
To: 'Ian Waldner' <iwaldner@saskpower.com>
Subject: RE: 302796240

Hi Ian,

At this point the developable space has been reduced due to Sask. Highways potential future intersection cloverleaf expansion.

The shaded are is the proposed developable space. At this point, the proposed lot layout is unknown, but will not likely exceed 8.

For the known lot (developer's lot) we will need a 400A service fed via a 150kVA transformer. See example SLD below:



Please call if you need more info, or have any questions.

Regards,

Jordan Michel, P. Eng.
Project Engineer
1220 31st St N
Lethbridge, AB T1H 5J8
jordan.m@hasegawa.ca
office: 403-328-2686, Ext. 115
mobile: 403-915-4923
fax: 403-328-2728
HASEGAWA
CONSULTING PROFESSIONAL ENGINEERS

From: Ian Waldner <iwaldner@saskpower.com>
Sent: August 26, 2021 12:21 PM
To: JORDAN.M@HASEGAWA.CA
Subject: 302796240

Jordan,
I have started to work on a cost for your new Subdivision on NE0338063 CORMAN PARK. I need a PDF file of the property/lot layout. Please return to this email address.

Thanks

Ian Waldner
SaskPower |Quote Expeditor
p. 306-934-7760 | email (iwaldner@saskpower.com) | saskpower.com

carol.s@hasegawa.ca

From:	iwi1@sasktel.net
Sent:	March 24, 2022 5:38 PM
To:	jordan.m@hasegawa.ca
Cc:	geoff.booth@outlook.com
Subject:	RE: FW: MD of Corman Park Commercial / Light-Industrial Development - Request for Water Information

Sorry Jordan,

Hit send too quick

On Thu, 24 Mar 2022 19:28:55 -0400, iwi1@sasktel.net wrote:

Answers to questions:

- Size of water line, available flow and pressure
  - 2" water line
  - Available flow - TBD - need engineering results
  - PSI: Guaranteed 20 PSI. This is a drip system with flow regulator min (.5 Imp GMP)
  - Water must be delivered to a holding tank and you must provide your pumping system from the tank.
  - The size of the line we would run to the edge of the property is based on the number of gallons to be consumed in order to keep chlorine level up.
- Location of existing infrastructure, and proposed extension path to our lot
  - E of 684 (Old Highway)(Approx 1/2 mile with 2 highways to directional bore under)
- Contribution requirements to become a member of the coop
  - Dependent on design and consumption
  - Water is provided if allocation and line capacity is available, If you only purchase one allocation today the others may not be available in the future.
  - Will the 13 lots be sold as separate entities. If so, each lot will require a separate curbstop.
- Construction timelines to obtain the service
  - Subject to time of year and contractor availability
  - Minimum 8 weeks to get permits

To move forward with an estimate we need answers to the following::

- Will the lots be sold individually?
- Would the client want to guarantee a minimum allocation for each lot now to ensure supply?
- Some kind of estimate for the other 12 lots
- To get firm flow rates will require engineering services and the costs would be billed back to you

On Thu, 24 Mar 2022 10:03:29 -0600, <jordan.m@hasegawa.ca> wrote:

Hi Heather,

Per our brief conversation this morning:

We are in the process of applying for development permit, and are looking for info with respect to existing and proposed options for the water service for our proposed subdivision (see attached)

Site Information:

- Subdivision will consist of up to 13 lots at full build out
- Phase 1 consists of one lot
  - Phase 1 Lot – Cardlock Gas Station with two buildings
  - One of the buildings will need water
    - Demand is for two bathrooms (one includes a shower)
    - Also included will be a hose bib on the exterior of the building

- Future lots' water requirements are unknown

Information we need:

- Size of water line, available flow and pressure
- Location of existing infrastructure, and proposed extension path to our lot
- Contribution requirements to become a member of the coop
- Construction timelines to obtain the service

Please confirm where we are currently showing the existing and proposed water lines on drawing C2.0.

- Water line labelling:
  - Existing – 'EX WAT'
  - Proposed – 'WAT'

Regards,

Jordan Michel, P. Eng.

Project Engineer

1220 31st St N

Lethbridge, AB T1H 5J8

jordan.m@hasegawa.ca

office: 403-328-2686, Ext. 115

mobile: 403-915-4923

fax: 403-328-2728

From: jordan.m@hasegawa.ca jordan.m@hasegawa.ca
Sent: September 27, 2021 3:04 PM
To: iwi1@sasktel.net
Subject: RE: FW: MD of Corman Park Commercial / Light-Industrial Development - Request for Water Information

Hi Heather,

Thanks for identifying this.

Lets stick to referring to it by the 'LSD10' title since that is where our client's site will be developed.

Jordan Michel, P. Eng.

Project Engineer

1220 31st St N

Lethbridge, AB T1H 5J8

jordan.m@hasegawa.ca

office: 403-328-2686, Ext. 115

mobile: 403-915-4923

fax: 403-328-2728

From: iwi1@sasktel.net <iwi1@sasktel.net>
Sent: September 27, 2021 3:02 PM
To: jordan.m@hasegawa.ca
Subject: RE: FW: MD of Corman Park Commercial / Light-Industrial Development - Request for Water Information

Hi Jordan

It looks like it is on four land titles.

Please see attachment.

Heather

On Mon, 27 Sep 2021 13:49:57 -0600, <jordan.m@hasegawa.ca> wrote:

See comments below in red:

Thanks

From: iwi1@sasktel.net <iwi1@sasktel.net>
Sent: September 27, 2021 1:35 PM
To: jordan.m@hasegawa.ca
Subject: Re: FW: MD of Corman Park Commercial / Light-Industrial Development - Request for Water Information

Hi Jordan

Looking at your drawing isn't LSD 9
-not sure what is meant by this statement. Please explain.
About the only thing I can tell you it is a 2 " line and it is a drip system.

I don’t know what the pressure is.
-please inquire when you reach out to your board. We are approaching a critical date in our project where our client needs to finalize their purchase decision. We would need this information as soon as possible.
Heather

On Mon, 27 Sep 2021 12:54:41 -0600, <jordan.m@hasegawa.ca> wrote:

Hi Heather,

If you are able to, will you provide me with the following info on the existing line:

- Size
- Flow
- Pressure

Thanks,

Jordan Michel, P. Eng.

Project Engineer

1220 31st St N

Lethbridge, AB T1H 5J8

jordan.m@hasegawa.ca

office: 403-328-2686, Ext. 115

mobile: 403-915-4923

fax: 403-328-2728

From: jordan.m@hasegawa.ca <jordan.m@hasegawa.ca>
Sent: September 27, 2021 10:10 AM
To: 'iwi1@sasktel.net' <iwi1@sasktel.net>
Subject: MD of Corman Park Commercial / Light-Industrial Development - Request for Water Information

Hi Heather,

Per our conversation this morning:

We are working with a client intending on developing some land in the MD of Corman Park.

The development will be between 50-80 acres, and will likely be divided into 8-10 lots. It can be assumed that most lots will require water.

The development will begin at the south and phasing will move north as development progresses.

Please present this to your board for approval, and let us know what capacity is available to tie into, and any access requirements that need to be considered.

Regards,

Jordan Michel, P. Eng.

Project Engineer

1220 31st St N

Lethbridge, AB T1H 5J8

jordan.m@hasegawa.ca

office: 403-328-2686, Ext. 115

mobile: 403-915-4923

fax: 403-328-2728

From: iwi1@sasktel.net <iwi1@sasktel.net>
Sent: August 23, 2021 3:34 PM
To: jordan.m@hasegawa.ca
Subject: map

Hi Jordan

Please see attachment for LSD 10 NE 3-38-6-W3.

If you have any questions, please call 306-242-6663.

Thanks
Heather Veitch
Intervalley Water

carol.s@hasegawa.ca

From:	jordan.m@hasegawa.ca
Sent:	July 8, 2022 12:01 PM
To:	'Mark Hasegawa'
Cc:	carol.s@hasegawa.ca
Subject:	FW: Corman Park Development

From: Eger, Ethan HI <ethan.eger@gov.sk.ca>
Sent: July 8, 2022 11:56 AM
To: jordan.m@hasegawa.ca
Subject: RE: Corman Park Development

Hi Jordan,

A condition of the Roadside Development Permit (RSD0004007) was that a TIA be approved before the final approval of the permit. The TIA was provided during the application process and, after meeting the aforementioned approval of the TIA, the Roadside Development Permit was issued in November 2021.

Thanks,

Ethan Eger (he/him)
Government of Saskatchewan
Engineering Intern
Traffic Engineering and Development, Ministry of Highways

18-3603 Millar Avenue
Saskatoon, Canada S7P 0B2
ethan.eger@gov.sk.ca

Saskatchewan

Twitter | LinkedIn | Facebook | YouTube

From: jordan.m@hasegawa.ca <jordan.m@hasegawa.ca>
Sent: Friday, July 8, 2022 11:32 AM
To: Eger, Ethan HI <ethan.eger@gov.sk.ca>
Subject: RE: Corman Park Development
Importance: High

WARNING: This message originated from a source that is not managed by **SaskBuilds and Procurement, Information Technology Division**. Do not visit links or open attachments unless you trust the sender's email ID and ensure it is not a spam/phishing email.

Hi Ethan,

We are planning to submit for CDR approval this Monday.

The RM of Corman Park requested that a response from MoH be included in our submission.

The response needs to say that the Roadside Development Permit RSD0004007 was issued based on MoH reviewing and accepting the TIA which was provided during the application process.

Are you able to reply to this email stating something like this in your own words?

Thanks,

Jordan Michel, P. Eng.
Project Engineer
1220 31st St N
Lethbridge, AB T1H 5J8
jordan.m@hasegawa.ca
office: 403-328-2686, Ext. 115
mobile: 403-915-4923
fax: 403-328-2728
HASEGAWA
CONSULTING PROFESSIONAL ENGINEERS

From: jordan.m@hasegawa.ca <jordan.m@hasegawa.ca>
Sent: July 4, 2022 2:20 PM
To: 'Eger, Ethan HI' <ethan.eger@gov.sk.ca>
Subject: RE: Corman Park Development

Hi Ethan,

That area was included with Phase 1 to incorporate adequate site development including grading, drainage and access.

To answer your question, this results in no changes to traffic volumes.

Let me know if you have any questions.

Regards,

Jordan Michel, P. Eng.
Project Engineer
1220 31st St N
Lethbridge, AB T1H 5J8
jordan.m@hasegawa.ca
office: 403-328-2686, Ext. 115
mobile: 403-915-4923
fax: 403-328-2728

HASEGAWA
CONSULTING PROFESSIONAL ENGINEERS

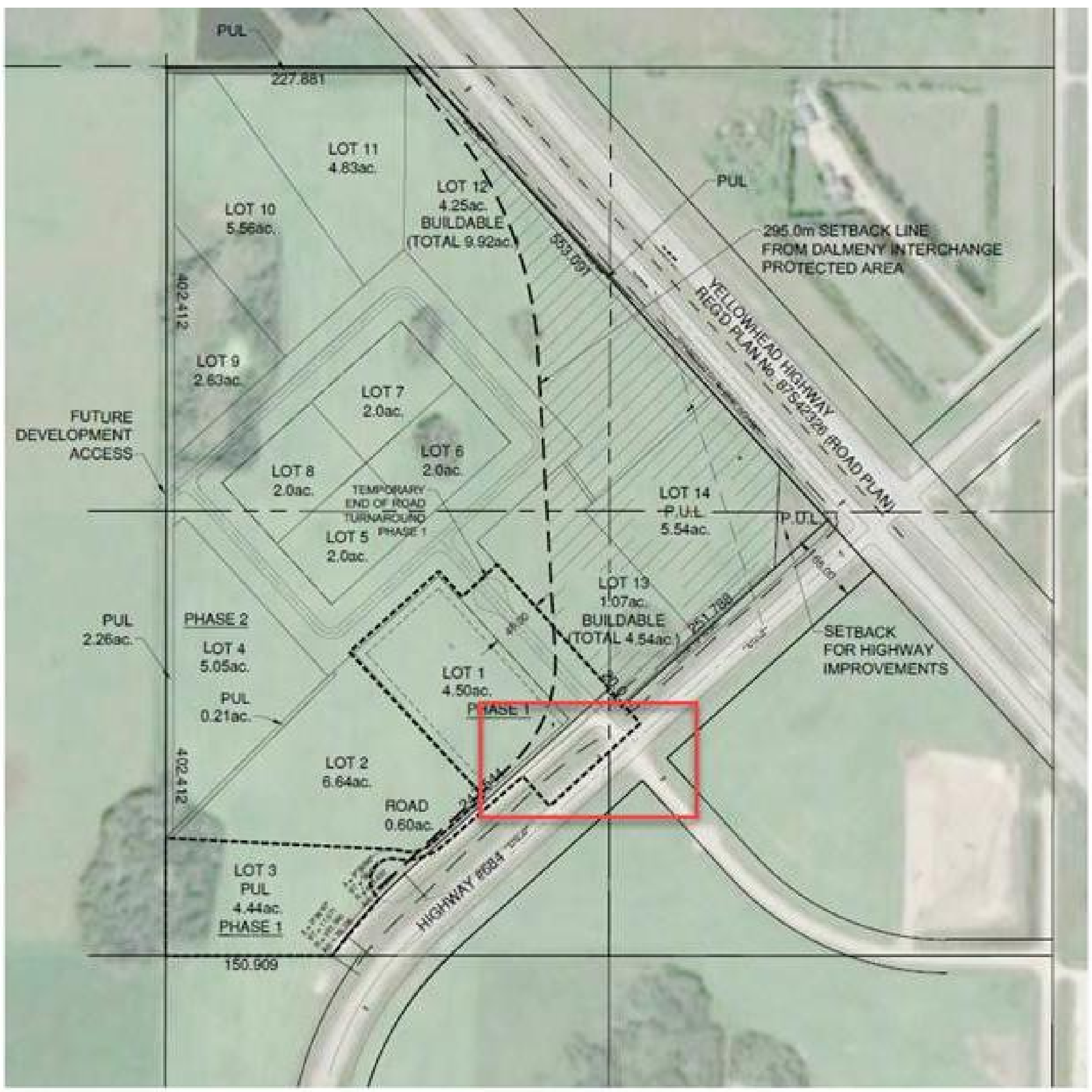
From: Eger, Ethan HI <ethan.eger@gov.sk.ca>
Sent: July 4, 2022 11:22 AM
To: jordan.m@hasegawa.ca
Subject: RE: Corman Park Development

Hi Jordan,

We have one question about your new plan.

In the image below, could you provide some detail regarding the added section shown in red? This extra section seems to be the only major difference between this overall plan and the old version.

Is it also safe to assume that there is no change in traffic volumes resulting from this revision?



Thanks,

Ethan Eger (he/him)
Government of Saskatchewan
Engineering Intern
Traffic Engineering and Development, Ministry of Highways

18-3603 Millar Avenue
Saskatoon, Canada S7P 0B2
ethan.eger@gov.sk.ca

Twitter | LinkedIn | Facebook | YouTube

From: Eger, Ethan HI
Sent: Monday, July 4, 2022 7:37 AM
To: jordan.m@hasegawa.ca
Subject: RE: Corman Park Development

Hi Jordan,

I'll discuss the changes with my supervisor today to see if your permit needs to get revised.

Thanks,

Ethan Eger (he/him)
Government of Saskatchewan
Engineering Intern
Traffic Engineering and Development, Ministry of Highways

18-3603 Millar Avenue
Saskatoon, Canada S7P 0B2
ethan.eger@gov.sk.ca

Twitter | LinkedIn | Facebook | YouTube

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From: jordan.m@hasegawa.ca <jordan.m@hasegawa.ca>
Sent: Thursday, June 30, 2022 1:56 PM
To: Eger, Ethan HI <ethan.eger@gov.sk.ca>
Subject: RE: Corman Park Development

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Hi Ethan,

I am reaching to discuss our project moving forward.

We are working with the RM of Corman Park in preparing and submitting a CDR complete with accompanying documentation (including a Roadside Development Permit) for their approval.

At this point we have obtained a TIA and received an approved Roadside Development Permit (RSD0004007) (see attached) from MoH for the proposed subdivision.

There have been a few minor changes to the proposed lot layout. (See attached)

My question is will this affect the status of the Roadside Development Permit, or can we continue to move forward with our CDR submittal to the municipality with the new proposed lot layout?

Please reply to this email, or feel free to call if you have any questions.

Regards,
Jordan Michel, P. Eng.
Project Engineer
1220 31st St N
Lethbridge, AB T1H 5J8
jordan.m@hasegawa.ca
office: 403-328-2686, Ext. 115
mobile: 403-915-4923
fax: 403-328-2728
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CONSULTING PROFESSIONAL ENGINEERS

From: Eger, Ethan HI <ethan.eger@gov.sk.ca>
Sent: June 20, 2022 8:37 AM
To: jordan.m@hasegawa.ca
Subject: Corman Park Development

Hi Jordan,

I can give you a call tomorrow to discuss the Corman Park Development you have been working on.

If there are only a few questions maybe you could send them over and I get find the answers before tomorrow.

Thanks,

Ethan Eger (he/him)
Government of Saskatchewan
Engineering Intern
Traffic Engineering and Development, Ministry of Highways

18-3603 Millar Avenue
Saskatoon, Canada S7P 0B2
ethan.eger@gov.sk.ca

Saskatchewan

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carol.s@hasegawa.ca

From:	Jessica Phelps <Jessica.Phelps@wsask.ca>
Sent:	July 12, 2022 3:41 PM
To:	carol.s@hasegawa.ca
Cc:	Spencer McNie; Caroline Wiebe; hasegawamark@gmail.com
Subject:	RE: Corman Park Development Drainage Plan Review

Hi Carol,

The revisions help to clarify that the development will not alter the natural discharge locations and quantity of runoff from the site.

WSA has no further comments at this time.

Regards,

Jessica

Jessica Phelps - Geoscientist-in-Training, B.Sc. Hons
Technologist, Rural Water Services
402 Royal Bank Tower 1101 - 101st Street
North Battleford, SK S9A 0Z5
Ph: 306.480.6792
wsask.ca | jessica.phelps@wsask.ca

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Water Security Agency

From: carol.s@hasegawa.ca <carol.s@hasegawa.ca>
Sent: Tuesday, July 12, 2022 12:24 PM
To: Jessica Phelps <Jessica.Phelps@wsask.ca>; hasegawamark@gmail.com
Cc: Spencer McNie <Spencer.McNie@wsask.ca>; Caroline Wiebe <Caroline.Wiebe@wsask.ca>
Subject: RE: Corman Park Development Drainage Plan Review

Hello Jessica,

Please see the attached revised drainage analysis for your review/approval. Please provide any additional comments as soon as possible so that we can submit it to the Corman Park RM this afternoon.

Thank you

Carol Smith, BA
Administrative Support
Email: carol.s@hasegawa.ca
Phone: 403-328-2686

Fax: 403-328-2728
Direct: 403-330-3300

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CONSULTING PROFESSIONAL ENGINEERS

From: Jessica Phelps <Jessica.Phelps@wsask.ca>
Sent: July 11, 2022 1:00 PM
To: hasegawamark@gmail.com
Cc: carol.s@hasegawa.ca; Spencer McNie <Spencer.McNie@wsask.ca>; Caroline Wiebe <Caroline.Wiebe@wsask.ca>
Subject: Corman Park Development Drainage Plan Review

Hi Mark,

Water Security Agency (WSA) Rural Water Services has completed our review of the document submitted for the proposed subdivision on NE 3-38-6 W3 in RM of Corman Park No. 344.

As noted in the analysis document, the area has several low spots that expand in wet years. It is proposed that the site will be graded, natural low spots filled, drainage ditches added, and that all water will be diverted to the existing culverts on the south side of the property. To maintain the predevelopment natural discharge quantities storage ponds should be created to permanently retain the displaced volume of water from the wetlands up to a 1:100 year event and the difference between pre and post development runoff volumes. If the natural outlet locations, quantity of water discharged, or drainage conditions are altered then a drainage approval from WSA will be required.

If you have any questions, please let me know.

Regards,

Jessica

Jessica Phelps - Geoscientist-in-Training, B.Sc. Hons
Technologist, Rural Water Services
402 Royal Bank Tower 1101 - 101st Street
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