COMPREHENSIVE DEVELOPMENT REVIEW

102068225 Saskatchewan Corp.

Prepared for:

THE RURAL MUNICIPALITY OF CORMAN PARK NO. 344

Prepared By:

Crosby Hanna & Associates

In Association With:

Catteral & Wright Consulting Engineers

December 2019
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CONTENTS

EXECUTIVE SUMMARY

1022068225 Sask Corp. (the Developer) is applying to rezone and subdivide a 10.6 acre (4.3 ha) parcel of land from AG – Agricultural 1 District to M1– Light Industrial District in the NW ¼, Section 36, Township 35, Range 4, W3M. This document shall serve as the Comprehensive Development Review submitted in support of the rezoning and subdivision application which addresses all matters of land use integration, potential conflict mitigation and the provision of services to the development. The purpose of applying for the M1 Light Industrial District is to provide for opportunities for the development of four (4) lots.

The proposed development is situated on lands located within the RM of Corman Park No. 344. The development is located immediately east of Range Road 3041, south of the existing rail line, approximately 1.1 km northeast of Provincial Highway #16. The Development is also located immediately to the east of a number of industrial parcels across from Range Road 3041 (East Floral Road).

A stormwater management report was completed in July, 2019 by Catteral & Wright Consulting Engineers. This stormwater management review determined that the required storm water detention pond capacity for the proposed development totals approximately 1400 m^3. The storm water management review determined that construction of a series of storm water ponds will sufficiently manage the storm water to maintain existing drainage patterns and outflow rates.

A Traffic Impact Assessment (TIA) was undertaken by Catterall & Wright in May, 2019. Turning lane movement counts were undertaken in May, 2019 at the Range Road 3041 and Township Road 360 intersection, the Slip Road and Township Road 360 intersection, the South Floral Siding and Township Road 360 intersection and the Freeborn Road and Township Road 360 intersection. Level of Service (LOS) analysis was completed for the full development build-out phase (year 2024). Based on the analyses conducted as a part of the TIA, Catterall & Wright concluded that the overall impact of the proposed development is minimal and does not significantly impact the capacity, operations or safety of the study and access intersections. Analysis completed within the TIA identified no capacity issues at full-build out (year 2024).All intersections will operate at an acceptable LOS with all individual movements operating at LOS A. A turning lane warrant analysis was completed and neither a right-turn lane or bypass lane are warranted. Recommendations were made respecting sight triangles to ensure sight distances along roadways and driveways are adequate. Lastly, the minimum required separation distance between the rail line and property distance exceeds the minimum 30 metre standard, as the site is located approximately 77 metres away. The sightline area at the grade crossing was also reviewed and it is clear from any obstruction that has the potential to block a driver's view.

There is currently no communal wastewater system for this development to connect to; therefore, the proposed wastewater solution for this development is individual septic tanks.

The estimated wastewater generated by the development is calculated based on average rates for industrial and commercial developments stated in the Saskatchewan Wastewater Disposal Guide (18 US gallons/day/employee). The businesses are expected to have between 3-4 fulltime staff and 1 or two staff that will be on site at the beginning of the day and end of the day. To be conservative,

Catteral and Wright recommends doubling this calculation to include 10 employees per lot. In total, the 4 lots will generate 2,725 L/day (720 US gallons/day). Standard septic truck sizing is 2,500 US gallons. It is recommended that each lot have a minimum 1,000 US gallon septic tank. Assuming a five day work week for these business' each septic tank would need to be emptied every 1-2 weeks.

SaskWater has a potable water system located just west of the proposed development site. Catteral & Wright has calculated the average day potable water demand to be approximately 2,725 L/day (0.5USgpm) for the entire development. Each lot may require an individual reservoir and pump in order to meet peak day demands and fire suppression, if required. The recommended minimum storage for each lot is equal to the average daily consumption if no fire suppression is required, or twice the average daily consumption if fire suppression is required.

The RM will need to correspond with Saskatoon Fire and Protective Services to set up general the general parameters for these services at the proposed Development. It is assumed that these services are currently provided to the existing East Floral Industrial Development and New Life Feeds development, and an extension of this development will not have a great impact on the existing agreement between the RM and Saskatoon Fire and Protective Services. Police services will be provided by the Corman Park Police Services and the Saskatoon Detachment of the Royal Canadian Mounted Police.

The proposed development is not located on land considered to be heritage sensitive, according to the Heritage Conservation Branch at the Ministry of Parks Culture and Sport. According to the Saskatchewan Conservation Data Centre, the proposed development is not located in an area considered to have potential critical wildlife habitat or in an area with rare or endangered species of plants and animals.

In October, 2019 a mail out was distributed to all neighbours within 1 mile (1.6 km) of the proposed subdivision, informing residents of this proposed development. One email was received in response noting that this development may be subject to a recent "Latecomers Clause" adopted by the RM in regard to a newly constructed exit ramp at the corner of Floral Road & Highway No. 16. This email also noted that the RM recently adopted new requirement for roadways serving industrial developments.

1 INTRODUCTION

1.1 PURPOSE

This document shall serve as the Comprehensive Development Review (CDR) document submitted in conjunction with the application to rezone the land from AG-1 – Agricultural 1 District to M1 – Light Industrial District in the NW ¼, Section 36, Township 35, Range 4, W3M. This review provides a framework for the rezoning and subdivision of the proposed parcel of land for the purpose of developing four lots to accommodate light industrial development.

The Developer of the project is 102068225 Saskatchewan Corporation and the Conceptual Site Plan for the Development is attached as Appendix "A" to this document.

Questions on the proposal or the material contained within this document should be directed to Jim Walters, RPP, MCIP, Principal Planner at Crosby Hanna & Associates (306-665-3441).

1.2 OVERVIEW

It is the intention of the Developer to rezone and subdivide the existing 10.6 acre (4.3 ha) site to accommodate four lots for light industrial development purposes. The proposed development is located southeast of the City of Saskatoon, north of Provincial Highway #16. There are a number of existing light industrial and highway commercial developments located in the immediate vicinity of the proposed development.

2 INVENTORY AND ANALYSIS

2.1 EXISTING LAND USE

The proposed development site consists of a 10.61 acre (4.29 ha) parcel of land located in the NW 1/4 of Section 36, Township 35, Range 4, W3M. The site is currently characterized by relatively flat terrain that has been disturbed by previous development.

Other land uses in the area consist of existing light industrial development at the East Floral Industrial Park, agricultural land (grain farming), as well as highway commercial development (Pleasure Way Industries). The closest highway to the proposed development is Provincial Highway #16, which is located approximately 1 km to the southwest of the southwest corner of the subject parcel (see location map on the following page).

The Existing Land Use Context of the Proposed Development is as Follows:

North

- CP Rail Line ROW	Adjacent to north boundary
- Agricultural land	Adjacent to north boundary
- Township Road 360	Approx. 100 m north of north boundary

South

- Agricultural land	Adjacent to south boundary

West

- Range Road 3041	Adjacent to west boundary
- East Floral Industrial Park	Adjacent to west boundary
- Provincial Highway #16	Approx. 1,200 m west of west boundary

East

- New Life Mills	Adjacent to east boundary
- Agricultural land	Approx. 300 m east of east boundary

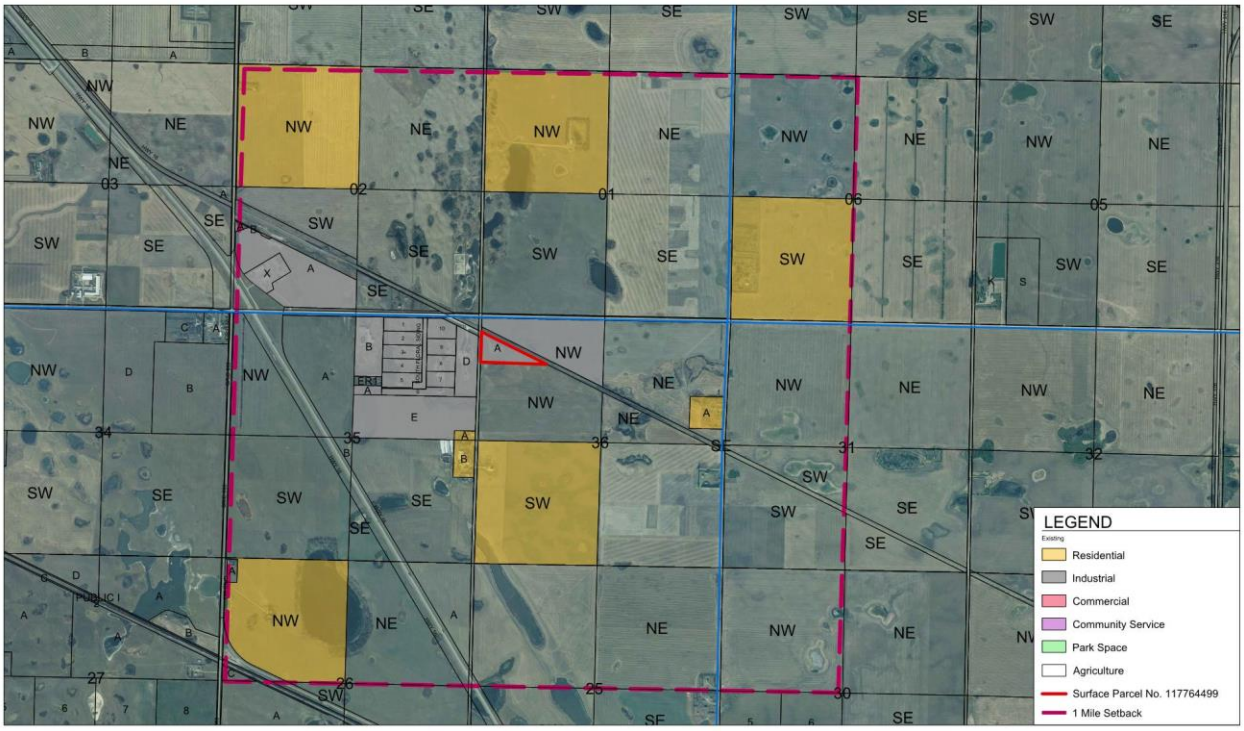


Figure 1. Proposed Light Industrial Development subject site.

2.2 PROPOSED LAND USE

The proposed land use at this parcel is to provide four lots to accommodate uses in the M1 – Light Industrial Development zoning district. The lots will range in size from approximately 0.80 ha to 1.48 hectares. It is the intent of the Developer to apply for subdivision concurrently with the rezoning application.

The proposed development is compatible with the existing land uses currently in the surrounding area, specifically the East Floral Industrial Park and New Life Mills.

2.3 POLICY CONTEXT

The proposed industrial development has been designed to meet the requirements of the Official Community Plan (OCP) and Zoning Bylaw (ZB) for the RM of Corman Park.

2.3.1 CORMAN PARK OFFICIAL COMMUNITY PLAN

Intensive Agricultural Objectives and Policies (Section 4) - Section 4 of the Official Community Plan identifies the following Agricultural Policies that are pertinent to this proposal.

4.2 Intensive Agricultural Policies

- 4.2.3: There are no existing ILO's within a separation distance that would cause a conflict with the proposed development.

Industrial Objectives and Policies (Section 6) – Section 6 of the Official Community Plan identifies the following Industrial Policies that are pertinent to this proposal.

6.2 General Industrial Policies

- 6.2.1: This document shall serve as the Comprehensive Development Review (CDR) as envisioned in the Corman Park Official Community Plan. This CDR addresses all matters of land use integration, zoning bylaw compliance, public consultation, as well as identification of the proposed municipal services to the development. It is understood that should any significant changes be proposed at the time of subdivision that would alter the concept and proposed municipal servicing in a major way, it could result in the requirement that a revised CDR document be submitted. However, the intent of this CDR has been to illustrate the servicing considerations (e.g. proposed access provisions, drainage considerations, potable water provisions, and proposed wastewater provisions), potential land use integration matters, public input considerations, policy and zoning compliance, as per the provisions in the M-1 Zoning District within the Corman Park Zoning Bylaw.

- 6.2.2: The subject property complies with the site requirements contained in this Section. The detailed consideration of these site requirements is addressed in other sections of this report.

- 6.2.3: This proposed development is located approximately six kilometres from the nearest urban municipality (City of Saskatoon).

- 6.2.4: All development which may take place on the subject property shall obtain a development permit prior to commencing construction and will comply with all relevant requirements contained in the Official Community Plan and Zoning Bylaw as well as all relevant provincial and federal legislation including but not limited to:
  a) *The Environmental Management and Protection Act, 2010;*
  b) *The Dangerous Goods Transportation Act;*
  c) *The Fire Safety Act;*
  d) *The Fire Safety Regulations; and*
  e) *National Building Code.*

- 6.2.5: This proposed development is not located within the required separation distances from an intensive livestock operation as specified in Section 4.2.3.

- 6.2.6: All approaches to individual lots will be located and constructed in accordance with relevant Municipal requirements.

- 6.2.7: Heritage and environmental considerations are included in Section 4 of this report.

- 6.2.8: Relevant engineering reports are included in Section 3 of this report.

- 6.2.9: The applicant is prepared to provide all infrastructure and service associated with this development.

- 6.2.10: The applicant is prepared to enter into a servicing agreement with the Municipality if required.

- 6.2.11: At the time this property is developed, Development Permits shall be obtained from the Municipality and the development on the site shall comply with all Zoning Bylaw requirements respecting parking, loading, landscaping, signage, buffering, building setbacks, and any other relevant standards.

6.3 Industrial Land Use Classification

- 6.3.4: This development is intended to accommodate light industrial uses as specified in the Official Community Plan. In this respect, the proposed zoning of this property is M1 – Light Industrial Development.

Land Conservation Policies (Section 9) – Section 9 of the Official Community Plan identifies the following land conservation policies that are applicable to this proposal:

9.2 Land Conservation Policies

- 9.2.3: The proposed development is not located on land considered to have heritage sensitivity, according to the Heritage Conservation Branch of the Ministry of Parks Culture and Sport (see attached query in Appendix B).

- 9.2.4: The proposed development is not located in any areas of significant wildlife or plant habitat, according to the Saskatchewan Conservation Data Centre (SKCDC) (attached as Appendix B).

- 9.2.9: A stormwater management report was completed in July, 2019 by Catteral & Wright Consulting Engineers. This stormwater management review determined that the required storm water detention pond capacity for the proposed development totals approximately 1400 m^3. The storm water management review determined that construction of a series of storm water ponds will sufficiently manage the storm water to maintain existing drainage patterns and outflow rates. (see attached drainage review and conceptual layout in Appendix C).

Servicing Policies (Section 11) – Section 11 of the Official Community Plan identifies the following servicing policies that are applicable to this proposal:

11.2 Servicing Policies

- 11.2.1: Access to the proposed development will occur via the existing Range Road 3041.

- 11.2.2: The developer will, at its expense, upgrade Range Road 3041 to primary grid standards adjacent to the subject property. A 10 metre easement will be taken from the subject property to accommodate necessary road widening.

  In addition, the developer will contribute $125,000 toward the future costs of paving Range Road 3041.

As described herein, this proposal fully conforms to all requirements of the Corman Park Official Community Plan.

2.3.2 RM OF CORMAN PARK ZONING BYLAW

The proposed development would require rezoning the property from AG-1 – Agricultural 1 District to M1 – Light Industrial District.

It is expected that the property will be used to accommodate four existing businesses which have business relationships with the Developer (102068225 Saskatchewan Corporation). These businesses will likely be classified as manufacturing or warehousing, which are permitted uses in the M1 Zoning District, or possibly a construction yard, which is a discretionary use in the M1 Zoning District. Prior to the placement of any equipment, structure or building on the proposed parcel. Future landowners will be responsible to apply for the appropriate permits and to obtain the necessary R.M. approvals.

The details on the proposed buildings which will be constructed on the subject property have not been finalized at this point in time. Should the RM approve this rezoning application and subsequent subdivision application, detailed information will be provided to the RM as part of the Development Permit process. Please be assured the development on these sites will fully conform to the appropriate development standards contained in the Zoning Bylaw including, but not limited to, use; setbacks; building height; signage; parking and loading, screening; storage and display; and landscaping.

It is the intention of the Developer to fully conform to all relevant Official Community Plan and Zoning Bylaw requirements in the development of these sites and the ongoing operation of these businesses.

3 TRANSPORTATION AND MUNICIPAL SERVICES

3.1 COMMUNITY ACCESS

The proposed development is located immediately west of Range Road 3041 with the CP Rail line bordering the northeast boundary of the parcel. Additionally, the proposed development is located approximately 1.5 km east of Provincial Highway #16. Catterall & Wright was contracted to undertake the Traffic Impact Assessment (TIA) in the winter of 2018 (attached as Appendix B).

WSP contacted the RM of Corman Park on May 14, 2019 to discuss any concerns the RM may have with the site. The RM requested that the following intersections be included in the study:

- Range Road 3041 and Township Road 360;
- Intersection west of Railway Track with Township Road 360;
- South Floral Siding and Township Road 360;
- Range Road 3042 (Freeborn Road) and Township Road 360; and,
- Highway 16 and Township Road 360.

Catterall & Wright also contacted the Ministry of Highways and Infrastructure on May 16, 2019 to confirm the study area and obtain the latest traffic volumes and five-year collision data in the vicinity of the project. The Ministry indicated that they do not require a Traffic Impact Assessment at the intersection of Highway 16 and Township Road 360, as the intersection is fully equipped with intersection improvements and the proposed development is not expected to warrant further improvements.

As illustrated on the Conceptual Site Plan, in Appendix A, access to the proposed development will be provided through a separate approach to each individual lot from Range Road 3041. The distance from the Township Road 360 centre-line to Access 1 through 4 are approximately 164 metres, 216 metres, 247 metres and 299 metres respectively.

Catterall & Wright undertook turning lane movement counts from May 28 to May 30, 2019 at the following intersections:

- Range Road 3041 and Township Road 360;
- Slip Road and Township Road 360;
- South Floral Siding and Township Road 360; and,
- Freeborn Road and Township Road 360.

The volumes were collected in the morning (7:30 am to 9:30 am) and evening (4:00 pm to 6:00 pm) peak periods to obtain peak hour traffic volumes. It was determined that the morning peak hour occurred between 7:30 am and 8:30 am while evening peak hour occurred between 4:30 pm and 5:30 pm. It was observed that truck traffic equated to approximately 45% of the total traffic, while the reminder (55%) included passenger cars, SUVs, and pickup trucks.

An annual growth rate of 2.0% was applied to background traffic, not including traffic volumes related to the project trips. Assuming full build out by 2024, the 2.0% annual growth rate was applied to the study intersections and turning movement volumes during the AM and PM peak hours were calculated.

New trips generated by the proposed development were established using the Institute of Transportation Engineers (ITE) Trip Generation Manual, 10th Edition. Based on the future land use of "General Light Industrial", the following conclusions were reached:

- The proposed site is expected to generate 216 vehicles daily;
- 31 trips are expected during the AM peak hour and 28 trips are expected during the PM peak hour;
- 27 vehicles will enter and 4 vehicles will depart during the AM peak hour; and,
- 24 vehicles will depart and 4 vehicles will enter during the PM peak hour.

A trip distribution assessment was undertaken and the site-generated traffic volumes were assigned to the study intersections, based on the assessment of how a vehicle would enter or exit the site. Total forecast volumes associated with the proposed development were calculated by combining the background traffic growth with the new trips associated with the development considering a full build-out condition. Total forecast volumes for the daily traffic and AM and PM design hour volumes were provided for year 2024.

Traffic operations were assessed for the total forecast volumes at the study intersections and the access intersections using Synchro 10.0 software. Level of Service (LOS) was examined for the AM and PM peak hour volumes with no change in intersection geometry. It was concluded that all study intersections are expected to operate at acceptable LOS for full build-out conditions (LOS A). Volume over Capacity (V/C) ratios and 95th percentile queue lengths were also concluded to be within the acceptable range.

Intersection turning lane warrants were also assessed to improve the potential traffic safety at the proposed access intersections. The warrants were conducted for the full build-out condition using the total forecast design hour volumes. As the proposed site generates more trips during the evening peak hour, the evening design hour volumes were used to conduct the warrant analysis. As the proposed site is expected to be fully developed by 2024, warrant analysis for right-turn lane and bypass lane were based on design hour volumes projected for year 2034 (Ministry-specified 10th year after the proposed construction date) with 2.0% annual growth rate. The results of the warrant analysis indicate that the right-turn lane and bypass lane are not warranted at the access intersections.

With respect to the CP railway line, it is recommended that the property fence be adjusted so the driver's sightline will remain clear, or that the Developer use a type of fence which does not block the driver's view. It is also indicated within the TIA that no additional modifications or improvements are required at the existing railway crossing. It is further noted that the daily train volume is 6 trains per day, and that there would need to be eight or more trains per day to warrant an increase in the level of control from a passive protection (signs only) to an active protection of

FLB (flashing lights and bells without gate).

Transport Canada Grade Crossing Standards were reviewed and the closest new intersection is 77 metres south of the railway crossing, which is more than the minimum distance of 30 metre spacing. Lastly, a sight triangle was drawn at the grade crossing using a railway design speed of 72 km/h and roadway design speed of 80 km/h. As the truck traffic constitutes approximately 45 percent of the total traffic, a single-unit truck was selected for sight distance calculations. It was noted that the sightline area at the grade crossing is clear from any sort of obstruction that has the potential to block a driver's view.

3.2 INTERNAL ROADS & SITE ACCESS

No internal roads are proposed for this development.

The approaches to each site will be located at the common property line between the two northerly sites and the two southerly sites in accordance with the plan attached hereto as Appendix A.

3.3 SEWAGE COLLECTION & WASTE WATER TREATMENT

There is currently no communal wastewater system for this development to connect to; therefore, the proposed wastewater solution for this development is individual septic tanks.

The estimated wastewater generated by the development is calculated based on average rates for industrial and commercial developments stated in the Saskatchewan Wastewater Disposal Guide (18 US gallons/day/employee). The businesses are expected to have between 3-4 fulltime staff and 1 or two staff that will be on site at the beginning of the day and end of the day. To be conservative, Catteral and Wright recommends doubling this calculation to include 10 employees per lot. In total, the 4 lots will generate 2,725 L/day (720 US gallons/day). Standard septic truck sizing is 2,500 US gallons. It is recommended that each lot have a minimum 1,000 US gallon septic tank. Assuming a five day work week for these business' each septic tank would need to be emptied every 1-2 weeks.

3.4 POTABLE WATER SUPPLY AND DISTRIBUTION

SaskWater has a potable water system located just west of the proposed development site. Catteral & Wright has calculated the average day potable water demand to be approximately 2,725 L/day (0.5USgpm) for the entire development. Each lot may require an individual reservoir and pump in order to meet peak day demands and fire suppression, if required. The recommended minimum storage for each lot is equal to the average daily consumption if no fire suppression is required, or twice the average daily consumption if fire suppression is required.

3.5 DRAINAGE

A Storm Water Management Review was completed by Catteral & Wright Consulting Engineers (attached as Appendix D). Presently, the site topography includes some rolling topography with some vegetation around the perimeter and localized low areas. The majority of the site drains from northeast to southwest. A small portion of the site on the east end drains to the east. Drainage for this site goes directly into existing ditches on the west side and north side of the parcel.

A preliminary grading plan for the proposed development has been prepared and is attached to Appendix D. The proposed development is to be subdivided into four parcels. As per discussions with RM staff each parcel is expected to have its own storm water management system. There is slightly more hard-surfacing included in the post development conditions compared to the pre-development conditions; the runoff coefficient for the pre-development condition is 0.14, compared to 0.18-0.25 for each of the post-development lot conditions.

The existing property currently has drainage to the west to the east ditch of Rang Road 3041. The middle section of the lot currently drains to a low area south of the property. The RM has indicated that each site will need to manage its own storm water via a storm water retention facility. As the natural drainage of the parcel is northeast to southwest, these ponds should be interconnected and have a single outlet to the highway ditch in the southwest. This will also assist in controlling the allowable release from the ponds to that of the pre-development flow as there will only be a single outlet to manage. The modelled pre-development runoff rate is approximately 1450 L/s.

In order to manage the increased impermeability and associated runoff of the proposed development, a preliminary grading plan with preliminary pond locations was developed. The purpose of the storm water pond is to is to provide attenuation during storm events, thereby minimizing the effect of the development on surrounding properties. Catteral & Wright prepared a preliminary lot grading plan for the development which contains all runoff from the site into a storm water detention pond system which includes individual ponds for each site and a single controlled outlet.

The ponds were sized to provide storage for the 1:100 year storm event with an additional 25% storage while maintaining a post-development runoff rate less than the pre-development runoff rate of approximately 1450 L/s. The development was modelled using XPSWMM software to confirm that the presented storm water detention pond can adequately manage the development's stormwater, thus maintaining the existing drainage patterns and flow rates.

The pond storage volume required for the full development totals 1400 cubic metres. A breakdown of the proposed pond storage volumes for each site is noted below:

- Site 1 = 260 cubic metres
- Site 2 = 275 Cubic metres
- Site 3 = 380 cubic metres
- Site4 = 480 cubic metres

The proposed storm water detention ponds should require minimal maintenance, limited to clearing vegetation growth near the culvert inlets.

The outlet rate of the storm sewer has been designed well below the pre-development runoff rate. This improves the downstream runoff condition and it allows for the front yards of this development to directly drain to the highway ditch.

3.6 SHALLOW UTILITIES

Shallow utilities (SaskPower, SaskEnergy, and SaskTel) are located in the immediate vicinity of the development. As such, it is not anticipated that servicing will be an issue. The necessary installation and connection fees will be borne by the individual lot owner.

3.7 FIRE AND PROTECTIVE SERVICES

The RM will need to correspond with Saskatoon Fire and Protective Services to set up general the general parameters for these services at the proposed Development. It is assumed that these services are currently provided to the existing East Floral Industrial Development and New Life Feeds, and an extension of this development will not have a great impact on the existing agreement between the RM and Saskatoon Fire and Protective Services. Police services will be provided by the Corman Park Police Services and the Saskatoon Detachment of the Royal Canadian Mounted Police.

4 HERITAGE AND ENVIRONMENTAL CONSIDERATIONS

4.1 HERITAGE CONSERVATION

According to the Heritage Conservation Branch at the Ministry of Tourism Parks Culture and Sport, the proposed development is not located in an area with any potential heritage sensitivity (query attached as Appendix C).

4.2 ENVIRONMENTAL CONSIDERATIONS

According to the Saskatchewan Conservation Data Centre, the proposed development is not located in a significant wildlife habitat or plant area (also attached as Appendix C).

5 STAGING AND IMPLEMENTATION

The Conceptual Site Plan, attached as Appendix A, details the proposed subdivision. A subdivision application will need to be approved the Community Planning Branch at the Ministry of Government Relations in due course.

6 PUBLIC CONSULTATION

In October 2019 a mail out was distributed to all neighbours within 1 mile (1.6 km) of the proposed expansion, informing residents of this proposed development. One e-mail was received in response. The comments noted in this email are summarized in Table 6-1:

Copies of the mail-out and all feedback received are attached as Appendix E.

Table 6-1:
Public Consultation and Developer's Response

Stakeholder	Comments/Concerns	Developer's Response
Laurie Bradley East Floral Industrial Park / East Cory Industrial Park	#1 I believe your client may be subject to a recent "Latecomers Clause" adopted by the RM in regard to a newly constructed "Exit Ramp' at the corner of Floral Road & Hwy 16 westbound lane. The construction cost of approx. $240,000 was shared by the RM (32%), the Ministry of Highways (32%), and East Floral In. Park (36%).	Thank you for this information. We will ensure that it is passed on to our client.
	#2 The RM recently adopted the requirement for internal roadways (and potentially adjoining RM roadways) to be paved to a 9 metre width, primary road specifications.	Thank you for this information. We will ensure that it is passed on to our client.

7 APPENDICES

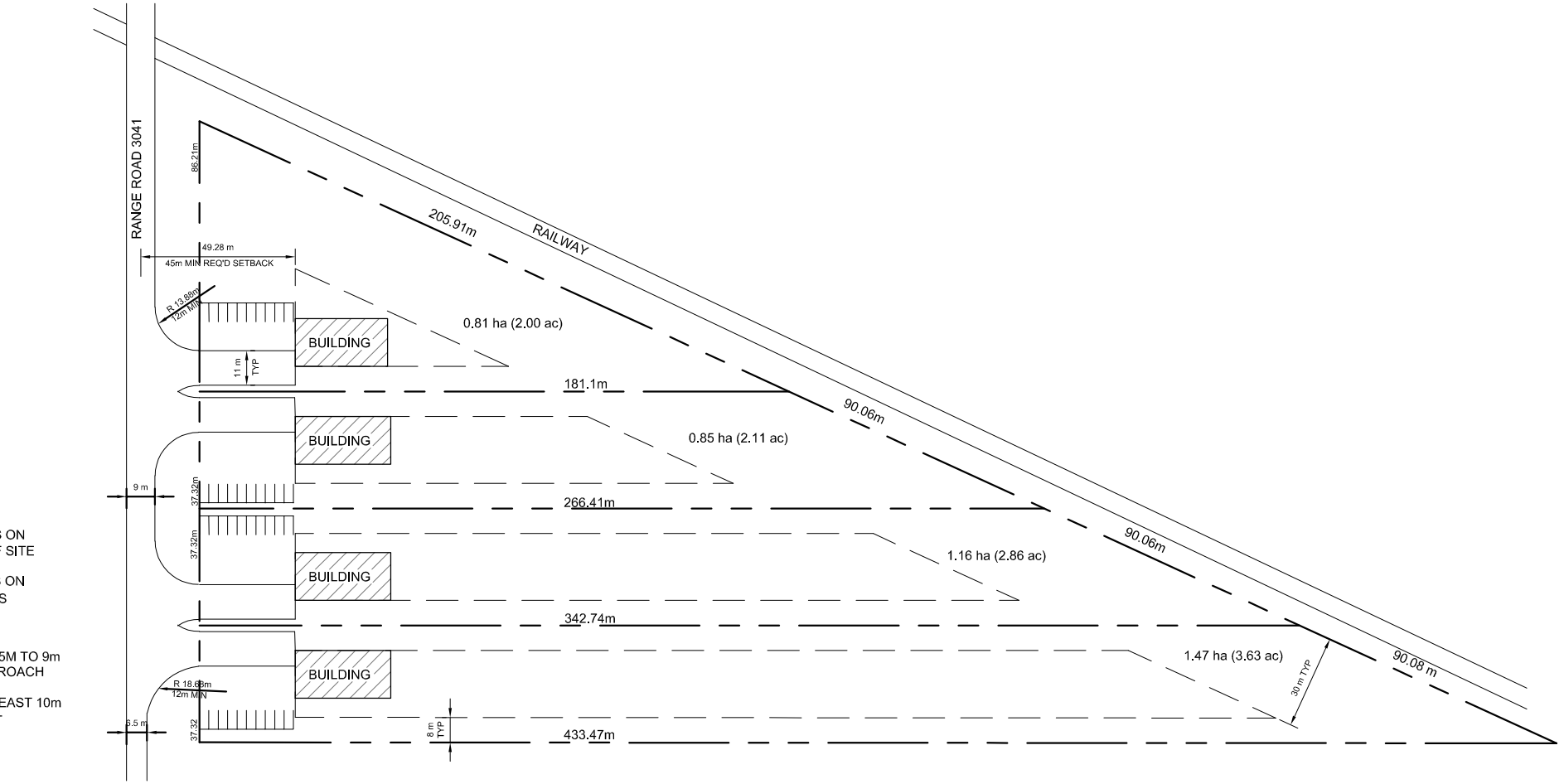
Appendix "A"
Conceptual Site Plan

RM TO PROVIDE DETAILS ON
LAFARGE LAND WEST OF SITE

RM TO PROVIDE DETAILS ON
TWO PROPERTY OWNERS
SOUTH OF SITE

ROAD WIDENED FROM 6.5M TO 9m
UNTIL SOUTH MOST APPROACH

PROPERTY LINE MOVED EAST 10m
TO INCREASE EASEMENT



1 PROPOSED SITE PLAN

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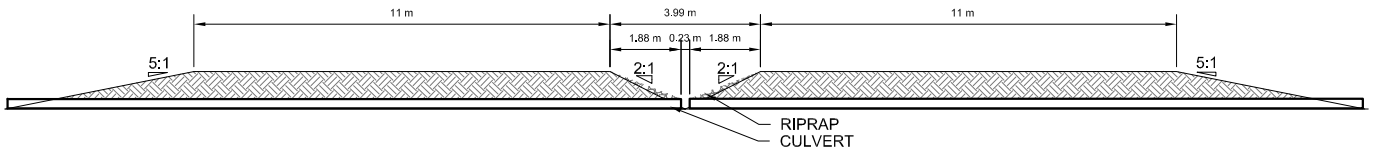

2 APPROACH DETAIL

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Appendix “B”
Traffic Impact Assessment

CATTERALL & WRIGHT | CONSULTING ENGINEERS

1221 – 8th STREET EAST | SASKATOON, SK S7H 0S5

TEL: (306) 343-7280 | www.cwce.ca | FAX: (306) 956-3199

June 19, 2019

102068225 Saskatchewan Corp.
36-102 Cope Cres
Saskatoon, SK S7T 0X2

via email: Chris.Luczka@baydo.ca

Attention: Mr. Mr. Chris Luczka

Re: Floral Road Development TIA within Parcel NW-36-35-04-3 – RM of Corman Park, SK

Catterall & Wright (C&W) is pleased to submit the following letter report outlining the results of the Traffic Impact Assessment (TIA) for the proposed Floral Road Development in the RM of Corman Park, SK.

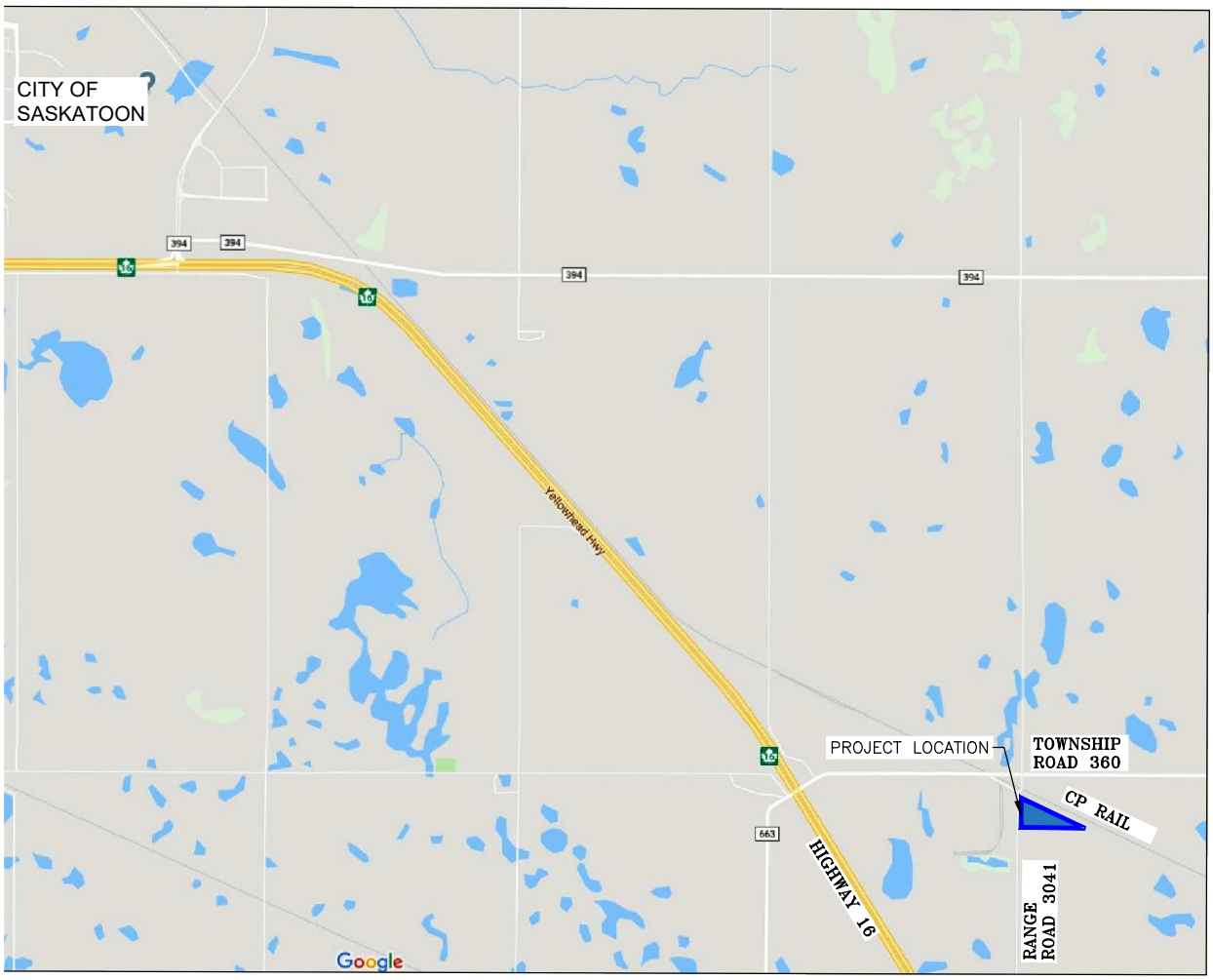
STUDY BACKGROUND

The 102068225 Saskatchewan Corp is proposing to develop an industrial development (Floral Road Development) located in the RM of Corman Park and bordered by Range Road 3041 on the west boundary and CP Railway Line on the northeast boundary as shown in **Figure 1**.

As part of development, 102068225 Saskatchewan Corp. retained C&W to complete the TIA report to determine the impact of the traffic generated by the proposed development on the study area intersections as well as property access intersections. The results will be used to develop a strategy to mitigate the adverse impact, if any. This report is best described as a complementary technical document and should be reviewed in conjunction with the Comprehensive Development Review (CDR) of the proposed site.

C&W contacted the RM of Corman Park on May 14, 2019 and Ministry of Highways and Infrastructure (Ministry) on May 16, 2019 to confirm the study area and obtain latest traffic volumes and five-year collision data in the vicinity of the project. The RM requested to include following intersections in the study area:

- Range Rd 3041 & Township Rd 360
- Intersection west of Railway Track with Township Rd 360
- South Floral Siding & Township Rd 360
- Range Rd 3042 (Freeborn Road) & Township Rd 360
- Highway 16 & Township Rd 360



DATE	REVISION

SCALE VERIFICATION

WHEN DRAWING IS PLOTTED FULL SIZE
THIS LINE IS 30mm IN LENGTH.

SCALE	DESIGNED
NTS	SNH
DRAWN	CHECKED
RJB	SNH
DATE	SHEET
19/06/11	1 of 8

DRAWING NUMBER FIGURE 1

CATTERALL & WRIGHT
CONSULTING ENGINEERS

1221 - 8th Street East
SASKATOON SK S7H 0S5
Tel: (306) 343-7280, Fax: (306) 956-3199

OWNER/CLIENT
102068225 SASKATCHEWAN CORP.

LOCATION
RM OF CORMAN PARK

PROJECT
FLORAL ROAD DEVELOPMENT TIA

SHEET TITLE
PROJECT LOCATION PLAN

However, the Ministry mentioned that they do not require a traffic impact assessment at the intersection of Highway 16 & Township Rd 360 as the intersection is fully equipped with intersection improvements and the proposed development is not expected to warrant further improvements.

PROPOSED DEVELOPMENT

The development site is proposed to be built within NW-36-35-04-3 in the RM of Corman Park and covers an area of 10.7 acres (43,301 sqm.). The proposed industrial development includes four (4) individual industrial lots, per the site plan attached as **Appendix A**. The access to the proposed site will be provided through a separate access road to each individual lot from the Range Rd 3041.

Construction of the proposed site is expected to start in fall 2019 and the site is assumed to be fully developed in 5 years (year 2024). The site plan reflects full build-out of the proposed development and no future expansion is currently planned.

EXISTING SYSTEM

The Township Rd 360 is a two-lane undivided paved roadway that runs east-west direction and intersects Range Rd 3041 north of the proposed site. The Range Rd 3041 is a two-lane undivided gravel roadway that runs north-south direction and located approximately 1.5 kilometers east of Highway 16. Based on the roadway classification, an 80 km/h speed was assumed for both the Township Rd 360 and Range Rd 3041.

The intersection at Township Rd 360 & Range Rd 3041 is a 4-legged, 2-way yield-controlled intersection with Township Rd 360 operating as free-flow. Freeborn Road forms a stop-controlled T-intersection and South Floral Siding forms an yield-controlled T-intersection with Township Rd 360 which operates free-flow. A diagonal road intersecting Township Rd 360 west of railway track and Range Rd 3041 south of railway track forms an yield-controlled Y-intersection with Township Rd 360. This diagonal road is named as Slip Road in this TIA report.

Access to the proposed site will be provided through a separate access road to each individual lot (total 4 lots) from the Range Rd 3041. The distance from the Township Rd 360 centerline to the Access 1, Access 2, Access 3 and Access 4 are approximately 164 meters, 216 meters, 247 meters and 299 meters respectively. The study intersections, access intersections and internal road layout is illustrated in **Figure 2**.

EXISTING TRAFFIC COUNTS

Turning movement counts (TMC) were conducted from May 28 to May 30, 2019 at the following intersections:

- Range Rd 3041 & Township Rd 360
- Slip Road & Township Rd 360
- South Floral Siding & Township Rd 360

- Freeborn Road & Township Rd 360

The volumes were collected during the morning (7:30 a.m. to 9:30 a.m.) and evening (4:00 p.m. to 6:00 p.m.) peak periods to obtain peak hour traffic volumes. The morning (AM) peak occurred from 7:30 a.m. to 8:30 a.m. and the evening peak occurred from 4:30 p.m. to 5:30 p.m. It was observed that the truck traffic was approximately 45% of the total traffic and the rest of 55% includes passenger cars, SUVs and pickup trucks. The average daily traffic (ADT) volumes were estimated based on the evening peak hour volumes assuming the evening peak is 10% of the ADT. A volume of 2 vehicles per hour was assumed for a turning movement with no traffic volume during the peak hour. The existing turning movement volumes for AM and PM peak periods at the study intersections are illustrated in **Figure 3**.

BACKGROUND TRAFFIC

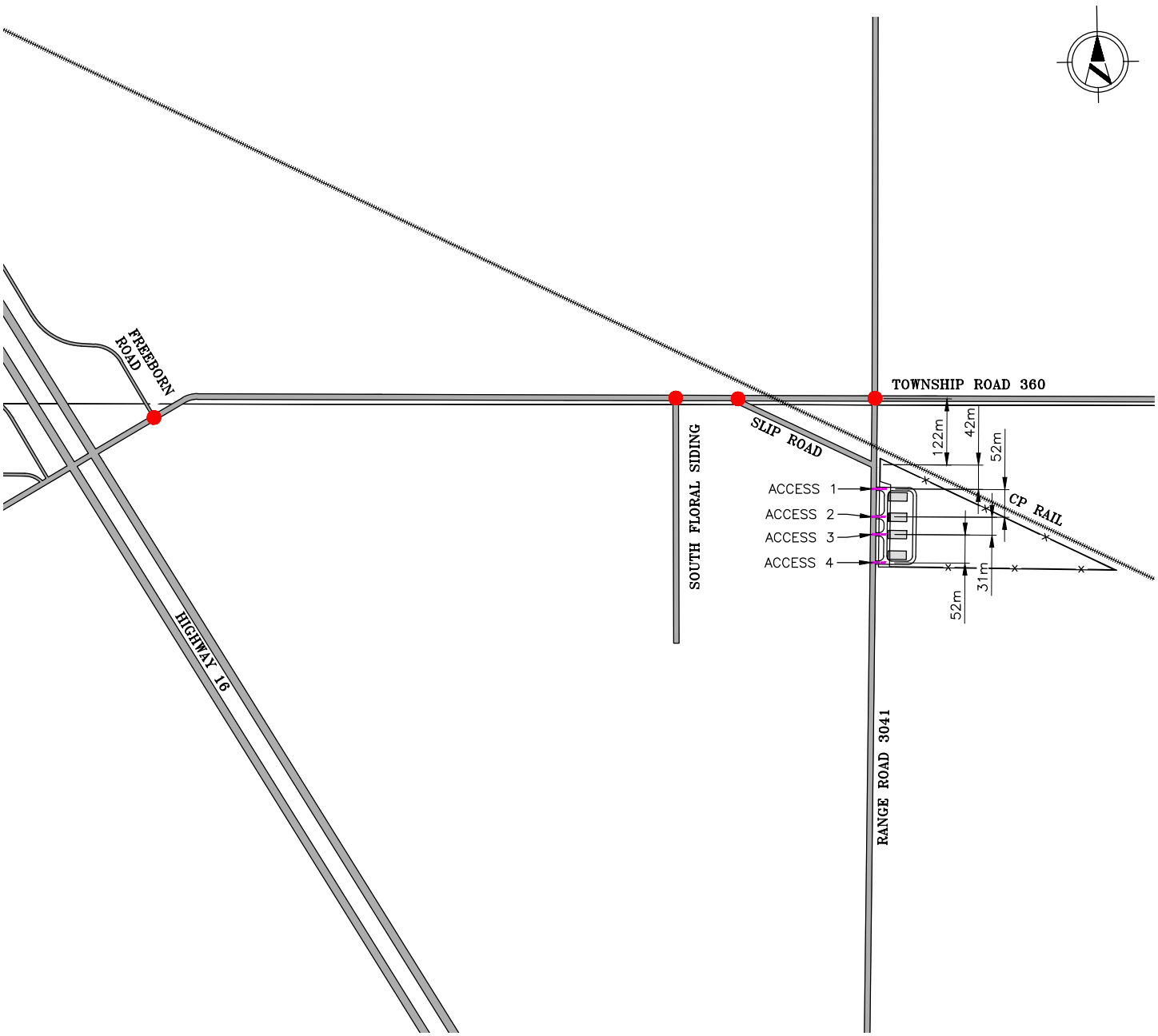
The Background traffic growth reflects the growth in traffic volumes over time that are not related to the project trips. An annual growth rate of 2% was applied to the study intersections. As the proposed site is expected to be fully developed in 2024, the existing traffic volumes were projected to year 2024 with a 2% annual growth rate. The future background (without project trips) turning movement volumes during AM and PM peak periods for year 2024 are shown in **Figure 4**.

DEVELOPMENT TRIPS

Site-generated trips from the proposed development were established using the Institute of Transportation Engineers (ITE) Trip Generation Manual, 10th Edition (ITE Manual). The ITE average trip generation rates, units and directional distribution are illustrated in **Table 1**.

Table 1 – ITE Average Trip Generation Rates

Land Use	ITE Code	Unit	AM Peak Hour			PM Peak Hour			Daily Trips		
			Rate	In (%)	Out (%)	Rate	In (%)	Out (%)	Rate	In (%)	Out (%)
General Light Industrial	110	1000 sq. ft. GFA	0.7	88	12	0.63	13	87	4.96	50	50



LEGEND:

- STUDY INTERSECTIONS
- PROPOSED ACCESS
- EXIST. ROAD

DATE	REVISION

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LOCATION: RM OF CORMAN PARK

PROJECT: FLORAL ROAD DEVELOPMENT TIA

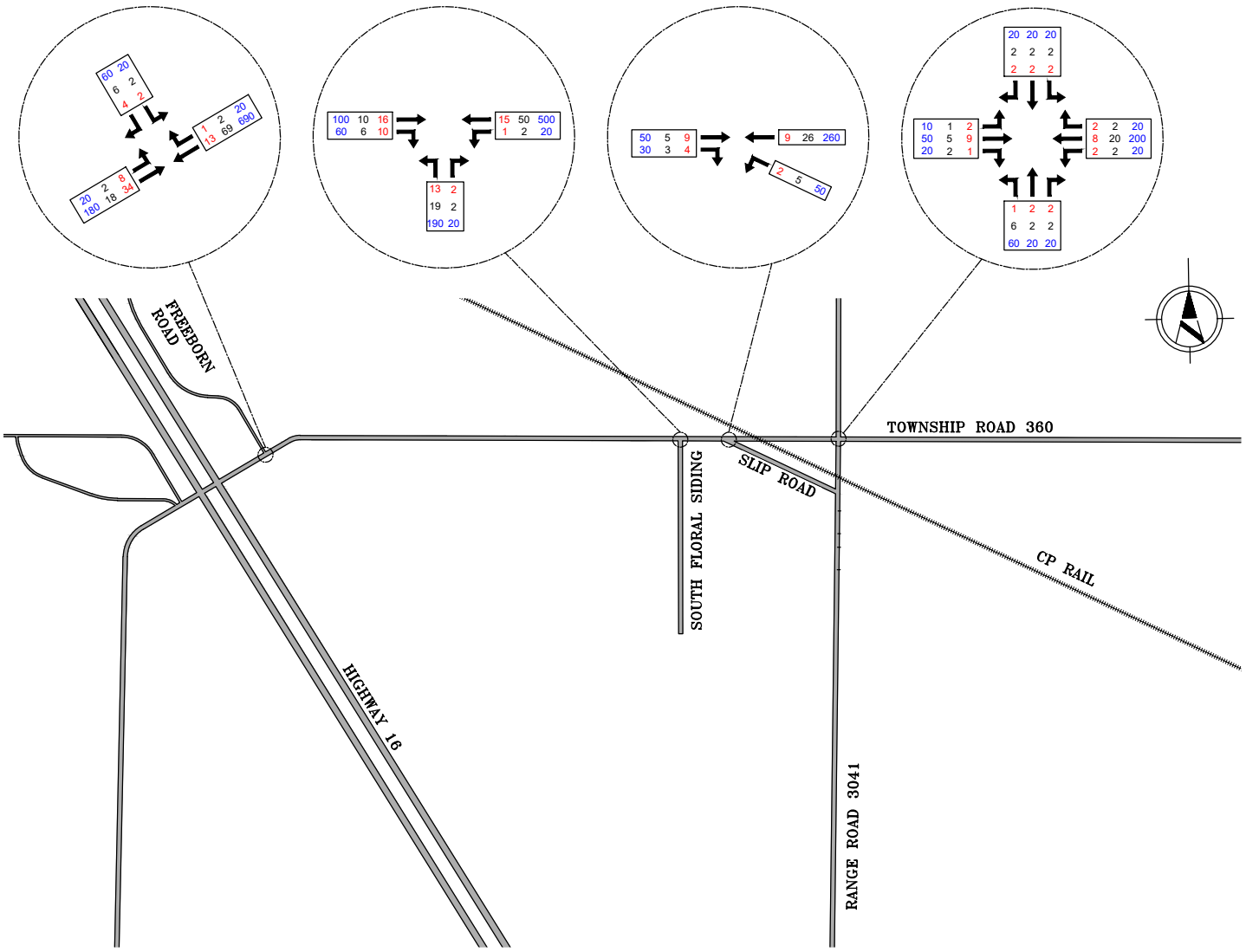
SHEET TITLE: SITE PLAN & STUDY AREA

SCALE VERIFICATION

WHEN DRAWING IS PLOTTED FULL SIZE THIS LINE IS 30mm IN LENGTH.

SCALE	DESIGNED
NTS	SNH
DRAWN	CHECKED
RJB	SNH
DATE	SHEET
19/06/11	2 of 8

DRAWING NUMBER: FIGURE 2



LEGEND:

20	AM PEAK VOLUME
20	PM PEAK VOLUME
20	AVERAGE DAILY TRAFFIC VOLUME (ADT)

DATE	REVISION

SCALE VERIFICATION

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LOCATION: RM OF CORMAN PARK

PROJECT: FLORAL ROAD DEVELOPMENT TIA

SHEET TITLE: EXISTING TURNING MOVEMENT VOLUMES (2019)

SCALE	DESIGNED
NTS	SNH
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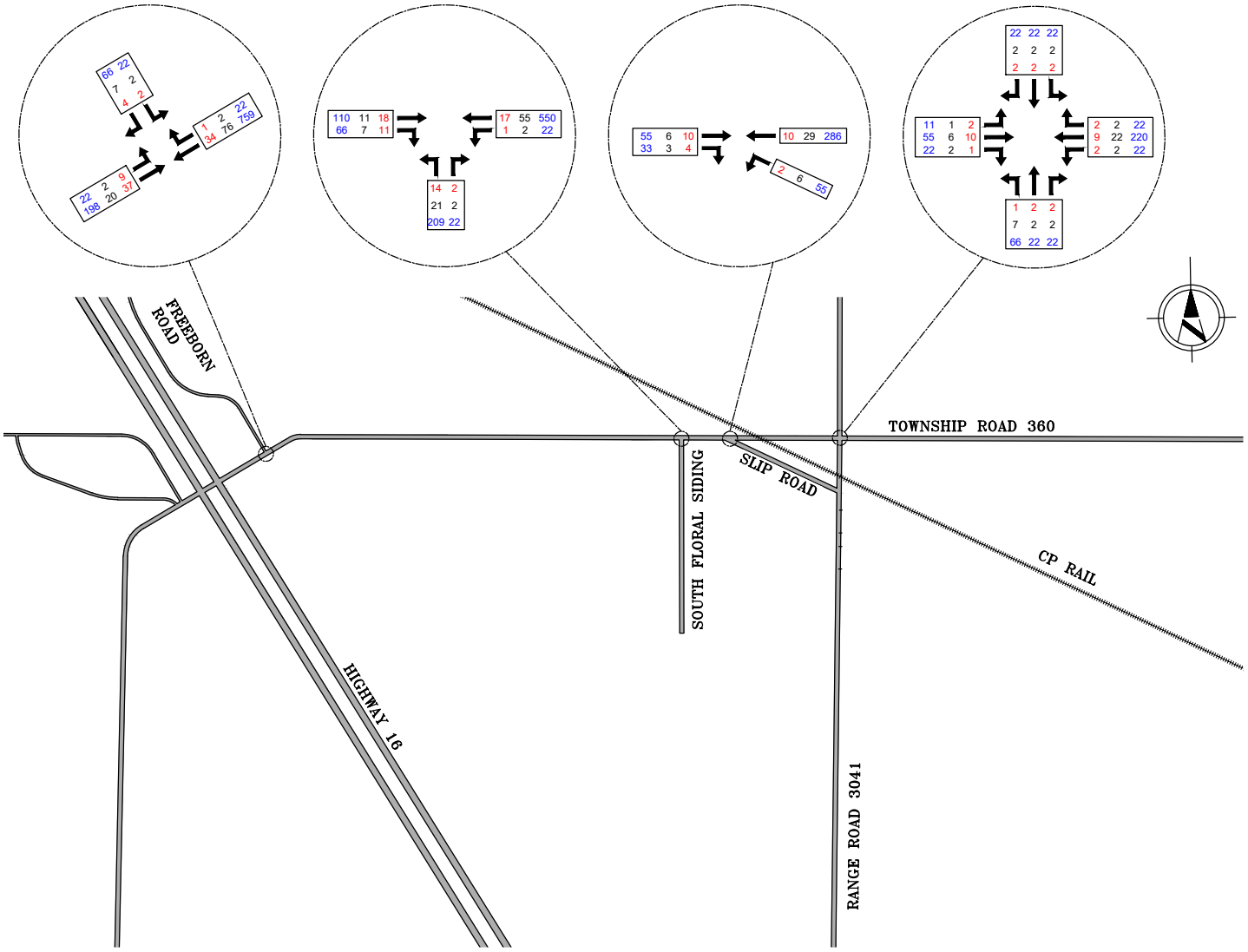
RJB	SNH
DATE	SHEET
19/06/11	3 of 8

DRAWING NUMBER: FIGURE 3



LEGEND:

20	AM PEAK VOLUME
20	PM PEAK VOLUME
20	AVERAGE DAILY TRAFFIC VOLUME (ADT)

DATE	REVISION

SCALE VERIFICATION

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LOCATION: RM OF CORMAN PARK

PROJECT: FLORAL ROAD DEVELOPMENT TIA

SHEET TITLE: BACKGROUND FORECAST VOLUMES (2024)

SCALE: NTS	DESIGNED: SNH
DRAWN: RJB	CHECKED: SNH
DATE: 19/06/11	SHEET: 4 of 8

DRAWING NUMBER: FIGURE 4

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Table 2 below summarizes the two-way vehicle trips anticipated to be generated from the proposed development daily and during the weekday AM and PM peak hours.

Table 2 – Trip Generation Estimate

Land Use	Size (1000 sq. ft.)	AM			PM			Daily		
		Total	In	Out	Total	In	Out	Total	In	Out
General Light Industrial	43.56	31	27	4	28	4	24	216	108	108

As shown in Table 2, the proposed site is expected to generate 216 vehicles daily, 31 trips during AM peak hour and 28 trips during PM peak hour. 27 vehicles will enter and 4 vehicles will depart from the proposed site during AM peak hour. During the PM peak hour, 4 vehicles will enter and 24 vehicles will depart.

TRIP DISTRIBUTION

The site-generated traffic volumes were assigned to study intersections based on the assessment of how a vehicle would enter or exit the site. The direction from which the traffic will approach and depart the project site depends upon several factors such as size of development, type of business, type of customers and surrounding population and roadway network. All trips from the proposed site are expected to travel to the north direction as the southbound traffic on Range Rd 3041 does not have access to southbound direction on Highway 16 due to a right-in and right-out intersection at Highway 16 and Range Rd 3041.

Considering the existing traffic volumes, surrounding population, jobs and commercial activities, the generated trips were assumed to be 70% to/from the west, 25% to/from the east and 5% to/from the north. The 70% trips to the west direction will further split at Highway 16 and Township Rd 360 intersection as 25% to/from the north, 20% to/from the south and 25% to/from the west. The graphical illustration of trip distribution pattern and the turning movement volumes of the site generated trips at study intersections and project access intersections are shown in **Figure 5**.

TOTAL FORECAST VOLUMES

Total forecast volumes for the future horizon (year 2024) are obtained by combining the background traffic growth with the new trips associated with the development considering a full build-out condition. **Figure 6** illustrates the total forecast volumes for the daily traffic as well as AM and PM design hour volumes for year 2024.

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The traffic operations were assessed for the total forecast volumes at the study intersections and the access intersections using Synchro 10.0 software. The intersections' level of services (LOS) was examined for AM and PM design hour volumes with no change in intersection geometry.

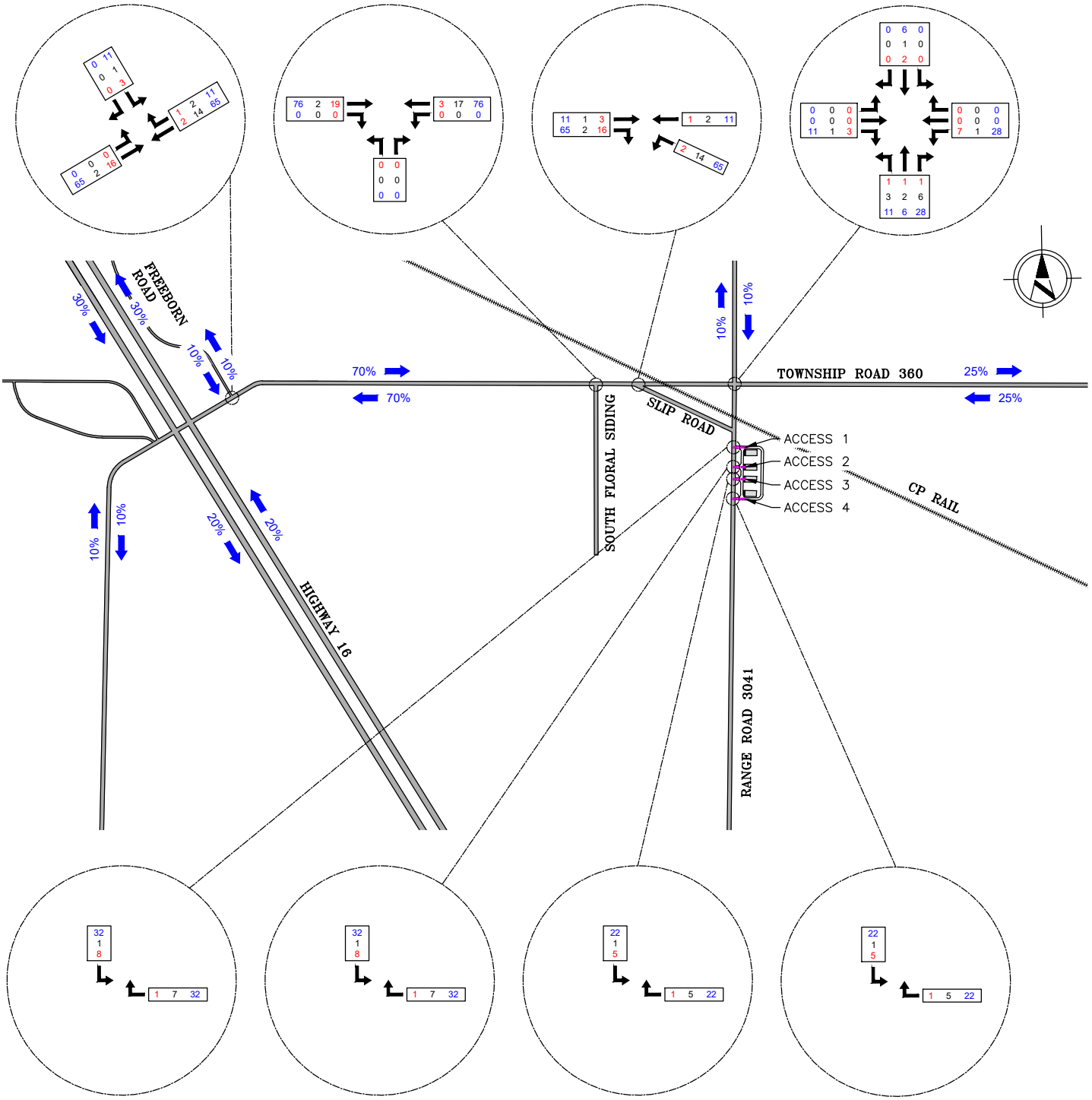
LOS for a stop-controlled or yield-controlled intersection is determined by the computed or measured control delay and is defined for each movement. LOS is not defined for the intersection as a whole. With only low turning volumes to/from the minor road and high through volumes on the main road, delays to turning vehicles can become excessive. As delays increase, turning vehicles will attempt to turn across unacceptable gaps which can present safety concerns. **Table 3** illustrates the relationship between level of service and average delay.

Table 3 - Level of Service vs. Average Delay

LOS	Delay Definition	Stop Controlled Intersection Controlled Delay Per Vehicle (sec/veh)
A	Little or no delay	<=10.0
B	Short traffic delay	> 10.0 and <= 15.0
C	Average traffic delay	> 15.0 and <= 25.0
D	Long traffic delay	> 25.0 and <= 35.0
E	Very long traffic delay	> 35.0 and <= 50.0
F	Failure	> 50.0

LOS D is typically considered the limit of acceptable operation and excessive delays tend to occur beyond this threshold.

The traffic analysis for the total forecast traffic condition (year 2024) for AM and PM peak hours at the study intersections are summarized in **Table 4** and results of Synchro analysis are attached in **Appendix B**.



LEGEND:

20	AM PEAK VOLUME
20	PM PEAK VOLUME
20	AVERAGE DAILY TRAFFIC VOLUME (ADT)
70% → / ← 70%	DIRECTIONAL DISTRIBUTION

DATE	REVISION

SCALE VERIFICATION

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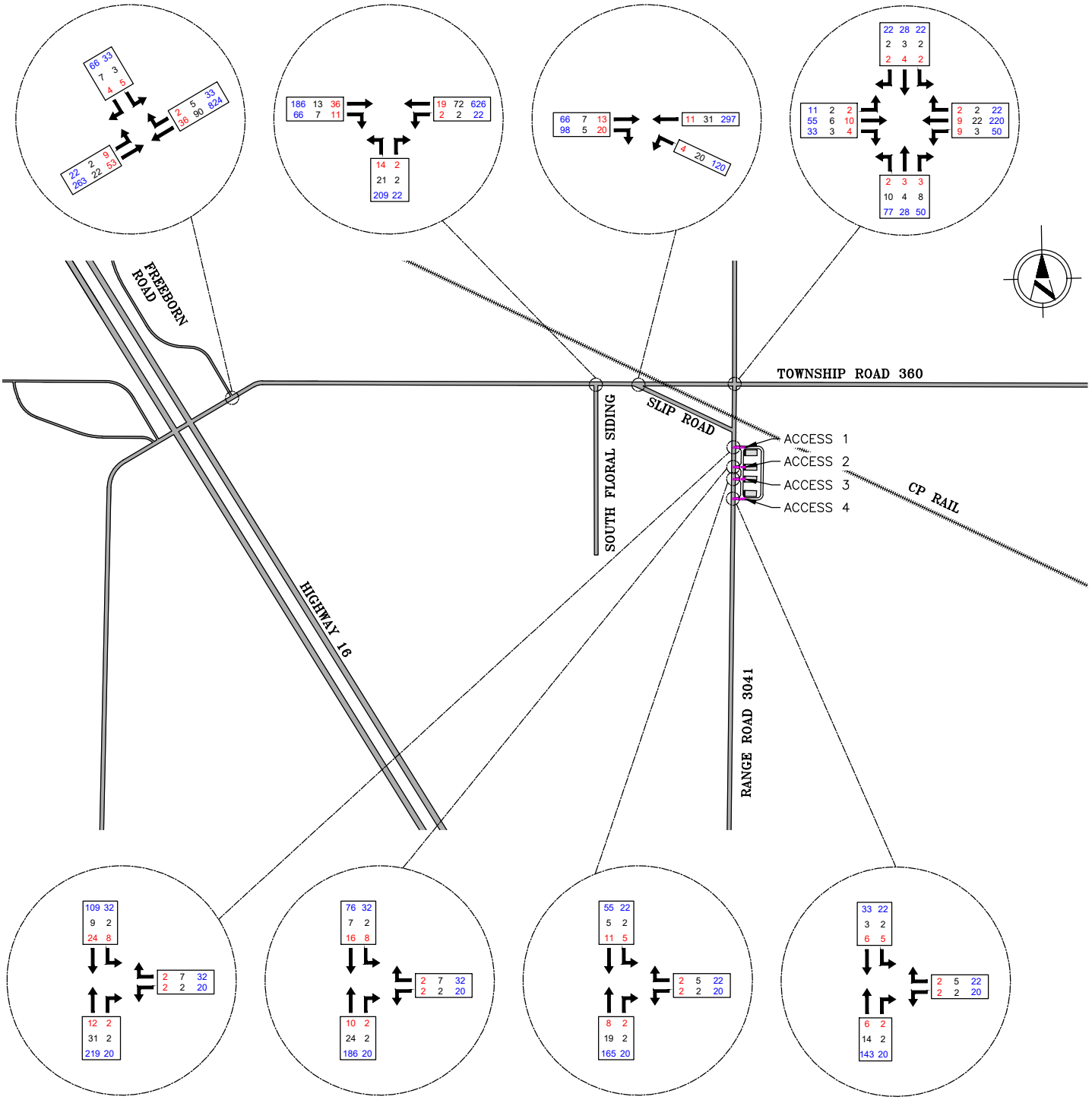
LOCATION: RM OF CORMAN PARK

PROJECT: FLORAL ROAD DEVELOPMENT TIA

SHEET TITLE: TRIP DISTRIBUTION AND ASSIGNMENT

SCALE	DESIGNED
NTS	SNH
DRAWN	CHECKED
RJB	SNH
DATE	SHEET
19/06/11	5 of 8

DRAWING NUMBER: FIGURE 5



LEGEND:

20	AM PEAK VOLUME
20	PM PEAK VOLUME
20	AVERAGE DAILY TRAFFIC VOLUME (ADT)

DATE	REVISION

SCALE VERIFICATION

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LOCATION: RM OF CORMAN PARK

PROJECT: FLORAL ROAD DEVELOPMENT TIA

SHEET TITLE: FUTURE TOTAL TRAFFIC VOLUMES (2024)

SCALE	DESIGNED
NTS	SNH
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RJB	SNH
DATE	SHEET
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DRAWING NUMBER: FIGURE 6

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Table 4 – LOS Results for the Study Intersections

Parameters	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
AM Peak Hour												
Township Rd 360 & Range Rd 3041												
V/C Ratios	0	0	0	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
95th Queue (m)	0	0	0	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
LOS	A	A	A	A	A	A	A	A	A	A	A	A
Township Rd 360 & Slip Road												
V/C Ratios	-	0.02	0.02	-	0.01	-	0	-	-	-	-	-
95th Queue (m)	-	0	0	-	0	-	0.1	-	-	-	-	-
LOS	-	A	A	-	A	-	A	-	-	-	-	-
Township Rd 360 & South Floral Siding Road												
V/C Ratios	-	0.03	0.03	0	0	-	0.02	-	0.02	-	-	-
95th Queue (m)	-	0	0	0	0	-	0.5	-	0.5	-	-	-
LOS	-	A	A	A	A	-	A	-	A	-	-	-
Township Rd 360 & Freeborn Road												
V/C Ratios	0.01	0.01	-	-	0.02	0.02	-	-	-	0.01	-	0.01
95th Queue (m)	0.2	0.2	-	-	0	0	-	-	-	0.2	-	0.2
LOS	A	A	-	-	A	A	-	-	-	A	-	A
PM Peak Hour												
Township Rd 360 & Range Rd 3041												
V/C Ratios	0	0	0	0	0	0	0.03	0.03	0.03	0.01	0.01	0.01
95th Queue (m)	0	0	0	0.1	0.1	0.1	0.6	0.6	0.6	0.2	0.2	0.2
LOS	A	A	A	A	A	A	A	A	A	A	A	A
Township Rd 360 & Slip Road												
V/C Ratios	-	0.01	0.01	-	0.02	-	0.03	-	-	-	-	-
95th Queue (m)	-	0	0	-	0	-	0.6	-	-	-	-	-
LOS	-	A	A	-	A	-	A	-	-	-	-	-
Township Rd 360 & South Floral Siding Road												
V/C Ratios	-	0.01	0.01	0	0	-	0.03	-	0.03	-	-	-
95th Queue (m)	-	0	0	0	0	-	0.7	-	0.7	-	-	-
LOS	-	A	A	A	A	-	A	-	A	-	-	-
Township Rd 360 & Freeborn Road												
V/C Ratios	0	0	-	-	0.06	0.06	-	-	-	0.01	-	0.01
95th Queue (m)	0	0	-	-	0	0	-	-	-	0.3	-	0.3
LOS	A	A	-	-	A	A	-	-	-	A	-	A

As shown in the above table, all study intersections are expected to operate at acceptable level of service for full build-out condition. Volume over Capacity (V/C) ratios and 95th percentile queue lengths will be within the acceptable range. Free flow eastbound and westbound movements on Township Road 360 at all study intersections will operate at LOS A during both AM and PM peak hours. The stop-controlled and yield-controlled northbound and southbound movements will also operate at LOS A during both AM and PM peak hours.

In addition to the study intersections, traffic operation analysis was conducted for the proposed access intersections with Range Road 3041. The full build-out condition analysis for AM and PM peak hours are summarized in **Table 5** and results of Synchro analysis are attached in **Appendix C.**

Table 5 – LOS Results for the Proposed Access Intersections

Parameters	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
AM Peak Hour												
Access Road 1												
V/C Ratios	-	-	-	0	-	0	-	0.01	0.01	0.01	0.01	-
95th Queue (m)	-	-	-	0.1	-	0.1	-	0	0	0.2	0.2	-
LOS	-	-	-	A	-	A	-	A	A	A	A	-
Access Road 2												
V/C Ratios	-	-	-	0	-	0	-	0.01	0.01	0.01	0.01	-
95th Queue (m)	-	-	-	0.1	-	0.1	-	0	0	0.2	0.2	-
LOS	-	-	-	A	-	A	-	A	A	A	A	-
Access Road 3												
V/C Ratios	-	-	-	0	-	0	-	0.01	0.01	0	0	-
95th Queue (m)	-	-	-	0.1	-	0.1	-	0	0	0.1	0.1	-
LOS	-	-	-	A	-	A	-	A	A	A	A	-
Access Road 4												
V/C Ratios	-	-	-	0	-	0	-	0.01	0.01	0	0	-
95th Queue (m)	-	-	-	0.1	-	0.1	-	0	0	0.1	0.1	-
LOS	-	-	-	A	-	A	-	A	A	A	A	-
PM Peak Hour												
Access Road 1												
V/C Ratios	-	-	-	0.01	-	0.01	-	0.02	0.02	0	0	-
95th Queue (m)	-	-	-	0.3	-	0.3	-	0	0	0	0	-
LOS	-	-	-	A	-	A	-	A	A	A	A	-
Access Road 2												
V/C Ratios	-	-	-	0.01	-	0.01	-	0.02	0.02	0	0	-

95th Queue (m)	-	-	-	0.2	-	0.2	-	0	0	0	0	-
LOS	-	-	-	A	-	A	-	A	A	A	A	-
Access Road 3												
V/C Ratios	-	-	-	0.01	-	0.01	-	0.01	0.01	0	0	-
95th Queue (m)	-	-	-	0.2	-	0.2	-	0	0	0	0	-
LOS	-	-	-	A	-	A	-	A	A	A	A	-
Access Road 4												
V/C Ratios	-	-	-	0.01	-	0.01	-	0.01	0.01	0	0	-
95th Queue (m)	-	-	-	0.2	-	0.2	-	0	0	0	0	-
LOS	-	-	-	A	-	A	-	A	A	A	A	-

As shown in above table, all access intersections are expected to operate acceptably for full build-out condition. V/C ratios and 95th percentile queue lengths are expected to be within the acceptable range. Northbound and southbound free flow movements on Range Road 3041 will operate at LOS A at all the access intersections during both the AM and PM peak hours. Westbound stop-controlled movements at all access intersections will also operate at LOS A during both the AM and PM peak hours.

INTERSECTION WARRANT ANALYSIS

Intersection turning lane warrants were assessed to improve the potential traffic safety at the proposed access intersections. The warrants were conducted for full build-out condition using the total forecast design hour volumes. As the proposed site generates more trips during evening peak hour, the evening design hour volumes were used to conduct the warrant analysis. The Ministry's System Improvement Warrants provide standard plans used to analyse the right-turn lanes (Plan No. 20614) and bypass lanes (Plan No. 20612) treatments.

Ministry specifies the 10th year after the proposed construction date as the analysis period. As the proposed site is expected to be fully developed in 2024, warrant analysis for right-turn lane and bypass lane were based on design hour volumes projected for year 2034 with 2% annual growth rate. Warrant analysis of the access intersections are included in **Appendix D** and the results of the analysis are shown in **Table 6**.

Table 9 – Intersection Treatment Warrant Results

Intersection	Right-Turn Lane Warranted?	Bypass Lane Warranted?
Access Road 1	No	No
Access Road 2	No	No
Access Road 3	No	No
Access Road 4	No	No

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The results of warrant analysis show that the right-turn lane and bypass lane are not warranted at all the access intersections.

SIGHT DISTANCE

The RM of Corman Park Zoning Bylaws provide standards for sight distance requirements at intersections. Figure 4 of RM Bylaws was used to draw a sight triangle at Access 1 (north most) and Access 4 (south most) intersections to make sure the sight distances along the access intersections are adequate to allow the drivers on Range Road 3041 and access intersections approaching simultaneously to see each other in time to prevent a collision at the intersection.

The sight triangles were drawn using 80 km/h design speed on Range Road 3041 and 30 km/h design speed on access driveways. The required sight triangles of the access intersections are illustrated in **Appendix E**. It was noted that a small portion of property fence at northwest corner is located within the sight triangle that may create safety issue. It is recommended that the property fence be adjusted so that the driver's sightline will remain clear or use a type of fence which does not block driver's view.

RAILWAY CROSSING ASSESSMENT

An existing CP railway line runs along the northeast boundary of the project site and crosses the Range Rd 3041 at northwest corner of the project site with a passive warning system. For a public at-grade crossing to warrant an active warning system without gate, Transport Canada specifies a minimum forecast cross-product of 2,000 or a minimum railway design speed of 129 km/h (80 mph) where there is no sidewalk, path or trail and a minimum railway design speed of 81 km/h (50 mph) where there is a sidewalk, path or trail. The cross-product of a railway crossing equals to the trains-per-day multiplied by the vehicles-per-day (vpd).

The 2019 Transport Canada Grade Crossing Inventory indicates that the maximum speed of trains at this crossing is 72 km/h (45 mph) and daily train volume is 6 trains per day. The daily vehicle forecast (2024) volume on Range Rd 3041 (both direction) at full build-out condition of the proposed development is 266 vpd as illustrated in Figure 6. With a cross-product of 1596 and the maximum train speed of 72 km/h, no additional modifications or improvements are required at the existing railway crossing. Note that there would need to be eight or more trains per day to warrant an increase in the level of control from a passive protection (signs only) to an active protection of FLB (flashing lights and bells without gate).

Proximity to an Intersection or Property Access

As per Transport Canada Grade Crossing Standards (Section 11), a new intersection or property access near a public grade crossing must be constructed

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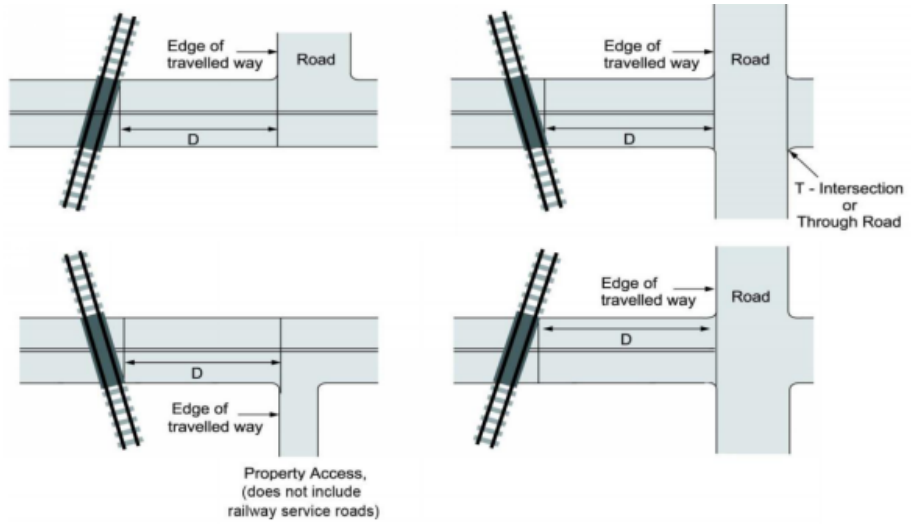
at a safe distance from the crossing so that no part of the travelled way of an intersecting road or driveway is closer than 30 meters (D) to the nearest rail of the grade crossing where the railway design speed is more than 25 km/h (15 mph) as shown in below illustration.



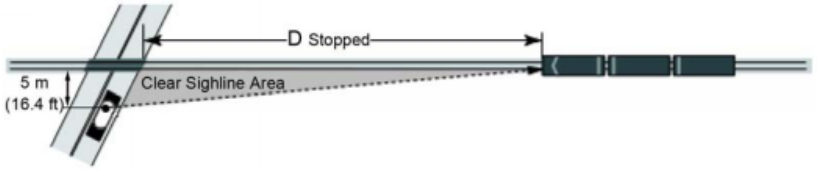
Source: Grade Crossing Standards, January 2019

The recommended location of the north most access (Access 1) of the proposed site on Range Rd 3041 is approximately 77 meters south of the railway crossing, meeting the Transport Canada minimum requirements.

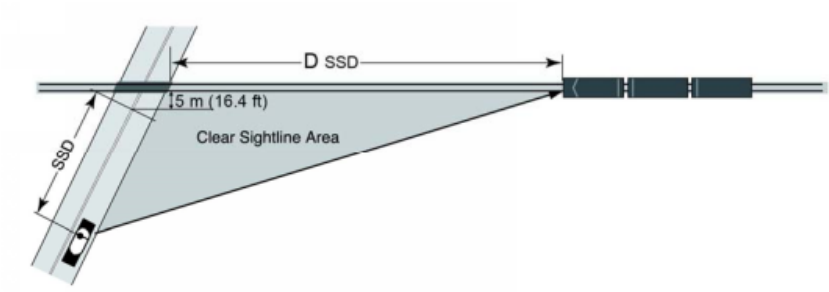
Minimum Sightline at Grade Crossing

As shown in below illustration, Transport Canada specifies two types of sight distances at a grade crossing which should remain clear from any sort of obstruction that has potential to block driver's view. For approaching vehicle toward a grade crossing, D_{SSD} is the minimum distance along the line of railway that a crossing user must see approaching railway equipment from the stopping sight distance (SSD), and does not apply if the grade crossing is equipped with a Stop sign or warning system. For stopped vehicle at a grade crossing, $D_{Stopped}$ is the minimum distance along the line of railway that a crossing user must be able to see approaching railway equipment from the stopped position at a Stop sign or at a distance of 5 meters from the railway line if the grade crossing is not equipped with a Stop sign or warning system.

(a) Sightlines for Users Stopped at a Grade Crossing (applicable to all quadrants).



(b) Sightlines for Users Approaching a Grade Crossing (applicable to all quadrants).



As the Range Rd 3041 crossing is equipped with a Stop sign, the stopping sight distance requirements for an approaching vehicle do not apply at this crossing. A sight triangle was drawn based on the minimum requirements for a stopped vehicle at grade crossing ($D_{Stopped}$) using a railway design speed of 72 km/h and roadway design speed of 80 km/h. As the truck traffic constitutes approximately 45 percent of the total traffic, a single-unit truck was selected for sight distance calculations. The required sight triangle at the railway crossing is illustrated in **Appendix F**. It was noted that the sightline area at the grade crossing is clear from any sort of obstruction that has potential to block a driver's view.

SUMMARY OF RECOMMENDATIONS

The purpose of the Traffic Impact Assessment was to ensure that the study intersections as well as the project access intersections will operate at a satisfactory Level of Service for existing and future traffic conditions at full build-out condition.

The proposed development includes four (4) industrial lots and a separate access to each industrial lot (Access 1 through Access 4) will be provided from Range Rd 3041 which is currently a two-lane undivided gravel roadway. The study area includes four (4) intersections with Township Rd 360 at Range Rd 3041, Slip Road, South Floral Siding and Freeborn Road.

Based on the traffic operation analysis, the overall impact of the proposed development is minimal and does not significantly impact the capacity, operations, or safety of the study and access intersections. Analysis completed within this TIA identifies no capacity issues and at full build-out condition (year

2024) and all study intersections and access intersections will operate at an acceptable level of service with all individual movements operating at LOS A.

Based on the turning lane warrant analysis, right-turn lane and bypass lane are not warranted at all the access intersections.

Sight triangles were drawn at the access intersections using 80 km/h design speed on Range Road 3041 and 30 km/h design speed on access driveways to make sure the sight distances along both roadways are adequate to allow the drivers of vehicles approaching simultaneously to see each other in time to prevent a collision at the intersection. It was noted that a small portion of property fence at northwest corner is located within the sight triangle that may create safety issue. It is recommended that the property fence be adjusted so that the driver's sightline will remain clear or use a type of fence which does not block driver's view.

The 2019 Transport Canada Grade Crossing Inventory indicates that the maximum speed of trains at Range Rd 3041 crossing is 72 km/h (45 mph) and daily train volume is 6 trains per day. As such, no upgrade or modifications are required at the existing crossing. The Transport Canada Grade Crossing Standards require a minimum 30 meters (D) spacing between the railway crossing and the roadway intersection / property access. The recommended north most access (Access 1) of the proposed site on Range Rd 3041 is located approximately 77 meters away from the railway crossing, meeting the Transport Canada minimum requirements.

A sight triangle was drawn at the grade crossing using a railway design speed of 72 km/h and roadway design speed of 80 km/h. As the truck traffic constitutes approximately 45 percent of the total traffic, a single-unit truck was selected for sight distance calculations. It was noted that the sightline area at the grade crossing is clear from any sort of obstruction that has potential to block driver's view.

Should any questions or concerns arise from this report, please contact Catterall & Wright and we would be more than happy to discuss.

Yours truly;
Catterall & Wright
Per:

Nadeem Hyder, P.Eng.

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Reviewed by:

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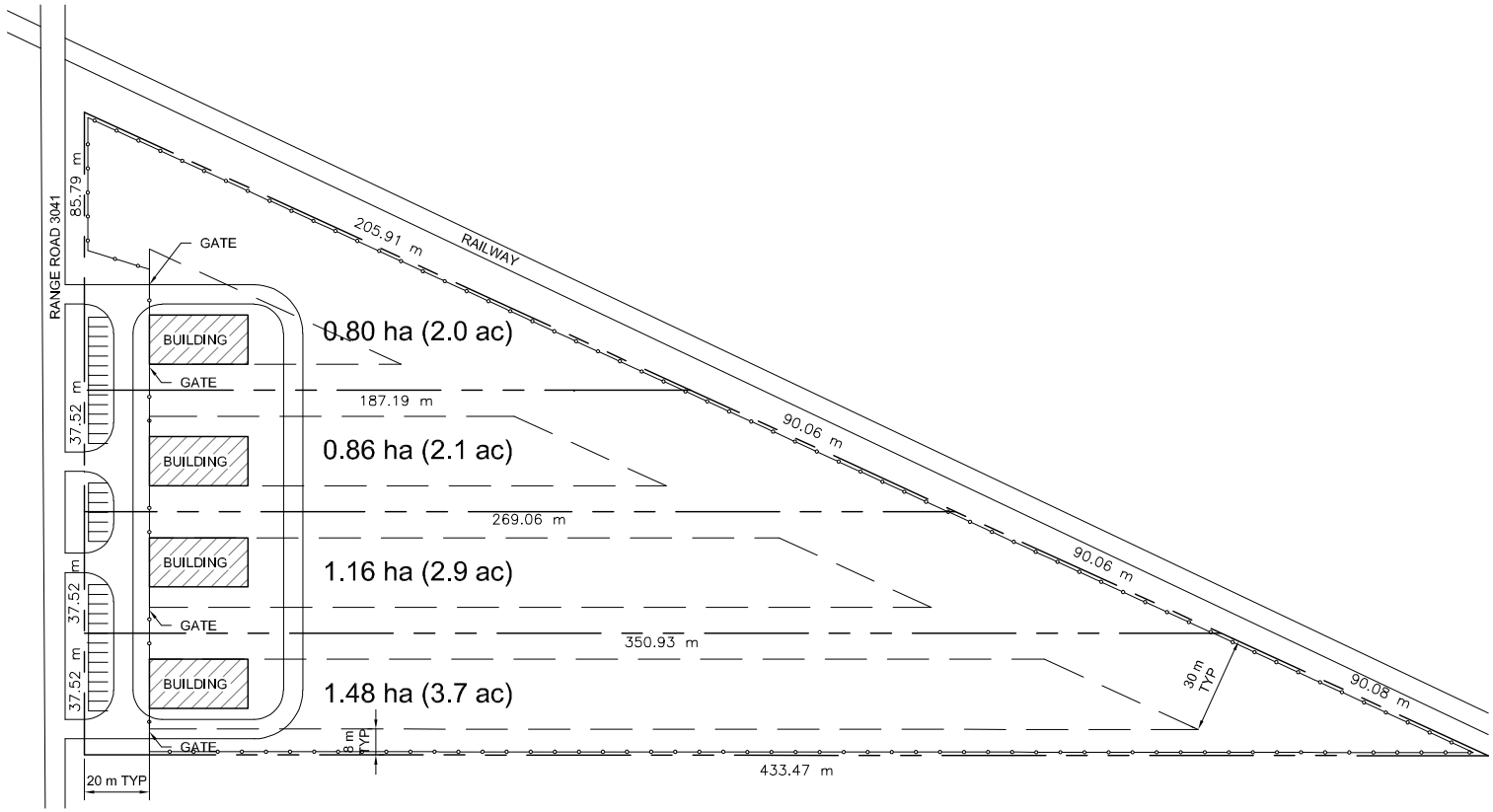
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
CATTERALL & WRIGHT
Number C848
Permission to Consult held by:

Discipline	Sk. Reg. No.	Signature
CIVIL	15426	

Appendix A

Site Plan of Proposed Development



1 SITE PLAN

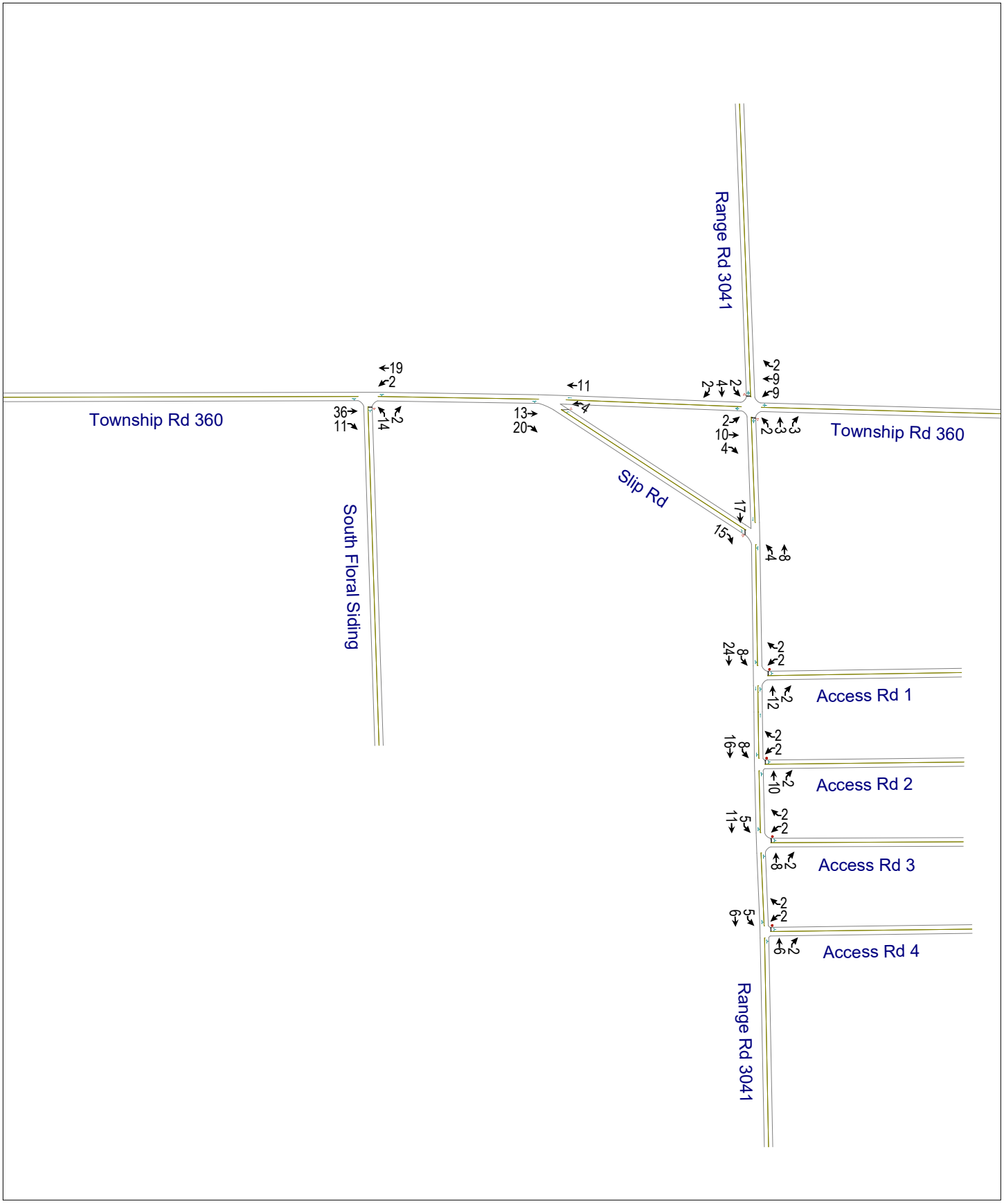
1:2000

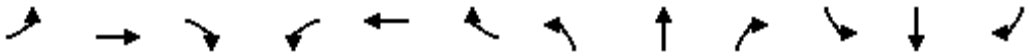
Baydo

Development Corporation

Appendix B

Results of Synchro Analysis at Study Intersections

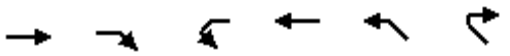

Township Rd 360
Township Rd 360
Range Rd 3041
Range Rd 3041
South Floral Siding
Slip Rd
Access Rd 1
Access Rd 2
Access Rd 3
Access Rd 4



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	10	4	9	9	2	2	3	3	2	4	2
Future Volume (Veh/h)	2	10	4	9	9	2	2	3	3	2	4	2
Sign Control		Free			Free			Yield			Yield	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	11	4	10	10	2	2	3	3	2	4	2
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	12			15			52	49	13	52	50	11
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	12			15			52	49	13	52	50	11
tC, single (s)	4.5			4.5			7.5	7.0	6.7	7.5	7.0	6.7
tC, 2 stage (s)												
tF (s)	2.6			2.6			3.9	4.4	3.7	3.9	4.4	3.7
p0 queue free %	100			99			100	100	100	100	99	100
cM capacity (veh/h)	1367			1363			839	759	955	839	758	958

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	17	22	8	8
Volume Left	2	10	2	2
Volume Right	4	2	3	2
cSH	1367	1363	844	821
Volume to Capacity	0.00	0.01	0.01	0.01
Queue Length 95th (m)	0.0	0.2	0.2	0.2
Control Delay (s)	0.9	3.5	9.3	9.4
Lane LOS	A	A	A	A
Approach Delay (s)	0.9	3.5	9.3	9.4
Approach LOS			A	A

Intersection Summary				
Average Delay	4.4			
Intersection Capacity Utilization	13.3%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations						
Traffic Volume (veh/h)	13	20	0	11	4	0
Future Volume (Veh/h)	13	20	0	11	4	0
Sign Control	Free			Free	Yield	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	14	22	0	12	4	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			36		37	25
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			36		37	25
tC, single (s)			4.5		6.8	6.7
tC, 2 stage (s)						
tF (s)			2.6		3.9	3.7
p0 queue free %			100		100	100
cM capacity (veh/h)			1338		877	940

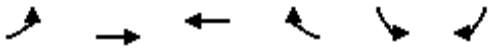
Direction, Lane #	EB 1	WB 1	NW 1
Volume Total	36	12	4
Volume Left	0	0	4
Volume Right	22	0	0
cSH	1700	1700	877
Volume to Capacity	0.02	0.01	0.00
Queue Length 95th (m)	0.0	0.0	0.1
Control Delay (s)	0.0	0.0	9.1
Lane LOS			A
Approach Delay (s)	0.0	0.0	9.1
Approach LOS			A

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	36	11	2	19	14	2
Future Volume (Veh/h)	36	11	2	19	14	2
Sign Control	Free			Free	Yield	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	39	12	2	21	15	2
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			51		70	45
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			51		70	45
tC, single (s)			4.5		6.8	6.7
tC, 2 stage (s)						
tF (s)			2.6		3.9	3.7
p0 queue free %			100		98	100
cM capacity (veh/h)			1320		837	915

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	51	23	17
Volume Left	0	2	15
Volume Right	12	0	2
cSH	1700	1320	845
Volume to Capacity	0.03	0.00	0.02
Queue Length 95th (m)	0.0	0.0	0.5
Control Delay (s)	0.0	0.7	9.3
Lane LOS		A	A
Approach Delay (s)	0.0	0.7	9.3
Approach LOS			A

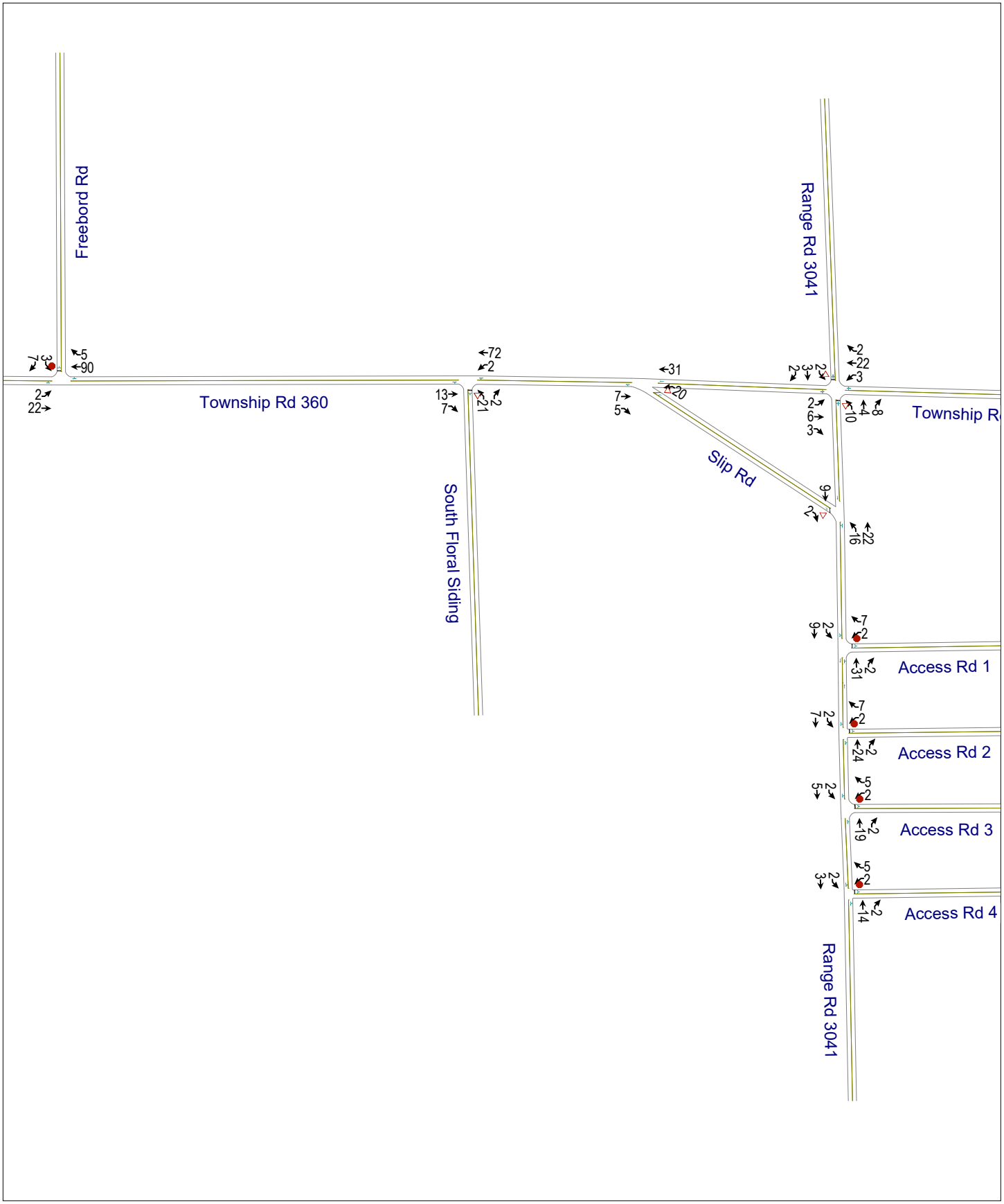
Intersection Summary			
Average Delay	1.9		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	9	53	36	2	5	4
Future Volume (Veh/h)	9	53	36	2	5	4
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	10	58	39	2	5	4
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	41				118	40
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	41				118	40
tC, single (s)	4.5				6.8	6.7
tC, 2 stage (s)						
tF (s)	2.6				3.9	3.7
p0 queue free %	99				99	100
cM capacity (veh/h)	1332				779	921

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	68	41	9
Volume Left	10	0	5
Volume Right	0	2	4
cSH	1332	1700	836
Volume to Capacity	0.01	0.02	0.01
Queue Length 95th (m)	0.2	0.0	0.2
Control Delay (s)	1.2	0.0	9.4
Lane LOS	A		A
Approach Delay (s)	1.2	0.0	9.4
Approach LOS			A

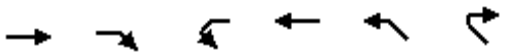
Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	20.0%	ICU Level of Service	A
Analysis Period (min)	15		


Freebord Rd
Township Rd 360
South Floral Siding
Slip Rd
Range Rd 3041
Township R
Access Rd 1
Access Rd 2
Access Rd 3
Access Rd 4
Range Rd 3041

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	6	3	3	22	2	10	4	8	2	3	2
Future Volume (Veh/h)	2	6	3	3	22	2	10	4	8	2	3	2
Sign Control		Free			Free			Yield			Yield	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	7	3	3	24	2	11	4	9	2	3	2
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	26			10			47	44	8	54	45	25
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	26			10			47	44	8	54	45	25
tC, single (s)	4.5			4.5			7.5	7.0	6.7	7.5	7.0	6.7
tC, 2 stage (s)												
tF (s)	2.6			2.6			3.9	4.4	3.7	3.9	4.4	3.7
p0 queue free %	100			100			99	99	99	100	100	100
cM capacity (veh/h)	1350			1370			850	768	961	833	767	940

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	12	29	24	7
Volume Left	2	3	11	2
Volume Right	3	2	9	2
cSH	1350	1370	872	830
Volume to Capacity	0.00	0.00	0.03	0.01
Queue Length 95th (m)	0.0	0.1	0.6	0.2
Control Delay (s)	1.3	0.8	9.2	9.4
Lane LOS	A	A	A	A
Approach Delay (s)	1.3	0.8	9.2	9.4
Approach LOS			A	A

Intersection Summary				
Average Delay	4.5			
Intersection Capacity Utilization	13.3%	ICU Level of Service		A
Analysis Period (min)	15			



Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations						
Traffic Volume (veh/h)	7	5	0	31	20	0
Future Volume (Veh/h)	7	5	0	31	20	0
Sign Control	Free			Free	Yield	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	8	5	0	34	22	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			13		44	10
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			13		44	10
tC, single (s)			4.5		6.8	6.7
tC, 2 stage (s)						
tF (s)			2.6		3.9	3.7
p0 queue free %			100		97	100
cM capacity (veh/h)			1366		868	958

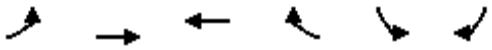
Direction, Lane #	EB 1	WB 1	NW 1
Volume Total	13	34	22
Volume Left	0	0	22
Volume Right	5	0	0
cSH	1700	1700	868
Volume to Capacity	0.01	0.02	0.03
Queue Length 95th (m)	0.0	0.0	0.6
Control Delay (s)	0.0	0.0	9.3
Lane LOS			A
Approach Delay (s)	0.0	0.0	9.3
Approach LOS			A

Intersection Summary			
Average Delay	3.0		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	13	7	2	72	21	2
Future Volume (Veh/h)	13	7	2	72	21	2
Sign Control	Free			Free	Yield	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	14	8	2	78	23	2
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			22		100	18
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			22		100	18
tC, single (s)			4.5		6.8	6.7
tC, 2 stage (s)						
tF (s)			2.6		3.9	3.7
p0 queue free %			100		97	100
cM capacity (veh/h)			1355		803	949

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	22	80	25
Volume Left	0	2	23
Volume Right	8	0	2
cSH	1700	1355	813
Volume to Capacity	0.01	0.00	0.03
Queue Length 95th (m)	0.0	0.0	0.7
Control Delay (s)	0.0	0.2	9.6
Lane LOS		A	A
Approach Delay (s)	0.0	0.2	9.6
Approach LOS			A

Intersection Summary			
Average Delay		2.0	
Intersection Capacity Utilization		15.4%	ICU Level of Service A
Analysis Period (min)		15	



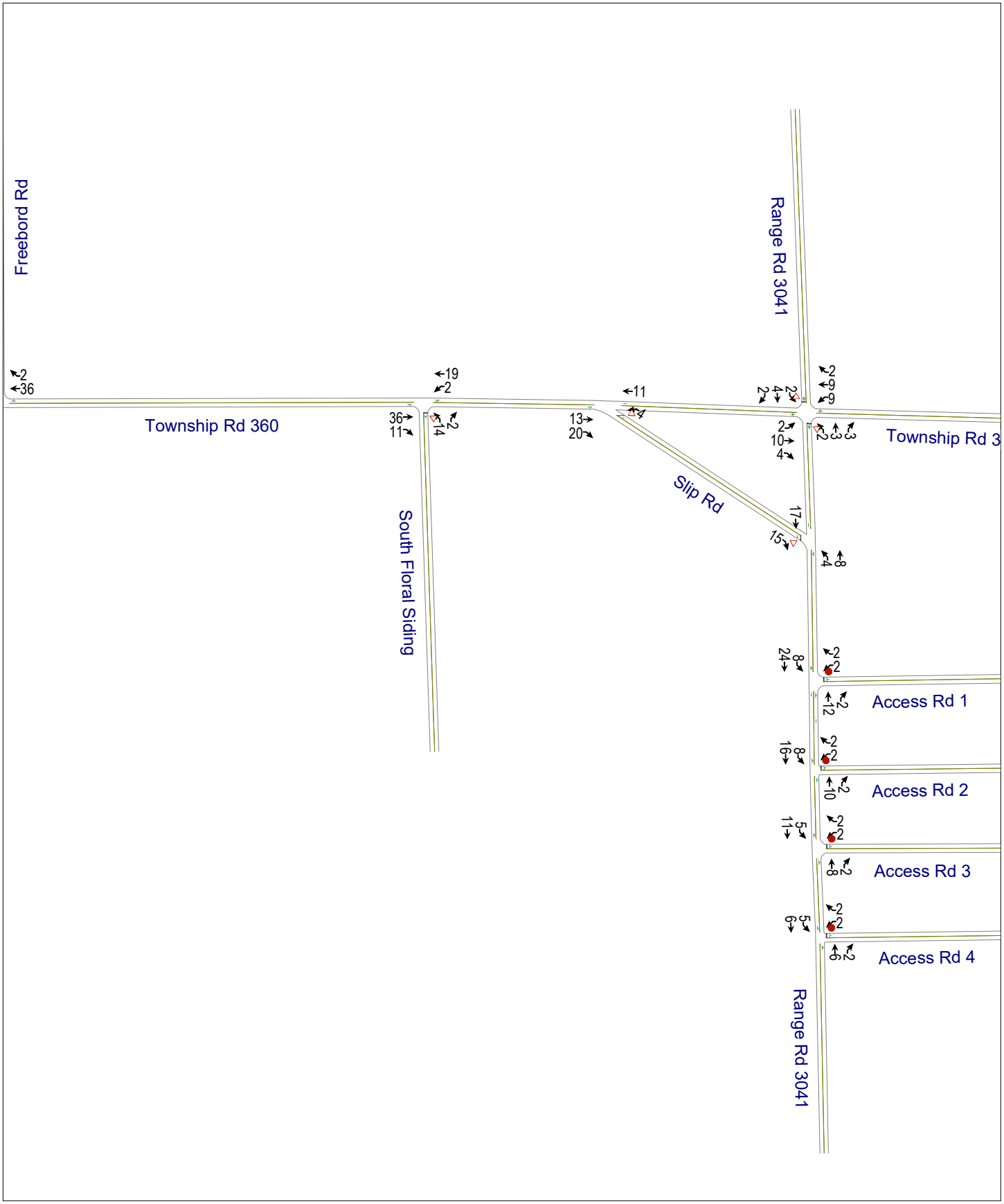
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	2	22	90	5	3	7
Future Volume (Veh/h)	2	22	90	5	3	7
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	24	98	5	3	8
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	103				128	100
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	103				128	100
tC, single (s)	4.5				6.8	6.7
tC, 2 stage (s)						
tF (s)	2.6				3.9	3.7
p0 queue free %	100				100	99
cM capacity (veh/h)	1259				772	849

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	26	103	11
Volume Left	2	0	3
Volume Right	0	5	8
cSH	1259	1700	827
Volume to Capacity	0.00	0.06	0.01
Queue Length 95th (m)	0.0	0.0	0.3
Control Delay (s)	0.6	0.0	9.4
Lane LOS	A		A
Approach Delay (s)	0.6	0.0	9.4
Approach LOS			A

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	15.0%	ICU Level of Service	A
Analysis Period (min)	15		

Appendix C

Results of Synchro Analysis at Access Intersections


Freebord Rd
Township Rd 360
South Floral Siding
Slip Rd
Range Rd 3041
Township Rd 3
Access Rd 1
Access Rd 2
Access Rd 3
Access Rd 4
Range Rd 3041

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	2	2	12	2	8	24
Future Volume (Veh/h)	2	2	12	2	8	24
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	2	13	2	9	26
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	58	14			15	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	58	14			15	
tC, single (s)	6.8	6.7			4.5	
tC, 2 stage (s)						
tF (s)	3.9	3.7			2.6	
p0 queue free %	100	100			99	
cM capacity (veh/h)	846	954			1363	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	4	15	35
Volume Left	2	0	9
Volume Right	2	2	0
cSH	897	1700	1363
Volume to Capacity	0.00	0.01	0.01
Queue Length 95th (m)	0.1	0.0	0.2
Control Delay (s)	9.0	0.0	2.0
Lane LOS	A		A
Approach Delay (s)	9.0	0.0	2.0
Approach LOS	A		

Intersection Summary			
Average Delay		2.0	
Intersection Capacity Utilization		18.3%	ICU Level of Service
Analysis Period (min)		15	

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	2	2	10	2	8	16
Future Volume (Veh/h)	2	2	10	2	8	16
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	2	11	2	9	17
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	47	12			13	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	47	12			13	
tC, single (s)	6.8	6.7			4.5	
tC, 2 stage (s)						
tF (s)	3.9	3.7			2.6	
p0 queue free %	100	100			99	
cM capacity (veh/h)	859	956			1366	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	4	13	26
Volume Left	2	0	9
Volume Right	2	2	0
cSH	905	1700	1366
Volume to Capacity	0.00	0.01	0.01
Queue Length 95th (m)	0.1	0.0	0.2
Control Delay (s)	9.0	0.0	2.7
Lane LOS	A		A
Approach Delay (s)	9.0	0.0	2.7
Approach LOS	A		

Intersection Summary			
Average Delay		2.5	
Intersection Capacity Utilization		17.9%	ICU Level of Service A
Analysis Period (min)		15	

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	2	2	8	2	5	11
Future Volume (Veh/h)	2	2	8	2	5	11
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	2	9	2	5	12
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	32	10			11	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	32	10			11	
tC, single (s)	6.8	6.7			4.5	
tC, 2 stage (s)						
tF (s)	3.9	3.7			2.6	
p0 queue free %	100	100			100	
cM capacity (veh/h)	879	959			1368	

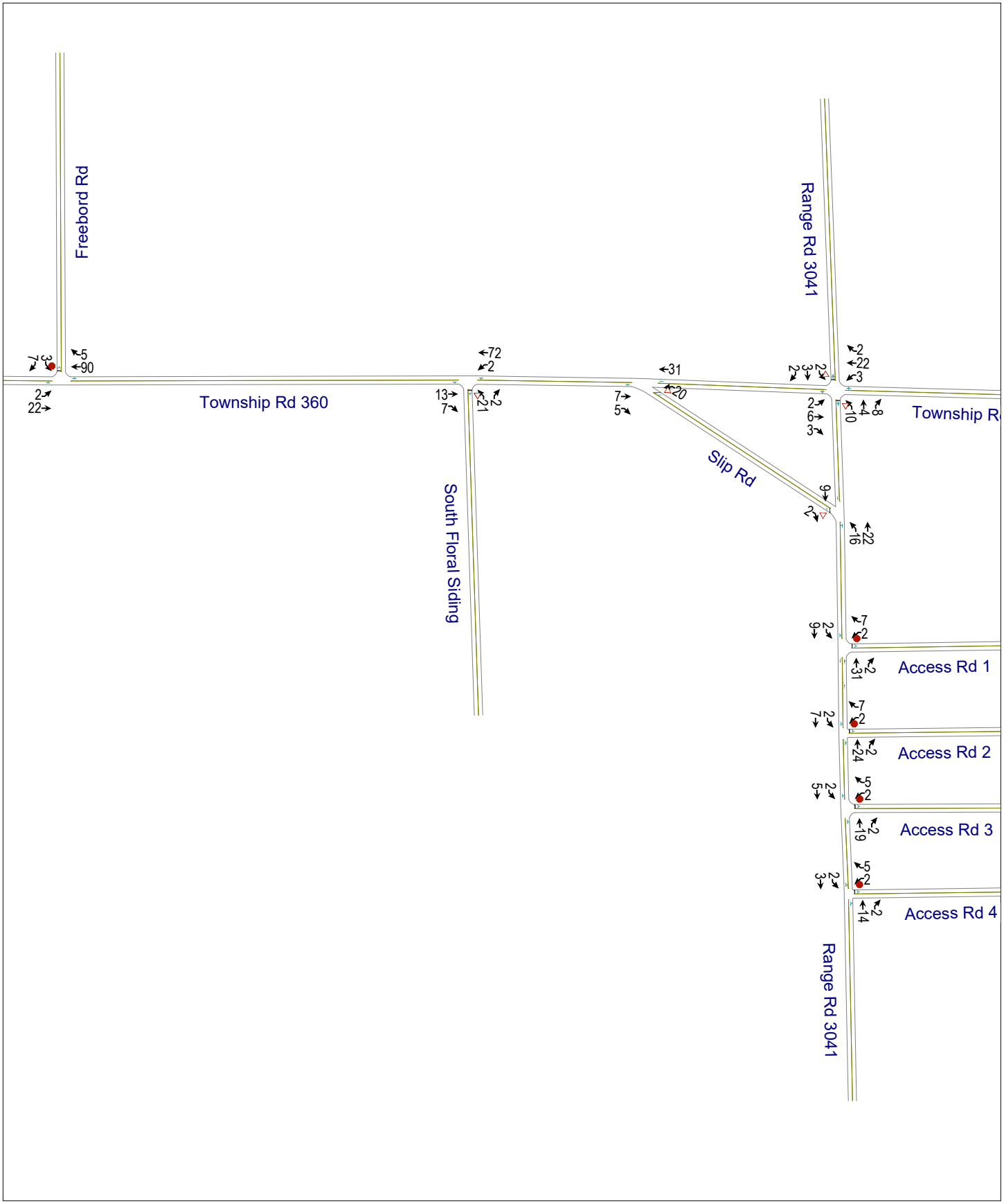
Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	4	11	17
Volume Left	2	0	5
Volume Right	2	2	0
cSH	917	1700	1368
Volume to Capacity	0.00	0.01	0.00
Queue Length 95th (m)	0.1	0.0	0.1
Control Delay (s)	8.9	0.0	2.3
Lane LOS	A		A
Approach Delay (s)	8.9	0.0	2.3
Approach LOS	A		

Intersection Summary			
Average Delay		2.3	
Intersection Capacity Utilization		15.0%	ICU Level of Service
Analysis Period (min)		15	

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	2	2	6	2	5	6
Future Volume (Veh/h)	2	2	6	2	5	6
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	2	7	2	5	7
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	25	8			9	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	25	8			9	
tC, single (s)	6.8	6.7			4.5	
tC, 2 stage (s)						
tF (s)	3.9	3.7			2.6	
p0 queue free %	100	100			100	
cM capacity (veh/h)	888	961			1371	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	4	9	12
Volume Left	2	0	5
Volume Right	2	2	0
cSH	923	1700	1371
Volume to Capacity	0.00	0.01	0.00
Queue Length 95th (m)	0.1	0.0	0.1
Control Delay (s)	8.9	0.0	3.2
Lane LOS	A		A
Approach Delay (s)	8.9	0.0	3.2
Approach LOS	A		

Intersection Summary			
Average Delay		3.0	
Intersection Capacity Utilization		14.8%	ICU Level of Service A
Analysis Period (min)		15	


Freebord Rd
Township Rd 360
South Floral Siding
Slip Rd
Range Rd 3041
Township R
Access Rd 1
Access Rd 2
Access Rd 3
Access Rd 4
Range Rd 3041

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	2	7	31	2	2	9
Future Volume (Veh/h)	2	7	31	2	2	9
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	8	34	2	2	10
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	49	35			36	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	49	35			36	
tC, single (s)	6.8	6.7			4.5	
tC, 2 stage (s)						
tF (s)	3.9	3.7			2.6	
p0 queue free %	100	99			100	
cM capacity (veh/h)	861	927			1338	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	10	36	12
Volume Left	2	0	2
Volume Right	8	2	0
cSH	913	1700	1338
Volume to Capacity	0.01	0.02	0.00
Queue Length 95th (m)	0.3	0.0	0.0
Control Delay (s)	9.0	0.0	1.3
Lane LOS	A		A
Approach Delay (s)	9.0	0.0	1.3
Approach LOS	A		

Intersection Summary			
Average Delay		1.8	
Intersection Capacity Utilization		13.3%	ICU Level of Service A
Analysis Period (min)		15	

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	2	7	24	2	2	7
Future Volume (Veh/h)	2	7	24	2	2	7
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	8	26	2	2	8
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	39	27			28	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	39	27			28	
tC, single (s)	6.8	6.7			4.5	
tC, 2 stage (s)						
tF (s)	3.9	3.7			2.6	
p0 queue free %	100	99			100	
cM capacity (veh/h)	873	937			1347	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	10	28	10
Volume Left	2	0	2
Volume Right	8	2	0
cSH	924	1700	1347
Volume to Capacity	0.01	0.02	0.00
Queue Length 95th (m)	0.2	0.0	0.0
Control Delay (s)	8.9	0.0	1.5
Lane LOS	A		A
Approach Delay (s)	8.9	0.0	1.5
Approach LOS	A		

Intersection Summary			
Average Delay		2.2	
Intersection Capacity Utilization		13.3%	ICU Level of Service A
Analysis Period (min)		15	

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	2	5	19	2	2	5
Future Volume (Veh/h)	2	5	19	2	2	5
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	5	21	2	2	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	31	22			23	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	31	22			23	
tC, single (s)	6.8	6.7			4.5	
tC, 2 stage (s)						
tF (s)	3.9	3.7			2.6	
p0 queue free %	100	99			100	
cM capacity (veh/h)	882	944			1354	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	7	23	7
Volume Left	2	0	2
Volume Right	5	2	0
cSH	925	1700	1354
Volume to Capacity	0.01	0.01	0.00
Queue Length 95th (m)	0.2	0.0	0.0
Control Delay (s)	8.9	0.0	2.2
Lane LOS	A		A
Approach Delay (s)	8.9	0.0	2.2
Approach LOS	A		

Intersection Summary			
Average Delay		2.1	
Intersection Capacity Utilization		13.3%	ICU Level of Service A
Analysis Period (min)		15	

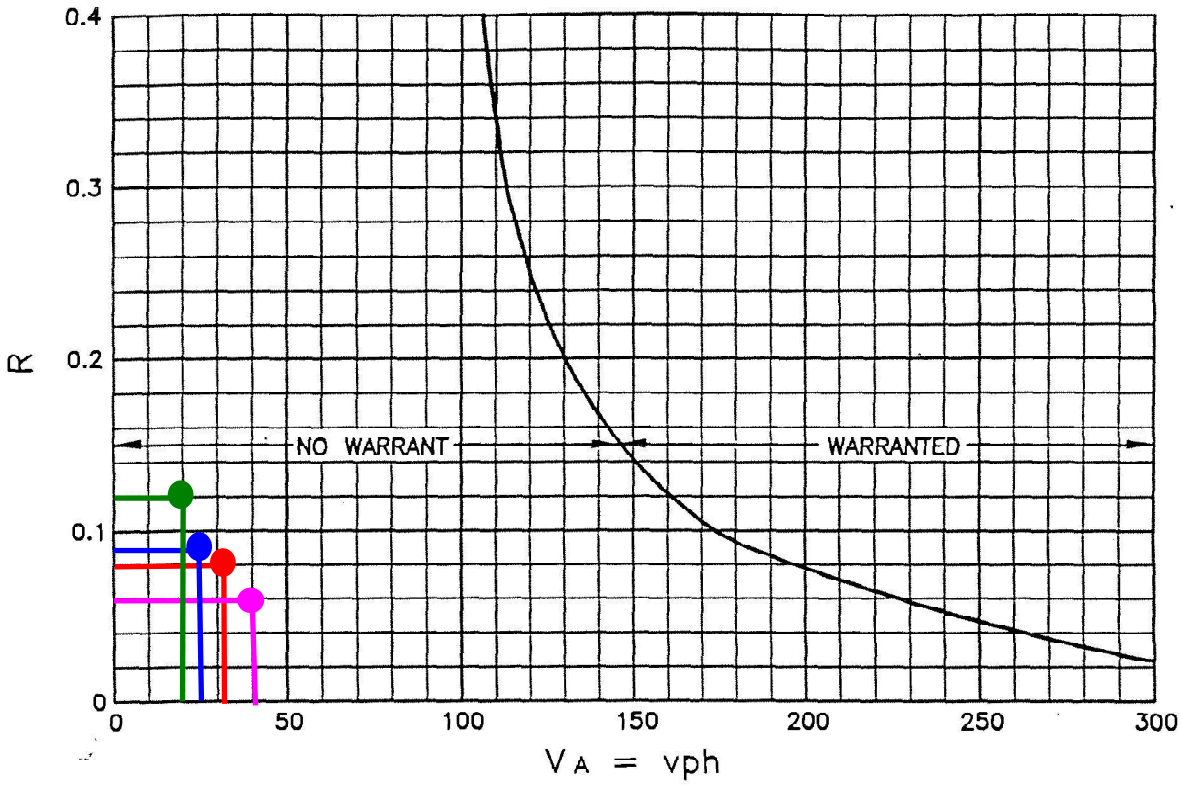
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	2	5	14	2	2	3
Future Volume (Veh/h)	2	5	14	2	2	3
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	5	15	2	2	3
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	23	16			17	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	23	16			17	
tC, single (s)	6.8	6.7			4.5	
tC, 2 stage (s)						
tF (s)	3.9	3.7			2.6	
p0 queue free %	100	99			100	
cM capacity (veh/h)	892	951			1361	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	7	17	5
Volume Left	2	0	2
Volume Right	5	2	0
cSH	934	1700	1361
Volume to Capacity	0.01	0.01	0.00
Queue Length 95th (m)	0.2	0.0	0.0
Control Delay (s)	8.9	0.0	3.1
Lane LOS	A		A
Approach Delay (s)	8.9	0.0	3.1
Approach LOS	A		

Intersection Summary			
Average Delay		2.7	
Intersection Capacity Utilization		13.3%	ICU Level of Service A
Analysis Period (min)		15	

Appendix D

Warrants for Intersection Treatment



Warrants are based on Design Hourly Volumes

V_A = Advancing Volume, includes Volume Right and Volume Left unless exclusive left turn lane.

V_R = Right Turn Volume, vph.

$R = V^R/V^A$

Warrants: NON FLARED INTERSECTION – Provide 3.7 m turning lane.
FLARED INTERSECTION – Lengthen deceleration lane to meet the right turn lane standard.

Access Road 1	Access Road 2	Access Road 3	Access Road 4
VA = (31+2)*1.2 = 40 vph VR = 2 vph R = VR/VA = 0.06	VA = (24+2)*1.2 = 31 vph VR = 2 vph R = VR/VA = 0.08	VA = (19+2)*1.2 = 25 vph VR = 2 vph R = VR/VA = 0.09	VA = (14+2)*1.2 = 20 vph VR = 2 vph R = VR/VA = 0.12
Not Warranted	Not Warranted	Not Warranted	Not Warranted

Saskatchewan Highways and Transportation

WARRANTS FOR RIGHT TURN LANES
RURAL HIGHWAYS

RECOMMENDED BY:		DIRECTOR TECH. STDS. & POLICIES	DATE	95.02.24	STANDARD PLAN NO	20614
APPROVED BY:		ASSIST. DEPUTY MINISTER OPERATIONS DIVISION	DATE	95-02-28	SHEET	1 of 2

LAST REV DATE: FEB.14,1995
ACAD DWG: 20614-1

NOTES:

1. Right turn lanes are warranted at the following locations:
   - intersections with other Provincial Highways.
   - Industrial Access Roads.
   - Provincial Campgrounds and Picnic Sites.

2. Use corrected peak hourly volumes (vph) projected to the 10th year after the proposed construction date. Refer to correction factors under DM 502-3 for further information.

3. Normally 0.6 m shoulder will be provided on turning lane.

4. 1.5 m shoulder may be provided on divided highways and at intersections where truck volumes are higher than normal, for example, at scale sites and access to industrial sites generating heavy truck volumes.

5. Length of the turning lane will be related to highway design speed and turning speed. See Standard Plan No. 20618.

6. For 4 lane highways, the advancing volume should be based on 50% of the total directional volume (vph) or 25% of the total volume (where directional split is not a factor), with no further reduction for left turn vehicles.

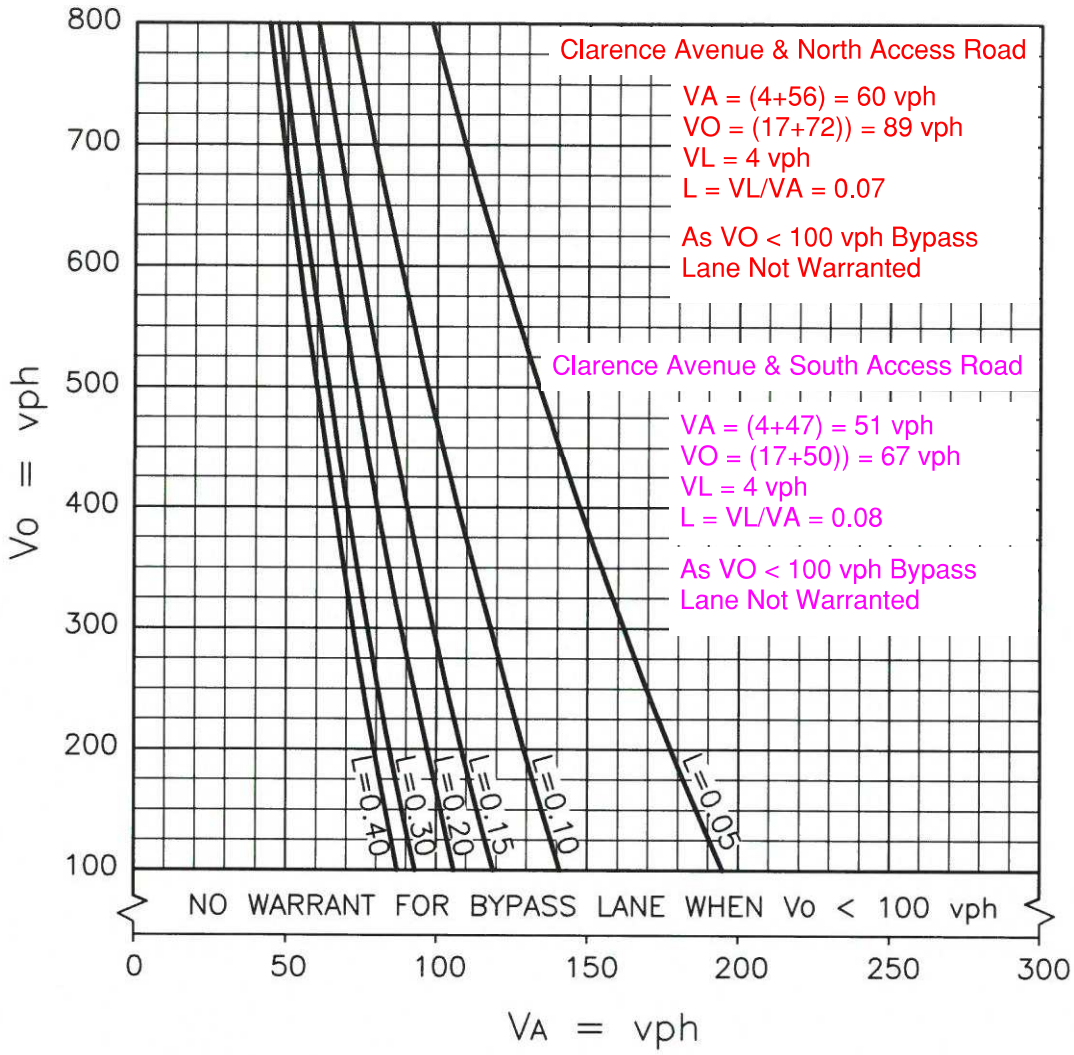
Saskatchewan Highways and Transportation

WARRANTS FOR RIGHT TURN LANES
RURAL HIGHWAYS

RECOMMENDED BY:		DIRECTOR TECH. STDS. & POLICIES	DATE	95.02.24	STANDARD PLAN NO	20614
APPROVED BY:		ASSIST. DEPUTY MINISTER OPERATIONS DIVISION	DATE	95-02-28	SHEET	2 of 2

LAST REV DATE: FEB.14,1995

ACAD DWG 1-2



V_A = Advancing volume, includes volume left and volume right unless exclusive right turn lane.

V_O = Opposing volume, includes volume left, and volume right unless separated right turning roadway (ramp).

V_L = Left turn volume.

$L = V_L / V_A$

NOTES:

1. Use corrected peak hourly volumes (vph) projected to the 10th year after the proposed construction date. Refer to correction factors under SKS 2.3.1–C for further information.
2. No warrant for a bypass lane is plotted point falls to left of applicable "L" line, or if L < 0.05.
3. If a bypass lane is not warranted, check flared intersection treatment warrants, Standard Plan 20613.
4. For additional information please refer to SKS 2.2.2–B, SKS 2.3.1–F, SKS 2.3.5–C & SKS 2.3.8–B.

Government of Saskatchewan
Ministry of Highways & Infrastructure

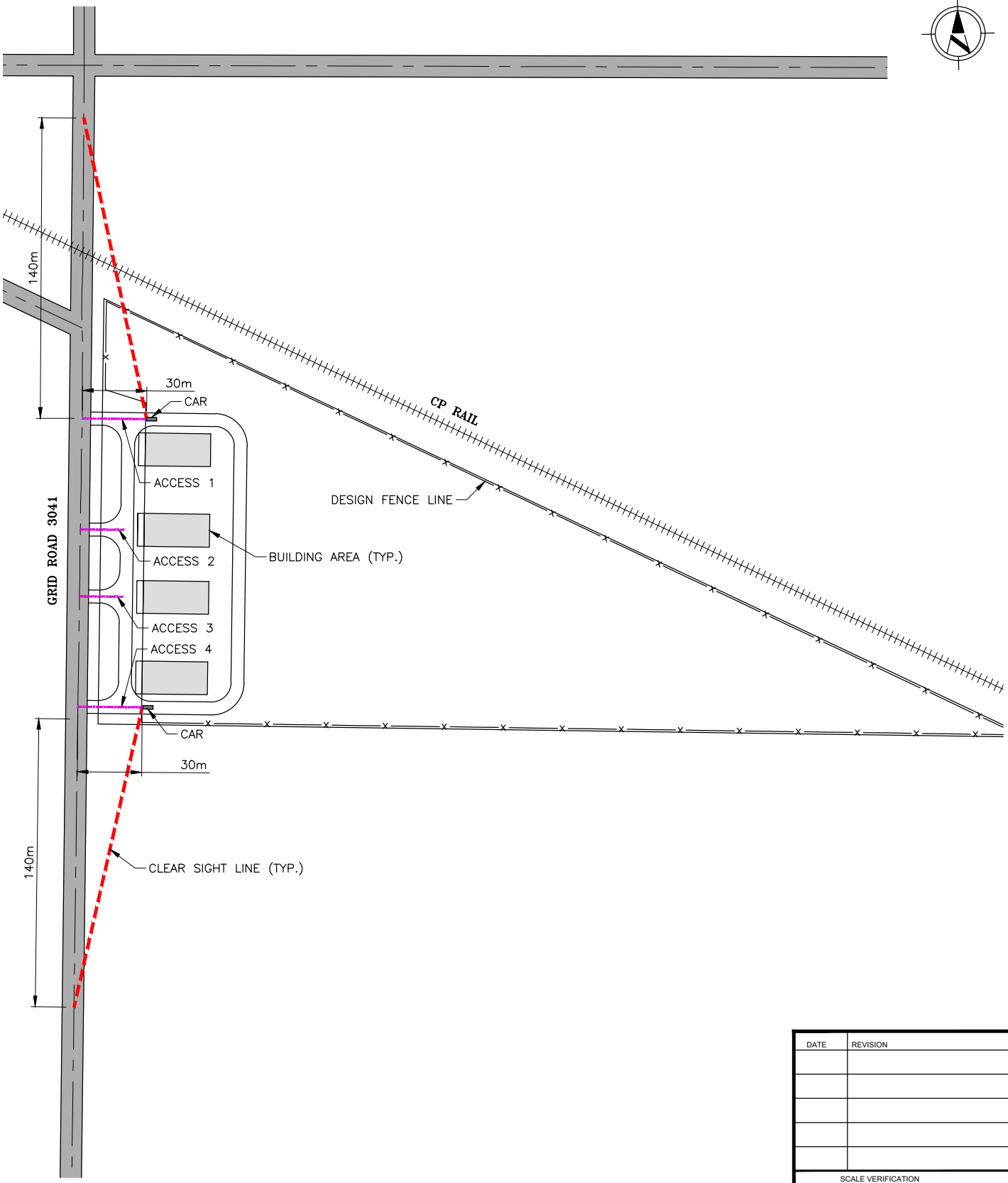
WARRANTS FOR
BYPASS LANE INTERSECTIONS
2 LANE RURAL HIGHWAYS

RECOMMENDED BY		DIRECTOR DESIGN & TRAFFIC ENG	DATE	2016-03-21	STANDARD PLAN NO	20612
APPROVED BY		A/EXECUTIVE DIRECTOR TECHNICAL STANDARDS BRANCH	DATE	May 5/16	SHEET	1 OF 1

ACAD DWG: SKS20612
LAST REV DATE: 16/01/27

Appendix E

Sight Distance Requirements at Access Intersections



N:\102068225 Saskatchewan Corp - 683\001 - Floral Road Development\Drawings\683-001.dwg Ryan B 19/06/19 - 9:58 A

DATE	REVISION

SCALE VERIFICATION

WHEN DRAWING IS PLOTTED FULL SIZE THIS LINE IS 30mm IN LENGTH.

SCALE	DESIGNED
NTS	SNH
DRAWN	CHECKED
RJB	SNH
DATE	SHEET
19/06/11	7 of 8

DRAWING NUMBER: APPENDIX E

CATTERALL & WRIGHT
CONSULTING ENGINEERS

1221 - 8th Street East
SASKATOON SK S7H 0S5
Tel: (306) 343-7280, Fax: (306) 956-3199

OWNER/CLIENT
102068225 SASKATCHEWAN CORP.

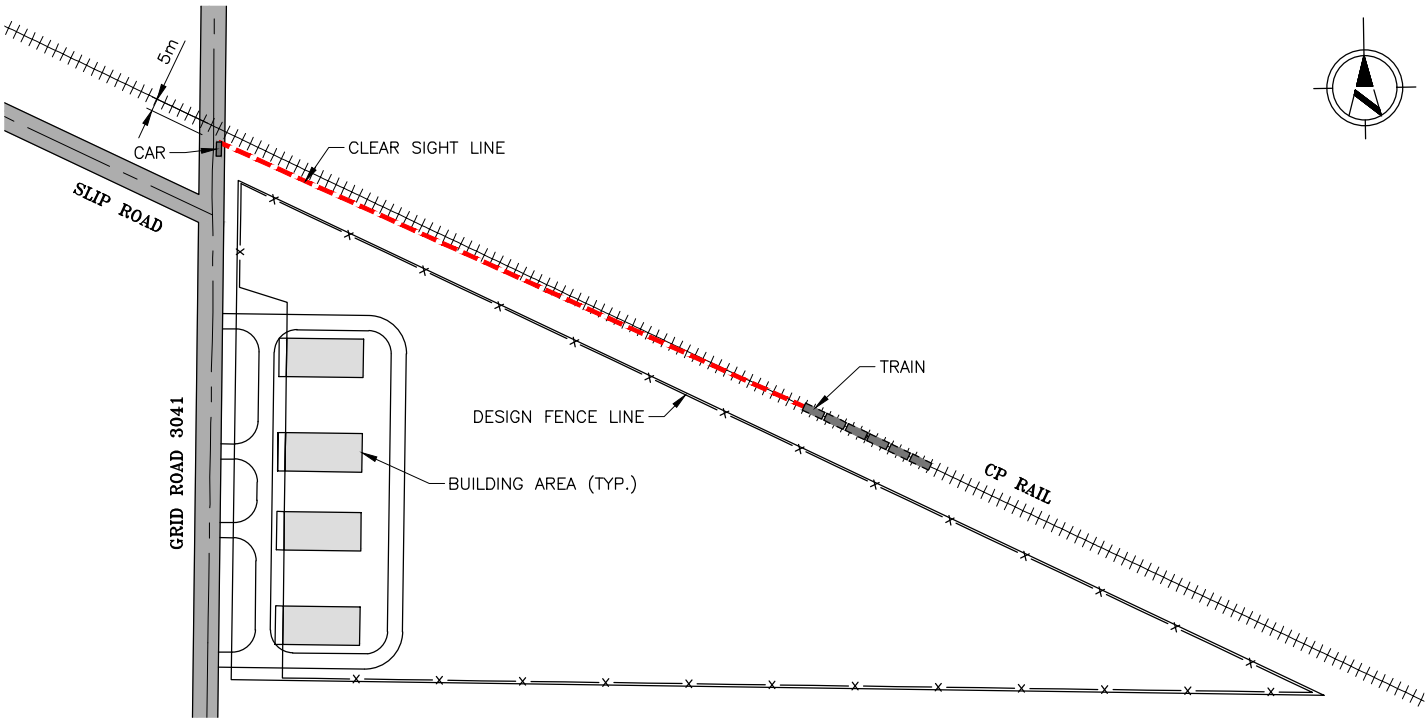
LOCATION
RM OF CORMAN PARK

PROJECT
FLORAL ROAD DEVELOPMENT TIA

SHEET TITLE
SIGHT DISTANCE AT ACCESS INTERSECTIONS

Appendix F

Sight Distance Requirements at Railway Crossing



SIGHTLINE FOR STOPPED VEHICHLES AT GRADE CROSSING

SCALE: NTS

DATE	REVISION

SCALE VERIFICATION

WHEN DRAWING IS PLOTTED FULL SIZE THIS LINE IS 30mm IN LENGTH.

CATTERALL & WRIGHT
CONSULTING ENGINEERS

1221 - 8th Street East
SASKATOON SK S7H 0S5
Tel: (306) 343-7280, Fax: (306) 956-3199

OWNER/CLIENT: 102068225 SASKATCHEWAN CORP.

LOCATION: RM OF CORMAN PARK

PROJECT: FLORAL ROAD DEVELOPMENT TIA

SHEET TITLE: SIGHT DISTANCE AT GRADE CROSSING

SCALE	DESIGNED
NTS	SNH
DRAWN	CHECKED
RJB	SNH
DATE	SHEET
19/06/11	8 of 8

DRAWING NUMBER: APPENDIX F

Appendix "C"
Heritage and Environmental Queries

Saskatchewan

Developers' Online Screening Tool

Inquiry was made on September 27, 2019 at 11:11 AM

You are inquiring about the heritage sensitivity of the following land location:

Quarter-section:	NW
Section:	36
Township:	35
Range:	4
Meridian:	3

This quarter-section is NOT heritage sensitive.

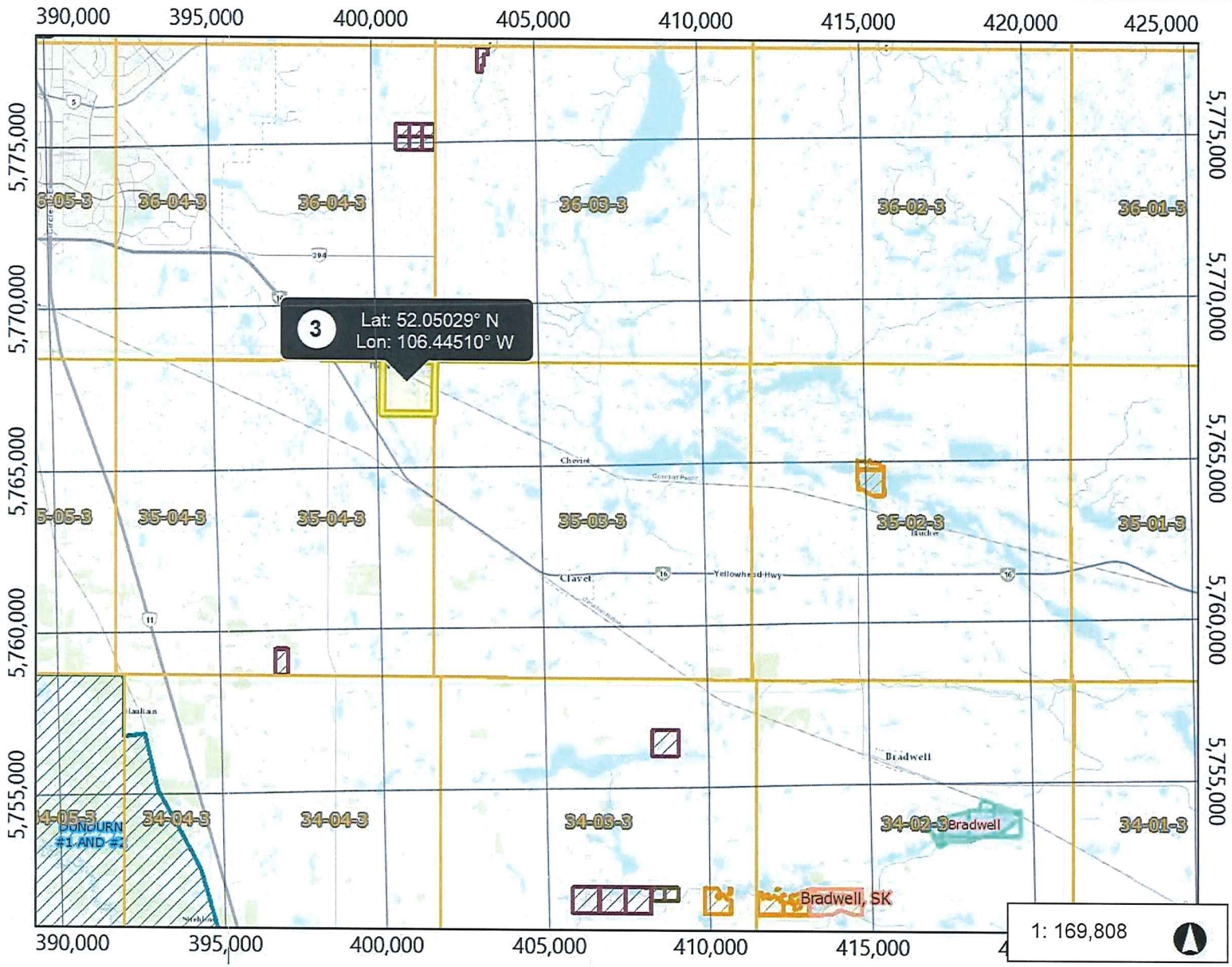
It is not necessary to submit the project to the Heritage Conservation Branch for screening. These results can be printed for submission to other regulatory bodies (e.g. Saskatchewan Environment, Saskatchewan Energy and Resources). Please email **arms@gov.sk.ca** if you have any questions.

Refine Search | New Search | Log Out

Saskatchewan

Government of Saskatchewan

Tools & Features Demonstration Site



Legend

- Provincial Boundary
- Township
- Water Security Agency
- Game Preserve
- National Wildlife Area
- Migratory Bird Sanctuary
- Conservation Easements
- Crown Land Subdivisions
- Ecological Reserves
- Fish and Wildlife Development
- Community Pastures - Federal
- Ramsar Wetland
- Reservior Development Areas
- Representative Areas
- Community Pastures - Provinc
- Special Management Areas
- Wildlife Habitat Protection (WH
- Wildlife Refuge
- Private Stewardship Agreemer
- Provincial Park
- National Park

1: 169,808

Notes

8.6 0 4.31 8.6 Kilometers

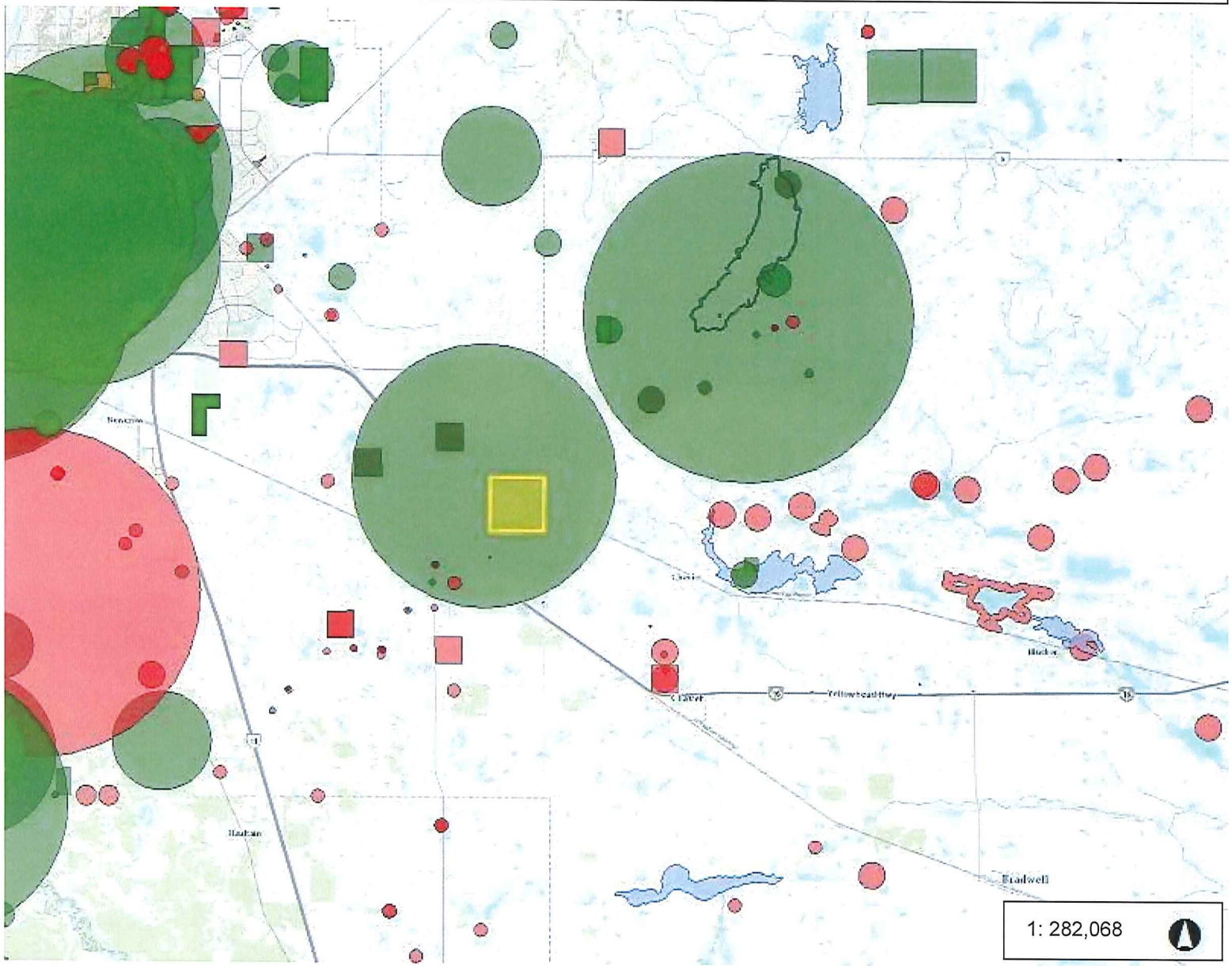
WGS_1984_Web_Mercator_Auxiliary_Sphere

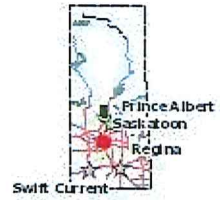
This map is a user generated static output from an Internet mapping site and is for reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable.

THIS MAP IS NOT TO BE USED FOR NAVIGATION

HABISask
hunting | angling | biodiversity

Tools & Features Demonstration Site





Legend

- Provincial Boundary
- Rare and Endangered Species
  - Vertebrate Animal
  - Invertebrate Animal
  - Animal Assemblage
  - Vascular Plant
  - Nonvascular Plant
  - Other (Botanical)
  - Fungus
- National Park
- Provincial Park

1: 282,068

Notes

14.3 0 7.16 14.3 Kilometers

WGS_1984_Web_Mercator_Auxiliary_Sphere

This map is a user generated static output from an Internet mapping site and is for reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable.
THIS MAP IS NOT TO BE USED FOR NAVIGATION

Appendix “D”
Storm Water Management Plan

SCALE BAR
0 50m 100m

SITE DESIGN C FACTOR SITE 1		
TYPE	AREA (sq.m)	2 YR C
CONCRETE	45	0.95
COMPACTED GRAVEL	1978	0.50
LANDSCAPING	5544	0.10
BUILDING	465	0.95
TOTAL	8032	0.25

SITE DESIGN C FACTOR SITE 2		
TYPE	AREA (sq.m)	2 YR C
CONCRETE	45	0.95
COMPACTED GRAVEL	1915	0.50
LANDSCAPING	6139	0.10
BUILDING	465	0.95
TOTAL	8564	0.24

SITE DESIGN C FACTOR SITE 3		
TYPE	AREA (sq.m)	2 YR C
CONCRETE	45	0.95
COMPACTED GRAVEL	1915	0.50
LANDSCAPING	9193	0.10
BUILDING	465	0.95
TOTAL	11618	0.20

SITE DESIGN C FACTOR SITE 4		
TYPE	AREA (sq.m)	2 YR C
CONCRETE	45	0.95
COMPACTED GRAVEL	1978	0.50
LANDSCAPING	12292	0.10
BUILDING	465	0.95
TOTAL	14780	0.18

CATTERALL & WRIGHT
CONSULTING ENGINEERS
1221 - 8th Street East
SASKATOON SK S7H 0S5
Tel: (306) 343-7280, Fax: (306) 956-3199

PRELIMINARY
NOT FOR CONSTRUCTION

LEGEND:

- EXIST. POWER POLE
- EXIST. SHRUBS
- EXIST. EASEMENT
- EXIST. GAS LINE
- EXIST. PHONE LINE
- EXIST. RAIL TRACK
- EXIST. DRAINAGE DITCH
- EXIST. OVERHEAD POWER LINE
- FENCE
- DESIGN CULVERT
- DESIGN DRAINAGE DIRECTION
- EXIST. GRAVEL ROAD
- DESIGN GRAVEL ROAD
- DESIGN BUILDING AREA

SCALE VERIFICATION
WHEN DRAWING IS PLOTTED FULL SIZE THIS LINE IS 60mm IN LENGTH.

DATE	REVISION

OWNER/CLIENT
102068225 SASKATCHEWAN CORP.

LOCATION
RM OF CORMAN PARK

PROJECT
FLORAL ROAD DEVELOPMENT

SHEET TITLE
PROPOSED DRAINAGE PLAN

SCALE 1:750	DESIGNED RJR
DRAWN RJB	CHECKED
DATE 19/09/26	SHEET 2 of 2

DRAWING NUMBER 683-00102

Appendix "E"
Public Consultation

Tim Steuart

From: Lynne Samson <lsamson@sasktel.net>
Sent: Saturday, October 26, 2019 7:32 PM
To: Tim Steuart
Subject: Oct. 15 / 2019 letter to adjacent landowners (East Floral Industrial Park)

Dear Jim / Tim @ Crosby Hanna.....

In regards to this proposed Industrial / Commercial Development in the RM of Corman Park, as one of the owners of the adjacent East Floral Industrial Park, I offer a few comments.....

#1.... I believe your client may be subject to a recent "Latecomer's Clause" adopted by the RM in regard to a newly constructed "Exit Ramp" at the corner of Floral Road & the Hwy. 16 westbound lane.The construction cost of approx. $240,000.00 was shared by the RM (32%), the Ministry of Highways (32%), and East Floral Ind. Park (36%).

#2.... The RM has recently adopted the requirement for internal roadways (and potentially adjoining RM roadways) be paved to a " 9 meter width, primary road spec. "

Both of these items are obviously costly and verifying their existence & their application to your client's proposed development in the RM of Corman Park may be helpful.

Regards...

Laurie Bradley

East Floral Ind. Park

East Cory Ind Park

306 221 0677

Appendix “F”
Geotechnical Report

P. MACHIBRODA ENGINEERING LTD.

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- Test Drilling Services
- Piezocone (CPTu) Testing
- Soils Testing
- Concrete Testing
- Asphalt Testing
- Pile Driving Analyzer (PDA) Testing

GEOTECHNICAL INVESTIGATION
PROPOSED BUILDINGS AND EQUIPMENT YARD
PARCEL A, PLAN 64519699, RANGE ROAD 3041
NEAR CLAVET, SASKATCHEWAN
PMEL FILE NO. 14263
APRIL 30, 2018

PREPARED FOR:

CJL INVESTMENTS LTD.
36 – 102 COPE WAY
SASKATOON, SASKATCHEWAN
S7T 0X2

ATTENTION: MR. STEPHEN GRAY, VICE PRESIDENT OPERATIONS

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1.0 INTRODUCTION

The following report has been prepared on the subsurface soil conditions existing at the site of the proposed Buildings and Equipment Yard to be constructed within Parcel A, Plan 64519699 east of Range Road 3041 near Clavet, Saskatchewan. The site is located within the NW¼-36-35-4-W3M. It is understood that the existing Building on the subject site will be demolished and seven (7) new single-storey Buildings will be constructed. The remainder of the site will be gravel surfacing. It is understood that recommendations for the proposed gravel parking/driving areas are not required.

Authorization to proceed with this investigation was provided via email on March 27, 2018. The terms of reference for this investigation were presented in PMEL Proposal No. 14263REV1, dated March 27, 2018.

The field test drilling, piezocone penetration testing (CPTu), piezometer installation and soil sampling were conducted on April 4, 5 and 6, 2018.

PMEL also conducted a Phase II Environmental Site Assessment (ESA) at the subject site at the same time as the geotechnical investigation (PMEL Report No. 14256 dated April 19, 2018). Five (5) test holes were drilled during the Phase II ESA and a piezometer was installed in one of the test holes for groundwater monitoring purposes. The field drill logs recorded during the Phase II ESA at the site have been included in Appendix B.

2.0 FIELD INVESTIGATION

2.1 Field Drilling Program

Nine (9) test holes, located as shown on the Site Plan, Drawing No. 14263-1, were dry drilled at the subject site using our truck-mounted, continuous flight, solid stem auger drill rig. The test holes were 150 mm in diameter and extended to depths of 6 to 15 metres below the existing ground surface.

Test hole drill logs were compiled during test drilling to record the soil stratification, the groundwater conditions, the position of unstable sloughing soils and the depths at which cobblestones and/or boulders were encountered. Standard penetration tests (N-index), utilizing a safety hammer with automatic trip, were performed during test drilling. Disturbed samples of auger cuttings, collected during test drilling, were sealed in plastic bags to minimize moisture loss. The soil samples were taken to our laboratory for analysis.

2.2 Piezocone Penetration Testing

Two (2) piezocone penetration tests (CPTu) were conducted during the field investigation. The CPTu tests extended to depths of 18.1 and 18.5 metres below the existing ground surface. The CPTu test locations have been shown on the Site Plan, Drawing No. 14263-1.

The piezocone penetration test consisted of pushing a cone, on the end of a series of rods, into the ground at a constant rate while recording near continuous measurements at the cone tip (i.e., q_t). Local side friction resistance measurements (i.e., f_s) were recorded on a friction sleeve located directly behind the cone tip. Pore-water pressure response (u) generated from the advancement of the cone into the soil was measured via a pore pressure filter located between the cone tip and friction sleeve. The piezocone tip had an apex angle of 60° and a 15 cm^2 base area. The friction sleeve had a perimeter area of 225 cm^2.

The equipment and procedures for conducting the cone penetration testing were undertaken in accordance with ASTM D-5778, "Standard Test Method for Performing Electronic Friction Cone and Piezocone Testing of Soils".

The test plots recorded during the cone sounding has been presented in Appendix C.

3.0 FIELD DRILL LOGS

The field drill logs recorded during test drilling have been shown plotted on Drawing Nos. 14263-2 to 10, inclusive.

The ground surface elevation at each Test Hole location was referenced to the top of the grade beam of the existing Building at the approximate location shown on the Site Plan, Drawing No. 14263-1. A datum elevation of 100.000 metres was assumed for the top of the grade beam.

3.1 Soil Profile

The general subgrade soil conditions consisted of a thin layer (i.e., 100 to 200 mm) of organic topsoil overlying glacial till, which extended to a depth of at least 15 metres below existing grade (i.e., the maximum depth drilled during the field investigation). Saturated, inter/intra till sand lenses/seams, cobblestones and/or boulders were encountered within the glacial till stratum.

Clay (extending to depths of between 0.6 and 1.4 metres) was encountered overlying the glacial till in Test Hole Nos. 18-4 and 18-7. Approximately 200 mm of sand was encountered at surface in Test Hole No. 18-4.

Clay fill was encountered in Test Hole Nos. 18-1, 18-2, 18-6 and 18-8, to depths of about 1 to 4.6 metres. Clay was encountered underlying the clay fill in Test Hole Nos. 18-1 and 18-2, to depths of 4.8 and 4.6 metres, respectively. Apparent hydrocarbon odour was reported in the clay soils between 3.5 and 4.5 metres in Test Hole No. 18-1. Pink and white colored debris was encountered between 0.9 and 1.1 metres in Test Hole No. 18-6.

The subgrade soils at the subject site were consistent with the soil conditions encountered during the Phase II ESA.

3.2 Groundwater Conditions, Sloughing

Groundwater seepage and sloughing conditions were encountered during test drilling. The depths at which groundwater seepage and sloughing conditions were encountered have been shown on the Field Drill Logs, Drawing Nos. 14263-2 to 10, inclusive.

A standpipe piezometer (slotted, 50 mm diameter, PVC pipe) was installed in Test Hole No. 18-104 during the Phase II ESA. The groundwater level in the standpipe piezometer was measured at a depth of about 3.4 metres below existing ground surface (i.e., elevation of 96.0 metres) on April 6, 2018. Higher groundwater levels should be expected following stabilization of the water levels and/or during or following spring thaw or periods of precipitation.

3.3 Cobblestones and Boulders

The glacial till consisted of a heterogeneous mixture of gravel, sand, silt and clay-sized particles. The glacial till strata also contained sorted deposits of the above particle sizes. In addition to the sorted deposits, a random distribution of larger particle sizes in the cobblestone range (60 to 200 mm) and boulder-sized range (larger than 200 mm) were encountered during test drilling. The depths at which cobblestones and boulders were encountered have been shown on the Field Drill Logs, Drawing Nos. 14263-2 to 10, inclusive.

It should be recognized that the statistical probability of encountering cobblestones and/or boulders in the nine small diameter Test Holes drilled at this site was low. Intertill deposits of cobblestones, boulders, boulder pavements and isolated deposits of saturated sand or gravel should be anticipated. The frequency of encountering such deposits will increase proportionately with the number and depth of piles installed and/or volume of soil excavated.

4.0 LABORATORY ANALYSIS

The soil classification and index tests performed during this investigation consisted of a visual classification of the soil, water contents, unit weights, grain size distribution analysis, Atterberg limits, and water soluble sulphates.

The results of the soil classification and index tests conducted on representative samples of soil have been plotted on the drill logs alongside the corresponding depths at which the samples were recovered, as shown on Drawing Nos. 14263-2 to 10, inclusive.

The results of the grain size distribution analysis has been presented in Appendix D.

5.0 DESIGN RECOMMENDATIONS

Based on the foregoing outline of soil test results, the following foundation considerations and design recommendations have been presented.

5.1 Design Considerations

The existing Building on-site will reportedly be demolished and seven single-storey Buildings will be constructed at the site.

In general, the subsurface soil conditions consisted of organic topsoil overlying clay fill, clay and/or sand overlying glacial till. The glacial till contained saturated sand lenses, cobblestones and/or boulders. The subsurface soils are considered frost susceptible and the average depth of frost penetration for a heated building in the Saskatoon, Saskatchewan area is approximately 1.8 metres. The soils at this site were frozen to a depth of about 0.8 to 1.2 metres below grade at the time of test drilling.

The groundwater table was measured to be based at an elevation of about 96.0 metres (i.e., 3.4 metres below existing grade) on April 6, 2018. Higher water levels should be expected during and/or following spring snowmelt and/or periods of precipitation.

The near surface subgrade soils were frozen at the time of our field investigation. Based on the results of the laboratory analysis, soft/wet subgrade conditions should also be expected near surface upon thawing. Special measures (i.e., over-excavation, geotextile, geogrid, cement stabilization and/or additional gravel fill) may be required during subgrade preparation.

As stated previously, the near surface subgrade soils were variable (i.e., consisted of variable deposits of sand, clay fill, clay and/or glacial till). In addition, soft/wet subgrade conditions should be expected within the upper deposits. As such, grade supported structures (i.e., perimeter thickened edge raft foundations) were considered, but are not recommended due to the potential for differential movement related to moisture fluctuations in the soil profile, variations in the soil profile, and potential consolidation settlement.

Drilled, cast-in-place concrete piles and/or belled caissons or helical screw piles should perform satisfactory as foundation support for the proposed Buildings. Construction difficulties associated with hard soil conditions, cobblestones, boulders, and saturated sand lenses/seams should be expected during the installation of piles at this site.

The near surface subgrade soils consisted of sand, clay fill, clay and/or glacial till. Floor slabs based entirely on the glacial till should perform satisfactorily. Floor slabs based on the clay fill, clay and/or variable soil conditions will be susceptible to differential movements related to moisture fluctuations in the soil profile, settlement of the clay fill, and/or differing soil characteristics.

Recommendations have been prepared for site preparation; drilled, cast-in-place concrete piles and/or belled caissons; helical screw piles; limit states resistance factors and serviceability; lateral thrust forces; floor slabs; grade beams; foundation concrete; and site classification for seismic site response.

5.2 Site Preparation

All organic topsoil, demolition debris, loose fill and deleterious materials should be removed from the proposed Building footprint. Staining and root intrusion from organic material and roots may be encountered during excavation within the subsurface mineral soils. If these conditions are suspected, a representative of the Geotechnical Consultant should inspect the site during excavation to verify the depth of unsuitable soil which should be removed in preparation of the site for construction. Refer to Appendix E for further information with respect to topsoil composition and soil structure.

The surface of the subgrade should be levelled and compacted to the following minimum density requirements.

Building Areas	-	96 percent of standard Proctor density at optimum moisture content;
Landscape Areas	-	90 percent of standard Proctor density at optimum moisture content.

Fill, required to bring the subgrade soil to the design elevation in the construction area, should preferably consist of granular material or the on-site glacial till. All proposed subgrade fill should be approved by the Geotechnical Consultant prior to placement. The fill should be placed in thin lifts (maximum 150 mm loose) and compacted to 96 percent of standard Proctor density at optimum moisture content.

The site should be graded to provide positive site drainage away from the proposed Building.

3. A minimum pile diameter of 400 mm is recommended for the primary structural loads. Larger pile diameters may be required to allow for the removal of cobbles and boulders in some pile holes.

4. The pile holes should be filled with concrete as soon as practical after drilling.

5. Casing will be required where groundwater seepage and sloughing conditions are encountered to maintain the pile holes open for placing of the reinforcing steel and concrete. The annular space between the casing and drilled hole must be filled with concrete. As casing is extracted, concrete in casing must have adequate head to displace all water in the annular space.

6. Due to the very stiff to hard nature of the glacial till, high-powered piling equipment is recommended.

7. A minimum centre-to-centre pile spacing of not less than three pile diameters is recommended.

8. A representative of the Geotechnical Consultant should inspect and document the installation of the drilled, cast-in-place concrete piles.

TABLE II. END BEARING PRESSURES (BELLED CAISSONS)

*Depth (metres)	End Bearing Pressure (kPa)	
	ULS	SLS
6 to 8 (stiff glacial till)	750	300
Below 8 (very stiff to hard glacial till)	1,000	400

*Belling depth may vary depending on the position of seepage, sloughing, cobbles and boulders.

Notes:

1. Bells must be formed a minimum of one (1) bell diameter into the appropriate bearing soils to develop the capacities presented in Table II.

2. When determining the compressive skin friction resistance of the pile, the portion of pile shaft within 1 shaft diameter above the roof of the bell should be discounted to account for interaction effects between the shaft and the bell.

3. Piles should be reinforced.

4. Belled caissons designed to resist uplift loading should have a minimum embedment ratio (d/b) of 3, where d = embedment depth and b = bell diameter (in metres). For bells installed to a shallower depth, the uplift capacity should be reviewed by the Geotechnical Consultant.

5. The vertical tensile capacity of the bell component of the pile may be estimated based on the bearing pressure presented in Table II applied to the effective area of the bell (i.e., area of bell minus cross-sectional area of shaft). Due to the interaction between the bell and shaft, the uplift resistance along the shaft should be neglected for the portion of the shaft within two (2) bell diameters from the base of the bell.

6. Concrete should be placed as soon as practical after cleaning the bell.

7. Casing will be required where groundwater seepage and sloughing conditions are encountered to maintain the pile holes open for placing of the reinforcing steel and concrete. The annular space between the casing and drilled hole must be filled with concrete. As casing is extracted, concrete in casing must have adequate head to displace all water in the annular space.

8. End bearing piles may be belled at the base to a maximum of three times the shaft diameter.

9. Due to the very stiff to hard nature of the glacial till, high-powered piling equipment is recommended.

10. The height of the bell should be designed to provide adequate concrete to distribute the unit stresses into the concrete without over-stressing the outer, non-reinforced concrete within the bell.

11. Full time inspection by a representative of the Geotechnical Consultant, employed directly by the Owner, is required to confirm pile bearing capacities and to verify suitable pile base conditions, prior to placing steel and concrete, and to document the installation of each end bearing caisson.

5.4 Helical Screw Piles

Due to the presence of cobblestones and/or boulders, sand lenses/layers and very stiff to hard consistency of the glacial till soils with depth, shallow termination of some helical screw piles should be expected.

Helical screw piles are installed by rotating a steel pipe, equipped with one or more helix flightings, into the ground. For single helix screw piles, pile capacity is derived from shearing resistance along the pile shaft (i.e., skin friction) as well as end bearing capacity of the helix.

For multi-helix piles, the pile capacity may be derived from the sum of the shearing resistance along the portion of the pipe shaft above the uppermost helix and end bearing capacity of each helix. The helical plates should be spaced a minimum of 3 helix diameters apart.

The ultimate (ULS) and serviceability (SLS) bearing pressures of the undisturbed soil have been presented in Tables III and IV. Resistance factors to reduce the provided ultimate skin friction and end bearing pressures to a value that is suitable for design have been presented in Section 5.5, Limit States Resistance Factors and Serviceability.

TABLE III. SKIN FRICTION BEARING PRESSURES (SCREW PILES)

Zone (metres)*	Skin Friction Bearing Pressure (kPa)	
	ULS	SLS
0 to 2 (or depth of fill)	0	0
2 (or depth of fill) to 5	25	10
5 to 8	35	15
Below 8	45	20

TABLE IV. END BEARING PRESSURES (SCREW PILES)

*Depth (metres)	End Bearing Pressure (kPa)	
	ULS	SLS
5.5 to 8	800	325
Below 8	1,600	600

Notes:

1. The minimum embedment depth of the uppermost helix for multi-helix piles should be ≥ 5.5 metres or H/D = 5 (whichever is greater), where H = depth to top helix, D = helix diameter.

2. Single helix screw piles should extend to a minimum depth of 6 metres below grade or H/D = 5 (whichever is greater).

3. When determining the compressive skin friction resistance of the pile shaft, the portion of the pile shaft within 1D above the uppermost helix should be discounted due to interaction effects between the pile shaft and helix. For piles subject to tensile loads, the zone of zero skin friction should be increased to 2D above the uppermost helix.

4. Compressive bearing capacity may be calculated utilizing the effective soil contact area of the helix (i.e., overall cross-sectional area for the lowest helix, helix area minus shaft area for upper helixes). Piles subject to tensile loads should use the effective area of the helix (i.e., helix area minus shaft) when determining uplift pile capacity.

5. A typical centre-to-centre pile spacing of 2.5D, where D=helix diameter, is recommended.

6. The helical plate shall be normal to the central shaft (within 3 degrees) over its entire length. Multiple helixes (if applicable) should be spaced at increments of the helix pitch to ensure that all helixes travel the same path during installation.

7. Continuous monitoring of the installation torque should be undertaken during installation to determine whether the screw pile has been damaged during installation and to monitor the consistency of the subsurface soils.

8. Screw piles should be designed on the basis of conventional static analysis using the provided bearing pressures presented in Tables III and IV and appropriate resistance factors as presented in Section 5.5. Installation torque should be used for monitoring purposes only and not for determination of pile capacity.

9. A representative of the Geotechnical Consultant should inspect and document the installation of each screw pile on a continuous basis.

5.5 Limit States Resistance Factors and Serviceability

Limit states are defined as those conditions under which a structure ceases to fulfill the function for which it was designed (i.e., unsatisfactory performance). In limit states design, two conditions are assessed with respect to performance, these are:

- ultimate limit states (ULS), and
- serviceability limit states (SLS)

Ultimate limit states are concerned with the collapse mechanisms of the structure (i.e., safety), whereas serviceability limit states consider mechanisms that restrict or constrain the intended use, function or occupancy of the structure.

A further discussion of the limit states design method is described in the Canadian Foundation Engineering Manual (CFEM, 2006) and the National Building Code of Canada (NBCC, 2015). As per NBCC - 2015, the following resistance factors may be applied to the ultimate bearing pressures to obtain the factored geotechnical resistance corresponding to ultimate limit states (ULS).

- Deep foundations:
  - Compressive Resistance, $\Phi = 0.4$
  - Tensile Resistance, $\Phi = 0.3$

For Limit States Design (LSD), a settlement analysis of the foundation must also be evaluated to ensure the structure is not negatively impacted by excessive settlement at the design load. This is also known as Serviceability Limit States (SLS) when designing on the basis of LSD.

With respect to SLS and deep foundation design, provided the piles are designed using the resistance factors presented above and good construction practices are followed, the amount of settlement of a deep foundation at the design load will be small and within tolerable limits (i.e., 5 to 15 mm).

Drilled, straight shaft piles derive the majority of their capacity from skin friction and would undergo less movement at the design load (i.e., 5 to 8 mm) as compared to belled caissons and helical screw piles. Belled caissons and helical screw piles derive a larger portion of carrying capacity in end bearing and would undergo more movement at the design load as compared to predominantly skin friction pile types (i.e., 10 to 15 mm).

The above is applicable to individual piles and small pile groups. Foundation settlement should be evaluated where large pile groups are employed to carry the foundation load (i.e., breadth of foundation or pile cap is a similar dimension as depth of piles) or large bell diameters are constructed (i.e., 3 metres or larger).

Pile foundations designed utilizing the provided SLS bearing capacities would perform similarly to pile foundations designed using the provided ULS capacities.

Piles exposed to lateral loads are typically designed to restrict lateral deflection of the pile head to tolerable limits. Lateral pile head deflection can be determined using the parameters presented in the following section.

5.6 Lateral Thrust Forces

Pile deflection typically governs the design of laterally loaded piles. Subgrade reaction theory may be utilized to estimate lateral pile deflection. The estimated coefficients of horizontal subgrade reaction of the subgrade soils have been presented in Table V.

TABLE V. ESTIMATED COEFFICIENTS OF HORIZONTAL SUBGRADE REACTION

*Zone (metres)	Coefficient of Horizontal Subgrade Reaction, k_s (kN/m^3)
0 to 1.5D	0
1.5D to 5	7,500/D
5 to 8	15,000/D
Below 8	30,000/D

*From existing grade. Where D = pile diameter.
For large diameter piles (i.e. exceeding 1.0 m) the zone of zero horizontal subgrade reaction should not exceed 1.5 m.

If a more detailed lateral analysis is deemed warranted, PMEL can model the interaction between the soil and the pile, in accordance with the *p-y* method. Specific pile details (i.e., loading, type, diameter, length, etc.) would be required in order to perform the analysis.

5.7 Floor Slabs

5.7.1 Grade-Supported Floor Slabs

There will reportedly be seven single-storey Buildings constructed at the subject site.

Based on the results of test drilling, the near surface subgrade soil conditions within each of the Buildings are anticipated to be as follows:

- Building 'A' (Test Hole No. 18-3) – glacial till
- Building 'B' (Test Hole No. 18-2 and 18-102) – approximately 4.2 metres of clay fill
- Building 'C' (Test Hole Nos. 18-1, 18-5 and 18-101) – approximately 1 metre of clay fill overlying clay or glacial till
- Building 'D' (Test Hole Nos. 18-5, 18-6, and 18-8) – approximately 1.2 metres of clay fill and/or glacial till
- Building 'E' (Test Hole Nos. 18-7 and 18-8) – approximately 1.0 metres of clay fill or 0.6 metres of clay overlying glacial till
- Building 'F' (Test Hole No. 18-9) – glacial till
- Building 'G' (Test Hole Nos. 18-4, 18-9, and 18-103) – sand overlying clay or glacial till

The corresponding Building designation for each of the seven buildings has been presented on the Site Plan, Drawing No. 14263-1. It should be noted that the soil conditions within each Building footprint may vary from what is anticipated. As such, it is recommended that the Geotechnical Consultant assess the soil conditions within each Building footprint following excavation and prior to placement of subgrade fill. Based on the actual conditions within the entire Building footprint, the floor slab support structure may need to be modified.

Floor slabs based entirely on the glacial till should perform satisfactorily.

Floor slabs based on the clay fill, clay and/or variable soil conditions will be susceptible to differential movements related to moisture fluctuations in the soil profile, settlement of the clay fill, and/or differing soil characteristics. The amount of slab movement depends on many factors (i.e., swelling potential of the clay, consolidation of the clay fill, consistency of the subgrade soils, existing overburden pressure, availability of free water, etc.) and is difficult to quantify.

The design recommendations presented below should lessen movements. If this option is constructed, some differential movement should be expected. If some differential movements/floor cracking cannot be tolerated, then a structural floor should be constructed.

Due to the quantity of fill encountered within the footprint of Building 'B', it is recommended that Building 'B' be constructed with a structural floor slab.

The near surface subgrade soils were frozen at the time of our field investigation. However, upon review of the laboratory test results, the clay soils encountered near surface may be soft and saturated upon thawing. Special measures (i.e., over-excavation, geotextile, geogrid, cement stabilization and/or additional gravel fill) may be required during subgrade preparation. The need for special measures in soft areas must be subject to review by the Geotechnical Consultant during field construction. Based on the actual conditions encountered at the time of construction, the floor slab support structure may need to be modified.

The following minimum provisions should be incorporated into the design of a conventional, heated, grade-supported, cast-in-place, reinforced concrete slab subject to light loading.

Notes:

1. Prepare the site in accordance with Section 5.2, Site Preparation.

2. **Buildings A and F:** Over-excavate, as required, to allow for the placement of a minimum of 150 mm of compacted granular base course between the floor slab and compacted subgrade.

3. **Building C, D and E:** Over-excavate, as required, to allow for the placement of a minimum of 1 metre of compacted granular fill between the floor slab and compacted subgrade. The uppermost 150 mm should consist of granular base course. The remaining granular fill could consist of granular sub-base. Alternately, the on-site glacial till soils could be utilized in place of some, or all, of the granular sub-base. The use of granular fill soils as backfill will minimize the magnitude of differential settlement related to the newly placed fill. If glacial till soils are utilized as backfill, additional differential movements should be expected (i.e., in comparison to granular fill backfill).

4. **Building G:** Over-excavate, as required, to allow for the placement of a minimum of 500 mm of compacted granular fill between the floor slab and compacted subgrade. The uppermost 150 mm should consist of granular base course. The remaining granular fill could consist of granular sub-base. Alternately, the on-site glacial till soils could be utilized in place of some, or all, of the granular sub-base. If glacial till soils are utilized as backfill, additional differential movements should be expected (i.e., in comparison to granular fill backfill).

5. The use of light equipment is recommended for moisture conditioning, levelling and compaction of the uppermost 150 mm of the subgrade at final design elevation. Cover the prepared subgrade soil with non-expansive fill as soon as practical after preparation.

6. Soft subgrade areas should be excavated and replaced with suitable soil compacted to 96 percent of standard Proctor density at optimum moisture content.

7. Subgrade fill should be placed in thin lifts (maximum 150 mm loose) and compacted to 96 percent of standard Proctor density at optimum moisture content.

8. Place the granular fill over the prepared subgrade. The granular fill should be placed in thin lifts (i.e., maximum of 150 mm) and compacted to 98 percent of standard Proctor density at optimum moisture content. Where used as structural fill, the glacial till should be placed in thin lifts (i.e., maximum of 150 mm) and compacted to 98 percent of standard Proctor density at optimum moisture content.

9. The granular fill should meet the aggregate specification presented in Table VI.

TABLE VI. AGGREGATE GRADATION REQUIREMENTS

Grain Size (mm)	Percent Passing	
	*Base Course	**Sub-Base Course
50.0	--	100
25.0	100	75 - 100
18.0	87 - 100	--
12.5	72 - 93	52 - 100
5.0	45 - 77	30 – 75
2.0	29 - 56	20 - 55
0.900	18 - 39	--
0.400	13 - 26	8 - 30
0.160	7 - 16	--
0.071	6 - 11	3 - 15
Plasticity Index (%)	0 – 6	0 – 6
Minimum CBR	65	25
% Fracture (min.)	50	--

*City of Saskatoon Base Course
**City of Saskatoon Sub-base Course

10. A soil gas membrane (i.e., radon gas and moisture resistant) should be installed between the underside of the floor slab and the granular fill.

11. Isolate the slab from foundation walls, columns, etc., by means of separation joints.

12. Reinforce the concrete slab and articulate the slab at regular intervals to provide for controlled cracking.

13. Provide positive site drainage away from the proposed Building(s).

14. Floor slabs should not be constructed on desiccated, wet, or frozen subgrade soil or base.

15. Frost should not be allowed to penetrate beneath the floor slab just prior to, during or after construction.

5.7.2 Structural Floor Slab

A structural floor slab (i.e., pile supported) is recommended for Building 'B'. A structural floor slab should also be constructed for the other Building if differential movements are considered unacceptable. The structural floor should be constructed with a minimum of 150 mm of compressible void filler between the subgrade soil and the underside of the floor slab. A soil gas membrane should be placed between the compressible void filler and the concrete floor. The compressible void filler should be installed in accordance with the manufacturer's specifications.

5.7.3 Exterior Slabs

Grade-supported concrete slabs exposed to freezing conditions (i.e., exterior slabs/sidewalks, etc.) will be subject to differential movements associated with frost action.

Where potential differential slab movements are not acceptable (e.g., front entrance), the placement of rigid polystyrene insulation beneath the slab could be considered to minimize the effects of frost. The insulation should have a minimum thickness of 75 mm and should extend from the perimeter face of the grade beam to a minimum distance of 1.8 metres beyond the outer edge of the slab. The slab and insulation should be positively graded to promote drainage. Alternately, the exterior slab could be supported on piles.

5.8 Grade Beams

The grade beams and pile caps should be reinforced at both top and bottom throughout their entire length. Grade beams should be constructed to allow for a minimum of 150 mm of net void space between the underside of the grade beam and the subgrade soil.

5.9 Foundation Concrete

The results of water soluble sulphate testing on soil samples recovered from the subject site have been summarized in Table VII.

TABLE VII. WATER SOLUBLE SULPHATE TEST RESULTS

Test Hole No.	Depth (m)	Soil Type	Water Soluble Sulphate (%)	*Class of Exposure	Degree of Sulphate Exposure
18-4	1.0	Clay	0.013	-	Negligible
18-8	6.0	Glacial Till	0.902	S-2	Severe

An examination of Table VII revealed that the measured sulphate concentration of the tested soils was between 0.013 and 0.902 percent, which is considered negligible to severe in terms of potential degree of sulphate attack. As such, it is recommended to utilize sulphate resistant cement for all foundation concrete in contact with the subgrade soils. All concrete at this site should be manufactured in accordance with current CSA standards.

It should be recognized that water soluble sulphate salts, combined with moist soils or low pH soils could render the soil highly corrosive to some types of metals in contact with the soil.

5.10 Site Classification for Seismic Site Response

Based on the subgrade soils encountered at this site, the site classification for seismic response, in accordance with Table 4.1.8.4.A of the NBCC (2015), is Site Class D.

6.0 LIMITATIONS

The presentation of the summary of the field drill logs and design recommendations has been completed as authorized. Nine, 150 mm diameter test holes were dry drilled using our continuous flight solid stem auger drilling equipment. Field drill logs were compiled for the Test Holes during test drilling which, we believe, were representative of the subsurface conditions at the Test Hole locations at the time of test drilling. Two (2) piezocone penetration tests (CPTu) were also conducted during the field investigation. The inferred subsoil stratigraphy has been shown on the attached CPTu plots.

Variations in the subsurface conditions from that shown on the drill logs/CPTu plots at locations other than the exact test locations should be anticipated. If conditions should differ from those reported here, then we should be notified immediately in order that we may examine the conditions in the field and reassess our recommendations in the light of any new findings.

Apparent hydrocarbon odour was reported in Test Hole No. 18-1. Phase I and II Environmental Site Assessments (ESAs) have been conducted by PMEL for this site (refer to PMEL File Nos. 14110 and 14256, respectively). A test hole adjacent Test Hole No. 18-1 (i.e., the test hole in which apparent hydrocarbon odour was reported), was drilled during the above-mentioned Phase II ESA. If, on the basis of any knowledge, other than that formally communicated to us, there is reason to suspect that environmentally sensitive materials not encountered during the geotechnical investigation and/or Phase II ESA may exist, then additional test holes should be drilled and samples recovered for chemical analysis.

The subsurface investigation necessitated the drilling of test holes. The test holes were backfilled at the completion of test drilling. Please be advised that some settlement of the backfill materials will occur which may leave a depression or an open hole. It is the responsibility of the client to inspect the site and backfill, as required, to ensure that the ground surface at each Test Hole location is maintained level with the existing grade.

This report has been prepared for the exclusive use of CJL Investments Ltd. and their agents for specific application to the proposed Buildings and Equipment Yard to be constructed within Parcel A, Plan 64519699 east of Range Road 3041 near Clavet, Saskatchewan. It has been prepared in accordance with generally accepted geotechnical engineering practices and no other warranty, express or implied, is made.

Any use which a Third Party makes of this report, or any reliance on decisions to be made based on it, is the responsibility of such Third Parties. Governing agencies such as municipal, provincial or federal agencies having jurisdiction with respect to this development and/or construction of the facilities described herein have full jurisdiction with respect to the described development.

Any other unspecified subsequent development would be considered Third Party and would, therefore, require prior review by PMEL. PMEL 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 acceptance of responsibility for the design/construction recommendations presented in this report is contingent on adequate and/or full time inspection (as required, based on site conditions at the time of construction) by a representative of the Geotechnical Consultant. PMEL will not accept any responsibility on this project for any unsatisfactory performance if adequate and/or full time inspection is not performed by a representative of PMEL.

If this report has been transmitted electronically, it has been digitally signed and secured with personal passwords to lock the document. Due to the possibility of digital modification, only originally signed reports and those reports sent directly by PMEL can be relied upon without fault.

We trust that this report fulfils your requirements for this project. Should you require additional information, please contact us.

P. MACHIBRODA ENGINEERING LTD.

PROFESSIONAL ENGINEER
J.C. KRASOWSKI MEMBER 16602
18 04 30
YR. MN. DAY
SASKATCHEWAN

Jennifer Krasowski, P.Eng.

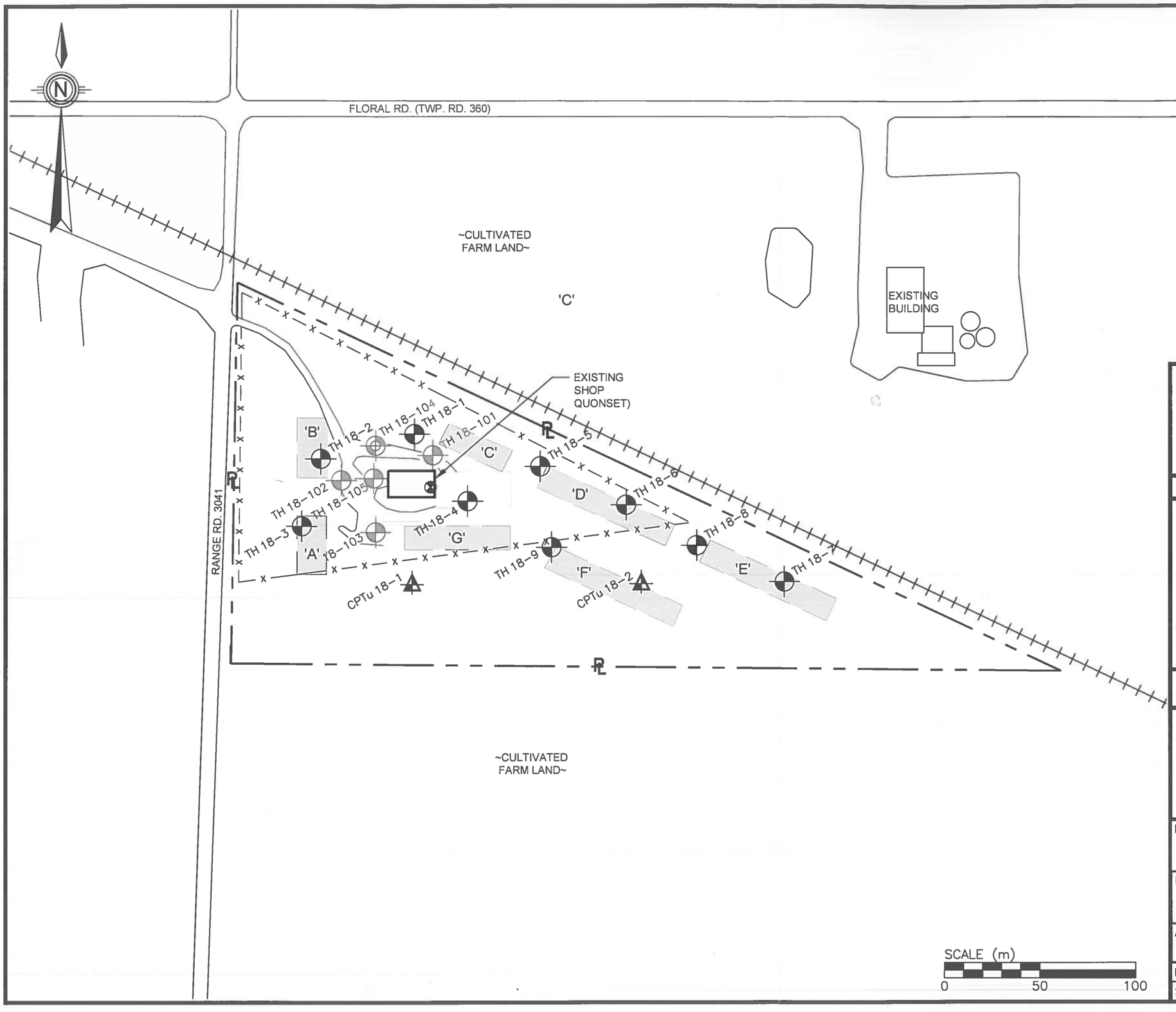
Terry Werbovetski, P. Eng., FEC
JK/TW/zz

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
P. MACHIBRODA ENGINEERING LTD.
Number 172
Permission to Consult held by:

Discipline	Sk. Reg. No.	Signature
Geotechnical	4955	18-04-30

P. MACHIBRODA
ENGINEERING LTD.
CONSULTING
GEOTECHNICAL/GEOENVIRONMENTAL
ENGINEERS

DRAWINGS



NOTE:
1. THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.
2. THIS DRAWING WAS COMPILED FROM GOOGLE EARTH PRO ©2018, IMAGE ©2018 DIGITALGLOBE, (IMAGERY DATE: 08/2315).
3. BENCHMARK: TOP OF GRADE BEAM OF EXISTING SHOP(QUONSET), MAN DOOR ON THE EAST SIDE. ASSUMED DATUM ELEVATION = 100.000 m.

LEGEND

- –PMEL TEST HOLE
- –PMEL ENVIRONMENTAL TEST HOLE)
- –PMEL PIEZOCONE PENETRATION TEST
- –BENCHMARK
- –PMEL ENVIRONMENTAL TEST HOLE, PIEZOMETER INSTALLED)
- –PROPERTY LINE
- –PROPOSED BUILDINGS

P. MACHIBRODA ENGINEERING LTD.

CONSULTING
GEOENVIRONMENTAL
GEOTECHNICAL
ENGINEERS

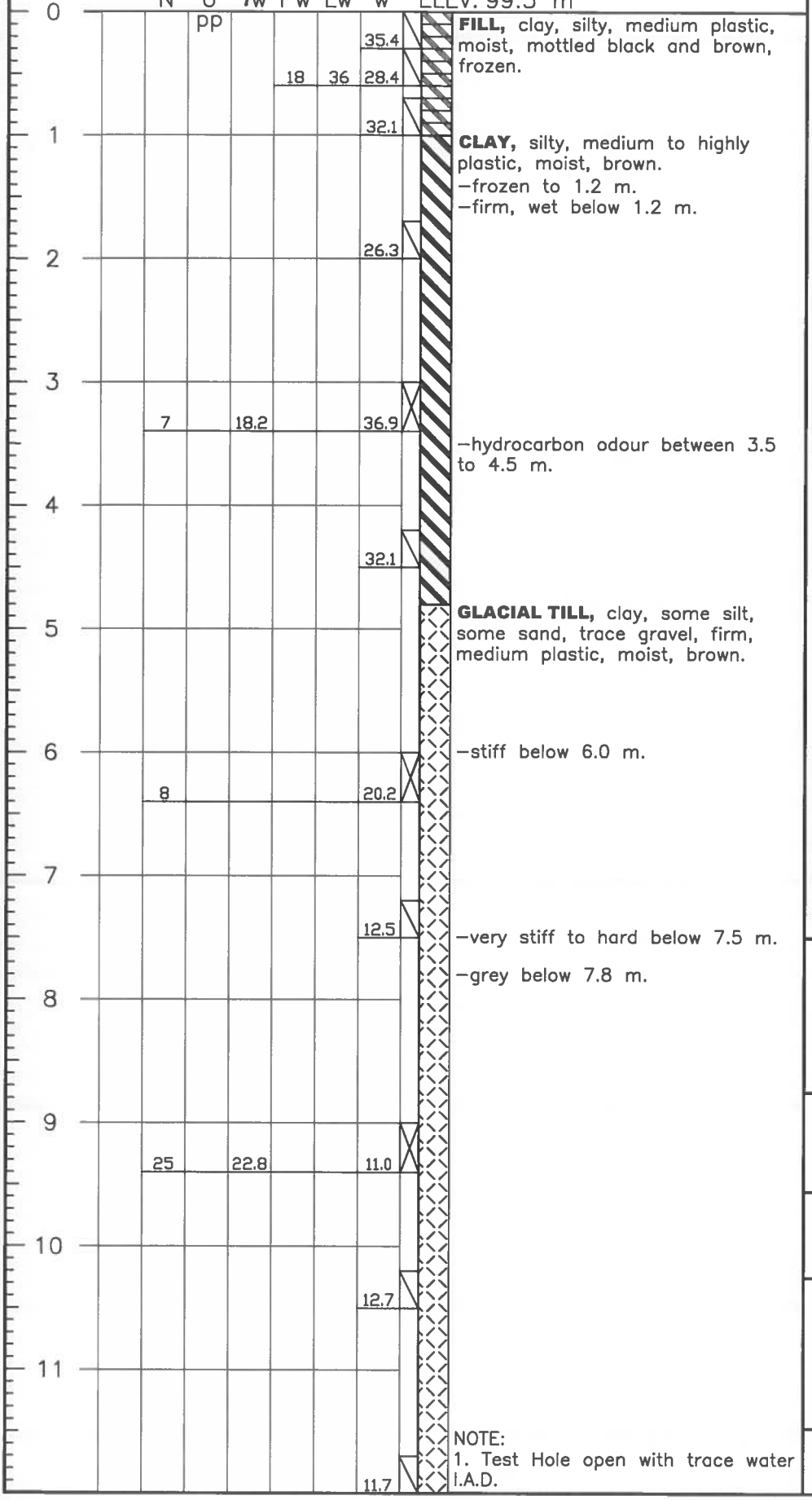
806 – 48th STREET EAST
SASKATOON, SK
S7K 3Y4

DRAWING TITLE:
SITE PLAN - TEST HOLE AND PIEZOCONE LOCATIONS

PROJECT:
PROPOSED BUILDINGS AND EQUIPMENT YARD
PARCEL A, PLAN 64519699, RANGE RD. 3041, NEAR CLAVET, SK

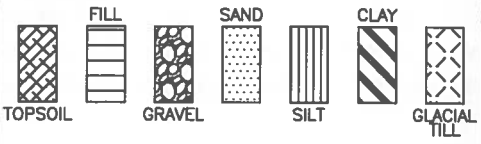
APPROVED BY:	DRAWN BY:
JK	BS
DATE: APRIL, 2018	DRAWING NUMBER: 14263-1
SCALE: 1:2000	

TEST HOLE 18-1



NOTE:
1. Test Hole open with trace water I.A.D.

LEGEND:



w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γ_w...WET UNIT WEIGHT (kN/m^3)

U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)

pp...POCKET PENETROMETER (kg/cm^2)

N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])

SO_4 .....SULPHATE CONTENT (PERCENT OF DRY SOIL WEIGHT)

P200...% PASSING No. 200 SIEVE

I.A.D.....IMMEDIATELY AFTER DRILLING

▽...RECORDED WATER LEVEL (TEST HOLE I.A.D.)

▼...RECORDED WATER LEVEL (PIEZO)

LIMITATIONS: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

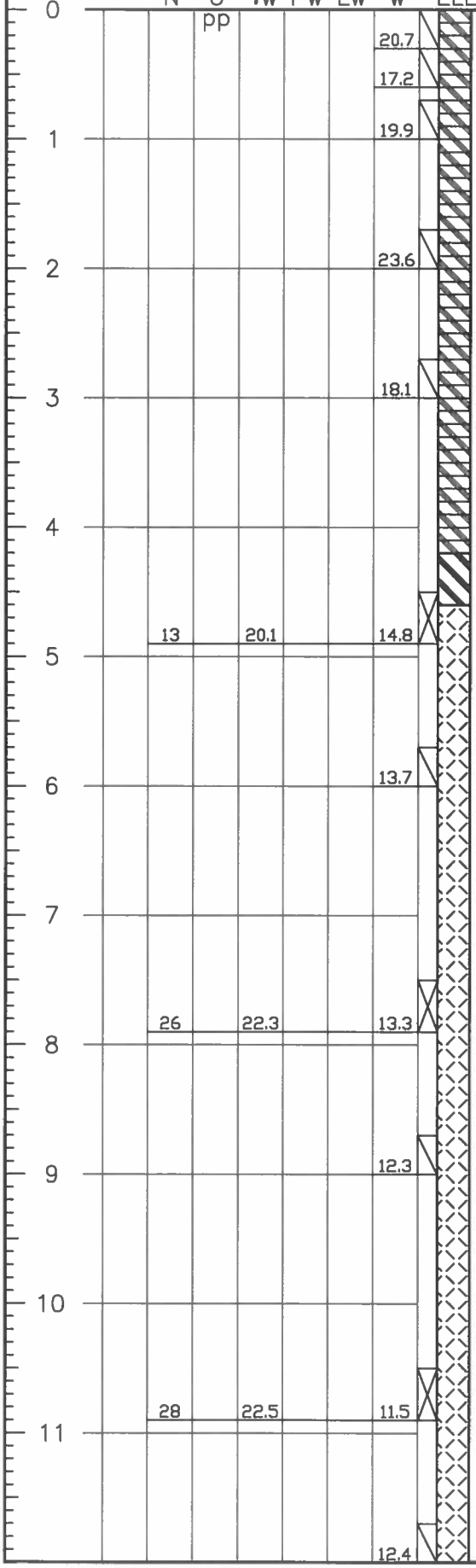
PROJECT:
PROPOSED BUILDINGS AND EQUIPMENT YARD

LOCATION:
PARCEL A, PLAN 64519699
RANGE RD. 3041, NEAR CLAVET, SK

NORTHING: 5768119 **EASTING:** 400289

DATE DRILLED:	DRAWING NUMBER:
APR 4/18	14263-2

TEST HOLE 18-2



FILL, clay, some silt, some sand, trace gravel, medium plastic, brown.

—frozen to 1.2 m.
—stiff, moist below 1.2

CLAY, silty, stiff, medium plastic, moist, brown.

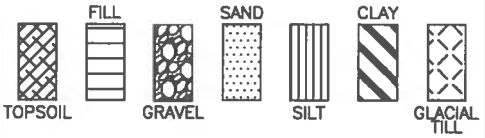
GLACIAL TILL, clay, some silt, some sand, trace gravel, stiff, medium plastic, moist, brown.

—very stiff to hard below 6.0 m.

—grey below 7.8 m.

CONTINUED ON NEXT PAGE

LEGEND:



w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γ_w...WET UNIT WEIGHT (kN/m^3)

U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)

pp...POCKET PENETROMETER (kg/cm^2)

N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])

SO_4 .....SULPHATE CONTENT (PERCENT OF DRY SOIL WEIGHT)

P200...% PASSING No. 200 SIEVE

I.A.D.....IMMEDIATELY AFTER DRILLING

▽...RECORDED WATER LEVEL (TEST HOLE I.A.D.)

▼...RECORDED WATER LEVEL (PIEZO)

LIMITATIONS: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

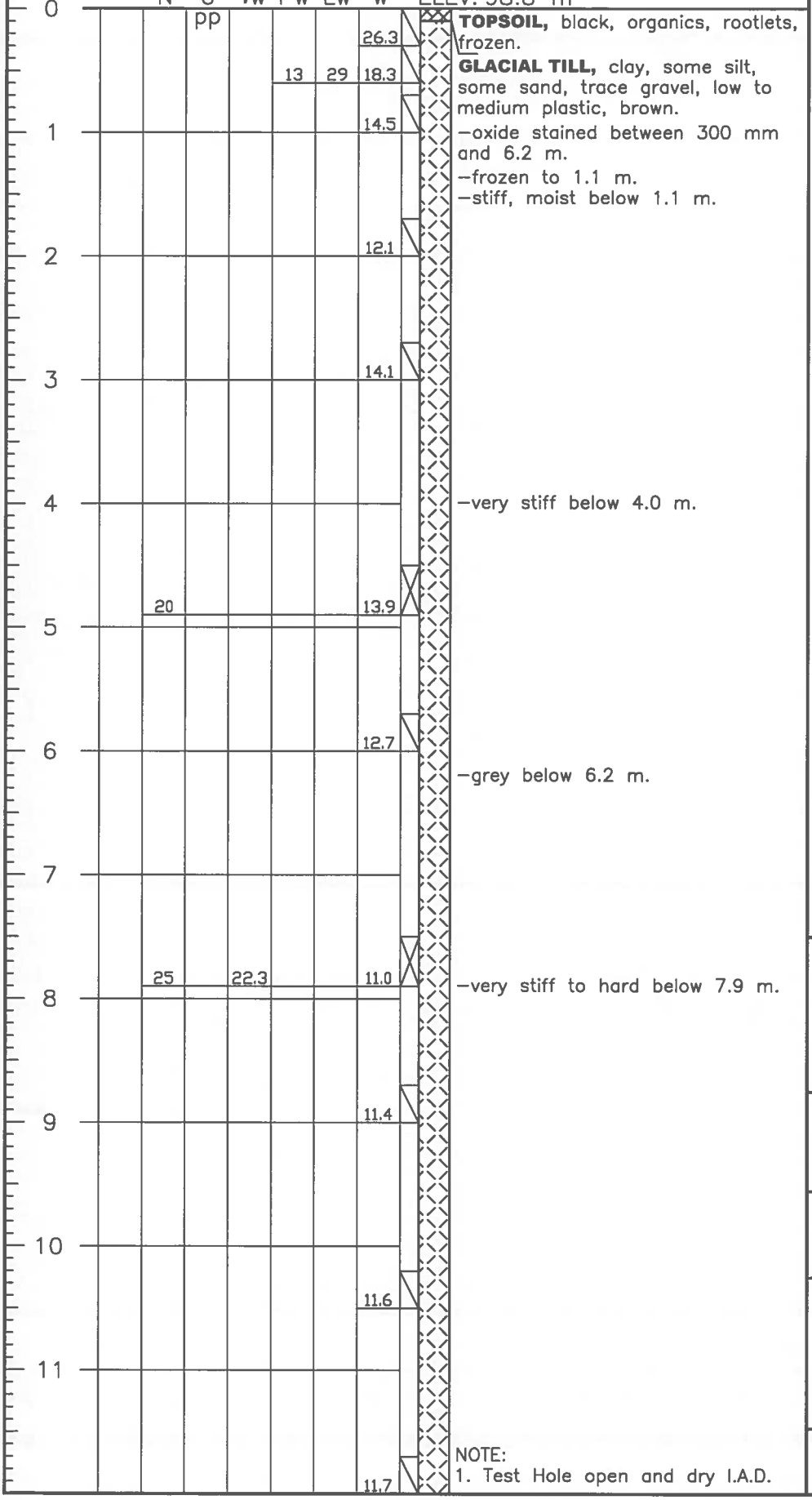
PROJECT:
PROPOSED BUILDINGS AND EQUIPMENT YARD

LOCATION:
PARCEL A, PLAN 64519699
RANGE RD 3041, NEAR CLAVET, SK

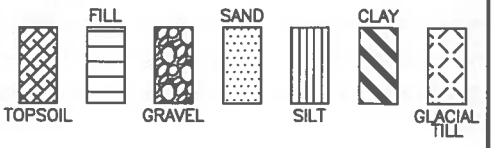
NORTHING: 5768106 **EASTING:** 400240

DATE DRILLED:	**DRAWING NUMBER:**
APR 4/18	14263-3

TEST HOLE 18-3



LEGEND:



w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γ_w...WET UNIT WEIGHT (kN/m^3)

U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)

pp...POCKET PENETROMETER (kg/cm^2)

N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])

SO_4 .....SULPHATE CONTENT (PERCENT OF DRY SOIL WEIGHT)

P200...% PASSING No. 200 SIEVE

I.A.D.....IMMEDIATELY AFTER DRILLING

▽...RECORDED WATER LEVEL (TEST HOLE I.A.D.)

▼...RECORDED WATER LEVEL (PIEZO)

LIMITATIONS: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT:

PROPOSED BUILDING AND EQUIPMENT YARD

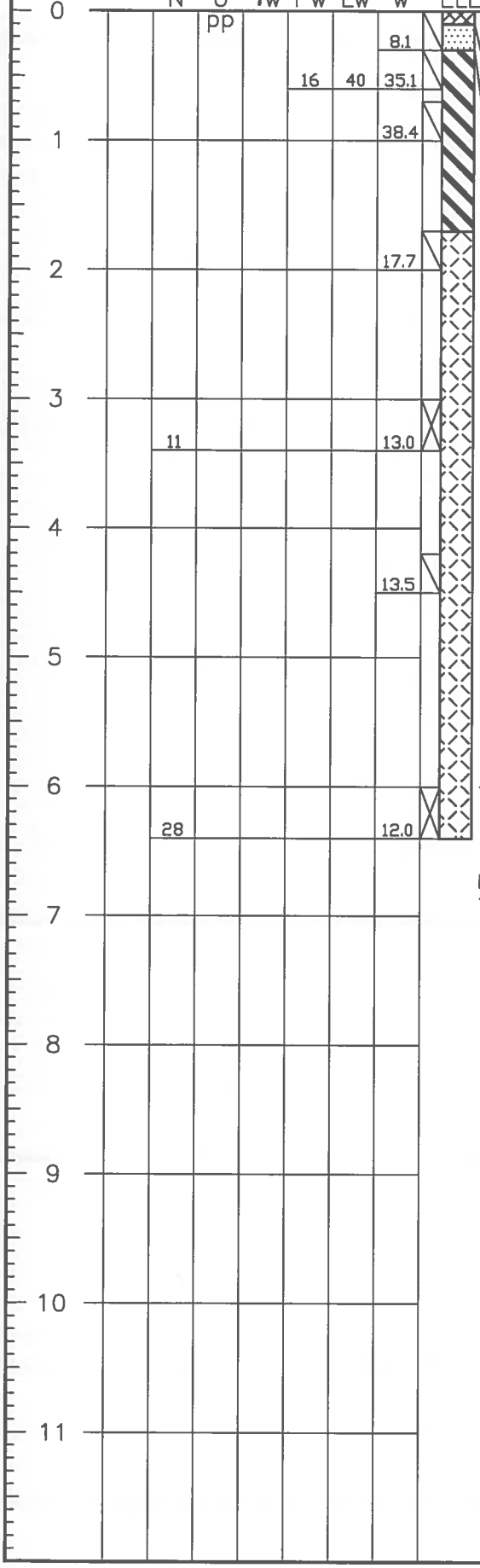
LOCATION:

PARCEL A, PLAN 64519699
RANGE RD. 3041, NEAR CLAVET, SK

NORTHING: 5768071 **EASTING:** 400230

DATE DRILLED:	**DRAWING NUMBER:**
APR 4/18	14263-4

TEST HOLE 18-4



TOPSOIL, black, organics, rootlets, frozen.

SAND, gravelly, well graded, fine to coarse grained, brown, frozen.

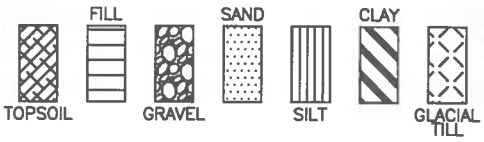
CLAY, silty, medium plastic, mottled brown.
–frozen to 1.0 m.
–wet, firm below 1.0 m.
–SO_4 = 0.013% at 1.0 m.

GLACIAL TILL, clay, some silt, some sand, trace gravel, stiff, medium plastic, moist, brown, oxide stained.

–very stiff to hard below 6.0 m.

NOTE:
1. Test Hole open and dry I.A.D.

LEGEND:



w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γ_w...WET UNIT WEIGHT (kN/m^3)

U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)

pp...POCKET PENETROMETER (kg/cm^2)

N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])

SO_4 .....SULPHATE CONTENT (PERCENT OF DRY SOIL WEIGHT)

P200...% PASSING No. 200 SIEVE

I.A.D.....IMMEDIATELY AFTER DRILLING

▽...RECORDED WATER LEVEL (TEST HOLE I.A.D.)

▼...RECORDED WATER LEVEL (PIEZO)

LIMITATIONS: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

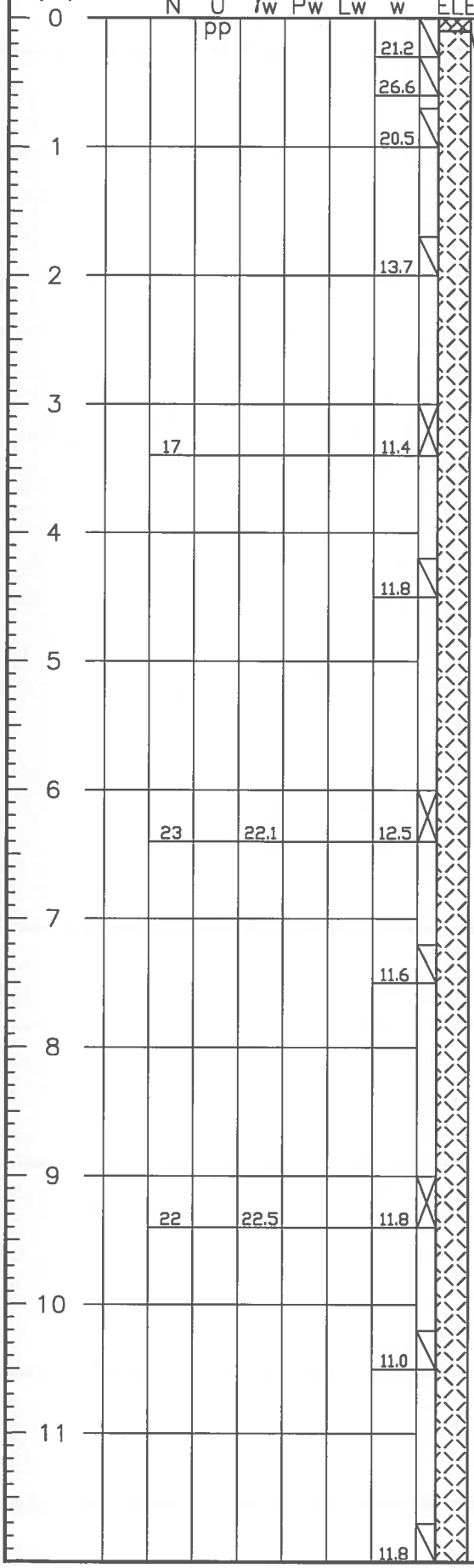
PROJECT:
PROPOSED BUILDINGS AND EQUIPMENT YARD

LOCATION:
PARCEL A, PLAN 64519699
RANGE RD. 3041, NEAR CLAVET, SK

NORTHING: 5768084 **EASTING:** 400317

DATE DRILLED:	DRAWING NUMBER:
APR 5/18	14263-5

TEST HOLE 18-5



NOTE:
1. Test Hole open and dry I.A.D.

LEGEND:

FILL, SAND, CLAY

TOPSOIL, GRAVEL, SILT, GLACIAL TILL

w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γ_w...WET UNIT WEIGHT (kN/m^3)

U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)

pp...POCKET PENETROMETER (kg/cm^2)

N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])

SO_4 .....SULPHATE CONTENT (PERCENT OF DRY SOIL WEIGHT)

P200...% PASSING No. 200 SIEVE

I.A.D.....IMMEDIATELY AFTER DRILLING

▽...RECORDED WATER LEVEL (TEST HOLE I.A.D.)

▼...RECORDED WATER LEVEL (PIEZO)

SHELBY TUBE, SPLIT SPOON, CUTTINGS

LIMITATIONS: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT:

PROPOSED BUILDINGS AND EQUIPMENT YARD

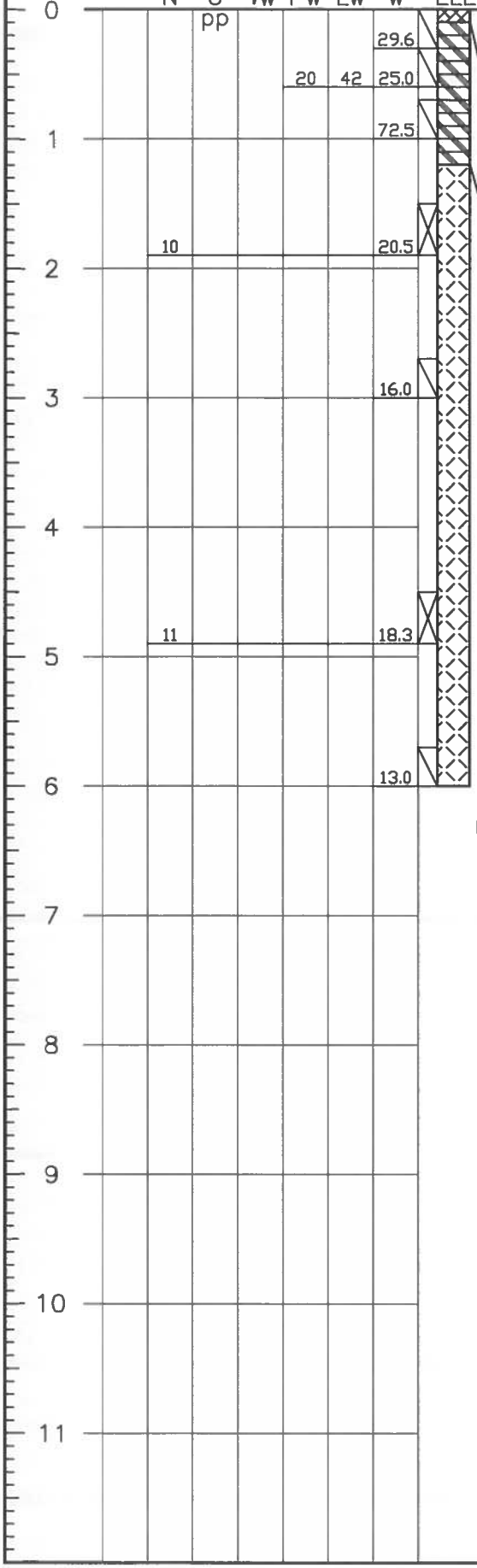
LOCATION:

PARCEL A, PLAN 64519699
RANGE RD. 3041, NEAR CLAVET, SK

NORTHING: 5768102 **EASTING:** 400355

DATE DRILLED:	**DRAWING NUMBER:**
APR 5/18	14263-6

TEST HOLE 18-6



TOPSOIL, black, organics, rootlets, frozen.

FILL, clay, some silt, some sand, trace gravel, stiff, medium plastic, moist, mottled brown.

–frozen to 900 mm.

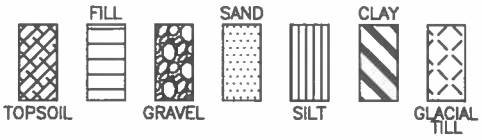
–firm, wet, pink and white debris below 900 mm.

GLACIAL TILL, clay, some silt, some sand, trace gravel, stiff, medium plastic, moist, brown, oxide stained.

–very stiff below 5.5 m.

NOTE:
1. Test Hole open and dry I.A.D.

LEGEND:



w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γ_w...WET UNIT WEIGHT (kN/m^3)

U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)

pp...POCKET PENETROMETER (kg/cm^2)

N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])

SO_4 .....SULPHATE CONTENT (PERCENT OF DRY SOIL WEIGHT)

P200...% PASSING No. 200 SIEVE

I.A.D.....IMMEDIATELY AFTER DRILLING

▽...RECORDED WATER LEVEL (TEST HOLE I.A.D.)

▼...RECORDED WATER LEVEL (PIEZO)

LIMITATIONS: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

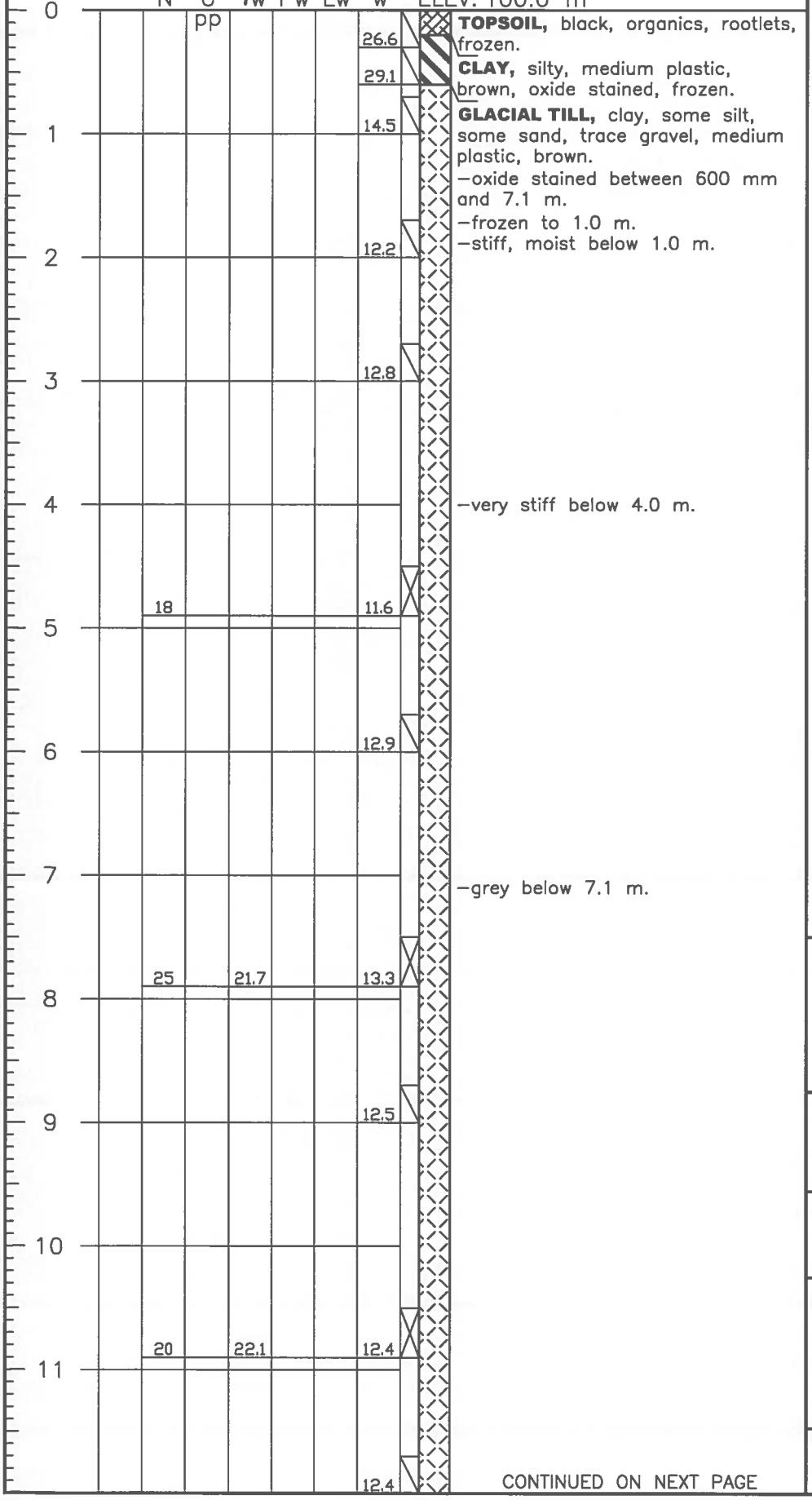
PROJECT:
PROPOSED BUILDINGS AND EQUIPMENT YARD

LOCATION:
PARCEL A, PLAN 64519699
RANGE RD. 3041, NEAR CLAVET, SK

NORTHING: 5768082 **EASTING:** 400400

DATE DRILLED:	**DRAWING NUMBER:**
APR 6/18	14263-7

TEST HOLE 18-7



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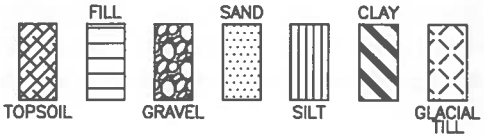
LEGEND:



w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γ_w...WET UNIT WEIGHT (kN/m^3)

U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)

pp...POCKET PENETROMETER (kg/cm^2)

N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])

SO_4 .....SULPHATE CONTENT (PERCENT OF DRY SOIL WEIGHT)

P200...% PASSING No. 200 SIEVE

I.A.D.....IMMEDIATELY AFTER DRILLING

▽...RECORDED WATER LEVEL (TEST HOLE I.A.D.)

▼...RECORDED WATER LEVEL (PIEZO)

LIMITATIONS: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

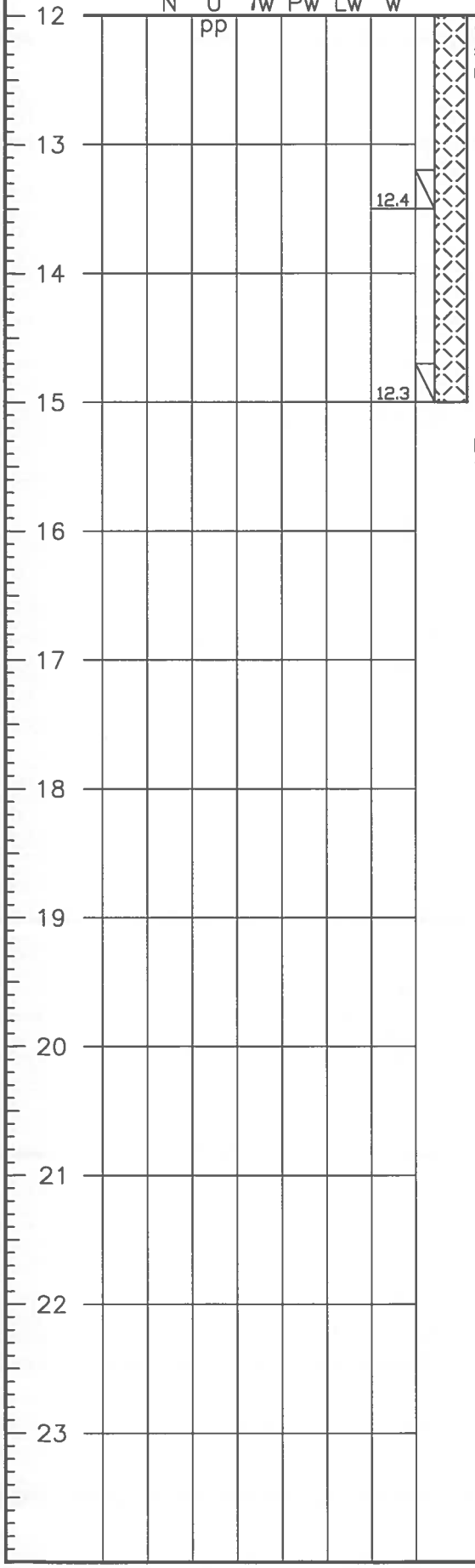
PROJECT:
PROPOSED BUILDINGS AND EQUIPMENT YARD

LOCATION:
PARCEL A, PLAN 64519699
RANGE RD. 3041, NEAR CLAVET, SK

NORTHING: 5768042 **EASTING:** 400483

DATE DRILLED:	DRAWING NUMBER:
APR 6/18	14263-8

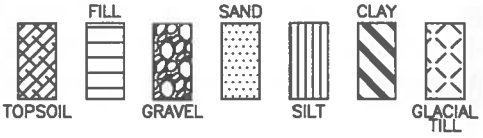
TEST HOLE 18-7



GLACIAL TILL, clay, some silt, some sand, trace gravel, very stiff, medium plastic, grey.

NOTE:
1. Test Hole open and dry I.A.D.

LEGEND:



w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γ_w...WET UNIT WEIGHT (kN/m^3)

U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)

pp...POCKET PENETROMETER (kg/cm^2)

N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])

SO_4 .....SULPHATE CONTENT (PERCENT OF DRY SOIL WEIGHT)

P200...% PASSING No. 200 SIEVE

I.A.D.....IMMEDIATELY AFTER DRILLING

▽...RECORDED WATER LEVEL (TEST HOLE I.A.D.)

▼...RECORDED WATER LEVEL (PIEZO)

LIMITATIONS: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

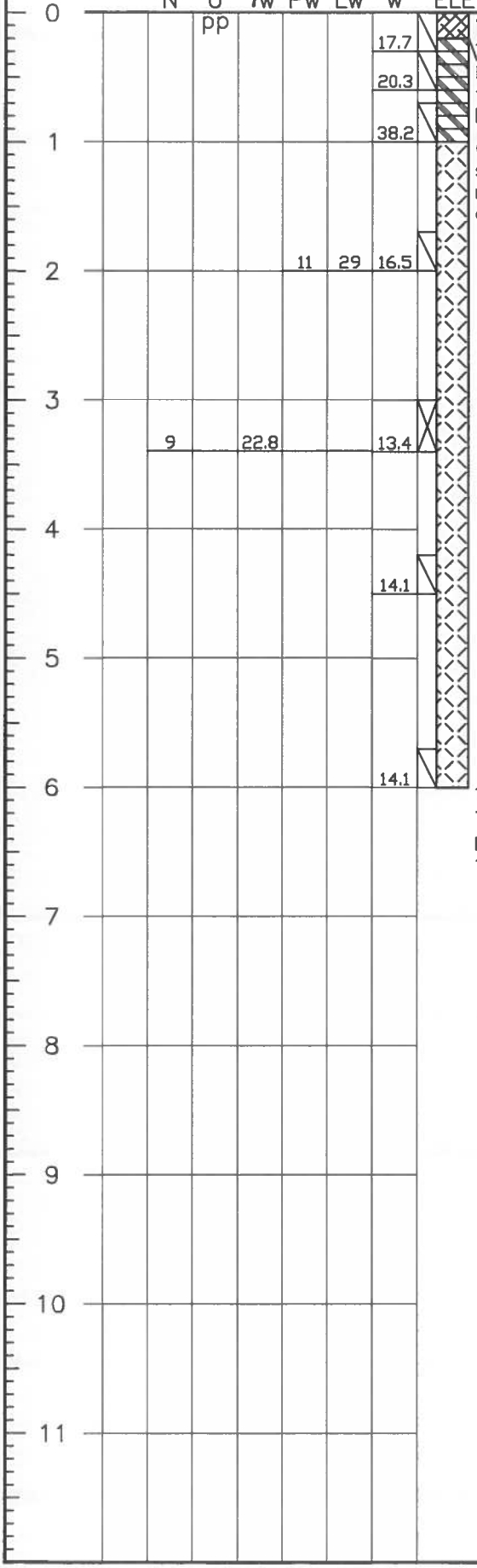
PROJECT:
PROPOSED BUILDINGS AND EQUIPMENT YARD

LOCATION:
PARCEL A, PLAN 64519699
RANGE RD. 3041, NEAR CLAVET, SK

NORTHING: 5768042 **EASTING:** 400483

DATE DRILLED:	DRAWING NUMBER:
APR 6/18	14263-8A

TEST HOLE 18-8



TOPSOIL, black, organics, rootlets, frozen.

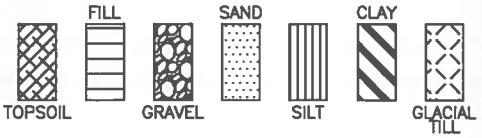
FILL, clay, some silt, some sand, trace gravel, medium plastic, brown, oxide stained, frozen.

GLACIAL TILL, clay, some silt, some sand, trace gravel, stiff, medium plastic, moist, brown, oxide stained.

–SO_4 = 0.902% at 6.0 m.
–cobbles/boulders at 6.0 m.

NOTE:
1. Test Hole open and dry I.A.D.

LEGEND:



w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γ_w...WET UNIT WEIGHT (kN/m^3)

U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)

pp...POCKET PENETROMETER (kg/cm^2)

N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])

SO_4 .....SULPHATE CONTENT (PERCENT OF DRY SOIL WEIGHT)

P200...% PASSING No. 200 SIEVE

I.A.D.....IMMEDIATELY AFTER DRILLING

▽...RECORDED WATER LEVEL (TEST HOLE I.A.D.)

▼...RECORDED WATER LEVEL (PIEZO)

LIMITATIONS: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

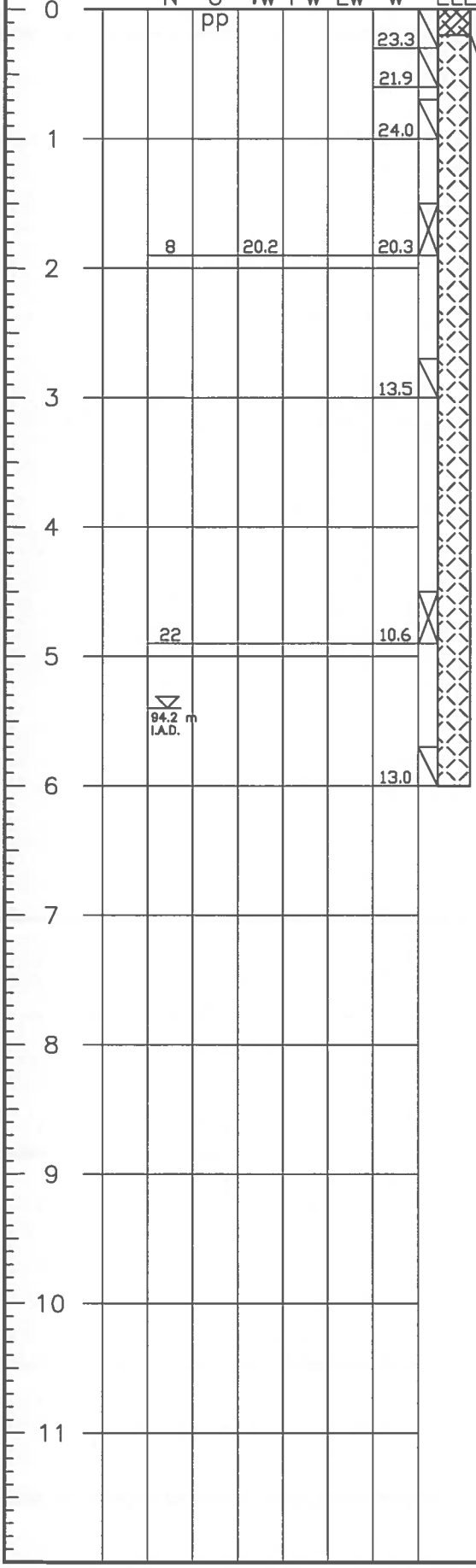
PROJECT:
PROPOSED BUILDINGS AND EQUIPMENT YARD

LOCATION:
PARCEL A, PLAN 64519699
RANGE RD. 3041, NEAR CLAVET, SK

NORTHING: 5768061 **EASTING:** 400437

DATE DRILLED:	DRAWING NUMBER:
APR 6/18	14263-9

TEST HOLE 18-9



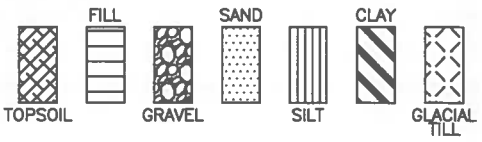
TOPSOIL, black, organics, rootlets, frozen.

GLACIAL TILL, clay, some silt, some sand, trace gravel, medium plastic, brown, oxide stained.
–frozen to 800 mm.
–stiff, moist below 800 mm.

–sand lense, seepage, sloughing between 4.2 and 4.3 m.

NOTE:
1. Test Hole sloughed to 5.4 m I.A.D.

LEGEND:



w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γ_w...WET UNIT WEIGHT (kN/m^3)

U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)

pp...POCKET PENETROMETER (kg/cm^2)

N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])

SO_4 .....SULPHATE CONTENT (PERCENT OF DRY SOIL WEIGHT)

P200...% PASSING No. 200 SIEVE

I.A.D.....IMMEDIATELY AFTER DRILLING

▽...RECORDED WATER LEVEL (TEST HOLE I.A.D.)

▼...RECORDED WATER LEVEL (PIEZO)

LIMITATIONS: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT:
PROPOSED BUILDINGS AND EQUIPMENT YARD

LOCATION:
PARCEL A, PLAN 64519699
RANGE RD. 3041, NEAR CLAVET, SK

NORTHING: 5768060 **EASTING:** 400361

DATE DRILLED:	**DRAWING NUMBER:**
APR 4/18	14263-10

APPENDIX A

EXPLANATION OF TERMS ON TEST HOLES LOGS

CLASSIFICATION OF SOILS

Coarse-Grained Soils: Soils containing particles that are visible to the naked eye. They include gravels and sands and are generally referred to as cohesionless or non-cohesive soils. Coarse-grained soils are soils having more than 50 percent of the dry weight larger than particle size 0.080 mm.

Fine-Grained Soils: Soils containing particles that are not visible to the naked eye. They include silts and clays. Fine-grained soils are soils having more than 50 percent of the dry weight smaller than particle size 0.080 mm.

Organic Soils: Soils containing a high natural organic content.

Soil Classification By Particle Size

Clay – particles of size	< 0.002 mm
Silt – particles of size	0.002 – 0.060 mm
Sand – particles of size	0.06 – 2.0 mm
Gravel – particles of size	2.0 – 60 mm
Cobbles – particles of size	60 – 200 mm
Boulders – particles of size	>200 mm

TERMS DESCRIBING CONSISTENCY OR CONDITION

Coarse-grained soils: Described in terms of compactness condition and are often interpreted from the results of a Standard Penetration Test (SPT). The standard penetration test is described as the number of blows, N, required to drive a 51 mm outside diameter (O.D.) split barrel sampler into the soil a distance of 0.3 m (from 0.15 m to 0.45 m) with a 63.5 kg weight having a free fall of 0.76 m.

Compactness Condition	SPT N-Index (blows per 0.3 m)
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	Over 50

Fine-Grained Soils: Classified in relation to undrained shear strength.

Consistency	Undrained Shear Strength (kPa)	N Value (Approximate)	Field Identification
Very Soft	<12	0-2	Easily penetrated several centimetres by the fist.
Soft	12-25	2-4	Easily penetrated several centimetres by the thumb.
Firm	25-50	4-8	Can be penetrated several centimetres by the thumb with moderate effort.
Stiff	50-100	8-15	Readily indented by the thumb, but penetrated only with great effort.
Very Stiff	100-200	15-30	Readily indented by the thumb nail.
Hard	>200	>30	Indented with difficulty by the thumbnail.

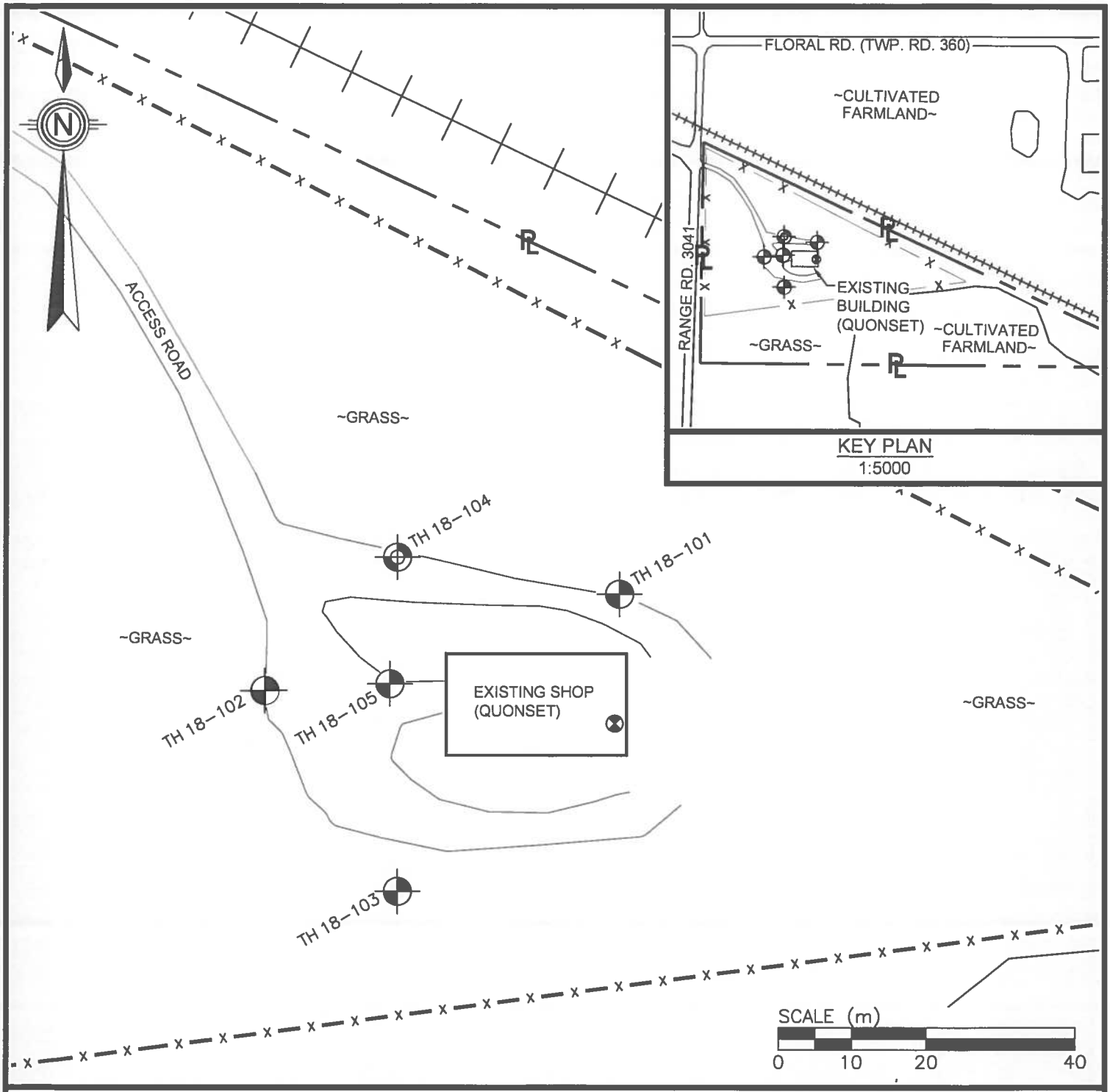
Organic Soils: Readily identified by colour, odour, spongy feel and frequently by fibrous texture.

DESCRIPTIVE TERMS COMMONLY USED TO CHARACTERIZE SOILS

Poorly Graded	- predominance of particles of one grain size.
Well Graded	- having no excess of particles in any size range with no intermediate sizes lacking.
Mottled	- marked with different coloured spots.
Nuggety	- structure consisting of small prismatic cubes.
Laminated	- structure consisting of thin layers of varying colour and texture.
Slickensided	- having inclined planes of weakness that are slick and glossy in appearance.
Fissured	- containing shrinkage cracks.
Fractured	- broken by randomly oriented interconnecting cracks in all 3 dimensions.

APPENDIX B

FIELD DRILL LOGS – PMEL REPORT NO. 14256



NOTE:
1. THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.
2. THIS DRAWING WAS COMPILED FROM GOOGLE EARTH PRO ©2018, IMAGE ©2018 DIGITALGLOBE, (IMAGERY DATE: 07/08/17).
3. BENCHMARK: TOP OF GRADE BEAM OF EXISITNG SHOP (QUONSET), MAN DOOR ON THE EAST SIDE. ASSUMED DATUM ELEVATION = 100.000 m.

LEGEND — PROPERTY LINE — PMEL TEST HOLE — PMEL TEST HOLE (PIEZOMETER INSTALLED) — BENCHMARK — x — x — CHAIN LINK FENCE

CONSULTING GEOENVIRONMENTAL GEOTECHNICAL ENGINEERS

P. MACHIBRODA ENGINEERING LTD.

806 – 48th STREET EAST
SASKATOON, SK
S7K 3Y4

DRAWING TITLE:

SITE PLAN - TEST HOLE LOCATIONS

PROJECT:

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
PARCEL A, PLAN 64519699, R.M. OF CORMAN PARK NO. 344, SK

APPROVED BY:	DRAWN BY:	DRAWING NUMBER:
CC/MK	BS	14256-1
DATE:	SCALE:	
APRIL, 2018	AS SHOWN	

P. MACHIBRODA ENGINEERING LTD.

TEST HOLE 18-101

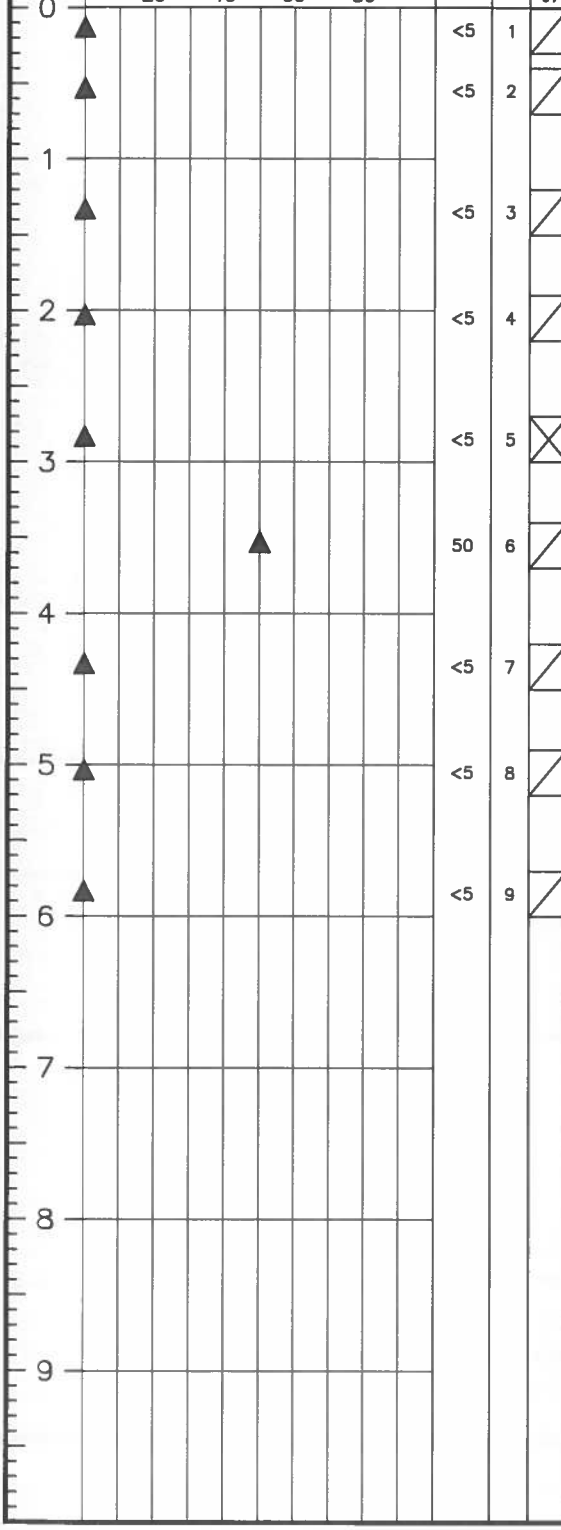
DRAWING NUMBER: 14256-2

PROJECT:
PHASE II - ENVIRONMENTAL SITE ASSESSMENT

LOCATION:
PARCEL A, PLAN 64519699, R.M. OF CORMAN PARK NO. 344, SK

DATE DRILLED:	LOGGED BY:	NORTHING (m):	EASTING (m):	GROUND SURFACE ELEVATION (m):	PIEZOMETER ELEVATION (m):
APRIL 4/18	CS	N/A	N/A	99.5	N/A

☒ SPLIT SPOON ■ SHELBY ⊘ CUTTINGS ▼ WATER LEVEL



PPM	SAMPLE NO.	SAMPLE TYPE	STRATIGRAPHY	SOIL DESCRIPTION	PIEZOMETER INSTALLATION
<5	1			**FILL,** clay, silty, medium plastic, moist, mottled black and brown, frozen.	
<5	2				
<5	3			**CLAY,** silty, firm, medium plastic, moist to wet, brown. –frozen to 1.2 m.	
<5	4				
<5	5				
50	6			–hydrocarbon odour between 3.5 and 4.5 m.	
<5	7				
<5	8			**GLACIAL TILL,** clay, some silt, some sand, trace gravel, firm, medium plastic, moist, brown.	
<5	9				

NOTE:
1. Test Hole open with trace water Immediately After Drilling.

P. MACHIBRODA ENGINEERING LTD.

TEST HOLE 18-102

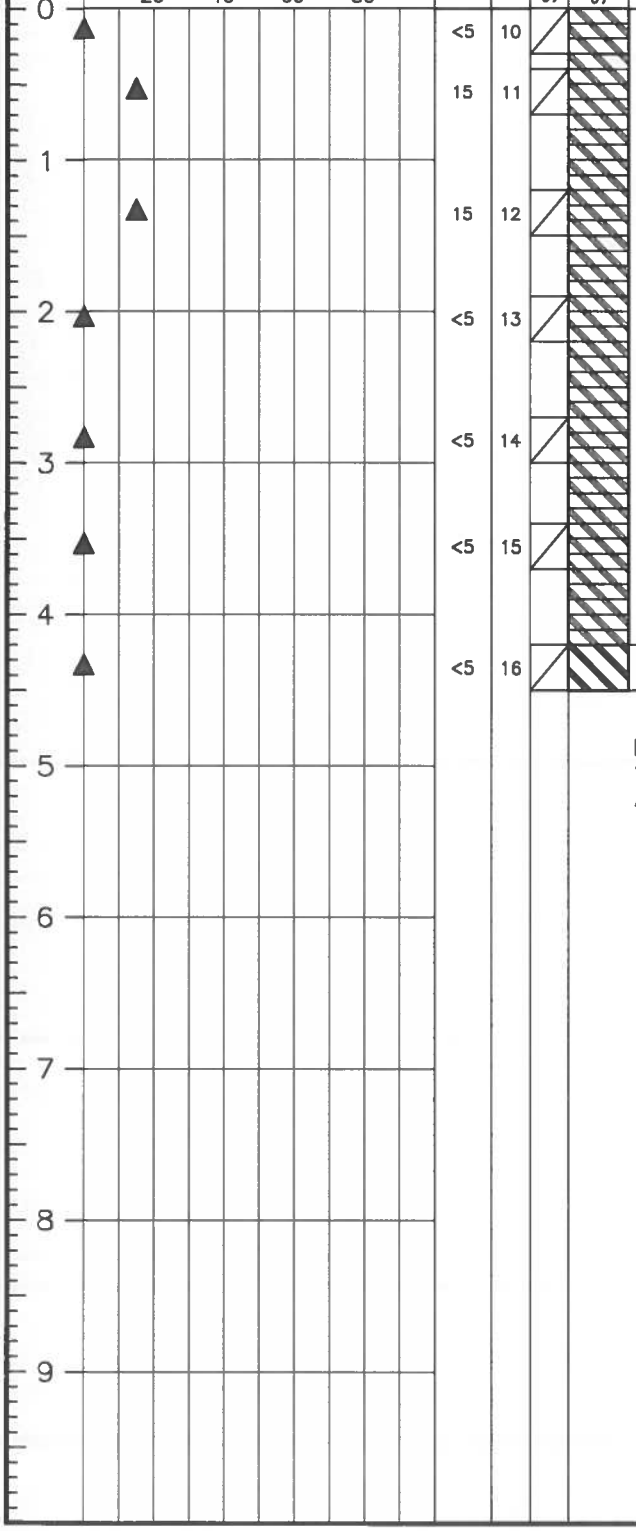
DRAWING NUMBER: 14256-3

PROJECT:
PHASE II - ENVIRONMENTAL SITE ASSESSMENT

LOCATION:
PARCEL A, PLAN 64519699, R.M. OF CORMAN PARK NO. 344, SK

DATE DRILLED:	LOGGED BY:	NORTHING (m):	EASTING (m):	GROUND SURFACE ELEVATION (m):	PIEZOMETER ELEVATION (m):
APRIL 4/18	CS	N/A	N/A	99.3	N/A

☒ SPLIT SPOON ■ SHELBY ☒ CUTTINGS ▼ WATER LEVEL



PPM	SAMPLE NO.	SAMPLE TYPE	STRATIGRAPHY	SOIL DESCRIPTION
<5	10			**FILL,** clay, some sand, trace gravel, stiff, medium plastic, moist, brown.
15	11			
15	12			–frozen to 1.2 m.
<5	13			
<5	14			
<5	15			
<5	16			**CLAY,** silty, stiff, medium plastic, moist, brown.

NOTE:
1. Test Hole open and dry Immediately After Drilling.

PIEZOMETER INSTALLATION

P. MACHIBRODA ENGINEERING LTD.

TEST HOLE 18-103

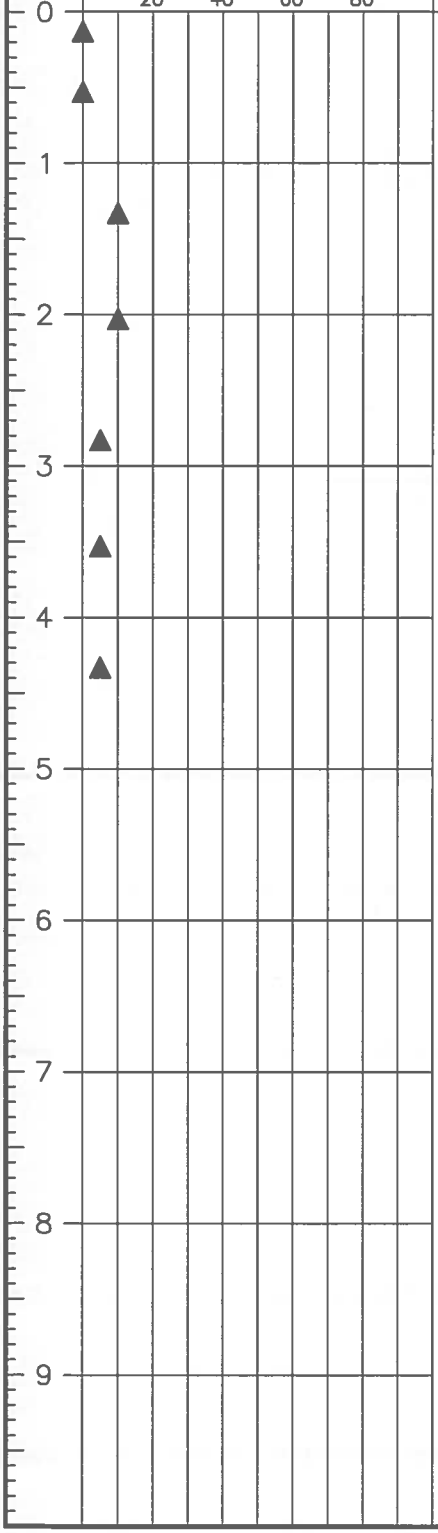
DRAWING NUMBER: 14256-4

PROJECT:
PHASE II - ENVIRONMENTAL SITE ASSESSMENT

LOCATION:
PARCEL A, PLAN 64519699, R.M. OF CORMAN PARK NO. 344, SK

DATE DRILLED:	LOGGED BY:	NORTHING (m):	EASTING (m):	GROUND SURFACE ELEVATION (m):	PIEZOMETER ELEVATION (m):
APRIL 4/18	CS	N/A	N/A	99.2	N/A

☒ SPLIT SPOON ■ SHELBY ☒ CUTTINGS ▼ WATER LEVEL



PPM	SAMPLE NO.	SAMPLE TYPE	STRATIGRAPHY	SOIL DESCRIPTION	PIEZOMETER INSTALLATION
<1	17			**GLACIAL TILL,** clay, some silt, some sand, trace gravel, stiff, medium plastic, moist, brown.	
<1	18			–oxide stained between 300 mm and 4.5 m.	
10	19				
10	20				
5	21				
5	22				
5	23				

NOTE:
1. Test Hole open and dry Immediately After Drilling.

P. MACHIBRODA ENGINEERING LTD.

TEST HOLE 18-104

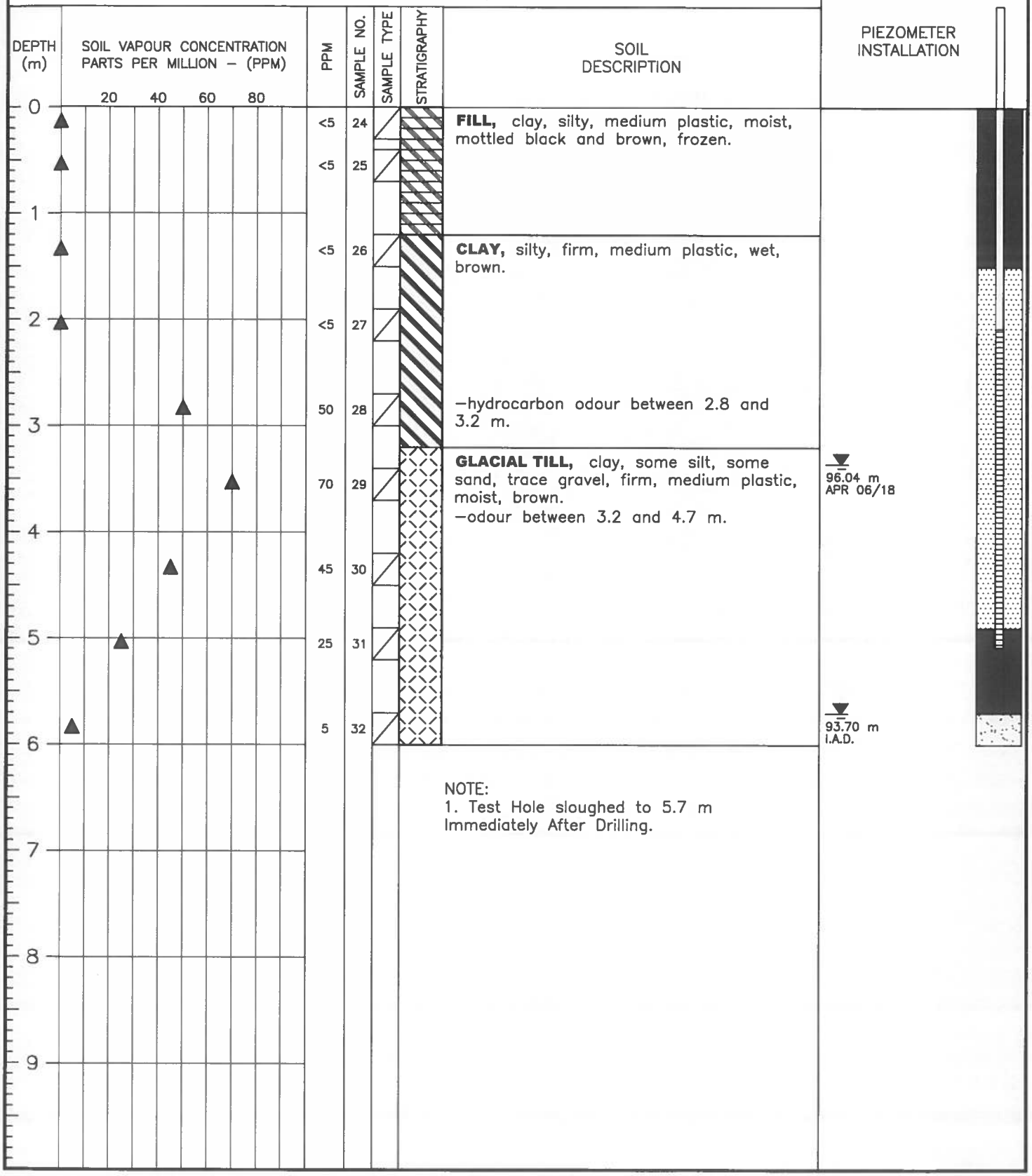
DRAWING NUMBER: 14256-5

PROJECT:
PHASE II - ENVIRONMENTAL SITE ASSESSMENT

LOCATION:
PARCEL A, PLAN 64519699, R.M. OF CORMAN PARK NO. 344, SK

DATE DRILLED:	LOGGED BY:	NORTHING (m):	EASTING (m):	GROUND SURFACE ELEVATION (m):	PIEZOMETER ELEVATION (m):
APRIL 4/18	CS	N/A	N/A	99.4	100.4

☒ SPLIT SPOON ■ SHELBY ☒ CUTTINGS ▼ WATER LEVEL



SOIL DESCRIPTION

FILL, clay, silty, medium plastic, moist, mottled black and brown, frozen.

CLAY, silty, firm, medium plastic, wet, brown.

–hydrocarbon odour between 2.8 and 3.2 m.

GLACIAL TILL, clay, some silt, some sand, trace gravel, firm, medium plastic, moist, brown.
–odour between 3.2 and 4.7 m.

PIEZOMETER INSTALLATION

▼ 96.04 m APR 06/18

▼ 93.70 m I.A.D.

NOTE:
1. Test Hole sloughed to 5.7 m Immediately After Drilling.

P. MACHIBRODA ENGINEERING LTD.

TEST HOLE 18-105

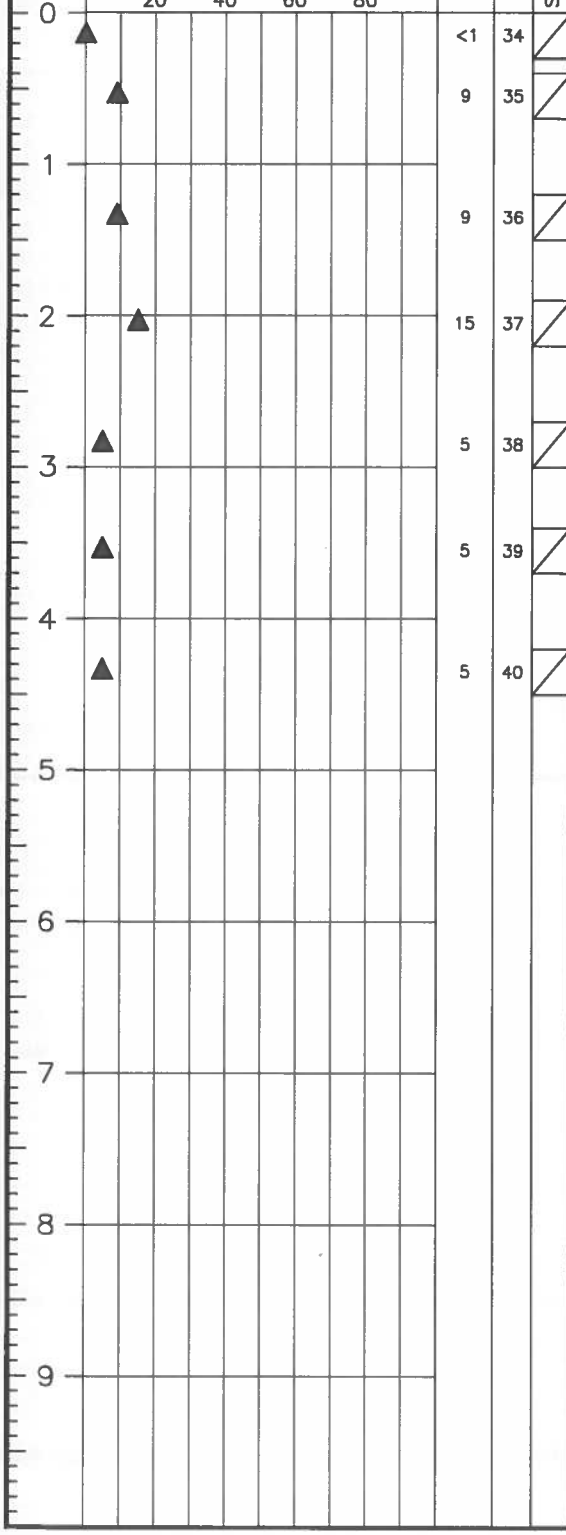
DRAWING NUMBER: 14256-6

PROJECT:
PHASE II - ENVIRONMENTAL SITE ASSESSMENT

LOCATION:
PARCEL A, PLAN 64519699, R.M. OF CORMAN PARK NO. 344, SK

DATE DRILLED:	LOGGED BY:	NORTHING (m):	EASTING (m):	GROUND SURFACE ELEVATION (m):	PIEZOMETER ELEVATION (m):
APRIL 4/18	CS	N/A	N/A	99.4	N/A

☒ SPLIT SPOON ■ SHELBY ⊘ CUTTINGS ▼ WATER LEVEL



PPM	SAMPLE NO.	SAMPLE TYPE	STRATIGRAPHY	SOIL DESCRIPTION	PIEZOMETER INSTALLATION
<1	34			**FILL,** clay, some silt, some sand, trace gravel, medium plastic, moist, mottled brown.	
9	35				
				–frozen to 1.0 m. –stiff below 1.0 m.	
9	36			–organics between 1.4 and 1.6 m.	
				–firm, moist to wet below 1.8 m.	
15	37				
5	38				
5	39				
5	40			**GLACIAL TILL,** clay, some silt, some sand, trace gravel, stiff, medium plastic, moist, brown.	

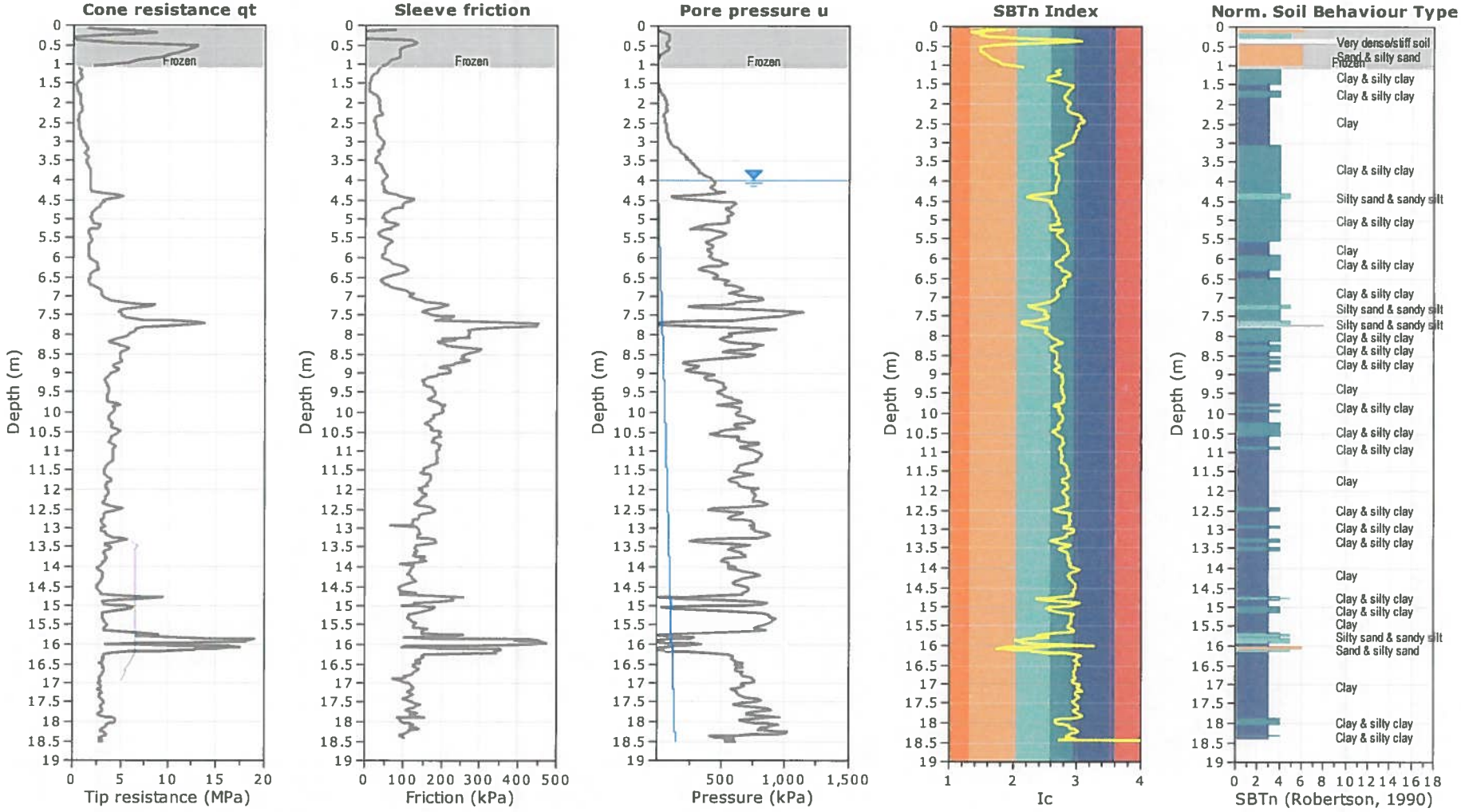
NOTE:
1. Test Hole open with trace water Immediately After Drilling.

APPENDIX C
CPTu PLOTS

P. Machibroda Engineering Ltd.
806-48th Street East
Saskatoon, Saskatchewan S7K 3Y4
www.machibroda.com

Project: **14263 - Proposed Buildings and Equipment Yard**
Location: **Range Road 3041, Near Clavet, Saskatchewan**

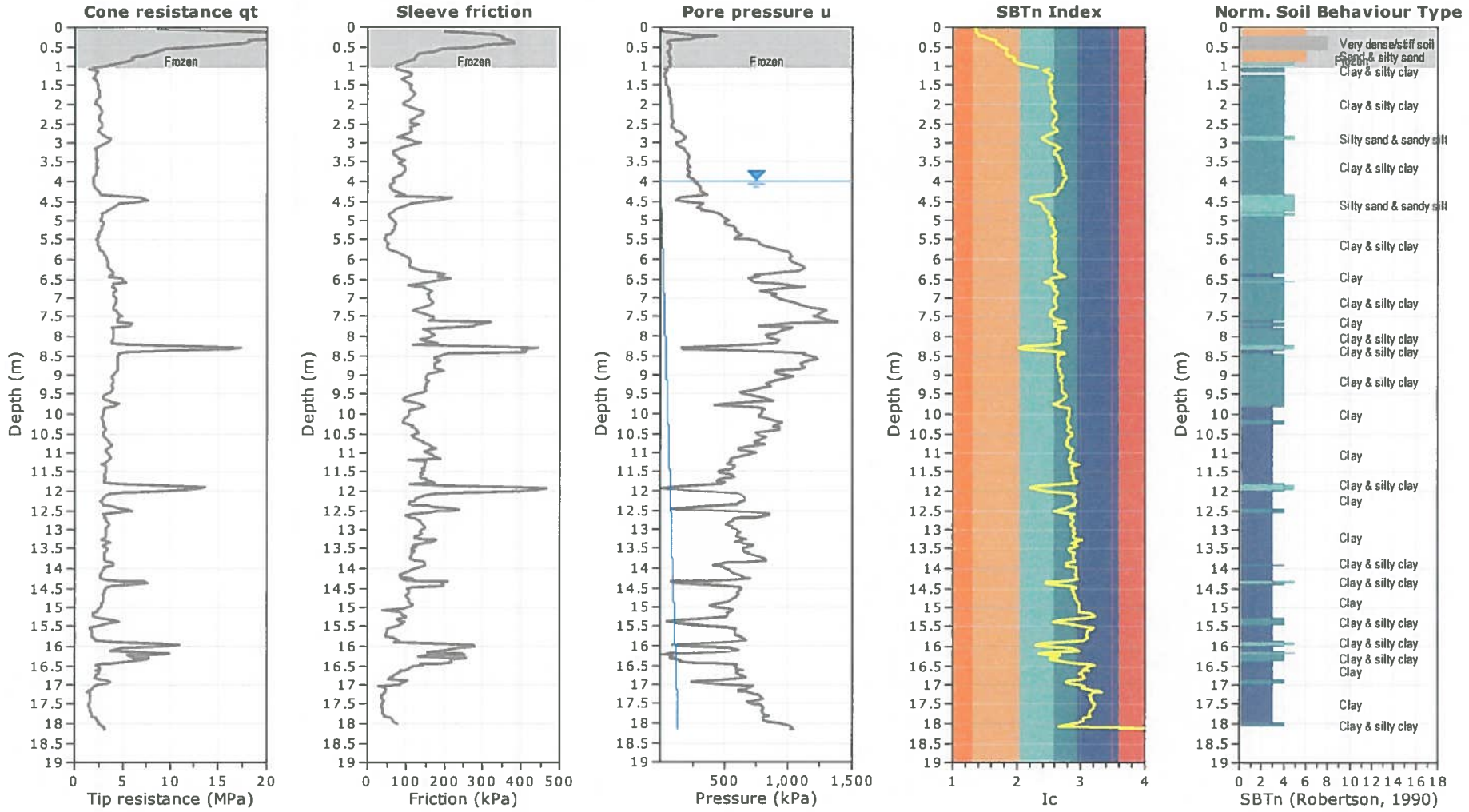
CPT: 18-1
Total depth: 18.54 m, Date: 06/04/2018
Surface Elevation: 99.40 m
Cone Type: 15 cm^2
Cone Operator: PMEL



P. Machibroda Engineering Ltd.
806-48th Street East
Saskatoon, Saskatchewan S7K 3Y4
www.machibroda.com

Project: **14263 - Proposed Buildings and Equipment Yard**
Location: **Range Road 3041, Near Clavet, Saskatchewan**

CPT: 18-2
Total depth: 18.14 m, Date: 06/04/2018
Surface Elevation: 100.00 m
Cone Type: 15 cm^2
Cone Operator: PMEL



APPENDIX D

GRAIN SIZE DISTRIBUTION ANALYSIS

P. MACHIBRODA ENGINEERING LTD.

ASTM D422: PARTICLE SIZE ANALYSIS OF SOILS

Project: Proposed Buildings and Equipment Yard

Location: Parcel A, Plan 64519699, Range Road 3041, Near Clavet, SK

Project No.: 14263

Date Tested: April 12, 2018

Test Hole No.: 18-1

Sample No.: 3

Depth (m): 1.0

Sieve Analysis:

Sieve	Diameter mm	% Finer
1.5"	38.1	100
1"	25.4	100
3/4"	19.1	100
1/2"	12.7	100
3/8"	9.5	100
# 4	4.75	100
# 10	2	100
# 20	0.85	100
# 40	0.425	99.4
#60	0.25	98.6
# 100	0.15	97.3
# 200	0.075	90.2

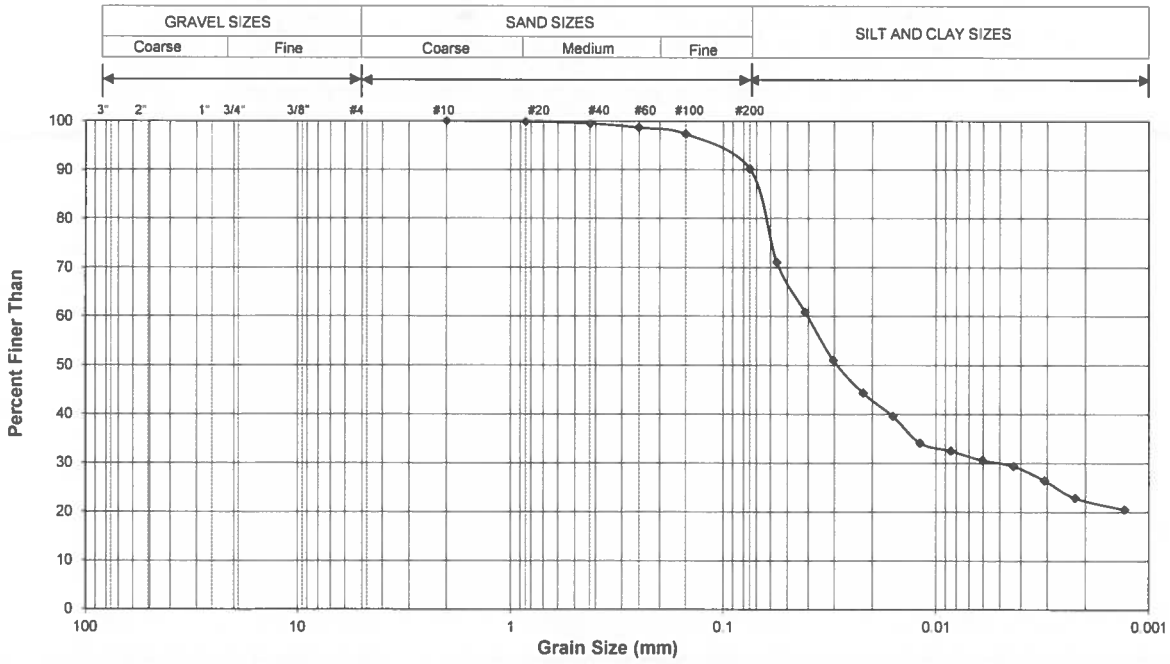
Hydrometer Analysis:

	Diameter mm	% Finer
Dispersing Agent:	0.0560	71.1
Sodium Hexametaphosphate	0.0414	60.9
	0.0304	51.0
	0.0220	44.4
	0.0159	39.6
	0.0119	34.1
	0.0085	32.5
	0.0060	30.6
	0.0043	29.4
	0.0031	26.5
	0.0022	22.9
	0.0013	20.5

Material Description:

% Gravel Sizes	% Sand Sizes	% Silt Sizes	% Clay Sizes
0	10	67	23

Remarks:



CERTIFIED BY CCIL Canadian Council of Independent Laboratories For specific tests as listed on www.ccil.com

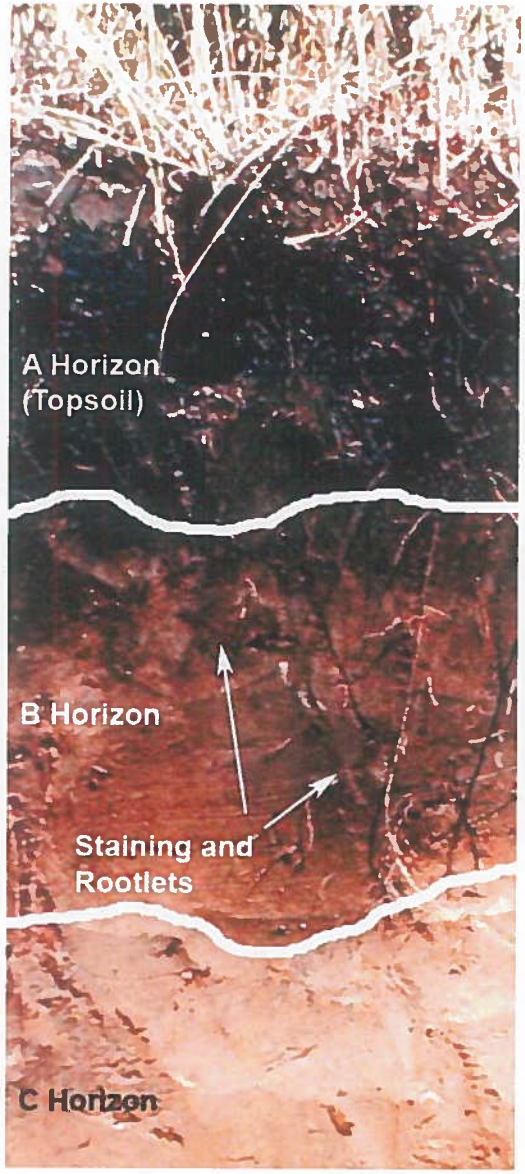
Drawing No.

Appendix D-1

WE CERTIFY TESTING PROCEDURES ARE IN ACCORDANCE WITH ASTM D422 STANDARD
P. MACHIBRODA ENGINEERING LTD.
PER Preston Schergevitch

APPENDIX E

TOPSOIL, ORGANIC MATTER AND ORGANICS



A Horizon

The A horizon is the topsoil layer of the soil strata. It is characterized by a build up of organic matter, and a lower unit weight than subsequent layers. The organic matter content of this layer is typically 4-10% by mass.

The colour of this horizon varies from dark black to brown, depending on surface vegetation and climatic conditions.

B Horizon

Typically reddish brown in colour and contains accumulations of matter that have been washed down from the A Horizon. The B horizon is generally composed of clay that has been washed out of the A Horizon, but can also contain iron, calcium and sodium deposits as well.

C Horizon

Unweathered parent soil.

Topsoil is a mixture of mineral soil and organic matter. The organic matter is developed from decaying biological material (leaves, grass, trees, animals, etc.) and contributes to the brown to black colour of the soil. Following the topsoil is the B horizon which is a transition layer, where staining from the overlying topsoil is common. This results in a darker colour of the soil immediately below the organic topsoil layer. Depending on the surface vegetation, rootlets may be present below the depth of topsoil. However it should be recognized that these rootlets are not the same as organic matter in topsoil.

Physically speaking in comparison to mineral soil, topsoil has a significantly lower bulk density and a lower unit weight as compared to the underlying parent soil. This is due to larger pore spaces and non mineral materials in the soil matrix. Along with lower density, topsoil is often spongy and colloidal/fibrous. The following figure is of a typical prairie soil. Each horizon is labelled accordingly to demonstrate a typical soil profile.

Reference

Henry L. 2003. Henry's Handbook of Soil and Water, Henry Perspectives, Saskatoon, SK.