

FINAL COMPREHENSIVE DEVELOPMENT REVIEW

MAJOR LAND CORPORATION COMMERCIAL DEVELOPMENT

Submitted to:

THE CORMAN PARK-SASKATOON PLANNING DISTRICT COMMISSION

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WSP

P. MACHIBRODA ENGINEERING LTD.

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EXECUTIVE SUMMARY

Major Land Corporation Development is applying to rezone a 48.85 acre (19.77 ha) parcel of land from DAG-1 – D-Agricultural 1 District to DC-1 – D-Arterial Commercial 1 District in the NE ¼, Section 35, Township 35, Range 3, W3M. This document shall serve as the Comprehensive Development Review submitted in support of the rezoning 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 D-C1 District rezoning is to provide for opportunities to develop a range of commercial uses. It is noted that the site plan presented in the report is a most liberal arrangement in terms of site density (54 lots total) based on the site development standards provided in the DC-1 Zoning District. Parcels will be subdivided as requested, as well as based on market conditions and desired parcel size. The Developer proactively requested this approach be undertaken in the CDR to allow flexibility for the development at full build out. It is believed that it is most likely that the proposed development may be less dense than designed for in the CDR; however, this report provides the required detail sufficient for any future development of land under the proposed DC-1 Zoning District.

The proposed development is situated on lands located within the RM of Corman Park No. 344 within the Corman Park-Saskatoon Planning District. The development is located south of the Grasswood commercial area, including the Grasswoods Indian Reserve (English River First Nation), approximately 1.6 km south of the southern extent of the City of Saskatoon, west of Provincial Highway #11. There are a number of existing commercial developments located in the immediate vicinity of the proposed commercial development.

A preliminary lot grading plan was undertaken by Catterall & Wright which illustrates all runoff from the site into a central storm water detention pond. The pond was sized to provide storage for the 1:100 year storm event plus 25% to ensure that the post-development runoff rate was equal to the pre-development runoff rate of 1,500 L/s. The storm water detention pond is designed to accommodate the increased runoff from the greater impermeable surface area of the development. It is noted in the report that the proposed storm water detention pond should require minimal maintenance, limited to clearing vegetation growth near the existing culvert inlet. It is noted that the drainage pond will be lined with suitable material to minimize the effects of both infiltration and exfiltration of the ground water. The geometric design of the pond side slopes was in accordance with current City of Saskatoon standards. The Water Security Agency reviewed the proposed drainage plan and indicated that Catterall & Wright's design characteristics and techniques are acceptable for the purposes of the project's stormwater mitigation.

A Traffic Impact Assessment (TIA) was undertaken by WSP in January, 2018. WSP undertook turning lane movement in January, 2018 at the Grasswood Road and Service Road intersection as well as the Floral Road and Service Road intersection. Level of Service (LOS) analysis was completed for both the full development build-out phase (10 years) as well as for the critical development phase to determine the threshold of when intersection upgrades would be required. Based on the analyses conducted as a part of the TIA, WSP made a series of recommendations including: (1) Align the east access on Grasswood Road with Jemini's east access (undertaken as a part of the design of the development); (2) Consider providing an all-way stop at the Grasswood Road and Service Road intersection for critical and full build-out development phases; and, (3)

Eastbound right-turn lane with channelization should be considered at the Grasswood Road and Service Road intersection to minimize unnecessary delays. Although no upgrades or modifications are required at the existing rail crossing that borders the west boundary of the subject parcel, it is recommended that any new intersections or access points constructed adjacent to the railway crossing be compliant with the Grade Crossing Standards and Regulations of minimum 30 m spacing between existing rail crossing and the new intersection/property access. The Ministry of Highways and Infrastructure reviewed the TIA and indicated that they do not have any further concerns with the content or recommendations presented in the TIA. The MHI will be provided a second opportunity to review and comment on the TIA at the time of subdivision. Consultation was also undertaken with CN Rail to ensure that there would be no adverse effects on the existing adjacent rail line.

Potable water will be supplied by the Dundurn Rural Water Utility (DRWU). The DRWU has a low pressure potable water system with a booster station located at the south east corner of Grasswood Road, west of the north-south rail line. This utility will manage the on-site water distribution lines and associated infrastructure.

Catterall & Wright calculated the wastewater generated by the development based on average rates for industrial and commercial developments, as per the Saskatchewan Onsite Wastewater Disposal Guide. It was concluded that the wastewater would total approximately 10,000 L/day. This value represents an average of one 2,500 gallon septic truck per day servicing the development. To be conservative, Catterall & Wright recommended doubling the calculation to 20,000 L/day. The estimated sewage volume allows for the development to employ 280 people, and requires that an average of two septic trucks per day would service the development. This value is consistent with the Traffic Impact Assessment (TIA) undertaken by WSP. The Saskatchewan Health Authority will need to review the proposed wastewater treatment system at each individual lot at the time of subdivision.

A geotechnical investigation and follow up report were completed between January and February 2016 by P. Machibroda Engineering Ltd. The objective of the investigation was to provide preliminary design recommendations to support the detailed design of the proposed development. Several recommendations concerning preliminary design; site preparation; subgrade excavation; excavation and dewatering; floor slab and foundation concrete; borrow material placement and compaction; drainage recommendations; roadway embankment design considerations; erosion protection recommendations; and, roadway and parking surface maintenance.

A letter was distributed to landowners within a mile of the proposed development in May, 2018. Residents and business owners were requested to provide feedback and ask any questions as it pertained to the proposed rezoning application. A total of 23 letters were distributed. Feedback was received by the English River First Nation, whose property is located to the north of the subject site.

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 DAG-1 – D-Agricultural 1 District DC1 – D-Arterial Commercial 1 District in the NE ¼, Section 35, Township 35, Range 5, W3M. This review provides a framework for the rezoning and subdivision of the proposed parcel of land for the purpose of developing up to 54 lots for commercial development purposes.

The Developer of the project is Major Land Corporation and the 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 eventually subdivide the land to accommodate up to 54 lots for commercial development purposes. The proposed development is located south of the Grasswood commercial area, including the Grasswoods Indian Reserve (English River First Nation), approximately 1.6 km south of the southern extent of the City of Saskatoon west of Provincial Highway #11. There are a number of existing commercial developments located in the immediate vicinity of the proposed development.

It is noted that the site plan layout presented is a most liberal arrangement in terms of site density based on the site development standards in the DC-1 Zoning District. The Developer proactively requested this approach be undertaken in the CDR to allow flexibility for the development at full build out. It is believed that it is most likely that the proposed development will be less dense than designed for in the CDR and associated municipal servicing report. A review of proposed lot development will be undertaken at the subdivision application and building permit application stages. However, the CDR should provide the required detail sufficient for any future development of land under the proposed DC-1 Zoning District. 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, that require consideration should this proposed development be built out at the highest density as per the provisions in the DC-1 Zoning District within the Corman Park-Saskatoon Planning District Zoning Bylaw.

The proposed development concept incorporates planning, and engineering development principles with the goal of enhancing property values, by promoting the convenient location the area has to offer, including the following:

1. The development is well situated in the Grasswood Commercial area, immediately south of Grasswood Road, west of Highway #11.
2. Should the City of Saskatoon extend potable waterlines or sewer lines to the development area in the future, applications to connect to the services shall be undertaken in accordance with the policies established by the City.
3. A Site Plan illustrating a 6 m buffer strip has been prepared, at the request of the RM of Corman Park (see site plan attached in Appendix A). The proposed buffer strip is located within the rear yards of lots located around the perimeter of the development, save for the ones on Grasswood Road. It is noted that a 5 m fire break will be required within the 6 m buffer, as per the requirements of the RM of Corman Park. The RM indicated that the Developer is responsible for the implementing such a plan. It is understood that all other landscaping provisions must adhere to the RM of Corman Park's commercial landscaping standards and will be the responsibility of future lot developers.

The Developer is aware that the City is targeting to begin work in 2019 on the South East Concept Plan and is looking forward to being an active stakeholder providing feedback as it pertains to potable water, waste water, storm water, interim rural development, transition of land use, development density and servicing to urban standards.

2 INVENTORY AND ANALYSIS

2.1 EXISTING LAND USE

The proposed development site consists of a 48.85 acre (19.77 ha) parcel of land located in the NE 1/4 of Section 35, Township 35, Range 5, W3M. The site is currently characterized by relatively flat terrain, with small depressions susceptible to retaining water during spring runoff, higher intensity rainfalls and wet years.

Other land uses in the area consist of existing commercial development at the Grasswood Indian Reserve (English River First Nation), agricultural land (both grain farming and pastureland), as well as recreational development (Jemini Arena). The closest highway to the proposed development is Provincial Highway #11, which is located approximately 375 m to the east of the east boundary of the subject parcel (see location map on the following page).

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

North

- | | |
|------------------------------------|--|
| - Grasswood Road | Adjacent to north boundary |
| - Jemini Arena | Across Grasswood Road to north |
| - Grasswood Commercial Development | Across Grasswood Road to north |
| - Grasswoods Indian Reserve | Across Grasswood Road to north |
| - City of Saskatoon | Approx. 1.6 km north of north boundary |

South

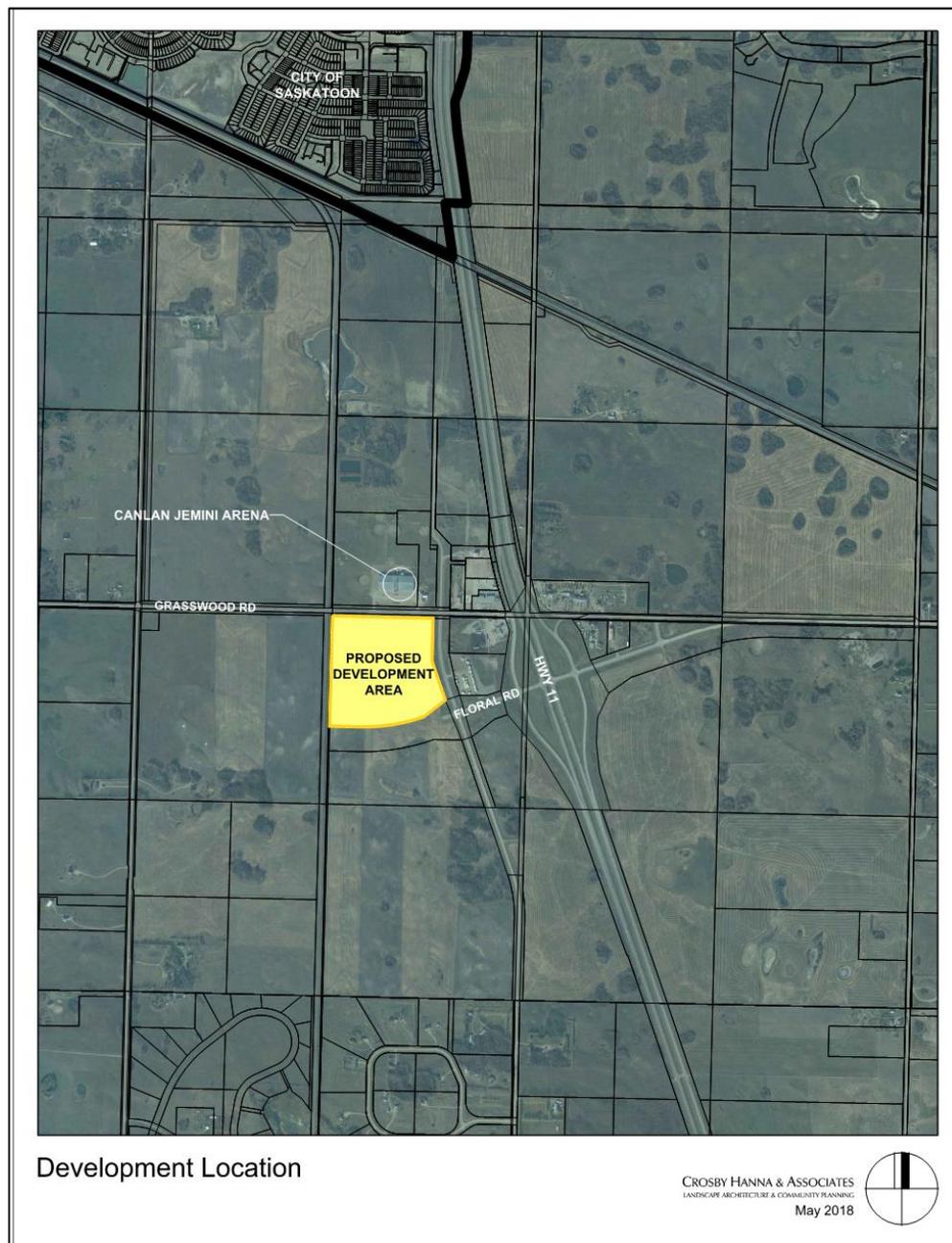
- | | |
|---------------------|--|
| - Agricultural land | Adjacent to south boundary |
| - Ashwood Estates | Approx. 1.1 km south of south boundary |
| - Grasswood Estates | Approx. 1.1 km south of south boundary |

West

- | | |
|---------------------|-------------------------------------|
| - Rail line | Adjacent to west boundary |
| - Agricultural land | Adjacent to west boundary |
| - Preston Avenue | Approx. 800 m west of west boundary |

East

- | | |
|-----------------------------------|-----------------------------|
| - Service Road/Range Road 3051 | Adjacent to east boundary |
| - Agra Foundations/Grasswood Esso | Across Range Road 3051 |
| - Highway #11 | 375 m east of east boundary |



Location of Proposed Major Land Corp. Commercial Development

2.2 PROPOSED LAND USE

The proposed land use at this parcel is for arterial commercial development. A total of up to 54 lots are proposed for the commercial development, and it is the intent of the Developer to rezone the parcel of land and undertake the subdivision of parcels in response to market demand.

Email correspondence from the RM of Corman Park Planning Department confirmed that there does not appear to be any land use conflicts with the proposed development, and that the land use designation in the Planning for Growth Regional Plan supports the commercial designation of the development (attached as Appendix B). It was noted by the RM Planning Department that the commercial development is in proximity to the railway, multi-parcel residential development to the south and possibly the Saskatoon Freeway Alignment, which has not yet been approved. However, the Ministry of Highways and Infrastructure (MHI) had the opportunity to review the proposed development and did not cite any concerns with respect to proximity to the future Saskatoon Freeway (see correspondence attached in Appendix C).

3 TRANSPORTATION AND MUNICIPAL SERVICES

3.1 COMMUNITY ACCESS

The proposed development is located immediately west of Range Road 3051 / Service Road and south of Grasswood Road. Additionally, the proposed development is located approximately 375 m west of Provincial Highway #11. WSP was contracted to undertake the Traffic Impact Assessment (TIA) in the winter of 2018 (attached as Appendix C).

WSP met with the Ministry of Highways and Infrastructure on January 16, 2018 to discuss the scope of the project and identify any initial concerns the Ministry may have with the site. The Ministry identified an interest in the operations of the intersections of Grasswood Road and the Service Road, as well as the Service Road and Floral Road. The Ministry did not identify the intersection at Floral Road and Highway #11 as an intersection of interest. Lastly, a controlled circle was identified within Section 36, Township 35, Range 5, W3M for a potential interchange, but this is outside of the proposed study area.

WSP also contacted the RM of Corman Park to discuss any initial concerns the RM may have with the site. The RM identified concerns regarding potential drainage issues on Grasswood Road; thus, access onto the site along Grasswood Road may not be a preferred option. However, a storm water management plan and report have been prepared to contend with any potential drainage concerns (see Appendix D).

Additional access options were considered prior to the finalization of the Concept Plan, including two accesses along the Service Road and one access on Grasswood Road and one along the Service Road. However, it was determined by the Developer and Municipal Engineers that providing two access points along Grasswood Road resulted in the most efficient development area.

The proposed development is located in proximity to two existing intersections included in the study (Grasswood Road and Service Road and Floral Road and Service Road). The TIA assumed the development will consist of 54 commercial lots and that two new accesses proposed along Grasswood Road would be built to serve the development. The TIA assumed that the development would be built out in 10 years. Capacity analyses were conducted for the following two study horizons:

- Full Development Build-Out Phase; and,
- Critical Development Phase to determine the threshold where intersection upgrades would be required.

WSP undertook turning lane movement counts the week of January 21st, 2018 at the Grasswood Road and Service Road intersection as well as the Floral Road and Service Road intersection. The volumes were collected in the morning (7:00 am to 9:00 am) and afternoon (4:00 pm to 6:00 pm) peak periods to capture commuter traffic. It was determined that the morning peak hour occurred between 7:30 am and 8:30 am for both study intersections while afternoon peak hour occurred between 4:30 pm and 5:30 pm for the Grasswood Road intersection and between 5:00 pm and 6:00 pm for the Floral Road intersection. Level of Service (LOS) analysis was completed, which

assesses the effectiveness of a transportation system, with LOS “A” equating to the best operating conditions and LOS “F” representing the failure of a movement or intersection.

Fifteen year growth factors of 1.80 for Grasswood Road and 1.50 for both Floral Road and the Service Road were applied to the traffic volumes anticipated without the demand of the proposed development to determine how the network will operate in the future horizon and comparing it to operations with the proposed site development. Based on these factors, it was determined that the Grasswood Road and Service Road intersection operates with minimal delays and queue lengths during the morning and afternoon peak hours for existing conditions, and is expected to continue to operate acceptably during both peaks for the background scenarios. The Floral Road and Service Road intersection also operates at acceptable conditions during both peak hours at existing traffic volumes and is expected to continue to operate acceptably for the background scenarios.

New trips generated by the proposed development were established using the Institute of Transportation Engineers (ITE) Trip Generation Manual, 9th Edition. Based on the future land use of a commercially zoned subdivision, the following assumptions were made:

- Development was categorized as a Shopping Centre, based on the definitions of the ITE;
- Gross Floor Area of each lot was assumed to be 20% of the lot size;
- New trips estimated on the Gross Leasable Area, which is 80% of the GTA;
- An additional 2 septic trucks per day (14 per week) were added to the proposed development, in the event that tanks are used for wastewater storage;
- The ITE standard of 31% internal capture rate between office and commercial uses was reduced by 10% and applied during the afternoon peak hour;

Total forecast volumes associated with the proposed development were calculated by combining the background growth volumes with the new and by-pass trips associated with the development. Total forecast growth volumes were assessed using Synchro 9.0 (industry-standard traffic analysis software).

WSP conducted a sensitivity analysis to determine the amount of development that will be required prior to intersection upgrades. For the study area, a LOS of E or v/c (volume to capacity ratio) of greater than 0.8 would be considered the critical parameter for intersection upgrades. Based on these assumptions, it was identified that the critical development phase where intersection improvements could be required is at least at 75% of full site development, or in year 8. With respect to the critical phase of development (year 8), the following conclusions were reached:

- The Grasswood Road and Service Road intersection is expected to continue to operate acceptably during morning peak hour while the northbound approach will reach LOS E during the afternoon peak hour at Year 8 of development.
- The Grasswood Road and Access 1 (east access) intersection is expected to operate at acceptable conditions during both peak hours at Year 8 of development.
- The Grasswood Road and Access 2 (west access) intersection is expected to operate acceptably during both peak hours at Year 8 development.
- The Floral Road and Service Road intersection is expected to continue to operate acceptably during both peak hours.

With respect to the full build out phase, the following conclusions were reached:

- The Grasswood Road and Service Road intersection is expected to continue to operate acceptably during the morning peak while the northbound approach fail (LOS F) with the existing two-way stop control during the afternoon peak hour at full site development.
- The Grasswood Road and Access 1 (east access) intersection is expected to operate with minimal delays and queuing during the morning peak hour at full build-out phase. While the northbound shared left turn/through lane is anticipated to fail (LOS F) during the afternoon peak hour, it is considered an acceptable condition for side streets with such a left-turn low volume and intersection controls to permit maximum capacity on Grasswood Road (LOS A).
- The Grasswood Road and Access 2 (west access) intersection is expected to operate acceptably during the morning peak hour while the northbound shared left-turn / through lane fails (LOS F) during the afternoon peak hour at full site development. Similar to the east access, it is considered acceptable conditions for minor roads to operate at this level when the left-turning volumes are so low and priority is given to the major road.
- The Floral Road and Service Road intersection is expected to continue to operate acceptably during both peak hours.

Based on the above conclusions, WSP made the following recommendations:

- Align the proposed east intersection on Grasswood Road with Jemini's access point (undertaken as a part of the design of the development);
- Consider providing an all-way stop at the Grasswood Road and Service Road intersection for critical and full build-out development phases as well as an eastbound right-turn lane with channelization should be considered at the Grasswood Road and Service Road intersection to minimize unnecessary delays. Both improvements to the Grasswood Road and Service Road approaches are expected to operate at LOS D or better for both peak hours;
- Although no upgrades or modifications are required at the existing rail crossing that borders the west boundary of the subject parcel, it is recommended that any new intersections or access points constructed adjacent to the railway crossing be compliant with the Grade Crossing Standards and Regulations of minimum 30 m spacing between existing rail crossing and the new intersection/property access. It is noted that the proposed west access to the subject site is 105.5 m east of the existing rail crossing.

Additional correspondence between MHI and Major Land Corporation was received as a part of the development with respect to a parcel tie-code removal application filed in 2017 between Surface Parcel 117770621 and Surface Parcel No. 117961993 for the purpose of creating separate titles for the severed parcels (also attached in Appendix C). It was recommended that application to remove the parcel tie codes be approved subject to a number of conditions. One of the conditions applies to a development restriction within a triangle formed 130m along intersecting grid roads. As such, a 0.64 ac cut-off is illustrated on the site plan, at the corner of Grasswood Road and Service Road, as a result of this requirement.

It is noted that the Traffic Impact Assessment was submitted to the Ministry of Highways and Infrastructure in July, 2018 (correspondence attached in Appendix C). Mr. Julian Petras of the MHI reviewed the TIA completed by WSP and indicated that the Ministry had no further concerns with the content or recommendations presented in the TIA. It was noted that the recommended

improvements do not directly impact any of the roadways under the Ministry's jurisdiction and as such will not require the formation of any sort of partnership agreement prior to construction. It is noted that a roadside development permit will be required prior to any work being completed at the Grasswood Road and Service Road intersection.

It is noted that the TIA will be submitted and reviewed by the Community Planning Branch of the Ministry of Municipal Relations at the time of subdivision and will be forwarded a second time to the MHI at the time of subdivision. The MHI will be given a second opportunity to review and comment on the conclusions and recommendations provided as a part of this study.

With respect to the proximity of the development to the existing CN Rail Line, contact was made with the rail company to determine whether there were any specific concerns or criteria that needed to be addressed by Major Land Corporation. As attached in Appendix C, CN provided criteria for non-sensitive uses in proximity to a main line. The following criteria were highlighted:

- 30 m setback of access points located near at-grade railway crossings;
- Potential need for a 1.83 metre chain link security fencing along the mutual property line;
- Confirmation that no adverse impacts to the existing drainage pattern on the railway right-of-way and that there will be no additional runoff to CN lands in the event of a 100-yr storm; and,
- An adequate setback to build and maintain the structure(s) off the right-of-way (in this case, a minimum 30 m setback is recommended for any buildings on the proposed Major Land Corp commercial development property).

With respect to the 30 m setback of access points located near at-grade railway crossings, the west access point to the development is located approximately 105.5 m east of the at-grade rail crossing. Secondly, the Developer has confirmed with CN that there will be no adverse impacts to the existing drainage pattern, and the municipal servicing study, including drainage report, along with the response from WSA was provided on October 4, 2018.

With respect to the 1.83 m chain link security fence, CN noted that this may not be applicable in a rural location where trespassing is not anticipated. The Developer does not believe that trespassing will be an issue, but will monitor the need for security fencing as the proposed development is built out.

With respect to the minimum suggested building setback, 30 m the Developer requested that CN reconsider this suggestion for the following reasons:

- The proposed Major Land Corp development is located adjacent to a branch line and not a main line to which the recommendations and requirements apply;
- There is already the requirement for a 8 m rear yard setback as noted in the Corman-Park Saskatoon Planning District Zoning Bylaw;
- There is a proposed 6m landscaped buffer on the periphery of the proposed development, which includes a 5m fire break, as per the RM of Corman Park's standards.

A follow-up phone conversation with Ms. Susanne Glenn-Rigny of CN was held on January 24, 2019. Ms. Glenn-Rigny indicated that as the development is not located in a primary main line and the list of uses within the DC1 District are considered non-sensitive uses, a 30 m setback would

not be required and indicated that it is the governing municipality's right to approve any required setbacks. The required 8 m rear yard setback was discussed and it was determined that the setback may be considered sufficient given that the proposed uses are not sensitive. Ms. Glenn-Rigney also indicated that the setback is in place so that a developer can reasonably construct and maintain a building without having to access the CN right-of-way, given that the rail line is not a main line. Written confirmation was received from Ms. Glenn-Rigney on March 11, 2019 identifying the above and is attached in Appendix C.

3.2 INTERNAL ROADS

The internal roads proposed for the development will be engineered and constructed to the RM of Corman Park's industrial road standards. It is understood that a 36 m right-of-way is deemed sufficient for this development.

3.3 SEWAGE COLLECTION & WASTE WATER TREATMENT

A municipal servicing review was undertaken by Catterall & Wright Consulting Engineers in May, 2018. It was determined that since there is currently no communal wastewater system in the immediate vicinity, the proposed solution with respect to wastewater collection and treatment at this development is individual septic holding tanks (see Appendix D for Municipal Servicing Study).

Catterall & Wright calculated the wastewater generated by the development based on average rates for industrial and commercial developments, as per the Saskatchewan Onsite Wastewater Disposal Guide. It was concluded that the wastewater would total approximately 10,000 L/day. This value represents an average of one 2,500 gallon septic truck per day servicing the development. To be conservative, Catterall & Wright recommended doubling the calculation to 20,000 L/day. The estimated sewage volume allows for the development to employ 280 people, and requires that an average of two septic trucks per day would service the development. This value is consistent with the Traffic Impact Assessment (TIA) undertaken by WSP Group.

It is noted in the municipal servicing review that should a City of Saskatoon sanitary sewer trunk be extended to Grasswood Road, the development would be able to connect to the City system.

The Saskatchewan Health Authority will be required to approve any proposed new wastewater treatment systems at the time a subdivision application is submitted to the Community Planning Branch at the Ministry of Municipal Relations. It is noted that individual lot owners will be responsible for the installation and maintenance of any proposed septic system, as approved by the Saskatchewan Health Authority.

3.4 POTABLE WATER SUPPLY AND DISTRIBUTION

Potable water will be supplied by the Dundurn Rural Water Utility (DRWU). The DRWU has a low pressure potable water system with a booster station located at the south east corner of Grasswood Road, west of the north-south rail line. This utility will manage the on-site water

distribution lines and associated infrastructure (see letter from the DRWU attached as Appendix E).

Catterall & Wright calculated that the average day potable water demand to be approximately 20,000 L/day (3.1 igpm) for the entire development at full build out. This potable water demand equals 0.23 igpm per hectare of land development. Each lot will require an individual holding tank 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. In addition to a larger holding tank, fire protection requires a larger pump and back-up generator. Each individual lot owner will be responsible for the installation and maintenance of their own holding tank and pumping equipment.

3.5 DRAINAGE AND STORMWATER MANAGEMENT

As a part of the municipal servicing study, Catterall & Wright undertook a drainage study and associated plan. The site itself measures 19.8 ha in size and includes the following:

- 13.2 ha of developable lot area;
- 2.7 ha dedicated to the storm water detention pond;
- 2.9 ha of roadways; and,
- 0.99 ha of Municipal Reserve along the east boundary of the property.

As illustrated within the proposed drainage plan in Appendix D, the grading plan includes preliminary grading of the lots, roads and elevations of the storm water detention pond. The preliminary grading ensures that all lots and road areas drain to the central storm pond. The excavation and fill areas required to create the grading plan are also included in the study.

The existing drainage outlet for the development is a 500mm corrugated steel pipe culvert running north under Grasswood Road, approximately 290 m east of the north/south rail line. The modelled pre-development runoff rate totals approximately 1,500 L/s.

A preliminary lot grading plan was undertaken by Catterall & Wright which illustrates all runoff from the site into a central storm water detention pond (attached in Appendix D). The pond was sized to provide storage for the 1:100 year storm event plus 25% to ensure that the post-development runoff rate was equal to the pre-development runoff rate of 1,500 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 storm water detention pond is designed to accommodate the increased runoff due to greater impermeable surface area of the development. The stormwater calculations assumed a pre-development runoff coefficient of 0.25 and a post-development runoff coefficient of 0.79. It is noted in the report that the proposed storm water detention pond should require minimal maintenance, limited to clearing vegetation growth near the existing culvert inlet. It is noted that the drainage pond will be lined with suitable material to minimize the effects of both infiltration and exfiltration of the ground water. The geometric design of the pond side slopes was in accordance with current City of Saskatoon standards.

A total volume of 12,000 m³ are required for the development, which is equivalent to approximately 890 m³ per hectare of development. This latter value can be used to ensure adequate storm water management is provided by the development in the event of a change in site layout.

The proposed development was referred to the Water Security Agency in October, 2018 for review. The WSA conducted an analysis of recent and historic aerial photography, a brief hydrological assessment, in-office file review and review of the June 2018 Comprehensive Development Review (CDR). The WSA indicated that there are numerous wetlands/depressions within the boundaries of the development, and also adjacent to the development property. It was noted that these types of depressions are integral to stormwater management in the region, and the storage must be reflected in the design and implementation of retention facilities. Along with a regulated outflow which matches pre-development flow rates, the retention facilities must also replicate the loss in permanent storage and the pre-development evaporative qualities. A review of the geotechnical report was also undertaken and it was commented that the results are consistent with other reports seen in the Grasswood area undertaken in the last decade or so. It was noted that the proposed pond will need an impermeable lining to prevent infiltration into the pond. Catterall & Wright have confirmed that the drainage pond will be lined with suitable material to minimize the effects of both infiltration and exfiltration of the ground water. The geometric design of the pond side slopes was undertaken in accordance with current City of Saskatoon standards. WSA indicated that Catterall & Wright's design characteristics and techniques are acceptable for the purposes of the project's stormwater mitigation.

Should the layout of the development change at the time of subdivision to fewer parcels, the drainage study will be revised accordingly. It is also noted that the municipal servicing study will be submitted and reviewed by the Community Planning Branch of the Ministry of Municipal Relations and ultimately will need to be approved by the Water Security Agency (WSA).

3.6 SHALLOW UTILITIES

A letter, also in Appendix F confirms that Loraas Disposal can provide Waste and Recycling removal services at the proposed Major Land Corporation commercial development.

Shallow utilities (SaskPower, SaskEnergy, 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 the general parameters for these services at the proposed Development. Police services will be provided by the Corman Park Police Services and the Saskatoon Detachment of the Royal Canadian Mounted Police.

4 HERITAGE, ENVIRONMENT AND GEOTECHNICAL

4.1 HERITAGE CONSERVATION

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

4.2 ENVIRONMENTAL CONSIDERATIONS

The proposed development is located on farmland. A query of HabiSask indicated that the development may be located on the very edge of an area with potential endangered vertebrate species however, the site itself is immediately adjacent to existing commercial development on land that does not have any tree cover, or existing permanent or seasonal water features (see environmental query also attached in Appendix G). Further environmental screening noted the presence of the olive-backed pocket mouse. Due to the historical nature of the occurrence (1955) and the agricultural operations occurring on site, the RM of Corman Park indicated that there are no concerns from an environmental perspective of this application proceeding.

The proposed development is also not located in the vicinity of any permanent water sources. The closest permanent water source, the South Saskatchewan River, is located approximately 7.5 km to the west.

4.3 GEOTECHNICAL ANALYSIS

A geotechnical investigation and follow up report were completed between January and February 2016 by P. Machibroda Engineering Ltd. (see attached report in Appendix H). The objective of the investigation was to provide geotechnical recommendations to support the detailed design of the proposed development. A total of 15 boreholes were drilled.

Geotechnical field tests, logging of soils and collection of soil samples for laboratory testing was undertaken. The laboratory tests of the soil samples obtained from the boreholes included visual soil classification, water content, unit weights, Atterberg limits, and grain size distribution analysis (results found in Geotechnical report attached as Appendix H).

The general soil profile consisted of a thin layer of organic topsoil overlying poorly graded sand followed by variable deposits of low plastic silt, medium to high plastic clay and sand. Extensive groundwater seepage and sloughing conditions were encountered during test drilling. The water levels in the standpipe piezometers installed at the site were between 0.8 and 2.4 metres below ground surface on February 8, 2016.

A total of fifteen test holes were drilled to depths ranging from 12 to 18 metres below ground surface and standpipe piezometers were installed in five of the test holes for groundwater monitoring purposes. Extensive groundwater seepage and sloughing conditions were encountered

during test drilling. It was concluded that the groundwater table varied from between 0.8 to 2.4 metres below existing ground surface on February 8, 2016. It was noted that higher groundwater conditions could be encountered, particularly during or following precipitation and/or spring thaw.

Six piezocone penetration tests (CPTu) were conducted during the field investigation to depths of about 9.6 to 23.8 metres below existing grade. CPTu tests are an *in situ* testing method used to determine the geotechnical engineering properties of soils and assessing subsurface stratigraphy, relative density, strength and equilibrium groundwater pressures. CPTu can be also used to carry out pore pressure dissipation test. An examination of the CPTu plots suggests that clay was encountered beneath the sand and extended to at least 23.8 metres below existing grade.

In terms of construction, preliminary design recommendations were made. Based on the understanding that the development will consist of commercial mixed with light industrial buildings, the typical foundation for this type of development consists of a pile and grade beam supported building with a grade supported main floor. It is noted that while basements are not typically constructed for this type of development, basement levels were not recommended based on the high groundwater conditions encountered at the site. With regards to foundation support, a deep foundation system consisting of driven, treated timber piles, driven open-end steel pipe, helical screw piles and continuous flight auger (CFA) piles would perform satisfactorily. Drilled, cast-in-place concrete piles were considered but not recommended due to the extensive groundwater seepage and sloughing conditions.

Additionally, thickened edge raft foundations bearing on naturally occurring sand or structural granular fill over sand could also be considered and should perform satisfactorily. Footing foundations were not recommended, again, due to the relatively high groundwater conditions. Additional recommendations were prepared for site preparation; driven, treated timber piles; driven, open-end steel pipe piles; helical screw piles; CFA piles; perimeter thickened edge rafts; limit states resistance factors and serviceability; excavating and dewatering; floor slabs; foundation concrete; grade beams; site classification for seismic site response; and subdivision roads and parking surfaces.

The report concludes with several recommendations concerning preliminary design; site preparation; subgrade excavation; excavation and dewatering; floor slab and foundation concrete; borrow material placement and compaction; drainage recommendations; roadway embankment design considerations; erosion protection recommendations; and, roadway and parking surface maintenance.

5 POLICY CONTEXT

The proposed Commercial Development is located within the RM of Corman Park – Saskatoon Planning District. As such, the proposed development has been designed to meet the requirements of the existing Corman Park Saskatoon Planning District Official Community Plan and Zoning Bylaw, as well as the Saskatoon North Partnership for Growth Regional Plan as described in Sections 5.1 through 5.3 below.

5.1 CORMAN PARK-SASKATOON PLANNING DISTRICT OFFICIAL COMMUNITY PLAN

Agricultural Objectives and Policies (Section 4) - Section 4 of the Official Community Plan identifies the following Agricultural Policies that are pertinent to the proposed Major Land Corporation commercial development.

4.3 Intensive Livestock Operation Policies

- Figure 1: Correspondence with RM of Corman Park administration indicated that there are no existing ILO's within a separation distance that would cause a conflict with the proposed development (correspondence attached in Appendix B of this report).

Commercial Sector Policies (Section 7) – Section 7 of the Official Community Plan identifies the following commercial sector policies that are pertinent to the proposed Major Land Corporation commercial development.

7.1 Comprehensive Development Reviews:

- This document shall serve as the Comprehensive Development Review (CDR) as required according to the Corman Park-Saskatoon Planning District Official Community Plan as it pertains to rezoning of land to provide opportunities for new commercial development. 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, that require consideration should this proposed development be built out at the highest density as per the provisions in the DC-1 Zoning District within the Corman Park-Saskatoon Planning District Zoning Bylaw.

7.2 Servicing and Development Policies:

- 7.2.1: The proposed commercial development is located in a suitable area that is compatible with adjacent and nearby uses, including the Grasswood Business Centre and Grasswoods Indian Reserve (English River First Nation). A number of highway commercial uses have been realized in the area, including gas stations, English River Business Complex, Subway Restaurant, the Saskatchewan Indigenous Cultural Centre, car wash, Minetec sales, and Office of the Treaty Commissioner.
- 7.2.3: The Developer is proposing to handle wastewater at each individual lot through a holding tank. Potable water will be supplied by the Dundurn Rural Water Utility (confirmation letter attached in Appendix E). Other utilities will be provided to each individual lot, and it will be up to the respective lot owners to contact SaskEnergy, SaskPower and SaskTel to apply for these services.
- 7.2.4: A servicing agreement between the Developer and the RM of Corman Park is expected to address, but is not necessarily limited to, the following:
 - Identify the proposed phasing, including the proposed construction timelines;
 - Identify roadway and approach specifications;
 - Identify off-site servicing fees, payable to the RM;
 - Identify the value of the required performance bond or letter of credit;
 - A total of 0.99 ha of land is proposed to be dedicated to Municipal Reserve. This meets the 5% land dedication requirement for commercial developments.
- 7.2.5: The proposed commercial development complies with the servicing objectives and policies, as outlined in sub-section 8, below.

7.3 Location and Access Policies

- 7.3.1: The proposed development is located within the area identified as “Future Commercial Area” according to the Future Land Use Map attached to the Corman Park-Saskatoon Planning District Official Community Plan.
- 7.3.4: The proposed development is located in a planned note at a key intersection of Grasswood Road and a service road that leads to Provincial Highway #11.
- 7.3.5(a)(b) and (c): The proposed development is located in an area where existing municipal roads (Grasswood Road and unnamed service road) are sufficient to support the development. In April, 2018 a Traffic Impact Assessment (TIA) was undertaken by WSP Group (attached in Appendix C). It was concluded that with the background traffic growth and new trips generated by the proposed development, the Grasswood Road and Service Road intersection is expected to begin to operate under constrained conditions at 75% site development, or Year 8. Both geometric improvements (turning lanes) and intersection control improvements (signals, roundabouts, all-way stops) were considered. It was recommended that an all-way stop control be considered at this intersection for the critical and full build-out development phases. In addition, an eastbound right-turn lane with

channelization should be considered at the Grasswood Road and Service Road intersection to minimize unnecessary delays. It is anticipated that the shared cost of the traffic improvements will be outlined in the Servicing Agreement at the time of subdivision.

- 7.3.5(d): The proposed development is located on land identified as Class 4, which according to the Canada Land Inventory, have severe limitations that restrict the range of crops that can be planted and/or require special conservation practices.
- 7.3.6: The proposed development is located at the intersections of Grasswood Road and Service Road and Floral Road and Service Road. All of these roads are municipally maintained roadways. The proposed internal road will be engineered and constructed to the RM of Corman Park's standards, which were updated in November, 2017. It is understood that a 36 m right-of-way is deemed sufficient for this development.
- 7.3.8: Correspondence with RM of Corman Park administration indicated that there are no existing ILO's within a separation distance that would cause a conflict (correspondence attached in Appendix B of this report).

7.5 Arterial Commercial Policies:

- 7.5.1: The proposed development includes opportunities for medium and large scale commercial activities where location adjacent to and exposure from major commercial highways is essential. This CDR has been prepared alongside the rezoning application that has been submitted requesting the parcel be rezoned from DAG-1 – D-Agricultural 1 District to DC-1 – D-Arterial Commercial 1 District. Permitted uses in this district include: Amusement and entertainment service; Animal health care facility; Auction facility; Automotive repair shop; Automotive sales/rentals; Commercial storage centre; Community care facility; Food service use; Interment service; Public market; Public utility or municipal facilities; Recreational vehicle sales/rentals; and, Retail store. A number of discretionary uses are also provided within this Zoning District. It is the intent of the Developer to market this parcel as “turn-key” and subdivide parcels as requested, as well as based on market conditions and desired parcel size. The Site Plan attached as Appendix A to this CDR represents the maximum buildout possible, given the minimum site size provided in the D-CR-1 Zoning District, as well as necessary drainage standards that require consideration.
- 7.5.2: It is the intent of the Developer to rezone the land to provide for arterial commercial development. The permitted uses in this district include: Amusement and entertainment service; Animal health care facility; Auction facility; Automotive repair shop; Automotive sales/rentals; Commercial storage centre; Community care facility; Food service use; Interment service; Public market; Public utility or municipal facilities; Recreational vehicle sales/rentals; and, Retail store. The proposed uses are not customarily associated with urban commercial developments and are more oriented towards the travelling public as well as local populations.

Servicing and Transportation Policies (Section 8) – Section 8 of the Official Community Plan identifies the following servicing and transportation policies that are pertinent to the proposed Major Land Corporation commercial development.

8.1 General Servicing Policies:

- 8.1.1: All costs associated with providing the required municipal services to the development will be borne by the Developer, or purchaser of a lot at the time of subdivision. Potable water will be supplied by the Dundurn Rural Water Utility (DRWU) (see letter attached in Appendix E). It is proposed that holding tanks be installed at each lot following subdivision to contend with wastewater management (see Municipal Servicing Report in Appendix D). Individual lot owners will be responsible for the installation of natural gas (SaskEnergy), power (SaskPower) and phone/internet (SaskTel) at the appropriate time.
- 8.1.3: This document shall serve as the Comprehensive Development Review (CDR) required as a part of the rezoning application that has been concurrently submitted requesting a rezoning from DAG-1 – D-Agricultural 1 District to DC-1 – D-Arterial Commercial 1 District. The CDR addresses matters of land use integration, including how the proposed development successfully integrates itself economically, socially, physically with the existing properties in the vicinity, as well as how the development can be municipally serviced by the existing and proposed infrastructure without creating an undue financial burden on the RM of Corman Park or the Province of Saskatchewan.

8.2 General Transportation Policies:

- 8.2.1: The proposed development is located at the corner of Grasswood Road and an existing Service Road. No new roads are being proposed to access the development.
- 8.2.2: In April, 2018 a Traffic Impact Assessment (TIA) was undertaken by WSP Group (see report attached as Appendix C). It was concluded that with the background traffic growth and new trips generated by the proposed development, the Grasswood Road and Service Road intersection is expected to begin to operate under constrained conditions at 75% site development, or Year 8. Both geometric improvements (turning lanes) and intersection control improvements (signals, roundabouts, all-way stops) were considered. It was recommended that an all-way stop control be considered at this intersection for the critical and full build-out development phases. In addition, an eastbound right-turn lane with channelization should be considered at the Grasswood Road and Service Road intersection to minimize unnecessary delays. It is anticipated that the shared cost of the traffic improvements will be outlined in the Servicing Agreement at the time of subdivision. The Ministry of Highways and Infrastructure reviewed the TIA and indicated that they do not have any further concerns with the content or recommendations presented in the TIA (correspondence also attached in Appendix C). The MHI will be provided a second opportunity to review and comment on the TIA at the time of subdivision.

- 8.2.3: The proposed development has been designed to ensure safe access and egress from the adjacent road (Grasswood Road). The proposed eastern access has been located immediately across Grasswood Road from the existing Jemini Arena access. The western access is more than 30 m east of the of the rail crossing, as outlined by Transport Canada Grade Crossing Standards, Article 11 (see TIA attached in Appendix C). Additional access options were considered prior to the finalization of the Concept Plan, including two accesses along the Service Road and one access on Grasswood Road and one along the Service Road. However, it was determined by the Developer and Municipal Engineers that providing two access points along Grasswood Road resulted in the most efficient development area. CN rail was also consulted in December, 2018 (correspondence attached in Appendix C). CN provided criteria for non-sensitive uses in proximity to a main line. The following criteria were highlighted: (1) 30 m setback of access points located near at-grade railway crossings; (2) Potential need for a 1.83 metre chain link security fencing along the mutual property line; (3) Confirmation that no adverse impacts to the existing drainage pattern on the railway right-of-way and that there will be no additional runoff to CN lands in the event of a 100-yr storm; and, (4) An adequate setback to build and maintain the structure(s) off the right-of-way (in this case, a minimum 30 m setback is recommended for any buildings on the proposed Major Land Corp commercial development property). The drainage study and associated correspondence from WSA was provided to CN Rail on January 8, 2019. Additionally, the Developer has agreed to monitor the need for a 1.83 m chain link security fence, as CN has indicated that this may not be a requirement given the rural setting in which the proposed development is situated. A follow-up phone conversation with Ms. Susanne Glenn-Rigny of CN was held on January 24, 2019, followed by written correspondence received on March 11, 2019. Ms. Glenn-Rigny indicated that as the development is not located in a primary main line and the list of uses within the DC1 District are considered non-sensitive uses, a 30 m setback would not be required and indicated that it is the governing municipality's right to approve any required setbacks (correspondence also attached in Appendix C).
- 8.2.4: WSP met with the Ministry of Highways and Infrastructure on January 16, 2018 to discuss the scope of the project and identify any initial concerns the Ministry may have with the site. The Ministry identified an interest in the operations of the intersections of Grasswood Road and the Service Road, as well as the Service Road and Floral Road. A controlled circle was also identified within Section 36, Township 35, Range 5, W3M for a potential interchange, outside of the proposed study area. WSP also contacted the RM of Corman Park to discuss any initial concerns the RM may have with the site. The RM identified concerns regarding potential drainage issues on Grasswood Road; thus, access onto the site along Grasswood Road may not be a preferred option. However, a drainage plan and report have been prepared to contend with any potential drainage concerns (see Appendix D). Catterall & Wright noted, however, that all low lying areas would be filled in and graded to engineered design standards.

8.3 Water and Sewage Management Policies:

- 8.3.5: The proposed development can be serviced by the necessary infrastructure, including potable water (see attached letter from the Dundurn Rural Water Utility in Appendix E). A

servicing agreement between the Developer and the RM of Corman Park is expected to address, but is not necessarily limited to, the following:

- Identify the proposed phasing, including the proposed construction timelines;
 - Identify roadway and approach specifications;
 - Identify off-site servicing fees, payable to the RM;
 - Identify the value of the required performance bond or letter of credit;
 - A total of 0.99 ha of land is proposed to be dedicated to Municipal Reserve. This meets the 5% land dedication requirement for commercial developments.
- 8.3.6: Should the City of Saskatoon extend potable waterlines to the development area in the future, applications to connect to the services shall be undertaken in accordance with the policies established by the City.

Environmental and Heritage Resource Policies (Section 10) – Section 10 of the Official Community Plan identifies the following environmental and heritage resource policies that are pertinent to the proposed Major Land Corporation commercial development.

10.1 General Policies:

- 10.1.2: The proposed development is not located on land deemed to be potentially heritage sensitive (see query attached in Appendix G).
- 10.1.2: The proposed development may be on the edge of an area known to have potentially rare or endangered vertebrate species; however, the site itself is immediately adjacent to existing commercial development on land that does not have any tree cover, or existing permanent or seasonal water features (see query attached in Appendix G). Further environmental screening noted the presence of the olive-backed pocket mouse. Due to the historical nature of the occurrence (1955) and the agricultural operations occurring on site, the RM of Corman Park indicated that there are no concerns from an environmental perspective of this application proceeding.

Plan Implementation Policies (Section 12) – Section 12 of the Official Community Plan identifies the following plan implementation policies that are applicable to the proposed Major Land Corporation commercial development.

12.2 Future Land Use Map Policies:

- 12.2.1: The proposed development is located on land identified within the Corman Park-Saskatoon Planning District Future Land Use Map as “Future Commercial Area”. The applicant is proposing to rezone the land from DAG-1 – D-Agricultural 1 District to DC-1 – D-Arterial Commercial 1 District.

12.4: Comprehensive Development Review Policies:

- 12.4.1(h): Major Land Corporation is applying to rezone the land from DAG-1 – D-Agricultural 1 District to DC-1 – D-Arterial Commercial 1 District. This document shall serve as the Comprehensive Development Review submitted in support of the rezoning

application which addresses all matters of land use integration, potential conflict mitigation and the provision of 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, that require consideration should this proposed development be built out at the highest density as per the provisions in the DC-1 Zoning District within the Corman Park-Saskatoon Planning District Zoning Bylaw.

- 12.4.4: Section 5 of this Comprehensive Development Review document provides the manner in which the proposed development is consistent with the Corman Park-Saskatoon Planning District Official Community Plan.
- 12.4.5: The Developer has been in contact with the Dundurn Rural Water Utility with respect to the provision of potable water. The DRWU has indicated that they are able to provide potable water to the development (see confirmation letter in Appendix E). Other utilities will be provided to each individual lot, and it will be up to the respective lot owners to contact SaskEnergy, SaskPower and SaskTel to apply for these services.

12.5: Zoning Bylaw Policies:

- 12.5.2: Major Land Corporation Development is applying to rezone the land from DAG-1 – D-Agricultural 1 District to DC-1 – D-Arterial Commercial 1 District. Section 5 of this Comprehensive Development Review document provides the manner in which the proposed development is consistent with the Corman Park-Saskatoon Planning District Official Community Plan. The proposed development is also located on land identified within the Corman Park-Saskatoon Planning District Future Land Use Map as “Future Commercial Area”, and as such, no amendments are being requested to the Future Land Use Map.
- 12.5.5: A servicing agreement between the Developer and the RM of Corman Park is expected to address, but is not necessarily limited to, the following:
 - Identify the proposed phasing, including the proposed construction timelines;
 - Identify roadway and approach specifications,;
 - Identify off-site servicing fees, payable to the RM;
 - Identify the value of the required performance bond or letter of credit;
 - A total of 0.99 ha of land is proposed to be dedicated to Municipal Reserve. This meets the 5% land dedication requirement for commercial developments.

12.9: Public Participation Policies:

- 12.9.2: In order to identify and address public concerns and prevent conflict, the Developer prepared a letter that was distributed to neighbours within one mile of the development

parcel (attached in Appendix I). The letter provided information as to the parcel location, including a location map as well as the proposed Zoning District (D-CR-1). The letter also detailed the results of the engineering studies and provided information concerning how potable water was to be provided to the site, as well as information concerning wastewater management, traffic implications, and stormwater management provisions. A total of 23 letters were distributed and no responses were received from neighbours.

5.2 SASKATOON NORTH PARTNERSHIP FOR GROWTH REGIONAL PLAN

The Saskatoon North Partnership for Growth (P4G) is a recently formalized collaborative which includes political and administrative representation from the partnering municipalities. The partnering municipalities consist of: the City of Saskatoon, the City of Warman, the City of Martensville, the Town of Osler, the RM of Corman Park, and the Saskatoon Regional Economic Development Authority (SREDA), who plays an advisory role.

The P4G membership is comprised of two committees: a P4G Regional Oversight Committee (ROC), consisting of political representatives and senior management officials; and, a P4G Planning and Administration Committee (PAC), consisting of planning and administrative staff from each municipality and a SREDA representative.

The proposed Major Land Corporation commercial development is located within the P4G region. In May 2017, a Draft of the P4G Regional Plan was presented and endorsed by the Regional Oversight Committee. The P4G Regional Plan establishes a coordinated approach to matters related to the physical, social, or economic circumstances of the Saskatoon region that may affect the development of the region as a whole, such as: land use; population; transportation; utilities; services; and, finances.

The following policies within the Regional Plan that are relevant to the proposed Major Land Corporation commercial development are identified and discussed below.

Economic Development Policies (Section 2):

- 2.02: The proposed commercial development will certainly promote growth in the region from an economic development standpoint. The applicant wishes to rezone the land to D-C1 – Arterial 1 Commercial District. The intent of this district is to facilitate a diverse range of commercial activities serving the traveling public and the local populations, displaying a high standard of appearance and focused at points of intersection with primary municipal roadways, provincial highways and the perimeter highway. This land offers a special opportunity to develop and integrate medium scale retail and traveler-oriented commercial uses with some larger commercial uses.
- 2.03: The proposed development will provide for an assortment of employment opportunities for residents of the City of Saskatoon and the RM of Corman Park. Employment will encourage job growth and will reflect the community infrastructure and resources in place.

Natural and Heritage Resource Policies (Section 4):

- 4.01: There are no Designated Municipal or Provincial Heritage Properties located within the boundaries of the proposed Major Land Corporation Commercial development.
- 4.04: The proposed development may be on the edge of an area known to have potentially rare or endangered vertebrate species; however, the site itself is immediately adjacent to existing commercial development on land that does not have any tree cover, or existing permanent or seasonal water features (see query attached in Appendix G). Further environmental screening noted the presence of the olive-backed pocket mouse. Due to the historical nature of the occurrence (1955) and the agricultural operations occurring on site, the RM of Corman Park indicated that there are no concerns from an environmental perspective of this application proceeding.
- 4.05: The development is not located on land to be considered heritage sensitive (see query attached in Appendix G).

Water Resources and Wetlands Policies (Section 6):

- 6.01: The proposed development will not alter the flow of surface water that detrimentally affects other property or the ecology of the existing drainage system. A preliminary lot grading plan was undertaken by Catterall & Wright which illustrates all runoff from the site into a central storm water detention pond (see report attached in Appendix D). The pond was sized to provide storage for the 1:100 year storm event plus 25% to ensure that the post-development runoff rate was equal to the pre-development runoff rate of 1,500 L/s. The storm water detention pond is designed to accommodate the increased runoff due to greater impermeable surface area of the development. It is noted in the report that the proposed storm water detention pond should require minimal maintenance, limited to clearing vegetation growth near the existing culvert inlet. A total volume of 12,000 m³ are required for the development, which is equivalent to approximately 890 m³ per hectare of development. This latter value can be used to ensure adequate storm water management is provided by the development in the event of a change in site layout. The proposed development was referred to the Water Security Agency in October, 2018 for review. A review of the geotechnical report was also undertaken and it was commented that the results are consistent with other reports seen in the Grasswood area undertaken in the last decade or so. It was noted that the proposed pond will need an impermeable lining to prevent infiltration into the pond. Catterall & Wright have confirmed that the drainage pond will be lined with suitable material to minimize the effects of both infiltration and exfiltration of the ground water. The geometric design of the pond side slopes was undertaken in accordance with current City of Saskatoon standards. WSA indicated that Catterall & Wright's design characteristics and techniques are acceptable for the purposes of the project's stormwater mitigation.
- 6.04: The site is currently characterized by relatively flat terrain, with small depressions susceptible to retaining water during spring runoff, higher intensity rainfalls and wet years. It is noted that it is the intent of the Developer to fill in all low areas to engineered design standards.

General Policies (Section 7):

- 7.01: The proposed development is located in an area that is compatible with surrounding land uses, including a number of commercial businesses in the Grasswood Commercial development to the north and east, Highway #11 to the east, and vacant agricultural land to the west and south.
- 7.02: The proposed development is located on land identified as Urban Commercial/Industrial on the Saskatoon North Partnership for Growth Regional Land Use Map which is compatible with the proposed rezoning application to the D-C1 Commercial District.
- 7.05: The proposed development is not located within an area that would cause any land use conflicts. A confirmation email was received from the RM of Corman Park Planning Department noting that the land use designation in the P4G Plan supports the proposed commercial zoning designation. It was indicated that it was important to note proximity to the railway, proximity to multi-parcel development to the south, and potential proximity to the Saskatoon Freeway Alignment (see email attached in Appendix B). A meeting with the Ministry of Highways and Infrastructure was undertaken in January, 2018 and no concerns were cited at the time with respect to the potential Saskatoon Freeway Alignment. The MHI reviewed the TIA in August 2018 and indicated that they do not have any further concerns with the content or recommendations presented in the TIA (correspondence also attached in Appendix C). The MHI will be provided a second opportunity to review and comment on the TIA at the time a subdivision application is made with the Community Planning Branch at the Ministry of Government Relations.
- 7.11(e): The proposed development is intended to accommodate future highway commercial uses. According to the P4G Plan, the intended uses in this district includes office and retail uses that are connected to urban servicing. It is noted in the municipal servicing review that should a City of Saskatoon sanitary sewer trunk or potable water line be extended to Grasswood Road, the development would be able to connect to the City system. However, the Dundurn Rural Water Utility has confirmed that they can supply potable water to the development (confirmation letter attached as Appendix E).

Agriculture Policies (Section 8):

- 8.05: The proposed commercial development is not located within the required separation distances from Intensive Livestock Operations to commercial uses as outlined in Table 1 of the Regional Plan. This was confirmed by the RM of Corman Park Planning Department in an email dated March 9, 2018, attached in Appendix B.

Future Urban Growth Area Policies (Section 12)

- 12.06: The proposed development can be serviced by the necessary infrastructure, including potable water (see attached letter from the Dundurn Rural Water Utility in Appendix E). At the time of subdivision, a servicing agreement between the Developer and the RM of Corman Park is expected to address, but is not necessarily limited to, the following:

- Identify the proposed phasing, including the proposed construction timelines;
 - Identify roadway and approach specifications;
 - Identify off-site servicing fees, payable to the RM;
 - Identify the value of the required performance bond or letter of credit;
 - A total of 0.99 ha of land is proposed to be dedicated to Municipal Reserve. This meets the 5% land dedication requirement for commercial developments.
- 12.12: A total of 0.99 ha of land is proposed to be dedicated to Municipal Reserve. This meets the 5% land dedication requirement for commercial developments.
 - 12.21: The proposed development is located on an area designated as Future Urban Commercial/Industrial, according to the P4G Regional Plan. A proposed Site Plan is attached as Appendix A.
 - 12.24(a): This document shall serve as the Comprehensive Development Review report for the proposed commercial development. It is noted that the site plan presented in the report is a most liberal arrangement in terms of site density based on the site development standards in the DC-1 Zoning District. The Developer proactively requested this approach be undertaken in the CDR to allow flexibility for the development at full build out. It is believed that it is most likely that the proposed development could be less dense than designed for in the CDR and associated municipal servicing report. A review of each proposed development will be undertaken at the building subdivision application and building permit application stages. However, the CDR should provide the required detail sufficient for any future development of land under the proposed DC-1 Zoning District.
 - 12.24(b) and (d): The internal roads proposed for the development will be engineered and constructed to the RM of Corman Park's standards. It is understood that a 36 m right-of-way is deemed sufficient for this development. In April, 2018 a Traffic Impact Assessment (TIA) was undertaken by WSP Group (see report attached in Appendix C). It was concluded that with the background traffic growth and new trips generated by the proposed development, the Grasswood Road and Service Road intersection is expected to begin to operate under constrained conditions at 75% site development, or Year 8. Both geometric improvements (turning lanes) and intersection control improvements (signals, roundabouts, all-way stops) were considered. It was recommended that an all-way stop control be considered at this intersection for the critical and full build-out development phases. In addition, an eastbound right-turn lane with channelization should be considered at the Grasswood Road and Service Road intersection to minimize unnecessary delays. It is anticipated that the shared cost of the traffic improvements will be outlined in the Servicing Agreement at the time of subdivision. CN rail was also consulted in December, 2018 (correspondence attached in Appendix C). CN provided criteria for non-sensitive uses in proximity to a main line. The following criteria were highlighted: (1) 30 m setback of access points located near at-grade railway crossings; (2) Potential need for a 1.83 metre chain link security fencing along the mutual property line; (3) Confirmation that no adverse impacts to the existing drainage pattern on the railway right-of-way and that there will be no additional runoff to CN lands in the event of a 100-yr storm; and, (4) An adequate setback to build and maintain the structure(s) off the right-of-way (in this case, a minimum

30 m setback is recommended for any buildings on the proposed Major Land Corp commercial development property). The drainage study and associated correspondence from WSA was provided to CN Rail on January 8, 2019. Additionally, the Developer has agreed to monitor the need for a 1.83 m chain link security fence, as CN has indicated that this may not be a requirement given the rural setting in which the proposed development is situated. A follow-up phone conversation with Ms. Susanne Glenn-Rigny of CN was held on January 24, 2019. Ms. Glenn-Rigny indicated that as the development is not located in a primary main line and the list of uses within the DC1 District are considered non-sensitive uses, a 30 m setback would not be required and indicated that it is the governing municipality's right to approve any required setbacks (correspondence attached in Appendix C). Email correspondence was received confirming the above on March 11, 2019 and is also attached in Appendix C.

- 12.25: It is noted in the municipal servicing review that should a City of Saskatoon sanitary sewer trunk line be extended to Grasswood Road, the development would be able to connect to the City system (see Appendix D). Potable water can be supplied by the Dundurn Rural Water Utility until and unless the City of Saskatoon extends potable water in the immediate vicinity of the development. As such, no urban services are being proposed at this development at this time.

General Policies (Section 21):

- 21.02: It is noted in the municipal servicing review that should a City of Saskatoon sanitary sewer trunk be extended to Grasswood Road, the development would be able to connect to the City system. Potable water can be supplied by the Dundurn Rural Water Utility until and unless the City of Saskatoon extends potable water in the immediate vicinity of the development. As such, no urban services are being proposed at this development at this time.
- 21.03: The proponent will be responsible for all costs associated with providing the infrastructure and services at the proposed commercial development. At the time of subdivision, a servicing agreement between the Developer and the RM of Corman Park is expected to address, but is not necessarily limited to, the following:
 - Identify the proposed phasing, including the proposed construction timelines;
 - Identify roadway and approach specifications;
 - Identify off-site servicing fees, payable to the RM;
 - Identify the value of the required performance bond or letter of credit;
 - A total of 0.99 ha of land is proposed to be dedicated to Municipal Reserve. This meets the 5% land dedication requirement for commercial developments.

Potable Water (Section 22):

- 22.01: The Developer has received confirmation from the Dundurn Rural Water Utility (DRWU) that potable water can be supplied to the development (letter attached in Appendix E).

Wastewater (Section 23):

- 23.04: It is proposed that holding tanks be installed at each lot following subdivision to contend with wastewater management (see Municipal Servicing report attached in Appendix D). At the time of subdivision, the Saskatchewan Health Authority will review the applications for wastewater treatment at each individual lot. It is noted in the municipal servicing review that should a City of Saskatoon sanitary sewer trunk be extended to Grasswood Road, the development would be able to connect to the City system in accordance with policies established by the City.

Stormwater and Drainage (Section 24):

- 24.02: A preliminary lot grading report and plan was undertaken by Catterall & Wright which illustrates all runoff from the site into a central storm water detention pond (attached in Appendix D). The pond was sized to provide storage for the 1:100 year storm event plus 25% to ensure that the post-development runoff rate was equal to the pre-development runoff rate of 1,500 L/s. The storm water detention pond is designed to accommodate the increased runoff due to greater impermeable surface area of the development. It is noted in the report that the proposed storm water detention pond should require minimal maintenance, limited to clearing vegetation growth near the existing culvert inlet. A total volume of 12,000 m³ are required for the development, which is equivalent to approximately 890 m³ per hectare of development. This latter value can be used to ensure adequate storm water management is provided by the development in the event of a change in site layout. The proposed development was referred to the Water Security Agency in October, 2018 for review. A review of the geotechnical report was also undertaken and it was commented that the results are consistent with other reports seen in the Grasswood area undertaken in the last decade or so. It was noted that the proposed pond will need an impermeable lining to prevent infiltration into the pond. Catterall & Wright have confirmed that the drainage pond will be lined with suitable material to minimize the effects of both infiltration and exfiltration of the ground water. The geometric design of the pond side slopes was undertaken in accordance with current City of Saskatoon standards. WSA indicated that Catterall & Wright's design characteristics and techniques are acceptable for the purposes of the project's stormwater mitigation.
- 24.06: The preliminary lot grading report and plan 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 (attached in Appendix D). Catterall & Wright have confirmed that the drainage pond will be lined with suitable material to minimize the effects of both infiltration and exfiltration of the ground water. The geometric design of the pond side slopes was undertaken in accordance with current City of Saskatoon standards.
- 24.10: The preliminary lot grading report and plan undertaken by Catterall & Wright illustrates a centralized pond that was sized to provide storage for the 1:100 year storm event plus 25% to ensure that the post-development runoff rate will equal the pre-development runoff rate of 1,500 L/s. WSA indicated that Catterall & Wright's design

characteristics and techniques are acceptable for the purposes of the project's stormwater mitigation.

Transportation (Section 25):

- 25.03: The proposed development has been designed to meet all municipal and provincial regulations respecting access to and from provincial highways and municipal roads.
- 25.04: The proposed commercial development is located immediately south of Grasswood Road and immediately east of an existing Service Road, both of which are municipally maintained roadways.
- 25.06: The proposed access points to the development were designed to ensure safe access and egress. The eastern access point along Grasswood Road has been aligned immediately to the south of the existing access point on the north side of Grasswood Road to the Canlan Jemini Arena. The west access point to the development is located approximately 85 m west of the Jemini west access, which is considered an acceptable distance. Other recommendations that were provided as a part of the Traffic Impact Assessment were to consider providing an all-way stop control at the Grasswood Road and Service Road intersection for critical and full build-out development phases. Additionally, consideration of an eastbound right-turn lane with channelization at the Grasswood Road and Service Road intersection to minimize unnecessary delays at 75% of full buildout. Lastly, spacing between the rail line and development entrance of at least 30 m was recommended. This was undertaken as part of the design of the development (see TIA attached in Appendix C). No comments were received from Canlan Jemini arena, despite a follow-up email and phone message on December 21, 2018 (correspondence attached in Appendix I).
- 25.06: Additional correspondence between MHI and Major Land Corporation was received as a part of the development with respect to a parcel tie-code removal application filed in 2017 between Surface Parcel 117770621 and Surface Parcel No. 117961993 for the purpose of creating separate titles for the severed parcels (also attached in Appendix C). It was recommended that application to remove the parcel tie codes be approved subject to a number of conditions. One of the conditions applies to a development restriction within a triangle formed 130m along intersecting grid roads. As such, a 0.64 ac cut-off is illustrated on the site plan, at the corner of Grasswood Road and Service Road, as a result of this requirement (see site plan attached in Appendix A).
- 25.08: With respect to the recommended eastbound right-turn lane at the Grasswood Road and Service Road intersection, it is anticipated that the shared cost of the traffic improvements will be outlined in the Servicing Agreement at the time of subdivision.
- 25.16: The Traffic Impact Assessment undertaken by WSP indicated that the 2017 Transport Canada Grade Crossing Inventory indicated that there are no trains going through the grade crossing. As such, no upgrades or modifications are required at the existing crossing. However, while the inventory listed zero trains per day at the existing crossing, it was recommended that any new access points constructed adjacent to the

railway crossing be compliant with the Grade Crossing Standards and Regulations of minimum 30 m spacing between the existing rail and new intersection. The proposed west access at the development is more than 30 m away from the rail crossing, meeting the Transport Canada minimum requirement (see TIA attached in Appendix C). CN rail was also consulted in December, 2018 (correspondence attached in Appendix C). CN provided criteria for non-sensitive uses in proximity to a main line. The following criteria were highlighted: (1) 30 m setback of access points located near at-grade railway crossings; (2) Potential need for a 1.83 metre chain link security fencing along the mutual property line; (3) Confirmation that no adverse impacts to the existing drainage pattern on the railway right-of-way and that there will be no additional runoff to CN lands in the event of a 100-yr storm; and, (4) An adequate setback to build and maintain the structure(s) off the right-of-way (in this case, a minimum 30 m setback is recommended for any buildings on the proposed Major Land Corp commercial development property). The drainage study and associated correspondence from WSA was provided to CN Rail on January 8, 2019. Additionally, the Developer has agreed to monitor the need for a 1.83 m chain link security fence, as CN has indicated that this may not be a requirement given the rural setting in which the proposed development is situated. A follow-up phone conversation with Ms. Susanne Glenn-Rigny of CN was held on January 24, 2019. Ms. Glenn-Rigny indicated that as the development is not located in a primary main line and the list of uses within the DC1 District are considered non-sensitive uses, a 30 m setback would not be required and indicated that it is the governing municipality's right to approve any required setbacks. Written correspondence identifying the above was received March 11, 2019 and is also attached in Appendix C.

Servicing Agreements (Section 27):

- 27.01: At the time of subdivision, a servicing agreement between the Developer and the RM of Corman Park is expected to address, but is not necessarily limited to, the following:
 - Identify the proposed phasing, including the proposed construction timelines;
 - Identify roadway and approach specifications;
 - Identify off-site servicing fees, payable to the RM;
 - Identify the value of the required performance bond or letter of credit;
 - A total of 0.99 ha of land is proposed to be dedicated to Municipal Reserve. This meets the 5% land dedication requirement for commercial developments.

Implementation (Section 30):

- 30.15: This document shall serve as the Comprehensive Development Review required for the rezoning application from DAG-1 – D-Agricultural 1 District to DC-1 – D-Arterial Commercial 1 District submitted in conjunction with this document. The purpose of the rezoning is to provide for opportunities to develop commercial uses, as provided in the DC-1 Zoning District.
- 30.16: This CDR addresses all matters of land use integration, servicing requirements, and public consultation that was undertaken as a part of the rezoning request.

- 30.17: This CDR outlines the geographic area and extent of analysis considered with respect to the rezoning from DAG-1 – D-Agricultural 1 District to DC-1 – D-Arterial Commercial 1 District. Land uses within one mile were mapped utilizing a mobile GPS unit. In order to identify and address public concerns and prevent conflict, the Developer prepared a letter that was distributed to neighbours within one mile of the development parcel (attached in Appendix I). The letter provided information as to the parcel location, including a location map and proposed land use application. The letter also detailed the results of the engineering studies and provided information concerning how potable water was to be provided to the site, as well as information concerning wastewater management, traffic implications, and stormwater management provisions. A total of 23 letters were distributed and no responses were received from neighbours. One letter was received by the English River First Nation (ERFN) citing concerns over the conclusions provided in the Traffic Impact Assessment, as well as the concern over the increase in stormwater runoff and the effect on the ERFN property. These concerns and subsequent responses are addressed in Section 7 of this report. The RM requested that additional targeted consultation be undertaken with Canlan Jemini arena. A second letter was sent to the facility and a follow-up phone call was placed on December 21, 2018 (correspondence attached in Appendix I). No feedback was received following these attempts at further consultation.
- 30.18: The Developer is proposing to handle wastewater at each individual lot through a holding tank. Potable water will be supplied by the Dundurn Rural Water Utility (confirmation letter attached in Appendix E). Other utilities will be provided to each individual lot, and it will be up to the respective lot owners to contact SaskEnergy, SaskPower and SaskTel to apply for these services.
- 30.20: The Developer wishes to rezone the land to D-C1 – D-Arterial Commercial 1 District for the purpose of developing up to 54 commercial lots. The uses provided in the DC-1 District are consistent with the Future Urban Commercial/Industrial designation provided on the Regional Land Use Map.

5.3 CORMAN PARK SASKATOON PLANNING DISTRICT ZONING BYLAW

The proposed development would require rezoning from DAG-1 – D-Agricultural 1 District to DC-1 – D-Arterial Commercial 1 District.

It is noted that the site plan presented in the report is a most liberal arrangement in terms of site density based on the site development standards in the DC-1 Zoning District. The Developer proactively requested this approach be undertaken in the CDR to allow flexibility for the development at full build out. A total of 54 lots are proposed at the development, but it is anticipated that the actual number of lots will be determined, based on market demand.

The following table provides a summary of the site development standards as outlined in the Corman Park-Saskatoon Planning District Zoning Bylaw, as well as the standards proposed for the Major Land Corporation commercial development.

**Table 1-1
Comparative Site Development Standards in D-C1 Zoning District**

Site Development Standards	Corman Park-Saskatoon Planning District Zoning Bylaw (D-C1)	Proposed Major Land Corporation Commercial Development
Total Site Area	No maximum	48.85 acres / 19.77 ha
Minimum Lot Size	0.2 ha (0.5 acres)	0.52 acres / 0.21 ha
Maximum Site Area	None	1.25 acres / 0.51 ha
Minimum Frontage	30 m	30 m
Total Area of Municipal Reserve	Either 5% or Cash-in-Lieu	0.99 ha (5% of total land base)

It is anticipated that each individual lot owner will be required to submit a landscaping plan prior to the issuance of a development permit for either a permitted or discretionary use in the D-C1 Zoning District.

Any required parking and loading requirements, accessory buildings, as well as proposed outside storage areas for the storage and display of finished goods, will also be identified at the time of the development permit application.

6 STAGING AND IMPLEMENTATION

A Proposed Site Plan, attached as Appendix A details the extent of the maximum number of lots (54) at the proposed Major Land Corporation Commercial Development location. It is anticipated that this development will be subdivided and built out in as a response to market demand. It is noted that Major Land Corporation will be leading the future subdivision of this parcel of land. The proposed pond and road will be developed according to the build out of 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, that require consideration should this proposed development be built out at the highest density as per the provisions in the DC-1 Zoning District within the Corman Park-Saskatoon Planning District Zoning Bylaw.

This subdivision will need to be approved by the Community Planning Branch at the Ministry of Government Relations.

7 PUBLIC CONSULTATION

On May 30, 2018 the RM distributed 23 letters to neighbours within one mile of the proposed development and provided information concerning the rezoning application. The letter is attached in Appendix I.

The letter provided information as to the parcel location, surrounding roads and land uses, and also provided additional detailed information concerning the technical aspects of the development including proposed wastewater treatment, potable water, anticipated traffic volumes and potential need for road improvements, and details pertaining to stormwater management.

Residents, businesses and landowners who were issued the letter were invited to access the technical reports online, and were provided the opportunity to ask questions or give feedback by phone or email.

One letter was received from the English River First Nation (ERFN), also attached in Appendix I, with feedback concerning the proposed development. The letter identifies the following concerns with the proposed development:

- Lack of consideration within the TIA of traffic generated from existing ERFN development;
- Lack of forecasted traffic volumes associated with the buildout of future development on the ERFN;
- Lack of forecasted truck volumes associated with the proposed commercial development;
- No consideration on the effect of the intersection of Highway 11 from the proposed development;
- Drainage concerns, particularly the existing drainage concerns on the ERFN property and the lack of consideration of existing storm water issues on this land; and,
- Concern over the proposed development contributing additional stormwater on the ERFN lands.

With respect to the comments received concerning drainage, it is noted that the stormwater management plan prepared by Catterall & Wright the drainage plan was undertaken so that the development can accommodate a 1:100 year flood event +25% on site. It is further noted that the ERFN property may not currently have a proper stormwater outlet, whereas the subject site of the proposed commercial development does. Lastly, while the volume of runoff will increase as a result of the proposed commercial development, the post-development runoff rates will not exceed the pre-development runoff rates as required by the RM's storm water management guidelines. The stormwater management plan was sent to the WSA for review and WSA indicated that Catterall & Wright's design characteristics and techniques are acceptable for the purposes of the project's stormwater mitigation.

With respect to the comments received by the ERFN identifying concerns with the TIA that was undertaken by WSP, the following points of clarification are made:

- The TIA takes into account existing development and also applied growth factors of 1.8 and 1.5, respectively which would account for significant growth in the immediate area.

These growth factors were added to the anticipated traffic volumes for the future Major Land Corp. commercial development.

- With respect to the comment about future development on the ERFN, WSP contacted the RM to inquire as to whether the RM was aware of any developments in the vicinity of the proposed Major Land Corp. commercial development, and the RM indicated that there were no proposed developments on the immediate horizon of which they were aware.
- With respect to the comment regarding the lack of forecasted truck traffic, it is noted that truck traffic is a part of the trip generation model as a part of the existing composition of total traffic. It is not industry standard to differentiate truck traffic from other traffic, unless the proposed use is a truck stop or other heavy industrial use associated with higher volumes of heavy truck traffic. It is further noted that the proposed zoning district for this development is D-Arterial Commercial 1 District (DC1) which would facilitate a diverse range of commercial activities serving the traveling public and local populations.
- With respect to the comment on the effect of the intersection at Highway 11 and Grasswood Road, neither the Ministry of Highways and Infrastructure nor the RM of Corman Park identified this as part of the scope of the TIA. Furthermore, the Ministry indicated that they do not have any further concerns with the content or recommendations presented in the TIA. The MHI will be provided a second opportunity to review and comment on the TIA at the time a subdivision application is made with the Community Planning Branch at the Ministry of Government Relations.

A response letter was sent to the English River First Nation on January 24, 2019 (also attached in Appendix I).

CN rail was also consulted in December, 2018 (correspondence attached in Appendix C). CN provided criteria for non-sensitive uses in proximity to a main line. The following criteria were highlighted: (1) 30 m setback of access points located near at-grade railway crossings; (2) Potential need for a 1.83 metre chain link security fencing along the mutual property line; (3) Confirmation that no adverse impacts to the existing drainage pattern on the railway right-of-way and that there will be no additional runoff to CN lands in the event of a 100-yr storm; and, (4) An adequate setback to build and maintain the structure(s) off the right-of-way (in this case, a minimum 30 m setback is recommended for any buildings on the proposed Major Land Corp commercial development property). The drainage study and associated correspondence from WSA was provided to CN Rail on January 8, 2019. Additionally, the Developer has agreed to monitor the need for a 1.83 m chain link security fence, as CN has indicated that this may not be a requirement given the rural setting in which the proposed development is situated. A follow-up phone conversation with Ms. Susanne Glenn-Rigny of CN was held on January 24, 2019. Ms. Glenn-Rigny indicated that as the development is not located in a primary main line and the list of uses within the DC1 District are considered non-sensitive uses, a 30 m setback would not be required and indicated that it is the governing municipality's right to approve any required setbacks. Lastly, Ms. Glenn-Rigny indicated that the intent of the suggested setbacks is to confirm that a developer can reasonably construct and maintain a building without having to access the CN right-of-way. Written correspondence confirming the above was received on March 11, 2019 and is also attached in Appendix C of the CDR.

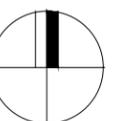
The RM requested that additional targeted consultation be undertaken with Canlan Jemini arena. A second letter was sent to the facility and a follow-up phone call was placed on December 21, 2018. No feedback was received following these attempts at further consultation.

APPENDICES

APPENDIX A
DEVELOPMENT CONCEPT PLAN



MAJOR LAND CORP. DEVELOPMENT
 PROPOSED SITE PLAN



APPENDIX B

CORRESPONDENCE WITH THE RM OF
CORMAN PARK

Maggie Schwab

From: Cory Boudreau <cboudreau@rmcormanpark.ca>
Sent: Friday, March 9, 2018 3:50 PM
To: Maggie Schwab
Subject: RE: Land Development - NE-35-35-5 W3M

There doesn't appear to be any that would cause conflict.

Important to note:

Proximity to the railway

Proximity to Multi-parcel development to the south

Possible Saskatoon Freeway Alignment – as MHI has not officially approved a single route.

Hope that helps!

Regards,

Cory Boudreau, B.A

Planner I,

R.M. of Corman Park 344

111 Pinehouse Drive, Saskatoon, SK. S7K 5W1

Ph: (306)975-1665 Fax: (306)242-6965



Please consider the environment before printing this e-mail

From: Maggie Schwab [mailto:mschwab@crosbyhanna.ca]
Sent: Friday, March 09, 2018 3:33 PM
To: Cory Boudreau <cboudreau@rmcormanpark.ca>
Subject: RE: Land Development - NE-35-35-5 W3M

OK. Thanks Cory; we are aware of the land use designation in the P4G Plan that supports the development.

How about any separation distances we should note in the CDR within the existing Planning District?

Maggie Schwab

CROSBY HANNA & ASSOCIATES

407C 1st Ave N, Saskatoon, SK S7K 1X5

306.665.3441 | www.crosbyhanna.ca

From: Cory Boudreau [mailto:cboudreau@rmcormanpark.ca]
Sent: Friday, March 9, 2018 3:31 PM
To: Maggie Schwab <mschwab@crosbyhanna.ca>
Subject: RE: Land Development - NE-35-35-5 W3M

Hi Maggie,

Unfortunately I am not familiar enough with the P4G plan and implementation at this time to provide a comprehensive overview.

As per the land use map it appears to be an appropriate use.

I would encourage you to review the draft documents found on the P4G website.

<http://partnershipforgrowth.ca/regional-plan/>

Cory Boudreau, B.A

Planner I,

R.M. of Corman Park 344

111 Pinehouse Drive, Saskatoon, SK. S7K 5W1

Ph: (306)975-1665 Fax: (306)242-6965



Please consider the environment before printing this e-mail

From: Maggie Schwab [<mailto:mschwab@crosbyhanna.ca>]

Sent: Friday, March 09, 2018 2:29 PM

To: Cory Boudreau <cboudreau@rmcormanpark.ca>

Subject: Land Development - NE-35-35-5 W3M

Hi Cory,

We've been retained by a Developer to undertake a CDR for an arterial commercial development in the NE ¼, Section 35, Township 35, Range 5, W3M. I've attached a photo of the parcel for your convenience.

Are there any potential land use conflicts within the prescribed separation distances as indicated in the P4G Regional Plan?

Thanks,
Maggie

Maggie Schwab M.A.

CROSBY HANNA & ASSOCIATES

407C 1st Ave N

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APPENDIX C

TRAFFIC IMPACT ASSESSMENT AND CORRESPONDENCE



2018-06-20

Confidential

Brett LaRoche, P.Eng.
Principal
Catterall & Wright | Consulting Engineers
1221 8th Street East, Saskatoon
S7H 0S5, SK

Dear Brett,

**RE: Grasswood Commercial Development in the NE-35-35-5 W3M on Grasswood Road
Traffic Impact Assessment**

WSP Canada Group limited (WSP) is pleased to provide the following letter report outlining the results for the Traffic Impact Assessment (TIA) completed for the proposed development located in the NE-35-35-5 W3M, just south of Saskatoon city limit. The purpose of the TIA is to determine the impacts of the traffic generated by the development on the adjacent road network, identify potential conflicts, and discuss mitigation measures to safely and effectively accommodate the development.

1 PROPOSED DEVELOPMENT

The proposed development will be located in the southwest quadrant of the Grasswood Road and Service Road intersection, immediately south of the Canlan Ice Sports (Jemini rink). There are two existing intersections included in the study that will be used by site traffic:

- Grasswood Road and Service Road; and,
- Floral Road and Service Road.

Figure 1 illustrates the location of the proposed site. The proposed development will consist of 51 to 54 commercial lots. The maximum number of lots (i.e. 54 lots) was assumed for a conservative estimate within the TIA. Two new accesses are proposed along Grasswood Road, as outlined below:

- Access 1 (east access) is approximately 40m west of the Jemini east access; and,
- Access 2 (west access) is approximately 85m west of the Jemini west access.

The development was assumed to be completed in 10 years at the following rates:

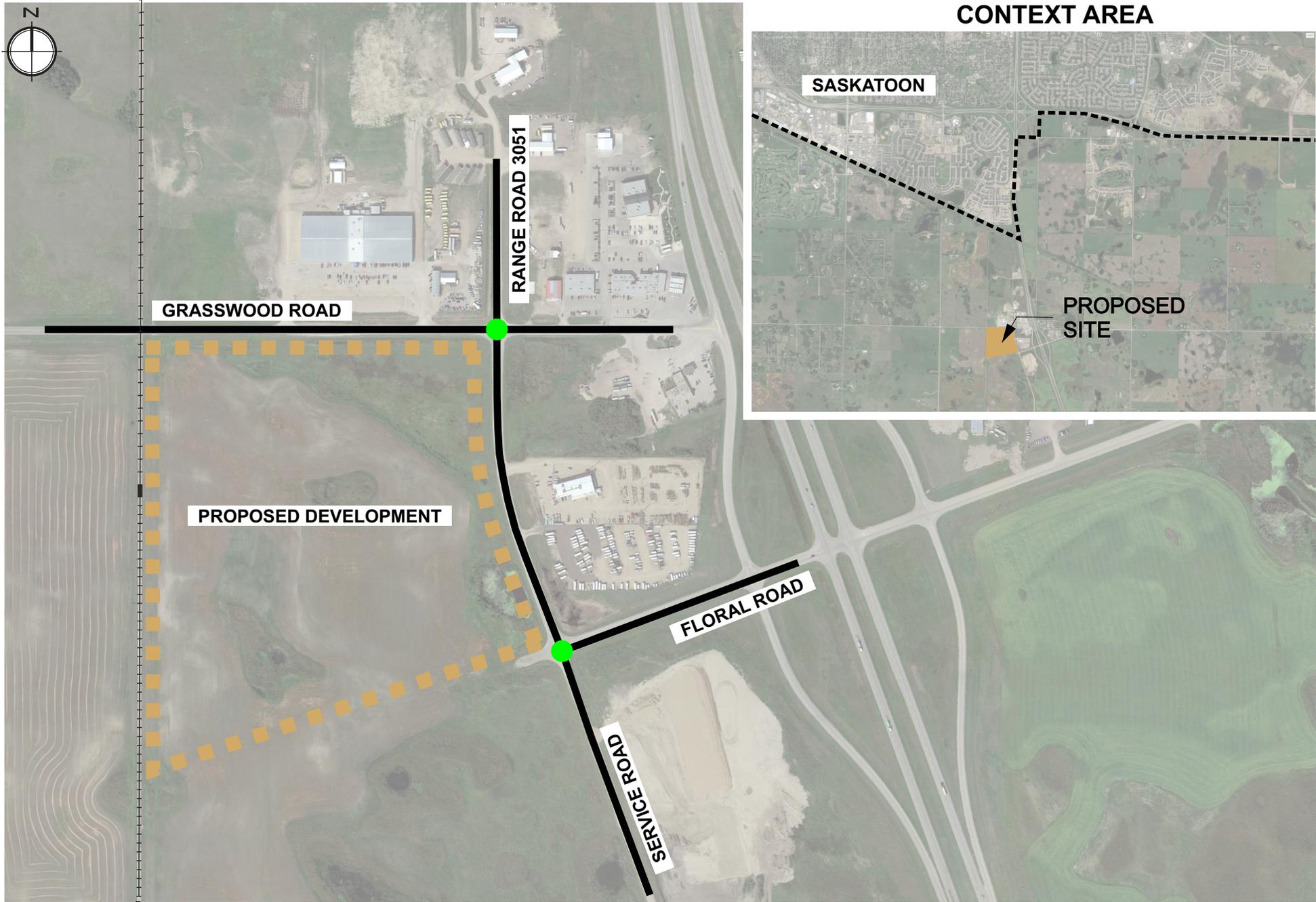
- 2020 Horizon: 0% development; and,
- An average of 25% development every two years after.

Capacity analyses were conducted for the following study horizons:

- Full Development Build-Out Phase; and,
- Critical Development Phase to determine the threshold where intersection upgrades will be required.

DRAWING: - Site Plan.cdr DATE: 2018-01-26 DRAWN BY: thala

NOTE: These design documents are prepared solely for the use by the party with whom the design professional has entered into a contract and there are no representations of any kind made by the design professional to any party with whom the design



LEGEND:

- Study Intersections
- Proposed Site
- CN Rail Line



203 Wellman Crescent
 Saskatoon, SK
 S7T 0J1
 tel: 306.665.6223
 fax: 306.665.8589

Issue Date - 2018-01-26
 Scale: 1:6715
 Aerial Imagery:
 Note: All Dimensions shown in
 Metres unless otherwise noted

FIGURE 1 | SITE PLAN AND STUDY INTERSECTIONS

GRASSWOOD COMMERCIAL DEVELOPMENT TIA



2 BACKGROUND INFORMATION

WSP and Crosby Hanna & Associates met with the Ministry of Highways and Infrastructure (Ministry) on January 16, 2018 to discuss the scope and identify any initial concerns the Ministry may have with the site. The Ministry identified an interest in the operations of the intersections identified above. A controlled circle was identified within the 36-35-5 W3M for a potential interchange, outside of the proposed development study area.

WSP also contacted the RM of Corman Park (RM) to discuss any initial concerns the RM may have with the site. The RM identified concerns regarding the existing drainage issues on Grasswood Road; thus, accesses onto the site along Grasswood Road may not be a preferred option.

There is a CN rail line immediately to the west of the proposed site. Due to the proximity of the railway crossing, potential conflicts as well as recommendations for minimum spacing between the crossing and intersection / access have been documented within the TIA.

3 EXISTING CONDITIONS

3.1 EXISTING ROAD NETWORK

The existing Grasswood Road and Service Road intersection is a two-way stop-controlled four-leg intersection with Grasswood Road operating free-flow. Grasswood Road and Service Road (south leg) are two-way undivided paved roadways while the north leg is a gravel section. Grasswood Road is posted at 80 km/h while Service Road posted at 60 km/h. There are street lights at the intersection.

The existing Floral Road and Service Road intersection is a stop-controlled T-intersection. Floral Road is the east link operating free-flow while Service Road is the north-south link with stop-control. Floral Road and Service Road (north leg) are two-way undivided paved roadways while the south leg is a gravel road. The southern portion of Service Road is posted at 80km/h and Floral Road was assumed to be 80 km/h. There are street lights at the intersection.

3.2 EXISTING TRAFFIC VOLUMES

Turning movement counts (TMC) were conducted the week of January 21, 2018 at the Grasswood Road and Service Road intersection as well as the Floral Road and Service Road intersection. The volumes were collected during the morning (7:00 a.m. to 9:00 a.m.) and afternoon (4:00 p.m. to 6:00 p.m.) peak periods to capture commuter traffic.

The morning peak hour occurred between 7:30 a.m. and 8:30 a.m. for both study intersections while the afternoon peak hour occurred between 4:30 p.m. and 5:30 p.m. for the Grasswood Road intersection and between 5:00 p.m. and 6:00 p.m. for the Floral Road intersection. Volume discrepancies on the Service Road between the Grasswood Road intersection and the Floral Road intersection were due to the driveway accesses to Agra Foundations Limited, and were not balanced in this study.

Figure 2 illustrates the existing morning and afternoon peak hour traffic volumes.

3.3 BACKGROUND FORECAST VOLUMES

The background forecast scenario is a projection of the traffic volumes anticipated without the demand of the proposed development. This analysis was conducted to determine how the network will operate in the future horizon without the proposed development, and is compared to operations with site development. The 15-year growth factors, provided by the Ministry, are 1.80 for Grasswood Road and 1.50 for both Floral Road and Service Road. **Figure 3** illustrates the 10-year (full build-out) background forecast traffic volumes during the morning and afternoon peak hour.



LEGEND:

AM / PM Peak Hour Volumes
(rounded to nearest 5)



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Figure 2 | EXISTING MORNING AND AFTERNOON PEAK HOUR VOLUMES

GRASSWOOD COMMERCIAL DEVELOPMENT TIA



LEGEND:

AM / PM Peak Hour Volumes
(rounded to nearest 5)



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**Figure 3 | 10-YR BACKGROUND FORECAST
AM AND PM PEAK HOUR VOLUMES**

GRASSWOOD COMMERCIAL DEVELOPMENT TIA



4 TRAFFIC OPERATIONS WITHOUT SITE TRAFFIC

Existing and background forecast volumes have been assessed using Synchro 9.0 (industry standard traffic analysis software). Capacity analysis for future horizons with site development traffic is presented in Section 6. The intersections were assessed during the morning and afternoon peak hours with no additional turning lanes or changes applied. **Tables 1 and 2** present the analysis results for existing and 10-year background forecast scenarios for the morning and afternoon peak hours, respectively.

Level of service (LOS) analysis assesses the effectiveness of a transportation system alphabetically from A to F, with LOS A equating to the best operating conditions and LOS F representing the failure of a movement or intersection. A detailed description of the level of service is attached in **Appendix A**.

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

Table 1 | LOS Results for Existing and 10-Year Background – Morning Peak Hour

		EASTBOUND			WESTBOUND			NORTHBOUND			SOUTHBOUND		
		LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Grasswood Road and Service Road													
Existing	V/C Ratio	0			0			0.05			0		
	95th Queue (m)	1			2			12			3		
	LOS	A			A			A			B		
Background (10YR)	V/C Ratio	0			0.01			0.08			0.01		
	95th Queue	2			4			12			6		
	LOS	A			A			B			B		
Floral Road and Service Road													
Existing	V/C Ratio				0			0.01			0.08		
	95th Queue (m)	-			0			-			11		
	LOS				A			A			A		
Background (10YR)	V/C Ratio				0			0.03			0.11		
	95th Queue (m)	-			0			-			14		
	LOS				A			A			A		

Table 2 | LOS Results for Existing and 10-Year Background – Afternoon Peak Hour

		EASTBOUND			WESTBOUND			NORTHBOUND			SOUTHBOUND		
		LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Grasswood Road and Service Road													
Existing	V/C Ratio	0			0.01			0.1			0		
	95th Queue (m)	0			3			13			3		
	LOS	A			A			B			A		
Background (10YR)	V/C Ratio	0			0.02			0.19			0.01		
	95th Queue	1			8			16			6		
	LOS	A			A			B			B		
Floral Road and Service Road													
Existing	V/C Ratio				0			0			0.15		
	95th Queue (m)	-			0			-			6		
	LOS				A			A			A		
Background (10YR)	V/C Ratio				0.01			0.02			0.22		
	95th Queue (m)	-			0			-			12		
	LOS				A			A			B		



Grasswood Road and Service Road Intersection | overall intersection operates with minimal delays and queue lengths during the morning and afternoon peak hours for existing conditions and is expected to continue to operate acceptably during both peak hours for the background forecast scenarios.

Floral Road and Service Road Intersection | overall intersection operates at acceptable conditions during the morning and afternoon peak hours for the existing conditions and is expected to continue to operate acceptably during both peaks for the background forecast scenarios.

5 TRIP GENERATION

New trips generated by the proposed development were established using the Institute of Transportation Engineers (ITE) Trip Generation Manual, 9th Edition (Manual). It was identified that the proposed development is located in a commercial zoned subdivision, based on the RM of Corman Park Future Land Use Map.¹

Based on the permitted and discretionary uses for D-Arterial Commercial 1 District (DC1), WSP reviewed Trip Generation land uses that best fitted potential development uses including Business Park (ITE Land Use 770), Office Park (ITE Land Use 750), Industrial Park (ITE Land Use 130), Shopping Center (ITE Land Use 820). It was identified that the Shopping Center uses generate the highest weekday daily volumes, and was used for conservative estimates.

As such, trip generation for the proposed development was estimated using the Shopping Center (ITE Land Use 820) where ITE defines this type of land use as an integrated group of commercial establishments that is planned, developed, owned and managed as a unit. Some centers contain non-merchandising facilities, such as office buildings, restaurants, post offices, banks. Since the Gross Floor Area (GFA) was not determined, it was assumed to be 20% of the lot size. New trips were estimated based on the Gross Leasable Area (GLA), which is typically 80% of the GFA.

It was identified that a maximum of 14 septic trucks per week is anticipated at full build-out phase to service the development. As such, an average of two trucks per day was assumed during the afternoon peak hour at full site development.

For mixed use development, it is likely that some trips to the site will be multi-use trips. ITE suggests up to 31% internal capture rate between office and commercial uses during the afternoon peak hour. No internal capture rate was provided for the morning peak hour. Since the proposed development is located in a rural environment, a 10% overall reduction was applied to the total trips generated rather than the 31% suggested by ITE.

Pass-by trips are made by vehicles already using the adjacent roadway and entering the site as an intermediate stop on the way to another destination. These trips may not be directly generated by the proposed land use. Although there is a reduction in the total number of new trips on the adjacent network, pass-by trips are still included in the total number of vehicles entering or exiting the site. For this type of land use, ITE suggests a 34% pass-by rate. The majority of the pass-by trips are expected to be Highway 11 traffic, which in turn will be additional traffic volumes on the study corridors. As such, a 10% pass-by rate was applied, assuming traffic already utilizing Grasswood Road and Service Road corridors.

Table 3 presents the trip generation for the proposed site for the morning and afternoon peak hour.

¹ RM of Corman Park, *Corman Park – Saskatoon Planning District Official Community Plan* (October 2017), Appendix B.



Table 3 | Trip Generation (rounded to nearest 5)

Land Use	ITE Code	Unit	Size	Morning Peak Hour			Afternoon Peak Hour		
				Enter	Exit	Total	Enter	Exit	Total
Commercial	820	GLA (1000 SF)	225.5	160	95	255	495	540	1035
<i>Internal Capture:</i>				0	0	0	50	55	100
<i>Pass-by Trips:</i>				15	15	30	50	50	100
<i>New Trips Added to Adjacent Network :</i>				145	80	225	395	435	830
<i>Assumptions:</i>									
<i>Gross Floor Area (GFA) was assumed to be 20% of total lot size.</i>									
<i>Gross Leasable Area (GLA) was assumed to be 80% of GFA.</i>									
<i>A 10% synergy was applied to the trips generated by commercial development.</i>									
<i>A 10% pass-by was applied to the trips generated by commercial development.</i>									
<i>An average of two septic trucks per day during the afternoon peak hour.</i>									

5.1 TRIP DISTRIBUTION AND ASSIGNMENT

The anticipated site-generated traffic volumes were applied to the network based on an assessment of how employees and / or customers would enter the site. The new traffic volumes (new and pass-by trips) were distributed through the road network using a comparison of the anticipated traffic patterns and adjacent uses. The assignment of new trips reflects vehicles entering the site using the nearest access and exiting via the most convenient access to return to the travel route.

As indicated above, all (new and pass-by) trips utilizing Highway 11 were considered as new trips added to the study network. As such, pass-by trips for Highway 11 were assumed to be zero while the majority of the pass-by trips were assumed to use Grasswood Road. Based on the existing and future forecast traffic volumes, it is anticipated that there will be minimal trips originated from Service Road. As such, no new trips were assumed to originate from Service Road.

Table 4 presents the distribution for the new and pass-by trips for the both peak hours.

Table 4 | Trip Distribution

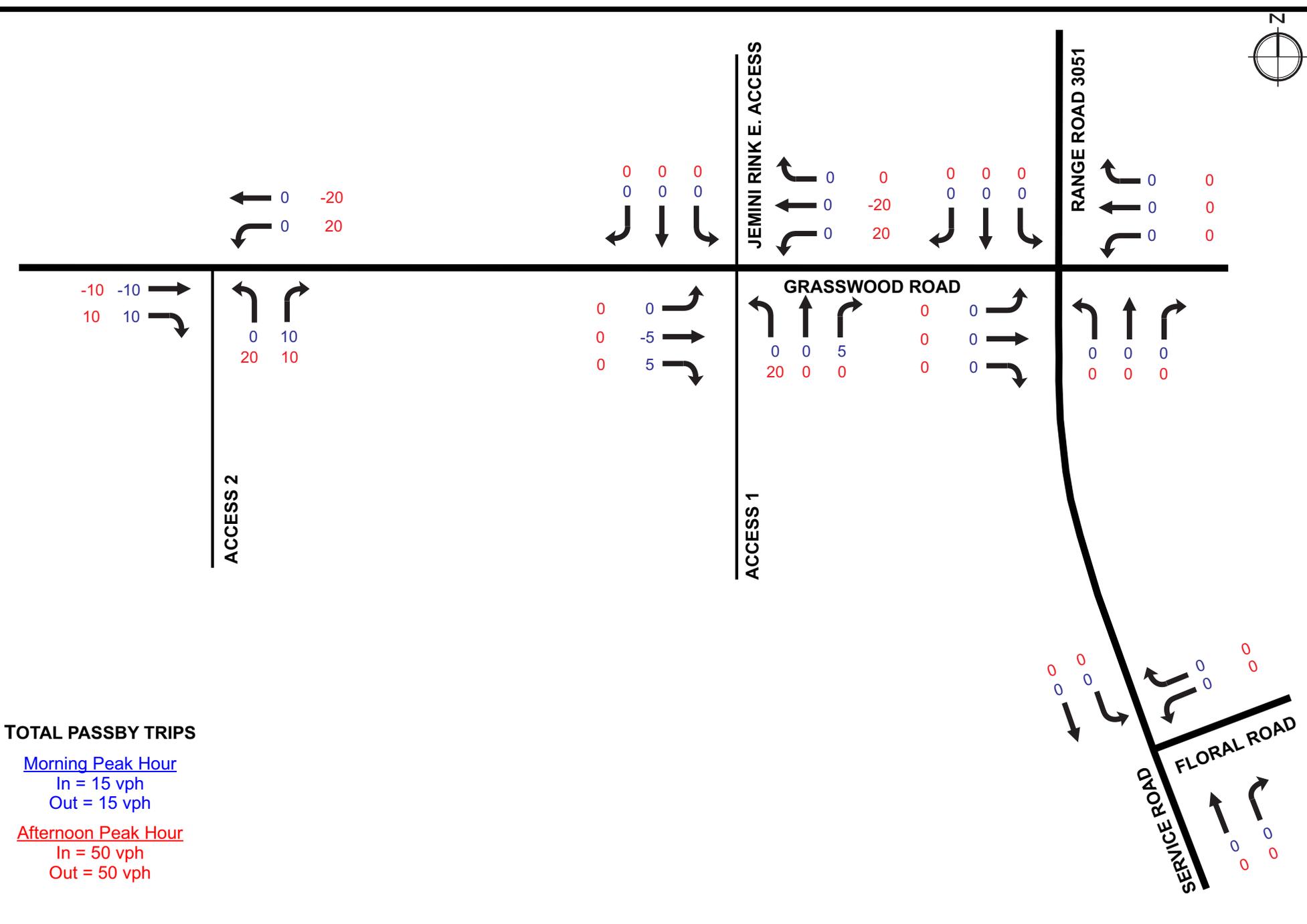
DIRECTION (TO / FROM)	ROADWAY	NEW TRIPS	PASS-BY TRIPS
North	Highway 11	35%	0%
South	Highway 11	35%	0%
	Service Road	0%	0%
East	Floral Road	5%	0%
West	Grasswood Road	25%	100%
Total:		100%	100%

Figures 4 and 5 illustrate the pass-by trips and new trips (full build-out) for the morning and afternoon peak hours at full build-out phase, respectively.

5.2 TOTAL FORECAST VOLUMES

The total forecast volumes associated with the development are obtained by combining the background growth volumes with the new and pass-by trips associated with the development. The morning and afternoon peak hour total forecast volumes for the full build-out phase are provided in **Figure 6**.

DRAWING: Passby Trips.cdr DATE: 2018-04-18 DRAWN BY: thala
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TOTAL PASSBY TRIPS

Morning Peak Hour
 In = 15 vph
 Out = 15 vph

Afternoon Peak Hour
 In = 50 vph
 Out = 50 vph

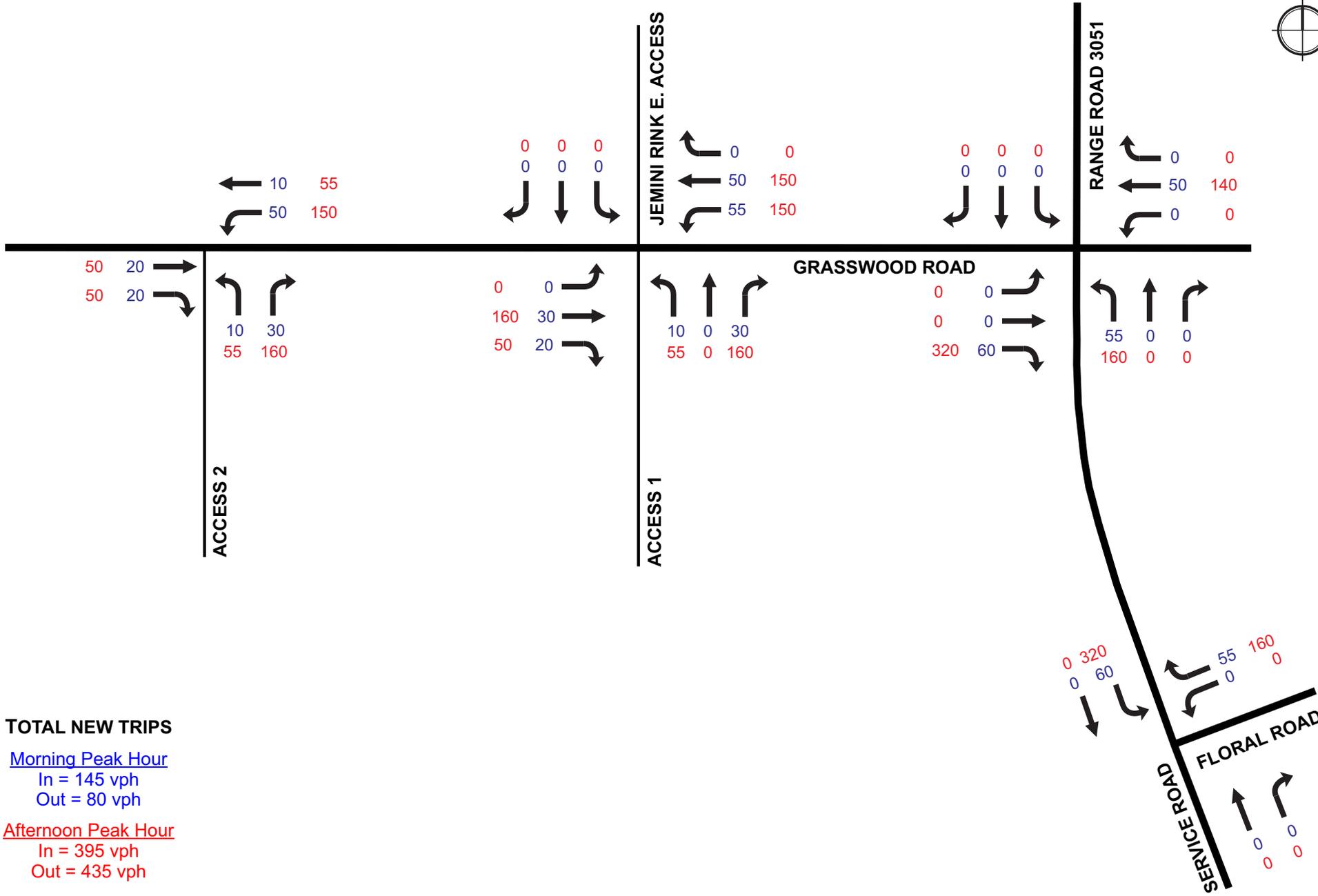
LEGEND:

AM / PM Peak Hour Volumes
 (rounded to nearest 5)

	203 Wellman Crescent Saskatoon, SK S7T 0J1 tel: 306.665.6223 fax: 306.665.8589	Issue Date - 2018-04-18 Scale: Aerial Imagery: Note: All Dimensions shown in Metres unless otherwise noted	FIGURE 4 TOTAL PASS-BY TRIPS - FULL BUILD-OUT PHASE GRASSWOOD COMMERCIAL DEVELOPMENT TIA
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NOTE: These design documents are prepared solely for the use by the party with whom the design professional has entered into a contract and there are no representations of any kind made by the design professional to any party with whom the design

DRAWING: New Trips.cdr DATE: 2018-04-18 DRAWN BY: thaita



TOTAL NEW TRIPS

Morning Peak Hour

In = 145 vph
Out = 80 vph

Afternoon Peak Hour

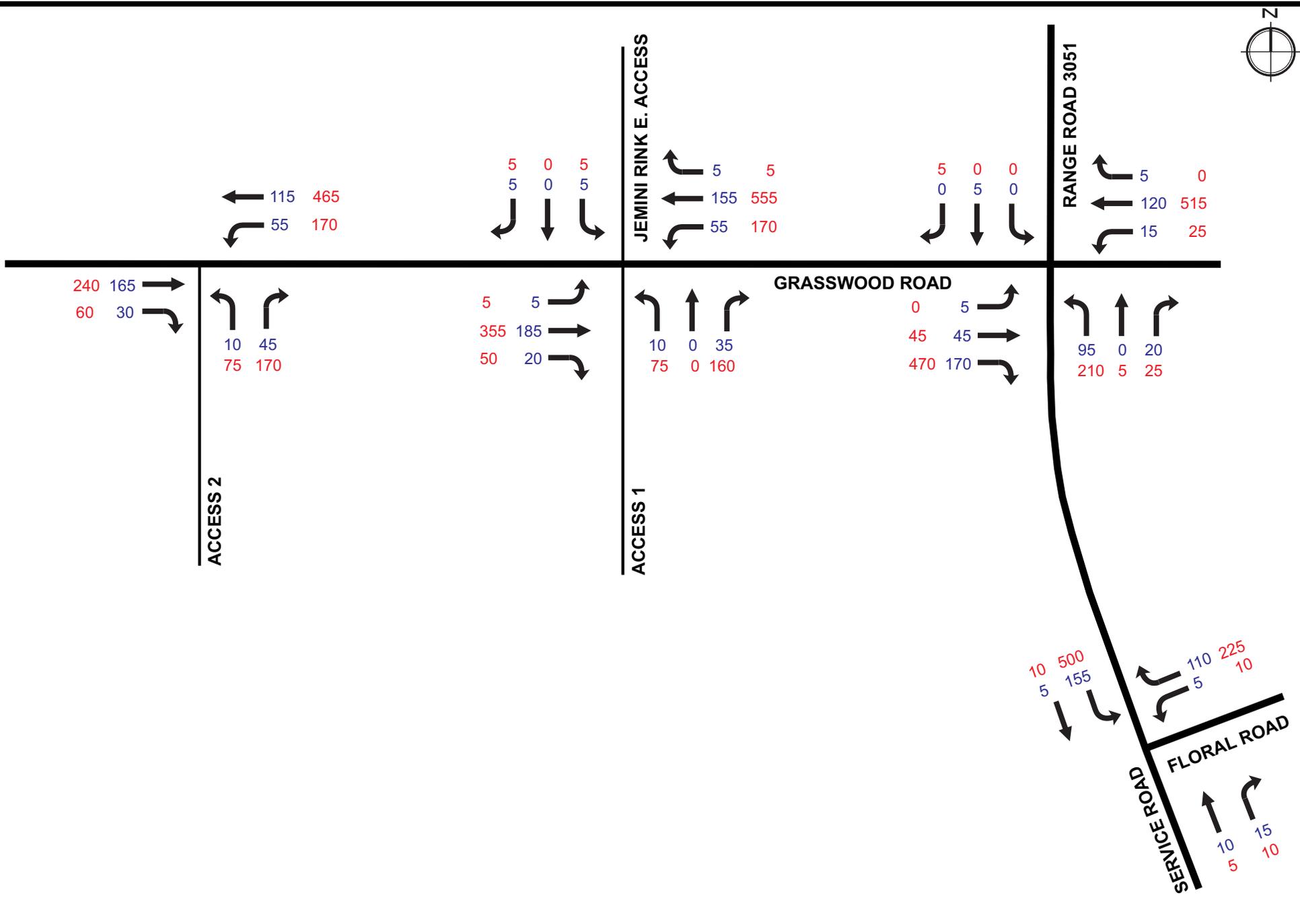
In = 395 vph
Out = 435 vph

LEGEND:

AM / PM Peak Hour Volumes
(rounded to nearest 5)

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DRAWING: Total Forecast.cdr DATE: 2018-04-18 DRAWN BY: thraia
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LEGEND:
 AM / PM Peak Hour Volumes
 (rounded to nearest 5)

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FIGURE 6 | TOTAL FORECAST SCENARIOS - FULL BUILD-OUT PHASE
 GRASSWOOD COMMERCIAL DEVELOPMENT TIA



6 TRAFFIC OPERATIONS WITH SITE TRAFFIC

The following sections summarize the capacity analysis results with site generated traffic at the study intersections. Based on the anticipated volumes, it was assumed that the configuration of the access points will include a shared left-turn / through lane and a right-turn lane on each leg.

6.1 FULL BUILD-OUT PHASE

Tables 5 and 6 present the capacity analysis results for the morning and afternoon peak hours for the total forecast scenarios with full site development.

Table 5 | LOS Results at Full Build-Out Phase – Morning Peak Hour

		EASTBOUND			WESTBOUND			NORTHBOUND			SOUTHBOUND		
		LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Grasswood Road and Service Road													
Total	V/C Ratio	0			0.01			0.19			0.01		
	95th Queue (m)	4			5			14			7		
	LOS	A			A			B			B		
Grasswood Road and Access 1													
Total	V/C Ratio	0			0.04			0.02		0.05	0.02		
	95th Queue (m)	2			8			9		14	9		
	LOS	A			A			B		A	B		
Grasswood Road and Access 2													
Total	V/C Ratio	0.12			0.04			0.02		0.06			
	95th Queue (m)	-			0			10		-	14		
	LOS	A			A			B		A			
Floral Road and Service Road													
Total	V/C Ratio				0			0.03		0.19			
	95th Queue (m)	-			0			-		14	17		
	LOS				A			A		B	B		

Table 6 | LOS Results at Full Build-Out Phase – Afternoon Peak Hour

		EASTBOUND			WESTBOUND			NORTHBOUND			SOUTHBOUND		
		LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Grasswood Road and Service Road													
Total	V/C Ratio	0			0.03			1.12			0.01		
	95th Queue (m)	4			25			52			6		
	LOS	A			A			F			B		
Grasswood Road and Access 1													
Total	V/C Ratio	0.01			0.17			0.81		0.27	0.1		
	95th Queue (m)	7			36			33		22	10		
	LOS	A			A			F		B	E		
Grasswood Road and Access 2													
Total	V/C Ratio	0.19			0.15			0.45		0.25			
	95th Queue (m)	-			3			26		-	21		
	LOS	A			A			E		B			
Floral Road and Service Road													
Total	V/C Ratio				0.01			0.02		0.66			
	95th Queue (m)	-			0			-		11	30		
	LOS				A			A		C	C		



Grasswood Road and Service Road Intersection | overall intersection is expected to continue to operate acceptably during the morning peak while the northbound approach (Service Road) is expected to fail (LOS F) during the afternoon peak hour.

Grasswood Road and Access 1 Intersection | is expected to operate at acceptable conditions (LOS A/B) during the morning peak hour. With the proposed lane arrangements, the northbound shared left-turn / through lane is expected to fail (LOS F) while the northbound right-turn lane is expected to operate at LOS B during the afternoon peak hour for the total forecast scenarios. Grasswood Road will continue to operate with minimal delays during both peak hours.

Grasswood Road and Access 2 Intersection | Grasswood Road is expected to continue to operate with minimal delays and queuing (LOS A) during the both peak hours. With the proposed lane arrangements, the northbound shared left-turn / through lane is expected to fail (LOS E) while the northbound right-turn lane is expected to operate at LOS B during the afternoon peak hour for the total forecast scenarios.

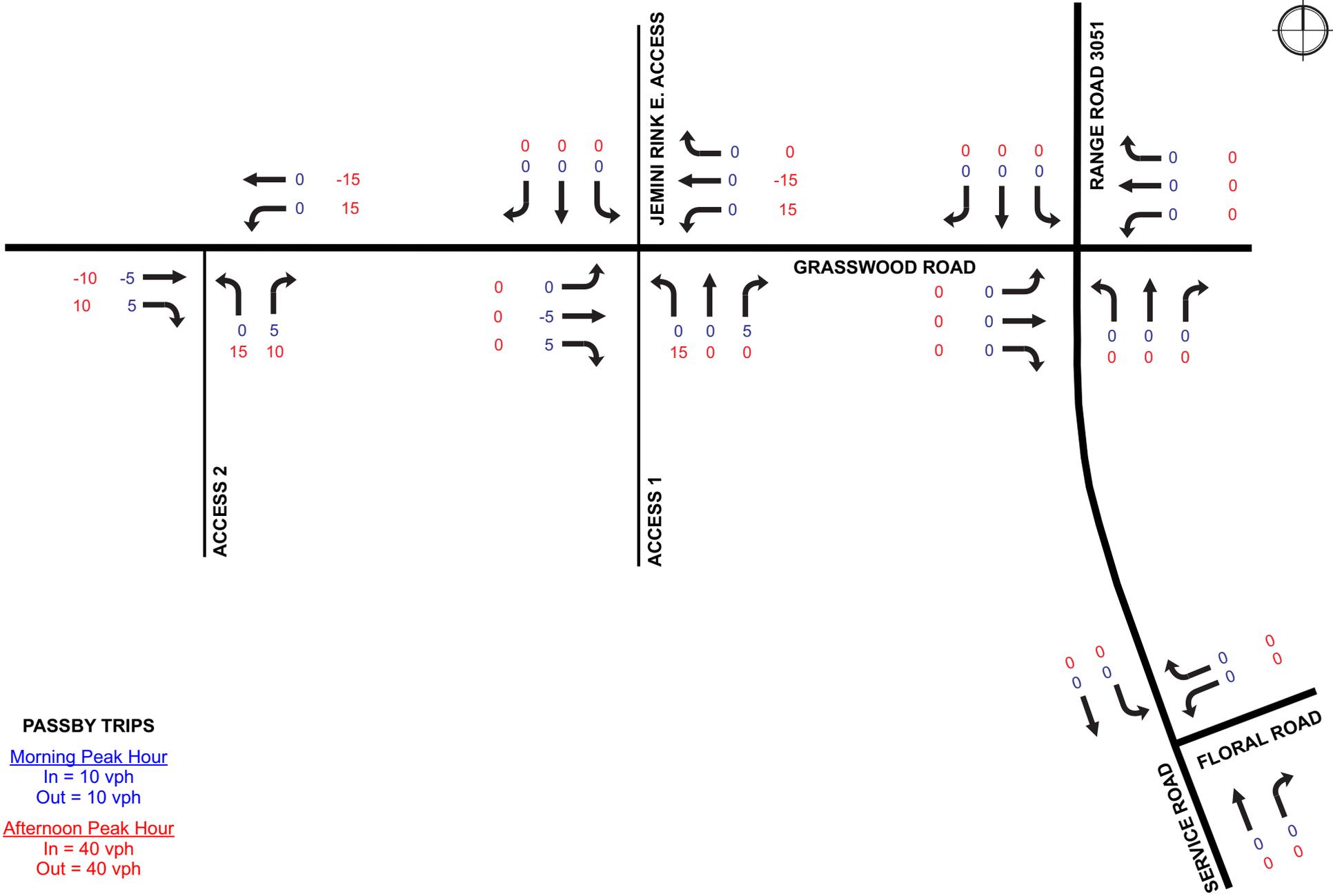
Floral Road and Service Road Intersection | overall intersection is expected to continue to operate at acceptable delays and queuing for both peak hours.

Capacity analysis indicates that the maximum 95th percentile queue on the eastbound approach at the Grasswood Road and Access 2 intersection is expected to be 3m (< 1 vehicle) during the afternoon peak hour. As such, there is no potential conflict of vehicle queues between the access and the rail crossing. For the Grasswood Road and Access 1 intersection, the 95th percentile queuing on the westbound approach is expected to be 36m (approx. 5 vehicles), within proximity of the Jemini east access (40m away). As such, it is recommended that the proposed east access on Grasswood Road be aligned with the existing Jemini rink east access. The Access 2 is located approximately 85m west of the Jemini west access, which is considered acceptable. While the northbound shared left-turn / through lanes at both Access 1 and Access 2 are anticipated to fail (LOS E/F), the intersection operations are considered acceptable to maintain free-flowing traffic on Grasswood Road.

6.2 CRITICAL DEVELOPMENT PHASE

In addition to the analysis of the full build-out phase, a sensitivity analysis was conducted to determine the amount of development that will require intersection upgrades. For the study area, LOS E or $v/c > 0.8$ is considered the critical parameter for intersection upgrades. Based on the above assumptions, it was identified that the critical development phase where intersection improvements will be required is at 75% site development (Year 8).

Figures 7, 8, and 9 illustrate the pass-by trips, new trips, and total forecast scenarios for the critical development phase, respectively.

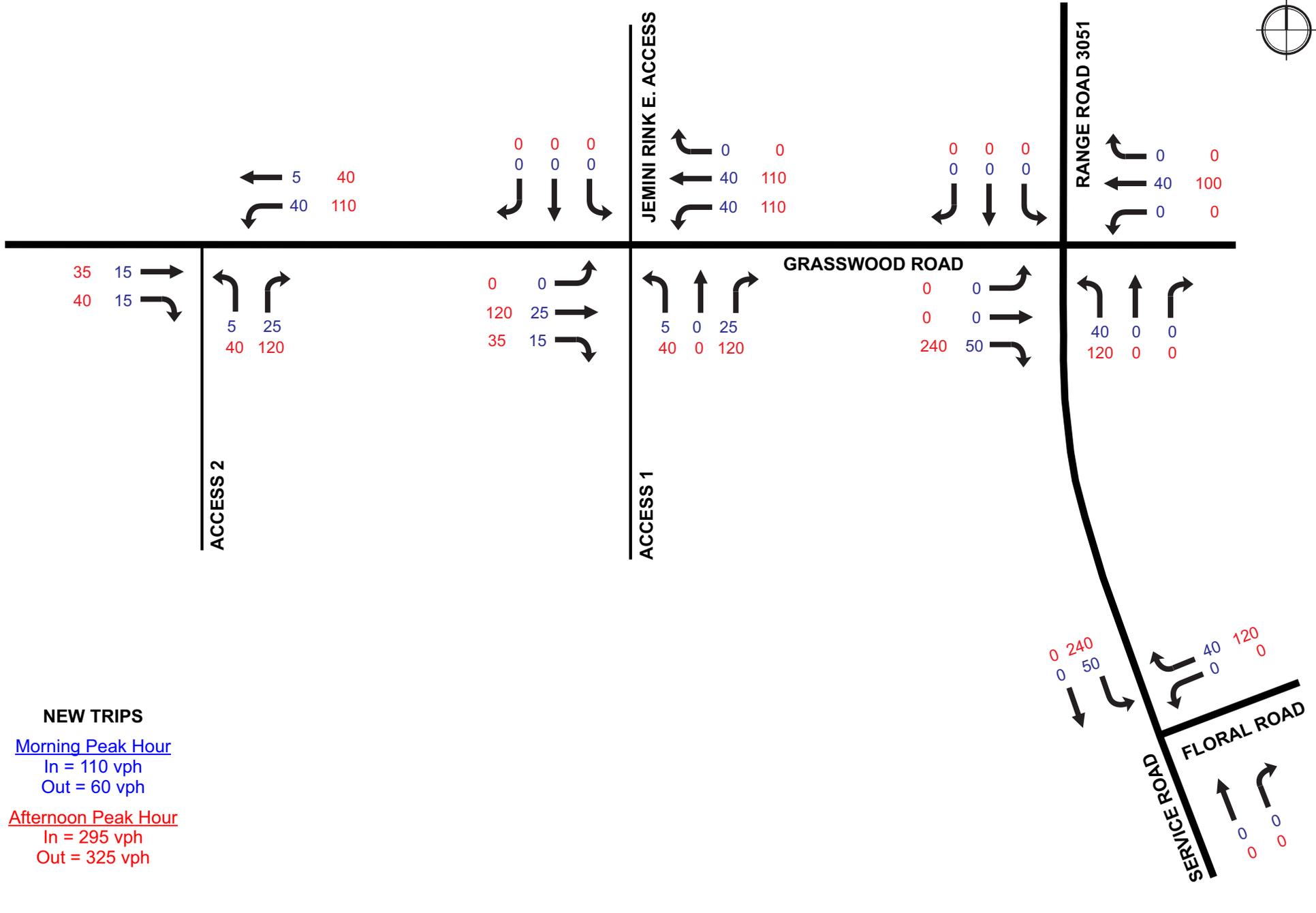


LEGEND:
 AM / PM Peak Hour Volumes
 (rounded to nearest 5)

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FIGURE 7 | PASS-BY TRIPS AT CRITICAL PHASE (YEAR 8)
 GRASSWOOD COMMERCIAL DEVELOPMENT TIA

DRAWING: Critical New Trips - Option 1.cdr DATE: 2018-04-18 DRAWN BY: thalia contract and there are no representations of any kind made by the design professional to any party with whom the design professional has entered into a

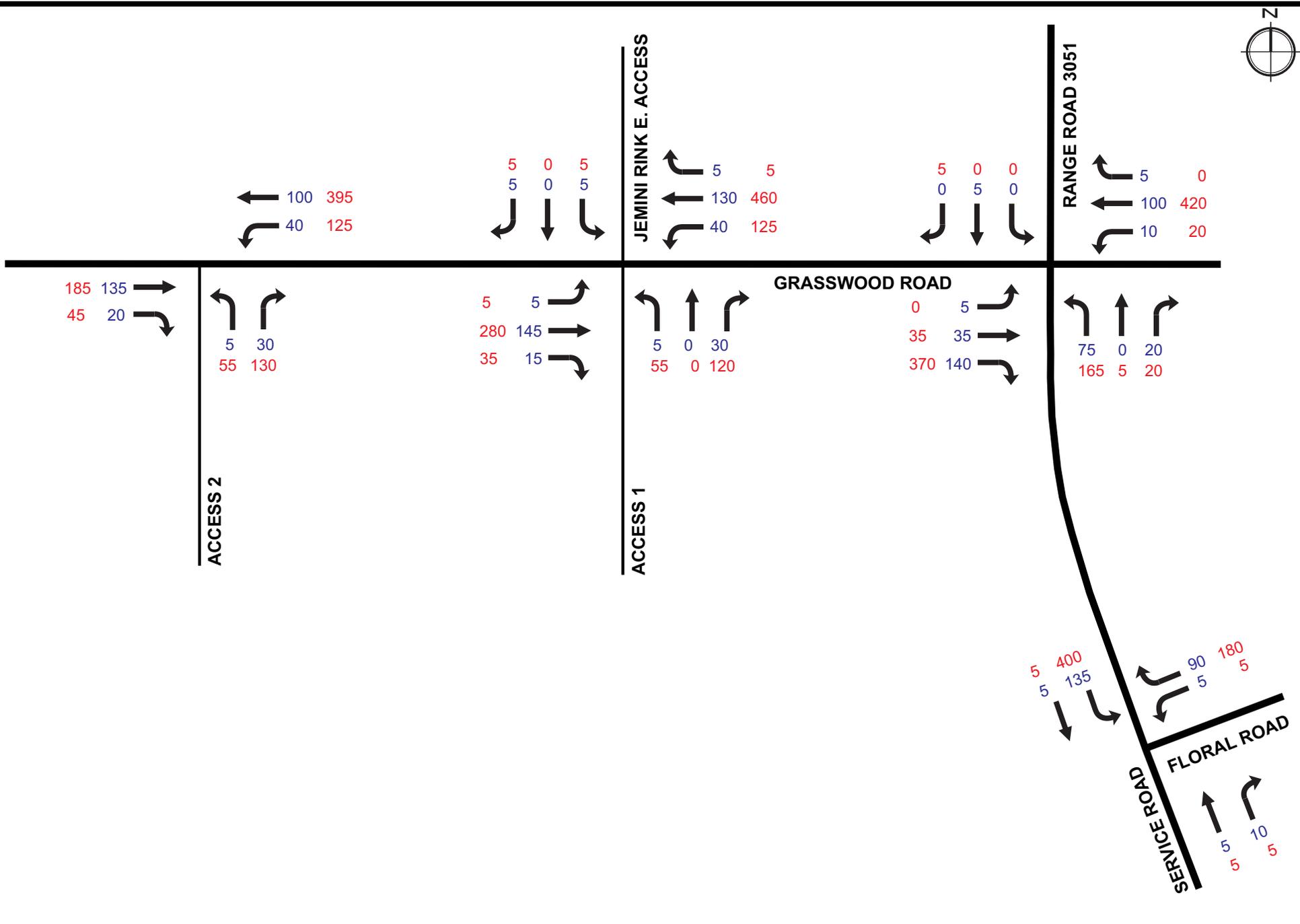



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**FIGURE 8 | NEW TRIPS AT CRITICAL PHASE
 (YEAR 8)**
 GRASSWOOD COMMERCIAL DEVELOPMENT TIA

DRAWING: Total Forecast Critical - Option 1.cdr DATE: 2018-04-18 DRAWN BY: thalentract and there are no representations of any kind made by the design professional to any party with whom the design professional has entered into a



LEGEND:

AM / PM Peak Hour Volumes
(rounded to nearest 5)

	203 Wellman Crescent Saskatoon, SK S7T 0J1 tel: 306.665.6223 fax: 306.665.8589	Issue Date - 2018-04-18 Scale: Aerial Imagery: Note: All Dimensions shown in Metres unless otherwise noted	FIGURE 9 TOTAL FORECAST SCENARIOS - CRITICAL PHASE GRASSWOOD COMMERCIAL DEVELOPMENT TIA
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Tables 7 and 8 summarize the anticipated traffic operations at the study intersections at the critical development phase (Year 8), assuming no additional turning lanes or changes applied.

Grasswood Road and Service Road Intersection | overall intersection is expected to operate with minimal delays and queuing during the morning peak hour. For the afternoon peak hour, the northbound approach is expected to reach LOS E while Grasswood Road operates at optimal conditions (LOS A).

Grasswood Road and Access 1 Intersection | overall intersection is expected to operate at acceptable conditions during both peak hours. The 95th percentile queue lengths on the westbound approach is expected to be 20m (approximately 3 vehicles) with no potential conflicts with the adjacent intersections.

Grasswood Road and Access 2 Intersection | overall intersection is expected to operate at acceptable conditions during both peak hours. There is minimal queuing on the eastbound approach with no conflicts anticipated between the west access and the railway crossing.

Floral Road and Service Road Intersection | overall intersection is expected to operate at acceptable conditions during both peak hours.

Table 7 | LOS Results for Critical Development Phase – Morning Peak Hour

		EASTBOUND			WESTBOUND			NORTHBOUND			SOUTHBOUND		
		LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Grasswood Road and Range Road 3051													
Total (YR-8)	V/C Ratio	0			0.01			0.14			0.01		
	95th Queue (m)	3			5			14			6		
	LOS	A			A			B			B		
Grasswood Road and Access 1													
Total (YR-8)	V/C Ratio	0			0.03			0.01		0.04	0.02		
	95th Queue (m)	1			5			6		13	9		
	LOS	A			A			B		A	B		
Grasswood Road and Access 2													
Total (YR-8)	V/C Ratio	0.1			0.03			0.01		0.04			
	95th Queue (m)	-	0		7			7		-	13		-
	LOS	A			A			B		A			
Floral Road and Service Road													
Total (YR-8)	V/C Ratio				0			0.02		0.16			
	95th Queue (m)	-			0			-		12	17		-
	LOS				A			A		A			

Table 8 | LOS Results for Critical Development Phase – Afternoon Peak Hour

		EASTBOUND			WESTBOUND			NORTHBOUND			SOUTHBOUND		
		LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Grasswood Road and Range Road 3051													
Total (YR-8)	V/C Ratio	0			0.02			0.66			0.01		
	95th Queue (m)	3			14			28			6		
	LOS	A			A			E			B		
Grasswood Road and Access 1													
Total (YR-8)	V/C Ratio	0			0.11			0.36		0.18	0.05		
	95th Queue (m)	5			20			19		20	9		
	LOS	A			A			E		B	D		
Grasswood Road and Access 2													
Total (YR-8)	V/C Ratio	0.15			0.1			0.23		0.17			
	95th Queue (m)	-	1		22			-		19	-		
	LOS	A			A			C		B			
Floral Road and Service Road													
Total (YR-8)	V/C Ratio				0			0.01		0.49			
	95th Queue (m)	-			1			-		10	25		-
	LOS				A			A		B			



7 MITIGATION MEASURES

With the background traffic growth and the new trips generated by the proposed development, the Grasswood Road and Service Road intersection is expected to begin to operate under constrained conditions at 75% site development on Year 8. In order to assess measures that may improve operations at the study intersection, the following options were considered:

- Geometric improvements (i.e. turning lanes); and,
- Intersection control improvements (i.e. signal, roundabout, all-way stop).

7.1 ALL-WAY STOP CONTROL (AWSC)

With the existing two-way stop control, Service Road has minimal gaps due to the high traffic flow on Grasswood Road, which results in significant delays. **Tables 9 and 10** summarize the capacity analysis results for the AWSC intersection for the critical phase (Year 8) and full build-out phase (Year 10) development scenarios during the morning and afternoon peak hours, respectively.

Table 9 | LOS Results for AWSC – Morning Peak Hour

		EASTBOUND			WESTBOUND			NORTHBOUND			SOUTHBOUND		
		LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Grasswood Road and Range Road 3051													
Total (YR-8)	V/C Ratio	0.05 0.13			0.15			0.12			0.01		
	95th Queue (m)	13 2			13			14			6		
	LOS	A A			A			A			A		
Total (YR-10)	V/C Ratio	0.07 0.17			0.18			0.15			0.01		
	95th Queue (m)	13 0			13			14			6		
	LOS	A A			A			A			A		

Table 10 | LOS Results for AWSC – Afternoon Peak Hour

		EASTBOUND			WESTBOUND			NORTHBOUND			SOUTHBOUND		
		LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Grasswood Road and Range Road 3051													
Total (YR-8)	V/C Ratio	0.06 0.37			0.64			0.32			0.01		
	95th Queue (m)	13 6			34			19			6		
	LOS	A A			C			B			A		
Total (YR-10)	V/C Ratio	0.08 0.48			0.83			0.44			0.01		
	95th Queue (m)	14 8			52			24			6		
	LOS	A A			D			B			A		

The Grasswood Road and Service Road intersection is anticipated to operate at optimal conditions during the morning peak hour for both the critical development and full site development horizons. For the critical development phase (Year 8), the northbound approach is expected to improve from LOS E to LOS B while the westbound approach will operate at LOS C during the afternoon peak hour. At full site development, the northbound approach is expected to continue to operate at LOS B while the westbound approach operates at LOS D. Although traffic volumes on each approach are not balanced, it is recommended that an all-way stop control should be considered at this intersection within this timeframe. Since the existing configuration of Grasswood Road does not permit outbound movements at the intersection with Highway 11, the majority of the outbound traffic volumes on Grasswood Road turn right at the intersection with the Service Road. As such, it is recommended that an eastbound right-turn lane with yield-controlled channelization be considered to minimize unnecessary delays.

8 RAILWAY CROSSING ASSESSMENT

The existing railway crossing on Grasswood Road has a passive warning system. For a public at-grade crossing to warrant a warning system with gates, Transport Canada specifies an 81 km/h (50 mph) or greater railway design speed or a minimum of 50,000 cross-product.

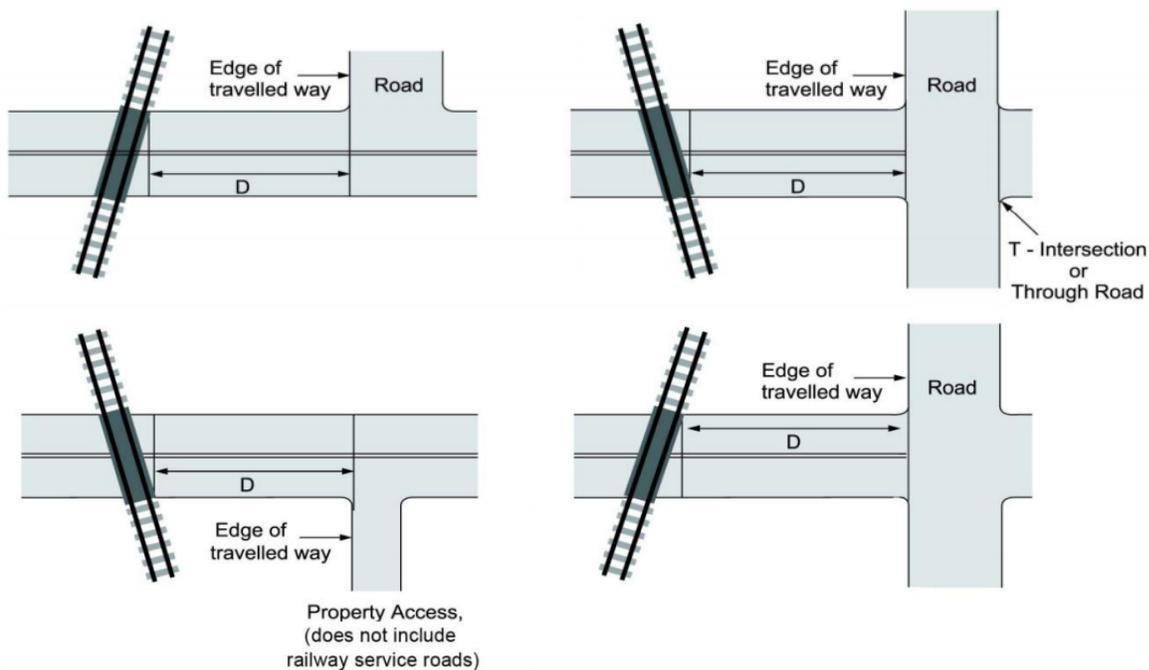
As per Transport Canada 2017 Grade Crossing Inventory², the existing railway crossing design speed is 40 km/h (25 mph). The cross-product of the railway crossing equates to the trains-per-day multiplied by the vehicles-per-day (vpd). The daily volumes were estimated based on the afternoon peak hour traffic volumes, assuming the afternoon peak hour is 10% of the daily traffic. The 2017 Transport Canada Grade Crossing Inventory indicates that the total trains per day is zero. As such, no additional modifications or improvements are required at the existing railway crossing. Note that there would need to be six or more trains per day to warrant an increase in the level of control at the rail crossing at the anticipated total forecast traffic volumes.

8.1 PROXIMITY TO AN INTERSECTION OR PROPERTY ACCESS

As per Transport Canada Grade Crossing Standards Article 11, a new intersection or access may be constructed on a road approach to a public crossing with a minimum of 30 m (D) away from the nearest rail of the grade crossing for a railway design speed greater than 25 km/h (15 mph), shown in **Figure 10**. Although the 2017 Transport Canada Grade Crossing inventory indicates that there is no train at this railway crossing, it is recommended that any new intersections or access points proposed adjacent to the grade crossing be compliant with the minimum requirement of the Grade Crossing Standards and Regulations, in the event that there will be trains utilizing this crossing in the future.

The recommended location of the west access is approximately 170m (Jemini rink west access) east of the railway crossing, meeting the Transport Canada minimum requirement.

Figure 10 | Proximity of Intersections or Entrances to Grade Crossings



Source: Grade Crossings Standards, July 2014

² Transport Canada, "Grade Crossing Inventory", Transport Canada, Record Modified 2017-11-28, <https://open.canada.ca/data/en/dataset/d0f54727-6c0b-4e5a-aa04-ea1463cf9f4c>



9 CONCLUSIONS AND RECOMMENDATIONS

The TIA was completed for the full site development horizon as well as at the point of critical phase development that will require intersection improvements. The following recommendations have resulted from the completion of this TIA:

- **Existing and 10-Year Background Scenarios:**
 - The Grasswood Road and Service Road intersection operates with minimal delays and queue lengths during the morning and afternoon peak hours for existing conditions, and is expected to continue to operate acceptably during both peaks for the background scenarios.
 - The Floral Road and Service Road intersection operates at acceptable conditions during both peak hours at existing traffic volumes and is expected to continue to operate acceptably for the background scenarios.
- **Access 1 and Access 2**
 - Based on the anticipated volumes, it is recommended that a northbound right-turn bay be provided at Access 1 and Access 2.
 - It is recommended that the access points be stop-controlled while Grasswood Road remain free-flowing.
 - The drainage issue concerns identified by the RM have been addressed in the Stormwater Management section in the Comprehensive Development Review.
 - It is recommended that Access 1 (east access) be realigned to intersect the Jemini east access to avoid any potential conflicts and queuing blockage.
 - The Access 2 (west access) is located approximately 85m west of the Jemini west access, which is considered acceptable. No improvements or modifications are required.
- **Critical Phase Development (Year 8):**
 - The Grasswood Road and Service Road intersection is expected to continue to operate acceptably during the morning peak while the northbound approach will reach LOS E during the afternoon peak hour at Year 8 development.
 - The Grasswood Road and Access 1 (east access) intersection is expected to operate at acceptable conditions during the morning peak hour. Although the northbound approach is expected to operate at LOS E in the afternoon peak, it is considered acceptable to maintain free-flowing traffic on Grasswood Road.
 - The Grasswood Road and Access 2 (west access) intersection is expected to operate acceptably during both peak hours at Year 8 development.
 - The Floral Road and Service Road intersection is expected to continue to operate acceptably during both peak hours.
- **Full Site Development (Year 10):**
 - The Grasswood Road and Service Road intersection is expected to continue to operate acceptably during the morning peak while the northbound approach fail (LOS F) with the existing two-way stop control during the afternoon peak hour at full site development.
 - The Grasswood Road and Access 1 (east access) intersection is expected to operate with minimal delays and queuing during the morning peak hour at full build-out phase. While the northbound shared left-turn / through lane is anticipated to fail (LOS F) during the afternoon peak hour, it is considered acceptable conditions for sidestreets with such a left-turn low volume and intersection controls to permit maximum capacity on Grasswood Road (LOS A).



- The Grasswood Road and Access 2 (west access) intersection is expected to operate acceptably during the morning peak hour while the northbound shared left-turn / through lane fails (LOS E) during the afternoon peak hour at full site development. Similar to the east access, it is considered acceptable conditions for minor roads to operate at this level when the left-turning volumes are so low and priority is given to the major road.
- The Floral Road and Service Road intersection is expected to continue to operate acceptably during both peak hours.
- A maximum of 14 septic trucks per week (or an average of two trucks per day) is anticipated at full site development. As such, the impacts of septic trucks on the adjacent road network is minimal.
- **Intersection Improvements:**
 - Based on the assumed rate of development for the proposed site and the projection used for the background traffic volumes on adjacent roadways, it is anticipated that the Grasswood Road and Service Road intersection improvements will be required at Year 8 Critical Phase Development (i.e. approx. 169,000 sq. ft. GLA).
 - It is recommended that an all-way stop control should be considered at the Grasswood Road and Service Road intersection for critical and full build-out development phases.
 - In addition, an eastbound right-turn lane with channelization should be considered at the Grasswood Road and Service Road intersection to minimize unnecessary delays.
 - With these improvements, the Grasswood Road and Service Road approaches are expected to operate at LOS D or better for both peak hours.
 - Monitor operations at the site accesses with the recommended lane configuration. The priority for traffic flow along Grasswood Road at the site intersections can be continually monitored beyond the study timeframe. Though not recommended, the next level of traffic control available at the site accesses would be all-way stop or traffic signals. The consideration for these modifications would require traffic volumes along Grasswood Road or at the site accesses to increase beyond the projection identified in this study.
- **Rail Crossing Review:**
 - The 2017 Transport Canada Grade Crossing Inventory indicates that there are no trains going through the grade crossing. As such, no upgrades or modifications are required at the existing crossing.
 - While the 2017 Grade Crossing Inventory indicates zero train per day at the existing crossing, it is recommended that any new intersections or access points constructed adjacent to the railway crossing be compliant with the Grade Crossing Standards and Regulations of minimum 30 m (D) spacing between the existing rail crossing and the new intersection / property access. The recommended west access on Grasswood Road is located approximately 170 m away from the rail crossing, meeting the Transport Canada minimum requirement.

* * * * *



We trust that study has been completed to your satisfaction. If you have any comments or require additional clarifications, please contact me at 306.518.0231 or email me at Nathan.gray@wsp.com

Yours sincerely,

A handwritten signature in blue ink, appearing to read 'Nathan Gray'.

Nathan Gray, P.Eng., PTOE
Manager, Transportation Planning

NG/AT
Appendix A – LOS Definitions
Appendix B – Synchro Summary

APPENDIX

A LOS DEFINITIONS



COMMONLY USED LEVEL OF SERVICE DEFINITIONS

Level of Service For Urban Arterial Road		Level of Service For Traffic Signal Controlled Intersection
<p>Free flowing traffic with average overall travel speed in the upper range.</p>	<div style="border: 1px solid black; width: 40px; height: 40px; margin: 0 auto; display: flex; align-items: center; justify-content: center; font-size: 24px; font-weight: bold;">A</div>	<p>Minimal delay experienced by motorists and no traffic signal phase is fully utilized. Very seldom does a motorist wait longer than the duration of one red signal interval. The approaches appear open, turning movements are easily made and drivers have freedom of operation. The (Poisson) probability is that 95% of the time all vehicles arriving on one complete cycle will clear during the next green interval.</p>
<p>Delay is not unreasonable. Average overall speeds drop due to intersection delay and intervehicular conflicts.</p>	<div style="border: 1px solid black; width: 40px; height: 40px; margin: 0 auto; display: flex; align-items: center; justify-content: center; font-size: 24px; font-weight: bold;">B</div>	<p>Traffic signal phases are occasionally fully utilized and delays experienced by motorists are not unreasonable. Many drivers begin to feel somewhat restricted within groups of vehicles approaching the intersection. The (Poisson) probability is that 90% of the time all vehicles arriving on one cycle will clear during the next green interval.</p>
<p>Traffic flow still stable with acceptable delays. Average overall travel speeds in the middle range.</p>	<div style="border: 1px solid black; width: 40px; height: 40px; margin: 0 auto; display: flex; align-items: center; justify-content: center; font-size: 24px; font-weight: bold;">C</div>	<p>Traffic signal phases are more frequently fully utilized, but delays are still acceptable. Drivers feel more restricted, may have to wait more than the duration of one red signal interval and queues may develop behind turning vehicles. The (Poisson) probability is that 75% of the time all vehicles arriving on one complete cycle will clear during the next green interval.</p>
<p>Approaching unstable flow. Delays at intersections may become extensive. Average overall speeds in the lower range.</p>	<div style="border: 1px solid black; width: 40px; height: 40px; margin: 0 auto; display: flex; align-items: center; justify-content: center; font-size: 24px; font-weight: bold;">D</div>	<p>Drivers experience increasing restriction and instability of flow. There are substantial delays to approaching vehicles during short peaks within the peak period but there are enough traffic signal cycles with lower demand to permit the occasional clearance of developing queues and prevent excessive back-ups. The (Poisson) probability is that 60% of the time all vehicles arriving on one complete cycle will clear during the next green interval.</p>
<p>Unstable flow. Continuous backup on approaches to intersections. Average overall traffic speed variable but in the lower range.</p>	<div style="border: 1px solid black; width: 40px; height: 40px; margin: 0 auto; display: flex; align-items: center; justify-content: center; font-size: 24px; font-weight: bold;">E</div>	<p>Traffic flow demand equals the capacity. Continuous delays are experienced. There are long queues of vehicles waiting upstream of the intersection and delays to vehicles may extend to several traffic signal cycles. The (Poisson) probability is that 50% of the time all vehicles arriving on one complete cycle will clear during the next green interval.</p>

**Level of Service (LOS) Definitions
for a Stop Controlled Intersection**

LOS	Average Delay per Vehicle (Seconds)	Description
A	0 - 10	Progression is very favourable.
B	>10 - 15	Progression is good. More vehicles delayed than LOS A, causing higher average delay.
C	>15 - 25	Progression is fair. The number of vehicles delayed is significant, though many vehicles are progressing well.
D	>25 - 35	Progression is unfavourable with high flow rate to capacity ratio. Many vehicles experience delay.
E	>35 - 50	Progression is poor. High flow rate to capacity ratio.
F	>50	Progression is very poor. Arrival rates exceed the capacity of the intersection. This level is considered unacceptable to most drivers.

APPENDIX

B SYNCHRO SUMMARY



HCM Unsignalized Intersection Capacity Analysis

5: Service Rd/Range Road 3051 & Grasswood Rd

02/05/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	29	71	9	46	1	29	0	16	0	1	0
Future Volume (Veh/h)	2	29	71	9	46	1	29	0	16	0	1	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	2	31	76	10	49	1	31	0	17	0	1	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	50			107			143	143	69	160	180	50
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	50			107			143	143	69	160	180	50
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			96	100	98	100	100	100
cM capacity (veh/h)	1557			1484			820	742	994	788	708	1019
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	109	60	48	1								
Volume Left	2	10	31	0								
Volume Right	76	1	17	0								
cSH	1557	1484	875	708								
Volume to Capacity	0.00	0.01	0.05	0.00								
Queue Length 95th (m)	0.0	0.2	1.3	0.0								
Control Delay (s)	0.1	1.3	9.4	10.1								
Lane LOS	A	A	A	B								
Approach Delay (s)	0.1	1.3	9.4	10.1								
Approach LOS			A	B								
Intersection Summary												
Average Delay			2.5									
Intersection Capacity Utilization			23.5%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

6: Service Rd & Floral Rd

02/05/2018

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	1	42	4	10	70	1
Future Volume (Veh/h)	1	42	4	10	70	1
Sign Control	Free		Stop			Stop
Grade	0%		0%			0%
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	1	43	4	10	72	1
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0		45	0	36	24
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0		45	0	36	24
tC, single (s)	4.1		6.5	6.2	7.1	6.5
tC, 2 stage (s)						
tF (s)	2.2		4.0	3.3	3.5	4.0
p0 queue free %	100		100	99	92	100
cM capacity (veh/h)	1604		840	1076	950	864
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	44	14	73			
Volume Left	1	0	72			
Volume Right	43	10	0			
cSH	1604	996	949			
Volume to Capacity	0.00	0.01	0.08			
Queue Length 95th (m)	0.0	0.3	1.9			
Control Delay (s)	0.2	8.7	9.1			
Lane LOS	A	A	A			
Approach Delay (s)	0.2	8.7	9.1			
Approach LOS		A	A			
Intersection Summary						
Average Delay			6.1			
Intersection Capacity Utilization			20.6%	ICU Level of Service	A	
Analysis Period (min)			15			

Summary of All Intervals

Run Number	1	10	2	3	4	5	6
Start Time	6:50	6:50	6:50	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1	1
Vehs Entered	203	213	218	234	202	236	242
Vehs Exited	197	216	217	233	203	233	246
Starting Vehs	2	6	3	3	5	2	9
Ending Vehs	8	3	4	4	4	5	5
Travel Distance (km)	197	216	217	229	204	235	247
Travel Time (hr)	3.6	4.0	4.0	4.2	3.9	4.4	4.6
Total Delay (hr)	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Total Stops	120	129	117	125	121	141	145
Fuel Used (l)	15.7	17.0	16.9	18.5	16.0	18.4	19.5

Summary of All Intervals

Run Number	7	8	9	Avg
Start Time	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70
Time Recorded (min)	60	60	60	60
# of Intervals	2	2	2	2
# of Recorded Intervals	1	1	1	1
Vehs Entered	219	229	230	222
Vehs Exited	223	233	228	223
Starting Vehs	5	7	5	4
Ending Vehs	1	3	7	3
Travel Distance (km)	228	233	239	225
Travel Time (hr)	4.3	4.3	4.4	4.1
Total Delay (hr)	0.2	0.2	0.2	0.2
Total Stops	161	135	142	133
Fuel Used (l)	18.2	18.5	19.0	17.8

Interval #0 Information Seeding

Start Time	6:50
End Time	7:00
Total Time (min)	10
Volumes adjusted by Growth Factors.	
No data recorded this interval.	

Interval #1 Information Recording

Start Time	7:00
End Time	8:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	10	2	3	4	5	6
Vehs Entered	203	213	218	234	202	236	242
Vehs Exited	197	216	217	233	203	233	246
Starting Vehs	2	6	3	3	5	2	9
Ending Vehs	8	3	4	4	4	5	5
Travel Distance (km)	197	216	217	229	204	235	247
Travel Time (hr)	3.6	4.0	4.0	4.2	3.9	4.4	4.6
Total Delay (hr)	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Total Stops	120	129	117	125	121	141	145
Fuel Used (l)	15.7	17.0	16.9	18.5	16.0	18.4	19.5

Interval #1 Information Recording

Start Time	7:00
End Time	8:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	7	8	9	Avg
Vehs Entered	219	229	230	222
Vehs Exited	223	233	228	223
Starting Vehs	5	7	5	4
Ending Vehs	1	3	7	3
Travel Distance (km)	228	233	239	225
Travel Time (hr)	4.3	4.3	4.4	4.1
Total Delay (hr)	0.2	0.2	0.2	0.2
Total Stops	161	135	142	133
Fuel Used (l)	18.2	18.5	19.0	17.8

5: Service Rd/Range Road 3051 & Grasswood Rd Performance by movement

6: Service Rd & Floral Rd Performance by movement

Total Network Performance

Queuing and Blocking Report

Baseline

01/31/2018

Intersection: 5: Service Rd/Range Road 3051 & Grasswood Rd

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (m)	2.1	3.0	10.7	4.5
Average Queue (m)	0.1	0.1	6.5	0.2
95th Queue (m)	1.2	1.9	12.3	2.5
Link Distance (m)	612.4	228.9	426.2	166.3
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 6: Service Rd & Floral Rd

Movement	NB	SB
Directions Served	TR	LT
Maximum Queue (m)	14.9	19.6
Average Queue (m)	3.4	8.9
95th Queue (m)	11.0	15.2
Link Distance (m)	132.6	426.2
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 0

HCM Unsignalized Intersection Capacity Analysis

5: Service Rd/Range Road 3051 & Grasswood Rd

01/26/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	28	102	15	245	0	38	1	18	0	0	2
Future Volume (Veh/h)	0	28	102	15	245	0	38	1	18	0	0	2
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	0	32	116	17	278	0	43	1	20	0	0	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	278			148			404	402	90	422	460	278
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	278			148			404	402	90	422	460	278
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			92	100	98	100	100	100
cM capacity (veh/h)	1291			1440			552	532	971	527	494	763
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	148	295	64	2								
Volume Left	0	17	43	0								
Volume Right	116	0	20	2								
cSH	1291	1440	638	763								
Volume to Capacity	0.00	0.01	0.10	0.00								
Queue Length 95th (m)	0.0	0.3	2.5	0.1								
Control Delay (s)	0.0	0.5	11.3	9.7								
Lane LOS		A	B	A								
Approach Delay (s)	0.0	0.5	11.3	9.7								
Approach LOS			B	A								
Intersection Summary												
Average Delay				1.8								
Intersection Capacity Utilization				41.4%	ICU Level of Service	A						
Analysis Period (min)				15								

HCM Unsignalized Intersection Capacity Analysis

6: Service Rd & Floral Rd

01/26/2018

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	7	50	1	3	134	4
Future Volume (Veh/h)	7	50	1	3	134	4
Sign Control	Free		Stop			Stop
Grade	0%		0%			0%
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	7	52	1	3	138	4
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0		66	0	44	40
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0		66	0	44	40
tC, single (s)	4.1		6.5	6.2	7.1	6.5
tC, 2 stage (s)						
tF (s)	2.2		4.0	3.3	3.5	4.0
p0 queue free %	100		100	100	85	100
cM capacity (veh/h)	1604		815	1076	945	843
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	59	4	142			
Volume Left	7	0	138			
Volume Right	52	3	0			
cSH	1604	997	942			
Volume to Capacity	0.00	0.00	0.15			
Queue Length 95th (m)	0.1	0.1	4.0			
Control Delay (s)	0.9	8.6	9.5			
Lane LOS	A	A	A			
Approach Delay (s)	0.9	8.6	9.5			
Approach LOS		A	A			
Intersection Summary						
Average Delay			7.0			
Intersection Capacity Utilization			24.4%	ICU Level of Service	A	
Analysis Period (min)			15			

Summary of All Intervals

Run Number	1	10	2	3	4	5	6
Start Time	4:50	4:50	4:50	4:50	4:50	4:50	4:50
End Time	6:00	6:00	6:00	6:00	6:00	6:00	6:00
Total Time (min)	70	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1	1
Vehs Entered	470	481	479	469	480	448	490
Vehs Exited	466	477	475	472	478	447	494
Starting Vehs	7	7	8	13	5	9	9
Ending Vehs	11	11	12	10	7	10	5
Travel Distance (km)	452	458	459	444	455	425	470
Travel Time (hr)	8.7	8.6	8.7	8.5	8.7	8.0	8.8
Total Delay (hr)	0.5	0.5	0.5	0.5	0.5	0.4	0.5
Total Stops	223	205	209	198	198	190	206
Fuel Used (l)	35.2	34.3	34.9	33.3	34.4	31.6	35.1

Summary of All Intervals

Run Number	7	8	9	Avg
Start Time	4:50	4:50	4:50	4:50
End Time	6:00	6:00	6:00	6:00
Total Time (min)	70	70	70	70
Time Recorded (min)	60	60	60	60
# of Intervals	2	2	2	2
# of Recorded Intervals	1	1	1	1
Vehs Entered	455	499	471	474
Vehs Exited	452	495	472	474
Starting Vehs	9	4	10	7
Ending Vehs	12	8	9	9
Travel Distance (km)	437	469	453	452
Travel Time (hr)	8.3	9.0	8.6	8.6
Total Delay (hr)	0.5	0.6	0.5	0.5
Total Stops	192	191	212	201
Fuel Used (l)	32.9	35.1	34.5	34.1

Interval #0 Information Seeding

Start Time	4:50
End Time	5:00
Total Time (min)	10
Volumes adjusted by Growth Factors.	
No data recorded this interval.	

Interval #1 Information Recording

Start Time	5:00
End Time	6:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	10	2	3	4	5	6
Vehs Entered	470	481	479	469	480	448	490
Vehs Exited	466	477	475	472	478	447	494
Starting Vehs	7	7	8	13	5	9	9
Ending Vehs	11	11	12	10	7	10	5
Travel Distance (km)	452	458	459	444	455	425	470
Travel Time (hr)	8.7	8.6	8.7	8.5	8.7	8.0	8.8
Total Delay (hr)	0.5	0.5	0.5	0.5	0.5	0.4	0.5
Total Stops	223	205	209	198	198	190	206
Fuel Used (l)	35.2	34.3	34.9	33.3	34.4	31.6	35.1

Interval #1 Information Recording

Start Time	5:00
End Time	6:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	7	8	9	Avg
Vehs Entered	455	499	471	474
Vehs Exited	452	495	472	474
Starting Vehs	9	4	10	7
Ending Vehs	12	8	9	9
Travel Distance (km)	437	469	453	452
Travel Time (hr)	8.3	9.0	8.6	8.6
Total Delay (hr)	0.5	0.6	0.5	0.5
Total Stops	192	191	212	201
Fuel Used (l)	32.9	35.1	34.5	34.1

Queuing and Blocking Report

Baseline

01/26/2018

Intersection: 5: Service Rd/Range Road 3051 & Grasswood Rd

Movement	WB	NB	SB
Directions Served	LTR	LTR	LTR
Maximum Queue (m)	7.5	14.2	5.6
Average Queue (m)	0.4	7.5	0.3
95th Queue (m)	3.0	13.0	3.0
Link Distance (m)	228.9	426.2	166.3
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 6: Service Rd & Floral Rd

Movement	NB	SB
Directions Served	TR	LT
Maximum Queue (m)	8.6	20.6
Average Queue (m)	1.3	10.5
95th Queue (m)	6.2	16.4
Link Distance (m)	132.6	426.2
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 0

HCM Unsignalized Intersection Capacity Analysis

5: Service Rd/Range Road 3051 & Grasswood Rd

01/31/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	45	110	15	70	5	40	0	20	0	5	0
Future Volume (Veh/h)	5	45	110	15	70	5	40	0	20	0	5	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	5	48	118	16	75	5	43	0	22	0	5	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	80			166			229	229	107	248	286	78
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	80			166			229	229	107	248	286	78
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			94	100	98	100	99	100
cM capacity (veh/h)	1518			1412			714	661	947	681	615	983
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	171	96	65	5								
Volume Left	5	16	43	0								
Volume Right	118	5	22	0								
cSH	1518	1412	779	615								
Volume to Capacity	0.00	0.01	0.08	0.01								
Queue Length 95th (m)	0.1	0.3	2.1	0.2								
Control Delay (s)	0.2	1.3	10.0	10.9								
Lane LOS	A	A	B	B								
Approach Delay (s)	0.2	1.3	10.0	10.9								
Approach LOS			B	B								
Intersection Summary												
Average Delay			2.6									
Intersection Capacity Utilization			27.9%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

6: Service Rd & Floral Rd

01/31/2018

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	5	55	10	15	95	5
Future Volume (Veh/h)	5	55	10	15	95	5
Sign Control	Free		Stop			Stop
Grade	0%		0%			0%
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	5	57	10	15	98	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0		67	0	58	38
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0		67	0	58	38
tC, single (s)	4.1		6.5	6.2	7.1	6.5
tC, 2 stage (s)						
tF (s)	2.2		4.0	3.3	3.5	4.0
p0 queue free %	100		99	99	89	99
cM capacity (veh/h)	1604		815	1076	907	845
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	62	25	103			
Volume Left	5	0	98			
Volume Right	57	15	0			
cSH	1604	954	904			
Volume to Capacity	0.00	0.03	0.11			
Queue Length 95th (m)	0.1	0.6	2.9			
Control Delay (s)	0.6	8.9	9.5			
Lane LOS	A	A	A			
Approach Delay (s)	0.6	8.9	9.5			
Approach LOS		A	A			
Intersection Summary						
Average Delay			6.5			
Intersection Capacity Utilization			22.5%	ICU Level of Service	A	
Analysis Period (min)			15			

Summary of All Intervals

Run Number	1	10	2	3	4	5	6
Start Time	6:50	6:50	6:50	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1	1
Vehs Entered	329	311	330	354	363	344	344
Vehs Exited	326	318	334	352	361	346	352
Starting Vehs	6	8	11	5	7	7	12
Ending Vehs	9	1	7	7	9	5	4
Travel Distance (km)	319	311	316	338	352	324	335
Travel Time (hr)	5.9	5.7	5.8	6.2	6.7	6.1	6.2
Total Delay (hr)	0.3	0.3	0.3	0.4	0.4	0.3	0.4
Total Stops	186	166	180	197	212	177	182
Fuel Used (l)	25.9	24.5	25.1	27.1	28.1	25.6	27.1

Summary of All Intervals

Run Number	7	8	9	Avg
Start Time	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70
Time Recorded (min)	60	60	60	60
# of Intervals	2	2	2	2
# of Recorded Intervals	1	1	1	1
Vehs Entered	325	353	337	337
Vehs Exited	327	354	328	340
Starting Vehs	5	6	3	4
Ending Vehs	3	5	12	4
Travel Distance (km)	318	351	318	328
Travel Time (hr)	5.9	6.6	5.9	6.1
Total Delay (hr)	0.4	0.4	0.3	0.3
Total Stops	201	207	178	188
Fuel Used (l)	25.5	28.4	25.5	26.3

Interval #0 Information Seeding

Start Time	6:50
End Time	7:00
Total Time (min)	10
Volumes adjusted by Growth Factors.	
No data recorded this interval.	

Interval #1 Information Recording

Start Time	7:00
End Time	8:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	10	2	3	4	5	6
Vehs Entered	329	311	330	354	363	344	344
Vehs Exited	326	318	334	352	361	346	352
Starting Vehs	6	8	11	5	7	7	12
Ending Vehs	9	1	7	7	9	5	4
Travel Distance (km)	319	311	316	338	352	324	335
Travel Time (hr)	5.9	5.7	5.8	6.2	6.7	6.1	6.2
Total Delay (hr)	0.3	0.3	0.3	0.4	0.4	0.3	0.4
Total Stops	186	166	180	197	212	177	182
Fuel Used (l)	25.9	24.5	25.1	27.1	28.1	25.6	27.1

Interval #1 Information Recording

Start Time	7:00
End Time	8:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	7	8	9	Avg
Vehs Entered	325	353	337	337
Vehs Exited	327	354	328	340
Starting Vehs	5	6	3	4
Ending Vehs	3	5	12	4
Travel Distance (km)	318	351	318	328
Travel Time (hr)	5.9	6.6	5.9	6.1
Total Delay (hr)	0.4	0.4	0.3	0.3
Total Stops	201	207	178	188
Fuel Used (l)	25.5	28.4	25.5	26.3

5: Service Rd/Range Road 3051 & Grasswood Rd Performance by movement

6: Service Rd & Floral Rd Performance by movement

Total Network Performance

Queuing and Blocking Report Baseline

01/31/2018

Intersection: 5: Service Rd/Range Road 3051 & Grasswood Rd

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (m)	3.8	8.6	11.1	9.1
Average Queue (m)	0.2	0.7	7.3	1.2
95th Queue (m)	1.9	4.3	12.2	6.2
Link Distance (m)	612.4	228.9	426.2	166.3
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 6: Service Rd & Floral Rd

Movement	NB	SB
Directions Served	TR	LT
Maximum Queue (m)	18.1	18.4
Average Queue (m)	5.3	9.5
95th Queue (m)	14.1	15.3
Link Distance (m)	132.6	426.2
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 0

HCM Unsignalized Intersection Capacity Analysis

5: Service Rd/Range Road 3051 & Grasswood Rd

01/31/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	45	155	25	375	0	50	5	25	0	0	5
Future Volume (Veh/h)	0	45	155	25	375	0	50	5	25	0	0	5
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	0	51	176	28	426	0	57	6	28	0	0	6
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	426			227			627	621	139	652	709	426
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	426			227			627	621	139	652	709	426
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			98			85	98	97	100	100	99
cM capacity (veh/h)	1139			1347			387	396	912	361	353	631
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	227	454	91	6								
Volume Left	0	28	57	0								
Volume Right	176	0	28	6								
cSH	1139	1347	472	631								
Volume to Capacity	0.00	0.02	0.19	0.01								
Queue Length 95th (m)	0.0	0.5	5.4	0.2								
Control Delay (s)	0.0	0.7	14.5	10.8								
Lane LOS		A	B	B								
Approach Delay (s)	0.0	0.7	14.5	10.8								
Approach LOS			B	B								
Intersection Summary												
Average Delay				2.2								
Intersection Capacity Utilization				54.3%	ICU Level of Service							A
Analysis Period (min)				15								

HCM Unsignalized Intersection Capacity Analysis

6: Service Rd & Floral Rd

01/31/2018



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		P			4
Traffic Volume (veh/h)	10	65	5	10	180	10
Future Volume (Veh/h)	10	65	5	10	180	10
Sign Control	Free		Stop			Stop
Grade	0%		0%			0%
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	10	67	5	10	186	10
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0		87	0	66	54
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0		87	0	66	54
tC, single (s)	4.1		6.5	6.2	7.1	6.5
tC, 2 stage (s)						
tF (s)	2.2		4.0	3.3	3.5	4.0
p0 queue free %	99		99	99	79	99
cM capacity (veh/h)	1604		792	1076	903	827
Direction, Lane #						
	WB 1	NB 1	SB 1			
Volume Total	77	15	196			
Volume Left	10	0	186			
Volume Right	67	10	0			
cSH	1604	961	899			
Volume to Capacity	0.01	0.02	0.22			
Queue Length 95th (m)	0.1	0.4	6.3			
Control Delay (s)	1.0	8.8	10.1			
Lane LOS	A	A	B			
Approach Delay (s)	1.0	8.8	10.1			
Approach LOS		A	B			
Intersection Summary						
Average Delay			7.6			
Intersection Capacity Utilization			28.4%	ICU Level of Service	A	
Analysis Period (min)			15			

Summary of All Intervals

Run Number	1	10	2	3	4	5	6
Start Time	4:50	4:50	4:50	4:50	4:50	4:50	4:50
End Time	6:00	6:00	6:00	6:00	6:00	6:00	6:00
Total Time (min)	70	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1	1
Vehs Entered	700	693	734	719	727	723	707
Vehs Exited	707	696	732	721	730	728	704
Starting Vehs	22	15	10	13	14	14	11
Ending Vehs	15	12	12	11	11	9	14
Travel Distance (km)	680	666	698	694	699	694	671
Travel Time (hr)	13.2	12.7	13.6	13.5	13.7	13.5	13.1
Total Delay (hr)	1.0	0.9	1.1	1.0	1.1	1.0	1.1
Total Stops	289	273	290	312	299	323	291
Fuel Used (l)	51.8	50.2	54.0	53.4	53.6	52.8	51.3

Summary of All Intervals

Run Number	7	8	9	Avg
Start Time	4:50	4:50	4:50	4:50
End Time	6:00	6:00	6:00	6:00
Total Time (min)	70	70	70	70
Time Recorded (min)	60	60	60	60
# of Intervals	2	2	2	2
# of Recorded Intervals	1	1	1	1
Vehs Entered	714	699	733	714
Vehs Exited	710	691	734	715
Starting Vehs	8	11	14	12
Ending Vehs	12	19	13	13
Travel Distance (km)	679	659	703	684
Travel Time (hr)	13.2	12.8	13.8	13.3
Total Delay (hr)	0.9	0.9	1.1	1.0
Total Stops	281	278	304	295
Fuel Used (l)	51.4	50.0	53.4	52.2

Interval #0 Information Seeding

Start Time	4:50
End Time	5:00
Total Time (min)	10
Volumes adjusted by Growth Factors.	
No data recorded this interval.	

Interval #1 Information Recording

Start Time	5:00
End Time	6:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	10	2	3	4	5	6
Vehs Entered	700	693	734	719	727	723	707
Vehs Exited	707	696	732	721	730	728	704
Starting Vehs	22	15	10	13	14	14	11
Ending Vehs	15	12	12	11	11	9	14
Travel Distance (km)	680	666	698	694	699	694	671
Travel Time (hr)	13.2	12.7	13.6	13.5	13.7	13.5	13.1
Total Delay (hr)	1.0	0.9	1.1	1.0	1.1	1.0	1.1
Total Stops	289	273	290	312	299	323	291
Fuel Used (l)	51.8	50.2	54.0	53.4	53.6	52.8	51.3

Interval #1 Information Recording

Start Time	5:00
End Time	6:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	7	8	9	Avg
Vehs Entered	714	699	733	714
Vehs Exited	710	691	734	715
Starting Vehs	8	11	14	12
Ending Vehs	12	19	13	13
Travel Distance (km)	679	659	703	684
Travel Time (hr)	13.2	12.8	13.8	13.3
Total Delay (hr)	0.9	0.9	1.1	1.0
Total Stops	281	278	304	295
Fuel Used (l)	51.4	50.0	53.4	52.2

5: Service Rd/Range Road 3051 & Grasswood Rd Performance by movement

6: Service Rd & Floral Rd Performance by movement

Total Network Performance

Queuing and Blocking Report Baseline

01/31/2018

Intersection: 5: Service Rd/Range Road 3051 & Grasswood Rd

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (m)	1.3	14.3	18.4	8.2
Average Queue (m)	0.0	1.7	9.1	1.3
95th Queue (m)	0.9	8.2	15.5	6.0
Link Distance (m)	612.4	228.9	426.2	166.3
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 6: Service Rd & Floral Rd

Movement	NB	SB
Directions Served	TR	LT
Maximum Queue (m)	12.8	22.4
Average Queue (m)	3.9	11.6
95th Queue (m)	11.5	18.1
Link Distance (m)	132.6	426.2
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 0

HCM Unsignalized Intersection Capacity Analysis

3: Access 2 & Grasswood Rd

04/18/2018

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↗			↖	↘	↗
Traffic Volume (veh/h)	165	30	55	115	10	45
Future Volume (Veh/h)	165	30	55	115	10	45
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)	179	33	60	125	11	49
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			212			440 196
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			212			440 196
tC, single (s)			4.1			6.4 6.2
tC, 2 stage (s)						
tF (s)			2.2			3.5 3.3
p0 queue free %			96			98 94
cM capacity (veh/h)			1358			549 846
Direction, Lane #	EB 1	WB 1	NB 1	NB 2		
Volume Total	212	185	11	49		
Volume Left	0	60	11	0		
Volume Right	33	0	0	49		
cSH	1700	1358	549	846		
Volume to Capacity	0.12	0.04	0.02	0.06		
Queue Length 95th (m)	0.0	1.1	0.5	1.4		
Control Delay (s)	0.0	2.8	11.7	9.5		
Lane LOS		A	B	A		
Approach Delay (s)	0.0	2.8	9.9			
Approach LOS			A			
Intersection Summary						
Average Delay			2.4			
Intersection Capacity Utilization			32.9%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

5: Service Rd/Range Road 3051 & Grasswood Rd

04/18/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	45	175	15	120	5	95	0	20	0	5	0
Future Volume (Veh/h)	5	45	175	15	120	5	95	0	20	0	5	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	5	48	188	16	129	5	102	0	22	0	5	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	134			236			318	318	142	338	410	132
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	134			236			318	318	142	338	410	132
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			84	100	98	100	99	100
cM capacity (veh/h)	1451			1331			623	589	906	594	524	918
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	241	150	124	5								
Volume Left	5	16	102	0								
Volume Right	188	5	22	0								
cSH	1451	1331	659	524								
Volume to Capacity	0.00	0.01	0.19	0.01								
Queue Length 95th (m)	0.1	0.3	5.2	0.2								
Control Delay (s)	0.2	0.9	11.7	11.9								
Lane LOS	A	A	B	B								
Approach Delay (s)	0.2	0.9	11.7	11.9								
Approach LOS			B	B								
Intersection Summary												
Average Delay			3.3									
Intersection Capacity Utilization			34.3%	ICU Level of Service						A		
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

6: Service Rd & Floral Rd

04/18/2018

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	5	110	10	15	155	5
Future Volume (Veh/h)	5	110	10	15	155	5
Sign Control	Free		Stop			Stop
Grade	0%		0%			0%
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	5	113	10	15	160	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0		123	0	86	66
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0		123	0	86	66
tC, single (s)	4.1		6.5	6.2	7.1	6.5
tC, 2 stage (s)						
tF (s)	2.2		4.0	3.3	3.5	4.0
p0 queue free %	100		99	99	82	99
cM capacity (veh/h)	1604		759	1076	869	816
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	118	25	165			
Volume Left	5	0	160			
Volume Right	113	15	0			
cSH	1604	922	867			
Volume to Capacity	0.00	0.03	0.19			
Queue Length 95th (m)	0.1	0.6	5.3			
Control Delay (s)	0.3	9.0	10.1			
Lane LOS	A	A	B			
Approach Delay (s)	0.3	9.0	10.1			
Approach LOS		A	B			
Intersection Summary						
Average Delay			6.3			
Intersection Capacity Utilization			29.3%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

11: Access 1 & Grasswood Rd

04/18/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	185	20	55	155	5	10	0	35	5	0	5
Future Volume (Veh/h)	5	185	20	55	155	5	10	0	35	5	0	5
Sign Control		Free			Free			Stop			Stop	
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)	5	201	22	60	168	5	11	0	38	5	0	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	173			223			518	515	212	550	524	170
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	173			223			518	515	212	550	524	170
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			96			98	100	95	99	100	99
cM capacity (veh/h)	1404			1346			449	441	828	409	436	873
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1							
Volume Total	228	233	11	38	10							
Volume Left	5	60	11	0	5							
Volume Right	22	5	0	38	5							
cSH	1404	1346	449	828	557							
Volume to Capacity	0.00	0.04	0.02	0.05	0.02							
Queue Length 95th (m)	0.1	1.1	0.6	1.1	0.4							
Control Delay (s)	0.2	2.3	13.2	9.6	11.6							
Lane LOS	A	A	B	A	B							
Approach Delay (s)	0.2	2.3	10.4		11.6							
Approach LOS			B		B							
Intersection Summary												
Average Delay			2.3									
Intersection Capacity Utilization			37.8%		ICU Level of Service				A			
Analysis Period (min)			15									

Summary of All Intervals

Run Number	1	10	2	3	4	5	6
Start Time	6:50	6:50	6:50	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1	1
Vehs Entered	597	575	603	589	569	591	617
Vehs Exited	598	576	610	592	571	592	615
Starting Vehs	13	7	9	21	12	13	10
Ending Vehs	12	6	2	18	10	12	12
Travel Distance (km)	536	506	551	534	500	537	554
Travel Time (hr)	11.0	10.2	11.4	10.8	10.2	11.1	11.4
Total Delay (hr)	0.9	0.8	1.0	0.9	0.8	1.0	1.0
Total Stops	447	396	477	421	415	465	456
Fuel Used (l)	47.0	44.1	48.6	46.2	44.0	46.6	48.4

Summary of All Intervals

Run Number	7	8	9	Avg
Start Time	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70
Time Recorded (min)	60	60	60	60
# of Intervals	2	2	2	2
# of Recorded Intervals	1	1	1	1
Vehs Entered	588	618	593	593
Vehs Exited	585	622	587	596
Starting Vehs	12	11	7	8
Ending Vehs	15	7	13	8
Travel Distance (km)	528	564	531	534
Travel Time (hr)	10.8	11.5	10.9	10.9
Total Delay (hr)	1.0	1.0	0.9	0.9
Total Stops	438	461	450	441
Fuel Used (l)	45.3	48.5	46.6	46.5

Interval #0 Information Seeding

Start Time	6:50
End Time	7:00
Total Time (min)	10
Volumes adjusted by Growth Factors.	
No data recorded this interval.	

Interval #1 Information Recording

Start Time	7:00
End Time	8:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	10	2	3	4	5	6
Vehs Entered	597	575	603	589	569	591	617
Vehs Exited	598	576	610	592	571	592	615
Starting Vehs	13	7	9	21	12	13	10
Ending Vehs	12	6	2	18	10	12	12
Travel Distance (km)	536	506	551	534	500	537	554
Travel Time (hr)	11.0	10.2	11.4	10.8	10.2	11.1	11.4
Total Delay (hr)	0.9	0.8	1.0	0.9	0.8	1.0	1.0
Total Stops	447	396	477	421	415	465	456
Fuel Used (l)	47.0	44.1	48.6	46.2	44.0	46.6	48.4

Interval #1 Information Recording

Start Time	7:00
End Time	8:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	7	8	9	Avg
Vehs Entered	588	618	593	593
Vehs Exited	585	622	587	596
Starting Vehs	12	11	7	8
Ending Vehs	15	7	13	8
Travel Distance (km)	528	564	531	534
Travel Time (hr)	10.8	11.5	10.9	10.9
Total Delay (hr)	1.0	1.0	0.9	0.9
Total Stops	438	461	450	441
Fuel Used (l)	45.3	48.5	46.6	46.5

3: Access 2 & Grasswood Rd Performance by movement

5: Service Rd/Range Road 3051 & Grasswood Rd Performance by movement

6: Service Rd & Floral Rd Performance by movement

11: Access 1 & Grasswood Rd Performance by movement

Total Network Performance

Queuing and Blocking Report
Baseline

04/18/2018

Intersection: 3: Access 2 & Grasswood Rd

Movement	WB	NB	NB
Directions Served	LT	L	R
Maximum Queue (m)	11.3	9.0	13.4
Average Queue (m)	2.5	2.7	7.2
95th Queue (m)	9.6	9.3	13.8
Link Distance (m)	278.6	74.9	74.9
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 5: Service Rd/Range Road 3051 & Grasswood Rd

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (m)	6.8	8.5	17.6	9.1
Average Queue (m)	0.4	0.7	9.4	1.4
95th Queue (m)	3.6	4.7	14.0	6.7
Link Distance (m)	71.1	228.9	426.2	166.3
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 6: Service Rd & Floral Rd

Movement	NB	SB
Directions Served	TR	LT
Maximum Queue (m)	17.2	21.3
Average Queue (m)	5.7	11.3
95th Queue (m)	14.2	17.7
Link Distance (m)	132.6	426.2
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Queuing and Blocking Report Baseline

04/18/2018

Intersection: 11: Access 1 & Grasswood Rd

Movement	EB	WB	NB	NB	SB
Directions Served	LTR	LTR	LT	R	LTR
Maximum Queue (m)	4.4	11.1	9.9	15.3	9.2
Average Queue (m)	0.2	1.9	2.3	6.2	2.6
95th Queue (m)	2.2	7.6	8.9	13.9	9.2
Link Distance (m)	278.6	71.1	74.9	74.9	66.6
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (m)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Network Summary

Network wide Queuing Penalty: 0

HCM Unsignalized Intersection Capacity Analysis

3: Access 2 & Grasswood Rd

04/18/2018

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↗			↖	↘	↗
Traffic Volume (veh/h)	240	60	170	465	75	170
Future Volume (Veh/h)	240	60	170	465	75	170
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)	261	65	185	505	82	185
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			326		1168	294
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			326		1168	294
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			85		55	75
cM capacity (veh/h)			1234		182	746
Direction, Lane #	EB 1	WB 1	NB 1	NB 2		
Volume Total	326	690	82	185		
Volume Left	0	185	82	0		
Volume Right	65	0	0	185		
cSH	1700	1234	182	746		
Volume to Capacity	0.19	0.15	0.45	0.25		
Queue Length 95th (m)	0.0	4.0	16.1	7.4		
Control Delay (s)	0.0	3.6	40.2	11.4		
Lane LOS		A	E	B		
Approach Delay (s)	0.0	3.6	20.3			
Approach LOS			C			
Intersection Summary						
Average Delay			6.1			
Intersection Capacity Utilization			64.3%	ICU Level of Service	C	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

5: Service Rd/Range Road 3051 & Grasswood Rd

04/18/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Volume (veh/h)	0	45	475	25	515	0	210	5	25	0	0	5
Future Volume (Veh/h)	0	45	475	25	515	0	210	5	25	0	0	5
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	0	51	540	28	585	0	239	6	28	0	0	6
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	585			591			968	962	321	993	1232	585
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	585			591			968	962	321	993	1232	585
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			97			0	98	96	100	100	99
cM capacity (veh/h)	995			990			227	250	722	208	173	513
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	591	613	273	6								
Volume Left	0	28	239	0								
Volume Right	540	0	28	6								
cSH	995	990	244	513								
Volume to Capacity	0.00	0.03	1.12	0.01								
Queue Length 95th (m)	0.0	0.7	91.8	0.3								
Control Delay (s)	0.0	0.8	136.4	12.1								
Lane LOS		A	F	B								
Approach Delay (s)	0.0	0.8	136.4	12.1								
Approach LOS			F	B								
Intersection Summary												
Average Delay				25.5								
Intersection Capacity Utilization				74.2%	ICU Level of Service	D						
Analysis Period (min)				15								

HCM Unsignalized Intersection Capacity Analysis

6: Service Rd & Floral Rd

04/18/2018



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		T			T
Traffic Volume (veh/h)	10	225	5	10	500	10
Future Volume (Veh/h)	10	225	5	10	500	10
Sign Control	Free		Stop			Stop
Grade	0%		0%			0%
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	10	232	5	10	515	10
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0		252	0	148	136
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0		252	0	148	136
tC, single (s)	4.1		6.5	6.2	7.1	6.5
tC, 2 stage (s)						
tF (s)	2.2		4.0	3.3	3.5	4.0
p0 queue free %	99		99	99	35	99
cM capacity (veh/h)	1604		642	1076	797	745
Direction, Lane #						
	WB 1	NB 1	SB 1			
Volume Total	242	15	525			
Volume Left	10	0	515			
Volume Right	232	10	0			
cSH	1604	878	796			
Volume to Capacity	0.01	0.02	0.66			
Queue Length 95th (m)	0.1	0.4	38.5			
Control Delay (s)	0.4	9.2	17.9			
Lane LOS	A	A	C			
Approach Delay (s)	0.4	9.2	17.9			
Approach LOS		A	C			
Intersection Summary						
Average Delay			12.3			
Intersection Capacity Utilization			56.0%	ICU Level of Service		B
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

11: Access 1 & Grasswood Rd

04/18/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	355	50	170	555	5	75	0	160	5	0	5
Future Volume (Veh/h)	5	355	50	170	555	5	75	0	160	5	0	5
Sign Control		Free			Free			Stop			Stop	
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)	5	386	54	185	603	5	82	0	174	5	0	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	608			440			1404	1401	413	1572	1426	606
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	608			440			1404	1401	413	1572	1426	606
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			83			19	100	73	91	100	99
cM capacity (veh/h)	970			1120			101	116	639	57	112	497
Direction, Lane #												
	EB 1	WB 1	NB 1	NB 2	SB 1							
Volume Total	445	793	82	174	10							
Volume Left	5	185	82	0	5							
Volume Right	54	5	0	174	5							
cSH	970	1120	101	639	102							
Volume to Capacity	0.01	0.17	0.81	0.27	0.10							
Queue Length 95th (m)	0.1	4.5	34.1	8.4	2.4							
Control Delay (s)	0.2	3.8	120.3	12.7	44.3							
Lane LOS	A	A	F	B	E							
Approach Delay (s)	0.2	3.8	47.2		44.3							
Approach LOS			E		E							
Intersection Summary												
Average Delay			10.4									
Intersection Capacity Utilization			78.2%		ICU Level of Service				D			
Analysis Period (min)			15									

Summary of All Intervals

Run Number	1	10	2	3	4	5	6
Start Time	6:50	6:50	6:50	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1	1
Vehs Entered	1613	1699	1563	1633	1638	1612	1678
Vehs Exited	1623	1678	1574	1639	1627	1612	1675
Starting Vehs	35	19	38	36	30	36	34
Ending Vehs	25	40	27	30	41	36	37
Travel Distance (km)	1320	1392	1297	1349	1351	1340	1396
Travel Time (hr)	33.4	36.2	32.7	35.5	34.2	33.4	35.6
Total Delay (hr)	7.3	8.5	7.0	8.8	7.5	6.8	8.0
Total Stops	1464	1616	1478	1487	1527	1531	1494
Fuel Used (l)	124.2	132.3	123.6	127.4	127.0	127.0	132.0

Summary of All Intervals

Run Number	7	8	9	Avg
Start Time	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70
Time Recorded (min)	60	60	60	60
# of Intervals	2	2	2	2
# of Recorded Intervals	1	1	1	1
Vehs Entered	1663	1596	1599	1626
Vehs Exited	1670	1613	1602	1632
Starting Vehs	43	44	44	35
Ending Vehs	36	27	41	31
Travel Distance (km)	1381	1336	1336	1350
Travel Time (hr)	36.5	33.7	34.2	34.5
Total Delay (hr)	9.2	7.3	7.7	7.8
Total Stops	1572	1450	1481	1511
Fuel Used (l)	131.9	125.8	127.2	127.8

Interval #0 Information Seeding

Start Time	6:50
End Time	7:00
Total Time (min)	10
Volumes adjusted by Growth Factors.	
No data recorded this interval.	

Interval #1 Information Recording

Start Time	7:00
End Time	8:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	10	2	3	4	5	6
Vehs Entered	1613	1699	1563	1633	1638	1612	1678
Vehs Exited	1623	1678	1574	1639	1627	1612	1675
Starting Vehs	35	19	38	36	30	36	34
Ending Vehs	25	40	27	30	41	36	37
Travel Distance (km)	1320	1392	1297	1349	1351	1340	1396
Travel Time (hr)	33.4	36.2	32.7	35.5	34.2	33.4	35.6
Total Delay (hr)	7.3	8.5	7.0	8.8	7.5	6.8	8.0
Total Stops	1464	1616	1478	1487	1527	1531	1494
Fuel Used (l)	124.2	132.3	123.6	127.4	127.0	127.0	132.0

Interval #1 Information Recording

Start Time	7:00
End Time	8:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	7	8	9	Avg
Vehs Entered	1663	1596	1599	1626
Vehs Exited	1670	1613	1602	1632
Starting Vehs	43	44	44	35
Ending Vehs	36	27	41	31
Travel Distance (km)	1381	1336	1336	1350
Travel Time (hr)	36.5	33.7	34.2	34.5
Total Delay (hr)	9.2	7.3	7.7	7.8
Total Stops	1572	1450	1481	1511
Fuel Used (l)	131.9	125.8	127.2	127.8

3: Access 2 & Grasswood Rd Performance by movement

5: Service Rd/Range Road 3051 & Grasswood Rd Performance by movement

6: Service Rd & Floral Rd Performance by movement

11: Access 1 & Grasswood Rd Performance by movement

Total Network Performance

Queuing and Blocking Report
Baseline

04/18/2018

Intersection: 3: Access 2 & Grasswood Rd

Movement	EB	WB	NB	NB
Directions Served	TR	LT	L	R
Maximum Queue (m)	6.1	34.6	23.4	26.0
Average Queue (m)	0.3	12.7	11.0	12.5
95th Queue (m)	2.7	26.1	20.3	20.7
Link Distance (m)	344.8	164.6	113.8	113.8
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 5: Service Rd/Range Road 3051 & Grasswood Rd

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (m)	8.3	45.0	63.1	9.0
Average Queue (m)	0.6	6.7	26.9	1.2
95th Queue (m)	4.2	25.1	51.8	6.1
Link Distance (m)	74.1	228.9	426.2	166.3
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 6: Service Rd & Floral Rd

Movement	NB	SB
Directions Served	TR	LT
Maximum Queue (m)	15.8	36.6
Average Queue (m)	3.4	18.8
95th Queue (m)	11.3	29.6
Link Distance (m)	132.6	426.2
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 11: Access 1 & Grasswood Rd

Movement	EB	WB	NB	NB	SB
Directions Served	LTR	LTR	LT	R	LTR
Maximum Queue (m)	12.8	52.3	43.4	26.5	11.6
Average Queue (m)	1.2	16.7	16.7	13.7	2.6
95th Queue (m)	6.8	36.4	33.2	22.4	9.5
Link Distance (m)	164.6	74.1	111.8	111.8	75.0
Upstream Blk Time (%)		0			
Queuing Penalty (veh)		0			
Storage Bay Dist (m)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Network Summary

Network wide Queuing Penalty: 0

HCM Unsignalized Intersection Capacity Analysis

3: Access 2 & Grasswood Rd

04/18/2018



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↶			↶	↶	↶
Traffic Volume (veh/h)	135	20	40	100	5	30
Future Volume (Veh/h)	135	20	40	100	5	30
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)	147	22	43	109	5	33
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			169		353	158
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			169		353	158
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			97		99	96
cM capacity (veh/h)			1409		625	887
Direction, Lane #	EB 1	WB 1	NB 1	NB 2		
Volume Total	169	152	5	33		
Volume Left	0	43	5	0		
Volume Right	22	0	0	33		
cSH	1700	1409	625	887		
Volume to Capacity	0.10	0.03	0.01	0.04		
Queue Length 95th (m)	0.0	0.7	0.2	0.9		
Control Delay (s)	0.0	2.3	10.8	9.2		
Lane LOS		A	B	A		
Approach Delay (s)	0.0	2.3	9.4			
Approach LOS			A			
Intersection Summary						
Average Delay			2.0			
Intersection Capacity Utilization			29.1%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

5: Service Rd/Range Road 3051 & Grasswood Rd

04/18/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	35	140	10	100	5	75	0	20	0	5	0
Future Volume (Veh/h)	5	35	140	10	100	5	75	0	20	0	5	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	5	38	151	11	108	5	81	0	22	0	5	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	113			189			258	258	114	278	332	110
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	113			189			258	258	114	278	332	110
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			88	100	98	100	99	100
cM capacity (veh/h)	1476			1385			684	639	939	653	581	943
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	194	124	103	5								
Volume Left	5	11	81	0								
Volume Right	151	5	22	0								
cSH	1476	1385	726	581								
Volume to Capacity	0.00	0.01	0.14	0.01								
Queue Length 95th (m)	0.1	0.2	3.7	0.2								
Control Delay (s)	0.2	0.7	10.8	11.2								
Lane LOS	A	A	B	B								
Approach Delay (s)	0.2	0.7	10.8	11.2								
Approach LOS			B	B								
Intersection Summary												
Average Delay			3.1									
Intersection Capacity Utilization			30.4%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

6: Service Rd & Floral Rd

04/18/2018

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	5	90	5	10	135	5
Future Volume (Veh/h)	5	90	5	10	135	5
Sign Control	Free		Stop			Stop
Grade	0%		0%			0%
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	5	93	5	10	139	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0		103	0	69	56
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0		103	0	69	56
tC, single (s)	4.1		6.5	6.2	7.1	6.5
tC, 2 stage (s)						
tF (s)	2.2		4.0	3.3	3.5	4.0
p0 queue free %	100		99	99	85	99
cM capacity (veh/h)	1604		779	1076	901	826
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	98	15	144			
Volume Left	5	0	139			
Volume Right	93	10	0			
cSH	1604	955	898			
Volume to Capacity	0.00	0.02	0.16			
Queue Length 95th (m)	0.1	0.4	4.3			
Control Delay (s)	0.4	8.8	9.8			
Lane LOS	A	A	A			
Approach Delay (s)	0.4	8.8	9.8			
Approach LOS		A	A			
Intersection Summary						
Average Delay			6.1			
Intersection Capacity Utilization			26.9%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

11: Access 1 & Grasswood Rd

04/18/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	145	15	40	130	5	5	0	30	5	0	5
Future Volume (Veh/h)	5	145	15	40	130	5	5	0	30	5	0	5
Sign Control		Free			Free			Stop			Stop	
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)	5	158	16	43	141	5	5	0	33	5	0	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	146			174			410	408	166	438	414	144
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	146			174			410	408	166	438	414	144
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			97			99	100	96	99	100	99
cM capacity (veh/h)	1436			1403			534	515	878	495	511	904
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1							
Volume Total	179	189	5	33	10							
Volume Left	5	43	5	0	5							
Volume Right	16	5	0	33	5							
cSH	1436	1403	534	878	640							
Volume to Capacity	0.00	0.03	0.01	0.04	0.02							
Queue Length 95th (m)	0.1	0.7	0.2	0.9	0.4							
Control Delay (s)	0.2	1.9	11.8	9.3	10.7							
Lane LOS	A	A	B	A	B							
Approach Delay (s)	0.2	1.9	9.6		10.7							
Approach LOS			A		B							
Intersection Summary												
Average Delay			2.1									
Intersection Capacity Utilization			33.3%	ICU Level of Service	A							
Analysis Period (min)			15									

Summary of All Intervals

Run Number	1	10	2	3	4	5	6
Start Time	6:50	6:50	6:50	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1	1
Vehs Entered	470	473	471	464	457	474	483
Vehs Exited	468	465	471	460	459	471	481
Starting Vehs	9	5	6	6	10	9	6
Ending Vehs	11	13	6	10	8	12	8
Travel Distance (km)	390	404	414	393	393	400	426
Travel Time (hr)	8.0	8.2	8.5	8.0	8.0	8.2	8.7
Total Delay (hr)	0.6	0.6	0.7	0.6	0.6	0.6	0.7
Total Stops	326	332	352	307	353	336	372
Fuel Used (l)	34.2	34.6	36.4	32.6	35.0	34.0	37.0

Summary of All Intervals

Run Number	7	8	9	Avg
Start Time	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70
Time Recorded (min)	60	60	60	60
# of Intervals	2	2	2	2
# of Recorded Intervals	1	1	1	1
Vehs Entered	493	497	476	474
Vehs Exited	499	500	477	477
Starting Vehs	10	10	9	5
Ending Vehs	4	7	8	7
Travel Distance (km)	405	423	411	406
Travel Time (hr)	8.4	8.6	8.5	8.3
Total Delay (hr)	0.7	0.7	0.7	0.7
Total Stops	345	353	355	341
Fuel Used (l)	34.9	36.9	36.2	35.2

Interval #0 Information Seeding

Start Time	6:50
End Time	7:00
Total Time (min)	10
Volumes adjusted by Growth Factors.	
No data recorded this interval.	

Interval #1 Information Recording

Start Time	7:00
End Time	8:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	10	2	3	4	5	6
Vehs Entered	470	473	471	464	457	474	483
Vehs Exited	468	465	471	460	459	471	481
Starting Vehs	9	5	6	6	10	9	6
Ending Vehs	11	13	6	10	8	12	8
Travel Distance (km)	390	404	414	393	393	400	426
Travel Time (hr)	8.0	8.2	8.5	8.0	8.0	8.2	8.7
Total Delay (hr)	0.6	0.6	0.7	0.6	0.6	0.6	0.7
Total Stops	326	332	352	307	353	336	372
Fuel Used (l)	34.2	34.6	36.4	32.6	35.0	34.0	37.0

Interval #1 Information Recording

Start Time	7:00
End Time	8:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	7	8	9	Avg
Vehs Entered	493	497	476	474
Vehs Exited	499	500	477	477
Starting Vehs	10	10	9	5
Ending Vehs	4	7	8	7
Travel Distance (km)	405	423	411	406
Travel Time (hr)	8.4	8.6	8.5	8.3
Total Delay (hr)	0.7	0.7	0.7	0.7
Total Stops	345	353	355	341
Fuel Used (l)	34.9	36.9	36.2	35.2

3: Access 2 & Grasswood Rd Performance by movement

5: Service Rd/Range Road 3051 & Grasswood Rd Performance by movement

6: Service Rd & Floral Rd Performance by movement

11: Access 1 & Grasswood Rd Performance by movement

Total Network Performance

Queuing and Blocking Report
Baseline

04/18/2018

Intersection: 3: Access 2 & Grasswood Rd

Movement	WB	NB	NB
Directions Served	LT	L	R
Maximum Queue (m)	10.0	9.0	13.5
Average Queue (m)	1.4	1.5	5.8
95th Queue (m)	7.0	7.0	13.2
Link Distance (m)	173.0	74.9	74.9
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 5: Service Rd/Range Road 3051 & Grasswood Rd

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (m)	5.9	9.3	17.6	9.1
Average Queue (m)	0.3	0.6	8.9	1.3
95th Queue (m)	3.0	4.7	13.7	6.4
Link Distance (m)	71.1	228.9	426.2	166.3
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 6: Service Rd & Floral Rd

Movement	NB	SB
Directions Served	TR	LT
Maximum Queue (m)	16.5	21.4
Average Queue (m)	4.0	10.7
95th Queue (m)	12.1	16.9
Link Distance (m)	132.6	426.2
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Queuing and Blocking Report Baseline

04/18/2018

Intersection: 11: Access 1 & Grasswood Rd

Movement	EB	WB	NB	NB	SB
Directions Served	LTR	LTR	LT	R	LTR
Maximum Queue (m)	1.5	8.2	9.0	13.1	10.5
Average Queue (m)	0.1	1.1	1.2	5.7	2.6
95th Queue (m)	1.1	5.3	6.2	13.1	9.3
Link Distance (m)	173.0	71.1	74.9	74.9	66.6
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (m)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Network Summary

Network wide Queuing Penalty: 0

HCM Unsignalized Intersection Capacity Analysis

3: Access 2 & Grasswood Rd

04/19/2018



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↩			↩	↩	↩
Traffic Volume (veh/h)	190	45	125	395	55	130
Future Volume (Veh/h)	190	45	125	395	55	130
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)	207	49	136	429	60	141
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			256		932	232
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			256		932	232
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			90		77	83
cM capacity (veh/h)			1309		265	808
Direction, Lane #	EB 1	WB 1	NB 1	NB 2		
Volume Total	256	565	60	141		
Volume Left	0	136	60	0		
Volume Right	49	0	0	141		
cSH	1700	1309	265	808		
Volume to Capacity	0.15	0.10	0.23	0.17		
Queue Length 95th (m)	0.0	2.6	6.5	4.8		
Control Delay (s)	0.0	2.8	22.5	10.4		
Lane LOS		A	C	B		
Approach Delay (s)	0.0	2.8	14.0			
Approach LOS			B			
Intersection Summary						
Average Delay			4.3			
Intersection Capacity Utilization			53.8%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
 5: Service Rd/Range Road 3051 & Grasswood Rd

04/19/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	35	370	20	420	0	165	5	20	0	0	5
Future Volume (Veh/h)	0	35	370	20	420	0	165	5	20	0	0	5
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	0	40	420	23	477	0	188	6	23	0	0	6
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	477			460			779	773	250	799	983	477
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	477			460			779	773	250	799	983	477
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			98			39	98	97	100	100	99
cM capacity (veh/h)	1090			1106			306	324	791	287	245	590
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	460	500	217	6								
Volume Left	0	23	188	0								
Volume Right	420	0	23	6								
cSH	1090	1106	328	590								
Volume to Capacity	0.00	0.02	0.66	0.01								
Queue Length 95th (m)	0.0	0.5	33.8	0.2								
Control Delay (s)	0.0	0.6	35.0	11.2								
Lane LOS		A	E	B								
Approach Delay (s)	0.0	0.6	35.0	11.2								
Approach LOS			E	B								
Intersection Summary												
Average Delay			6.7									
Intersection Capacity Utilization			62.3%	ICU Level of Service	B							
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

6: Service Rd & Floral Rd

04/19/2018

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	5	180	5	5	400	5
Future Volume (Veh/h)	5	180	5	5	400	5
Sign Control	Free		Stop			Stop
Grade	0%		0%			0%
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	5	186	5	5	412	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0		196	0	110	103
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0		196	0	110	103
tC, single (s)	4.1		6.5	6.2	7.1	6.5
tC, 2 stage (s)						
tF (s)	2.2		4.0	3.3	3.5	4.0
p0 queue free %	100		99	100	52	99
cM capacity (veh/h)	1604		692	1076	850	779
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	191	10	417			
Volume Left	5	0	412			
Volume Right	186	5	0			
cSH	1604	842	849			
Volume to Capacity	0.00	0.01	0.49			
Queue Length 95th (m)	0.1	0.3	20.9			
Control Delay (s)	0.2	9.3	13.3			
Lane LOS	A	A	B			
Approach Delay (s)	0.2	9.3	13.3			
Approach LOS		A	B			
Intersection Summary						
Average Delay			9.2			
Intersection Capacity Utilization			47.2%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

11: Access 1 & Grasswood Rd

04/19/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	280	35	125	460	5	55	0	120	5	0	5
Future Volume (Veh/h)	5	280	35	125	460	5	55	0	120	5	0	5
Sign Control		Free			Free			Stop			Stop	
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)	5	304	38	136	500	5	60	0	130	5	0	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	505			342			1112	1110	323	1238	1126	502
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	505			342			1112	1110	323	1238	1126	502
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			89			64	100	82	96	100	99
cM capacity (veh/h)	1060			1217			168	185	718	114	181	569
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1							
Volume Total	347	641	60	130	10							
Volume Left	5	136	60	0	5							
Volume Right	38	5	0	130	5							
cSH	1060	1217	168	718	190							
Volume to Capacity	0.00	0.11	0.36	0.18	0.05							
Queue Length 95th (m)	0.1	2.9	11.4	5.0	1.3							
Control Delay (s)	0.2	2.8	37.9	11.1	25.0							
Lane LOS	A	A	E	B	D							
Approach Delay (s)	0.2	2.8	19.6		25.0							
Approach LOS			C		D							
Intersection Summary												
Average Delay			4.9									
Intersection Capacity Utilization			63.9%	ICU Level of Service		B						
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

3: Access 2 & Grasswood Rd

04/18/2018



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↶			↷	↶	↷
Traffic Volume (veh/h)	190	45	125	395	55	130
Future Volume (Veh/h)	190	45	125	395	55	130
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)	207	49	136	429	60	141
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			256		932	232
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			256		932	232
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			90		77	83
cM capacity (veh/h)			1309		265	808

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	256	565	60	141
Volume Left	0	136	60	0
Volume Right	49	0	0	141
cSH	1700	1309	265	808
Volume to Capacity	0.15	0.10	0.23	0.17
Queue Length 95th (m)	0.0	2.6	6.5	4.8
Control Delay (s)	0.0	2.8	22.5	10.4
Lane LOS		A	C	B
Approach Delay (s)	0.0	2.8	14.0	
Approach LOS			B	

Intersection Summary			
Average Delay		4.3	
Intersection Capacity Utilization		53.8%	ICU Level of Service
Analysis Period (min)		15	A

HCM Unsignalized Intersection Capacity Analysis

5: Service Rd/Range Road 3051 & Grasswood Rd

04/18/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Volume (veh/h)	0	35	370	20	420	0	165	5	20	0	0	5
Future Volume (Veh/h)	0	35	370	20	420	0	165	5	20	0	0	5
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	0	40	420	23	477	0	188	6	23	0	0	6
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	477			460			779	773	250	799	983	477
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	477			460			779	773	250	799	983	477
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			98			39	98	97	100	100	99
cM capacity (veh/h)	1090			1106			306	324	791	287	245	590
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	460	500	217	6								
Volume Left	0	23	188	0								
Volume Right	420	0	23	6								
cSH	1090	1106	328	590								
Volume to Capacity	0.00	0.02	0.66	0.01								
Queue Length 95th (m)	0.0	0.5	33.8	0.2								
Control Delay (s)	0.0	0.6	35.0	11.2								
Lane LOS		A	E	B								
Approach Delay (s)	0.0	0.6	35.0	11.2								
Approach LOS			E	B								
Intersection Summary												
Average Delay			6.7									
Intersection Capacity Utilization			62.3%		ICU Level of Service					B		
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

6: Service Rd & Floral Rd

04/18/2018

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	5	180	5	5	400	5
Future Volume (Veh/h)	5	180	5	5	400	5
Sign Control	Free		Stop			Stop
Grade	0%		0%			0%
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	5	186	5	5	412	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	0		196	0	110	103
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0		196	0	110	103
tC, single (s)	4.1		6.5	6.2	7.1	6.5
tC, 2 stage (s)						
tF (s)	2.2		4.0	3.3	3.5	4.0
p0 queue free %	100		99	100	52	99
cM capacity (veh/h)	1604		692	1076	850	779
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	191	10	417			
Volume Left	5	0	412			
Volume Right	186	5	0			
cSH	1604	842	849			
Volume to Capacity	0.00	0.01	0.49			
Queue Length 95th (m)	0.1	0.3	20.9			
Control Delay (s)	0.2	9.3	13.3			
Lane LOS	A	A	B			
Approach Delay (s)	0.2	9.3	13.3			
Approach LOS		A	B			
Intersection Summary						
Average Delay			9.2			
Intersection Capacity Utilization			47.2%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

11: Access 1 & Grasswood Rd

04/18/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	280	35	125	460	5	55	0	120	5	0	5
Future Volume (Veh/h)	5	280	35	125	460	5	55	0	120	5	0	5
Sign Control		Free			Free			Stop			Stop	
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)	5	304	38	136	500	5	60	0	130	5	0	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	505			342			1112	1110	323	1238	1126	502
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	505			342			1112	1110	323	1238	1126	502
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			89			64	100	82	96	100	99
cM capacity (veh/h)	1060			1217			168	185	718	114	181	569
Direction, Lane #												
	EB 1	WB 1	NB 1	NB 2	SB 1							
Volume Total	347	641	60	130	10							
Volume Left	5	136	60	0	5							
Volume Right	38	5	0	130	5							
cSH	1060	1217	168	718	190							
Volume to Capacity	0.00	0.11	0.36	0.18	0.05							
Queue Length 95th (m)	0.1	2.9	11.4	5.0	1.3							
Control Delay (s)	0.2	2.8	37.9	11.1	25.0							
Lane LOS	A	A	E	B	D							
Approach Delay (s)	0.2	2.8	19.6		25.0							
Approach LOS			C		D							
Intersection Summary												
Average Delay			4.9									
Intersection Capacity Utilization			63.9%	ICU Level of Service		B						
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
 5: Service Rd/Range Road 3051 & Grasswood Rd

04/18/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	5	35	140	10	100	5	75	0	20	0	5	0
Future Volume (vph)	5	35	140	10	100	5	75	0	20	0	5	0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	5	38	151	11	108	5	81	0	22	0	5	0
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1							
Volume Total (vph)	43	151	124	103	5							
Volume Left (vph)	5	0	11	81	0							
Volume Right (vph)	0	151	5	22	0							
Hadj (s)	0.06	-0.57	0.03	0.06	0.03							
Departure Headway (s)	4.3	3.2	4.2	4.3	4.4							
Degree Utilization, x	0.05	0.13	0.15	0.12	0.01							
Capacity (veh/h)	800	1121	824	793	765							
Control Delay (s)	7.6	6.7	7.9	8.0	7.5							
Approach Delay (s)	6.9		7.9	8.0	7.5							
Approach LOS	A		A	A	A							

Intersection Summary

Delay	7.5		
Level of Service	A		
Intersection Capacity Utilization	31.5%	ICU Level of Service	A
Analysis Period (min)	15		

Summary of All Intervals

Run Number	1	10	2	3	4	5	6
Start Time	6:50	6:50	6:50	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1	1
Vehs Entered	393	399	423	371	396	407	426
Vehs Exited	394	396	421	370	391	413	422
Starting Vehs	3	0	4	2	3	7	2
Ending Vehs	2	3	6	3	8	1	6
Travel Distance (km)	144	146	154	136	144	150	156
Travel Time (hr)	3.7	3.8	3.9	3.4	3.7	3.9	3.9
Total Delay (hr)	0.8	0.8	0.8	0.7	0.8	0.8	0.9
Total Stops	275	251	265	241	257	260	265
Fuel Used (l)	14.1	14.3	15.4	13.2	14.1	14.5	15.6

Summary of All Intervals

Run Number	7	8	9	Avg
Start Time	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70
Time Recorded (min)	60	60	60	60
# of Intervals	2	2	2	2
# of Recorded Intervals	1	1	1	1
Vehs Entered	390	409	374	399
Vehs Exited	394	412	379	399
Starting Vehs	5	4	8	4
Ending Vehs	1	1	3	2
Travel Distance (km)	143	151	138	146
Travel Time (hr)	3.6	3.9	3.5	3.7
Total Delay (hr)	0.7	0.9	0.7	0.8
Total Stops	240	279	237	256
Fuel Used (l)	13.9	14.5	13.4	14.3

Interval #0 Information Seeding

Start Time	6:50
End Time	7:00
Total Time (min)	10
Volumes adjusted by Growth Factors.	
No data recorded this interval.	

Interval #1 Information Recording

Start Time	7:00
End Time	8:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	10	2	3	4	5	6
Vehs Entered	393	399	423	371	396	407	426
Vehs Exited	394	396	421	370	391	413	422
Starting Vehs	3	0	4	2	3	7	2
Ending Vehs	2	3	6	3	8	1	6
Travel Distance (km)	144	146	154	136	144	150	156
Travel Time (hr)	3.7	3.8	3.9	3.4	3.7	3.9	3.9
Total Delay (hr)	0.8	0.8	0.8	0.7	0.8	0.8	0.9
Total Stops	275	251	265	241	257	260	265
Fuel Used (l)	14.1	14.3	15.4	13.2	14.1	14.5	15.6

Interval #1 Information Recording

Start Time	7:00
End Time	8:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	7	8	9	Avg
Vehs Entered	390	409	374	399
Vehs Exited	394	412	379	399
Starting Vehs	5	4	8	4
Ending Vehs	1	1	3	2
Travel Distance (km)	143	151	138	146
Travel Time (hr)	3.6	3.9	3.5	3.7
Total Delay (hr)	0.7	0.9	0.7	0.8
Total Stops	240	279	237	256
Fuel Used (l)	13.9	14.5	13.4	14.3

5: Service Rd/Range Road 3051 & Grasswood Rd Performance by movement

Total Network Performance

Queuing and Blocking Report

Baseline

04/18/2018

Intersection: 5: Service Rd/Range Road 3051 & Grasswood Rd

Movement	EB	EB	WB	NB	SB
Directions Served	LT	R	LTR	LTR	LTR
Maximum Queue (m)	12.8	1.5	16.4	17.5	9.0
Average Queue (m)	6.5	0.1	8.3	8.5	1.2
95th Queue (m)	12.8	2.0	12.6	13.7	6.1
Link Distance (m)	128.8	128.8	227.0	207.9	166.3
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (m)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Network Summary

Network wide Queuing Penalty: 0

HCM Unsignalized Intersection Capacity Analysis
 5: Service Rd/Range Road 3051 & Grasswood Rd

04/18/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	0	35	370	20	420	0	165	5	20	0	0	5
Future Volume (vph)	0	35	370	20	420	0	165	5	20	0	0	5
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	0	40	420	23	477	0	188	6	23	0	0	6
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1							
Volume Total (vph)	40	420	500	217	6							
Volume Left (vph)	0	0	23	188	0							
Volume Right (vph)	0	420	0	23	6							
Hadj (s)	0.02	-0.58	0.03	0.13	-0.58							
Departure Headway (s)	5.2	3.2	4.6	5.4	5.0							
Degree Utilization, x	0.06	0.37	0.64	0.32	0.01							
Capacity (veh/h)	635	1114	753	616	620							
Control Delay (s)	8.5	8.1	15.5	10.9	8.0							
Approach Delay (s)	8.1		15.5	10.9	8.0							
Approach LOS	A		C	B	A							

Intersection Summary

Delay	11.7		
Level of Service	B		
Intersection Capacity Utilization	59.5%	ICU Level of Service	B
Analysis Period (min)	15		

Summary of All Intervals

Run Number	1	10	2	3	4	5	6
Start Time	6:50	6:50	6:50	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1	1
Vehs Entered	1072	1059	1035	1085	1000	1021	1010
Vehs Exited	1072	1057	1039	1081	1002	1020	1007
Starting Vehs	9	12	14	9	11	11	8
Ending Vehs	9	14	10	13	9	12	11
Travel Distance (km)	388	383	375	392	362	370	365
Travel Time (hr)	10.9	10.8	10.5	11.1	10.2	10.4	10.4
Total Delay (hr)	3.4	3.3	3.2	3.5	3.2	3.2	3.3
Total Stops	695	680	675	721	668	672	648
Fuel Used (l)	40.7	39.6	39.5	40.6	37.6	37.9	38.2

Summary of All Intervals

Run Number	7	8	9	Avg
Start Time	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70
Time Recorded (min)	60	60	60	60
# of Intervals	2	2	2	2
# of Recorded Intervals	1	1	1	1
Vehs Entered	1077	1076	1009	1042
Vehs Exited	1085	1078	1018	1046
Starting Vehs	15	9	17	10
Ending Vehs	7	7	8	9
Travel Distance (km)	392	390	368	378
Travel Time (hr)	11.1	11.0	10.3	10.7
Total Delay (hr)	3.5	3.4	3.2	3.3
Total Stops	737	719	672	688
Fuel Used (l)	41.3	40.9	38.5	39.5

Interval #0 Information Seeding

Start Time	6:50
End Time	7:00
Total Time (min)	10
Volumes adjusted by Growth Factors.	
No data recorded this interval.	

Interval #1 Information Recording

Start Time	7:00
End Time	8:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	10	2	3	4	5	6
Vehs Entered	1072	1059	1035	1085	1000	1021	1010
Vehs Exited	1072	1057	1039	1081	1002	1020	1007
Starting Vehs	9	12	14	9	11	11	8
Ending Vehs	9	14	10	13	9	12	11
Travel Distance (km)	388	383	375	392	362	370	365
Travel Time (hr)	10.9	10.8	10.5	11.1	10.2	10.4	10.4
Total Delay (hr)	3.4	3.3	3.2	3.5	3.2	3.2	3.3
Total Stops	695	680	675	721	668	672	648
Fuel Used (l)	40.7	39.6	39.5	40.6	37.6	37.9	38.2

Interval #1 Information Recording

Start Time	7:00
End Time	8:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	7	8	9	Avg
Vehs Entered	1077	1076	1009	1042
Vehs Exited	1085	1078	1018	1046
Starting Vehs	15	9	17	10
Ending Vehs	7	7	8	9
Travel Distance (km)	392	390	368	378
Travel Time (hr)	11.1	11.0	10.3	10.7
Total Delay (hr)	3.5	3.4	3.2	3.3
Total Stops	737	719	672	688
Fuel Used (l)	41.3	40.9	38.5	39.5

5: Service Rd/Range Road 3051 & Grasswood Rd Performance by movement

Total Network Performance

Queuing and Blocking Report

Baseline

04/18/2018

Intersection: 5: Service Rd/Range Road 3051 & Grasswood Rd

Movement	EB	EB	WB	NB	SB
Directions Served	LT	R	LTR	LTR	LTR
Maximum Queue (m)	12.8	13.4	40.0	24.1	8.2
Average Queue (m)	6.0	0.6	20.1	11.7	1.1
95th Queue (m)	13.3	6.0	33.7	19.2	5.5
Link Distance (m)	126.1	126.1	227.0	207.9	166.3
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (m)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Network Summary

Network wide Queuing Penalty: 0

HCM Unsignalized Intersection Capacity Analysis
 5: Service Rd/Range Road 3051 & Grasswood Rd

04/18/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	5	45	175	15	120	5	95	0	20	0	5	0
Future Volume (vph)	5	45	175	15	120	5	95	0	20	0	5	0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	5	48	188	16	129	5	102	0	22	0	5	0
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1							
Volume Total (vph)	53	188	150	124	5							
Volume Left (vph)	5	0	16	102	0							
Volume Right (vph)	0	188	5	22	0							
Hadj (s)	0.05	-0.57	0.04	0.09	0.03							
Departure Headway (s)	4.4	3.2	4.3	4.5	4.5							
Degree Utilization, x	0.07	0.17	0.18	0.15	0.01							
Capacity (veh/h)	781	1121	806	769	739							
Control Delay (s)	7.7	6.8	8.2	8.3	7.6							
Approach Delay (s)	7.0		8.2	8.3	7.6							
Approach LOS	A		A	A	A							

Intersection Summary

Delay		7.7										
Level of Service		A										
Intersection Capacity Utilization		33.9%	ICU Level of Service		A							
Analysis Period (min)		15										

Summary of All Intervals

Run Number	1	10	2	3	4	5	6
Start Time	6:50	6:50	6:50	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1	1
Vehs Entered	475	484	515	448	487	473	496
Vehs Exited	472	482	514	448	487	476	493
Starting Vehs	2	1	5	2	4	7	5
Ending Vehs	5	3	6	2	4	4	8
Travel Distance (km)	175	176	189	165	179	173	182
Travel Time (hr)	4.5	4.6	4.9	4.2	4.6	4.5	4.7
Total Delay (hr)	1.0	1.0	1.1	0.9	1.0	0.9	1.1
Total Stops	336	301	327	299	322	301	308
Fuel Used (l)	17.2	17.6	18.9	16.2	17.6	17.1	18.2

Summary of All Intervals

Run Number	7	8	9	Avg
Start Time	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70
Time Recorded (min)	60	60	60	60
# of Intervals	2	2	2	2
# of Recorded Intervals	1	1	1	1
Vehs Entered	474	530	452	484
Vehs Exited	479	532	457	483
Starting Vehs	6	4	8	4
Ending Vehs	1	2	3	2
Travel Distance (km)	175	194	167	177
Travel Time (hr)	4.5	5.1	4.3	4.6
Total Delay (hr)	1.0	1.1	0.9	1.0
Total Stops	315	346	306	317
Fuel Used (l)	17.3	19.0	16.3	17.5

Interval #0 Information Seeding

Start Time	6:50
End Time	7:00
Total Time (min)	10
Volumes adjusted by Growth Factors.	
No data recorded this interval.	

Interval #1 Information Recording

Start Time	7:00
End Time	8:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	10	2	3	4	5	6
Vehs Entered	475	484	515	448	487	473	496
Vehs Exited	472	482	514	448	487	476	493
Starting Vehs	2	1	5	2	4	7	5
Ending Vehs	5	3	6	2	4	4	8
Travel Distance (km)	175	176	189	165	179	173	182
Travel Time (hr)	4.5	4.6	4.9	4.2	4.6	4.5	4.7
Total Delay (hr)	1.0	1.0	1.1	0.9	1.0	0.9	1.1
Total Stops	336	301	327	299	322	301	308
Fuel Used (l)	17.2	17.6	18.9	16.2	17.6	17.1	18.2

Interval #1 Information Recording

Start Time	7:00
End Time	8:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	7	8	9	Avg
Vehs Entered	474	530	452	484
Vehs Exited	479	532	457	483
Starting Vehs	6	4	8	4
Ending Vehs	1	2	3	2
Travel Distance (km)	175	194	167	177
Travel Time (hr)	4.5	5.1	4.3	4.6
Total Delay (hr)	1.0	1.1	0.9	1.0
Total Stops	315	346	306	317
Fuel Used (l)	17.3	19.0	16.3	17.5

5: Service Rd/Range Road 3051 & Grasswood Rd Performance by movement

Total Network Performance

Queuing and Blocking Report

Baseline

04/18/2018

Intersection: 5: Service Rd/Range Road 3051 & Grasswood Rd

Movement	EB	WB	NB	SB
Directions Served	LT	LTR	LTR	LTR
Maximum Queue (m)	13.1	16.8	17.7	9.1
Average Queue (m)	7.2	8.6	9.1	1.3
95th Queue (m)	13.1	13.0	13.6	6.4
Link Distance (m)	128.8	227.0	207.9	166.3
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 0

HCM Unsignalized Intersection Capacity Analysis
 5: Service Rd/Range Road 3051 & Grasswood Rd

04/18/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	0	45	475	25	515	0	210	5	25	0	0	5
Future Volume (vph)	0	45	475	25	515	0	210	5	25	0	0	5
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	0	51	540	28	585	0	239	6	28	0	0	6
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1							
Volume Total (vph)	51	540	613	273	6							
Volume Left (vph)	0	0	28	239	0							
Volume Right (vph)	0	540	0	28	6							
Hadj (s)	0.02	-0.58	0.03	0.13	-0.58							
Departure Headway (s)	5.6	3.2	4.9	5.8	5.6							
Degree Utilization, x	0.08	0.48	0.83	0.44	0.01							
Capacity (veh/h)	598	1116	728	592	581							
Control Delay (s)	9.1	9.1	26.7	13.1	8.6							
Approach Delay (s)	9.1		26.7	13.1	8.6							
Approach LOS	A		D	B	A							

Intersection Summary

Delay	17.1		
Level of Service	C		
Intersection Capacity Utilization	71.2%	ICU Level of Service	C
Analysis Period (min)	15		

Summary of All Intervals

Run Number	1	10	2	3	4	5	6
Start Time	6:50	6:50	6:50	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1	1
Vehs Entered	1309	1301	1342	1327	1293	1286	1282
Vehs Exited	1317	1290	1344	1328	1300	1282	1287
Starting Vehs	15	12	22	13	17	17	14
Ending Vehs	7	23	20	12	10	21	9
Travel Distance (km)	515	508	527	520	508	505	503
Travel Time (hr)	14.6	14.8	15.8	15.1	14.7	14.5	14.5
Total Delay (hr)	4.6	5.0	5.6	5.1	4.8	4.7	4.8
Total Stops	840	848	893	858	845	860	819
Fuel Used (l)	53.0	52.0	54.9	53.1	51.9	51.1	51.1

Summary of All Intervals

Run Number	7	8	9	Avg
Start Time	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70
Time Recorded (min)	60	60	60	60
# of Intervals	2	2	2	2
# of Recorded Intervals	1	1	1	1
Vehs Entered	1335	1347	1241	1306
Vehs Exited	1338	1351	1253	1310
Starting Vehs	16	12	23	16
Ending Vehs	13	8	11	12
Travel Distance (km)	524	529	490	513
Travel Time (hr)	15.0	15.8	14.1	14.9
Total Delay (hr)	4.9	5.6	4.6	5.0
Total Stops	870	903	832	856
Fuel Used (l)	53.6	54.5	50.4	52.6

Interval #0 Information Seeding

Start Time	6:50
End Time	7:00
Total Time (min)	10
Volumes adjusted by Growth Factors.	
No data recorded this interval.	

Interval #1 Information Recording

Start Time	7:00
End Time	8:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	10	2	3	4	5	6
Vehs Entered	1309	1301	1342	1327	1293	1286	1282
Vehs Exited	1317	1290	1344	1328	1300	1282	1287
Starting Vehs	15	12	22	13	17	17	14
Ending Vehs	7	23	20	12	10	21	9
Travel Distance (km)	515	508	527	520	508	505	503
Travel Time (hr)	14.6	14.8	15.8	15.1	14.7	14.5	14.5
Total Delay (hr)	4.6	5.0	5.6	5.1	4.8	4.7	4.8
Total Stops	840	848	893	858	845	860	819
Fuel Used (l)	53.0	52.0	54.9	53.1	51.9	51.1	51.1

Interval #1 Information Recording

Start Time	7:00
End Time	8:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	7	8	9	Avg
Vehs Entered	1335	1347	1241	1306
Vehs Exited	1338	1351	1253	1310
Starting Vehs	16	12	23	16
Ending Vehs	13	8	11	12
Travel Distance (km)	524	529	490	513
Travel Time (hr)	15.0	15.8	14.1	14.9
Total Delay (hr)	4.9	5.6	4.6	5.0
Total Stops	870	903	832	856
Fuel Used (l)	53.6	54.5	50.4	52.6

5: Service Rd/Range Road 3051 & Grasswood Rd Performance by movement

Total Network Performance

Queuing and Blocking Report

Baseline

04/18/2018

Intersection: 5: Service Rd/Range Road 3051 & Grasswood Rd

Movement	EB	EB	WB	NB	SB
Directions Served	LT	R	LTR	LTR	LTR
Maximum Queue (m)	14.2	17.0	64.7	28.0	8.2
Average Queue (m)	7.1	0.9	28.7	14.4	1.2
95th Queue (m)	13.6	7.8	51.8	23.5	5.9
Link Distance (m)	157.8	157.8	227.0	207.9	166.3
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (m)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Network Summary

Network wide Queuing Penalty: 0

Maggie Schwab

From: Petras, Julian HI <julian.petras@gov.sk.ca>
Sent: Wednesday, August 1, 2018 11:44 AM
To: Thai, Amy
Cc: Gray, Nathan; Maggie Schwab; Carolyn Mathison; Brett LaRoche; Buchko, Michelle HI
Subject: RE: Grasswood Commercial Development TIA

Good Morning Amy,

Thank you for the clarification on those assumptions. With that cleared up, the Ministry does not have any further concerns with the content or recommendations presented in the TIA. Given that the recommended improvements do not directly impact any of the roadways under the Ministry's jurisdiction, I do not believe we will need to form any sort of partnership agreement prior to construction. However, a roadside development permit will be required prior to any work being completed at the Grasswood Road and Service Road intersection.

Let me know if you have any questions.

Regards,

Julian Petras, Engineer-In-Training
Government of Saskatchewan
Operations Project Engineer
Traffic Engineering and Development , Ministry of Highways and Infrastructure

Unit #18 – 3603 Millar Avenue
Saskatoon, SK S7P 0B2

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From: Thai, Amy [mailto:Amy.Thai@wsp.com]
Sent: Tuesday, July 31, 2018 11:13 AM
To: Petras, Julian HI
Cc: Gray, Nathan; Maggie Schwab; Carolyn Mathison; Brett LaRoche; Buchko, Michelle HI
Subject: RE: Grasswood Commercial Development TIA

Morning Julian,

Please see attached the RM of Corman Park guidelines for the DC1 zone development and the development site plan.

The majority of the lots are 30m x 70m = 2100sq.m. With the RM's requirements for setbacks, the maximum allowable building size would be = 14m x 32m = 448sq.m. GFA, which is approximately 21% of the lot size. Thus, we assumed 20% gross floor area of the lot size.

The gross leasable area excludes the exterior walls, storage / utility rooms, etc. As such, the GLA is typically considered to be 80% of the GFA.

If you have any other questions or require further clarifications, please let me know.

Thank you,
Amy

From: Petras, Julian HI [mailto:julian.petras@gov.sk.ca]

Sent: Wednesday, July 25, 2018 1:09 PM

To: Thai, Amy <Amy.Thai@wsp.com>

Cc: Gray, Nathan <Nathan.Gray@wsp.com>; Maggie Schwab <mschwab@crosbyhanna.ca>; Carolyn Mathison <c.mathison@cwce.ca>; Brett LaRoche <b.laroche@cwce.ca>; Buchko, Michelle HI <michelle.buchko@gov.sk.ca>

Subject: RE: Grasswood Commercial Development TIA

Good Afternoon Everyone,

The Ministry has completed its initial review of the Grasswood Commercial Development TIA and there was one area that we require some additional clarification. Could you please provide a source or more justification for the assumptions that Gross Floor Area will be 20% of the lot size and Gross Leasable Area will be 80% of the Gross Floor Area.

Regards,

Julian Petras, Engineer-In-Training
Government of Saskatchewan
Operations Project Engineer
Traffic Engineering and Development , Ministry of Highways and Infrastructure

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From: Thai, Amy [mailto:Amy.Thai@wsp.com]

Sent: Wednesday, June 20, 2018 11:22 AM

To: Petras, Julian HI

Cc: Gray, Nathan; Maggie Schwab; Carolyn Mathison; Brett LaRoche
Subject: Grasswood Commercial Development TIA

Hello Julian,

Please find attached the report for the Grasswood Commercial Development Traffic Impact Assessment.

If you have any questions or require further clarifications, please let me know.

Thanks,
Amy

Amy Thai, EIT
Planner
Transportation Planning



t: 306.518.0272
m: 306.665.6223
f: 306.665.8589

203 Wellman Crescent
Saskatoon, Saskatchewan, Canada S7T 0J1

www.wsp.com

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Monday, Sept 25/17



Council Planning Report – Item 9D3

SUBDIVISION 2017/42

Owner/Applicant: Major Land Corporation
Legal Land Description: NE 35-35-5-W3
Council Division: 2

1. Proposed Development: Subdivision – Parcel Tie-Code Removal

2. Commission Recommendation:

“That the application of Major Land Corporation to remove the parcel tie-codes between Surface Parcel No. 117770621 and Surface Parcel No. 117961993 in the NE 35-35-5-W3 for the purpose of creating separate titles for severed parcels be APPROVED subject to:

- i. The applicant being solely responsible for all of the costs of the parcel tie-code removal;*
- ii. Obtaining the necessary approvals and complying with the requirements and recommendations of all government ministries and agencies including but not limited to the Ministry of Environment and Ministry of Highways & Infrastructure, including:
 - a. any permanent development within 90 metres of the highway right-of-way requires a permit from the Ministry of Highways and Infrastructure, with minimum setback distances of 60 metres from the highway for homes and 55 metres from the highway for trees, shrubs, granaries, commercial development, etc.;*
 - b. any new access to the Access Road (Hwy 11-08-83) will require a permit from the Ministry of Highways and Infrastructure; and*
 - c. No development within a triangle formed by measuring the following distances from the intersection of the roadway centerlines and joining the points so obtained:
 - 130 metres (427 feet) along the highway centerline;*
 - 130 metres (427 feet) along on the centerline of the intersecting grid road.***
- iii. Any new approach required to access the parcels must be constructed subject to consultation with, and approval from either the R.M. Director of Public Works or the Ministry of Highways and Infrastructure, as required;*
- iv. The applicant applying for a development permit and building permit prior to development occurring on site, including the approval of a subdivision and rezoning application as required.”*

3. Summary:

- Currently the subject property is comprised of two parcels tied together and considered as one 34.83 ha (86.06 acre) parcel; the applicant is proposing to remove the parcel ties to create separate and independent land titles.

- Surface Parcel No. 117770621, the northern parcel comprised of 19.77 ha (48.85 acres) and Surface Parcel No. 117961993, the southern parcel comprised of 15.06 ha (37.21 acres).
- Zoning for the subject properties is D-Agricultural 1 (DAG1) District; at this time no rezoning is required.
- The parcels were created through the relocation of the intersection of Highway No. 11 and Grasswood Road (Township Road 360), as approved by the Ministry of Government Relations – Community Planning Branch in July, 2001.
- At that time, policies were not in place to allow for severed parcels; under current policies, the parcel tie-codes can be removed and development can occur on each parcel.
- If approved, the new parcels will be utilized for agricultural purposes in the interim, however they are designated as “Commercial” on the Future Land Use Map within the District Official Community Plan (DOCP). A change in use from agricultural on the either parcel in the future will require a new application to be submitted and approved.
- Access is currently via an extended cul-de-sac, at the intersection of two service roads for Highway No. 11. The northern parcel is also bordered by Grasswood Road (Township Road 360), an R.M. maintained roadway, on a 45 metre right-of-way.
- The application meets the requirements of the Corman Park-Saskatoon Planning District Zoning Bylaw and Official Community Plan.

4. Bylaw Compliance:

Corman Park-Saskatoon Planning District Official Community Plan (DOCP):

<i>Section</i>	<i>Policy</i>	<i>Compliance</i>
<i>Section 4: Agricultural Objectives and Policies</i>		
4.2.1.	The minimum parcel size to remain as an agricultural parcel is 80 acres, or equivalent. Due to the re-construction of Highway No. 11 and previous subdivisions, removal of the parcel ties will allow for each parcel to be considered equivalent to 80 acres.	Yes
4.6.1.	The remnant quarter section is being subdivided to create two agricultural holdings.	Yes
<i>Section 8: Servicing and Transportation Objectives and Policies</i>		
8.2.4.	The application was referred to the Ministry of Highways and Infrastructure (MHI) for comments, as the parcels are adjacent to Highway No. 11 and utilize a service road maintained by MHI. Preliminary comments were received, noting the removal of the parcel ties can proceed. Official comments are currently outstanding.	Yes

Corman Park-Saskatoon Planning District Zoning Bylaw:

<i>Section</i>	<i>Policy</i>	<i>Compliance</i>
<i>Section 3: Standards of Development</i>		
3.7.1.	<p>Based on the online database, provided by the Ministry of Environment (MOE) and the Saskatchewan Conservation Data Centre (SKCDC), the results of the search noted the presence of the olive-backed pocket mouse. This occurrence is dated 1955. Due to the historical nature of the occurrence and the agricultural operations occurring on site, there are no concerns with the application proceeding.</p> <p>The Ministry of Environment was provided a referral from the Ministry of Government Relations – Community Planning Branch. Their comments are currently outstanding.</p> <p>Utilizing the online search tool for the Ministry of Parks, Culture and Sport – Heritage Branch, the subject parcel has been cleared of any heritage sensitivities.</p>	Yes
3.21.1.	<p>Access to the parcels is currently via an extended cul-de-sac, at the intersection of two service roads for Highway No. 11, maintained by the Ministry of Highways and Infrastructure. The northern parcel is also bordered by Grasswood Road (Township Road 360), an R.M. maintained roadway, on a 45 metre right-of-way.</p>	Yes
<i>Schedule C: D-Agricultural District (DAG1)</i>		
2.1.	<p>The continued use of the parcels will remain to be agricultural in nature.</p>	Yes
8.1.	<p>The minimum parcel size to remain as an agricultural parcel is 80 acres, or equivalent. Due to the re-construction of Highway No. 11 and previous subdivisions, removal of the parcel ties will allow for each parcel to be considered equivalent to 80 acres.</p>	Yes
8.2. & 8.3.	<p>The parcels are currently vacant of development; the applicant will be required to meet all setback distances from property lines as determined by the R.M. and/or the Ministry of Highways and Infrastructure (MHI).</p>	Yes

5. Interdepartmental Implications:

If a new approach is required to access the northern parcel, Surface Parcel No. 117770621, approval for the construction of the approach must be granted by the R.M. Director of Public Works prior to construction.

6. Financial Implications:

The subdivision servicing fee is not required, as the parcels are to be utilized for agricultural purposes.

The applicant is exempt from the Municipal Reserve requirement as the parcels are larger than four hectares in size and are for agricultural purposes.

7. Legal Implications: N/A

8. Alternative Options:
Council may defer consideration of the application pending a further review where required.

9. Public Consultation Summary: N/A

10. Regulatory Correspondence:

Ministry of Environment: The application was referred to the Ministry of Environment by Community Planning; their comments are currently outstanding.

Based on the online database, provided by the Ministry of Environment (MOE) and the Saskatchewan Conservation Data Centre (SKCDC), the results of the search noted the presence of the olive-backed pocket mouse. This occurrence is dated 1955. Due to the historical nature of the occurrence and the agricultural operations occurring on site, there are no concerns with the application proceeding.

Ministry of Highways and Infrastructure (MHI): R.M. Administration contacted MHI prior to submittal of the application to ensure that there was no concern with the parcel tie removal proceeding; preliminary comments note that there is no concern with removal of the parcel ties. The application was formally referred to MHI by Community Planning due to the close proximity to Highway No. 11 and because access is currently provided by a portion of roadway maintained by MHI.

At the time of the DPC meeting MHI comments were outstanding. Comments from the MHI have been received and follow this report, however the MHI has no objections, providing that:

1. any permanent development within 90 metres of the highway right-of-way requires a permit from MHI, with minimum setback distances of 60 metres from the highway for homes and 55 metres from the highway for trees, shrubs, granaries, commercial development, etc.;
2. any new access to the Access Road (Hwy 11-08-83) will require a permit from MHI; and
3. No development within a triangle formed by measuring the following distances from the intersection of the roadway centerlines and joining the points so obtained:
 - 130 metres (427 feet) along the highway centerline;
 - 130 metres (427 feet) along on the centerline of the intersecting grid road.

City of Saskatoon: The application was referred to the City of Saskatoon by Community Planning; their comments note they have no affected facilities in the vicinity, and that any changes to the land use will require a new application. There are no concerns with the application proceeding; full comments follow this report.

11. Other Considerations:

If approved, the new parcels will be utilized for agricultural purposes in the interim, however they are designated as "Commercial" on the Future Land Use Map within the District Official Community Plan. A change in use from agricultural on the either parcel in the future whether through subdivision, rezoning or development permit approval, will require a new application to be submitted and approved including the submission of any additional information including a Comprehensive Development Review and any technical studies as required.

12. District Planning Commission (DPC):

The District Planning Commission heard this application at the September 6, 2017 meeting. The Commission had no concerns and supported the application as presented.



Subdivision Application: Subject Property Aerial Image	Applicant: Major Land Corporation
	Legal Land Description: NE 35-35-5-W3
	Date of Consideration: September 6, 2017



Subdivision Application: Subject Property Aerial Image	Applicant: Major Land Corporation
	Legal Land Description: NE 35-35-5-W3
	Date of Consideration: September 6, 2017



Government
of
Saskatchewan

Ministry of Highways and Infrastructure
Design & Innovation - Central
18, 3603 Millar Avenue
Saskatoon, Canada S7P 0B2

September 1, 2017

Our File: C.S. 11-08 Sub
Municipal File: R0668-17S

Shawn Dukart
Ministry of Government Relations
Room 978, 122 - 3rd Avenue North
Saskatoon, SK S7K 2H6

Re: Proposed Subdivision
R.M. of Corman Park No. 344
NE 1/4 35-35-05-W3M
Intended Use: Commercial & Tie Code Removal

The Ministry of Highways and Infrastructure has reviewed the above mentioned subdivision proposal. Our Ministry has no objections providing the following conditions are met:

1. Any permanent development within 90 metres of the highway right-of-way requires a permit from this Ministry. Minimum setback from the existing roadway centreline is 60 metres for homes and 55 metres for trees, shrubs, granaries, commercial development, etc.
2. Any new access to the Access Road (Hwy 11-08-83) will require a permit from this Ministry.
3. No development within a triangle formed by measuring the following distances from the intersection of the roadway centrelines and joining the points so obtained:
 - 130 metres (427 feet) along the highway centreline;
 - 130 metres (427 feet) along the centreline of the intersecting grid road.

Please quote both file numbers on return correspondence.

Jennifer Fertuck, P. Eng.
Director, Traffic Engineering and Development
Central Region

Ministry Contact: Andrew Nicholls, Phone (306) 933-5801, Fax (306) 933-5805



PROPOSED SUBDIVISION

HWY 11
NE 1/4 35-35-05-W3M
km 28.3

DRAWN BY	A NICHOLLS	DATE	17/08/31	CS	11-08	TAB NO	A4-SUBDIV
DESIGNED BY		DATE		CONTRACT		SHEET	1 OF 1

ACAD DWG: 3063535_P448
LAST REV DATE: 17/09/01

August 25, 2017

Shawn Dukart, Planning Consultant
Community Planning Branch
Ministry of Government Relations
Room 978 - 122 Third Avenue North
Saskatoon SK S7K 2H6

Dear Mr. Dukart:

**Re: Rural Municipality of Corman Park No. 344
NE ¼ Section 35-35-5 W3M
Proposed Subdivision (Parcel Tie Removal) – Agricultural
Our File No.: PL 4240-20**

Thank you for referring this proposed subdivision application to the City of Saskatoon (City). The Planning and Development Division understands the proposed subdivision is intended to accommodate a parcel tie removal that would result in an additional legal parcel.

The proposed subdivision indicates that the land use of the newly proposed parcel, and the remaining parcel is intended to remain as agricultural at this time. The proposed subdivision location is identified as Future Commercial on the Corman Park – Saskatoon Planning District Official Community Plan – Future Land Use Map, as well as Urban Commercial/Industrial on the Saskatoon North Partnership for Growth Regional Land Use Map. If a land use change is proposed for either parcel in the future, additional application requirements will apply. Further information on that process is available from the Rural Municipality of Corman Park office.

The Planning and Development Division is not aware of any land use in the vicinity of the proposed parcel or any site conditions that would make the proposed parcel unsuitable for the intended uses. Also, the City does not have any facilities that would be negatively affected by the proposal.

If you have any questions, please feel free to contact me.

Yours truly,



Ian Williamson, MCIP, RPP, Senior Planner
Planning and Development Division (306-657-8640)

IW:df

cc: Rebecca Row, Director of Planning and Development, RM of Corman Park

Maggie Schwab

From: Susanne Glenn-Rigny <Susanne.Glenn-Rigny@cn.ca>
Sent: Monday, March 11, 2019 2:33 PM
To: Maggie Schwab
Subject: FW: Proposed Commercial Development - RM of Corman Park
Attachments: CN Rail - PML - Non-sensitive.pdf

Good afternoon Maggie,

My apologies for the delay in this response.

Please find attached CN's requirements for non-sensitive uses in proximity to a Principal Main Line.

Any variation in the setbacks needs to be supported with building and site specific drawings. While we request the 15 meter setback for non-sensitive uses, it could be possible to reduce this to 8 meters. However, CN reviews these requests as applications are circulated. We can not give a blanket approval that we would approve a reduction to 8 meters for all the sites. It depends on the use, design of the site and design of the building. If a building is less than the recommended 15 meters, we would have to consider the structure of walls that would be impacted by a train derailment.

The final decision on site design always rests with the approving agency, and CN remains a commenting agency.

If you wish, I can speak to the municipality directly about this matter.

Regards

Susanne

Susanne Glenn-Rigny, MCIP, RPP, OUQ

Agente principale/Senior Officer
Planification et développement communautaires/
Community Planning and Development

 Affaires juridiques/Law Department

935, rue de La Gauchetière Ouest

15e étage

Montréal (Québec) H3B 2M9

Téléphone: (514) 399-7844

Télécopieur: (514) 399-4296

Cell (514) 919-7844

Email: susanne.glenn-rigny@cn.ca

Precision Railroading: Doing it well and always improving

From: Maggie Schwab <mschwab@crosbyhanna.ca>
Sent: January 24, 2019 10:41 AM
To: Susanne Glenn-Rigny
Subject: Proposed Commercial Development - RM of Corman Park

Hi Susanne,

Thanks for the discussion on the proposed commercial development in the RM of Corman Park today.

I've attached the TIA and the Municipal Servicing Study, along with the email chain between Saadia and myself below, as per your request.

As discussed, the RM of Corman Park has requested we get something in writing from CN with respect to any required setbacks. The Developer is hoping that the RM's required 8 m rear yard setback is sufficient for the uses that are permitted on-site. Here is the link to access the Corman Park-Saskatoon Planning District Zoning Bylaw (the Developer is looking to rezone the parcel to DC1):

<http://www.rm-cormanpark.ca/DocumentCenter/View/194/Corman-Park---Saskatoon-Planning-District-Zoning-Bylaw---Bylaw-No-2310-PDF?bidId>

Thanks for your help today!

Kindest regards,

Maggie Schwab MCIP, RPP
CROSBY HANNA & ASSOCIATES
407C 1st Ave N
Saskatoon, SK S7K 1X5
t : 306.665.3441
f : 306.652.9613
e : mschwab@crosbyhanna.ca
www.crosbyhanna.ca

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From: Maggie Schwab
Sent: Wednesday, January 16, 2019 8:47 AM
To: 'Proximity' <proximity@cn.ca>
Cc: Jim Walters <jwalters@crosbyhanna.ca>
Subject: RE: Proposed Commercial Development - RM of Corman Park

Good Morning Saadia,

I was wondering if you have had an opportunity to consider the Developer's response to CN's feedback as it pertains to the proposed commercial development?

Kindest regards,

Maggie Schwab MCIP, RPP

CROSBY HANNA & ASSOCIATES

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From: Maggie Schwab

Sent: Tuesday, January 8, 2019 11:04 AM

To: 'Proximity' <proximity@cn.ca>

Cc: Jim Walters <jwalters@crosbyhanna.ca>

Subject: RE: Proposed Commercial Development - RM of Corman Park

Good Morning Saadia,

Thank you for your help in providing us with a response from CN with respect to the proposed Major Land Corporation commercial development.

I have attached the Civil Engineering Review for the proposed project which includes a drainage plan. The Drainage Plan has been designed to accommodate a 1:100 year flood plus 25% as per the requirements of the RM of Corman Park. The Plan has already been reviewed and approved by the Water Security Agency.

With respect to the chain link fence, the proposed development is located in a rural area and trespassing is not anticipated to be an issue.

I can confirm that the closest access point is located 105.5 m to the east of the rail crossing, which exceeds the 30 m setback.

With respect to the recommended 30 m setback from any structure, I am wondering if the required 8 m rear yard setback, as per the Zoning Bylaw is sufficient? I see that the recommended protective measures you sent to us are for uses adjacent to a Main Line. The proposed development is located adjacent to a branch line and not a main line. Please confirm whether this rear yard setback is sufficient.

I will also make note that we are undertaking a landscape plan for this proposed development which will include a 6 m municipal buffer (including a 5 m fire break) for lots located around the periphery of the development, including the proposed lots adjacent to the rail line.

I look forward to hearing back from you.

Kindest regards,

Maggie Schwab MCIP, RPP

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From: Proximity [<mailto:proximity@cn.ca>]

Sent: Thursday, December 27, 2018 9:57 AM

To: Maggie Schwab <mschwab@crosbyhanna.ca>

Subject: RE: Proposed Commercial Development - RM of Corman Park

Maggie,

Thank you for reaching out to CN on the subject proposal.

I have attached CN's criteria for non-sensitive uses in proximity to a main-line. Our particular areas of focus would be the following:

- An adequate setback to build and maintain the structure(s) off of the right-of-way;
- The provision of 1.83 meter chain link security fencing along the mutual property line, be installed and maintained by the owner (may not be applicable in a rural location where trespassing is not anticipated);
- Confirmation that there will be no adverse impacts to the existing drainage pattern (in terms of flow rate, volume or any other parameter) on the railway right-of-way and that there will be no additional runoff to CN lands in the event of a 100-yr storm;
- A 30 meter setback of access points to avoid the potential for impacts to traffic safety when located near at-grade railway crossings.

Sincerely,

Saadia Jamil

Jr. Community Planning & Development Officer

 Affaires juridiques / Law Department

935, rue de La Gauchetière Ouest

15e étage

Montréal (Québec) H3B 2M9

Téléphone: (514) 399-7291

Télécopieur: (514) 399-4296

Email : saadia.jamil@cn.ca

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From: Maggie Schwab <mschwab@crosbyhanna.ca>
Sent: Friday, December 21, 2018 3:02 PM
To: Proximity <proximity@cn.ca>
Subject: Proposed Commercial Development - RM of Corman Park

Good Afternoon,

I just spoke with Saadia Jamil with regards to a proposed rezoning application that we have submitted to the RM of Corman Park, south of the City of Saskatoon, on behalf of Major Land Corporation.

Major Land Corporation is applying to rezone a 48.85 acre (19.77 ha) piece of land from DAG-1 D- Agricultural 1 District to DC-1 – D-Arterial Commercial 1 District in the Saskatoon Corman Park Planning District. You can find a list of the permitted and discretionary uses under the DC-1 District in the Zoning Bylaw here:

<http://www.rm-cormanpark.ca/DocumentCenter/View/194/Corman-Park---Saskatoon-Planning-District-Zoning-Bylaw---Bylaw-No-2310-PDF?bidId=>

The RM of Corman Park has requested that we consult with CN with respect to any conditions/restrictions that need to be considered with respect to this development.

I have attached both the engineered drawings as well as a location map for your convenience. I'll note that we had a Traffic Impact Assessment undertaken as a part of this rezoning application and the Traffic Engineers noted that the 2017 Transport Canada Grade Crossing Inventory indicates that the total trains per day is zero. It is my understanding from Saadia, however, that the corridor may still be active and that there may still be the requirement for a setback for structures.

If someone could kindly provide these setbacks to me in writing, along with any other considerations that need to be undertaken, it would be greatly appreciated.

Kindest regards,

Maggie Schwab MCIP, RPP

CROSBY HANNA & ASSOCIATES

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APPENDIX D

MUNICIPAL SERVICING REPORT



CATTERALL & WRIGHT
CONSULTING ENGINEERS

CATTERALL & WRIGHT | CONSULTING ENGINEERS

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

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

May 2018

GRASSWOOD (NE 35-35-05-W3) CIVIL ENGINEERING REVIEW

FOR:

MAJOR LAND CORPORATION

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4.0	Sewage Collection.....	2
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1.0 Introduction

Catterall & Wright has prepared the following Civil Engineering Review for inclusion with the Comprehensive Development Review (CDR) for Major Land Corporation to review development options for NE 35-35-05-W3 – a commercially zoned property in the Rural Municipality of Corman Park. The following sections summarize the engineering review completed and outline the recommended servicing for the development.

2.0 Site Layout

The site area totals 19.8 ha, which includes 13.2 ha of developable lot area, 2.7 ha storm water detention pond, 2.9 ha roadways, and 1.0 ha Municipal Reserve (MR). The grading site plan is shown on Drawing 225-14701 in Appendix A. The grading plan includes preliminary grading of the lots, roads, and elevations of the storm water detention pond. The preliminary grading ensures that all lots and road areas drain to the central storm pond. The excavation and fill areas required to create the grading plan are shown on Drawing 225-14702 in Appendix A.

It is important to note that the site plan layout presented in this report is a most conservative arrangement in terms of site density based Site Development Standards from Section L – Saskatoon Planning District Zoning Bylaw; the developer has proactively requested this approach for the CDR. The motivation behind this approach is to allow flexibility for the ultimate development. Most likely, the eventual development will be less dense than that designed for in this report. Review of each development will still occur at the building permit stage; however, the acceptance of this CDR should suffice for any future development on this land under the proposed zoning.

3.0 Storm Water Management

The existing drainage outlet for the development is a 500mm corrugated steel pipe (CSP) culvert running north under Grasswood Road; this culvert is located approximately 290 metres east of the north/south rail line. The modelled pre-development runoff rate totals approximately 1500 L/s.

Catterall & Wright prepared a preliminary lot grading plan for the development which contains all runoff from the site into a central storm water detention pond. The pond was sized to provide storage for the 1:100 year storm event plus 25% and to ensure the post-development runoff rate was equal to the pre-development runoff rate of approximately 1500 L/s. The development was modelled using XPSWMM software to confirm that the presented storm water detention pond can adequately manage the development's storm water, thus maintaining the existing drainage patterns and flow rates.

The storm water detention pond is designed to accommodate the increased runoff due to greater impermeable surface area of the development. Storm water calculations assumed a pre-development

runoff coefficient of 0.25 and a post-development combined runoff coefficient of 0.78; this calculation is included in Table 1 within Appendix B.

The proposed storm water detention pond should require minimal maintenance, limited to clearing vegetation growth near the existing culvert inlet.

The pond storage volume required totals 12,000 cubic metres for the development, which is equivalent to approximately 890 cubic metres per hectare of lot development. This value can be used to ensure adequate storm water management is provided by the development in the event of a change in site layout.

4.0 Sewage Collection

There is currently no communal waste water system for this development to connect to; therefore, the proposed waste water solution for this development is individual septic holding tanks. The types of commercial developments included in the D-Arterial Commercial 1 District (DC1) Permitted Uses would all typically be able to operate sufficiently with individual septic tank systems. Many of the Discretionary Uses would also operate sufficiently on such a system, but would need to be reviewed prior to approval.

The estimated wastewater generated by the development is calculated based on average rates for industrial and commercial developments stated in the Saskatchewan Onsite Wastewater Disposal Guide and totals approximately 10,000 L/day. This value results in an average of one 2500 gallon septic trunk per day servicing the development. To be conservative, Catterall & Wright recommends doubling this calculation to 20,000 L/day. This estimated sewage volume allows for the development to employ 280 people, and requires that an average of two septic trucks per day would service the development. This value is consistent with the Traffic Impact Assessment (TIA) and the other sections of this servicing report.

It is important to mention that if a City of Saskatoon sanitary sewer trunk is extended to Grasswood Road, the development would be able to connect to the City system.

5.0 Potable Water

The Dundurn Rural Water Utility (DRWU) has a low pressure potable water system with a booster station located at the south east corner of Grasswood Road west of the north-south rail line. The development has received a letter confirming that the Dundurn Rural Water Utility has the availability to supply potable water ; however, the flow rate will need to be confirmed with SaskWater (Appendix C).

Catterall & Wright has calculated the average day potable water demand to be approximately 20,000 L/day (3.1 igpm) for the entire development. This potable water demand equals 0.23 igpm per

hectare of land developed. Each lot will 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. In addition to a larger reservoir, fire protection requires a larger pump and a back-up generator. Each individual lot owner will be responsible for their reservoir and pumping equipment.

6.0 Summary

In conclusion, the Civil engineering review determined the land reviewed in this report (NE 35-35-05-W3) is suitable for the proposed commercial development. Drainage issues are a concern within the RM near the development; however, the storm water management review determined that construction of a storm water pond will sufficiently manage the storm water to maintain existing drainage patterns and outflow rates. Septic holding tanks are recommended for the development's wastewater. Conservative wastewater estimates suggest a total sewage volume equivalent to two septic trucks per day. There is a potable water utility available for the development to connect to, which should easily supply the development's average day demands. Each lot will require individual water tanks and pumps to accommodate peak demands and fire suppression, if required.

Respectfully submitted,

Catterall & Wright

Per:



Carolyn Mathison, Engineer-in-Training

Reviewed:



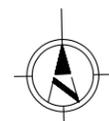
Brett LaRoche, P.Eng.

7.0 [Appendix A – Engineered Drawings](#)

GRASSWOOD ROAD

EXIST. 500mm
CULVERT
S INV. 510.56
N INV. 510.41

CSP CULVERT
INVERTS TO MATCH
EXIST. DITCH



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:

- DRAINAGE GRADE & DIRECTION
- FINISHED GROUND ELEV.
- CULVERT INVERT
- SAFE BUILDING ELEVATION
- CULVERT
- EXIST. GROUND CONTOUR
- EXIST. ROAD
- MUNICIPAL RESERVE

SCALE VERIFICATION

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

DATE	REVISION

19/01/25 ISSUED FOR REVIEW

18/05/17 ISSUED FOR REVIEW

OWNER/CLIENT

MAJOR LAND CORPORATION

LOCATION

RM CORMAN PARK NE 35-35-05 W3M

PROJECT

GRASSWOOD CDR

SHEET TITLE

**PRELIMINARY GRADING
SITE PLAN**

SCALE	DESIGNED
1:2500	CSM
DRAWN	CHECKED
ERL	BAL
DATE	SHEET
18/05/01	1 of 3

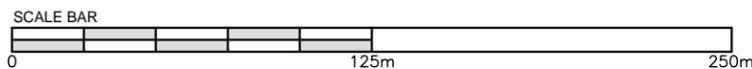
DRAWING NUMBER
225-14701

RAILWAY

SERVICE ROAD

STORM POND
HWL 511.55
NWL 510.77
FLOOR 508.77
7:1 SLOPES

NOTE:
-DRAWING TO BE PRINTED IN COLOUR.

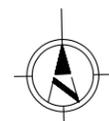


GRASSWOOD ROAD

EXIST. 500mm
CULVERT
S INV. 510.56
N INV. 510.41

CSP CULVERT
INVERTS TO MATCH
EXIST. DITCH

CSP CULVERT
INVERTS TO MATCH
EXIST. DITCH



CATTERALL & WRIGHT
CONSULTING ENGINEERS

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SASKATOON SK S7H 0S5
Tel: (306) 343-7280, Fax: (306) 956-3199

PRELIMINARY
NOT FOR CONSTRUCTION

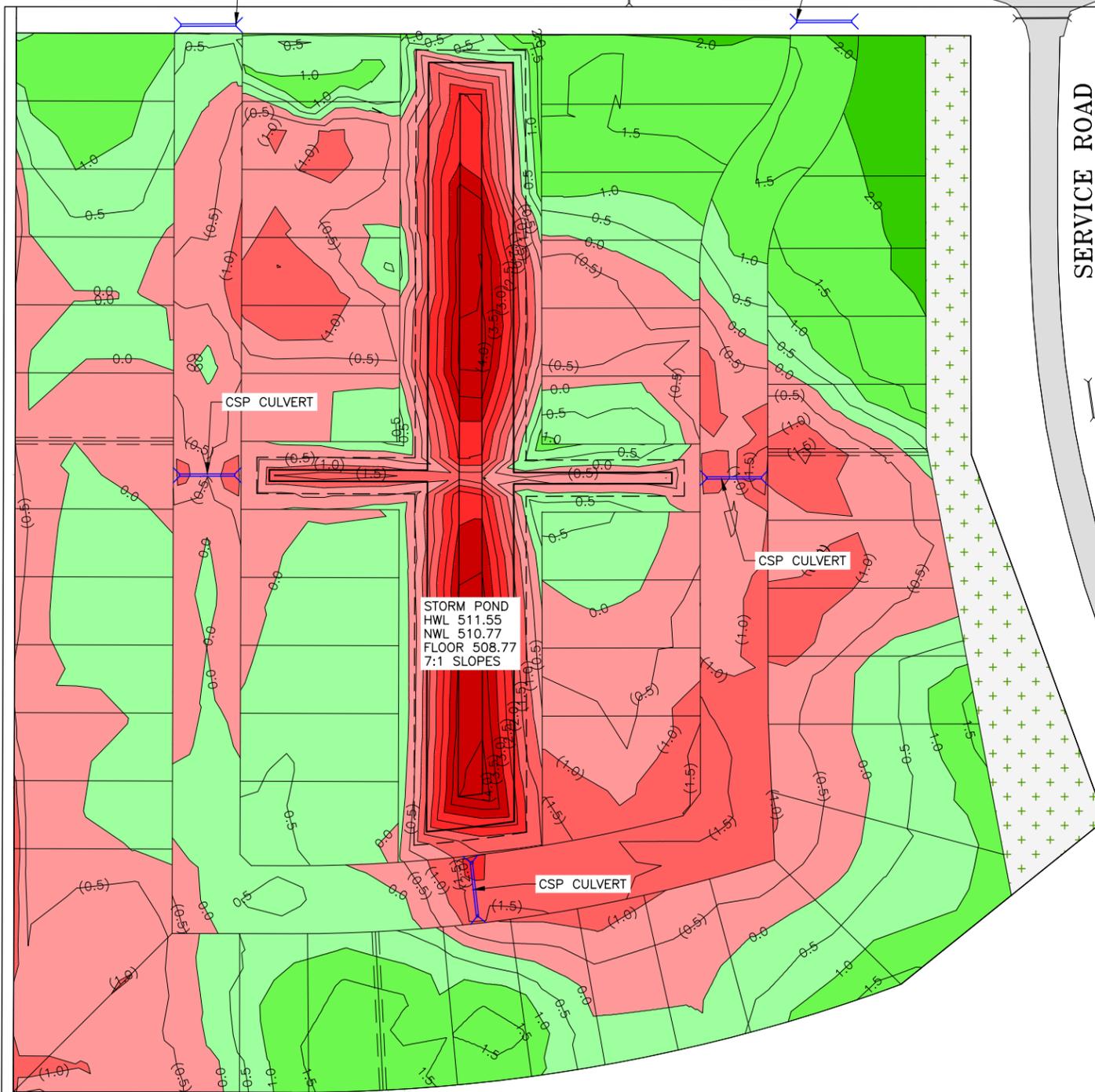
LEGEND:

- X.X — FILL CONTOUR
- (X.X) — CUT CONTOUR
- |—|— CULVERT
- FILL AREA
- CUT AREA
- |—|— EXIST. ROAD
- + + + MUNICIPAL RESERVE

CUT/FILL DEPTH		
NO.	ELEVATION RANGE	COLOUR
1	-5.0 TO -3.0	■
2	-3.0 TO -2.0	■
3	-2.0 TO -1.0	■
4	-1.0 TO 0.0	■
5	0.0 TO 1.0	■
6	1.0 TO 2.0	■
7	2.0 TO 3.0	■

RAILWAY

SERVICE ROAD

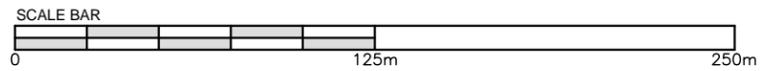


STORM POND
HWL 511.55
NWL 510.77
FLOOR 508.77
7:1 SLOPES

CSP CULVERT

CSP CULVERT

CSP CULVERT



NOTE:
—DRAWING TO BE PRINTED IN COLOUR.

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

DATE	REVISION

19/01/25 ISSUED FOR REVIEW
18/05/17 ISSUED FOR REVIEW

OWNER/CLIENT
MAJOR LAND CORPORATION

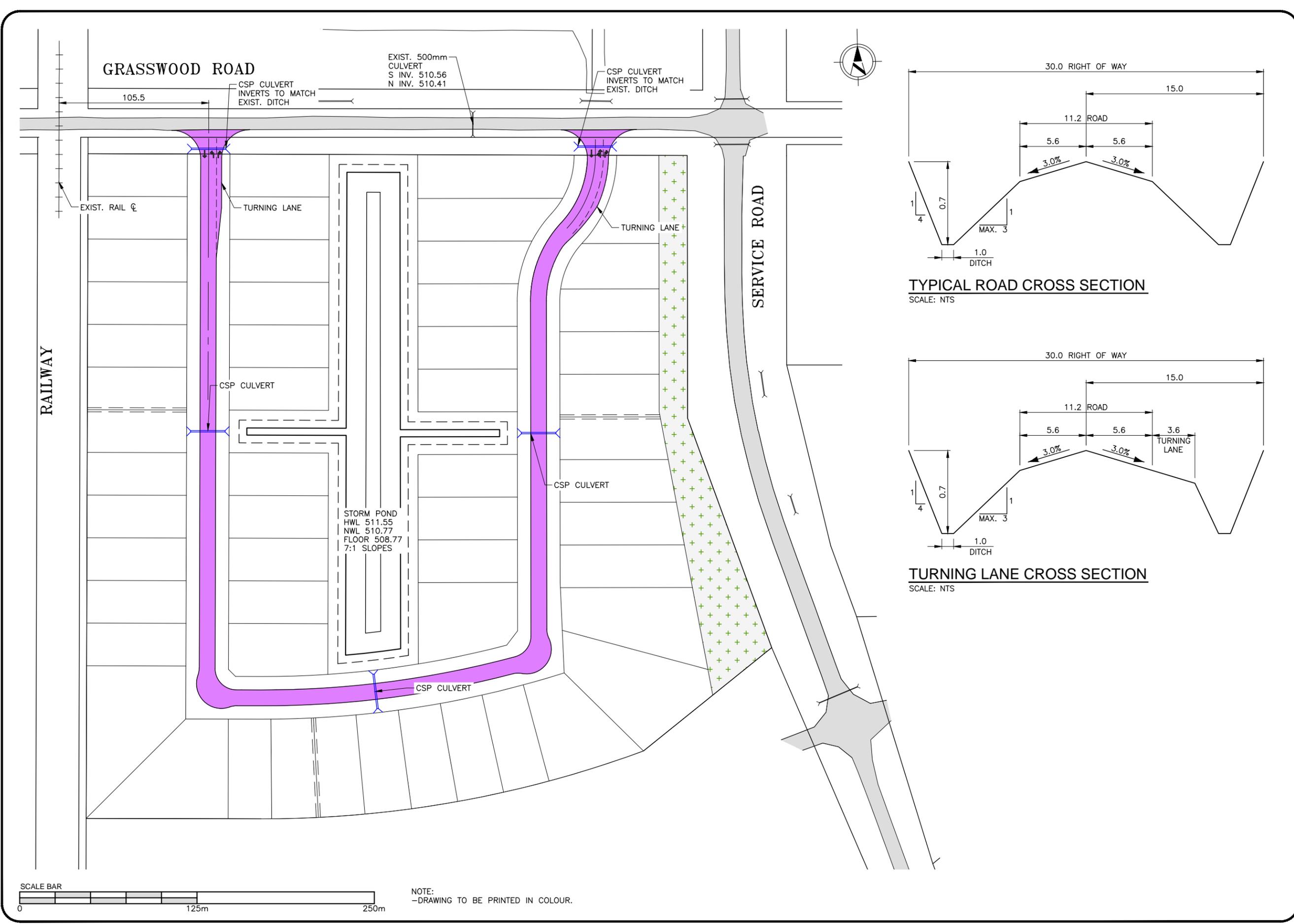
LOCATION
RM CORMAN PARK NE 35-35-05 W3M

PROJECT
GRASSWOOD CDR

SHEET TITLE
**ROUGH GRADING
CUT/FILL SITE PLAN**

SCALE	DESIGNED
1:2500	CSM
DRAWN	CHECKED
ERL	BAL
DATE	SHEET
18/05/01	2 of 3
DRAWING NUMBER	225-14702

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GRASSWOOD ROAD

EXIST. 500mm
CULVERT
S INV. 510.56
N INV. 510.41

CSP CULVERT
INVERTS TO MATCH
EXIST. DITCH

105.5

CSP CULVERT
INVERTS TO MATCH
EXIST. DITCH

EXIST. RAIL ☉

TURNING LANE

TURNING LANE

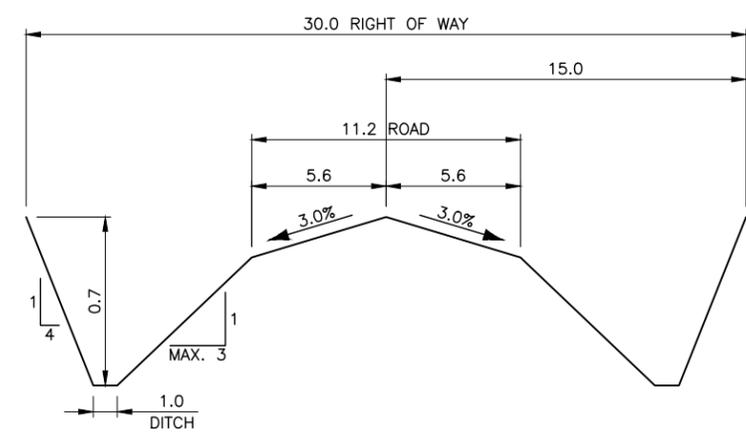
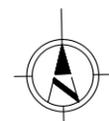
SERVICE ROAD

CSP CULVERT

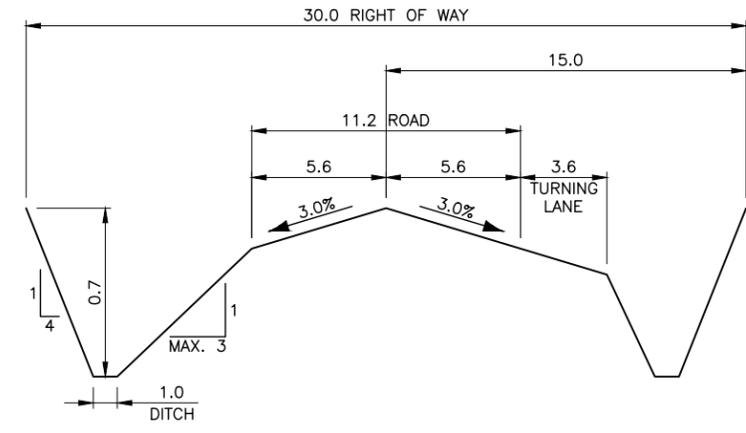
CSP CULVERT

STORM POND
HWL 511.55
NWL 510.77
FLOOR 508.77
7:1 SLOPES

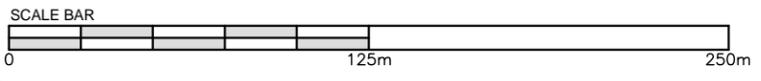
CSP CULVERT



TYPICAL ROAD CROSS SECTION
SCALE: NTS



TURNING LANE CROSS SECTION
SCALE: NTS



NOTE:
-DRAWING TO BE PRINTED IN COLOUR.



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CONSULTING ENGINEERS
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SASKATOON SK S7H 0S5
Tel: (306) 343-7280, Fax: (306) 956-3199

PRELIMINARY
NOT FOR CONSTRUCTION

LEGEND:

- CULVERT
- DESIGN ROAD
- EXIST. ROAD
- MUNICIPAL RESERVE

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

DATE	REVISION
19/01/25	ISSUED FOR REVIEW
18/05/17	ISSUED FOR REVIEW
OWNER/CLIENT MAJOR LAND CORPORATION	
LOCATION RM CORMAN PARK NE 35-35-05 W3M	
PROJECT GRASSWOOD CDR	
SHEET TITLE ROADWAY SITE PLAN	
SCALE 1:2500	DESIGNED CSM
DRAWN ERL	CHECKED BAL
DATE 18/05/15	SHEET 3 of 3
DRAWING NUMBER 225-14703	

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8.0 Appendix B – Combined Runoff Coefficient Calculation

Table 1: Post-Development Combined Runoff Coefficient Calculation

Surface:	Runoff Coefficient, c:	Area (sq.m.):	Percentage Area Covered (%)	Combined Runoff Coefficient
Pond	1.0	27,000	13.7	0.137
Commercial Development	0.75	131,708	66.6	0.50
Road	0.95	29,100	14.7	0.14
MR	0.05	9,894	5.0	0.0025
Total Development		197,702		0.78

9.0 [Appendix C – Correspondence - Dundurn Rural Water Utility](#)



DUNDURN RURAL WATER UTILITY

PO BOX 442

DUNDURN SK S0K 1K0

Phone: 306-492-2566

Fax: 306-492-2564

E-mail: drwu@sasktel.net

March 20, 2018

CROSBY HANNA & ASSOCIATES

407C 1st Ave N

Saskatoon, SK S7K 1X5

sent via e-mail

Attn.: Maggie Schwab

RE: Development in the NE 35 – 35 – 5 – W3 (immediately south of Grasswood Road, across from the Jemini Arena)

The Dundurn Rural Water Utility would like to confirm the availability of treated potable water in principle for your new project. Details will need to be discussed prior to making any final commitment on water to be delivered. If we can supply water to this quarter section, we could supply 27 igpm which is 0.5igpm for 54 lots.

The Utility will need to confirm that SaskWater will be able to provide the Dundurn Rural Water with the additional flow rate.

Thank you.

Yours truly,

DUNDURN RURAL WATER UTILITY

Rosalind Arndt (via e-mail)

Rosalind L. Arndt
Administrator

/rla

APPENDIX E

CORRESPONDENCE WITH DRWU



DUNDURN RURAL WATER UTILITY

PO BOX 442

DUNDURN SK S0K 1K0

Phone: 306-492-2566

Fax: 306-492-2564

E-mail: drwu@sasktel.net

March 20, 2018

CROSBY HANNA & ASSOCIATES

407C 1st Ave N

Saskatoon, SK S7K 1X5

sent via e-mail

Attn.: Maggie Schwab

RE: Development in the NE 35 – 35 – 5 – W3 (immediately south of Grasswood Road, across from the Jemini Arena)

The Dundurn Rural Water Utility would like to confirm the availability of treated potable water in principle for your new project. Details will need to be discussed prior to making any final commitment on water to be delivered. If we can supply water to this quarter section, we could supply 27 igpm which is 0.5igpm for 54 lots.

The Utility will need to confirm that SaskWater will be able to provide the Dundurn Rural Water with the additional flow rate.

Thank you.

Yours truly,

DUNDURN RURAL WATER UTILITY

Rosalind Arndt (via e-mail)

Rosalind L. Arndt
Administrator

/rla

APPENDIX F

CORRESPONDENCE WITH LORAAS DISPOSAL



Crosby Hanna & Associates
407C 1st Ave N
Saskatoon, SK S7K1X5

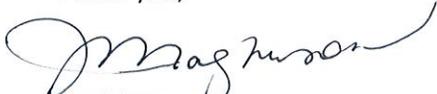
May 15/18

Attn: Maggie Schwab

Please accept this letter of confirmation in providing Waste/Recycle Removal Services in future for the proposed commercial development location located at NE 35 35 5 W3, south side of Grasswood Rd across from Jemini Arenas).

Any further questions please feel free in contacting us.

Thank you,



Jan Magnuson
Inside Sales
Loraas Division

Saskatchewan Owned & Operated Since 1965
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APPENDIX G

HERITAGE AND ENVIRONMENTAL QUERIES



ABOUT PARKS, CULTURE AND SPORT

Inquiry was made on March 9, 2018 at 2:35 PM

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

Quarter-section:
NE
Section:
35
Township:
35
Range:
5
Meridian:
3

This quarter-section is NOT heritage sensitive.

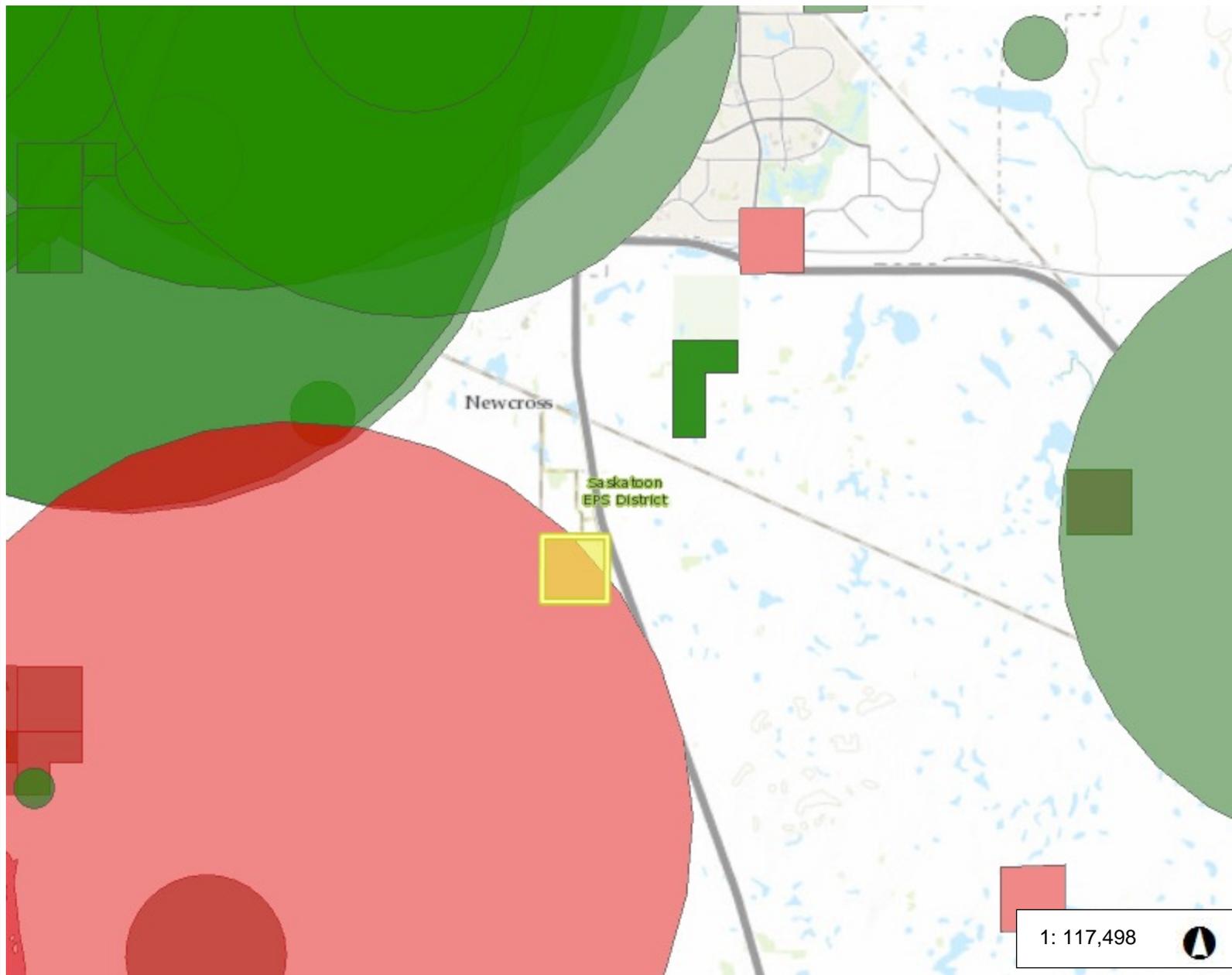
It is not necessary to submit the project to the Heritage Conservation Branch for screening. These results can be printed for submission to other regulatory bodies (e.g. Saskatchewan Environment, Saskatchewan Industry and Resources). Please email arms@gov.sk.ca if you have any questions.

Inquiry was made on March 9, 2018 at 2:35 PM

[Home](#) / [About PCS](#) / [Heritage](#) / [Developers' Online Screening Tool](#) / [Land Locations Search](#)

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North Ridge Environmental Screening



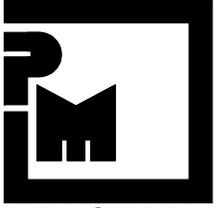
- Legend**
- Provincial Boundary
 - Ecological Protection Specialis Rare and Endangered Species
 - Vertebrate Animal
 - Invertebrate Animal
 - Animal Assemblage
 - Vascular Plant
 - Nonvascular Plant
 - Other (Botanical)
 - Fungus
 - National Park
 - Provincial Park

1: 117,498



Notes

APPENDIX H
GEOTECHNICAL REPORT



**P. MACHIBRODA
ENGINEERING
LTD.**

CONSULTING
GEOTECHNICAL
GEOENVIRONMENTAL
ENGINEERS AND
GEOSCIENTISTS

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WEB:
www.machibroda.com

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



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Companies/Canada

**GEOTECHNICAL INVESTIGATION
PROPOSED SUBDIVISION
NE1/4-35-35-05-W3M
GRASSWOOD, SASKATCHEWAN
PMEL FILE NO. 10678
FEBRUARY 12, 2016**

PREPARED FOR:

**MAJOR LAND CORPORATION
3037 FAITHFULL AVENUE
SASKATOON, SASKATCHEWAN
S7K 8B3**

ATTENTION: MR. DARRYL ALTMAN

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10678-10	Field Drill Log and Soil Test Results
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LIST OF DRAWINGS (Continued...)

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1.0 INTRODUCTION

The following report has been prepared on the subsurface soil conditions encountered at the site of the proposed Subdivision to be constructed within the NE1/4-35-35-05-W3M in Grasswood, Saskatchewan. More specifically, the subject property is located within Parcel Nos. 117770621 and 117961993.

Written authorization to proceed with this investigation was provided on July 25, 2015. The field investigation was delayed until the winter to allow access into areas of the site which were reportedly wet and soft. The Terms of Reference for this investigation were presented in P. Machibroda Engineering Ltd. (PMEL) Proposal No. 10678REV1, dated July 17, 2015.

The field test drilling and soil sampling were conducted on January 7, 8, 14, 26 and February 1, 2016. Groundwater monitoring was conducted on February 8, 2016.

2.0 FIELD INVESTIGATION

2.1 Field Drilling Program

Fifteen test holes, located as shown on the Site Plan, Drawing No. 10678-1, were dry drilled using our continuous flight, solid and hollow stem drilling equipment. Tracked equipment was utilized to access areas of the site that were not cultivated and appeared to be soft. The test holes were 150/200 mm in diameter and extended to depths of 12 to 18 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. The test hole drill logs have been shown plotted on Drawing Nos. 10678-2 to 17, inclusive.

Both disturbed and relatively undisturbed soil samples were recovered during test drilling. Relatively undisturbed soil samples were recovered by hydraulically pressing thin-walled Shelby tubes into the bottom of the test holes as test drilling progressed. The Shelby tube samples were sealed to minimize moisture loss.

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.

Standard penetration tests (SPT), utilizing a safety hammer with automatic trip were performed during test drilling.

Standpipe piezometers (slotted, 50 mm diameter PVC pipe), were installed in Test Hole Nos. 16-3, 16-7, 16-9, 16-14 and 16-16 for groundwater monitoring purposes.

2.2 Piezocone Penetration Testing

Six piezocone penetration tests (CPTu) were conducted during the field investigation to depths of about 9.6 to 23.8 metres below existing grade. The CPTu test locations have been shown on the Site Plan, Drawing No. 10678-1.

The piezocone penetration tests consisted of pushing a cone, on the end of a series of rods, into the ground at a constant rate and near continuous measurements were made of the resistance to penetration of the cone. Local side friction resistance measurements were also made on a friction sleeve during penetration. Pore-water pressure response generated from the advancement of the cone into the soil was measured via a pore pressure filter located directly behind the cone tip. The piezocone tip had an apex angle of 60° and a 15 cm² base area. The friction sleeve had a perimeter area of 225 cm².

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 soundings have 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. 10678-2 to 17, inclusive.

The plan location at each Test Hole location was surveyed using handheld Global Positioning Equipment (Trimble, Model No. GeoXH 6000). The vertical accuracy of the equipment is within approximately ± 600 mm.

3.1 Soil Profile

Detailed descriptions of the site stratigraphy are presented on the Test Hole Logs, Drawing Nos. 10678-2 to 17, inclusive. In general the subgrade soil conditions consisted of a thin layer of organic topsoil overlying sand followed by variable deposits of low plastic silt, medium to highly plastic clay and sand which extended to a depth of at least 18 metres below existing grade, the maximum depth drilled with our test holes at this site.

Examination of the CPTu plots suggests that clay was encountered beneath the sand and extended to at least 23.8 metres below existing grade (i.e., the maximum depth penetrated with the CPTu soundings).

3.2 Groundwater Conditions, Sloughing

Extensive 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. 10678-2 to 17, inclusive.

The groundwater levels recorded in the piezometers installed during the field investigation have been summarized in Table I.

TABLE I. RECORDED GROUNDWATER LEVELS

Test Hole No.	Approx. Ground Surface Elevation (m)	Approx. Piezometer Rim Elevation (m)	Groundwater Levels (February 8, 2016)
16-3	511.6	512.6	510.8
16-7	512.8	513.8	511.0
16-9	513.9	514.9	511.5
16-14	512.8	513.8	511.2
16-16	513.3	514.3	511.3

An examination of Table I revealed that the groundwater table varied from between 0.8 to 2.4 metres below existing ground surface on February 8, 2016. Higher groundwater conditions could be encountered, particularly during or following precipitation and/or spring thaw.

3.3 Cobblestones and Boulders

Cobblestones and/or boulders were not encountered at the subject site during test drilling.

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, Atterberg limits, grain size distribution analysis, unconsolidated undrained compressive strength tests and water soluble sulphate contents.

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. 10678-2 to 17, inclusive.

The results of the grain size distribution analyses have been shown on Drawing Nos. 10678-18 and 19.

5.0 DESIGN RECOMMENDATIONS

The purpose of this investigation was to evaluate the existing subsurface soil and groundwater conditions for potential site development. The recommendations presented in this report may be used for preliminary design purposes. Site specific geotechnical investigations are recommended once the nature and location of the proposed Building structures have been finalized.

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

5.1 Design Considerations

The general subsurface soil conditions consisted of a thin layer of organic topsoil overlying poorly graded sand followed by variable deposits of low plastic silt, medium to highly plastic clay and sand. Extensive groundwater seepage and sloughing conditions were encountered during test drilling. The water levels in the standpipe piezometers installed at the site were between 0.8 and 2.4 metres below ground surface on February 8, 2016.

The subgrade soils are considered frost susceptible when combined with freezing temperature and a source of water. The average depth of frost penetration for the Grasswood, Saskatchewan area is about 1.8 to 2.2 metres.

It is understood that the proposed development will be comprised of light industrial buildings, commercial mixed or a combination of the two and that the final site configuration has not been finalized. The typical foundation support for this type of development typically consists of a pile and grade beam supported building with a grade supported main floor.

Although typically not constructed for this type of development, basement levels are not recommended based on the high groundwater conditions encountered at the site. Basements could be considered if the site grades are raised and the finished basement level is situated above or close to the existing ground elevation. Installation of piezometers at the exact building location and groundwater monitoring is recommended.

The high groundwater conditions could cause construction difficulties in some areas of the site, particularly in the non-cultivated areas where the groundwater table appeared to be higher. Typically, the earthwork can generally be accomplished using scrapers and bulldozer equipment. However, excavation in wet areas may require the use of backhoe excavation equipment or dragline excavators.

With regards to foundation support, a deep foundation system consisting of driven, treated timber piles, driven open-end steel pipe, helical screw piles and continuous flight auger (CFA) piles would perform satisfactorily. Drilled, cast-in-place concrete piles were considered but are not recommended due to the extensive groundwater seepage and sloughing conditions encountered at the site associated with wet sands.

Thickened edge raft foundations bearing on naturally occurring sand or structural granular fill over sand could also be considered and should perform satisfactorily. Thickened edge rafts bearing on imported clay fill are not recommended.

Footing foundations are not recommended due to the relatively high groundwater conditions. A perimeter thickened edge raft bearing at or near existing grade is preferred over excavating to install footings.

The near surface soils consisted primarily of sand. Grade supported floor slabs should perform satisfactorily at this site.

Recommendations have been prepared for site preparation; driven, treated timber piles; driven, open-end steel pipe piles; helical screw piles; continuous flight auger piles; perimeter thickened edge rafts; limit states resistance factors and serviceability; excavating and dewatering; floor slabs; foundation concrete; grade beams; site classification for seismic site response; and subdivision roads and parking structures.

5.2 Site Preparation

5.2.1 General

All organic topsoil, organics and other deleterious materials should be stripped from the construction areas and removed off-site. Approximately 100 to 600 mm of topsoil was encountered at the test hole locations during test drilling. Deeper thicknesses of topsoil should not be ruled out in other areas of the site. A further description on topsoil composition and structure has been presented in Appendix B.

The surface of the subgrade should be scarified (to a depth of 150 mm), moisture conditioned, levelled and compacted to +/- 2% of optimum moisture content to the following minimum density requirements.

Building Areas	- 96 percent of standard Proctor density at optimum moisture content.
Roadway and Parking Areas	- 96 percent of standard Proctor density at optimum moisture content.
Non-Critical Areas Requiring Subgrade Support	- 90 percent of standard Proctor density at optimum moisture content.

5.2.2 Fill Requirements

Where fill is required to raise the level of the subgrade to the design elevation, the existing sand soils, free of organic or deleterious material, are considered suitable. The depth of borrow will be limited by the elevation of the groundwater table at the time of excavation. Higher perched groundwater conditions could be encountered in certain times of the year (after spring thaw and/or precipitation events).

Utilization of sand soils at or beneath the groundwater table will require drying in order to place and compact to optimum density. Silt and clay soils that are in a softened condition are not considered suitable.

The sand is considered fine grained and poorly graded and may be easily disturbed during placement which may make it difficult to work with. A confining layer of granular base course will be required at the finished design elevation in order to protect the sand from disturbance due to construction traffic.

Depending on the thickness of granular structure above the in-situ sand, utilization of geogrid reinforcement (such as Tensar BX 1100 or TX 130) prior to placement of granular fill may be required where wet conditions exist at the subgrade level.

Subgrade fill material should be placed in thin lifts (lift thickness depends on type of compaction equipment, but in general, maximum 150 mm loose lifts are recommended). The soil should be compacted by the necessary compaction equipment to meet the specified compaction recommendations.

Sheepsfoot pad compactors are recommended for compaction of fine grained fill whereas smooth drum rollers are recommended for granular material. It is suggested that subgrade fill be compacted to 96 percent of standard Proctor density at optimum moisture content.

For areas that are sensitive to settlement and require strong subgrade support, consideration could be given to increasing the required compactive effort to 98 percent of standard Proctor density at optimum moisture content.

A representative of the Geotechnical Consultant should provide quality control during placement of the fill.

5.2.3 Soft Subgrade Conditions

Where softened silt or clay is encountered and scarification and drying the soil is not an option, overexcavation and replacement of a minimum of 400 mm of the softened soil with non-woven geotextile (eg. Nilex 4553) reinforced granular pitrun fill could be considered to provide stable subgrade support for additional fill lifts.

Utilization of geogrid in tandem with the geotextile may be required depending on the strength of the subgrade level and amount of fill being placed. In general, geogrid would be beneficial for subgrades that are very soft to soft in consistency and total fill thicknesses of approximately 500 mm or less. In this case, a combination geogrid/geotextile such as NAUE Combigrid that combines both materials in one product could be a viable option.

Level the subgrade soil and ensure the geotextile/geogrid is laid flat with no bunching before placing any material, and, overlap the geotextile/geogrid at least 500 mm. The granular fill should be placed by end dump and spread methods in one lift using tracked construction equipment, ensuring all equipment travels on the placed fill and not on the exposed geotextile/geogrid.

The placed fill should be lightly compacted using static compaction equipment. Care should be taken not to over compact the lift to attain 96 percent standard Proctor density as the primary purpose of the initial 400 mm is to bridge the underlying soils and provide a strong bearing layer to build up from. Subsequent fill lifts to bring the subgrade up to design elevation should consist of granular pitrun fill placed and compacted in accordance with Section 5.2.2.

If rolling subgrade conditions persist after placing the 400 mm stabilizing lift and it is anticipated that the required compaction will not be attained on subsequent fill lifts (i.e., 98 percent Proctor density), placement of geogrid reinforcement prior to placing additional fill lifts is recommended.

The geogrid (such as Tensar TX130) should be placed (by hand) over the leveled fill surface using an overlap of 500 mm on adjoining pieces. A minimum of 225 mm of granular fill should be placed over the geogrid in a single lift, ensuring equipment is working on top of the lift and not in contact with the geogrid. Compact the granular fill material to 96 percent of standard Proctor density using static compaction equipment (no vibratory equipment). Construct the remaining structure in accordance with Section 5.2.2.

The need for special measures (i.e., geogrid) and/or gravel fill in soft areas should be subject to review by the Geotechnical Consultant during the field construction and based on the actual conditions, the required fill thickness, the proposed construction equipment and the intended use for the designated area.

5.3 Driven, Treated Timber Piles

Driven, treated timber piles may be designed on the basis of skin friction only. The ultimate skin friction bearing pressures for driven, treated timber piles are as follows:

TABLE II. SKIN FRICTION BEARING PRESSURES (TIMBER PILES)

Zone (metres)	Ultimate Skin Friction Bearing Pressure (kPa)
0 to 2	0
Below 2	60

Resistance factors to reduce the provided ultimate skin friction bearing pressures to a value that is suitable for design have been presented in Section 5.8, Limit States Resistance Factors and Serviceability.

Notes:

1. For drop hammers, a minimum drop hammer mass of twice the mass of the pile, but not exceeding five times the mass of the pile, is recommended.
2. Pre-boring in advance of pile installation may be required to facilitate installation through fill or frozen ground. A pre-bore diameter that is smaller than the pile shaft is recommended (maximum 90 percent). The pre-bore depth should be limited to a depth of 2 metres below ground surface or depth of fill.
3. To minimize the potential for frost jacking, driven, treated timber piles should have a minimum embedment length of 6 metres. If the termination criteria is achieved at a depth which is significantly shallower than the design depth, then the pile capacity should be reviewed. Pre-boring may be required if the termination criteria is achieved prematurely.
4. A minimum centre-to-centre spacing of not less than three pile diameters is recommended.
5. Timber piles should not be subject to hard driving. The potential problems as a result of hard driving are splitting of the pile, brooming of the pile toe and bowing or breaking of the pile. Piles banding may be required to minimize potential damage during driving. To reduce the potential for damage, driving must be stopped upon satisfying the following termination criteria.

TABLE III. TERMINATION CRITERIA (TIMBER PILES)

Nominal Pile Size mm/No.	Rated Energy Per Hammer Blow (Joules)*	Termination Criteria Hammer Blows for 25 mm Penetration
250/10	25,000 (18,500 ft - lbs)	2
275/11	27,000 (20,000 ft - lbs)	3
300/12	30,000 (22,000 ft - lbs)	3
355/14	35,000 (26,000 ft - lbs)	4

*1 foot - pound - force = 1.356 Joules

6. The structural capacity of each pile should be confirmed by a structural engineer to ensure that over-stressing of the pile does not occur.
7. Pile driving records should be maintained during driving of all piles and should be assessed by pile driving analyses to confirm the design capacity of the piles.
8. A representative of the Geotechnical Consultant should inspect and document the installation of each driven, treated timber pile.

5.4 Driven, Open-End Steel Pipe Piles

Driven, open-end steel pipe piles may be designed on the basis of skin friction only. The ultimate skin friction bearing pressures for driven, open-end steel pipe piles are as follows:

TABLE IV. SKIN FRICTION BEARING PRESSURES (OPEN-END, PIPE PILES)

Zone (metres)	Ultimate Skin Friction Bearing Pressure (kPa)
0 to 2	0
Below 2	50

Resistance factors to reduce the provided ultimate skin friction bearing pressures to a value that is suitable for design have been presented in Section 5.8, Limit States Resistance Factors and Serviceability.

1. To minimize the potential for frost jacking, driven, steel pipe piles should have a minimum embedment length of 8 metres.
2. A minimum pipe wall thickness of 9.5 mm is recommended.
3. A minimum pile spacing of three times the shaft diameter is recommended.

4. Pre-boring in advance of pile installation may be required to facilitate installation through fill or frozen ground. A pre-bore diameter that is smaller than the pile shaft is recommended (maximum 90 percent). The pre-bore depth should be limited to a depth of 2 metres below ground surface or depth of fill.
5. Although not anticipated, if the pile terminates at a depth significantly shallower than the design length, the pile capacity should be reviewed by the Geotechnical Consultant.
6. Steel piles should be driven with a hammer of appropriate size and rated energy, depending on the pile design load requirements. The pile-driving hammer should be approved in advance of construction and the required pile set should be determined by dynamic analyses (such as wave equation analyses) for the specified hammer and pile sizes.
7. As a guideline, a minimum rated energy of 20 to 30 kJ is recommended for small cross-sections and up to 50 kJ for large cross-sections. The maximum driving energy should not exceed 630 J per square cm of steel cross-sectional area to avoid damage to the pile section.
8. Pile driving records should be maintained during driving of all piles and should be assessed by pile driving analyses to confirm the design capacity of the piles.
9. The installation of each pile and the elevation monitoring of each pile within nine pile widths which could be affected by the installation of adjacent piles should be documented during construction by a representative of the Geotechnical Consultant. Each pile should be inspected for damage or heave as a result of the driving operations.

10. After inspection of the pile is complete and upon removal of any accumulated water in the pipe, the pipe should be filled with wet cast (minimum 100 mm slump) 25 MPa concrete. If it is not possible to remove the water from the pipe pile, then the concrete should be placed using a tremie, or an anti-washout admixture could be added to the wet mix concrete to minimize segregation of the concrete in the water.

5.5 Helical Screw Piles

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 portion of the pile shaft above the helix (i.e., skin friction) as well as end bearing capacity of the helix.

For multi-helix piles, pile capacity may be derived from the sum of the shearing resistance along the portion of pile 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 skin friction and end bearing pressures of the undisturbed soil have been presented in Tables V and VI below. Resistance factors to reduce the provided ultimate bearing pressures to a value that is suitable for design have been presented in Section 5.8, Limit States Resistance Factors and Serviceability.

TABLE V. SKIN FRICTION BEARING PRESSURES (SCREW PILES)

Zone (metres)	Ultimate Skin Friction Bearing Pressure (kPa)
0 to 2	0
Below 2	30

TABLE VI. END BEARING PRESSURE (SCREW PILES)

Depth (metres)	Ultimate End Bearing Pressure (kPa)
3 to 10	500
Below 10	750

Notes:

1. The minimum embedment depth of the uppermost helix for multi-helix piles should be ≥ 3 metres or $H/D = 3$ (whichever is greater), where H = depth to top helix and D = helix diameter.
2. Single helix screw piles should extend to a minimum depth of 5 metres below grade or $H/D = 3$ (whichever is greater).
3. For determination of skin friction capacity, the effective shaft length (L_{eff}) may be taken as the depth of embedment of the pile shaft (to the top of the uppermost helix, H) minus a length equal to the diameter of the uppermost helix (D), $L_{\text{eff}} = H - D - 2$.
4. End 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).
5. A minimum centre-to-centre pile spacing of $2.5B$, where B =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 Table V and VI. Installation torque should be used for monitoring purposes only and not to determine pile capacity.

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

5.6 Continuous Flight Auger Piles

CFA piles are installed by drilling a continuous flight, hollow stem auger into the ground, followed by pressure injection of concrete and simultaneous extraction of the hollow stem auger. CFA piles may be designed on the basis of skin friction capacity.

The capacity of a CFA pile is highly dependent on the injection pressure and on properties of the soil into which the concrete is being injected. Continuous monitoring is recommended to document the installation of each CFA pile installed at this site.

The ultimate (ULS) bearing pressures of the undisturbed soil have been presented below.

Resistance factors to reduce the provided ultimate bearing pressures to a value that is suitable for design have been presented in Section 5.8, Limit States Resistance Factors and Serviceability.

TABLE VII. SKIN FRICTION BEARING PRESSURES (CFA PILES)

Zone (metres)	Ultimate Skin Friction Bearing Pressures (kPa)
0 to 2	0
Below 2	50

Notes:

1. To minimize the potential for frost jacking, CFA piles should be extended to a minimum depth of 6 metres below finished ground surface.
2. Piles should be reinforced.

3. A minimum pile diameter of 400 mm is recommended for the primary structural loads.
4. A minimum centre-to-centre pile spacing of not less than three pile diameters is recommended.
5. A representative of the Geotechnical Consultant must inspect and document the installation of the CFA, cast-in-place concrete piles.
6. Continuous pile monitoring using modern technology (i.e., computerized recording system) is recommended to verify approximate pile cross-sectional area and integrity.

5.7 Perimeter Thickened Edge Raft

The following minimum provisions should be incorporated into the design of a grade-supported, cast-in-place, reinforced thickened edge raft foundation.

1. All deleterious and organic material shall be removed from the raft footprint. After removal of any unsuitable material and/or overexcavation required to reach the design subgrade level, proof roll the subgrade with a heavy piece of equipment such as a fully loaded single or tandem axle truck of sufficient axle load to expose any soft areas in the subgrade. Overexcavate and replace soft areas with structural granular fill placed and compacted in thin lifts (150 mm loose) to 98 percent of standard Proctor density at optimum moisture content. Refer to Section 5.2.3, Soft Subgrade Conditions for a further discussion on subgrade preparation in soft areas.
2. A minimum of 300 mm of crushed granular base course material is recommended beneath the raft.

3. The granular base course fill should be placed in thin lifts (maximum 150 mm loose) and compacted to 98 percent of standard Proctor density at optimum moisture content.
4. The thickened edge raft, bearing on compacted granular fill over the prepared subgrade soil, may be designed to exert an ultimate bearing pressure of 300 kPa (Ultimate Limit State – ULS). The Serviceability Limit State (SLS) bearing pressure equivalent to 25 mm of settlement is 125 kPa.
5. Rigid polystyrene insulation is recommended alongside the thickened edge foundation to minimize potential uplift due to frost.
6. The insulation should be placed adjacent the foundation a minimum depth of 300 mm below finished grade and should be positively sloped to direct water away from the foundation.
7. The insulation should be a minimum thickness of 50 mm and should extend at least 1.8 metres away from the foundation. A vertical sheet of insulation should be fastened to the foundation above the horizontal insulation and should extend up to the insulated exterior wall. For unheated structures, the insulation should extend beneath the entire floor slab area and the thickness increased to 100 mm.
8. Reinforce the concrete slab and articulate the slab at regular intervals to provide for controlled cracking.
9. Provide positive site drainage away from the raft.
10. The raft should not be constructed on desiccated, wet, or frozen subgrade soil or base.
11. Frost should not be allowed to penetrate beneath the raft just prior to, or during construction.

5.8 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, 2010).

As per NBCC - 2010, the following resistance factors may be applied to the ultimate bearing pressures presented in previous sections of the report to obtain the factored geotechnical resistance corresponding to ultimate limit states (ULS).

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

To satisfy serviceability limit states, 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.

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 (within the range of 5 to 15 mm).

Timber piles, driven steel piles and CFA 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 helical screw piles. Screw piles are predominantly end bearing piles 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).

With respect to SLS and thickened edge raft foundations, the provided SLS bearing capacity presented in Section 5.7 is based on a settlement of 25 mm and typical raft thickening dimensions of 1 metres for a continuous footing and 2 metres by 2 metres for square footings. If a lesser settlement is required and/or larger slab thickening dimension will be constructed, PMEL should re-evaluate the recommended SLS bearing capacity.

5.9 Excavations and Dewatering

It is anticipated that the proposed excavations at this site will be shallow and completed with unbraced, sloped side walls. The long-term stability of the excavation walls will be affected by wetting and drying of the exposed excavation walls, the depth of excavation, the length of time that the excavation remains open and the consistency and structure (degree of fracturing, slickensiding, etc.) of the subgrade soils. The recommended minimum sideslopes for excavations at this site have been presented in Table VIII.

TABLE VIII. RECOMMENDED MINIMUM EXCAVATION SIDESLOPES

Soil Type	*Minimum Safe Sideslope	
	Horizontal	Vertical
Sand or Silt (moist)	2	1
Clay	1	1

* Slope flattening and dewatering will be required where groundwater seepage and sloughing conditions are encountered to maintain stability.

The water levels in the standpipe piezometers installed at the site were between 0.8 and 2.4 metres below ground surface on February 8, 2016. Construction difficulties associated with flowing sands will be encountered with excavations that extend below the groundwater table. Dewatering in the form of sand points will be required for excavations that extend through sand below the water table. The groundwater table should be lowered approximately 600 mm below the underside of the proposed excavation level in order to provide dry working conditions and a stable working platform. Lesser dewatering efforts should be successful where clay is the predominant soil type within the depth of the excavation. Groundwater seepage and precipitation runoff should be collected in a drainage system at the base of the excavation (i.e., drainage ditches/interceptors, sump pits). The drainage system should drain positively to a collection sump(s) equipped with a sump pump(s).

Utilization of open-cut excavation for utility installation may not be feasible in areas of the site where the groundwater table is high and the soil conditions consist of wet flowing sands. Trenchless utility installation techniques may be required in these areas. The upper sand was in a loose to compact condition with an estimated SPT blow count in the order of approximately 5. Medium to highly plastic clay soils were encountered in some areas of the site within the upper 3 metres of the soil profile. The clay was firm to stiff in consistency with an estimated undrained shear strength of 50 kPa. The total unit weight of the clay and sand soils may be taken as 18 kN/m³. A submerged unit weight of 8 kN/m³ may be utilized below the elevation of the groundwater table.

5.10 Floor Slabs

The surficial subgrade soil conditions consisted predominantly of sand. Grade supported floor slabs bearing on sand soils should perform satisfactorily at this site.

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

1. Prepare the site in accordance with Section 5.2, Site Preparation. To provide a level working surface and uniform subgrade support, provide a minimum of 150 mm of crushed, granular base course beneath the underside of the slab.
2. Excavate soft subgrade areas and replace with suitable, non-expansive fill, placed and compacted to 96 percent of standard Proctor density at optimum moisture content.
3. Subgrade fill, if required, should preferably consist of granular soil or on-site sand soils, placed in thin lifts (maximum 150 mm loose) and compacted to at least of 96 percent of standard Proctor density at optimum moisture content.
4. The granular base course material should be compacted to a minimum of 98 percent of standard Proctor density at optimum moisture content.
5. Isolate the slab from foundation walls, columns, etc., by means of separation joints.
6. Reinforce the concrete slab and articulate the slab at regular intervals to provide for controlled cracking.
7. Provide positive site drainage away from the building.

8. Floor slabs should not be constructed on desiccated, wet, or frozen subgrade soil, fill or base.
9. Frost should not be allowed to penetrate beneath the floor slab just prior to, during or after construction.

5.11 Foundation Concrete

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

TABLE IX. WATER SOLUBLE SULPHATE TEST RESULTS

Test Hole No.	Depth (m)	Soil Type	Water Soluble Sulphate (%)	Class of Exposure	Degree of Sulphate Exposure
16-1	6.0	Clay	0.027	---	Negligible
16-7	3.0	Clay	<0.010	---	Negligible
16-13	4.5	Clay	0.017	---	Negligible

An examination of Table IX revealed that the measured sulphate content varied from less than 0.010 to 0.027 percent, which is considered negligible in terms of potential degree of sulphate attack. Based on the test results General use cement (CSA Designation GU) may be used for all foundation concrete in contact with the soil. However, water-soluble sulphate salts (gypsum crystals) are known to exist in the geologic deposits in this region. For this reason, sulphate resistant cement is recommended for all concrete pile foundations constructed at this site. Surface concrete elements bearing on naturally occurring sand or imported granular fill may be designed using general use cement. Sulphate resistant cement may be warranted if imported clay fill from off site is used in the site grading activities. Further sulphate testing is recommended if this is the case. All concrete at this site should be manufactured in accordance with current CSA standards.

5.12 Grade Beams

The grade beams should be reinforced at both top and bottom throughout their entire length. Grade beams should be constructed with a minimum of 100 mm of appropriate compressible material between the underside of the grade beam and the subgrade soil.

5.13 Site Classification for Seismic Site Response

Based on the consistency of the subgrade soils encountered at this site and Table 4.1.8.4A of the 2010 National Building Code, the site classification for seismic site response falls within Class D.

5.14 Subdivision Roads and Parking Structures

It is anticipated that the local soils will be used for construction of subdivision roads and parking areas.

It is also anticipated that the subdivision roads and parking areas will be subject to predominantly passenger car and light truck traffic and infrequent heavy truck traffic. As a subgrade support, the California Bearing Ratio (CBR) rating of the compacted subgrade sand soil should be in the order of 5 to 10.

Based on the CBR rating, the following pavement and granular surfacing structures have been presented.

TABLE X. THICKNESS FOR ROADWAY STRUCTURES

Road Structure	Light to Medium Truck/Passenger Vehicle Traffic (mm)		Heavy Truck Traffic (mm)	
	Asphalt	Gravelled	Asphalt	Gravelled
Asphalt Concrete	65	--	100	--
Granular Base (CBR=65)	150	150	150	150
Granular Sub-Base (CBR=20)	150	300	250	450
Prepared Subgrade*	(150)	(150)	(150)	(150)
Geotextile	As Required	As Required	As Required	As Required
Total Thickness	365	450	500	600

* Scarified, moisture conditioned and re-compacted to 96 percent of standard Proctor density

All granular fill placed above the subgrade elevation should be placed in thin lifts (150 mm loose, maximum) and compacted to 98 percent of standard Proctor density. The granular base and sub-base course material should meet the following aggregate gradation requirements.

TABLE XI. AGGREGATE GRADATION REQUIREMENTS

Grain Size (mm)	Percent Passing	
	Base Course	Sub-Base Course
50.0	--	100
31.5	100	--
25.0	--	75 - 100
18.0	75 - 90	--
12.5	65 - 83	52 - 100
5.0	40 - 69	30 - 75
2.0	26 - 47	20 - 55
0.900	17 - 32	--
0.400	12 - 22	8 - 30
0.160	7 - 14	--
0.080	6 - 11	3 - 15
Plasticity Index (%)	0 - 6	0 - 6
CBR (min.)	65	25
% Fracture (min.)	45	--

The following minimum general recommendations should be incorporated into the design of the proposed Subdivision roads and parking structures.

1. Prepare the site in accordance with Section 5.2, Site Preparation.
2. Excavate soft subgrade areas and replace with suitable soil compacted to a minimum of 96 percent of standard Proctor density at optimum moisture content. Geotextile may be required to reinforce and stabilize the subgrade soils.
3. All borrow material for the subject roadways and parking areas should be placed in thin lifts (maximum 150 mm loose) and compacted to at least 96 percent of standard Proctor density at optimum moisture content.

4. In cut areas, the subgrade should be scarified (to 150 in light traffic areas and 300 mm in heavy traffic areas) and re-compacted to 96 percent of standard Proctor density.
5. All common borrow used for embankment construction should consist of imported granular material or on-site sand soils.
6. All granular fill should be placed in thin lifts (maximum 150 mm loose) and compacted to at least 98 percent of standard Proctor density.
7. Positive surface drainage is recommended to minimize the potential for moisture infiltration into the subgrade soil. Ditches and culverts should be provided where necessary to provide adequate site drainage. Surface water should be prevented from seeping back under the outer edges of the pavement structure.
8. Roadway embankment slopes should be no steeper than 3.0 Horizontal to 1.0 Vertical (3H:1V). Similarly, ditch sideslopes should be no steeper than 3H:1V.
9. Erosion protection is recommended for all embankment sideslopes. The slopes should be covered with topsoil and seeded to encourage vegetation growth. Alternately, erosion control blankets (North American Green S150 or equivalent) or hydromulch could be installed.
10. Periodic maintenance of the granular/pavement surface will be required (i.e., grading of the gravel surface or crack sealing of the pavement surface). The final road grade should be elevated a minimum of 600 mm above the average terrain to minimize snow accumulation on the road.

6.0 LIMITATIONS

The presentation of the summary of the field drill logs and preliminary design recommendations has been completed as authorized. Fifteen, 150/200 mm diameter test holes were dry drilled using our continuous flight solid and hollow 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.

Six piezocone penetration tests were 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 and 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.

The Terms of Reference for this investigation did not include any environmental assessment of the site. No detectable evidence of environmentally sensitive materials was detected during the actual time of the field test drilling program. If, on the basis of any knowledge, other than that formally communicated to us, there is reason to suspect that environmentally sensitive materials may exist, then additional test holes should be drilled and samples recovered for chemical analysis.

The subsurface investigation necessitated the drilling of deep 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 Major Land Corporation and their agents for specific application to the proposed Subdivision to be constructed within the NE1/4 35-35-05-W3M in Grasswood, 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 Party. Governing Agencies such as municipal, provincial, or federal agencies having jurisdictions 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 with respect to the foundation system 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 the report fulfils your requirements for this project. Please call if you have any questions or additional information is required.

P. MACHIBRODA ENGINEERING LTD.

Ag.

Arjun Paul, Engineer-in-Training

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	10461	<i>K. Pardoski</i>
		<i>16-02-12</i>



Kelly Pardoski, P. Eng.

AP/KP:tbs:ldw



**P. MACHIBRODA
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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 USING HANDHELD GPS EQUIPMENT (TRIMBLE, MODEL No. GeoXH 6000).

LEGEND	-PMEL TEST HOLE	-PMEL TEST HOLE (PIEZOMETER INSTALLED)	-PMEL PIEZOCONE PENETRATION TEST	-PROPERTY LINE
	- O/H - PMEL TEST HOLE			

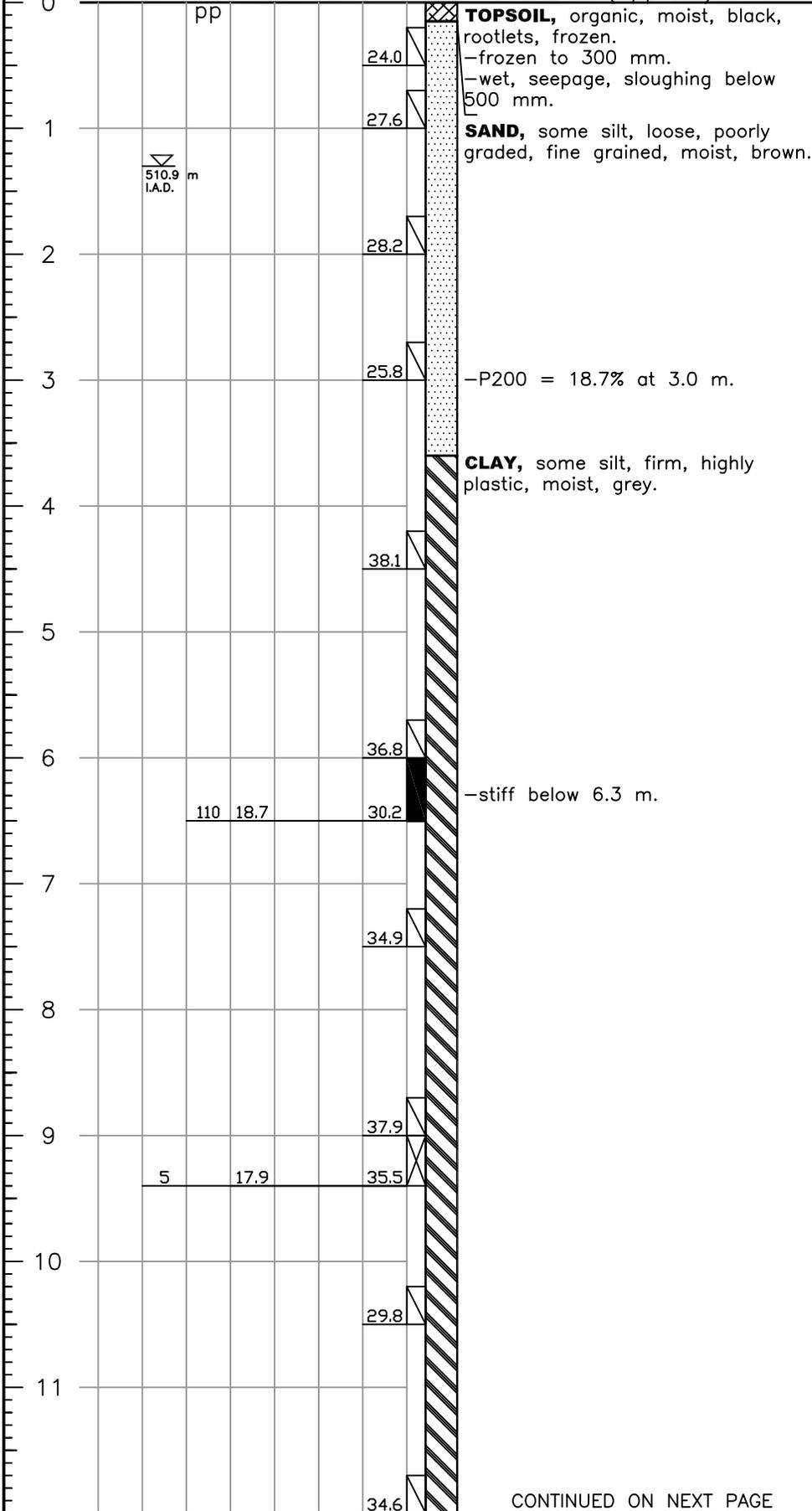
<p>CONSULTING GEOENVIRONMENTAL GEOTECHNICAL ENGINEERS</p> <p>P. MACHIBRODA ENGINEERING LTD.</p> <p>806 - 48th STREET EAST SASKATOON, SK S7K 3Y4</p>	DRAWING TITLE:		
	SITE PLAN - TEST HOLE AND PIEZOCONE LOCATIONS		
	PROJECT:		
	PROPOSED SUBDIVISION NE1/4-35-35-05-W3M, GRASSWOOD, SK		
APPROVED BY:	DRAWN BY:	DRAWING NUMBER:	
AP	SD	10678-1	
DATE:	SCALE:		
FEBRUARY, 2015	1:5000		

TEST HOLE 16-1

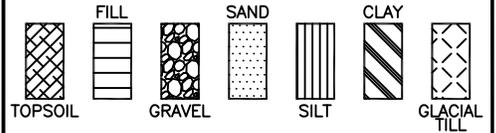
DEPTH
(m)

N UU γ_w Pw Lw w

ELEV: 512.2 m (Approx.)



LEGEND:



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

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γ_w ...WET UNIT WEIGHT (kN/m³)

UU.....TRIAXIAL COMPRESSIVE STRENGTH (kPa)

pp...POCKET PENETROMETER (kg/cm²)

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

SO₄SULPHATE 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.



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**FIELD DRILL LOG
AND
SOIL TEST RESULTS**

PROJECT:

PROPOSED SUBDIVISION

LOCATION:

NE1/4-35-35-05-W3M,
GRASSWOOD, SK

NORTHING: 5768482 **EASTING:** 389592

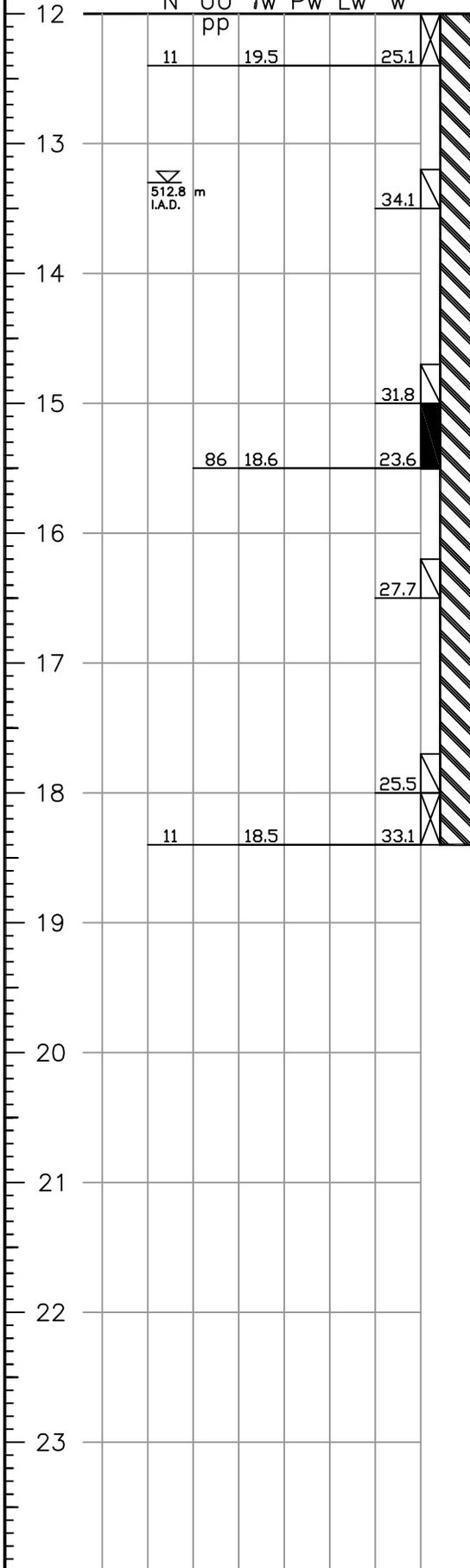
DATE DRILLED:
JAN 14/16

DRAWING NUMBER:
10678-2

CONTINUED ON NEXT PAGE

TEST HOLE 16-1

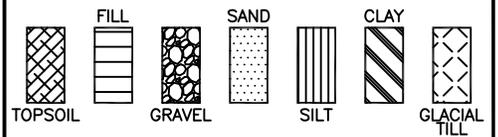
DEPTH
(m)



NOTE:
 1. Hollow stem auger installed to 4.3 m.
 2. Test Hole sloughed to 4.2 m after removing hollow stem.

CLAY, silty, firm to stiff, highly plastic, moist, grey.

LEGEND:



- w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)
- Lw...LIQUID LIMIT
- Pw...PLASTIC LIMIT
- γ_w ...WET UNIT WEIGHT (kN/m³)
- UU.....TRIAxIAL COMPRESSIVE STRENGTH (kPa)
- pp...POCKET PENETROMETER (kg/cm²)
- N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])
- SO₄SULPHATE 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.



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LTD.**

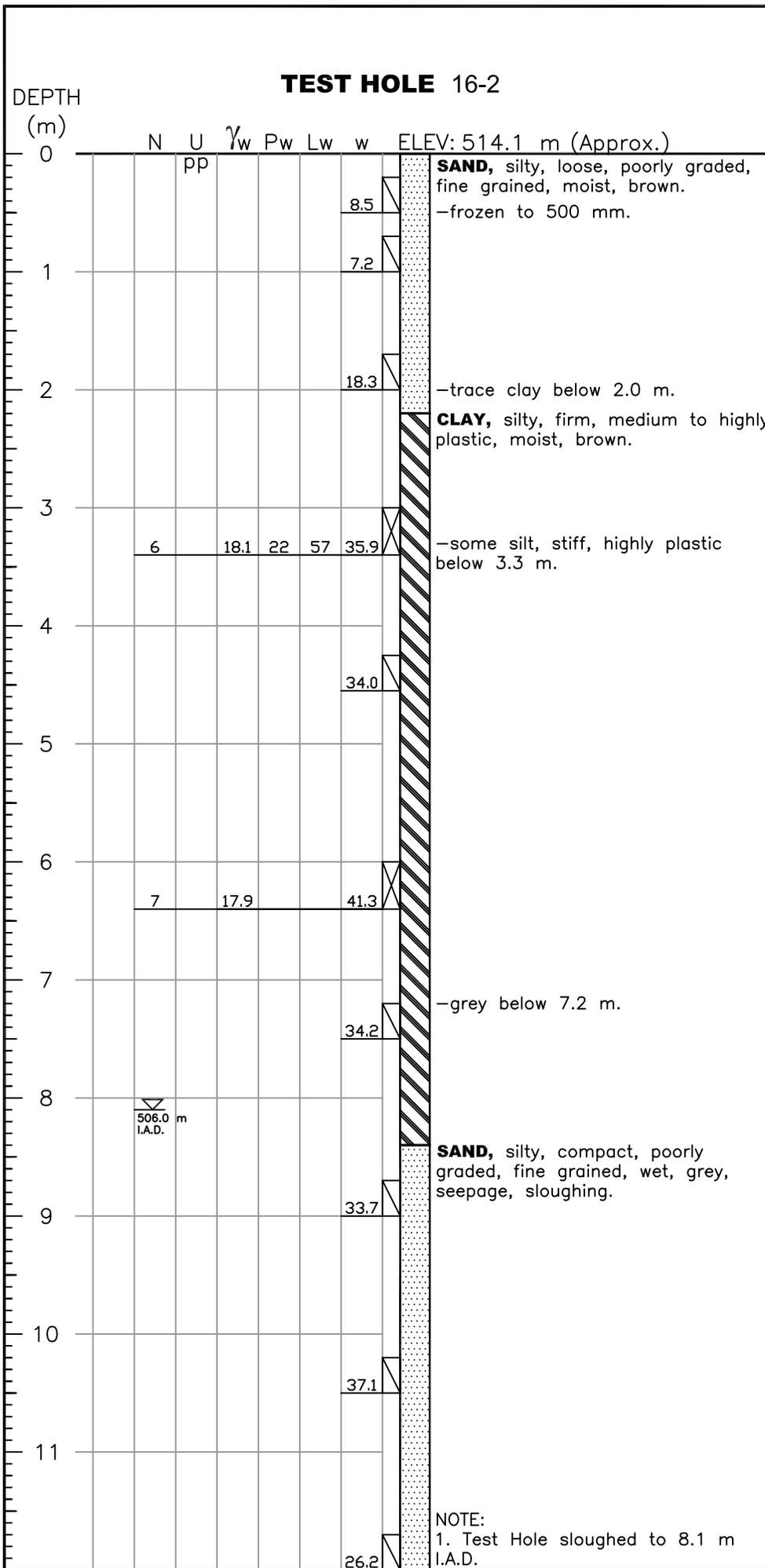
**FIELD DRILL LOG
AND
SOIL TEST RESULTS**

PROJECT:
PROPOSED SUBDIVISION

LOCATION:
NE1/4-35-35-05-W3M,
GRASSWOOD, SK

NORTHING: 5768482 **EASTING:** 389592

DATE DRILLED: JAN 14/16 **DRAWING NUMBER:** 10678-2A



LEGEND:

- TOPSOIL
- FILL
- GRAVEL
- SAND
- SILT
- CLAY
- GLACIAL TILL

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

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γ_w ...WET UNIT WEIGHT (kN/m³)

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

pp...POCKET PENETROMETER (kg/cm²)

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

SO₄SULPHATE 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 SUBDIVISION

LOCATION: NE1/4-35-35-05-W3M, GRASSWOOD, SK

NORTHING: 5768464 **EASTING:** 389704

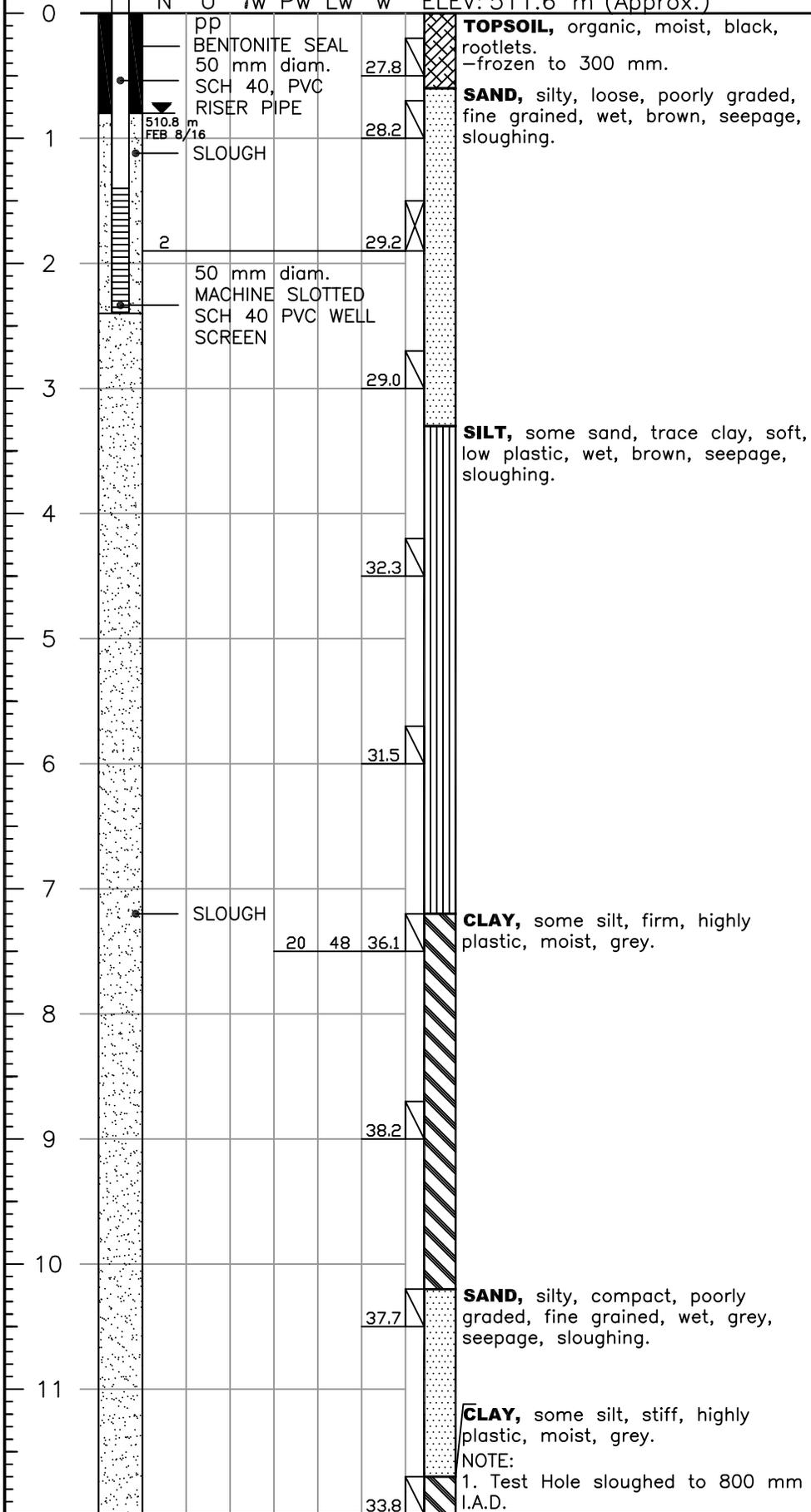
DATE DRILLED: JAN 7/16	DRAWING NUMBER: 10678-3
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NOTE:
1. Test Hole sloughed to 8.1 m I.A.D.

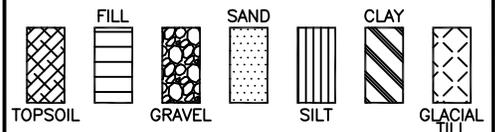
PIEZO. ELEV.= 512.6 m (Approx.)

TEST HOLE 16-3

DEPTH (m)



LEGEND:



w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)
 Lw...LIQUID LIMIT
 Pw...PLASTIC LIMIT
 γ_w ...WET UNIT WEIGHT (kN/m³)
 U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)
 pp...POCKET PENETROMETER (kg/cm²)
 N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])
 SO₄SULPHATE 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)



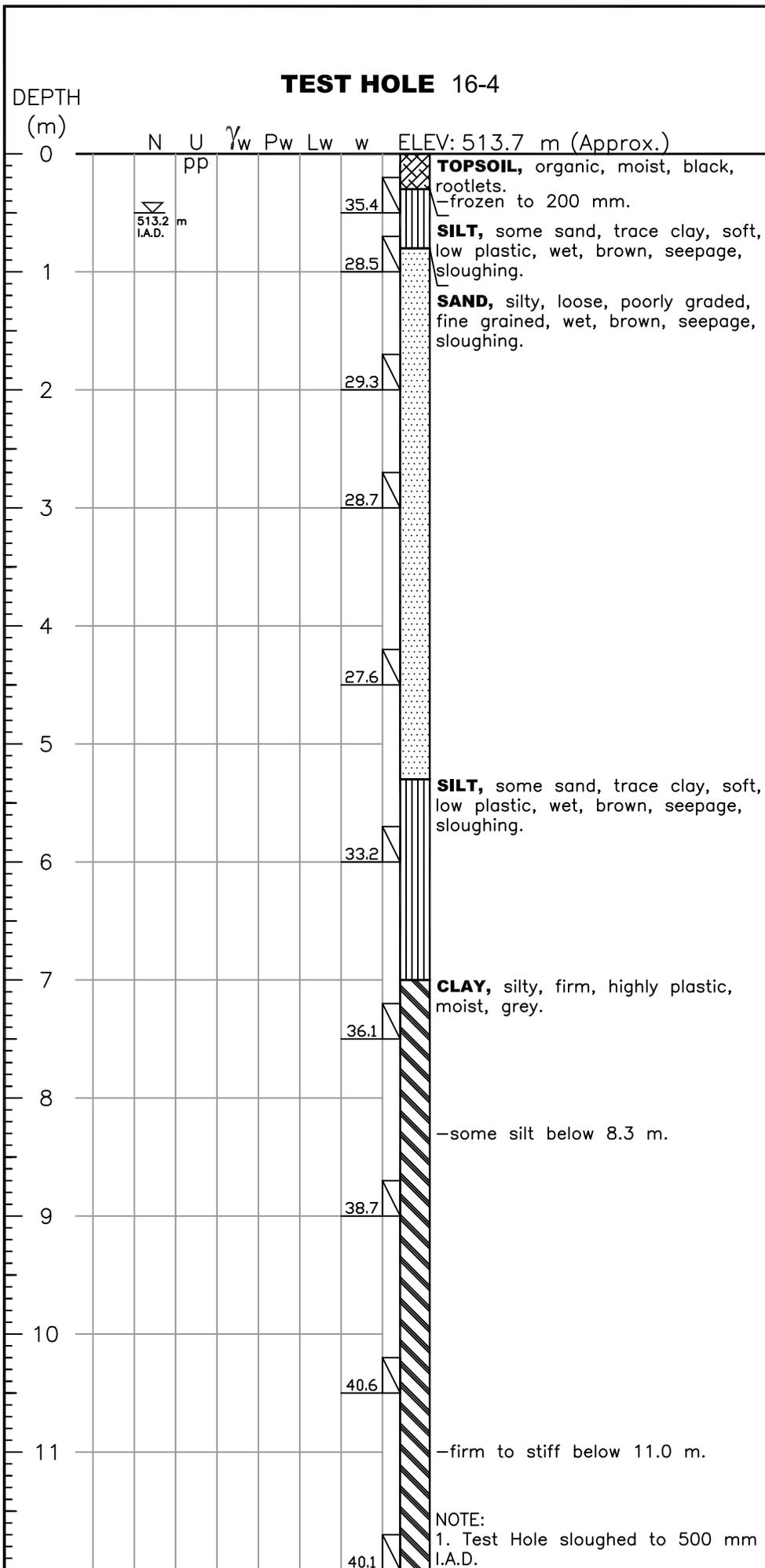
LIMITATIONS: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.



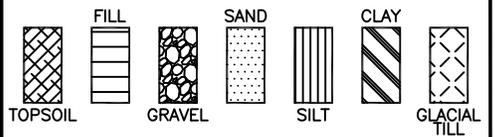
P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT: PROPOSED SUBDIVISION	
LOCATION: NE1/4-35-35-05-W3M, GRASSWOOD, SK	
NORTHING: 5768467	EASTING: 389812
DATE DRILLED: JAN 7/16	DRAWING NUMBER: 10678-4



LEGEND:



w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)
 Lw...LIQUID LIMIT
 Pw...PLASTIC LIMIT
 γ_w ...WET UNIT WEIGHT (kN/m³)
 U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)
 pp...POCKET PENETROMETER (kg/cm²)
 N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])
 SO₄SULPHATE 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 SUBDIVISION

LOCATION:
NE1/4-35-35-05-W3M,
GRASSWOOD, SK

NORTHING: 5768657 **EASTING:** 389870

DATE DRILLED: JAN 7/16	DRAWING NUMBER: 10678-5
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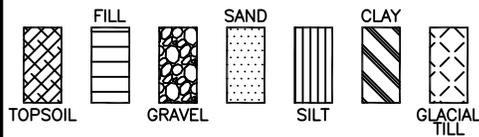
TEST HOLE 16-5

DEPTH (m)

DEPTH (m)	N	U	γ_w	P _w	L _w	w
0		pp				
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						

INTENTIONALLY LEFT BLANK REPLACED WITH CPTu 16-2

LEGEND:



- w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)
 - L_w...LIQUID LIMIT
 - P_w...PLASTIC LIMIT
 - γ_w ...WET UNIT WEIGHT (kN/m³)
 - U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)
 - pp...POCKET PENETROMETER (kg/cm²)
 - N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])
 - SO₄SULPHATE 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)
-

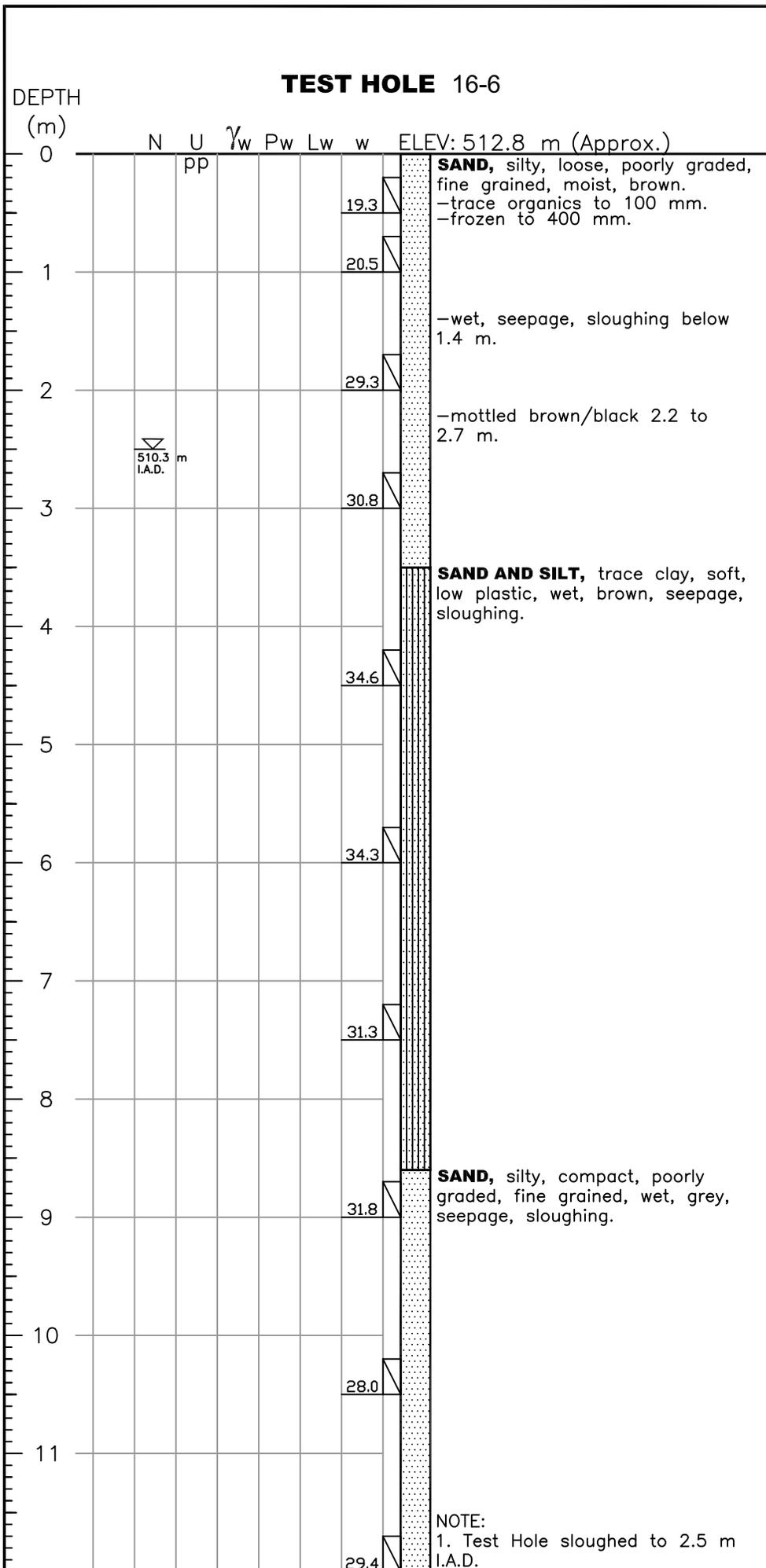
LIMITATIONS: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.



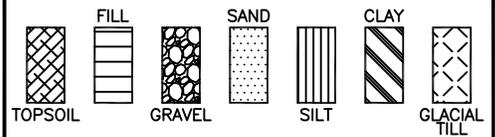
P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT: PROPOSED SUBDIVISION	
LOCATION: NE1/4-35-35-05-W3M, GRASSWOOD, SK	
NORTHING:	EASTING:
DATE DRILLED: JAN 7/16	DRAWING NUMBER: 10678-6



LEGEND:



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

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γ_w ...WET UNIT WEIGHT (kN/m³)

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

pp...POCKET PENETROMETER (kg/cm²)

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

SO₄SULPHATE 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
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LTD.**

**FIELD DRILL LOG
AND
SOIL TEST RESULTS**

PROJECT:
PROPOSED SUBDIVISION

LOCATION:
NE1/4-35-35-05-W3M,
GRASSWOOD, SK

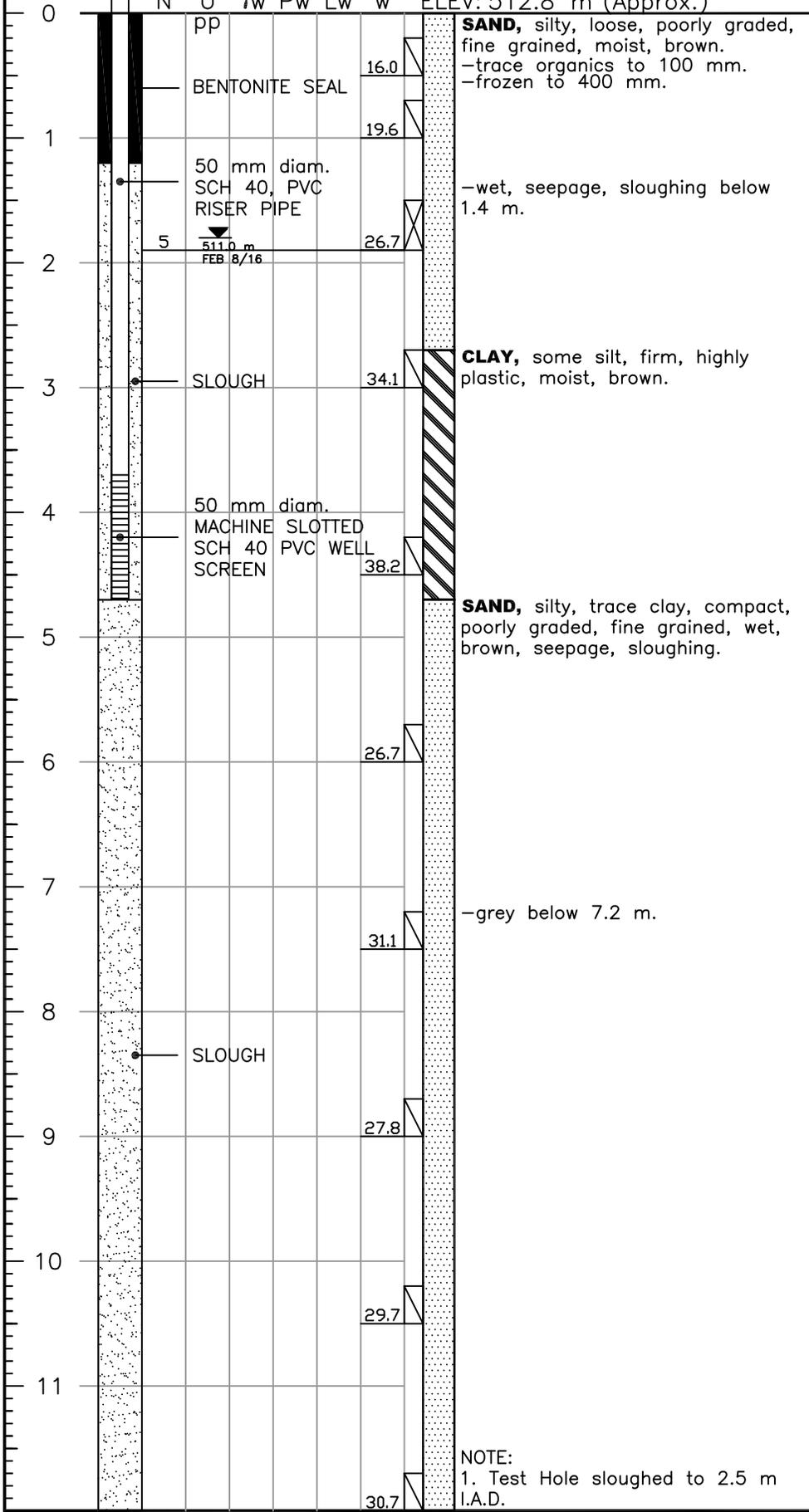
NORTHING: 5768355 **EASTING:** 389641

DATE DRILLED: JAN 7/16	DRAWING NUMBER: 10678-7
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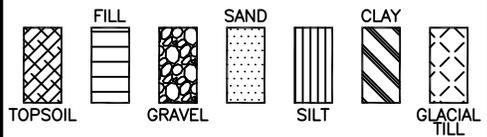
PIEZO. ELEV.= 513.8 m (Approx.)

TEST HOLE 16-7

DEPTH (m)



LEGEND:



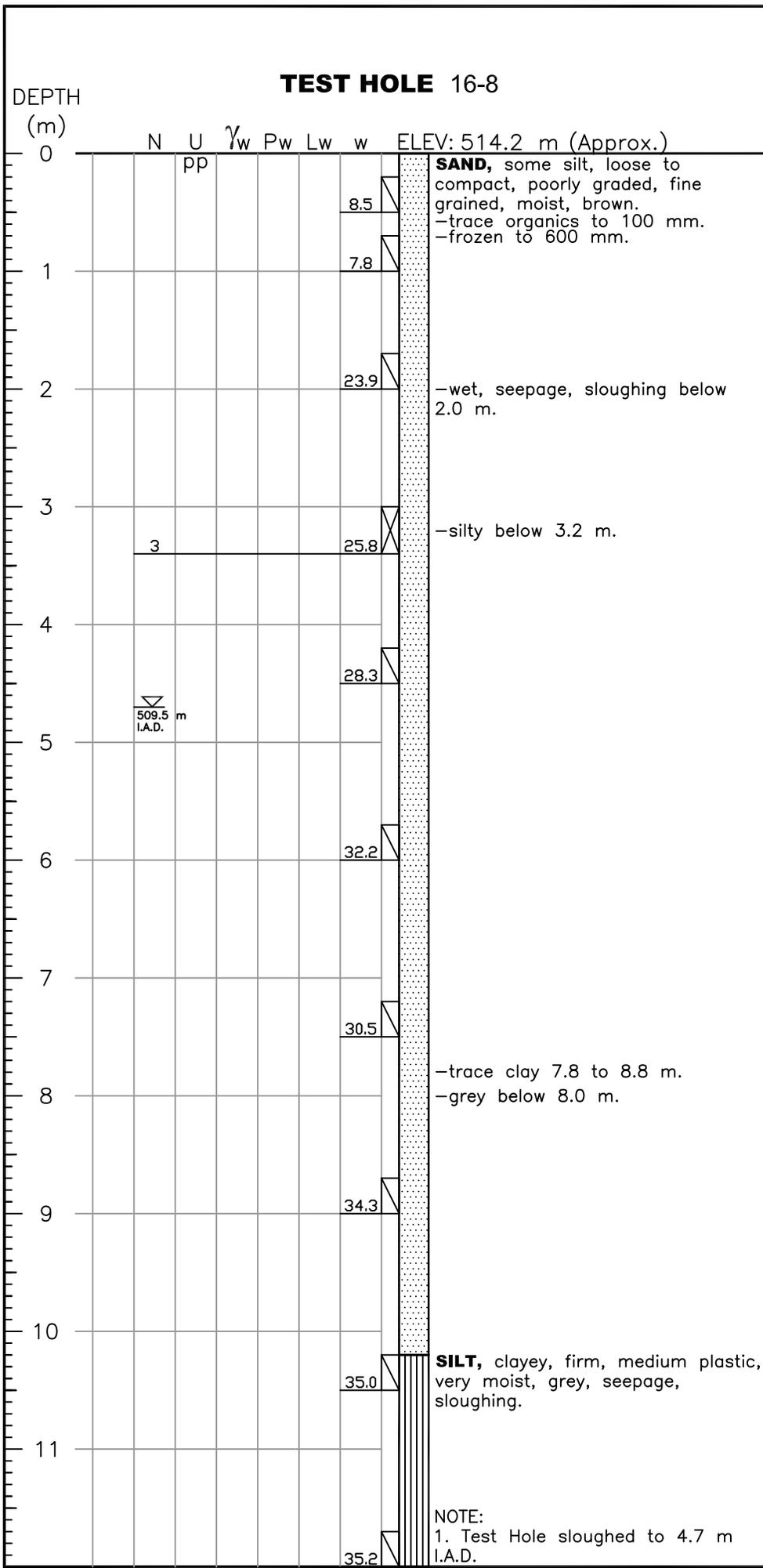
- w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)
- Lw...LIQUID LIMIT
- Pw...PLASTIC LIMIT
- γ_w ...WET UNIT WEIGHT (kN/m³)
- U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)
- pp...POCKET PENETROMETER (kg/cm²)
- N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])
- SO₄SULPHATE 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.



FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT: PROPOSED SUBDIVISION	
LOCATION: NE1/4-35-35-05-W3M, GRASSWOOD, SK	
NORTHING: 5768216	EASTING: 389634
DATE DRILLED: JAN 8/16	DRAWING NUMBER: 10678-8



LEGEND:

TOPSOIL	FILL	GRAVEL	SAND	SILT	CLAY	GLACIAL TILL

- w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)
 - Lw...LIQUID LIMIT
 - Pw...PLASTIC LIMIT
 - γ_w ...WET UNIT WEIGHT (kN/m³)
 - U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)
 - pp...POCKET PENETROMETER (kg/cm²)
 - N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])
 - SO₄SULPHATE 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.
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FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT:
PROPOSED SUBDIVISION

LOCATION:
NE1/4-35-35-05-W3M,
GRASSWOOD, SK

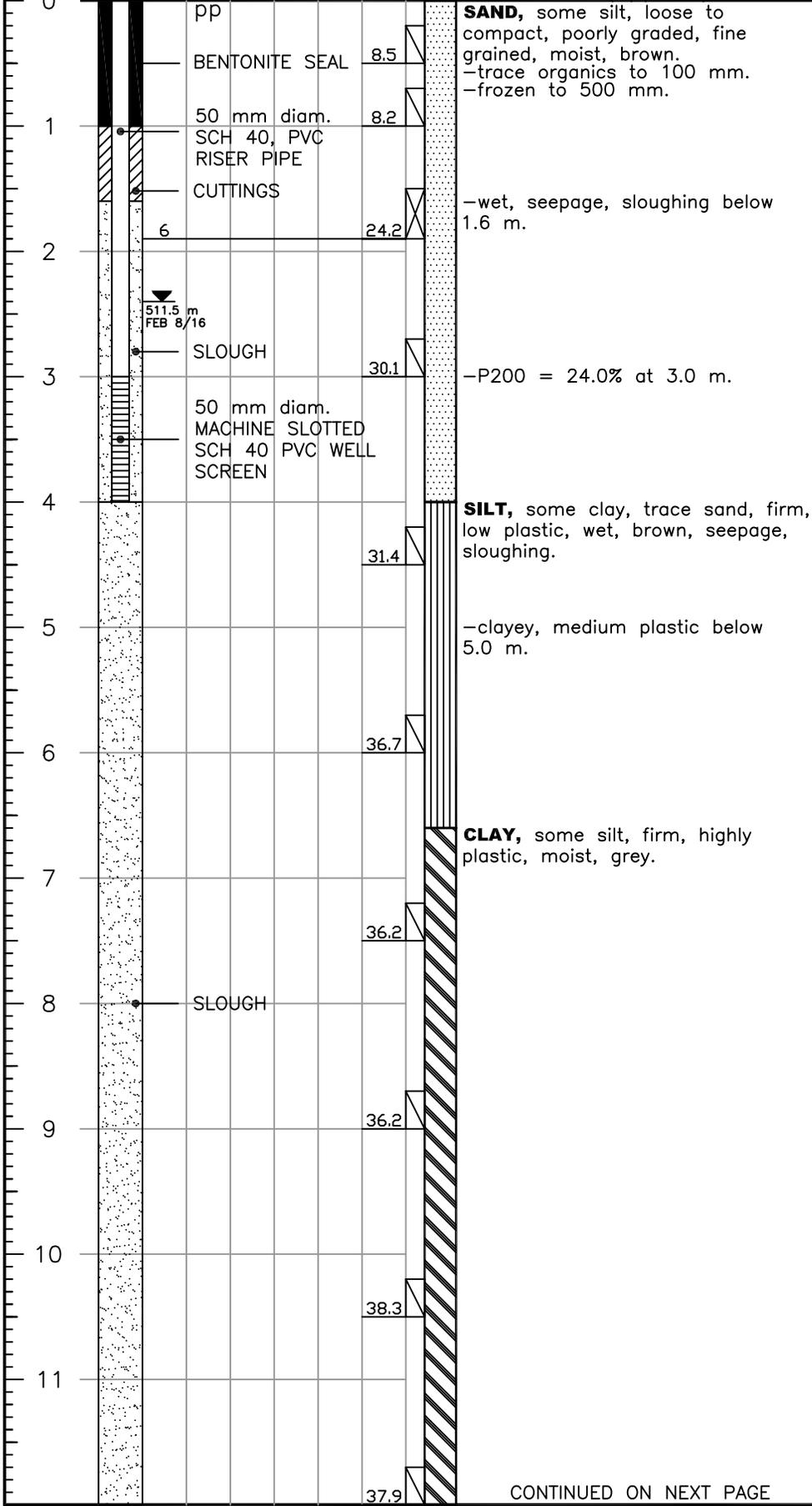
NORTHING: 5768267 **EASTING:** 389917

DATE DRILLED: JAN 14/16	DRAWING NUMBER: 10678-9
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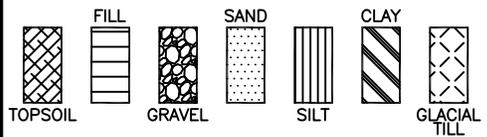
NOTE:
1. Test Hole sloughed to 4.7 m I.A.D.

TEST HOLE 16-9

DEPTH (m)



LEGEND:



- w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)
- Lw...LIQUID LIMIT
- Pw...PLASTIC LIMIT
- γw...WET UNIT WEIGHT (kN/m³)
- U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)
- pp...POCKET PENETROMETER (kg/cm²)
- N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])
- SO₄SULPHATE 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.



FIELD DRILL LOG AND SOIL TEST RESULTS

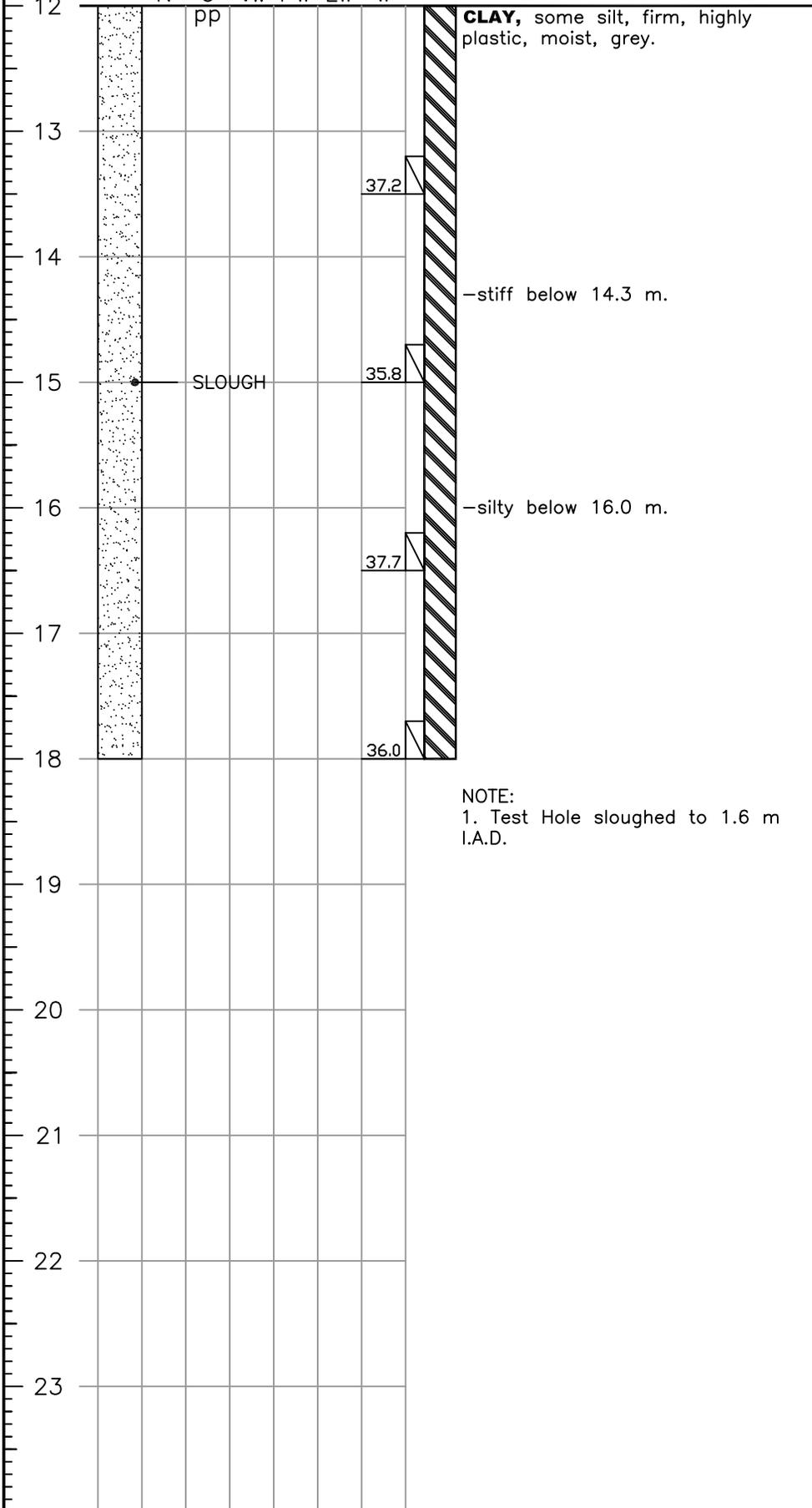
PROJECT: PROPOSED SUBDIVISION	
LOCATION: NE1/4-35-35-05-W3M, GRASSWOOD, SK	
NORTHING: 5768155	EASTING: 389922
DATE DRILLED: JAN 14/16	DRAWING NUMBER: 10678-10

CONTINUED ON NEXT PAGE

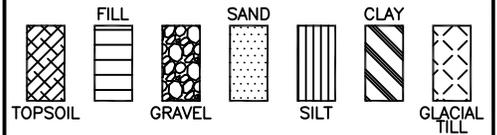
TEST HOLE 16-9

DEPTH
(m)

N U γ_w Pw Lw w



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])
- SO₄SULPHATE 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 SUBDIVISION

LOCATION:

NE1/4-35-35-05-W3M,
GRASSWOOD, SK

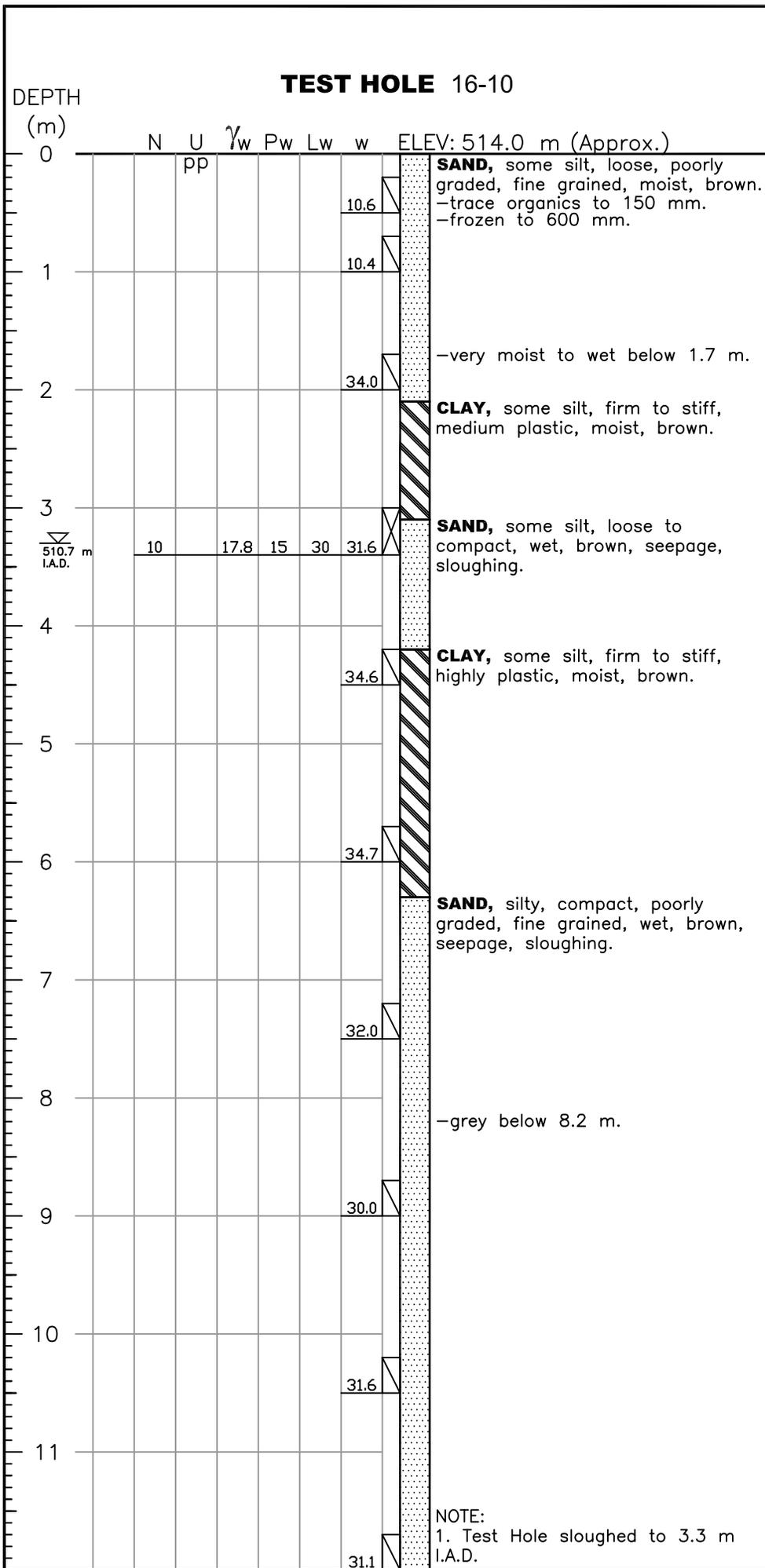
NORTHING: 5768155 **EASTING:** 389922

DATE DRILLED:

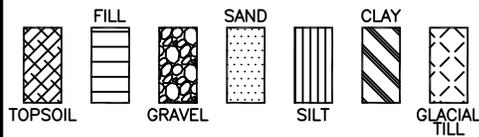
JAN 14/16

DRAWING NUMBER:

10678-10A



LEGEND:



- w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)
- L_w...LIQUID LIMIT
- P_w...PLASTIC LIMIT
- γ_w...WET UNIT WEIGHT (kN/m³)
- U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)
- pp...POCKET PENETROMETER (kg/cm²)
- N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])
- SO₄SULPHATE 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.

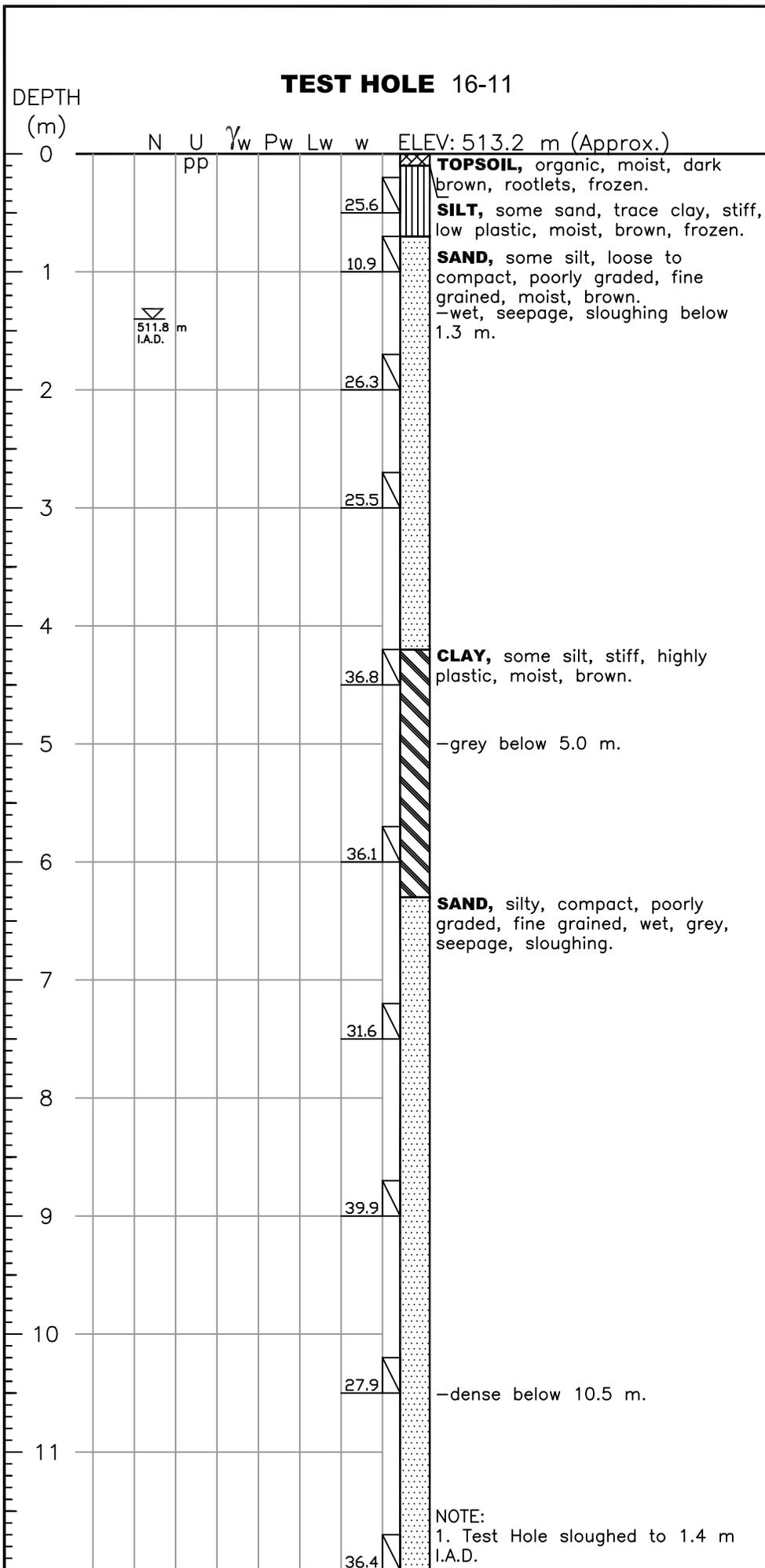


**P. MACHIBRODA
ENGINEERING
LTD.**

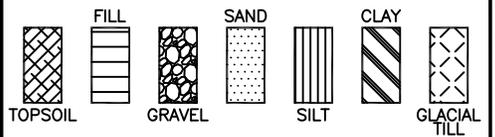
**FIELD DRILL LOG
AND
SOIL TEST RESULTS**

PROJECT: PROPOSED SUBDIVISION	
LOCATION: NE1/4-35-35-05-W3M, GRASSWOOD, SK	
NORTHING: 5768115 EASTING: 389769	
DATE DRILLED: JAN 14/16	DRAWING NUMBER: 10678-11

NOTE:
1. Test Hole sloughed to 3.3 m I.A.D.

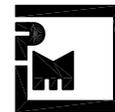


LEGEND:



- w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)
- L_w...LIQUID LIMIT
- P_w...PLASTIC LIMIT
- γ_w ...WET UNIT WEIGHT (kN/m³)
- U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)
- pp...POCKET PENETROMETER (kg/cm²)
- N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])
- SO₄SULPHATE 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 SUBDIVISION

LOCATION:

NE1/4-35-35-05-W3M,
GRASSWOOD, SK

NORTHING: 5767899 **EASTING:** 389591

DATE DRILLED:
JAN 26/16

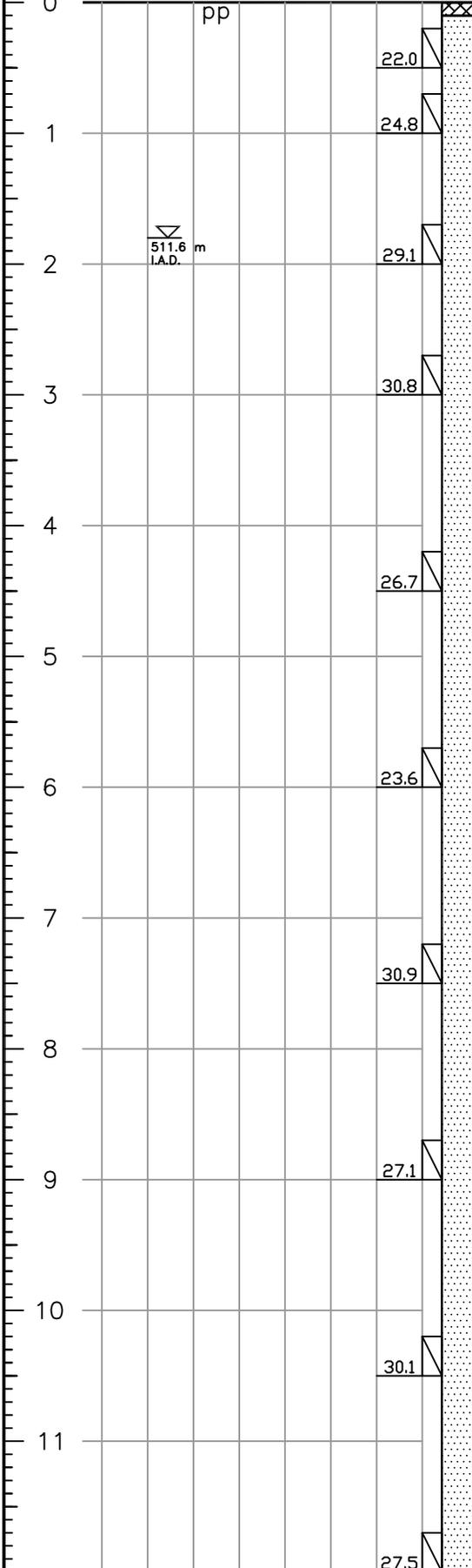
DRAWING NUMBER:
10678-12

TEST HOLE 16-12

DEPTH
(m)

N U γ_w Pw Lw w

ELEV: 513.4 m (Approx.)

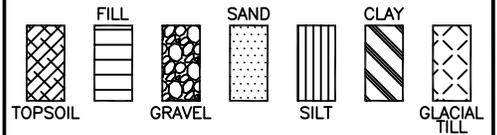


TOPSOIL, organic, moist, dark brown, rootlets, frozen.

SAND, silty, loose to compact, poorly graded, fine grained, moist, brown.
-frozen to 800 mm.
-wet, seepage, sloughing below 1.2 m.
-clayey seam 1.8 to 2.3 m.

-some silt, dense, grey below 9.2 m.

LEGEND:



- w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)
- Lw...LIQUID LIMIT
- Pw...PLASTIC LIMIT
- γ_w ...WET UNIT WEIGHT (kN/m³)
- U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)
- pp...POCKET PENETROMETER (kg/cm²)
- N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])
- SO₄SULPHATE 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.



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ENGINEERING
LTD.**

**FIELD DRILL LOG
AND
SOIL TEST RESULTS**

PROJECT:

PROPOSED SUBDIVISION

LOCATION:

NE1/4-35-35-05-W3M,
GRASSWOOD, SK

NORTHING: 5767905 **EASTING:** 389742

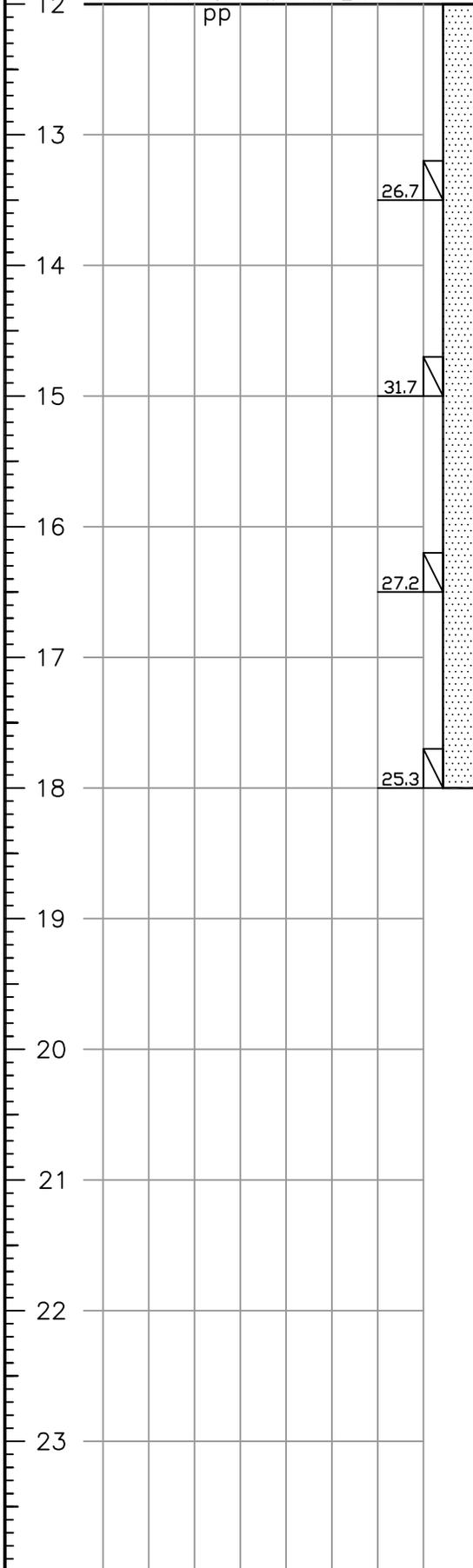
DATE DRILLED:
FEB 1/16

DRAWING NUMBER:
10678-13

TEST HOLE 16-12

DEPTH
(m)

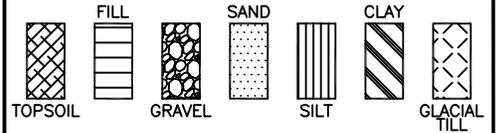
N U γ_w Pw Lw w
pp



SAND, some silt, dense, poorly graded, fine grained, wet, seepage, sloughing, grey.

NOTE:
1. Test Hole sloughed to 1.8 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/m³)

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

pp...POCKET PENETROMETER (kg/cm²)

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

SO₄SULPHATE 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 SUBDIVISION

LOCATION:

NE1/4-35-35-05-W3M,
GRASSWOOD, SK

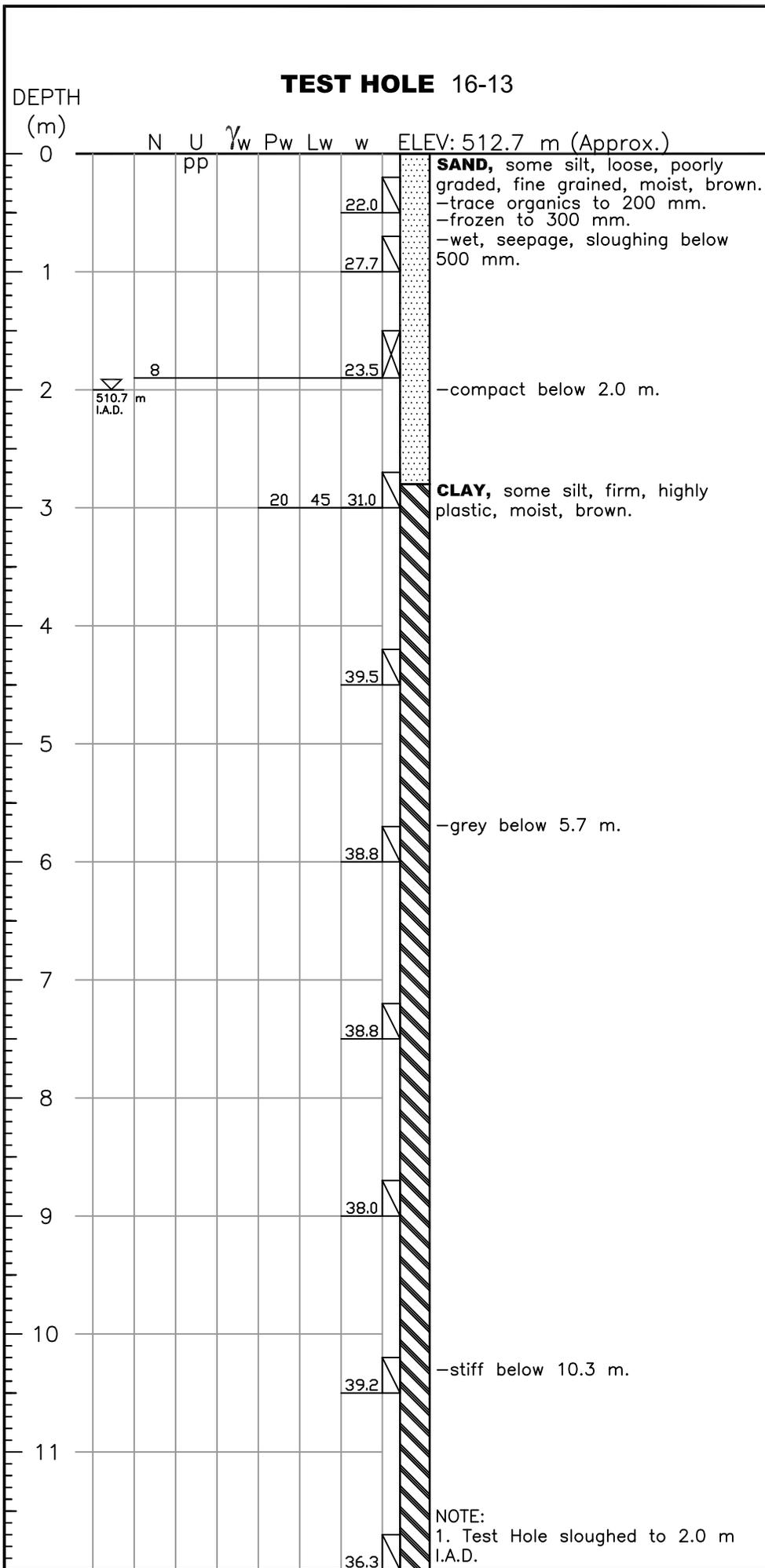
NORTHING: 5767905 **EASTING:** 389742

DATE DRILLED:

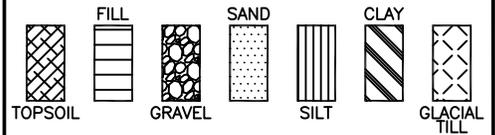
FEB 1/16

DRAWING NUMBER:

10678-13A



LEGEND:



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

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γ_w ...WET UNIT WEIGHT (kN/m³)

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

pp...POCKET PENETROMETER (kg/cm²)

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

SO₄SULPHATE 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 SUBDIVISION

LOCATION:

NE1/4-35-35-05-W3M,
GRASSWOOD, SK

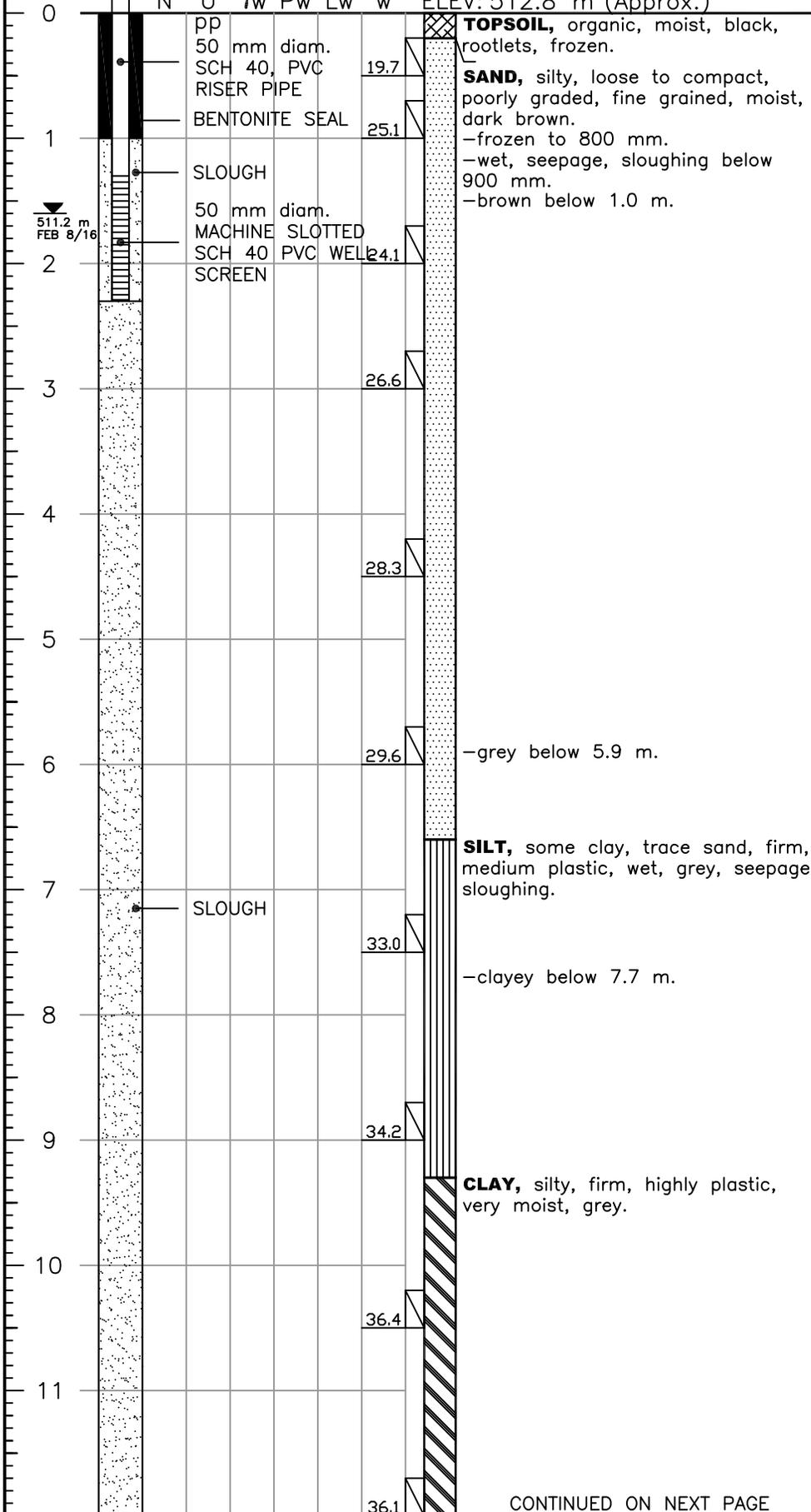
NORTHING: 5767874 **EASTING:** 389924

DATE DRILLED:
JAN 8/16

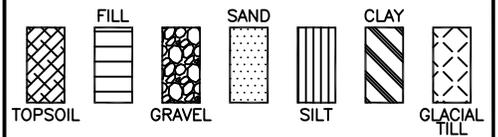
DRAWING NUMBER:
10678-14

TEST HOLE 16-14

DEPTH (m)



LEGEND:



- w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)
- Lw...LIQUID LIMIT
- Pw...PLASTIC LIMIT
- γ_w ...WET UNIT WEIGHT (kN/m³)
- U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)
- pp...POCKET PENETROMETER (kg/cm²)
- N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])
- SO₄SULPHATE 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.



FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT:
PROPOSED SUBDIVISION

LOCATION:
NE1/4-35-35-05-W3M,
GRASSWOOD, SK

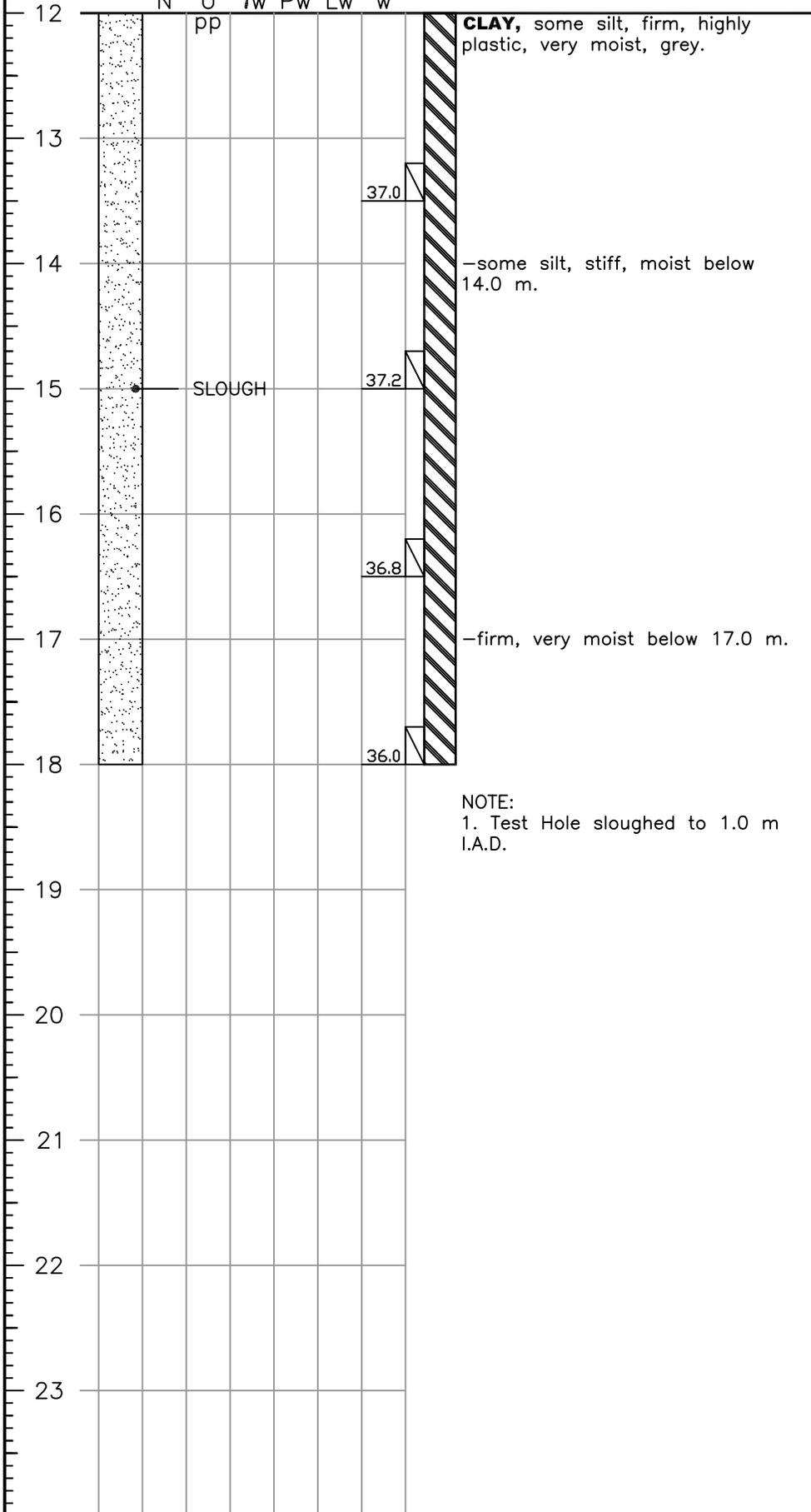
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DATE DRILLED: FEB 1/16 **DRAWING NUMBER:** 10678-15

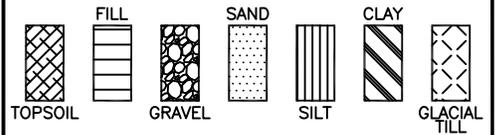
CONTINUED ON NEXT PAGE

TEST HOLE 16-14

DEPTH
(m)



LEGEND:



- w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)
- L_w...LIQUID LIMIT
- P_w...PLASTIC LIMIT
- γ_w ...WET UNIT WEIGHT (kN/m³)
- U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)
- pp...POCKET PENETROMETER (kg/cm²)
- N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])
- SO₄SULPHATE 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 SUBDIVISION

LOCATION:

NE1/4-35-35-05-W3M,
GRASSWOOD, SK

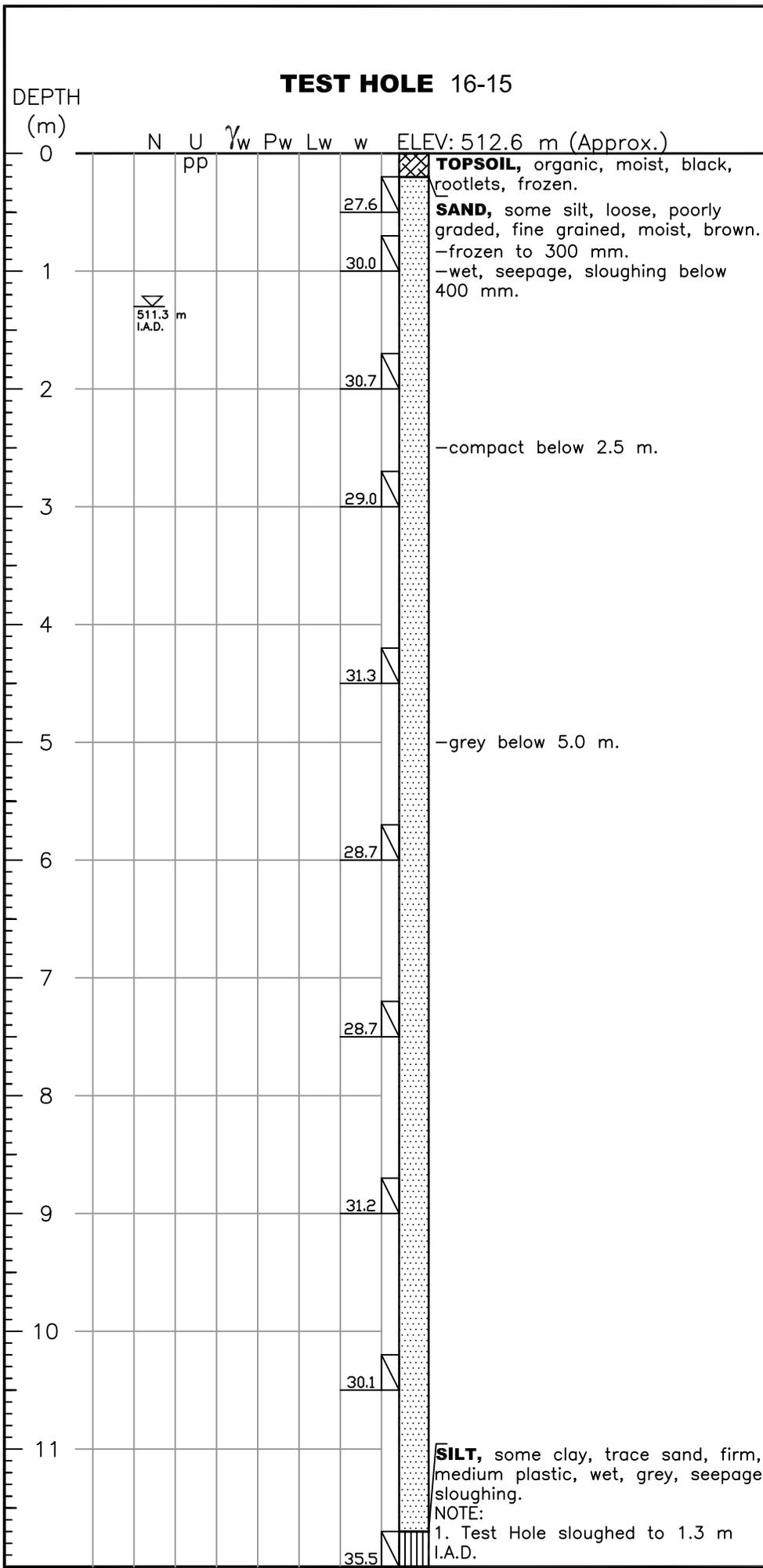
NORTHING: 5767791 **EASTING:** 390076

DATE DRILLED:

FEB 1/16

DRAWING NUMBER:

10678-15A



LEGEND:

TOPSOIL	FILL	GRAVEL	SAND	SILT	CLAY	GLACIAL TILL

w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)
 Lw...LIQUID LIMIT
 Pw...PLASTIC LIMIT
 γ_w ...WET UNIT WEIGHT (kN/m³)
 U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)
 pp...POCKET PENETROMETER (kg/cm²)
 N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])
 SO₄SULPHATE 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 SUBDIVISION

LOCATION:
NE1/4-35-35-05-W3M,
GRASSWOOD, SK

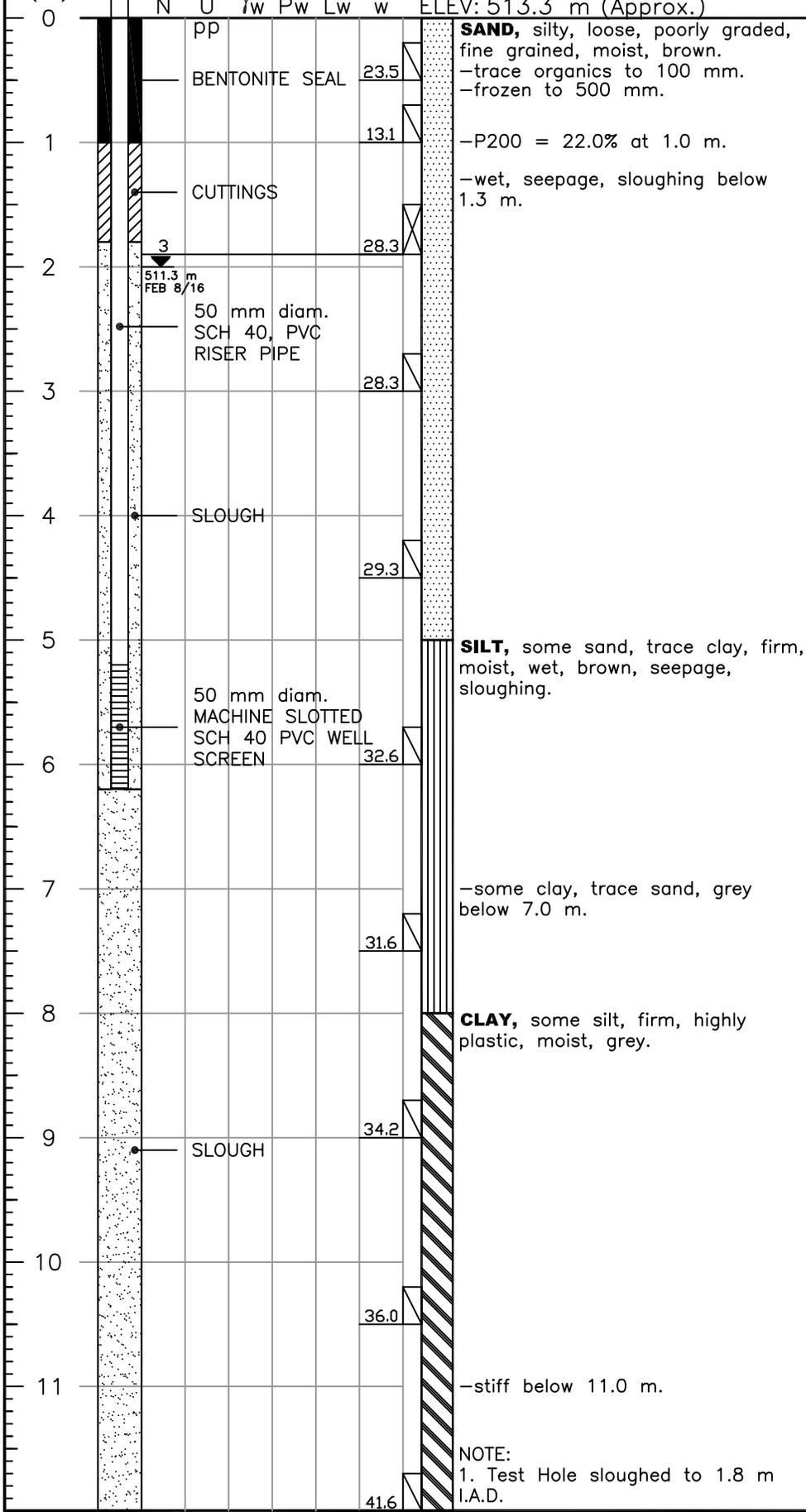
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DATE DRILLED: JAN 8/16	DRAWING NUMBER: 10678-16
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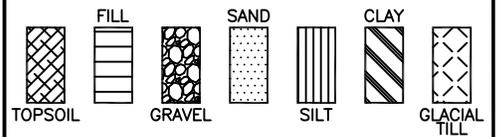
PIEZO. ELEV.= 514.3 m (Approx.)

TEST HOLE 16-16

DEPTH (m)



LEGEND:



- w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)
- L_w ...LIQUID LIMIT
- P_w ...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])
- SO₄SULPHATE 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 SUBDIVISION

LOCATION:
NE1/4-35-35-05-W3M,
GRASSWOOD, SK

NORTHING: 5767773 **EASTING:** 389736

DATE DRILLED: JAN 8/16	DRAWING NUMBER: 10678-17
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NOTE:
1. Test Hole sloughed to 1.8 m I.A.D.

GRAIN SIZE DISTRIBUTION TEST REPORT

Test Method : ASTM C136

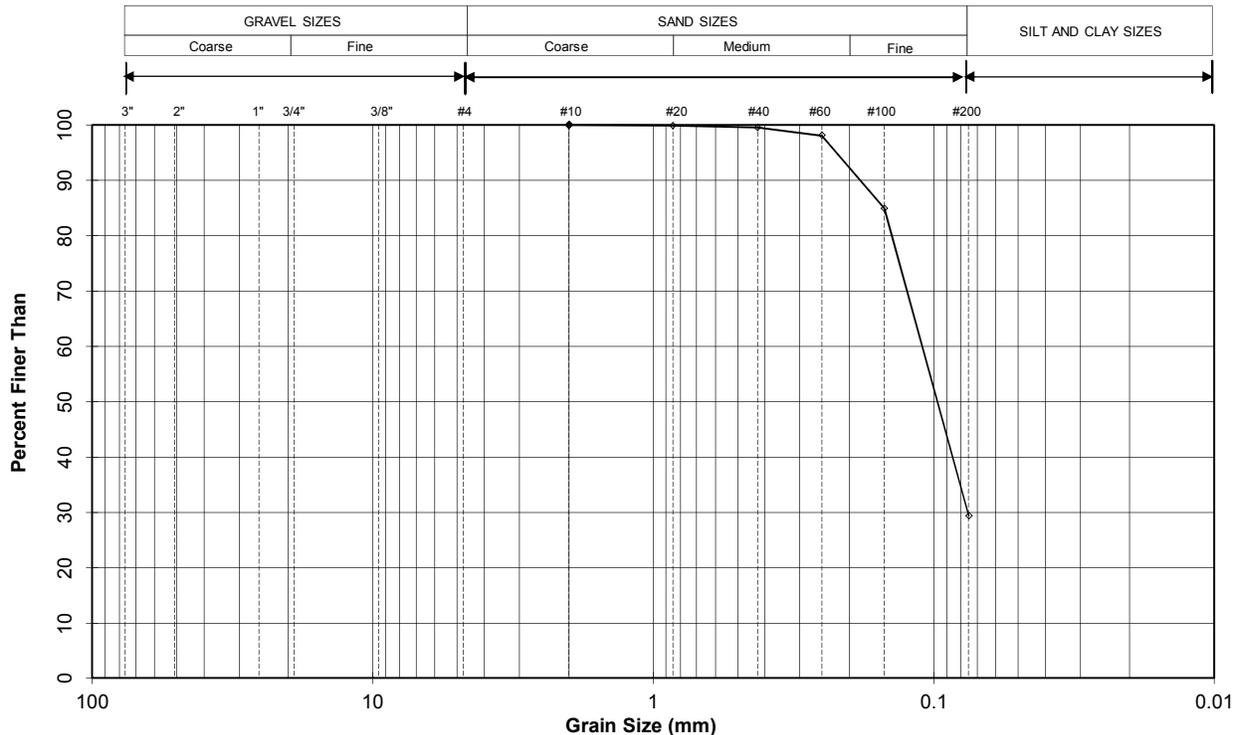
Project: Proposed Subdivision
Location: Grasswood, Saskatchewan
Project No.: 10678
Date Tested: January 15, 2016
Test Hole No.: 16-6
Sample No.: 30
Depth: 4.5

Sieve	Diameter mm	% Finer	Specification	
			Max	Min
3"	76.200	100		
2.5"	63.500	100		
2"	50.000	100		
1.5"	37.500	100		
1	25.000	100		
0.75	19.000	100		
0.5	12.500	100		
0.375	9.500	100		
4	4.750	100		
10	2.000	100		
20	0.850	100		
40	0.425	100		
60	0.250	98		
100	0.150	85		
200	0.075	29		

Material Description:

% Gravel Sizes	% Sand Sizes 71	% Silt and Clay Sizes 29
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Remarks:



**P. MACHIBRODA
ENGINEERING LTD.**

DRAWING NO.

10678-18

ASTM D422: GRAIN SIZE ANALYSIS OF SOIL

Project: Proposed Subdivision
 Grasswood, SK
Project No.: 10678
Date Tested: February 3, 2016
Test Hole No.: 16-14
Sample No.: 145
Depth (m): 7.5

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	99.9
#60	0.25	99.8
# 100	0.15	99.3
# 200	0.075	80.5

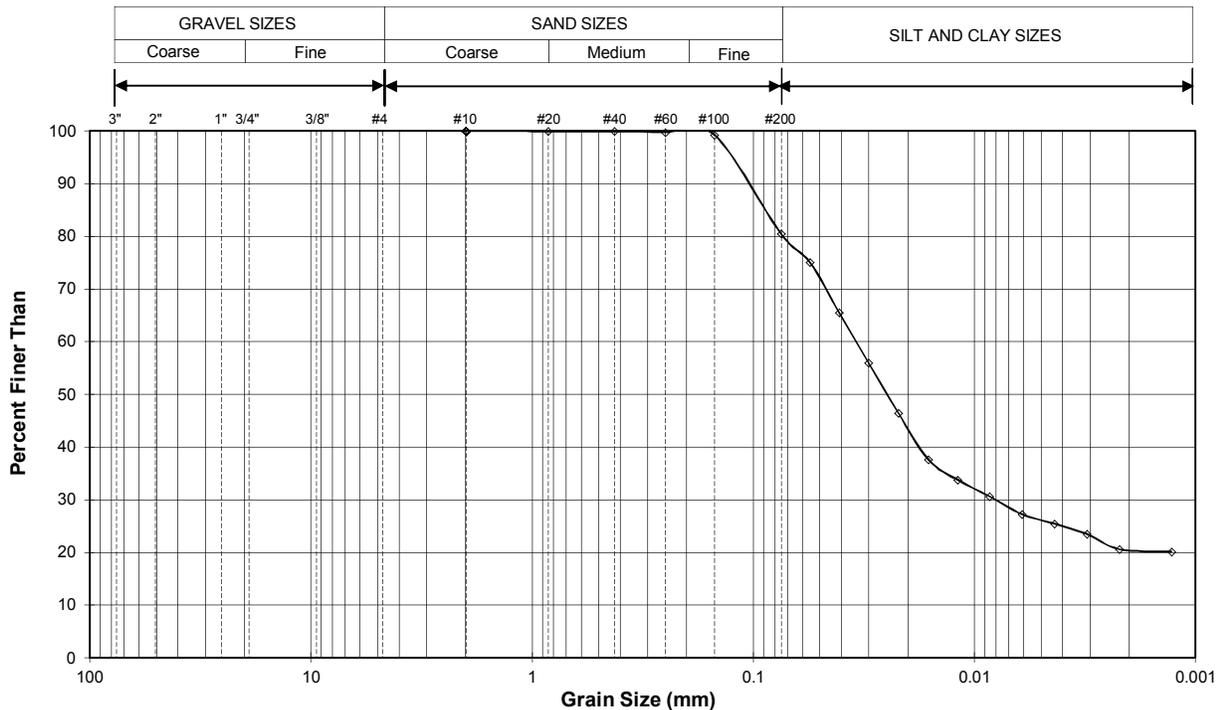
Hydrometer Analysis:

	Diameter mm	% Finer
Dispersing Agent:	0.0555	75.1
<i>Sodium Hexametaphosphate</i>	0.0410	65.6
	0.0302	56.0
	0.0221	46.5
	0.0162	37.6
	0.0120	33.8
	0.0085	30.6
	0.0061	27.3
	0.0044	25.5
	0.0031	23.5
	0.0022	20.6
	0.0013	20.1

Material Description:

% Gravel Sizes	% Sand Sizes	% Silt Sizes	% Clay Sizes
0	20	60	20

Remarks:



APPENDIX A

EXPLANATION OF TERMS ON TEST HOLE 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.

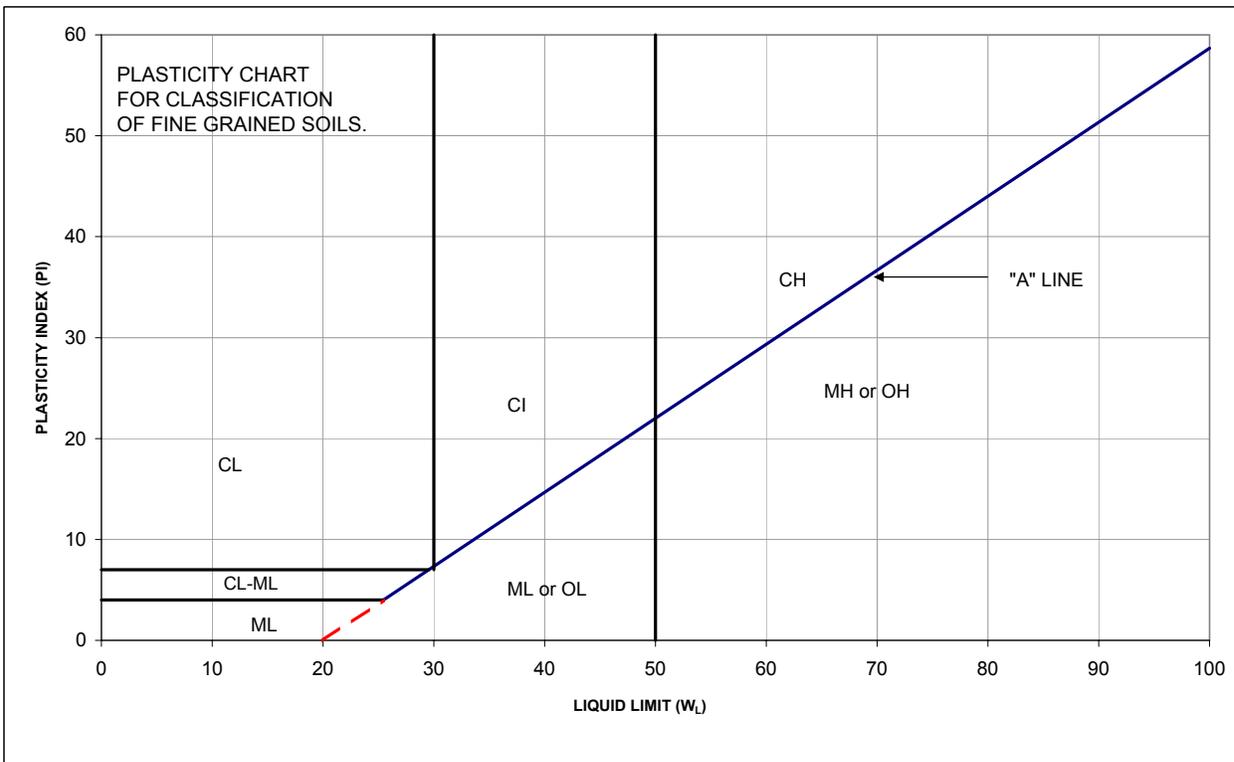
Organic Soils: Readily identified by colour, odour, spongy feel and frequently by fibrous texture.

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.

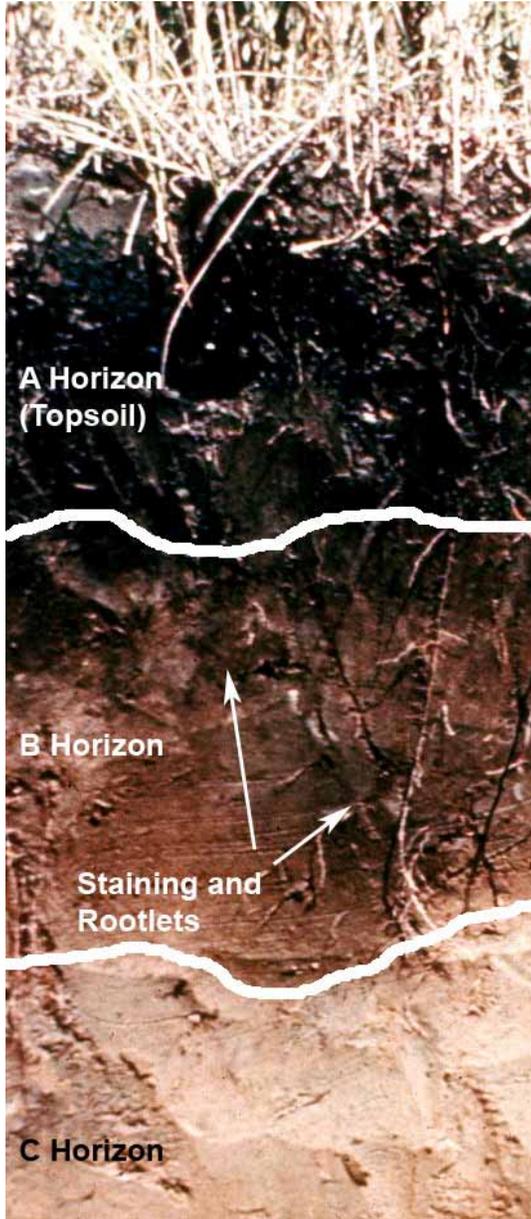
SOIL CLASSIFICATION SYSTEM (MODIFIED U.S.C.)

MAJOR DIVISION		GROUP SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA
HIGHLY ORGANIC SOILS		Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS	STRONG COLOUR OR ODOUR AND OFTEN FIBROUS TEXTURE
COARSE-GRAINED SOILS (MORE THAN HALF BY WEIGHT LARGER THAN NO. 200 SIEVE SIZE)	GRAVELS More than half coarse fraction larger than No. 4 sieve size	CLEAN GRAVELS	GW WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES <5% FINES	$C_u = \frac{D_{60}}{D_{10}} > 4$ $C_c = \frac{(D_{30})^2}{D_{60} \times D_{10}} = 1 \text{ to } 3$
			GP POORLY-GRADED GRAVELS AND GRAVEL-SAND MIXTURES <5% FINES	NOT MEETING ALL ABOVE REQUIREMENTS FOR GW
		DIRTY GRAVELS	GM SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES >12% FINES	ATTERBERG LIMITS BELOW "A" LINE OR $PI < 4$
			GC CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES >12% FINES	ATTERBERG LIMITS ABOVE "A" LINE WITH $PI > 7$
	SANDS More than half coarse fraction smaller than No. 4 sieve size	CLEAN SANDS	SW WELL-GRADED SANDS, GRAVELLY SANDS MIXTURES <5% FINES	$C_u = \frac{D_{60}}{D_{10}} > 6$ $C_c = \frac{(D_{30})^2}{D_{60} \times D_{10}} = 1 \text{ to } 3$
			SP POORLY-GRADED SANDS OR GRAVELLY SANDS <5% FINES	NOT MEETING ALL GRADATION REQUIREMENTS FOR SW
		DIRTY SANDS	SM SILTY SANDS, SAND-SILT MIXTURES >12% FINES	ATTERBERG LIMITS BELOW "A" LINE OR $PI < 4$
			SC CLAYEY SANDS, SAND-CLAY MIXTURES >12% FINES	ATTERBERG LIMITS ABOVE "A" LINE WITH $PI > 7$
FINE-GRAINED SOILS (MORE THAN HALF BY WEIGHT PASSING NO. 200 SIEVE SIZE)	SILTS Below "A" line on plasticity chart; negligible organic content	ML INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT PLASTICITY	$W_L < 50$	
		MH INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS	$W_L > 50$	
	CLAYS Above "A" line on plasticity chart; negligible organic content	CL INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY, OR SILTY CLAYS, LEAN CLAYS	$W_L < 30$	
		CI INORGANIC CLAYS OF MEDIUM PLASTICITY, SILTY CLAYS	$W_L > 30 < 50$	
		CH INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	$W_L > 50$	
	ORGANIC SILTS & ORGANIC CLAYS Below "A" line on plasticity chart	OL ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	$W_L < 50$	
		OH ORGANIC CLAYS OF HIGH PLASTICITY	$W_L > 50$	



APPENDIX B

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.

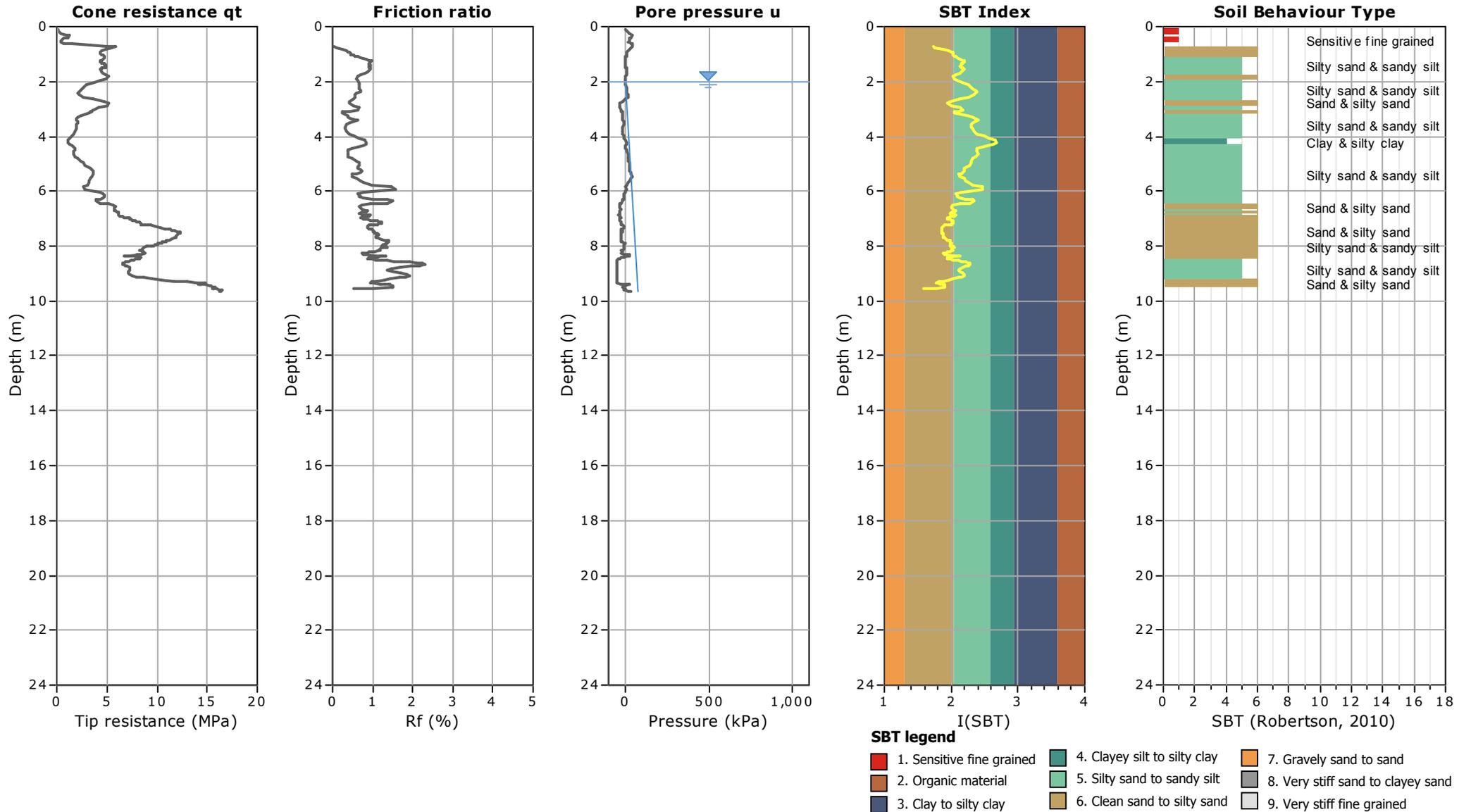
APPENDIX C

PIEZOCONE PENETRATION TEST PLOTS



Project: Proposed Subdivision

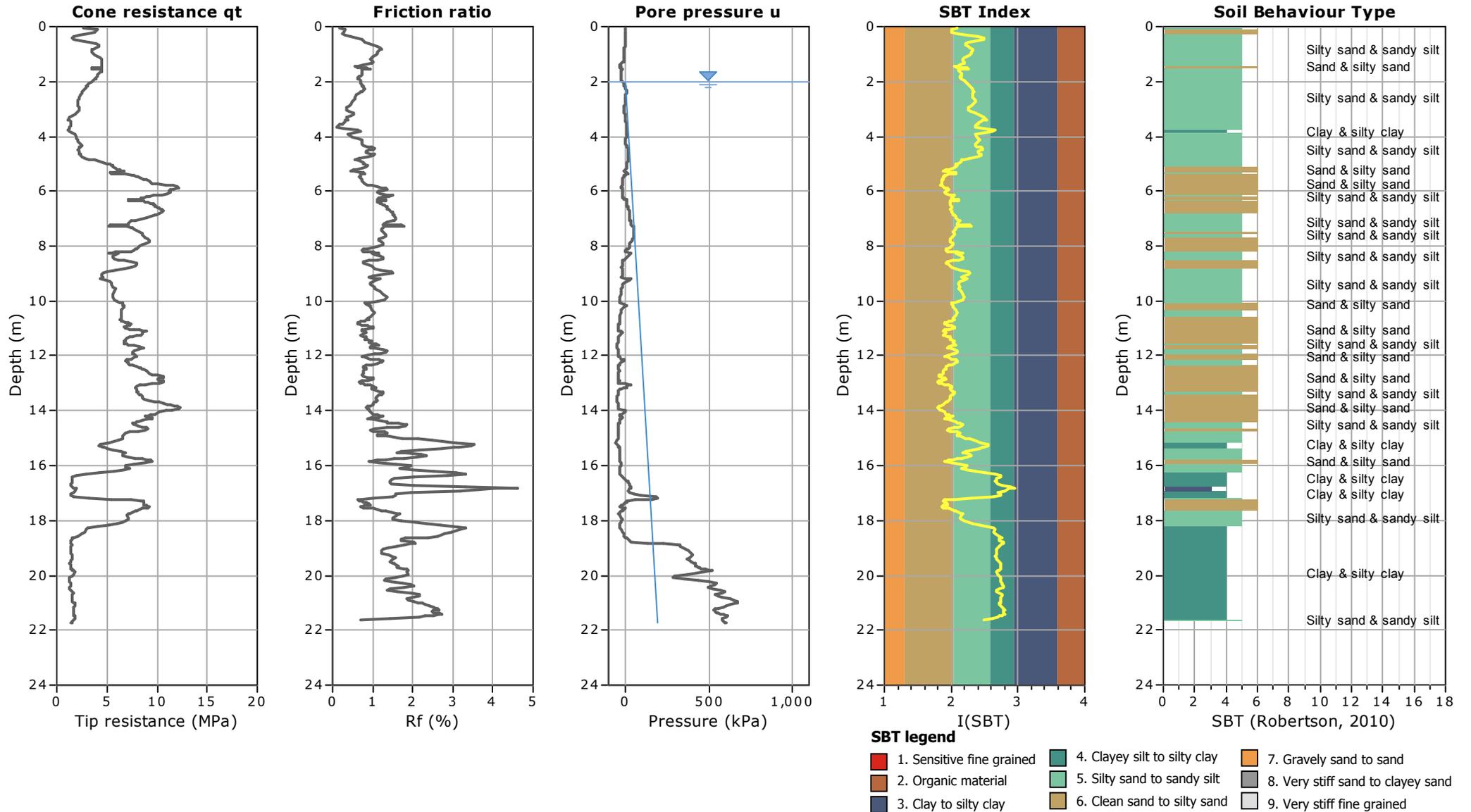
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Project: Proposed Subdivision

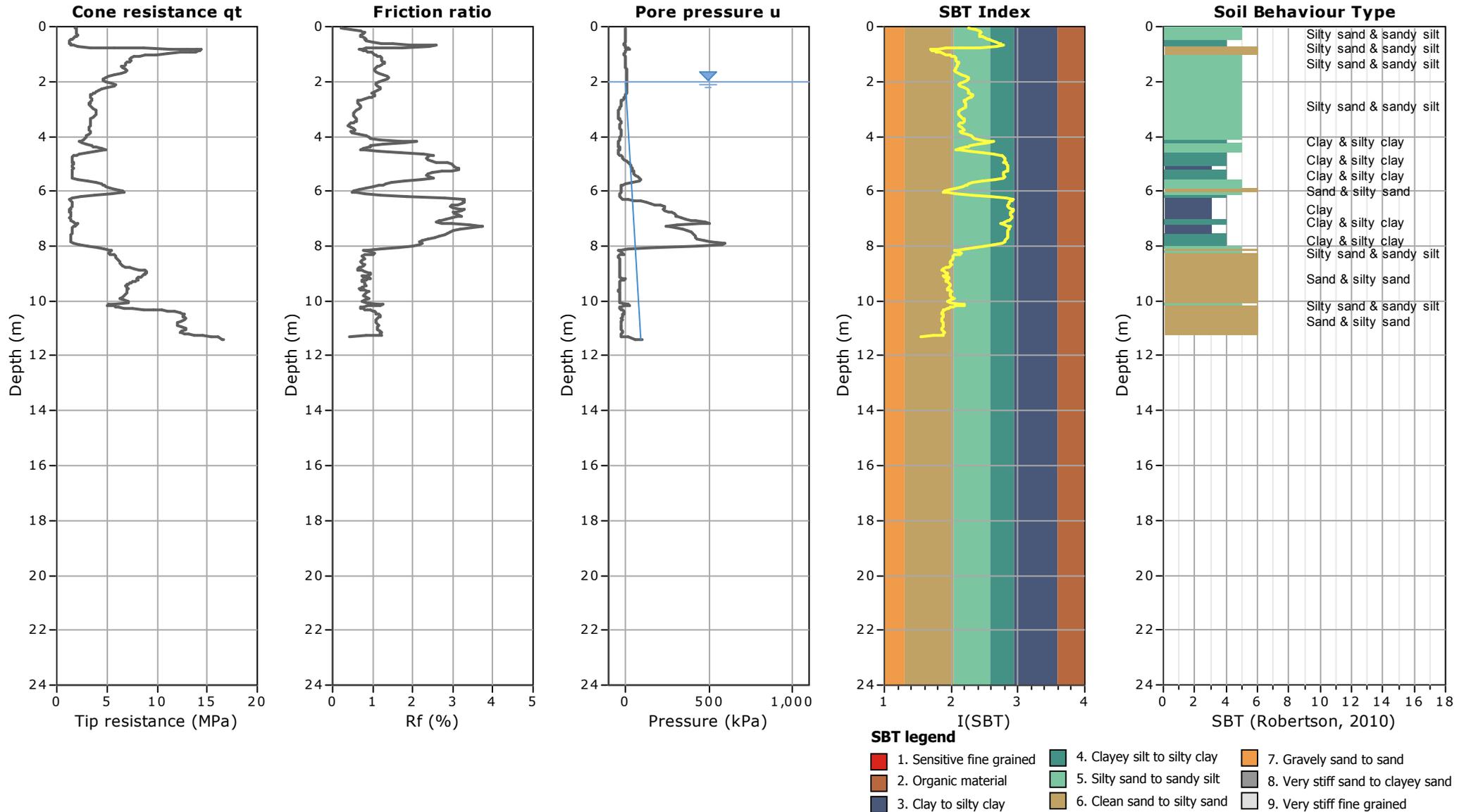
Location: NE1/4-35-35-05-W3M, Grasswood, Saskatchewan





Project: Proposed Subdivision

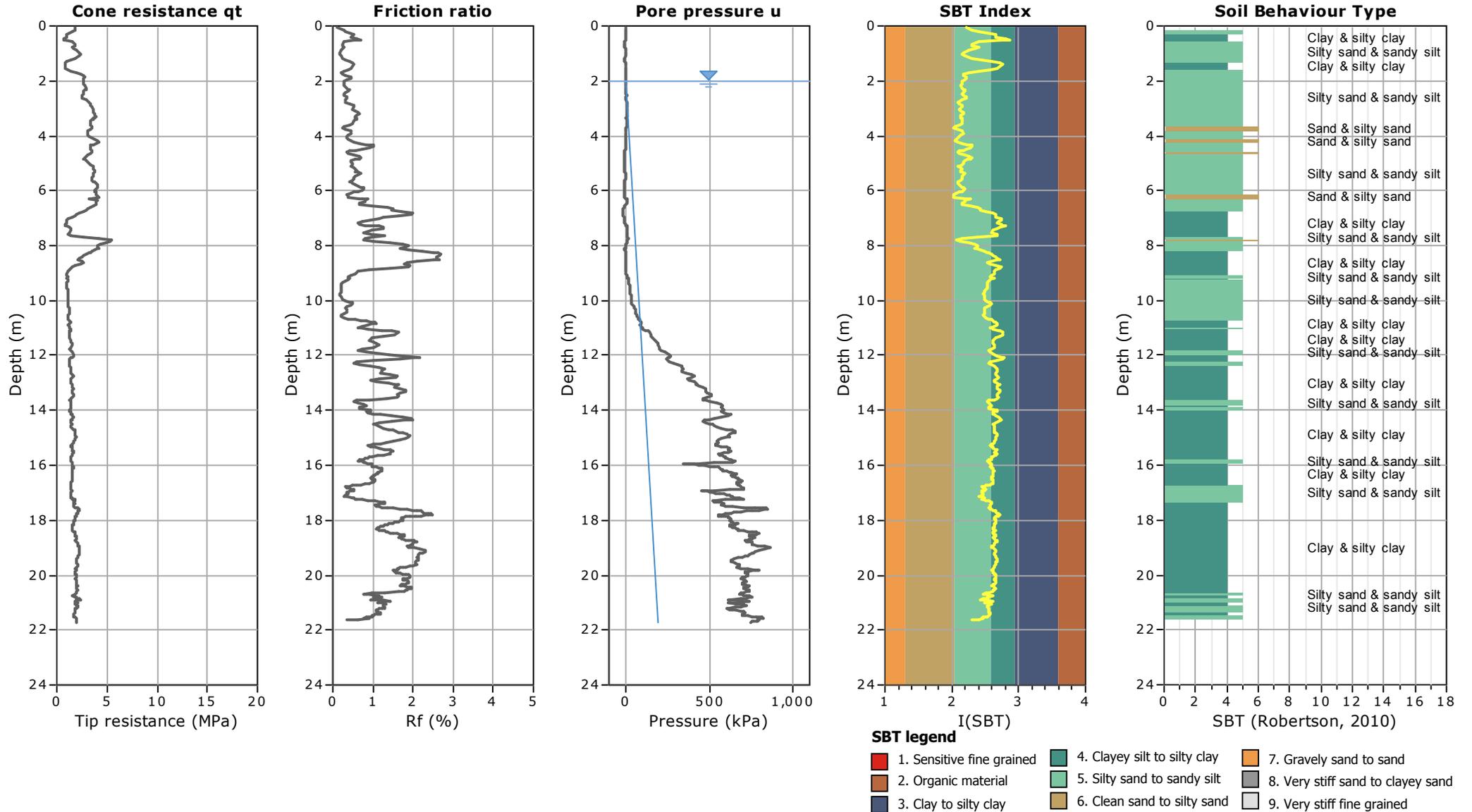
Location: NE1/4-35-35-05-W3M, Grasswood, Saskatchewan





Project: Proposed Subdivision

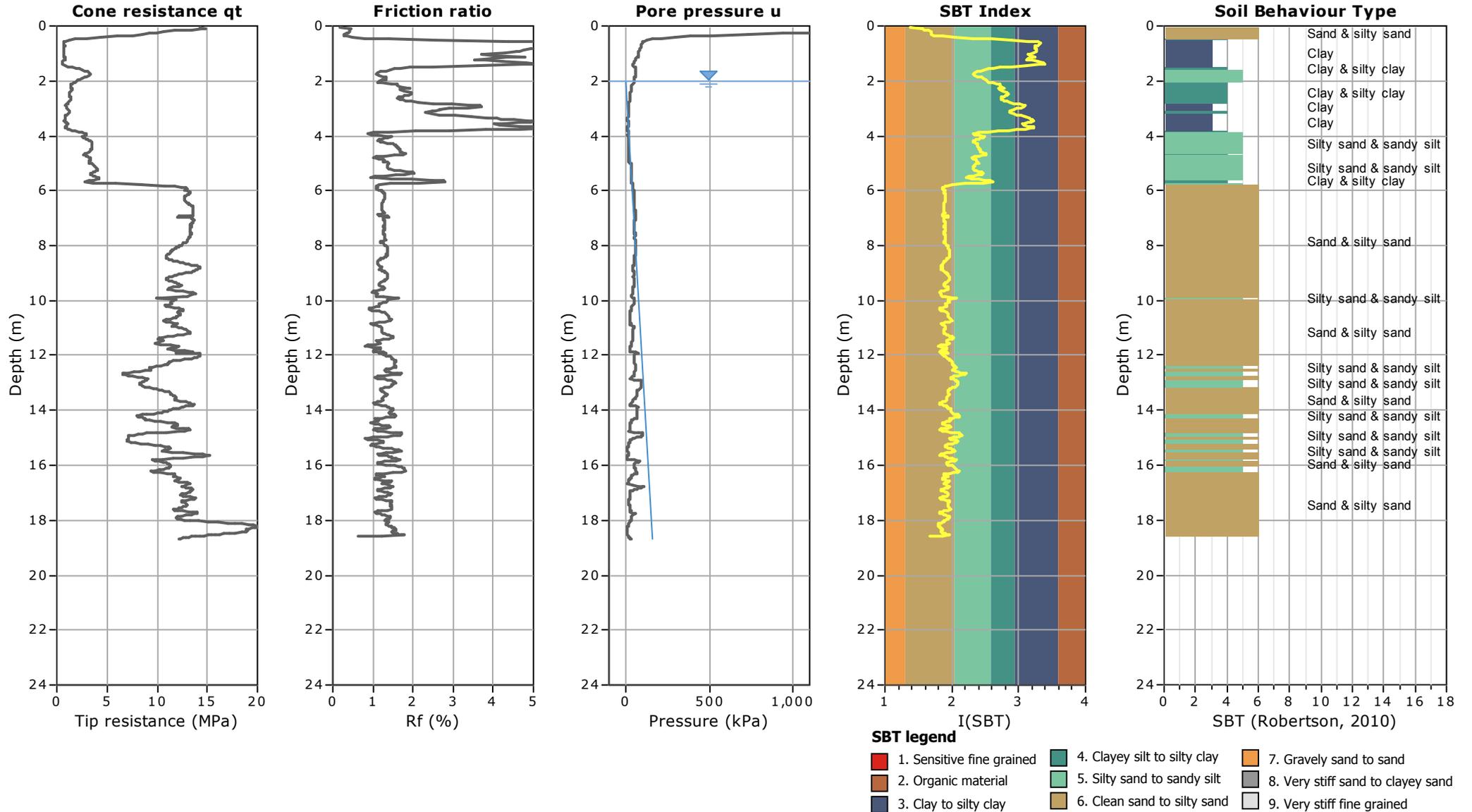
Location: NE1/4-35-35-05-W3M, Grasswood, Saskatchewan





Project: Proposed Subdivision

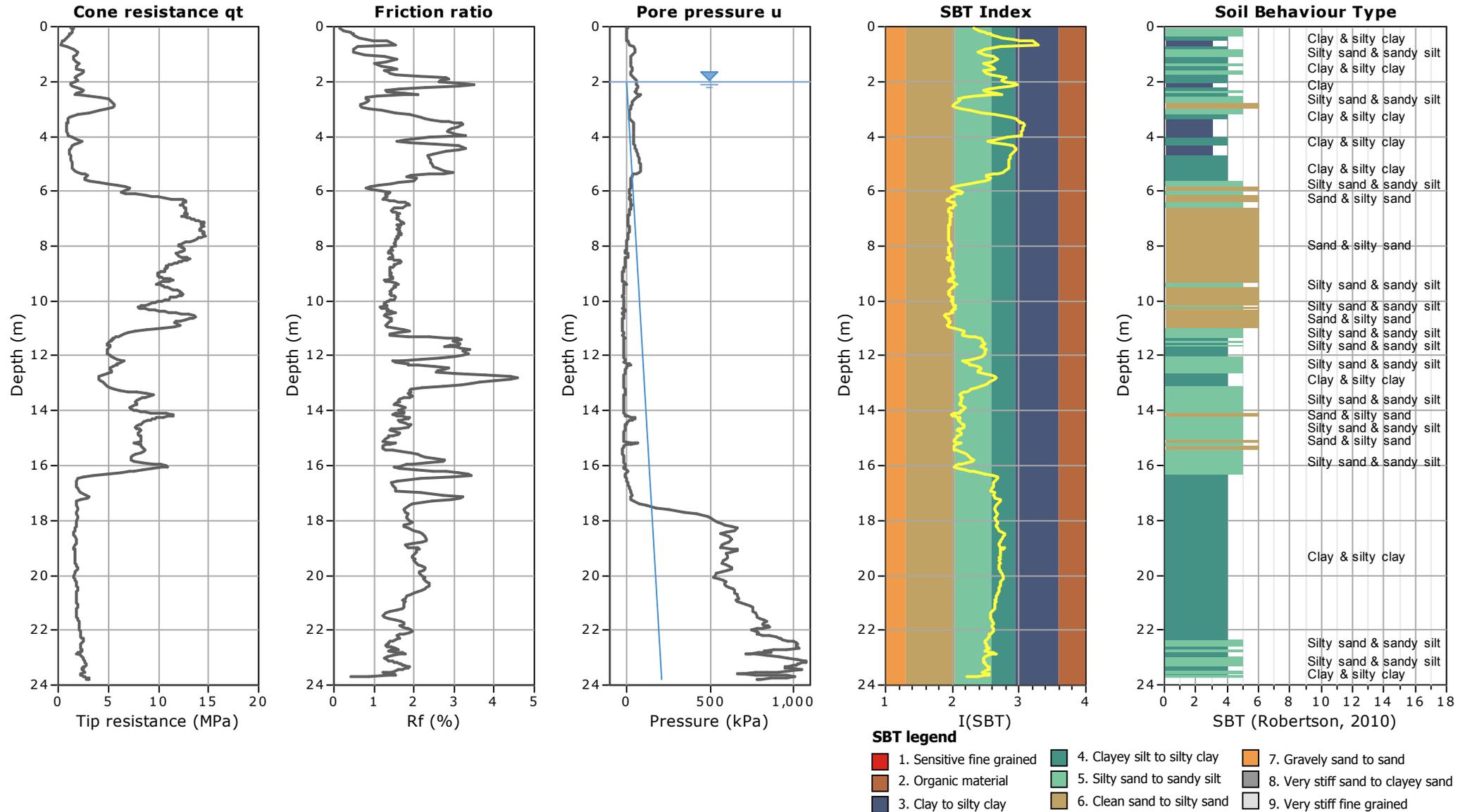
Location: NE1/4-35-35-05-W3M, Grasswood, Saskatchewan





Project: Proposed Subdivision

Location: NE1/4-35-35-05-W3M, Grasswood, Saskatchewan



APPENDIX I

PUBLIC CONSULTATION INFORMATION

May 29, 2018

Dear Sir or Madam,

The intent of this letter is to inform you of a proposed rezoning application that will be submitted by Major Land Corporation to the Corman Park-Saskatoon Planning District Commission. The proposed development is situated at the following location:

- **NE ¼, Section 35, Township 35, Range 5, W3M**

The proposed commercial development is located south of the Grasswood commercial area, in the southwest quadrant of the Grasswood Road and existing service road intersection, immediately south of the Canlan Jemini Arena in the R.M. of Corman Park and within the Corman Park – Saskatoon Planning District (See Map 1).

The Developer is applying to rezone a 48.85 acre (19.77 ha) parcel from DAG-1 – D-Agricultural 1 District to DC-1 – D-Arterial Commercial 1 District. The purpose of the rezoning is to provide for up to 54 lots to be developed for commercial purposes. Subsequent subdivision applications will be made to the Community Planning Branch at the Ministry of Government Relations at the appropriate time. A Draft Concept Plan has also been attached to this letter (see Map 2). The actual number of lots on site could be less than 54, and will be subject to market demand.

Potable water will be provided to the development by the Dundurn Rural Water Utility. The DRWU has a low pressure potable water system with a booster station located at the south east corner of Grasswood Road, west of the north-south rail line. This utility will manage the on-site water distribution lines and associated infrastructure. Each lot will require an individual reservoir and pump in order to meet peak day demands and fire suppression, if required. Each individual lot owner will be responsible for the installation and maintenance of their own reservoir and pumping equipment.

Septic tanks will be utilized and all wastewater produced at the development will be hauled to a licensed facility.

A Traffic Impact Analysis (TIA) was undertaken as a part of this development project. Based on the analyses conducted as a part of the TIA, the following recommendations were made, including:

- (1) Align the east access on Grasswood Road with Jemini's east access (undertaken as a part of the design of the development);
- (2) Consider providing an all-way stop control at the Grasswood Road and Service Road intersection for critical and full build-out development phases.

- (3) Consideration of an eastbound right-turn lane with channelization at the Grasswood Road and Service Road intersection to minimize unnecessary delays at 75% of full buildout; and,
- (4) Spacing between the rail line and development entrance of at least 30 m (undertaken as part of the design of the development).

A preliminary lot grading plan was undertaken and illustrates all runoff from the site into a central storm water detention pond. The pond was sized to provide storage for the 1:100 year storm event plus 25% to ensure that the post-development runoff rate was equal to the pre-development runoff rate of 1,500 L/s. The storm water detention pond is designed to accommodate the increased runoff due to greater impermeable surface area of the development. It is noted that the proposed storm water detention pond should require minimal maintenance, limited to clearing vegetation growth near the existing culvert inlet. A total volume of 12,000 m³ are required for the development, which is equivalent to approximately 890 m³ per hectare of development.

The Traffic Impact Assessment, municipal servicing study and geotechnical study can be viewed and downloaded online at www.crosbyhanna.ca/downloads.

The Developer wishes to consult with neighbours and receive feedback regarding the proposed rezoning application. Following the public consultation, all feedback will be included in a presentation to the Corman Park-Saskatoon Planning District Commission, in conjunction with the Comprehensive Development Review that has been prepared, where all matters of land use integration, environmental and social considerations, and engineering infrastructure will be addressed.

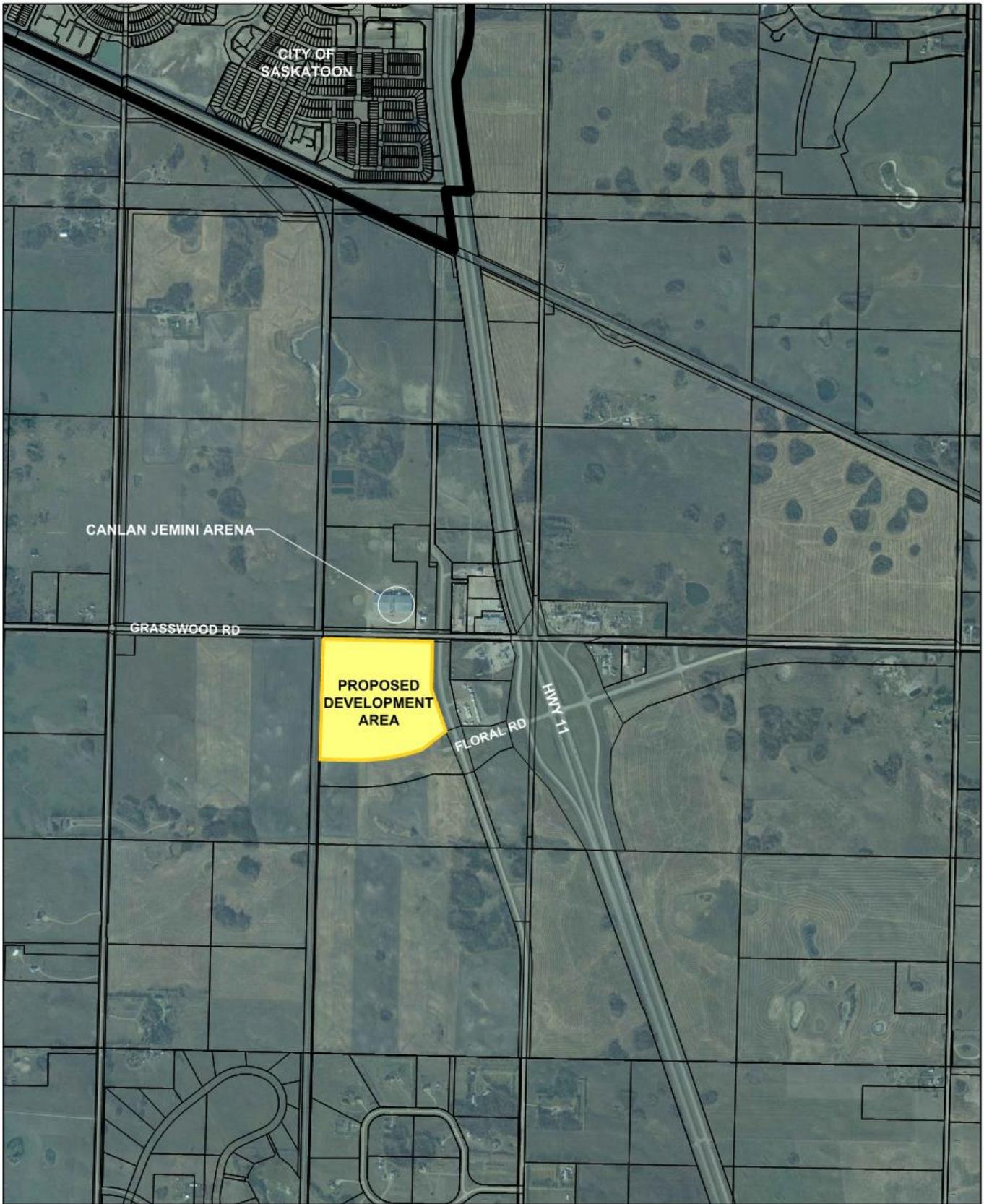
If you have any questions or comments regarding this proposed development, please submit them via email to Maggie Schwab by Monday June 18, 2018 at mschwab@crosbyhanna.ca

We look forward to hearing from you.



Jim Walters, MCIP, RPP
CROSBY HANNA & ASSOCIATES

MAP 1: LOCATION OF PROPOSED DEVELOPMENT



Development Location



January 10th, 2019

Jim Walters, MCIP, RPP
Crosby Hanna & Associates
407C 1st Avenue N
Saskatoon, SK
S7K 1X5

Dear Jim,

Re: Major Land Corp. Rezone on NE ¼, Section 35, Township 35, Range 5, W3M

Thank you for the notification of a proposed rezone on NE ¼, Section 35, Township 35, Range 5, W3M by Major Land Corporation. English River First Nation holds 140 acres of land in close proximity to the proposed development and as such provides the following concerns:

- The TIA submitted as part of the development didn't take into account any traffic generated from our existing development. As well the forecasted traffic volumes did not appear to account for the full build out of our development.
- The TIA does not mention any percentage of trucks as a component of the new traffic generated by the development (other than septic trucks) and how they may effect flows and the adjacent network.
- The TIA did not determine the effect on the intersection of Highway 11 from the proposed development. The TIA should model and forecast the effect from the increased traffic volumes using the existing Grasswood Road and Highway 11 intersection and ramps. Particular attention should be paid to the eastbound to northbound left turn during the pm peak. Background traffic from the full build out of the English River development should be added to this model.
- Currently there is no natural outlet for storm water on our lands. Storm water has been increasing year over year and the water table on our land is very high. As part of the collaborative effort with the Saskatoon North Partnership for Growth we have been working with the RM of Corman Park and the City of Saskatoon on servicing strategies for our lands. This proposed development does not appear to take into consideration the existing storm water issue on our land and the lack of an outlet. But rather this proposal appears to add to the existing storm water problem by draining onto our land. This proposed solution is unacceptable to English River First Nation as our net developable acres will be reduced from the additional storm water.
- Further we would like to remind you of the Section 11: Aboriginal Involvement in the Corman Park – Saskatoon Planning District Official Community Plan.

Thank you for providing English River First Nation an opportunity to provide comments on this proposed development. We look forward to having further discussion in order to ensure our concerns are addressed.

Thank You,



Lorne Wolfe
English River First Nation

cc: Rebecca Row, Director of Planning & Development
RM of Corman Park, 111 Pinehouse Drive, Saskatoon, SK; S7K 5W1

Jennifer Fertuck, Director of Traffic Engineering & Development
Highways and Infrastructure, Unit 18 – 3603 Millar Ave., Saskatoon, SK; S7P 0B2



January 24, 2019

Mr. Lorne Wolfe
Des Nedhe Development Limited Partnership
English River First Nation
301 – 2555 Grasswood Road East
Saskatoon, SK S7T 0K1

RE: MAJOR LAND CORPORATION COMMERCIAL DEVELOPMENT

Dear Mr. Wolfe,

Thank you for your letter dated January 10th, 2019 regarding the proposed Major Land Corporation Commercial Development at the NE-35-35-5 W3M.

With respect to the comments received concerning drainage, it is noted that the stormwater management plan prepared by Catterall & Wright the drainage plan was undertaken so that the development can accommodate a 1:100 year flood event +25% on site. It is further noted that the ERFN property may not currently have a proper stormwater outlet, whereas the subject site of the proposed commercial development does. Lastly, while the volume of runoff will increase as a result of the proposed commercial development, the post-development runoff rates will not exceed the pre-development runoff rates as required by the RM's storm water management guidelines. The stormwater management plan was sent to the WSA for review and WSA indicated that Catterall & Wright's design characteristics and techniques are acceptable for the purposes of the project's stormwater mitigation.

With respect to the comments received identifying concerns with the TIA that was undertaken by WSP, the following points of clarification are made:

- The TIA takes into account existing development and also applied growth factors of 1.8 and 1.5, respectively which would account for significant growth in the immediate area. These growth factors were added to the anticipated traffic volumes for the future Major Land Corp. commercial development.
- With respect to the comment about future development on the ERFN, WSP contacted the RM to inquire as to whether the RM was aware of any developments in the vicinity of the proposed Major Land Corp. commercial development, and the RM indicated that there were no proposed developments on the immediate horizon of which they were aware.
- With respect to the comment regarding the lack of forecasted truck traffic, it is noted that truck traffic is a part of the trip generation model as a part of the existing composition of total traffic. It is not industry standard to differentiate truck traffic from other traffic, unless the proposed use is a truck stop or other heavy industrial use associated with higher volumes of heavy truck traffic. It is further noted that the proposed zoning district for this

development is D-Arterial Commercial 1 District (DC1) which would facilitate a diverse range of commercial activities serving the traveling public and local populations.

- With respect to the comment on the effect of the intersection at Highway 11 and Grasswood Road, neither the Ministry of Highways and Infrastructure nor the RM of Corman Park identified this as part of the scope of the TIA. Furthermore, the Ministry indicated that they do not have any further concerns with the content or recommendations presented in the TIA. The MHI will be provided a second opportunity to review and comment on the TIA at the time a subdivision application is made with the Community Planning Branch at the Ministry of Government Relations.

For your information, the next steps in the process will be to revise the Comprehensive Development Review document and submit it to the RM of Corman Park for a second review. Should you have any questions about the process in the interim, we would suggest you contact either myself or the RM of Corman Park directly.

Kindest regards,



Jim Walters, MCIP, RPP
CROSBY HANNA & ASSOCIATES

CC: Vicky Reaney, RPP MCIP
RM of Corman Park via email

Maggie Schwab

From: Jim Walters
Sent: Thursday, January 24, 2019 1:23 PM
To: Maggie Schwab
Subject: FW: Proposed Land Development Major Land Corp
Attachments: Appendix I Public Consultation Letter.pdf

Jim Walters MCIP RPP

CROSBY HANNA & ASSOCIATES

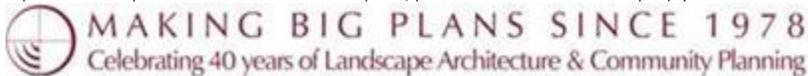
407C 1st Ave N
Saskatoon, SK S7K 1X5
t : 306.665.3441

e : jwalters@crosbyhanna.ca

www.crosbyhanna.ca

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From: Jim Walters
Sent: Friday, December 21, 2018 9:38 AM
To: dsachs@icesports.com
Subject: Proposed Land Development Major Land Corp

Hi Don, I am a planner with Crosby Hanna and Associates in Saskatoon.

I have attached a letter describing the proposed development that we are assisting with. Note that the proposed development site is directly across Grasswood Road from Jemini. Please ignore the timeline for comment outlined in the letter. Our deadline for comments is January 18th. The Developer intends to formally apply to the RM in February or March. Please let me know if you have any questions.

Jim Walters MCIP RPP

CROSBY HANNA & ASSOCIATES

407C 1st Ave N
Saskatoon, SK S7K 1X5
t : 306.665.3441

e : jwalters@crosbyhanna.ca

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