Whisper River ESTATES

NORTH PRAIRIE DEVELOPMENTS

COMPREHENSIVE DEVELOPMENT REVIEW

September 2015

Associated Engineering

NORTH PRAIRIE DEVELOPMENTS LTD.

RM OF CORMAN PARK #344

CONTENTS

INTRODUCTION

This Comprehensive Development Review (CDR) report is being submitted pursuant to Section 5.2.3.1 of the Rural Municipality of Corman Park Official Community Plan in support of an application to rezone and subdivide land for a new residential development referred to as Whisper River Estates Phase II. This report provides an overview of how the proposed multi-lot country residential development successfully integrates itself with existing properties, owners, and development in the immediate vicinity. In addition to addressing matters of land use integration, this CDR assesses the capacity of the supportive municipal and provincial infrastructure as it relates the demand created by the proposed development and describes the method of servicing and level of service intended to be provided.

DEVELOPMENT SUMMARY

NW 16-38-4-W3M

Gross Area 59.77 ha

Municipal Reserve 5.98 ha

15 Residential Lots

Average Lot Size 2.5 ha

Development Density 0.38 units/ha

Development Summary

The developer, North Prairie Developments is a family owned and operated business, established over two decades ago in Saskatchewan. The company evolved from small beginnings in Saskatoon in 1987 to one of the largest development companies in the province. North Prairie Developments has built in excess of 2500 units of single and multi-family homes throughout Saskatchewan. Today North Prairie Developments has four divisions within the company; multi-family housing, single-family housing, land development and commercial development. The developer is seeking to rezone approximately 60 hectares (150 acres) from AG - Agricultural District and AR1 – Agricultural Residential

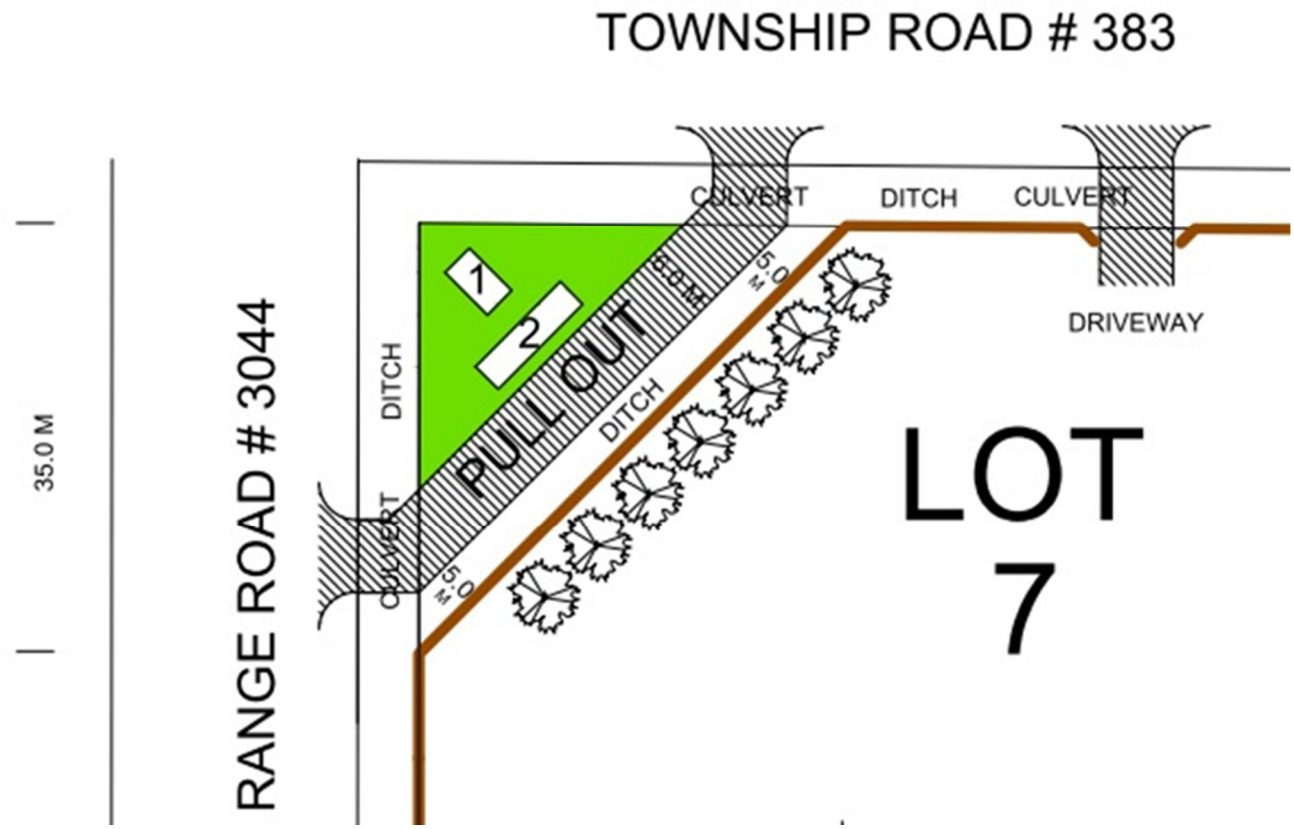
1 District to CR1 – Country Residential 1 District – Low Density to allow the subdivision of 15 single family acreage lots ranging in size between 2.06 hectares (5.08 acres) and 3.72 hectares (9.19 acres). A copy of the Plan of Proposed Subdivision is attached as Appendix A.

The lots in the development are designed with a long depth format that is commonly used within riverfront developments to maximize property exposure to a natural valley or watercourse and also represents a traditional form of development which is present in the Mennonite communities in the northern area of the RM. The long depth format coupled with a larger lot size provides opportunity for the integration of agrarian lifestyles and country residency by providing a sufficient land base to host small scale intensive agricultural operations (non-livestock).

The larger sites reduce runoff generated by development by retaining larger areas

of undeveloped land within the subdivision, allowing for greater local infiltration and minimizing the need for site grading. The long depth format also permits a greater setback from the roadway, reducing any potential nuisance from dust.

A turn out is intended to be located at the northwest corner of the proposed development providing an area for community mail boxes and erection of an entry monument sign with a community billboard. This will allow residents to safely exit the grid road to access the mail boxes and check the community billboard.



The development site is well situated within an area containing significant natural amenities including the South Saskatchewan River Valley, and the existing ravine located along the eastern boundary of the site. A 15-metre public corridor along the rear property boundary of lots 7 – 15, allows public access to the ravine and the surrounding municipal reserve specifically designed to maximize public access and exposure to these areas. The dedication of the ravine as municipal reserve will ensure that the area remains undeveloped and accessible by the public.

The proposed development represents the expansion of Whisper River Estates which is an existing residential subdivision formerly known as Cathedral Bluffs North. The subject property is relatively flat cultivated farmland but a ravine and natural grassland transverses the site's eastern boundary, providing a significant natural amenity for local residents and supporting passive recreational activities while also acting as an adequate discharge point for runoff generated from development in the area.

The proposed development has direct access to two all-weather municipal roads (Range Road 3044 and Township Road 383). Property services include a full range of shallow utilities including natural gas, electricity, telephone and internet service, and a potable water line operated by the Intervalley Water Inc. Waste water disposal is intended to be managed by individual private onsite systems.

Dedicated Lands

The Planning Development Act, 2007, governs the provision of dedicated lands such as municipal reserve. The legislation stipulates:

- Ü the types of uses which can occur on the lands considered to be municipal reserve;
- Ü how much land is required;
- Ü who obtains the titles to the designated land; and
- Ü transactions required for the designated land.

Municipal reserve is land that is dedicated to the municipality to provide for public open space which can accommodate features such as public recreation areas, natural areas, or agricultural uses. The Planning Development Act, 2007, Section 186 (3)(a), requires that 10% of the land area for a proposed residential subdivision be provided for municipal reserve. The 10% municipal reserve area requires a transaction to occur between the developer and the municipality. This municipal reserve requirement can be met by the provision of land in the subdivision, or by cash-in-lieu payment (at the land value in a subdivided but un-serviced state), or a combination of both land and cash-in-lieu.

Whisper River Estates Phase II provides land in the subdivision for the municipal reserve dedication. The amount of land provided for the municipal reserve dedication is 20.61 hectares (50.93 acres). This municipal reserve land will provide the public access to an area maintained in its natural state – unbroken land covered in native grass, brush, and trees – that can be used for active recreation such as walking, jogging, horseback riding, cross country skiing, or recreational vehicles such as snowmobiles or motorcycles. A ravine and small water hole is located in the MR dedication; however, these water bodies are considered to be seasonal and disappear during drier years.

The following calculation confirms the required amount of land dedication for 10% of the proposed residential subdivision as defined in *The Planning Development Act 2007*, Division 2, Section 186 (3)(a). This calculation is represented as such for Whisper River Estates:

- Ü Gross Land Area = 59.77 ha
- Ü 10 % MR Requirement = 59.77*10 % = 5.98 hectares (14.78 acres) is the required municipal reserve dedication for the Whisper River Estates Phase II residential subdivision
- Ü Currently, Whisper River Estates provides 20.61 hectares (50.93 acres) for municipal reserve land which is approximately 3.4 times more than the 10 % requirement represented above.

TABLE 1: LAND ALLOCATIONS

Phase 2			
	Hectares	**Acres**	**% of Phase 2 Development Area**
Gross Development	59.77	147.72	-
Right-of-Way Widening	0.84	2.08	1.4

10 % Municipal Reserve *	5.98	14.78	-

LAND USE CONTEXT

Whisper River Estates Phase II is located in the RM of Corman Park No. 344 (the RM) within the NW 16-38-4-W3M, directly north of Cathedral Bluffs and west of Whisper River Estates. The development site takes full advantage of the natural amenity provided its proximity to the South Saskatchewan River valley which is situated approximately 1 kilometre east of the proposed development site.

The development location has been selected based primarily on its proximity to existing complementary development and to take advantage of the area's natural beauty and amenity. The proposed subdivision also benefits from its access to an existing municipal road network capable of serving the development and a full range of existing shallow utilities in the immediate vicinity, reducing the need for significant infrastructure upgrades in the area.

The subject site is situated in an active farming community. Although the site has been traditionally cultivated, the Canadian Land Inventory rates the local soils as a Class 4, which is considered marginal by the RM of Corman Park Official Community Plan. The soil limitations include one or more of the following:

- Ü Undesirable structure
- Ü Low permeability
- Ü A restricted rooting zone because of soil characteristics
- Ü Low natural fertility
- Ü Low moisture holding capacity
- Ü Salinity

The surrounding land uses within a 1.6 km radius of the proposed development area comprise a mixture of residential and cultivated agricultural lands including two intensive livestock operations (ILOs). The two ILOs consist of an eight animal unit hog farm to the northwest and a 400 – 500 animal unit cattle farm northeast of the proposed development. Both ILOs are located outside of the respective separation distance from a multi-parcel country residential development as prescribed by the RM bylaws.

Residential development in the area immediately surrounding the subject site includes six agricultural residences, six single parcel country residential sites and two multi-lot country residential developments.

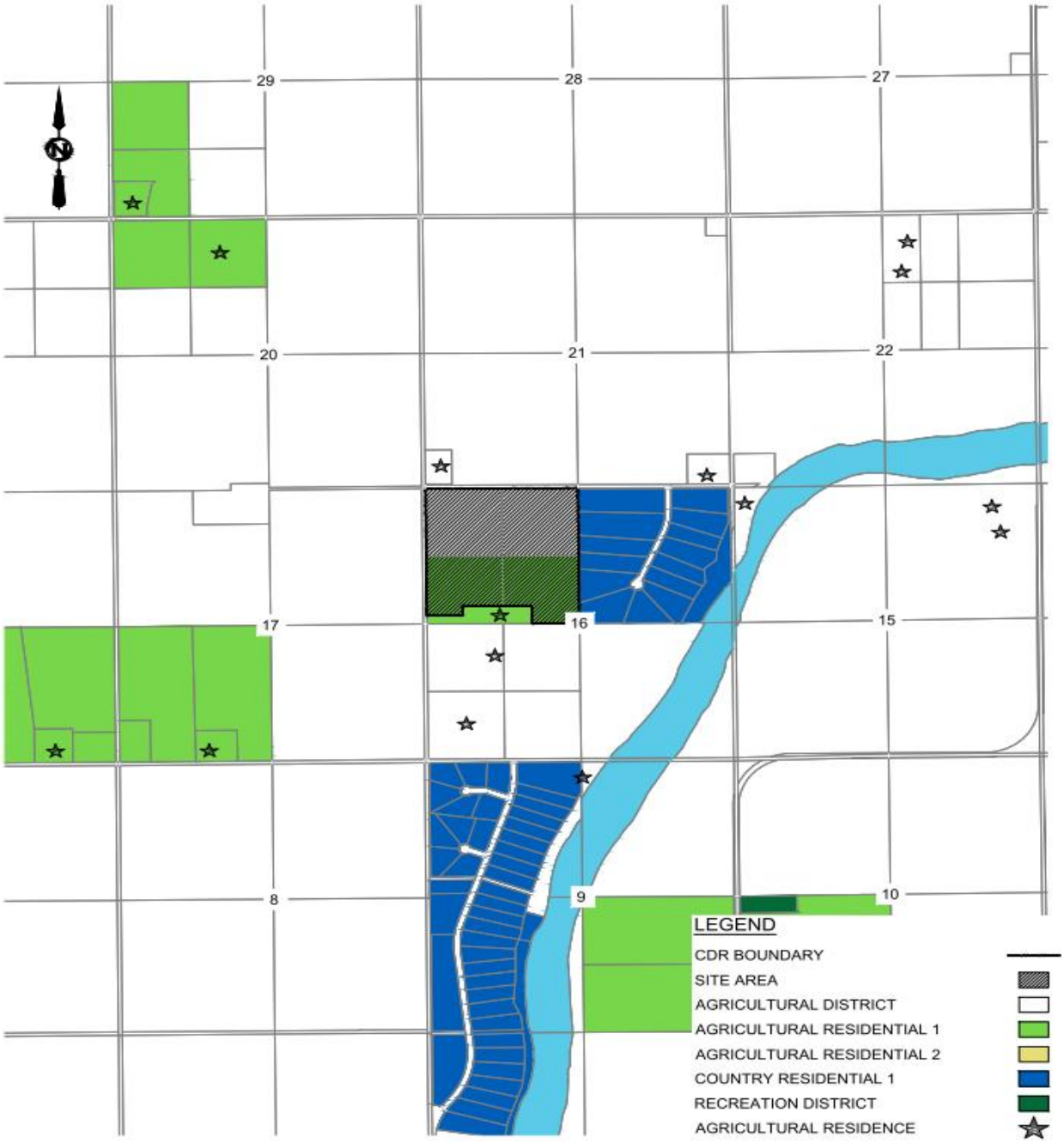


FIGURE 1: ADJACENT LAND USES

Whisper River Estates and Cathedral Bluffs are located directly east and south of the subject property. The development pattern illustrated in the PPS attached to this report as Appendix A provides for a similar long lot riverbank development as found in these two existing residential developments in the area.

Figure 1 identifies the adjacent land uses and Figure 2 identifies the location and separation distances applied from each of the ILOs in the vicinity of the subject site.

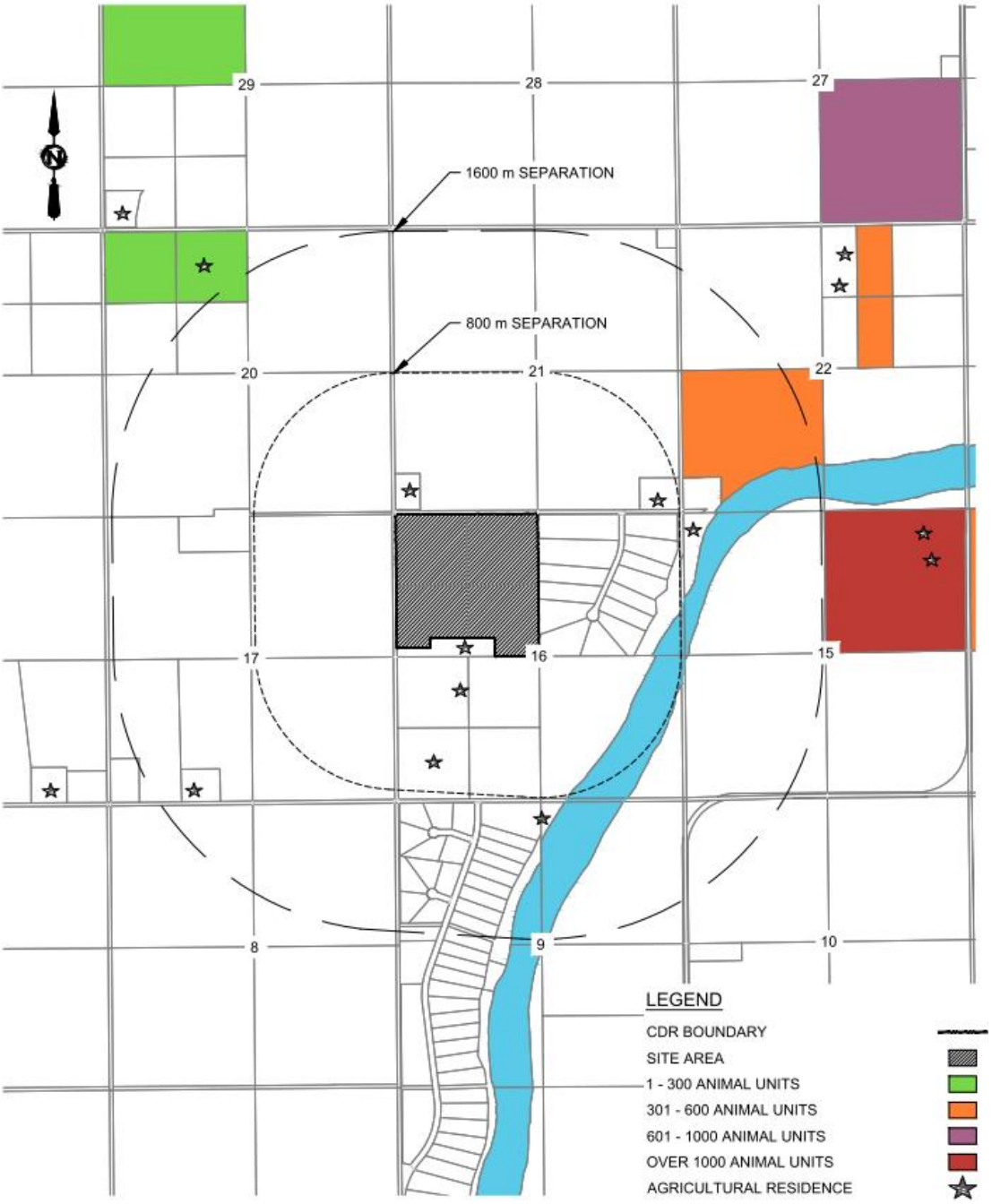


FIGURE 2: ILO SETBACK

INVENTORY AND ANALYSIS

Existing Conditions

The proposed development area comprises approximately 60 hectares (150 acres) and has been actively farmed in the past. This development area is currently zoned AG – Agricultural District and AR1 – Agricultural Residential 1 District as per the RM of Corman Park Zoning Map.

The development area generally slopes from west to east at a 1% grade towards the ravine situated along the eastern boundary of the site. The natural slope of the land combined with larger lot areas promotes positive drainage of the area with very little grading required. The ravine acts as an adequate point of discharge with run-off eventually flowing into the South Saskatchewan River.

PRELIMINARY GEOTECHNICAL REPORT

A preliminary geotechnical investigation was prepared by P.Machibroda Engineering Ltd. to evaluate the existing local subsurface soil and groundwater conditions and to provide general geotechnical recommendations for the construction of single family homes on the development site.

A total of nine test holes were dry drilled with a 150 mm diameter and extended to depths of 7.2 to 10.5 metres below the existing surface. Test hole logs were compiled during the drilling to record soil stratification, groundwater conditions, the position of unstable sloughing soils, and the depths at which cobblestones and/or boulders were encountered. Standpipe piezometers were installed in 5 of the 9 test holes.

The soil profile consisted of a thin layer of topsoil followed by glacial till extending to depths of at least 10.5 metres. Intertill and sand layers/lenses were encountered throughout the glacial till stratum. A sand layer was encountered at test hole no. 15-4 just below the top soil layer to a depth of 1.77 metres.

Groundwater seepage and sloughing conditions were encountered during test drilling. These conditions were measured at depths ranging from 2.8 to 3.4 metres below the existing grade on April 8, 2015. Groundwater conditions will fluctuate seasonally and higher groundwater conditions can be encountered during or after periods of precipitation or spring thaw.

Cobblestones and/or boulders were encountered in 4 of the 9 test holes at depths of 0.2 metres to 7.2 metres below existing grade. The cobblestones ranged in size from 60 to 200 mm and boulder-sizes larger than 200 mm should be expected at the subject site.

Site preparation for the surface of the subgrade should be levelled and compacted to the following minimum density requirements:

- Ü Building Areas – 96 percent of standard Proctor density at optimum moisture content;
- Ü Roadway Areas – 96 percent of standard Proctor density at optimum moisture content;
- Ü Landscaped Areas – 90 percent of standard Proctor density at optimum moisture content.

Fill required to bring the subgrade soil to the design elevation should consist of granular material or the on-site glacial till soils and should be placed in thin lifts (maximum 150 mm) and compacted to 96 percent of standard proctor density at optimum moisture content.

On-site excavation may be completed with unbraced, slope side walls. The long-term stability of the excavation walls will be affected by wetting and drying, the length of time the excavation remains open, and the consistency and structure of the subgrade soils. Based on the results of groundwater monitoring, de-watering of the excavations may be required during construction below the groundwater table. The de-watering should be conducted on a case by case basis over the time period for which the excavation is left open.

A minimum soil cover of 2.5 metres is recommended for underground pipeline construction. It should be feasible to construct the open cut trenches for the underground pipeline using conventional earth moving equipment. De-watering may be required and should be performed on a case by case basis using drainage ditches drained to sump pits equipped with sump pumps. Where soft compressible soils are encountered, over-excavation to a minimum depth of 300 mm below the founding elevation should occur and replaced with clean, free-draining, non-frost susceptible, compacted granular material. All backfill above the pipeline should be placed in thin lifts not exceeding 300 mm and compacted to 96 percent of standard proctor density.

A footing foundation based within naturally deposited, undisturbed stiff to very stiff glacial till or sand should perform satisfactorily. If the foundation is constructed during freezing conditions, the subgrade soil at the design footing elevation must be protected from freezing. If it is not practical to keep the subgrade from freezing then a deep foundation system should be constructed.

A deep foundation consisting of drilled, cast-in-place concrete piles could be utilized as a foundation system for garages and decks at the site. Drilled, cast-in-place, straight shaft pile should be designed on the basis of skin friction only.

The near surface subgrade soil conditions consisted of glacial till and/or sand. Grade-supported floor slabs should perform satisfactorily at this site.

The preliminary geotechnical investigation confirms the general suitability of the area to support residential development proposed but recommends that lot specific detailed geotechnical investigations are performed once building details and locations have been finalized.

NATURAL AND HERITAGE RESOURCES

Natural Resources

The area proposed for development has been previously cultivated and a review of the Saskatchewan Conservation Data Centre online screening tool confirmed that there are no significant terrestrial or aquatic resources located in the area. A copy of this online data is illustrated on the map in Appendix B.

In addition to the online screening, a Phase 1 Environmental Site Assessment (ESA) was completed by P. Machibroda Engineering, for the development area. The ESA consists of a review of available background and historical information, a visual site review, and a report of the findings. The purpose of the ESA was to determine if any potential contaminants or environmental concerns exist on the subject property from previous uses on or near the site.

This review confirmed that there was no record of any activities in the vicinity which could have resulted in site contamination. Existing aerial photography shows the property has been previously farmed with lands to the east being converted for residential purposes. The Saskatchewan Ministry of Environment online database confirmed that there were no recorded spills or record of storage of hazardous substances on the site and a property file search conducted by the RM revealed that no building permits have been issued on the development site.

The visual site review confirmed the subject property as bare land with no evidence of the following uses being located on the site: buildings, liquid waste, solid waste, hazardous substances or waste dangerous goods, and storage tanks (above or below grade).

Based on the review of available background and historical information, and a visual site review, the subject property is considered to have low environmental hazard potential and no further investigation is warranted at this time (e.g. Phase II ESA) as per the study's findings.

Heritage Resources

The RM of Corman Park is committed to the protection of historic, archaeological, and other cultural features and sites from incompatible development. The Heritage Conservation Branch of the Ministry of Parks, Culture, and Sport governs heritage resources in the province. The Heritage Conservation Branch provides an online searchable database which can be used by developers to determine whether a parcel of land contains heritage or archaeological resources. Where this potential is identified, a copy of the development concept for the property must be submitted for comment by their office to confirm the need for any additional investigation.

A query was performed of the online database and the results of the inquiry are attached in Appendix B. The query confirmed that the subject property required additional heritage screening and consultation with the Heritage Conservation Branch. The Heritage Branch was contacted on February 23, 2015 via email which confirmed the following:

"There are no recorded heritage sites located in conflict with the proposed subdivision. While there is native prairie located within the project area, this portion of the development area will be part of the municipal reserve and will not be impacted by construction activities. As such, the potential for heritage sites to be adversely affected by this development is low. Our office (The Heritage Conservation Branch) has no concerns with the subdivision proceeding as planned."

Appendix B contains the letter received in support of the development proceeding as planned.

Development Servicing

SHALLOW UTILITIES

SaskPower, SaskTel, and SaskEnergy currently provide a full range of services within the area surrounding the development. Existing overhead power lines extend from Range Road 3044 along the Township Road 383 right-of- way east to Whisper River Estates Phase I. SaskTel operates a service line on the adjacent quarter section which parallels Range Road 3044 and provides telephone services to an existing acreage in the southwest corner of the ¼ section. SaskEnergy operates a gas line which extends north from Cathedral Bluffs through the SE 16–38–4–W3M providing natural gas services to Whisper River Estates Phase I. Based on the current location of these utility systems, the proposed subdivision should be able to be serviced without any complications are significant upgrades requires.

MUNICIPAL ROADWAYS AND ACCESS

Direct access is provided to the subdivided lots via Range Road 3044 and Township Road 383. Both roadways are all-weather gravel surfaced constructed on a 20 metre road right of way to a standard fully capable of accommodating existing and forecasted traffic without any upgrades required. It should be noted that neither municipal roadway is a

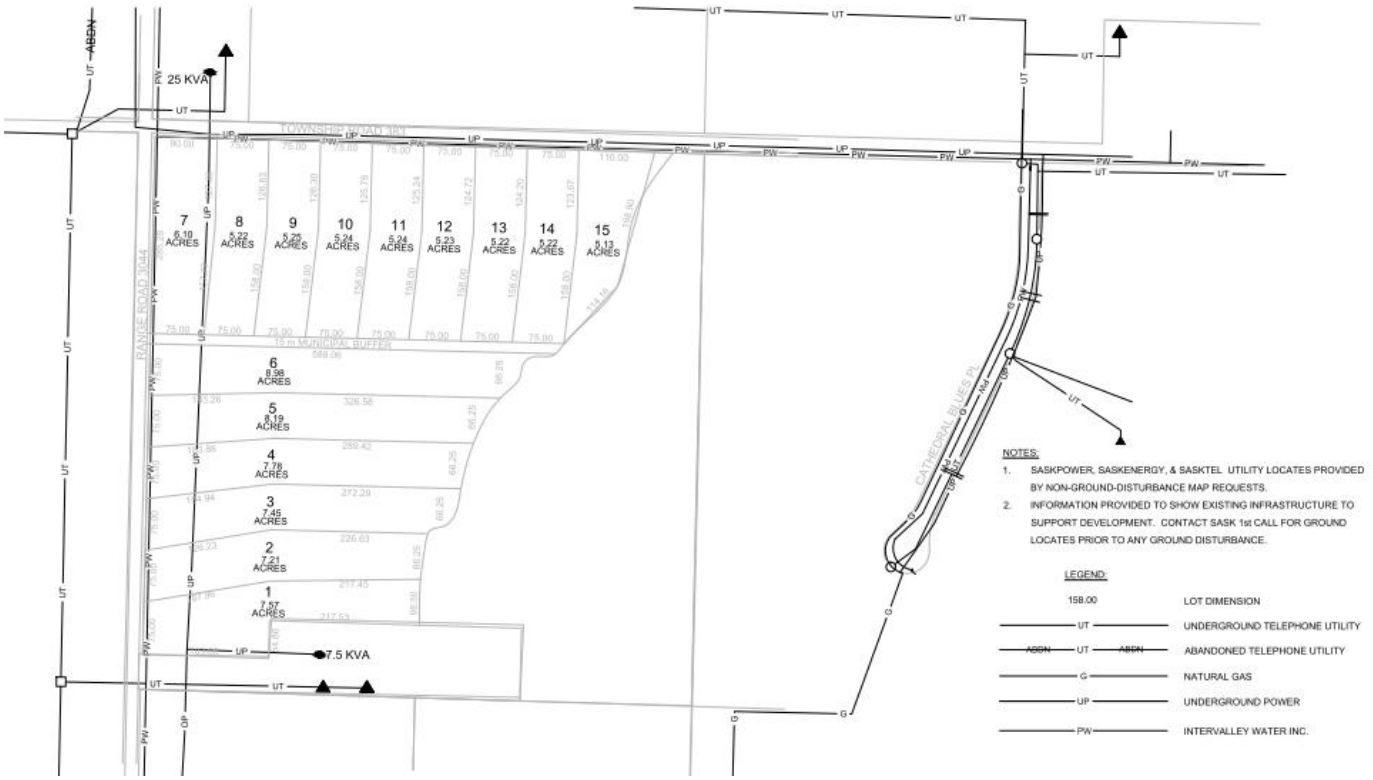


FIGURE 3: SERVICING PLAN

thru road in the area. Range Road 3044 terminates at its intersection at Township Road 382 at the northern end of Cathedral Bluffs. It is highly unlikely that this roadway will be developed south of this point given its proximity to lots within Cathedral Bluffs which reinforces the idea that traffic along this road will be limited to local property owners. Similarly, Township Road 383 extends along the northern boundary of Phase I, extending to the South Saskatchewan River Valley and terminates at this point, leaving very little possibility of traffic levels being high.

The Plan of Proposed Subdivision provides a five metre easement along the development side of both municipal roads to accommodate future road widening as all new roads within the RM are constructed on a 30 metre road allowance. See Appendix G for details on side slopes, back slopes, and road grades.

To ensure road conditions are appropriately maintained in the vicinity of the subdivision, North Prairie Developments and the RM have mutually agreed on a maintenance agreement whereas North Prairie Developments remains responsible for all road maintenance costs incurred along the ¼ section until each phase of Whisper River Estates reaches a 75% build-out. At 75% build-out the subdivision is perceived to generate a sufficient tax base to enable this responsibility to be transferred back to the RM.

POTABLE WATER SUPPLY

Potable water will be supplied to the development via a low pressure water distribution line owned and operated by Intervalley Water Inc. (IWI). Low pressure water distribution systems require each

individual lot owner to install a cistern and a pressure system to meet local domestic water requirements.

IWI would be responsible for supply, repairs, and maintenance of the lines leading to each lot boundary, while individual lot owners would be responsible for constructing individual service connections to the main supply line. IWI would manage the administration of water utility including client billing. A copy of the service agreement is attached as Appendix B.

FIRE FLOWS

An analysis of the IWI system was completed to determine if the volume and flow rates would support fire flow requirements. In order to determine the IWI system's available capacity as an emergency fire water source, the following assumptions have been made:

- Ü Assume 15 lots in the North Prairie subdivision with a total demand of 0.57 L/s;
- Ü Assume 15 lots in the Whisper River subdivision with a total demand of 0.57 L/s;
- Ü Fire supply would be located along the north edge of section 16-38-04-W3M;
- Ü Minimum system pressure during a fire must not drop below 20 psi anywhere in the system (~20 psi at the hydrant);
- Ü Worst case scenario occurs when all the users are drawing water from the system resulting in a total demand on the SE section of the IWI system of 2.17 L/s; and

The pump station discharge pressure (PH1 East Pipeline) could be increased to 81 psi to maximize the fire flow available. This reaches the system pressure rating (100 psi) in low areas and cannot be further increased without system modifications.

In addition, it is understood the Cathedral Bluffs may be connected to the IWI system. This would result in additional demand on the east half of the system, but would also likely improve capacity by looping the east portion of the system. Two cases with Cathedral Bluffs have also been included, one with the estimated average daily demand (ADD) flow of 0.6 L/s, and one at an estimated maximum daily demand (MDD) flow of 1.8 L/s (peaking factor of 3). The resulting fire flows in each case are summarized below.

TABLE 2: AVAILABLE FIRE FLOWS

Scenario	Fire Flow Available (L/s)	Lowest System Pressure (kPa)	Low Pressure Node
Base Layout (no Cathedral)	0.77	137.2	Whisper/North Prairie
Cathedral ADD	1.39	138.6	Whisper/North Prairie
Cathedral MDD	0.72	137.2	Whisper/North Prairie

The NFPA 1142, *Standard on Water Supplies for Suburban and Rural Fire Fighting*, applies to areas where an adequate and reliable water supply system does not exist and states that the minimum required water supply for structures without exposure hazards is 2000 gallons. This minimum has been

increased to 2500 gallons to compensate for a fourteen (14) minutes estimated response time as suggested by the City of Warman Fire Department.

Using Table 1 – NFPA 1142 Fire Flow Rate, a total water supply of 2,500 gallons corresponds to a fire flow rate of 250 gpm (15.8 L/s). Based on the table above, the IWI system is not capable of meeting an on demand firefighting supply. It should be also noted that this portion of the IWI system is served by a single pump (no backup), and their pump station does not yet have backup power.

WASTEWATER DISPOSAL

The preliminary hydrogeological investigation prepared by P. Machibroda Engineering Ltd. in consultation with the Saskatoon District Health Region (SDHR) recommends Type ll mounds as the preferred type of private onsite wastewater disposal systems to be used for the management of wastewater. The installation, maintenance, and repair of these private onsite wastewater disposal systems are the responsibility of each property owner. The installation of the disposal system is expected to occur as part of a building permit associated with the construction of the principle dwelling. Prior to the installation of the disposal system, the property owner will be required to obtain the Onsite Sewage Works Application from the SDHR and satisfy the municipal standards as identified in the RM of Corman Park Zoning Bylaw, *Section 3(10) Private Wastewater Treatment Systems*.

Below is a brief review of the findings in the hydrogeological investigation.

Based on a review of the drill log results, it was revealed that the surficial fill sand or glacial till soils at the site are classified as “loam,” “silt loam,” “sandy loam” or “clay loam." In accordance with SaskHealth (2009) all of these soil types are considered suitable for development of onsite wastewater treatment systems. Groundwater monitoring was conducted on April 8, 2015, which suggests that Nitrate-Nitrogen released from onsite wastewater treatment systems represents a low risk of impact to groundwater resources in the vicinity of the site. In other words the lower aquifers at the site are considered to be hydraulically isolated from the site.

Assuming a single family dwelling with three bedrooms is constructed on each lot in the proposed subdivision the expected volume of sewage per day is calculated as follows:

V = (VP) x (Pia) x (B)

Where:

V = expected sewage volume (L/day)

Vp = volume of sewage generated per person per day = 340 L/person/day

Pa = Persons per bedroom = 1.5 persons/bedroom

B = No. of Bedrooms = 3

V = (340 L/person/day) x (1.5 persons/bedroom) x (3 bedrooms) = 1,530 L/Day

Based on the results of the investigation, holding tanks, chamber systems and type I/II mounds are considered suitable for wastewater treatment at the site. However, since the soils located across the majority of the site are relatively impermeable, Type ll mounds would be the preferred type of onsite wastewater treatment system. Mounds sizes may have to be increased to account for the low flow

properties of the surficial soils at the site. Improper mound sizing could result in soil erosion or surficial pooling of effluent on lawns.

It is expected that the installation of Type II mounds will be a requirement in the servicing agreement and enforced by the RM as part of the development permit process.

Section 5.2.3.14 of the RM of Corman Park OCP requires developments proposing the installation of private onsite wastewater disposal systems to create a legal entity to act as a utility to manage the ongoing monitoring of these private systems. Initially, the developer will establish and operate the utility until there is sufficient residency within the subdivision to allow the formation of a community association to manage the utility. The primary purpose of the utility will be to establish a legal body with the authority to collect an annual fee from its subscribers to fund the regular inspection of all of the private onsite wastewater disposal systems within the subdivision.

The frequency of inspections will be established through consultations with the SDHR and based upon the information presented in the hydrogeological report. The RM will be supplied with a report summarizing the results of the inspections. The inspections will confirm if the systems are operating according to their design – where a system is not operating correctly, the property owner and the RM will be notified at which time, it is expected that the RM will notify the SDHR of the issue, triggering the initiation of enforcement. The utility will neither own or take responsibility for individual systems – this responsibility remains with the property owner – the utility simply provides funding for regular system inspections.

DRAINAGE

A conceptual drainage plan was completed by Associated Engineering Ltd. to acknowledge the sites ability to drain storm water effectively. This conceptual drainage plan was completed through an investigation of the City of Saskatoon records for a 1:100 year storm event on June 24, 1983 which provides the effective flow rate associated with this type of event. This value was used to help identify the pre-development and post development flow rates.

The pre-development lands are considered as a combination of native and disturbed grassland with soils consisting of sand, gravel, and silt/clay over glacial till clay; providing a pre-development runoff coefficient of 0.30. The post development land is anticipated to consist of rangeland, country residential buildings, graveled roads and lots with an estimated 10% impervious site coverage which provides a post development area a runoff coefficient of 0.40.

The runoff calculations were completed using the Rational Method, and Soil Conservation Service curve system. The land in its pre-development state during the 1:100 year event generates an estimated volume of 17,616 m^3 and a flow rate of 2.45 m^3/s. The land post development during the 1:100 year event has an estimated volume of 23,488 m^3 and a flow rate of 3.26 m^3/s. This suggests that in the worst case scenario for the post development of the land during a 1:100 year storm event; an additional 5,872 m^3 of runoff will be generated and will require some form of retention.

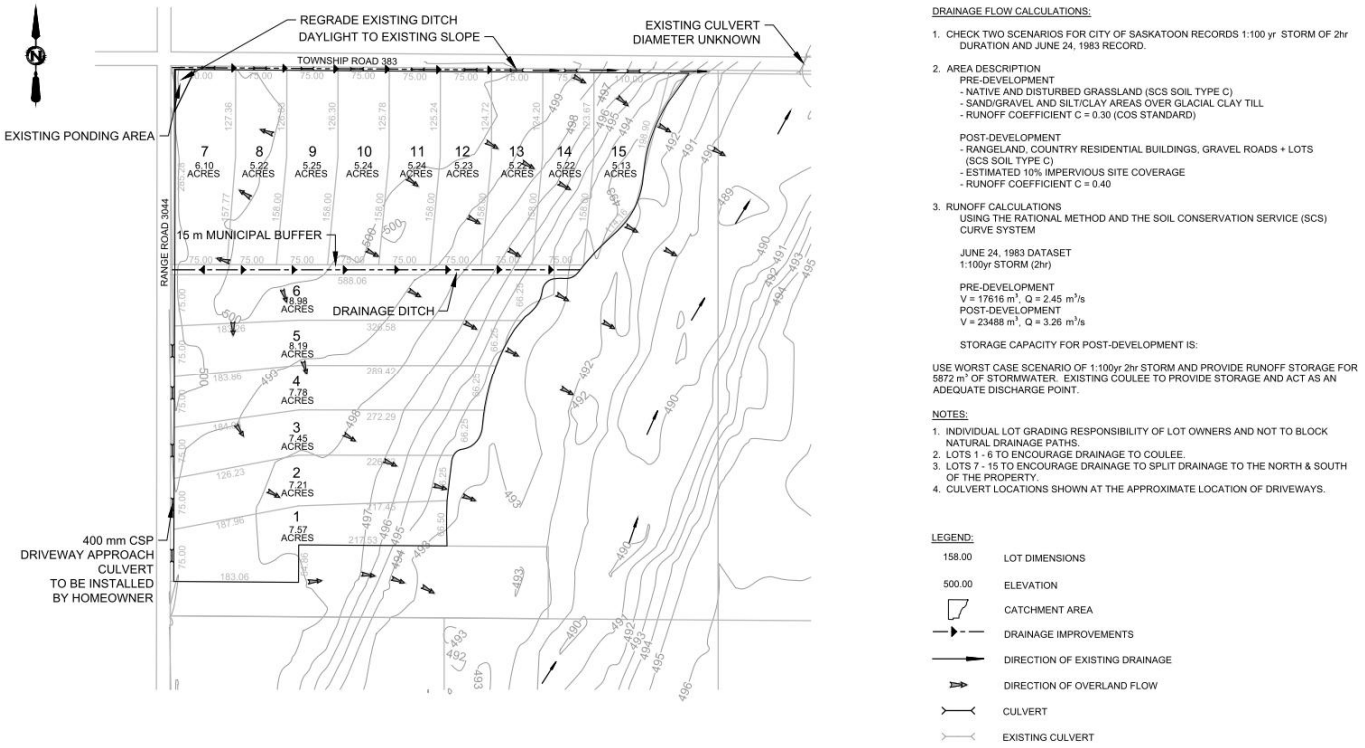


FIGURE 4: DRAINAGE PLAN

This additional storage will be provided in the ravine designated as municipal reserve which will act as an adequate storage and discharge point.

Additionally, to further support the drainage of the country residential development, the conceptual drainage plan identifies ditch improvements to the south of Township Road 383 beginning at the intersection of Range Road 3044 directed towards the ravine to the east. These improvements include a 15 m wide municipal buffer along the back of lots 7 through 15 and the side of lot 6 to provide a drainage route through the middle of the development towards the existing coulee.

The conceptual drainage plan has been submitted to Water Security Agency to receive comment and they have confirmed it provides an acceptable level of service for this development.

FIRE AND PROTECTIVE SERVICES

Consultations with Mr. Russ Austin, Deputy Fire Chief for the City of Warman Fire Department, confirmed they will provide fire protection services to the development based upon an existing service agreement with the RM. The Warman Fire Departments response protocol to this area consists of one full engine crew (truck holds 800 gallons), one 3500 gallon tanker truck, and an estimated response timeframe of 14 minutes. In an ideal situation, the Warman Fire Department would respond with two fire engines and two 3500 gallon tanker trucks. If an emergency event is large enough, the Warman Fire Department confirmed they have worked with other municipal fire departments to assist with emergency response.

Mr. Austin confirmed that the size of the lots benefits firefighting as greater separation between buildings allows the fire department to focus its resources on the source of the fire, decreasing the concern with the fire spreading to adjacent structures.

Police services will be provided by the Corman Park Police Service and the Warman Detachment of the RCMP. The RCMP is primarily responsible for criminal matters in the RM and Corman Park Police have a specific mandate of enforcement of provincial statutes, municipal bylaws and providing assistance to other police agencies as required on other matters within the RM.

The City of Warman Fire Department and the Corman Park Police Service were contacted regarding the development and there were no concerns expressed with extending emergency services to the area. Correspondence from the City of Warman Fire Department and RM of Corman Park Police Services are attached in Appendix B.

SCHOOLS

The proposed development is located in the Prairie Spirit School Division No. 206 and the nearest school is located in the City of Warman. Lori Jeschke, the Learning Superintendent at the Prairie Spirit School Division, was contacted to confirm the capability of the City of Warman schools to accommodate the additional student base generated by the development.

The following calculation was used to identify an estimated number of school aged children residing within the new development:

- Ü Average # of children per single family dwelling unit in the RM of Corman Park (as per Stats Canada Data) multiplied by the number of lots proposed in the subdivision that will contain single family dwelling units
- Ü 1.2 (children/house) * 15 (lots) = 18 (average # of children living in the subdivision)

Lori Jesche confirmed that the Warman schools have sufficient capacities to accommodate an additional 18 students that may be generated by this subdivision. This correspondence is attached in Appendix B.

SOLID WASTE MANAGEMENT

Solid waste disposal for the development will be managed by one of several licensed companies operating in the Saskatoon area. It will be the responsibility of individual residents to contract these services as needed. To ensure that a valid service provider was available, Loraas Disposal was contacted and confirmed that they would be able to service the new subdivision.

POLICY CONTEXT

RM of Corman Park Official Community Plan

Section 5: Country Residential Objectives and Policies	
5.1. The Country Residential Objectives of the Plan shall be:	
5.1.1. To ensure that country residential development does not conflict with agricultural uses.	The proposed development is situated in an area where existing residential development has occurred. The proposed development

	exceeds the separation distances prescribed for neighboring ILOs.
5.1.2. To ensure that country residential development takes place in a planned manner.	The development has been planned and located to: · take advantage of the existing natural vistas and recreational opportunities provided by the South Saskatchewan River valley. · provide larger lots to minimize property grading and the overall disruption of natural areas during site development · take advantage of existing developed municipal roadways and shallow utilities.
5.1.3. To direct country residential development away from highly productive agricultural areas, and to allow for better utilization of agricultural land.	The development site is rated as a Class 4 pursuant to the Canada Land Inventory Soil Classification System which is considered marginal agricultural lands according to the RM OCP.
5.1.4. To minimize possible negative impact of country residential development on other land uses in the Municipality and on the environment.	The large lot format supports an agrarian lifestyle by providing a sufficient land base to allow residents to host non-intensive forms of animal husbandry and small scale intensive agricultural pursuits. The large lot design minimizes the percentage of the lot area requiring grading; allowing large tracts of property to remain undeveloped.
5.1.5. To ensure that country residential development provides a high quality living environment through appropriate design, density and location.	The proposed development is situated in the direct vicinity of the South Saskatchewan River Valley, allowing residents to take full advantage of its natural amenity and passive recreational opportunities. The large lot design maximizes site layout options, allowing residents to insulate themselves from adjacent properties and traffic along the municipal roadways. The moderate density of development and large lot design minimizes the potential impacts of intensive residential development on the natural environment by minimizing the development footprint in relation to the overall land area.
5.1.6. To minimize the economic costs of country residential development to the Municipality.	The modest density of development helps to minimize any incremental increase in traffic and long term road maintenance costs. The proposed development does not require the expansion of the RMs road network, taking advantage of existing roadways. A road maintenance agreement has been

	executed which requires the developer to fund all road maintenance costs in the immediate vicinity of the subdivision until both phases are 75% built-out, minimizing the RMs short and midterm financial responsibilities.
5.2.3.1. A Comprehensive Development Review (CDR) shall be completed prior to consideration of an application to rezone or subdivide land for multi-parcel country residential use and shall address all matters of land use integration, environmental sustainability, public involvement and potential conflict mitigation, and the provision of services to the development as set out in the Zoning Bylaw.	This CDR has been prepared in support of a rezoning and subdivision application.
5.2.3.3. Preference will be given to proposals that: **a) include significant natural or built amenities or other features which provide for a high quality living environment;** **b) promote and include environmental and social innovation; and** **c) significantly increase housing options available to people wishing to live in Corman Park.**	The development is situated to take advantage of the natural amenity and passive recreational opportunities provided by the South Saskatchewan River valley. The ravine located along the eastern boundary of the proposed development site is intended to be designated as municipal reserve to ensure it is protected from development and retained for public access. The long lot, lower density riverbank subdivision design provides a unique development opportunity when compared to other higher density country residential subdivisions in the RM.
5.2.3.5. The number and arrangement of approved lots shall be determined on a case by case basis and shall have consideration for: **a) the carrying capacity of the lands proposed for development based on site conditions, environmental considerations and potential impacts, and other factors that may warrant consideration in the design of the proposal;** **b) the suitability and availability of municipal and other services and infrastructure necessary to support the proposal; and** **c) the compatibility of the proposed subdivision design with that of the surrounding area.**	The developer has purposely chosen to develop the lands at lower density to minimize the impact of development on the natural environment by reducing the proportion of each lot which will require grading and preparation. The density proposed is well within the carrying capacity of the lands. The decision to promote a lower density minimizes any incremental increase in traffic which will assist in minimizing the impact of the development on municipal roadway infrastructure. The long lot subdivision design is consistent with lots within the Cathedral Bluffs subdivision.
5.2.3.6. The Municipality will ensure that	The subdivision design includes the dedication

new multi-parcel country residential subdivision proposals incorporate environmentally sustainable subdivision design principles including but not limited to the following: **a) the subdivision design shall respond to and incorporate existing natural resources including: wildlife corridors and habitat, topographic features and environmentally sensitive lands with particular attention to hydrologic features and systems; and** **b) the design of lots and internal roadways shall seek to minimize the length of roads constructed within the subdivision and to arrange house sites effectively relative to natural features and efficient roadway networks.**	of 20.61 hectares of municipal reserve which encompasses the natural ravine and surrounding area along the eastern boundary of the plan area. This area is most likely to have the highest natural value and will be protected as a result of its public dedication. The subdivision of residential lots is focused within areas previously cultivated. The lower density and larger lots proposed will help to reduce the impact of residential development on the lands by reducing the proportion of land which will require grading relative to the larger development area. The proposed development does not require the construction of any additional municipal roadways.
5.2.3.7. The maximum size of the development area for an individual multi-parcel country residential development shall be 64.8 ha (160 acres).	The proposed subdivision area comprises approximately 60 hectares.
5.2.3.10. Comprehensive Development Reviews shall include a clear record of substantial public consultation including involvement in concept development, public review of the development options, and evidence of conflict resolution initiatives where necessary.	The developer initially engaged local property owners through a direct mailing, notifying them of the intention to develop the lands and describing the form and density of development. Prior to submitting this report, a copy was posted on a dedicated project website to enable property owners to access, review and comment on its contents.
5.2.3.13. All new proposals for multi-parcel country residential subdivision shall be serviced by a common potable water system in a legal form that is acceptable to the Municipality.	See Potable Water Supply
5.2.3.14. All multi-parcel country residential developments shall be required as a condition of approval, to create and administrate a septic system utility in a legal form that is acceptable to the Municipality and the Saskatoon District Health Region to monitor the ongoing operation and maintenance of onsite wastewater systems within the proposed development, providing the Municipality with regular, qualified, reports at intervals determined by Council on a case by case basis. **These reports shall confirm that all onsite wastewater systems are being adequately maintained and effectively operated or to**	See Wastewater Disposal

identify necessary remedial works to be undertaken.	
5.2.3.15. Where a multi-parcel country residential development is proposed on lands near or abutting an existing multi-parcel country residential development, the proposed development shall be designed to complement the existing development and respond to the reasonable concerns and interests of the residents of the existing development and where required by Council, shall provide visual buffering, house site separation, complementary lot sizing or any other measures necessary to achieve compatible land use and development.	Phase I and II of Whisper River Estates share a common large lot design and are connected to one another by the municipal reserve lands. Although the lot orientations are not identical, the complementary lot sizing promotes a similar overall development density.
5.2.3.17. Subdivision designs within multi-parcel country residential developments shall not result in the creation of any building sites located: **a) within the distance of an intensive livestock operation as outlined in Section 4.2.3;** **b) on hazard land;** **c) within 1 km (0.6 mile) of a hazardous industry measured from the property boundary of the hazardous industry to the property boundary of the closest developable parcel;** **d) within 1 km (0.6 mile) of a rural industrial park measured from the property boundary of closest developable parcel located within the rural industrial park to the property boundary of the closest developable multi-parcel country residential parcel;** **e) within 305 m (1000 ft.) of a sewage lagoon site;** **f) within 457 m (1500 ft.) of a solid waste disposal site; and** **g) on conservation lands.**	a) The proposed development meets the separation distances prescribed in the OCP. b) The preliminary geotechnical investigation prepared for the development did not identify any hazardous physical conditions on the site. c) The Phase I ESA confirmed that there are no records of any hazardous industries within 1 kilometre of the development site d) There are no industrial park developments within 1 kilometre of the development site. e) The development is not located within 305 metres of a sewage lagoon. f) The development site is not located within 457 metres of a solid waste disposal site. g) The development site is not considered conservation lands
5.2.3.18. Development must recognize and conserve areas containing significant wildlife habitat, cultural and historic resources.	See Natural and Heritage Resources
5.2.3.19. Multi-parcel country residential subdivisions shall not be permitted on lands predominantly identified as prime agricultural lands according to the Canada	The development site is situated on Class 4 Lands which are considered marginal by the RM OCP.

Land Inventory (C.L.I) Soil Class Rating System and under agricultural production except where food production is an essential component of the development or where the development requires location on prime lands.	
5.2.3.20. Multi-parcel country residential subdivisions proposed in the vicinity of a provincial highway shall consult and provide evidence of compliance with the requirements of the Saskatchewan Ministry of Highways and Infrastructure.	The nearest provincial highway, Highway No. 11, is a distance of 4.7 km from the proposed development. The Saskatchewan Ministry of Highways and Infrastructure (MHI) were contacted for comments and MHI had no concerns with the proposed development. Their comments are attached in Appendix B.
5.2.3.21. Council shall consider the capacity of existing school and bus facilities or the feasibility of expanding this capacity to suit a development when reviewing multi- parcel country residential subdivision proposals.	See Schools
5.2.3.22. Approved multi-parcel developments shall be phased to ensure that roadway development and the provision of other services does not unnecessarily precede lot development.	This phase of Whisper River Estates comprises 15 residential lots.
Section 11: Servicing Objectives and Policies	
11.1.1. To provide an effective and efficient road network throughout the Municipality to facilitate traffic flow generated by the variety of land uses.	The development will use the existing municipal roads which provide access to existing agricultural and country residential residences in the area. By using these existing municipal roads the RM will not take on additional roads for maintenance.
11.2.1. All new development proposals in close proximity to any road in the Municipality shall allow for expansion of those roads to standards designated by Council.	The Plan of Proposed Subdivision identifies a 5 metre road widening easement along both municipal roadways abutting the subdivision to accommodate future road widening.
11.2.2. Any person proposing a subdivision and/or development of land shall, as a condition of approval, construct at his or her own expense and to standards established by the Council such roads as may be required by the subdivision and/or development.	The existing municipal road network is suitable to support the proposed development and no upgrades are warranted.
11.2.3. All development proposals shall have regard to existing school and school bus capacity.	The Prairie Spirit School Division has been contacted and confirmed they are capable of accommodating the additional students that

	may result from the proposed development.

RM of Corman Park Zoning Bylaw

7. Development along Riverbanks and Hazard Lands:	
7.1. Development or subdivision proposed on or within 30 m (100 ft) of the crest of a slope greater than 20% shall require supporting evidence of slope stability by a Professional Engineer licensed to practice in the Province of Saskatchewan.	The proposed development is located adjacent to an escarpment with a maximum slope of 4 %. The preliminary geotechnical investigation completed by P. Machibroda Engineering Ltd. confirms the suitability of the land for development. See Appendix D**.**
7.2. The Development Officer in consultation with a geotechnical engineer may impose special conditions on a development permit, including but not limited to, engineered footings or specialized drainage and or septic systems in an effort to protect against erosion and or stability of the bank.	The preliminary geotechnical investigation has not identified the need for any specialized construction techniques within the development area.
7.3. Trees or vegetation shall not be cleared from any land within 20 m (66 ft) of any watercourse, water body, escarpment, or of the crest of a slope greater than 20%, where the removal could have a negative impact on the water body or bank stability.	The proposed property lines do not extend beyond the boundaries of land which has been previously cultivated. All lands along the escarpment and within the ravine have been dedicated as Municipal Reserve to ensure that development does not encroach on this significant natural amenity.
10. Private Wastewater Treatment Systems:	
10.1. The Development Officer, in conjunction with appropriate provincial regulatory agencies, shall determine the suitability of a site proposed for subdivision to accommodate a private wastewater treatment system within the subdivision review process.	A hydrogeological report prepared for the site by P. Machibroda Engineering concludes that based upon local conditions, holding tanks, chamber systems, package treatment or Type II mounds are suitable for use within the development with a Type II mound being the minimum preferred method.
10.2. A development permit shall not be issued for a residential development until all appropriate permits have been obtained from appropriate provincial regulatory agencies and all Municipal standards have been met for the private wastewater treatment system.	The installation of the disposal system will be addressed as part of a building permit associated with the construction of the principle dwellings. Prior to the installation of the disposal system, the property owner will be required to obtain the Onsite Sewage Works Application from the SDHR and meet the municipal standards as identified in the RM of Corman Park Zoning Bylaw, Section 3(10) Private Wastewater Treatment Systems.
10.3. Upon receipt of an application for multi-parcel country residential subdivision, the application will be evaluated based upon the Saskatchewan	The hydrogeological report confirms that there are at least four domestic wells within 1 km of the development area. Based upon this condition, the site is considered to be a

Onsite Wastewater Disposal Guide (the Guide) as provided by the Saskatoon District Health Region.	sensitive location by the Guide. The proposed development density would be considered medium. Based upon the Matrix of Sewage Systems Permit Requirements contained within the Guide, these two conditions reinforce the appropriateness of employing holding tanks, chamber systems, package treatment or Type II mounds. This combination of conditions also supports the need for a detailed site investigation to be conducted by individual lot owners at the time of development as part of the RM of Corman Park Building Permit process.
10.5. As a condition of approval for all multi-parcel country residential developments relying on private onsite treatment systems, the developer is required to create a septic utility in a legal form acceptable to the Municipality to regulate and oversee the general operation and ongoing maintenance of private onsite wastewater disposal systems within the development to ensure that systems continue to function effectively.	The developer will establish and operate a septic utility until there is sufficient residency within the subdivision to allow the formation of a community association to take over management of the utility. The primary purpose of the utility will be to establish a legal body with the authority to collect an annual fee from its subscribers to fund the regular inspection of all of the private onsite wastewater disposal systems within the subdivision.
13. Site Development Regulations:	
13.14. The Development Officer may require, as a condition of approval for a development permit, that an applicant submit a lot grading and drainage plan to the Municipality for approval.	A conceptual drainage plan has been completed for the development which addresses the 1:100 year storm event.
13.15. Where a proposed development alters site drainage potentially affecting adjacent or downstream properties, the applicant shall be required to submit an engineered design for the proposed drainage works incorporating sufficient capacity to accommodate surface water runoff for a 1:100 year storm event with no incremental increase in offsite flows in excess of what would have been generated from the property prior to the new development.	An Application to Operate and Construct Drainage Works was submitted to the Water Security Agency (WSA). Comments from the WSA (Appendix F) state that the site development and proposed on/off site drainage management will not require an approval from the WSA.
13.16. Drainage works shall be constructed at the owner's expense to provide for adequate surface water drainage that does not adversely affect adjacent properties, or the stability of the land.	
16. Municipal Services:	
16.4. A development permit shall not be issued for a non-agricultural use unless the site intended to be used, or upon which a	Access to the development area is provided by two existing all-weather municipal roads that are constructed with sufficient capacity to

building or structure is to be erected, abuts, or has frontage on a graded all-weather municipal roadway or provincial highway.	accommodate the forecasted traffic generated by this development.
16.6. All site access from municipal roadways shall be to the satisfaction of the Director of Operations with respect to location, design, and construction standards. The Director of Operations shall take into account safety and the physical capability of roads that are proposed to serve the development.	The Director of Operations was consulted and indicated that there are no concerns with the proposed subdivision in relation to the existing municipal road network.
16.13. All new multi-parcel country residential development shall be serviced by a centralized potable waterline administrated in a legal form acceptable to the Municipality.	Intervalley Water Inc. currently maintains a low pressure waterline that provides service to Phase I. This same low pressure waterline will provide service to Phase II.
SECTION 5 - ZONING DISTRICTS	
SCHEDULE E - CR 1 - COUNTRY RESIDENTIAL 1 DISTRICT - LOW DENSITY	
1. THE INTENT OF THE CR 1 DISTRICT SHALL BE: **The purpose of this district is to accommodate a country residential development in a rural environment where the essential land requirement is for a building site and space rather than for productive agricultural purposes.**	The proposed development will accommodate single family dwelling units on large acreage lots. Residential dwellings are a permitted use within this zoning district.
3. THE SITE REGULATIONS IN THE CR 1 DISTRICT SHALL BE: **In addition to the general provisions contained in this Bylaw the following regulations shall apply to every development in this district.** **3.1 THE AREA REQUIREMENTS FOR PERMITTED USES SHALL BE:** **The minimum site area shall be 0.4 ha (1 acre) and the maximum site area shall be 4.05 ha (10 acres).**	The minimum and maximum site area for lots within this development is 2.1 hectares (5.18 acres) and 3.72 hectares (9.19 acres) respectively and both fall within the allowable site areas prescribed for this zoning district.
4. THE RESIDENTIAL LOT DENSITY AND SCALE OF DEVELOPMENT IN THE CR 1 DISTRICT SHALL BE: **4.1. The maximum residential density for multi-parcel residential development shall be one residential lot per acre, maintaining an overall average minimum lot size of 2.47 acres throughout the proposed**	The average lot size for Whisper River Estates is calculated to be 2.5 hectares (6.29 acres) which is greater than the overall average minimum lot size requirement of 2.47 acres. The estimated density for the development is 0.38 units per hectare (0.15 units per acres). Including the excess municipal reserve

subdivision. **4.2. Parcels contained within the development, designated as undeveloped public open space in excess of the minimum required for municipal reserve by legislation shall be included in the calculation of the average lot size for a development.** **4.3. The maximum size of the development area for an individual multi-parcel country residential development shall be 64.8 ha (160 acres).**	dedication above 10 % requirement adds to the average lot size calculating it at 3.59 hectares (8.87 acres). The proposed development area is approximately 60 hectares (148 acres) in size which is less than the maximum size for an individual multi-parcel country residential development.

Specific Technical Analysis and Reports

North Prairie Developments has compiled and appended the following technical analysis and reports to support the Whisper River Estates Phase II CDR.

- Ü Appendix A – Proposed Plan of Subdivision
- Ü Appendix C – Phase 1 Environmental Site Assessment
- Ü Appendix D – Preliminary Geotechnical Report
- Ü Appendix E – Hydrogeological Investigation Report
- Ü Appendix F – Application to Operate and Construct Drainage Works
- Ü Appendix G – Summary of Basic Standards – Subdivision and Special Roads

CONSULTATIONS AND ENGAGEMENT

Public Engagement

A project newsletter was prepared and mailed to property owners situated within 1.6 km of the development site in early 2014 summarizing the proposed development and inviting comments concerning the proposed subdivision and development of this site. The project newsletter directed comments to Associated Engineering, providing both telephone and email contact information. A project specific website was subsequently established to share additional information concerning the development and to gather input regarding the proposed development. The project website recorded 37 unique views but there were no written or verbal comments received as a result of this written notification. A copy of the initial project newsletter is attached to this report as Appendix B.

At the direction of the RM, a second communication was mailed to all property owners in 2015 and a copy of this CDR report was published on the project website to allow affected property owners to review the details concerning the proposed development of the site. At the time of publishing this report, the website recorded 49 unique views and four registered connections. A single email response has been received from the notice. A copy of this email is attached to this report as Appendix B.

Within this response, the affected landowner has expressed concern with the increased traffic generated by both phases of development. The affected landowner resides at the intersection of

Range Road 3044 and Township Road 383. Based upon the Transportation Association of Canada standards, residential dwellings on average generate approximately 10 vehicle trips per day. Given the location of the development and the distance from major commercial and employment areas, it is likely that this is an overestimate as typical trips will tend to be consolidated based upon longer travel distances to these places. Based upon the estate above, it is expected that the two phases combined may generate up to 310 vehicle trips per day along Township Road 383. As Phase II comprises a total of 15 lots, a total of 150 vehicle trips would be directly associated with the current proposal. Additionally, based upon the lot layout, six of the proposed lots are orientated along and directly access Range Road 3044, further reducing the vehicles traveling past the affected residence. Adding 300 vehicles per day to a road which sees little if any traffic is a change, but these forecasted traffic levels are considered moderate for a rural road and are not considered to create a traffic safety hazard.

Regulatory Consultations

Regulatory Agency	
Ministry of Highways and Infrastructure	The Ministry of Highways and Infrastructure was contacted to provide comments for this proposed subdivision. At this time the Ministry has no comments regarding this proposed subdivision due to the distance of the proposed development from the provincial highway network.
Heritage Conservation Branch, Ministry of Parks, Culture and Sport	An application was submitted to the Ministry regarding the potential heritage sensitivity of the development site. A heritage clearance letter was subsequently received confirming that the development could proceed without further investigation required.
Ministry of Environment	The Saskatchewan Conservation Data Centre (Sask CDC) provides an interactive map for viewing rare and endangered element occurrences across the province. The Sask CDC indicates there are no rare or endangered elements within the proposed development area.
Water Security Agency	The Water Security Agency has no concerns with the plan moving forward.
Saskatoon District Health Region	A copy of the hydrogeological report was submitted to the SDHR for review. The SDHR confirmed that the recommendations presented in the above noted report are appropriate.
City of Warman Fire Protective Services	The City of Warman Fire Protective Services was consulted concerning the level of service provided and response time associated with fire protection for the area.
Corman Park Police Services	The Corman Park Police Service was able to confirm its ability to support the proposed development within the current resources available.

APPENDIX A: PLAN OF PROPOSED SUBDIVISION

APPENDIX B: CORRESPONDANCE

APPENDIX C: PHASE 1 ESA

APPENDIX D: PRELIMINARY GEOTECHNICAL REPORT

APPENDIX E: HYDROGEOLOGICAL REPORT

APPENDIX F: APPLICATION TO OPERATE DRAINAGE WORKS

APPENDIX G: MUNICIPAL ROAD STANDARDS

APPENDIX H: SERVICING SUMMARY WORKSHEET

Whisper River ESTATES

NORTH PRAIRIE DEVELOPMENTS

COMPREHENSIVE DEVELOPMENT REVIEW

September 2015

Associated Engineering

NORTH PRAIRIE DEVELOPMENTS LTD.

RM OF CORMAN PARK #344

CONTENTS

INTRODUCTION

This Comprehensive Development Review (CDR) report is being submitted pursuant to Section 5.2.3.1 of the Rural Municipality of Corman Park Official Community Plan in support of an application to rezone and subdivide land for a new residential development referred to as Whisper River Estates Phase II. This report provides an overview of how the proposed multi-lot country residential development successfully integrates itself with existing properties, owners, and development in the immediate vicinity. In addition to addressing matters of land use integration, this CDR assesses the capacity of the supportive municipal and provincial infrastructure as it relates the demand created by the proposed development and describes the method of servicing and level of service intended to be provided.

DEVELOPMENT SUMMARY

NW 16-38-4-W3M

Gross Area 59.77 ha

Municipal Reserve 5.98 ha

15 Residential Lots

Average Lot Size 2.5 ha

Development Density 0.38 units/ha

Development Summary

The developer, North Prairie Developments is a family owned and operated business, established over two decades ago in Saskatchewan. The company evolved from small beginnings in Saskatoon in 1987 to one of the largest development companies in the province. North Prairie Developments has built in excess of 2500 units of single and multi-family homes throughout Saskatchewan. Today North Prairie Developments has four divisions within the company; multi-family housing, single-family housing, land development and commercial development. The developer is seeking to rezone approximately 60 hectares (150 acres) from AG - Agricultural District and AR1 – Agricultural Residential

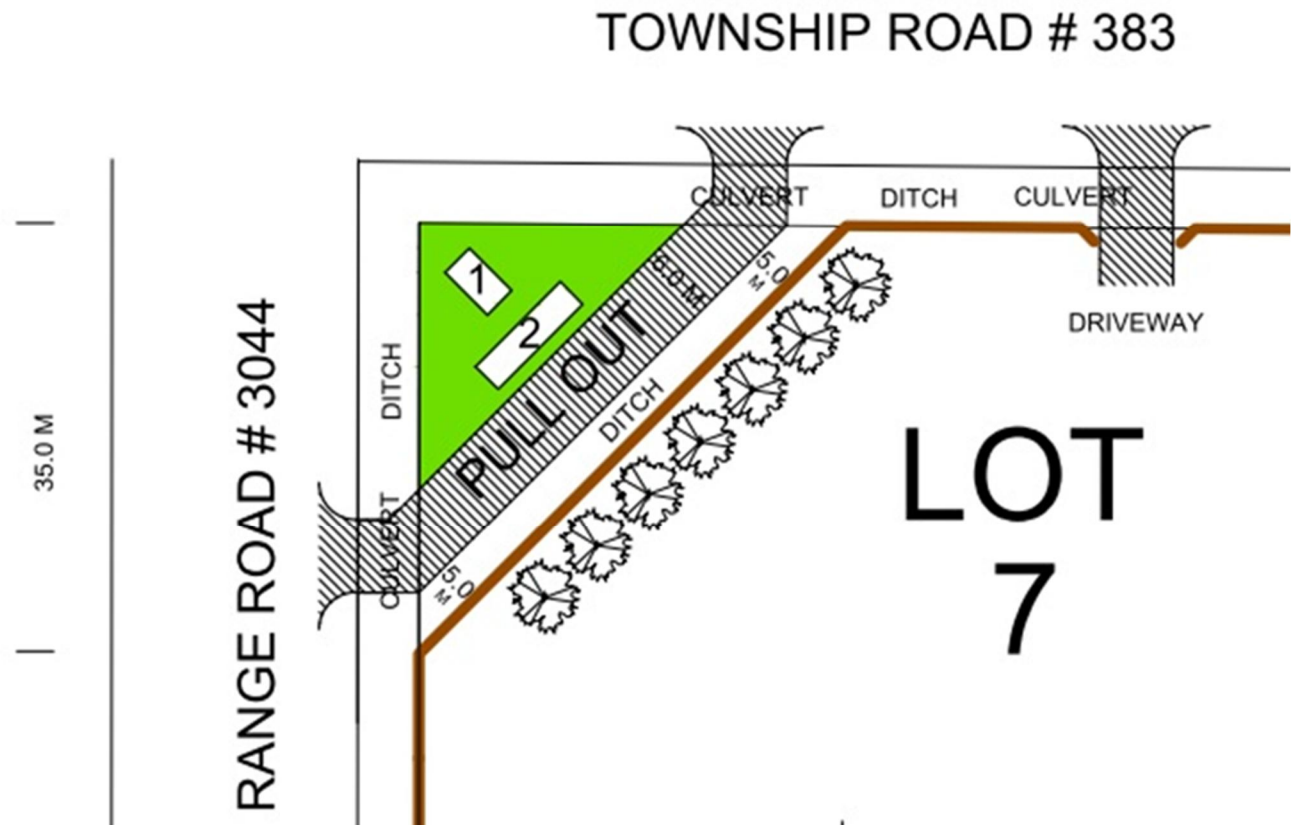
1 District to CR1 – Country Residential 1 District – Low Density to allow the subdivision of 15 single family acreage lots ranging in size between 2.06 hectares (5.08 acres) and 3.72 hectares (9.19 acres). A copy of the Plan of Proposed Subdivision is attached as Appendix A.

The lots in the development are designed with a long depth format that is commonly used within riverfront developments to maximize property exposure to a natural valley or watercourse and also represents a traditional form of development which is present in the Mennonite communities in the northern area of the RM. The long depth format coupled with a larger lot size provides opportunity for the integration of agrarian lifestyles and country residency by providing a sufficient land base to host small scale intensive agricultural operations (non-livestock).

The larger sites reduce runoff generated by development by retaining larger areas

of undeveloped land within the subdivision, allowing for greater local infiltration and minimizing the need for site grading. The long depth format also permits a greater setback from the roadway, reducing any potential nuisance from dust.

A turn out is intended to be located at the northwest corner of the proposed development providing an area for community mail boxes and erection of an entry monument sign with a community billboard. This will allow residents to safely exit the grid road to access the mail boxes and check the community billboard.



The development site is well situated within an area containing significant natural amenities including the South Saskatchewan River Valley, and the existing ravine located along the eastern boundary of the site. A 15-metre public corridor along the rear property boundary of lots 7 – 15, allows public access to the ravine and the surrounding municipal reserve specifically designed to maximize public access and exposure to these areas. The dedication of the ravine as municipal reserve will ensure that the area remains undeveloped and accessible by the public.

The proposed development represents the expansion of Whisper River Estates which is an existing residential subdivision formerly known as Cathedral Bluffs North. The subject property is relatively flat cultivated farmland but a ravine and natural grassland transverses the site's eastern boundary, providing a significant natural amenity for local residents and supporting passive recreational activities while also acting as an adequate discharge point for runoff generated from development in the area.

The proposed development has direct access to two all-weather municipal roads (Range Road 3044 and Township Road 383). Property services include a full range of shallow utilities including natural gas, electricity, telephone and internet service, and a potable water line operated by the Intervalley Water Inc. Waste water disposal is intended to be managed by individual private onsite systems.

Dedicated Lands

The Planning Development Act, 2007, governs the provision of dedicated lands such as municipal reserve. The legislation stipulates:

- Ü the types of uses which can occur on the lands considered to be municipal reserve;
- Ü how much land is required;
- Ü who obtains the titles to the designated land; and
- Ü transactions required for the designated land.

Municipal reserve is land that is dedicated to the municipality to provide for public open space which can accommodate features such as public recreation areas, natural areas, or agricultural uses. The Planning Development Act, 2007, Section 186 (3)(a), requires that 10% of the land area for a proposed residential subdivision be provided for municipal reserve. The 10% municipal reserve area requires a transaction to occur between the developer and the municipality. This municipal reserve requirement can be met by the provision of land in the subdivision, or by cash-in-lieu payment (at the land value in a subdivided but un-serviced state), or a combination of both land and cash-in-lieu.

Whisper River Estates Phase II provides land in the subdivision for the municipal reserve dedication. The amount of land provided for the municipal reserve dedication is 20.61 hectares (50.93 acres). This municipal reserve land will provide the public access to an area maintained in its natural state – unbroken land covered in native grass, brush, and trees – that can be used for active recreation such as walking, jogging, horseback riding, cross country skiing, or recreational vehicles such as snowmobiles or motorcycles. A ravine and small water hole is located in the MR dedication; however, these water bodies are considered to be seasonal and disappear during drier years.

The following calculation confirms the required amount of land dedication for 10% of the proposed residential subdivision as defined in *The Planning Development Act 2007*, Division 2, Section 186 (3)(a). This calculation is represented as such for Whisper River Estates:

- Ü Gross Land Area = 59.77 ha
- Ü 10 % MR Requirement = 59.77*10 % = 5.98 hectares (14.78 acres) is the required municipal reserve dedication for the Whisper River Estates Phase II residential subdivision
- Ü Currently, Whisper River Estates provides 20.61 hectares (50.93 acres) for municipal reserve land which is approximately 3.4 times more than the 10 % requirement represented above.

TABLE 1: LAND ALLOCATIONS

Phase 2			
	Hectares	**Acres**	**% of Phase 2 Development Area**
Gross Development	59.77	147.72	-
Right-of-Way Widening	0.84	2.08	1.4

10 % Municipal Reserve *	5.98	14.78	-

LAND USE CONTEXT

Whisper River Estates Phase II is located in the RM of Corman Park No. 344 (the RM) within the NW 16-38-4-W3M, directly north of Cathedral Bluffs and west of Whisper River Estates. The development site takes full advantage of the natural amenity provided its proximity to the South Saskatchewan River valley which is situated approximately 1 kilometre east of the proposed development site.

The development location has been selected based primarily on its proximity to existing complementary development and to take advantage of the area's natural beauty and amenity. The proposed subdivision also benefits from its access to an existing municipal road network capable of serving the development and a full range of existing shallow utilities in the immediate vicinity, reducing the need for significant infrastructure upgrades in the area.

The subject site is situated in an active farming community. Although the site has been traditionally cultivated, the Canadian Land Inventory rates the local soils as a Class 4, which is considered marginal by the RM of Corman Park Official Community Plan. The soil limitations include one or more of the following:

- Ü Undesirable structure
- Ü Low permeability
- Ü A restricted rooting zone because of soil characteristics
- Ü Low natural fertility
- Ü Low moisture holding capacity
- Ü Salinity

The surrounding land uses within a 1.6 km radius of the proposed development area comprise a mixture of residential and cultivated agricultural lands including two intensive livestock operations (ILOs). The two ILOs consist of an eight animal unit hog farm to the northwest and a 400 – 500 animal unit cattle farm northeast of the proposed development. Both ILOs are located outside of the respective separation distance from a multi-parcel country residential development as prescribed by the RM bylaws.

Residential development in the area immediately surrounding the subject site includes six agricultural residences, six single parcel country residential sites and two multi-lot country residential developments.

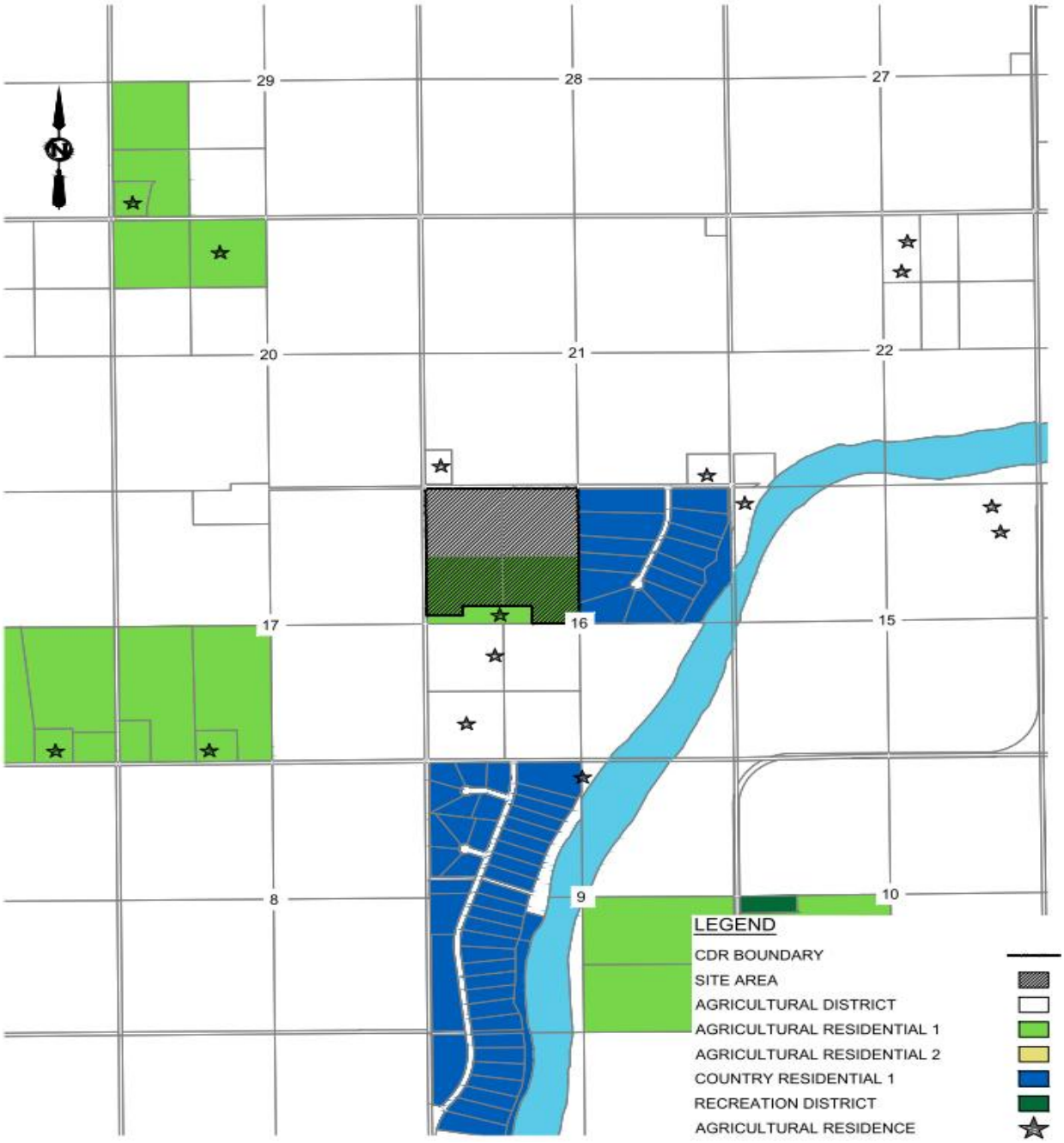


FIGURE 1: ADJACENT LAND USES

Whisper River Estates and Cathedral Bluffs are located directly east and south of the subject property. The development pattern illustrated in the PPS attached to this report as Appendix A provides for a similar long lot riverbank development as found in these two existing residential developments in the area.

Figure 1 identifies the adjacent land uses and Figure 2 identifies the location and separation distances applied from each of the ILOs in the vicinity of the subject site.

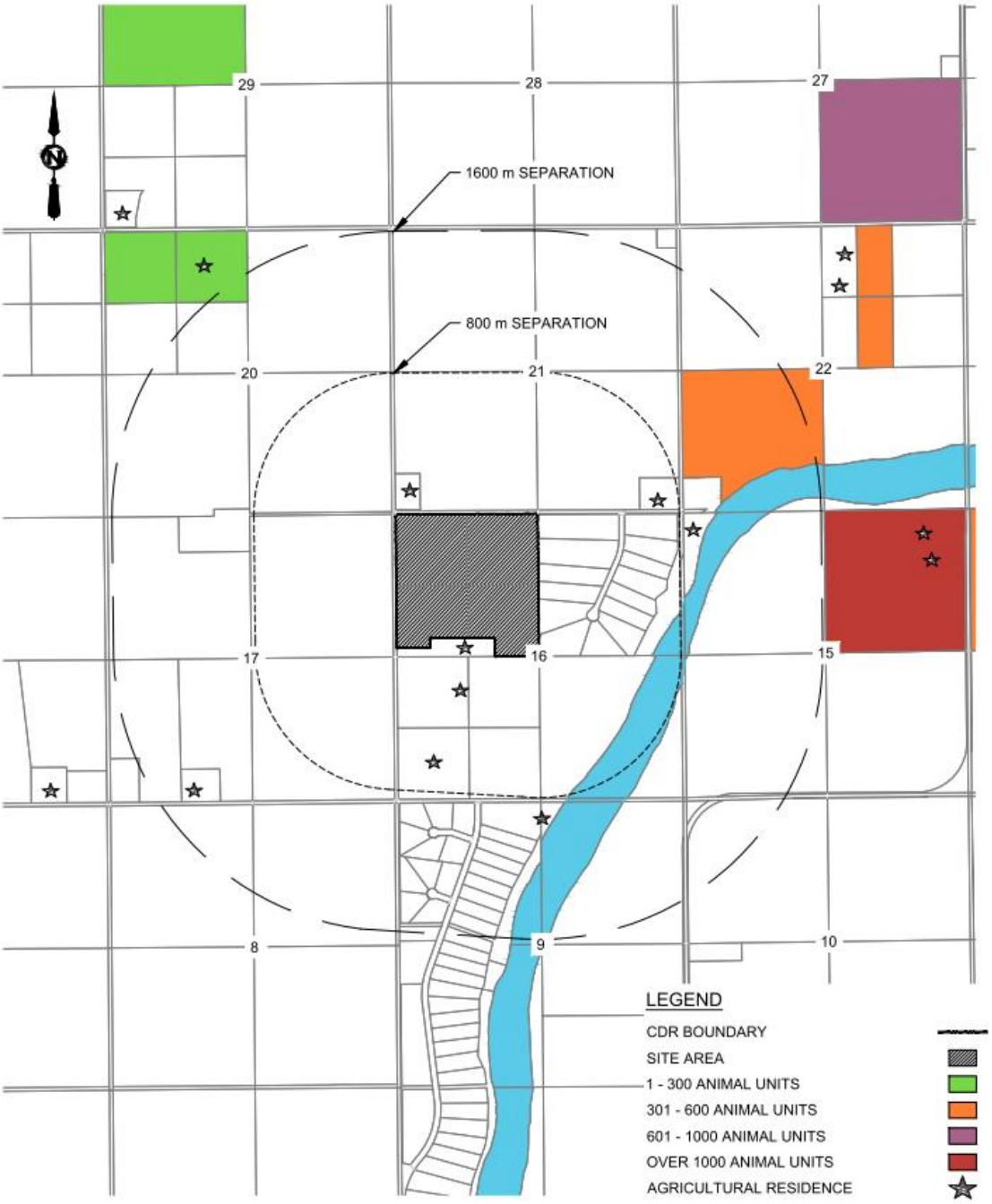


FIGURE 2: ILO SETBACK

INVENTORY AND ANALYSIS

Existing Conditions

The proposed development area comprises approximately 60 hectares (150 acres) and has been actively farmed in the past. This development area is currently zoned AG – Agricultural District and AR1 – Agricultural Residential 1 District as per the RM of Corman Park Zoning Map.

The development area generally slopes from west to east at a 1% grade towards the ravine situated along the eastern boundary of the site. The natural slope of the land combined with larger lot areas promotes positive drainage of the area with very little grading required. The ravine acts as an adequate point of discharge with run-off eventually flowing into the South Saskatchewan River.

PRELIMINARY GEOTECHNICAL REPORT

A preliminary geotechnical investigation was prepared by P.Machibroda Engineering Ltd. to evaluate the existing local subsurface soil and groundwater conditions and to provide general geotechnical recommendations for the construction of single family homes on the development site.

A total of nine test holes were dry drilled with a 150 mm diameter and extended to depths of 7.2 to 10.5 metres below the existing surface. Test hole logs were compiled during the drilling to record soil stratification, groundwater conditions, the position of unstable sloughing soils, and the depths at which cobblestones and/or boulders were encountered. Standpipe piezometers were installed in 5 of the 9 test holes.

The soil profile consisted of a thin layer of topsoil followed by glacial till extending to depths of at least 10.5 metres. Intertill and sand layers/lenses were encountered throughout the glacial till stratum. A sand layer was encountered at test hole no. 15-4 just below the top soil layer to a depth of 1.77 metres.

Groundwater seepage and sloughing conditions were encountered during test drilling. These conditions were measured at depths ranging from 2.8 to 3.4 metres below the existing grade on April 8, 2015. Groundwater conditions will fluctuate seasonally and higher groundwater conditions can be encountered during or after periods of precipitation or spring thaw.

Cobblestones and/or boulders were encountered in 4 of the 9 test holes at depths of 0.2 metres to 7.2 metres below existing grade. The cobblestones ranged in size from 60 to 200 mm and boulder-sizes larger than 200 mm should be expected at the subject site.

Site preparation for the surface of the subgrade should be levelled and compacted to the following minimum density requirements:

- Ü Building Areas – 96 percent of standard Proctor density at optimum moisture content;
- Ü Roadway Areas – 96 percent of standard Proctor density at optimum moisture content;
- Ü Landscaped Areas – 90 percent of standard Proctor density at optimum moisture content.

Fill required to bring the subgrade soil to the design elevation should consist of granular material or the on-site glacial till soils and should be placed in thin lifts (maximum 150 mm) and compacted to 96 percent of standard proctor density at optimum moisture content.

On-site excavation may be completed with unbraced, slope side walls. The long-term stability of the excavation walls will be affected by wetting and drying, the length of time the excavation remains open, and the consistency and structure of the subgrade soils. Based on the results of groundwater monitoring, de-watering of the excavations may be required during construction below the groundwater table. The de-watering should be conducted on a case by case basis over the time period for which the excavation is left open.

A minimum soil cover of 2.5 metres is recommended for underground pipeline construction. It should be feasible to construct the open cut trenches for the underground pipeline using conventional earth moving equipment. De-watering may be required and should be performed on a case by case basis using drainage ditches drained to sump pits equipped with sump pumps. Where soft compressible soils are encountered, over-excavation to a minimum depth of 300 mm below the founding elevation should occur and replaced with clean, free-draining, non-frost susceptible, compacted granular material. All backfill above the pipeline should be placed in thin lifts not exceeding 300 mm and compacted to 96 percent of standard proctor density.

A footing foundation based within naturally deposited, undisturbed stiff to very stiff glacial till or sand should perform satisfactorily. If the foundation is constructed during freezing conditions, the subgrade soil at the design footing elevation must be protected from freezing. If it is not practical to keep the subgrade from freezing then a deep foundation system should be constructed.

A deep foundation consisting of drilled, cast-in-place concrete piles could be utilized as a foundation system for garages and decks at the site. Drilled, cast-in-place, straight shaft pile should be designed on the basis of skin friction only.

The near surface subgrade soil conditions consisted of glacial till and/or sand. Grade-supported floor slabs should perform satisfactorily at this site.

The preliminary geotechnical investigation confirms the general suitability of the area to support residential development proposed but recommends that lot specific detailed geotechnical investigations are performed once building details and locations have been finalized.

NATURAL AND HERITAGE RESOURCES

Natural Resources

The area proposed for development has been previously cultivated and a review of the Saskatchewan Conservation Data Centre online screening tool confirmed that there are no significant terrestrial or aquatic resources located in the area. A copy of this online data is illustrated on the map in Appendix B.

In addition to the online screening, a Phase 1 Environmental Site Assessment (ESA) was completed by P. Machibroda Engineering, for the development area. The ESA consists of a review of available background and historical information, a visual site review, and a report of the findings. The purpose of the ESA was to determine if any potential contaminants or environmental concerns exist on the subject property from previous uses on or near the site.

This review confirmed that there was no record of any activities in the vicinity which could have resulted in site contamination. Existing aerial photography shows the property has been previously farmed with lands to the east being converted for residential purposes. The Saskatchewan Ministry of Environment online database confirmed that there were no recorded spills or record of storage of hazardous substances on the site and a property file search conducted by the RM revealed that no building permits have been issued on the development site.

The visual site review confirmed the subject property as bare land with no evidence of the following uses being located on the site: buildings, liquid waste, solid waste, hazardous substances or waste dangerous goods, and storage tanks (above or below grade).

Based on the review of available background and historical information, and a visual site review, the subject property is considered to have low environmental hazard potential and no further investigation is warranted at this time (e.g. Phase II ESA) as per the study's findings.

Heritage Resources

The RM of Corman Park is committed to the protection of historic, archaeological, and other cultural features and sites from incompatible development. The Heritage Conservation Branch of the Ministry of Parks, Culture, and Sport governs heritage resources in the province. The Heritage Conservation Branch provides an online searchable database which can be used by developers to determine whether a parcel of land contains heritage or archaeological resources. Where this potential is identified, a copy of the development concept for the property must be submitted for comment by their office to confirm the need for any additional investigation.

A query was performed of the online database and the results of the inquiry are attached in Appendix B. The query confirmed that the subject property required additional heritage screening and consultation with the Heritage Conservation Branch. The Heritage Branch was contacted on February 23, 2015 via email which confirmed the following:

"There are no recorded heritage sites located in conflict with the proposed subdivision. While there is native prairie located within the project area, this portion of the development area will be part of the municipal reserve and will not be impacted by construction activities. As such, the potential for heritage sites to be adversely affected by this development is low. Our office (The Heritage Conservation Branch) has no concerns with the subdivision proceeding as planned."

Appendix B contains the letter received in support of the development proceeding as planned.

Development Servicing

SHALLOW UTILITIES

SaskPower, SaskTel, and SaskEnergy currently provide a full range of services within the area surrounding the development. Existing overhead power lines extend from Range Road 3044 along the Township Road 383 right-of- way east to Whisper River Estates Phase I. SaskTel operates a service line on the adjacent quarter section which parallels Range Road 3044 and provides telephone services to an existing acreage in the southwest corner of the ¼ section. SaskEnergy operates a gas line which extends north from Cathedral Bluffs through the SE 16–38–4–W3M providing natural gas services to Whisper River Estates Phase I. Based on the current location of these utility systems, the proposed subdivision should be able to be serviced without any complications are significant upgrades requires.

MUNICIPAL ROADWAYS AND ACCESS

Direct access is provided to the subdivided lots via Range Road 3044 and Township Road 383. Both roadways are all-weather gravel surfaced constructed on a 20 metre road right of way to a standard fully capable of accommodating existing and forecasted traffic without any upgrades required. It should be noted that neither municipal roadway is a

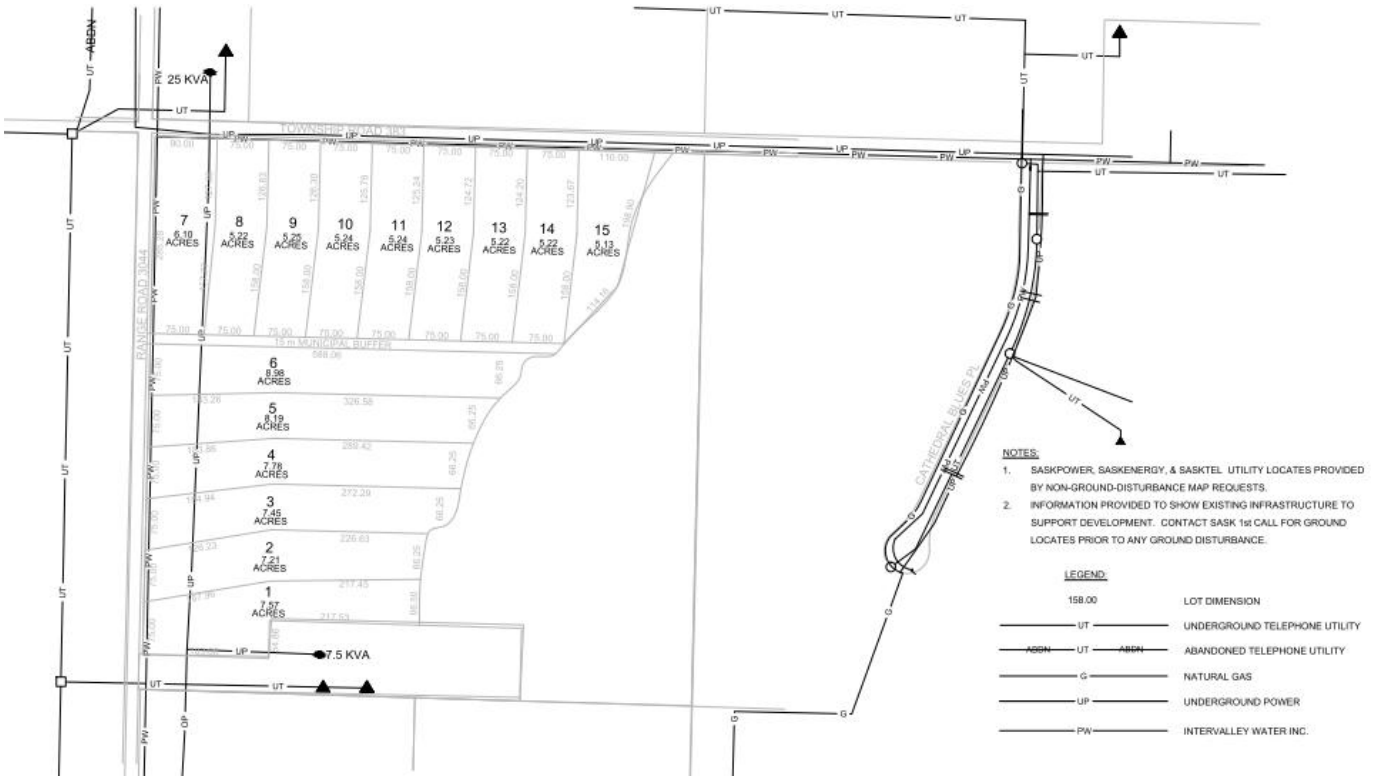


FIGURE 3: SERVICING PLAN

thru road in the area. Range Road 3044 terminates at its intersection at Township Road 382 at the northern end of Cathedral Bluffs. It is highly unlikely that this roadway will be developed south of this point given its proximity to lots within Cathedral Bluffs which reinforces the idea that traffic along this road will be limited to local property owners. Similarly, Township Road 383 extends along the northern boundary of Phase I, extending to the South Saskatchewan River Valley and terminates at this point, leaving very little possibility of traffic levels being high.

The Plan of Proposed Subdivision provides a five metre easement along the development side of both municipal roads to accommodate future road widening as all new roads within the RM are constructed on a 30 metre road allowance. See Appendix G for details on side slopes, back slopes, and road grades.

To ensure road conditions are appropriately maintained in the vicinity of the subdivision, North Prairie Developments and the RM have mutually agreed on a maintenance agreement whereas North Prairie Developments remains responsible for all road maintenance costs incurred along the ¼ section until each phase of Whisper River Estates reaches a 75% build-out. At 75% build-out the subdivision is perceived to generate a sufficient tax base to enable this responsibility to be transferred back to the RM.

POTABLE WATER SUPPLY

Potable water will be supplied to the development via a low pressure water distribution line owned and operated by Intervalley Water Inc. (IWI). Low pressure water distribution systems require each

individual lot owner to install a cistern and a pressure system to meet local domestic water requirements.

IWI would be responsible for supply, repairs, and maintenance of the lines leading to each lot boundary, while individual lot owners would be responsible for constructing individual service connections to the main supply line. IWI would manage the administration of water utility including client billing. A copy of the service agreement is attached as Appendix B.

FIRE FLOWS

An analysis of the IWI system was completed to determine if the volume and flow rates would support fire flow requirements. In order to determine the IWI system's available capacity as an emergency fire water source, the following assumptions have been made:

- Ü Assume 15 lots in the North Prairie subdivision with a total demand of 0.57 L/s;
- Ü Assume 15 lots in the Whisper River subdivision with a total demand of 0.57 L/s;
- Ü Fire supply would be located along the north edge of section 16-38-04-W3M;
- Ü Minimum system pressure during a fire must not drop below 20 psi anywhere in the system (~20 psi at the hydrant);
- Ü Worst case scenario occurs when all the users are drawing water from the system resulting in a total demand on the SE section of the IWI system of 2.17 L/s; and

The pump station discharge pressure (PH1 East Pipeline) could be increased to 81 psi to maximize the fire flow available. This reaches the system pressure rating (100 psi) in low areas and cannot be further increased without system modifications.

In addition, it is understood the Cathedral Bluffs may be connected to the IWI system. This would result in additional demand on the east half of the system, but would also likely improve capacity by looping the east portion of the system. Two cases with Cathedral Bluffs have also been included, one with the estimated average daily demand (ADD) flow of 0.6 L/s, and one at an estimated maximum daily demand (MDD) flow of 1.8 L/s (peaking factor of 3). The resulting fire flows in each case are summarized below.

TABLE 2: AVAILABLE FIRE FLOWS

Scenario	Fire Flow Available (L/s)	Lowest System Pressure (kPa)	Low Pressure Node
Base Layout (no Cathedral)	0.77	137.2	Whisper/North Prairie
Cathedral ADD	1.39	138.6	Whisper/North Prairie
Cathedral MDD	0.72	137.2	Whisper/North Prairie

The NFPA 1142, *Standard on Water Supplies for Suburban and Rural Fire Fighting*, applies to areas where an adequate and reliable water supply system does not exist and states that the minimum required water supply for structures without exposure hazards is 2000 gallons. This minimum has been

increased to 2500 gallons to compensate for a fourteen (14) minutes estimated response time as suggested by the City of Warman Fire Department.

Using Table 1 – NFPA 1142 Fire Flow Rate, a total water supply of 2,500 gallons corresponds to a fire flow rate of 250 gpm (15.8 L/s). Based on the table above, the IWI system is not capable of meeting an on demand firefighting supply. It should be also noted that this portion of the IWI system is served by a single pump (no backup), and their pump station does not yet have backup power.

WASTEWATER DISPOSAL

The preliminary hydrogeological investigation prepared by P. Machibroda Engineering Ltd. in consultation with the Saskatoon District Health Region (SDHR) recommends Type ll mounds as the preferred type of private onsite wastewater disposal systems to be used for the management of wastewater. The installation, maintenance, and repair of these private onsite wastewater disposal systems are the responsibility of each property owner. The installation of the disposal system is expected to occur as part of a building permit associated with the construction of the principle dwelling. Prior to the installation of the disposal system, the property owner will be required to obtain the Onsite Sewage Works Application from the SDHR and satisfy the municipal standards as identified in the RM of Corman Park Zoning Bylaw, *Section 3(10) Private Wastewater Treatment Systems*.

Below is a brief review of the findings in the hydrogeological investigation.

Based on a review of the drill log results, it was revealed that the surficial fill sand or glacial till soils at the site are classified as “loam,” “silt loam,” “sandy loam” or “clay loam." In accordance with SaskHealth (2009) all of these soil types are considered suitable for development of onsite wastewater treatment systems. Groundwater monitoring was conducted on April 8, 2015, which suggests that Nitrate-Nitrogen released from onsite wastewater treatment systems represents a low risk of impact to groundwater resources in the vicinity of the site. In other words the lower aquifers at the site are considered to be hydraulically isolated from the site.

Assuming a single family dwelling with three bedrooms is constructed on each lot in the proposed subdivision the expected volume of sewage per day is calculated as follows:

V = (VP) x (Pia) x (B)

Where:

V = expected sewage volume (L/day)

Vp = volume of sewage generated per person per day = 340 L/person/day

Pa = Persons per bedroom = 1.5 persons/bedroom

B = No. of Bedrooms = 3

V = (340 L/person/day) x (1.5 persons/bedroom) x (3 bedrooms) = 1,530 L/Day

Based on the results of the investigation, holding tanks, chamber systems and type I/II mounds are considered suitable for wastewater treatment at the site. However, since the soils located across the majority of the site are relatively impermeable, Type ll mounds would be the preferred type of onsite wastewater treatment system. Mounds sizes may have to be increased to account for the low flow

properties of the surficial soils at the site. Improper mound sizing could result in soil erosion or surficial pooling of effluent on lawns.

It is expected that the installation of Type II mounds will be a requirement in the servicing agreement and enforced by the RM as part of the development permit process.

Section 5.2.3.14 of the RM of Corman Park OCP requires developments proposing the installation of private onsite wastewater disposal systems to create a legal entity to act as a utility to manage the ongoing monitoring of these private systems. Initially, the developer will establish and operate the utility until there is sufficient residency within the subdivision to allow the formation of a community association to manage the utility. The primary purpose of the utility will be to establish a legal body with the authority to collect an annual fee from its subscribers to fund the regular inspection of all of the private onsite wastewater disposal systems within the subdivision.

The frequency of inspections will be established through consultations with the SDHR and based upon the information presented in the hydrogeological report. The RM will be supplied with a report summarizing the results of the inspections. The inspections will confirm if the systems are operating according to their design – where a system is not operating correctly, the property owner and the RM will be notified at which time, it is expected that the RM will notify the SDHR of the issue, triggering the initiation of enforcement. The utility will neither own or take responsibility for individual systems – this responsibility remains with the property owner – the utility simply provides funding for regular system inspections.

DRAINAGE

A conceptual drainage plan was completed by Associated Engineering Ltd. to acknowledge the sites ability to drain storm water effectively. This conceptual drainage plan was completed through an investigation of the City of Saskatoon records for a 1:100 year storm event on June 24, 1983 which provides the effective flow rate associated with this type of event. This value was used to help identify the pre-development and post development flow rates.

The pre-development lands are considered as a combination of native and disturbed grassland with soils consisting of sand, gravel, and silt/clay over glacial till clay; providing a pre-development runoff coefficient of 0.30. The post development land is anticipated to consist of rangeland, country residential buildings, graveled roads and lots with an estimated 10% impervious site coverage which provides a post development area a runoff coefficient of 0.40.

The runoff calculations were completed using the Rational Method, and Soil Conservation Service curve system. The land in its pre-development state during the 1:100 year event generates an estimated volume of 17,616 m^3 and a flow rate of 2.45 m^3/s. The land post development during the 1:100 year event has an estimated volume of 23,488 m^3 and a flow rate of 3.26 m^3/s. This suggests that in the worst case scenario for the post development of the land during a 1:100 year storm event; an additional 5,872 m^3 of runoff will be generated and will require some form of retention.

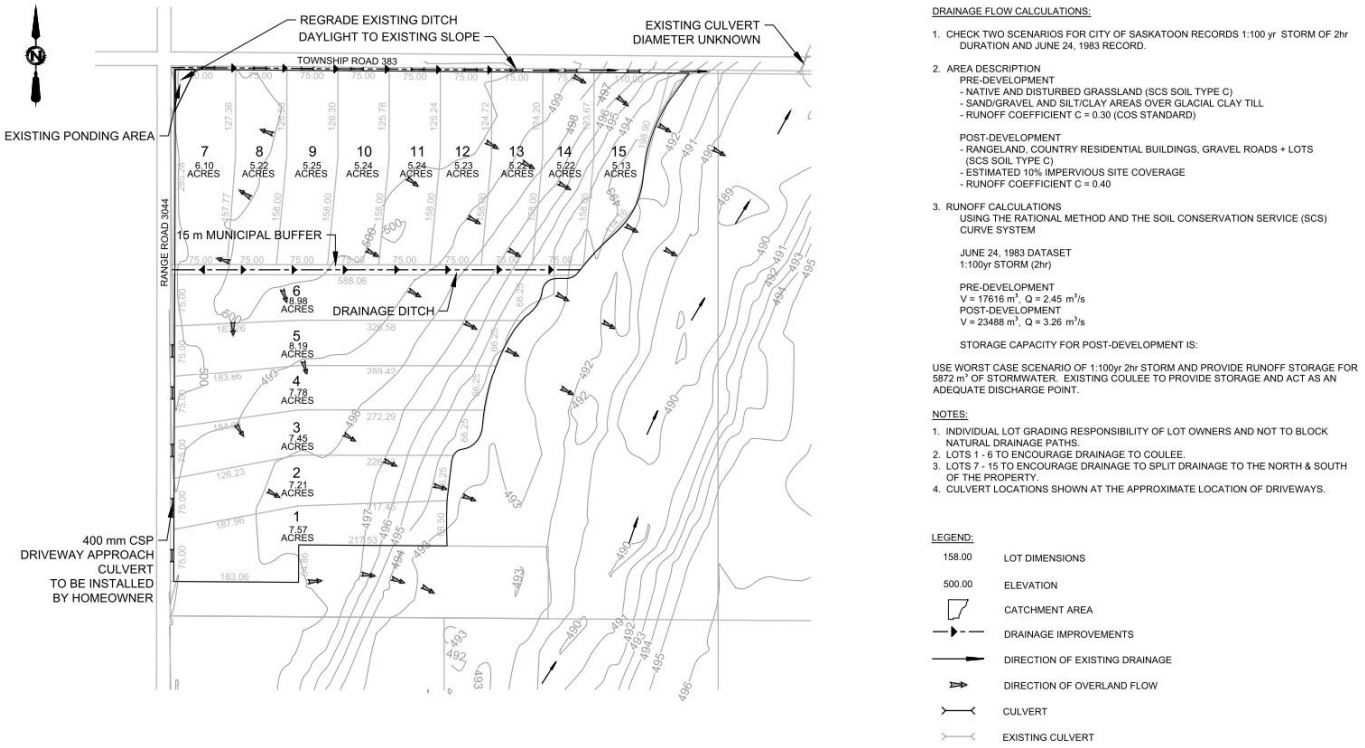


FIGURE 4: DRAINAGE PLAN

This additional storage will be provided in the ravine designated as municipal reserve which will act as an adequate storage and discharge point.

Additionally, to further support the drainage of the country residential development, the conceptual drainage plan identifies ditch improvements to the south of Township Road 383 beginning at the intersection of Range Road 3044 directed towards the ravine to the east. These improvements include a 15 m wide municipal buffer along the back of lots 7 through 15 and the side of lot 6 to provide a drainage route through the middle of the development towards the existing coulee.

The conceptual drainage plan has been submitted to Water Security Agency to receive comment and they have confirmed it provides an acceptable level of service for this development.

FIRE AND PROTECTIVE SERVICES

Consultations with Mr. Russ Austin, Deputy Fire Chief for the City of Warman Fire Department, confirmed they will provide fire protection services to the development based upon an existing service agreement with the RM. The Warman Fire Departments response protocol to this area consists of one full engine crew (truck holds 800 gallons), one 3500 gallon tanker truck, and an estimated response timeframe of 14 minutes. In an ideal situation, the Warman Fire Department would respond with two fire engines and two 3500 gallon tanker trucks. If an emergency event is large enough, the Warman Fire Department confirmed they have worked with other municipal fire departments to assist with emergency response.

Mr. Austin confirmed that the size of the lots benefits firefighting as greater separation between buildings allows the fire department to focus its resources on the source of the fire, decreasing the concern with the fire spreading to adjacent structures.

Police services will be provided by the Corman Park Police Service and the Warman Detachment of the RCMP. The RCMP is primarily responsible for criminal matters in the RM and Corman Park Police have a specific mandate of enforcement of provincial statutes, municipal bylaws and providing assistance to other police agencies as required on other matters within the RM.

The City of Warman Fire Department and the Corman Park Police Service were contacted regarding the development and there were no concerns expressed with extending emergency services to the area. Correspondence from the City of Warman Fire Department and RM of Corman Park Police Services are attached in Appendix B.

SCHOOLS

The proposed development is located in the Prairie Spirit School Division No. 206 and the nearest school is located in the City of Warman. Lori Jeschke, the Learning Superintendent at the Prairie Spirit School Division, was contacted to confirm the capability of the City of Warman schools to accommodate the additional student base generated by the development.

The following calculation was used to identify an estimated number of school aged children residing within the new development:

- Ü Average # of children per single family dwelling unit in the RM of Corman Park (as per Stats Canada Data) multiplied by the number of lots proposed in the subdivision that will contain single family dwelling units
- Ü 1.2 (children/house) * 15 (lots) = 18 (average # of children living in the subdivision)

Lori Jesche confirmed that the Warman schools have sufficient capacities to accommodate an additional 18 students that may be generated by this subdivision. This correspondence is attached in Appendix B.

SOLID WASTE MANAGEMENT

Solid waste disposal for the development will be managed by one of several licensed companies operating in the Saskatoon area. It will be the responsibility of individual residents to contract these services as needed. To ensure that a valid service provider was available, Loraas Disposal was contacted and confirmed that they would be able to service the new subdivision.

POLICY CONTEXT

RM of Corman Park Official Community Plan

Section 5: Country Residential Objectives and Policies	
5.1. The Country Residential Objectives of the Plan shall be:	
5.1.1. To ensure that country residential development does not conflict with agricultural uses.	The proposed development is situated in an area where existing residential development has occurred. The proposed development

	exceeds the separation distances prescribed for neighboring ILOs.
5.1.2. To ensure that country residential development takes place in a planned manner.	The development has been planned and located to: · take advantage of the existing natural vistas and recreational opportunities provided by the South Saskatchewan River valley. · provide larger lots to minimize property grading and the overall disruption of natural areas during site development · take advantage of existing developed municipal roadways and shallow utilities.
5.1.3. To direct country residential development away from highly productive agricultural areas, and to allow for better utilization of agricultural land.	The development site is rated as a Class 4 pursuant to the Canada Land Inventory Soil Classification System which is considered marginal agricultural lands according to the RM OCP.
5.1.4. To minimize possible negative impact of country residential development on other land uses in the Municipality and on the environment.	The large lot format supports an agrarian lifestyle by providing a sufficient land base to allow residents to host non-intensive forms of animal husbandry and small scale intensive agricultural pursuits. The large lot design minimizes the percentage of the lot area requiring grading; allowing large tracts of property to remain undeveloped.
5.1.5. To ensure that country residential development provides a high quality living environment through appropriate design, density and location.	The proposed development is situated in the direct vicinity of the South Saskatchewan River Valley, allowing residents to take full advantage of its natural amenity and passive recreational opportunities. The large lot design maximizes site layout options, allowing residents to insulate themselves from adjacent properties and traffic along the municipal roadways. The moderate density of development and large lot design minimizes the potential impacts of intensive residential development on the natural environment by minimizing the development footprint in relation to the overall land area.
5.1.6. To minimize the economic costs of country residential development to the Municipality.	The modest density of development helps to minimize any incremental increase in traffic and long term road maintenance costs. The proposed development does not require the expansion of the RMs road network, taking advantage of existing roadways. A road maintenance agreement has been

	executed which requires the developer to fund all road maintenance costs in the immediate vicinity of the subdivision until both phases are 75% built-out, minimizing the RMs short and midterm financial responsibilities.
5.2.3.1. A Comprehensive Development Review (CDR) shall be completed prior to consideration of an application to rezone or subdivide land for multi-parcel country residential use and shall address all matters of land use integration, environmental sustainability, public involvement and potential conflict mitigation, and the provision of services to the development as set out in the Zoning Bylaw.	This CDR has been prepared in support of a rezoning and subdivision application.
5.2.3.3. Preference will be given to proposals that: **a) include significant natural or built amenities or other features which provide for a high quality living environment;** **b) promote and include environmental and social innovation; and** **c) significantly increase housing options available to people wishing to live in Corman Park.**	The development is situated to take advantage of the natural amenity and passive recreational opportunities provided by the South Saskatchewan River valley. The ravine located along the eastern boundary of the proposed development site is intended to be designated as municipal reserve to ensure it is protected from development and retained for public access. The long lot, lower density riverbank subdivision design provides a unique development opportunity when compared to other higher density country residential subdivisions in the RM.
5.2.3.5. The number and arrangement of approved lots shall be determined on a case by case basis and shall have consideration for: **a) the carrying capacity of the lands proposed for development based on site conditions, environmental considerations and potential impacts, and other factors that may warrant consideration in the design of the proposal;** **b) the suitability and availability of municipal and other services and infrastructure necessary to support the proposal; and** **c) the compatibility of the proposed subdivision design with that of the surrounding area.**	The developer has purposely chosen to develop the lands at lower density to minimize the impact of development on the natural environment by reducing the proportion of each lot which will require grading and preparation. The density proposed is well within the carrying capacity of the lands. The decision to promote a lower density minimizes any incremental increase in traffic which will assist in minimizing the impact of the development on municipal roadway infrastructure. The long lot subdivision design is consistent with lots within the Cathedral Bluffs subdivision.
5.2.3.6. The Municipality will ensure that	The subdivision design includes the dedication

new multi-parcel country residential subdivision proposals incorporate environmentally sustainable subdivision design principles including but not limited to the following: **a) the subdivision design shall respond to and incorporate existing natural resources including: wildlife corridors and habitat, topographic features and environmentally sensitive lands with particular attention to hydrologic features and systems; and** **b) the design of lots and internal roadways shall seek to minimize the length of roads constructed within the subdivision and to arrange house sites effectively relative to natural features and efficient roadway networks.**	of 20.61 hectares of municipal reserve which encompasses the natural ravine and surrounding area along the eastern boundary of the plan area. This area is most likely to have the highest natural value and will be protected as a result of its public dedication. The subdivision of residential lots is focused within areas previously cultivated. The lower density and larger lots proposed will help to reduce the impact of residential development on the lands by reducing the proportion of land which will require grading relative to the larger development area. The proposed development does not require the construction of any additional municipal roadways.
5.2.3.7. The maximum size of the development area for an individual multi-parcel country residential development shall be 64.8 ha (160 acres).	The proposed subdivision area comprises approximately 60 hectares.
5.2.3.10. Comprehensive Development Reviews shall include a clear record of substantial public consultation including involvement in concept development, public review of the development options, and evidence of conflict resolution initiatives where necessary.	The developer initially engaged local property owners through a direct mailing, notifying them of the intention to develop the lands and describing the form and density of development. Prior to submitting this report, a copy was posted on a dedicated project website to enable property owners to access, review and comment on its contents.
5.2.3.13. All new proposals for multi-parcel country residential subdivision shall be serviced by a common potable water system in a legal form that is acceptable to the Municipality.	See Potable Water Supply
5.2.3.14. All multi-parcel country residential developments shall be required as a condition of approval, to create and administrate a septic system utility in a legal form that is acceptable to the Municipality and the Saskatoon District Health Region to monitor the ongoing operation and maintenance of onsite wastewater systems within the proposed development, providing the Municipality with regular, qualified, reports at intervals determined by Council on a case by case basis. **These reports shall confirm that all onsite wastewater systems are being adequately maintained and effectively operated or to**	See Wastewater Disposal

identify necessary remedial works to be undertaken.	
5.2.3.15. Where a multi-parcel country residential development is proposed on lands near or abutting an existing multi-parcel country residential development, the proposed development shall be designed to complement the existing development and respond to the reasonable concerns and interests of the residents of the existing development and where required by Council, shall provide visual buffering, house site separation, complementary lot sizing or any other measures necessary to achieve compatible land use and development.	Phase I and II of Whisper River Estates share a common large lot design and are connected to one another by the municipal reserve lands. Although the lot orientations are not identical, the complementary lot sizing promotes a similar overall development density.
5.2.3.17. Subdivision designs within multi-parcel country residential developments shall not result in the creation of any building sites located: **a) within the distance of an intensive livestock operation as outlined in Section 4.2.3;** **b) on hazard land;** **c) within 1 km (0.6 mile) of a hazardous industry measured from the property boundary of the hazardous industry to the property boundary of the closest developable parcel;** **d) within 1 km (0.6 mile) of a rural industrial park measured from the property boundary of closest developable parcel located within the rural industrial park to the property boundary of the closest developable multi-parcel country residential parcel;** **e) within 305 m (1000 ft.) of a sewage lagoon site;** **f) within 457 m (1500 ft.) of a solid waste disposal site; and** **g) on conservation lands.**	a) The proposed development meets the separation distances prescribed in the OCP. b) The preliminary geotechnical investigation prepared for the development did not identify any hazardous physical conditions on the site. c) The Phase I ESA confirmed that there are no records of any hazardous industries within 1 kilometre of the development site d) There are no industrial park developments within 1 kilometre of the development site. e) The development is not located within 305 metres of a sewage lagoon. f) The development site is not located within 457 metres of a solid waste disposal site. g) The development site is not considered conservation lands
5.2.3.18. Development must recognize and conserve areas containing significant wildlife habitat, cultural and historic resources.	See Natural and Heritage Resources
5.2.3.19. Multi-parcel country residential subdivisions shall not be permitted on lands predominantly identified as prime agricultural lands according to the Canada	The development site is situated on Class 4 Lands which are considered marginal by the RM OCP.

Land Inventory (C.L.I) Soil Class Rating System and under agricultural production except where food production is an essential component of the development or where the development requires location on prime lands.	
5.2.3.20. Multi-parcel country residential subdivisions proposed in the vicinity of a provincial highway shall consult and provide evidence of compliance with the requirements of the Saskatchewan Ministry of Highways and Infrastructure.	The nearest provincial highway, Highway No. 11, is a distance of 4.7 km from the proposed development. The Saskatchewan Ministry of Highways and Infrastructure (MHI) were contacted for comments and MHI had no concerns with the proposed development. Their comments are attached in Appendix B.
5.2.3.21. Council shall consider the capacity of existing school and bus facilities or the feasibility of expanding this capacity to suit a development when reviewing multi- parcel country residential subdivision proposals.	See Schools
5.2.3.22. Approved multi-parcel developments shall be phased to ensure that roadway development and the provision of other services does not unnecessarily precede lot development.	This phase of Whisper River Estates comprises 15 residential lots.
Section 11: Servicing Objectives and Policies	
11.1.1. To provide an effective and efficient road network throughout the Municipality to facilitate traffic flow generated by the variety of land uses.	The development will use the existing municipal roads which provide access to existing agricultural and country residential residences in the area. By using these existing municipal roads the RM will not take on additional roads for maintenance.
11.2.1. All new development proposals in close proximity to any road in the Municipality shall allow for expansion of those roads to standards designated by Council.	The Plan of Proposed Subdivision identifies a 5 metre road widening easement along both municipal roadways abutting the subdivision to accommodate future road widening.
11.2.2. Any person proposing a subdivision and/or development of land shall, as a condition of approval, construct at his or her own expense and to standards established by the Council such roads as may be required by the subdivision and/or development.	The existing municipal road network is suitable to support the proposed development and no upgrades are warranted.
11.2.3. All development proposals shall have regard to existing school and school bus capacity.	The Prairie Spirit School Division has been contacted and confirmed they are capable of accommodating the additional students that

	may result from the proposed development.

RM of Corman Park Zoning Bylaw

7. Development along Riverbanks and Hazard Lands:	
7.1. Development or subdivision proposed on or within 30 m (100 ft) of the crest of a slope greater than 20% shall require supporting evidence of slope stability by a Professional Engineer licensed to practice in the Province of Saskatchewan.	The proposed development is located adjacent to an escarpment with a maximum slope of 4 %. The preliminary geotechnical investigation completed by P. Machibroda Engineering Ltd. confirms the suitability of the land for development. See Appendix D**.**
7.2. The Development Officer in consultation with a geotechnical engineer may impose special conditions on a development permit, including but not limited to, engineered footings or specialized drainage and or septic systems in an effort to protect against erosion and or stability of the bank.	The preliminary geotechnical investigation has not identified the need for any specialized construction techniques within the development area.
7.3. Trees or vegetation shall not be cleared from any land within 20 m (66 ft) of any watercourse, water body, escarpment, or of the crest of a slope greater than 20%, where the removal could have a negative impact on the water body or bank stability.	The proposed property lines do not extend beyond the boundaries of land which has been previously cultivated. All lands along the escarpment and within the ravine have been dedicated as Municipal Reserve to ensure that development does not encroach on this significant natural amenity.
10. Private Wastewater Treatment Systems:	
10.1. The Development Officer, in conjunction with appropriate provincial regulatory agencies, shall determine the suitability of a site proposed for subdivision to accommodate a private wastewater treatment system within the subdivision review process.	A hydrogeological report prepared for the site by P. Machibroda Engineering concludes that based upon local conditions, holding tanks, chamber systems, package treatment or Type II mounds are suitable for use within the development with a Type II mound being the minimum preferred method.
10.2. A development permit shall not be issued for a residential development until all appropriate permits have been obtained from appropriate provincial regulatory agencies and all Municipal standards have been met for the private wastewater treatment system.	The installation of the disposal system will be addressed as part of a building permit associated with the construction of the principle dwellings. Prior to the installation of the disposal system, the property owner will be required to obtain the Onsite Sewage Works Application from the SDHR and meet the municipal standards as identified in the RM of Corman Park Zoning Bylaw, Section 3(10) Private Wastewater Treatment Systems.
10.3. Upon receipt of an application for multi-parcel country residential subdivision, the application will be evaluated based upon the Saskatchewan	The hydrogeological report confirms that there are at least four domestic wells within 1 km of the development area. Based upon this condition, the site is considered to be a

Onsite Wastewater Disposal Guide (the Guide) as provided by the Saskatoon District Health Region.	sensitive location by the Guide. The proposed development density would be considered medium. Based upon the Matrix of Sewage Systems Permit Requirements contained within the Guide, these two conditions reinforce the appropriateness of employing holding tanks, chamber systems, package treatment or Type II mounds. This combination of conditions also supports the need for a detailed site investigation to be conducted by individual lot owners at the time of development as part of the RM of Corman Park Building Permit process.
10.5. As a condition of approval for all multi-parcel country residential developments relying on private onsite treatment systems, the developer is required to create a septic utility in a legal form acceptable to the Municipality to regulate and oversee the general operation and ongoing maintenance of private onsite wastewater disposal systems within the development to ensure that systems continue to function effectively.	The developer will establish and operate a septic utility until there is sufficient residency within the subdivision to allow the formation of a community association to take over management of the utility. The primary purpose of the utility will be to establish a legal body with the authority to collect an annual fee from its subscribers to fund the regular inspection of all of the private onsite wastewater disposal systems within the subdivision.
13. Site Development Regulations:	
13.14. The Development Officer may require, as a condition of approval for a development permit, that an applicant submit a lot grading and drainage plan to the Municipality for approval.	A conceptual drainage plan has been completed for the development which addresses the 1:100 year storm event.
13.15. Where a proposed development alters site drainage potentially affecting adjacent or downstream properties, the applicant shall be required to submit an engineered design for the proposed drainage works incorporating sufficient capacity to accommodate surface water runoff for a 1:100 year storm event with no incremental increase in offsite flows in excess of what would have been generated from the property prior to the new development.	An Application to Operate and Construct Drainage Works was submitted to the Water Security Agency (WSA). Comments from the WSA (Appendix F) state that the site development and proposed on/off site drainage management will not require an approval from the WSA.
13.16. Drainage works shall be constructed at the owner's expense to provide for adequate surface water drainage that does not adversely affect adjacent properties, or the stability of the land.	
16. Municipal Services:	
16.4. A development permit shall not be issued for a non-agricultural use unless the site intended to be used, or upon which a	Access to the development area is provided by two existing all-weather municipal roads that are constructed with sufficient capacity to

building or structure is to be erected, abuts, or has frontage on a graded all-weather municipal roadway or provincial highway.	accommodate the forecasted traffic generated by this development.
16.6. All site access from municipal roadways shall be to the satisfaction of the Director of Operations with respect to location, design, and construction standards. The Director of Operations shall take into account safety and the physical capability of roads that are proposed to serve the development.	The Director of Operations was consulted and indicated that there are no concerns with the proposed subdivision in relation to the existing municipal road network.
16.13. All new multi-parcel country residential development shall be serviced by a centralized potable waterline administrated in a legal form acceptable to the Municipality.	Intervalley Water Inc. currently maintains a low pressure waterline that provides service to Phase I. This same low pressure waterline will provide service to Phase II.
SECTION 5 - ZONING DISTRICTS	
SCHEDULE E - CR 1 - COUNTRY RESIDENTIAL 1 DISTRICT - LOW DENSITY	
1. THE INTENT OF THE CR 1 DISTRICT SHALL BE: **The purpose of this district is to accommodate a country residential development in a rural environment where the essential land requirement is for a building site and space rather than for productive agricultural purposes.**	The proposed development will accommodate single family dwelling units on large acreage lots. Residential dwellings are a permitted use within this zoning district.
3. THE SITE REGULATIONS IN THE CR 1 DISTRICT SHALL BE: **In addition to the general provisions contained in this Bylaw the following regulations shall apply to every development in this district.** **3.1 THE AREA REQUIREMENTS FOR PERMITTED USES SHALL BE:** **The minimum site area shall be 0.4 ha (1 acre) and the maximum site area shall be 4.05 ha (10 acres).**	The minimum and maximum site area for lots within this development is 2.1 hectares (5.18 acres) and 3.72 hectares (9.19 acres) respectively and both fall within the allowable site areas prescribed for this zoning district.
4. THE RESIDENTIAL LOT DENSITY AND SCALE OF DEVELOPMENT IN THE CR 1 DISTRICT SHALL BE: **4.1. The maximum residential density for multi-parcel residential development shall be one residential lot per acre, maintaining an overall average minimum lot size of 2.47 acres throughout the proposed**	The average lot size for Whisper River Estates is calculated to be 2.5 hectares (6.29 acres) which is greater than the overall average minimum lot size requirement of 2.47 acres. The estimated density for the development is 0.38 units per hectare (0.15 units per acres). Including the excess municipal reserve

subdivision. **4.2. Parcels contained within the development, designated as undeveloped public open space in excess of the minimum required for municipal reserve by legislation shall be included in the calculation of the average lot size for a development.** **4.3. The maximum size of the development area for an individual multi-parcel country residential development shall be 64.8 ha (160 acres).**	dedication above 10 % requirement adds to the average lot size calculating it at 3.59 hectares (8.87 acres). The proposed development area is approximately 60 hectares (148 acres) in size which is less than the maximum size for an individual multi-parcel country residential development.

Specific Technical Analysis and Reports

North Prairie Developments has compiled and appended the following technical analysis and reports to support the Whisper River Estates Phase II CDR.

- Ü Appendix A – Proposed Plan of Subdivision
- Ü Appendix C – Phase 1 Environmental Site Assessment
- Ü Appendix D – Preliminary Geotechnical Report
- Ü Appendix E – Hydrogeological Investigation Report
- Ü Appendix F – Application to Operate and Construct Drainage Works
- Ü Appendix G – Summary of Basic Standards – Subdivision and Special Roads

CONSULTATIONS AND ENGAGEMENT

Public Engagement

A project newsletter was prepared and mailed to property owners situated within 1.6 km of the development site in early 2014 summarizing the proposed development and inviting comments concerning the proposed subdivision and development of this site. The project newsletter directed comments to Associated Engineering, providing both telephone and email contact information. A project specific website was subsequently established to share additional information concerning the development and to gather input regarding the proposed development. The project website recorded 37 unique views but there were no written or verbal comments received as a result of this written notification. A copy of the initial project newsletter is attached to this report as Appendix B.

At the direction of the RM, a second communication was mailed to all property owners in 2015 and a copy of this CDR report was published on the project website to allow affected property owners to review the details concerning the proposed development of the site. At the time of publishing this report, the website recorded 49 unique views and four registered connections. A single email response has been received from the notice. A copy of this email is attached to this report as Appendix B.

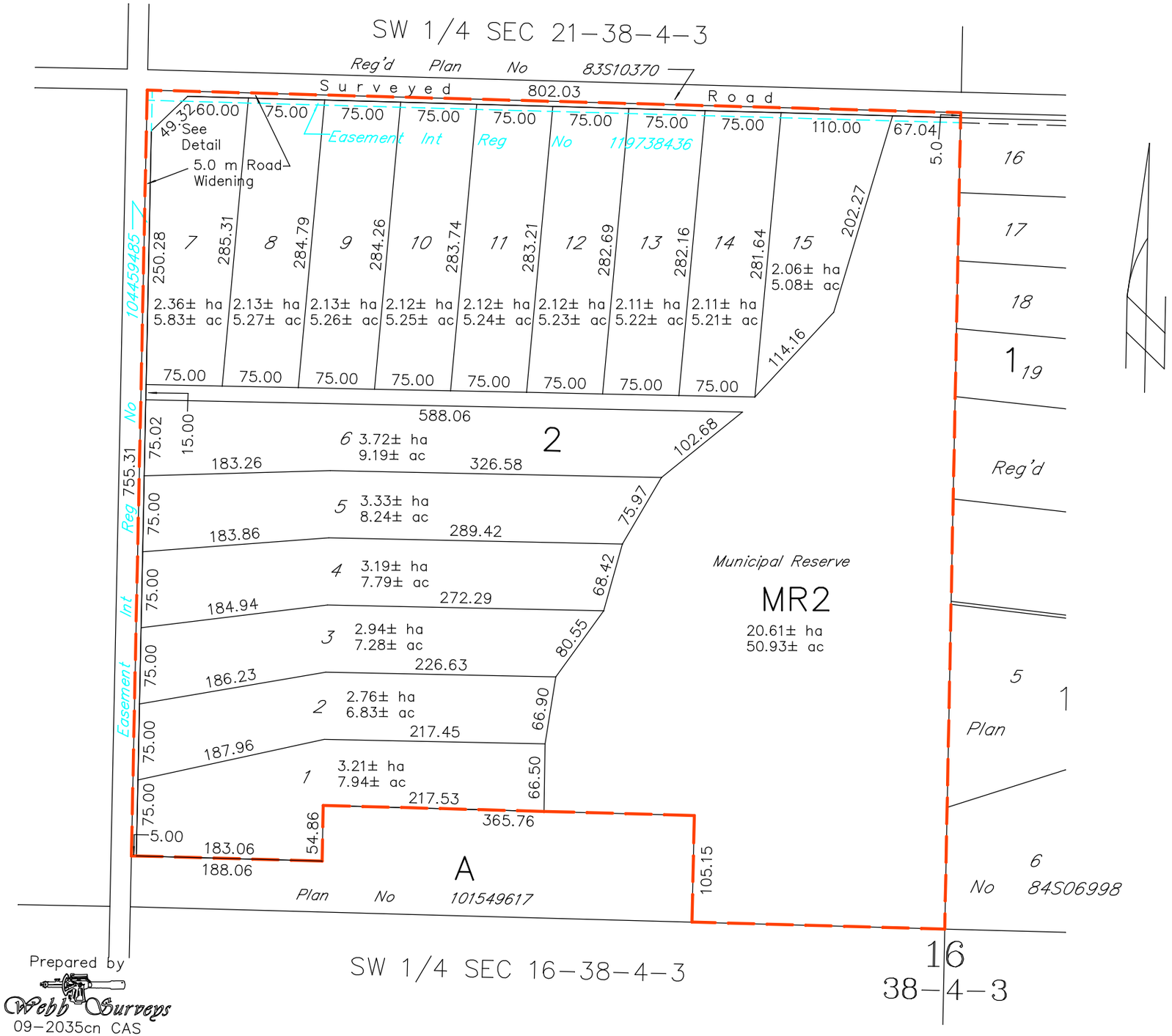
Within this response, the affected landowner has expressed concern with the increased traffic generated by both phases of development. The affected landowner resides at the intersection of

Range Road 3044 and Township Road 383. Based upon the Transportation Association of Canada standards, residential dwellings on average generate approximately 10 vehicle trips per day. Given the location of the development and the distance from major commercial and employment areas, it is likely that this is an overestimate as typical trips will tend to be consolidated based upon longer travel distances to these places. Based upon the estate above, it is expected that the two phases combined may generate up to 310 vehicle trips per day along Township Road 383. As Phase II comprises a total of 15 lots, a total of 150 vehicle trips would be directly associated with the current proposal. Additionally, based upon the lot layout, six of the proposed lots are orientated along and directly access Range Road 3044, further reducing the vehicles traveling past the affected residence. Adding 300 vehicles per day to a road which sees little if any traffic is a change, but these forecasted traffic levels are considered moderate for a rural road and are not considered to create a traffic safety hazard.

Regulatory Consultations

Regulatory Agency	
Ministry of Highways and Infrastructure	The Ministry of Highways and Infrastructure was contacted to provide comments for this proposed subdivision. At this time the Ministry has no comments regarding this proposed subdivision due to the distance of the proposed development from the provincial highway network.
Heritage Conservation Branch, Ministry of Parks, Culture and Sport	An application was submitted to the Ministry regarding the potential heritage sensitivity of the development site. A heritage clearance letter was subsequently received confirming that the development could proceed without further investigation required.
Ministry of Environment	The Saskatchewan Conservation Data Centre (Sask CDC) provides an interactive map for viewing rare and endangered element occurrences across the province. The Sask CDC indicates there are no rare or endangered elements within the proposed development area.
Water Security Agency	The Water Security Agency has no concerns with the plan moving forward.
Saskatoon District Health Region	A copy of the hydrogeological report was submitted to the SDHR for review. The SDHR confirmed that the recommendations presented in the above noted report are appropriate.
City of Warman Fire Protective Services	The City of Warman Fire Protective Services was consulted concerning the level of service provided and response time associated with fire protection for the area.
Corman Park Police Services	The Corman Park Police Service was able to confirm its ability to support the proposed development within the current resources available.

APPENDIX A: PLAN OF PROPOSED SUBDIVISION



Prepared by
Webb Surveys
09-2035cn CAS

WHISPER RIVER ESTATES, PH II

Whisper River ESTATES

PLAN OF PROPOSED SUBDIVISION OF PART OF NW 1/4 SEC 16-38-4-3 SASKATCHEWAN RM OF CORMAN PARK NO 344 SCALE 1:5000

T.R. Webb, February 2015
Saskatchewan Land Surveyor

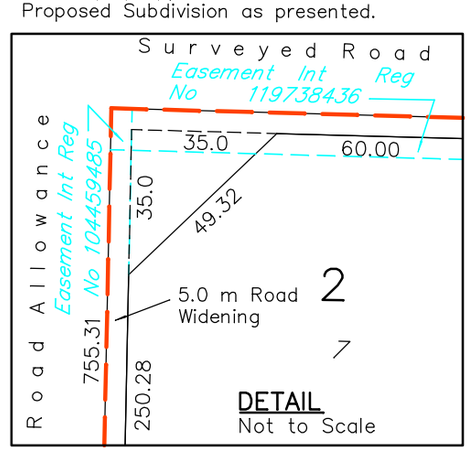
Seal

Dimensions shown are in metres and decimals thereof.

Portion of this plan to be subdivided is outlined with a bold, dashed line and contains 59.84± ha (147.87± ac) which includes 0.84± ha (2.07± ha) for road widening.

Dimensions are approximate and may vary from the final plan of survey by ±1.0 m.

Registered Owner dd/mm/yy
The signature above indicates that I (we) approve the Plan of Proposed Subdivision as presented.



APPENDIX B: CORRESPONDANCE

Riversong ESTATES

North Prairie Developments Ltd.

Purpose

This letter is being sent to local landowners to inform you of a proposed multi-parcel residential development in your immediate area. An application has been submitted to the RM as part of their call for proposals. The following information is provided to local landowners to elicit your comments and to access your local knowledge of the area to ensure the proposed residential development positively integrates itself into the existing built environment.

Development

Riversong Estates Phase II is a proposed multi-lot country residential development located within the NW 1/4 16-38-4-W3M. The proposed development includes 14 lots encompassing 38.5 hectares of land with an average lot size of 2.75 ha (6.79 acres).

The location is ideal as it is situated among other country residential developments as well as adjacent to the river and a ravine. The ravine runs through the development property providing a natural amenity for the residents.

The concept design includes a long lot format similar to Riversong Estates Phase I located in the adjacent quarter section. The long lot format is commonly used within riverfront developments including Cathedral Bluffs to the south to maximize property exposure to a natural valley or watercourse.

The long lot format coupled with a larger lot size provides opportunity for the potential integration of agrarian lifestyles and country residency by providing a sufficient land base to host non-intensive forms of animal husbandry and small scale intensive agricultural pursuits. The larger sites reduce runoff generated by development by retaining larger areas of undeveloped land within the subdivision, allowing for greater local infiltration. The long lot format also permits a greater setback from the roadway, reducing any potential nuisance from dust.

Servicing

A 15-metre public corridor has been incorporated into the development, along lots 1 - 9, allowing public access to the ravine and the surrounding municipal reserve.

Potable water will be provided by Intervalley Water Inc. via an existing water line servicing Riversong Estates Phase I. Individual lot owners are responsible for installing private pressure systems to distribute water throughout their site.

Private onsite wastewater disposal systems will be used.

All shallow utilities have sufficient capacity to provide service to the development.

An engineered drainage plan will be completed prior to development to manage any potential runoff from the site. The drainage plan will include lot grading to allow drainage to flow overland via ditches into the ravine.

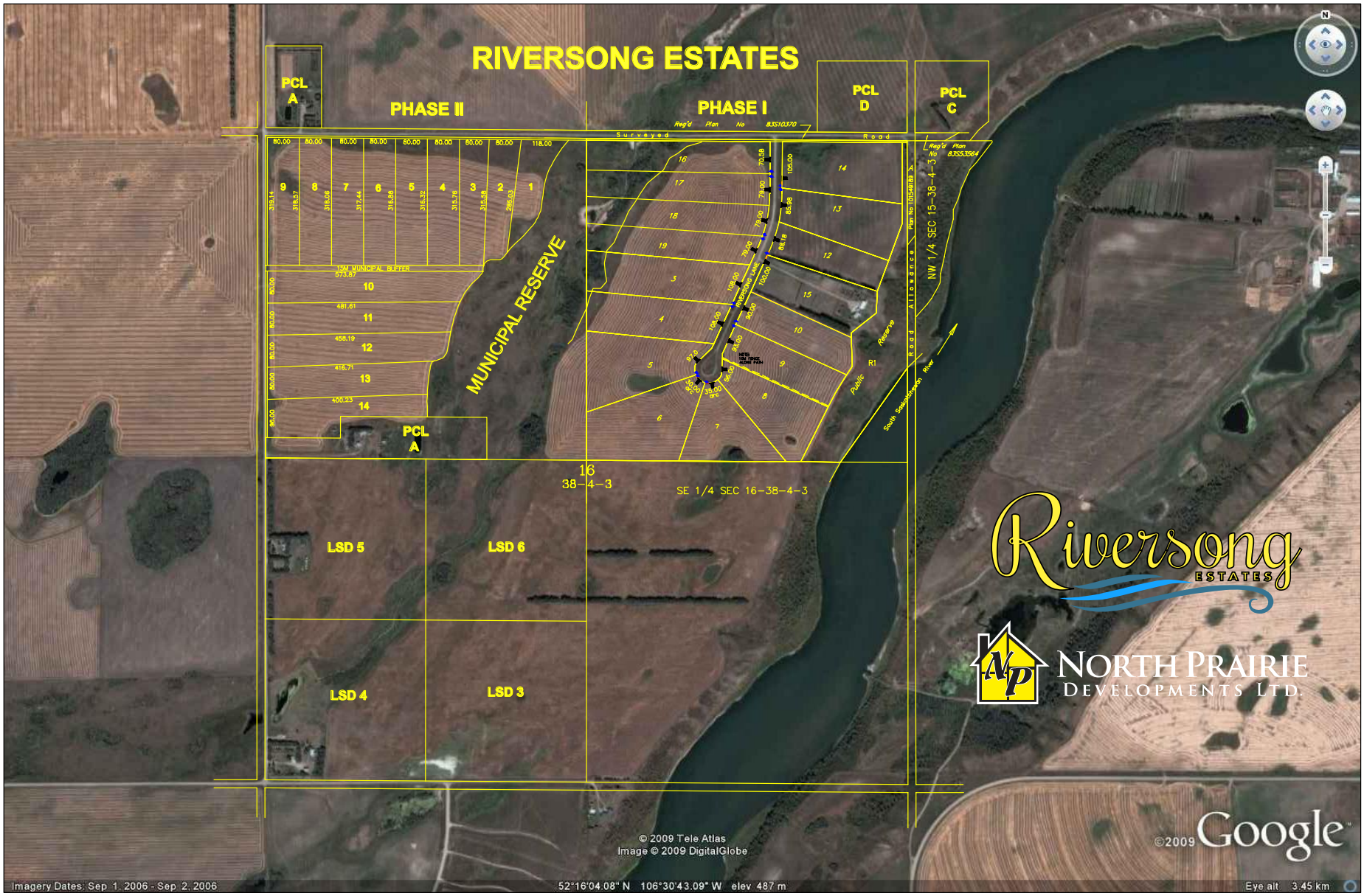
Amenities

The development site is well situated within an area containing significant natural amenities including the South Saskatchewan River Valley and the existing ravine located along the eastern boundary of the site.

The subdivision has been specifically designed to maximize public access and exposure to these areas and the dedication of the ravine as municipal reserve will ensure that the area remains untouched and accessible by the public.

Contact Us:

Please contact us and provide us with your comments at an online forum which has been established for this development at www.placespeak.com. This forum provides continued access to additional information on the proposed development as it becomes available, promotes upcoming public events and enables stakeholders to post their comments and questions and see other peoples comments. Or you may contact Kylie McLean at 306-653-4969 or by email at mcleank@ae.ca.


RIVERSONG ESTATES
PCL A
PHASE II
PHASE I
PCL D
PCL C
MUNICIPAL RESERVE
PCL A
16
38-4-3
SE 1/4 SEC 16-38-4-3
NW 1/4 SEC 15-38-4-3
LSD 5
LSD 6
LSD 4
LSD 3
Riversong
ESTATES
NORTH PRAIRIE
DEVELOPMENTS LTD.
© 2009 Tele Atlas
Image © 2009 DigitalGlobe
©2009 Google
Imagery Dates: Sep 1, 2006 - Sep 2, 2006
52°16'04.08" N 106°30'43.09" W elev 487 m
Eye alt 3.45 km

English

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Riversong Estates Phase II

By Associated Engineering Ltd | Archived

Overview | Discussions 2 | Resources 2 | Events 0 | Notice Board 0

Invite To Topic

Like | Share 0 | Tweet

77
unique views

Riversong Estates Phase II is a proposed multi-lot country residential development located in the RM of Corman Park.

How can you help?

There are several ways that you can contribute your ideas and opinions to this consultation. Help inform and influence the outcome:

- Share the word with friends and family
- Post on the notice board
- Participate in discussions

Contact Information

Associated Engineering Ltd

Kylie McLean
Project Planner
mcleank@ae.ca
(306) 653-4969

English

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Follow Discussions | Discussion Policy

Feedback on Proposed Development

Rating 0

By Topic Administrator | Dec 3rd, 2013, 7:07 AM | 20 views | 1 posts

Please provide us with your comments.

0 0

Follow this Discussion

Post a Comment > | Read 1 Comments >

By Topic Administrator | Dec 6th, 2013, 12:17 PM

Rating 0

A presentation of the proposed development will be held at the RM office on Friday, December 13 at 11:00am. The presentation will include a brief description of the development and a summary of the comments received. The RM office is located at 111 Pinehouse Drive, Saskatoon. [Less]

0 0

Reply to this post > | Read 0 Replies

Contact Information

Associated Engineering Ltd

Kylie McLean
Project Planner
mcleank@ae.ca
(306) 653-4969

Bill Delainey

From: Ruben Friesen <ruben.f@sasktel.net>
Sent: Sunday, October 04, 2015 4:11 PM
To: Bill Delainey
Subject: Proposed development, Whisper River Estates Phase II

Project Manager
Associated Engineering

Hi Bill Delainey,

I am sending this email in response to your Public Notice letter (dated Sept 15 but only received Sept 25) regarding the proposed development by North Prairie of Whisper River Estates phase II (NW16-38-4-W3). I have tried a few times to connect with and log into the discussion area on the "placespeak.com" web address that you listed in the letter, but was unsuccessful on all occasions. I did however review the draft copy of the CDR report posted on the website, and these are my concerns:

As you know, my residence is right on the corner of Twp Rd 383 & Range Rd 3044 and is the property most severely impacted by both phases of the Whipser River Estates development. ALL TRAFFIC MUST GO PAST MY RESIDENCE. With just one new residence being constructed this summer in Phase 1, there has been a tenfold increase in the traffic, along with the associated negative effects on road conditions, noise, decreased safety, and especially DUST. I hate to think of the unbearable situation that an increase in traffic caused by 30 more residences using this road would have, not to mention the increased truck and heavy equipment traffic during construction.

I think there has been a failure to do a comprehensive traffic analysis on the real effects this proposal will have on existing property owners, as well as future residents. Perhaps such a study should be done by an independent third party.

Respectfully,

Ruben Friesen
SW21-38-4-W3

AGREEMENT

BETWEEN: Intervalley Water Inc., hereinafter referred to as "Intervalley Water";

AND: North Prairie Developments Ltd., hereinafter referred to as North Prairie";

DATED: This 19th day of August, 2015.

WHEREAS

a) Intervalley Water owns and operates a potable water distribution system that extends past the Northwest Quarter of Section 16, Township 38, Range 4, West of the 3rd Meridian, and whereas;

b) North Prairie owns certain property, some of which is currently being proposed for a country residential development, hereinafter referred to as the "Lands", consisting of:
   1. LSD 11, Sec 16, Twp 38, Rge 04, W3, containing 35.93-acres;
   2. LSD 12, Sec 16, Twp 38, Rge 04, W3, containing 32.03-acres;
   3. LSD 13, Sec 16, Twp 38, Rge 04, W3, containing 39.89-acres;
   4. LSD 14, Sec 16, Twp 38, Rge 04, W3, containing 39.87-acres, and whereas;

c) North Prairie previously constructed said water line past its Lands, under the provision of an Agreement between Intervalley Water and North Prairie dated July 26, 2012, and whereas;

d) North Prairie is desirous to construct service connections from the adjacent Intervalley Water distribution system to provide potable water service to its Lands, and whereas;

e) Intervalley Water is agreeable to allow North Prairie to construct service connections to service said Lands and to assume operation and ownership of the service connections upon completion, subject to certain terms and conditions.

NOW THEREFORE IT IS AGREED THAT

1. WATER SERVICE CONNECTION CONSTRUCTION
   North Prairie shall be allowed to construct fourteen (14) service connections, hereinafter referred to as the "Work", from the existing potable water distribution line located adjacent to its Lands, to the property line of its Lands, as follows:

   a) Six (6) Service Connections along Rge. Road 3044 to provide potable water service to proposed Lots 1 to 6 inclusive, Block 2, as shown on the Plan of Proposed Subdivision attached as Appendix "A".
   b) Eight (8) Service Connections along Twp. Road 383 to provide potable water service to proposed Lots 7 to 10 inclusive and Lots 12 to 15 inclusive, Block 2, as shown of the Plan of Proposed Subdivision attached as Appendix "A".
   c) It is acknowledged that there is an existing Service Connection to proposed Lot 11, Block 2 previously constructed by North Prairie pursuant to the previous Agreement noted in the preamble Clause (c).

2. CONNECTION FEE
    a) North Prairie shall pay to Intervalley Water the lump sum of $2,500.00 for each new connection, in compensation for the right in Section 1 to connect to their existing water infrastructure and distribution system.
    b) The Connection Fee in this section shall be paid by North Prairie upon issuance of the Certificate of Substantial Completion for the construction of the service connections in Section 7.
    c) North Prairie shall have the option to add or delete the number and locations of service connections to its Lands listed in Section 1, based on the final approved subdivision.

3. TERMINATION OF PREVIOUS LATE COMER CONNECTION CLAUSE:
    At the request of Intervalley Water and in consideration of the Connection Fee charged in Clause 2, North Prairie agrees that upon this Agreement coming into full force and effect that they will waive and terminate any further claim to compensation pursuant to Clause (12), titled "Late Comer Connections", in the previous Agreement dated July 26, 2012, .

4. WATER VOLUME
    Intervalley Water shall provide the following water volume quantity to each service connection in Whisper River Estates Phase 1 and Phase 2, as follows:
    a) The fourteen (14) new water service connections constructed to Lots 1 to 10 inclusive and Lots 12 to 15 inclusive, Block 2, under the provisions of this Agreement, shall each receive 10,000 imperial gallons per month.
    b) The one (1) existing water service connection constructed to Lot 11, Block 2 under the previous Agreement dated July 26, 2012, shall have its water volume allocation reduced from 21,600 imperial gallons per month to 10,000 imperial gallons per month.
    c) The fourteen (14) existing water service connections constructed to Lots 3, 4, 5, 6, 7, 9, 10, 12, 13, 14, 16, 17, 18 and 19, Block 1 in the NE 16-38-04-W3 under the previous Agreement dated July 26, 2012, shall each have their water volume allocation reduced from 21,600 imperial gallons per month to 10,000 imperial gallons per month.

5. ENGINEERING
    a) As a condition of approval by Intervalley Water to permit North Prairie to undertake the Work, North Prairie shall engage Associated Engineering of Saskatoon, Saskatchewan, or other consulting engineer as Intervalley Water may approve, to design, administer and supervise all construction work and shall pay for the design work, administration, field supervision and expenses of the engineer.
    b) All design work and construction work shall be completed in accordance with accepted engineering and environmental standards.
    c) Intervalley Water shall have final approval of the work design and all engineering and construction standards associated therewith.

6. CONSTRUCTION COSTS
    North Prairie shall be responsible to contract for and to pay all costs and expenses associated with the Work, including but not limited to.
    a) Engineering design and supervision.
    b) Contractor contracts for construction work.
    c) Road and ditch repairs.
    d) Utility locates and repairs.

7. COMMISIONING & OWNERSHIP
    a) Upon completion of the construction of the Work, the engineer shall issue the Certificate of Substantial Completion and shall commission the Work for operation and distribution of potable water to customers.
    b) As part of the commissioning of the Work and prior to the transfer of title to Intervalley Water, the engineer shall provide satisfactory documentation and certificates that the construction Work is free and clear of all liens and encumbrances against North Prairie.
    c) Title to the completed Work shall pass to Intervalley Water at the time of commissioning, who shall thereafter have total and complete ownership of said Work.

8. CUSTOMERS
    a) Any owner or future owner of a lot sold by North Prairie that is serviced by the Work, shall as a condition of purchase, be required to be a member of Intervalley Water.
    b) Any customer who has a curb cock installed to their property pursuant to this Section, shall be subject to the standard monthly curb cock charge as established by Intervalley Water for all such customers.
    c) Customers who have a curb cock installed to their property, are responsible to pay for all costs of future extension of the water line from the curb cock to their house or building, and such construction shall be subject to the standards and conditions established by Intervalley Water. This work shall include but not be limited to, trenching and installation of the line, payment of the deposit and installation of the meter assembly and flush out of the line.

9. WARRANTY
    North Prairie and its contractors shall warranty the Work for a period of one year from the date of commissioning, and shall repair or replace any defective work or materials to the satisfaction of the engineer.

10. LIABILITY
    a) North Prairie shall maintain liability insurance in the amount of $2,000,000.00 for bodily injury, property damage and non-owned auto claims resulting from the Work.
    b) North Prairie shall indemnify Intervalley Water from all liability claims associated with the Work pursuant to this agreement.

11. CANCELLATION
    North Prairie shall have the right to cancel this agreement and vacate all obligations hereunder if the proposed 15-lot subdivision does not receive final subdivision approval and is not registered at Land Titles.

12. ASSIGNMENT
    North Prairie shall have the right to assign this Agreement to another company.

13. COMMUNICATION
    a) North Prairie and Intervalley Water shall at all times communicate all information related to the construction of the Work to the other Party so that each Party maintains full knowledge of the construction work status and progress.
    b) Construction communication may be made by regular pre-paid mail, by facsimile, by e-mail or by personal delivery to the addresses provided in Section 15.
    c) Each Party shall co-operate with the other for the mutual satisfactory completion of the Work.

14. ARBITRATION

In the case of any dispute between North Prairie and Intervalley Water arising out of the performance of this Agreement or afterwards as to any matter hereunder, either Party hereto shall be entitled to give to the other notice of such dispute and demand arbitration thereof. Such notice and demand being given, each Party shall at once appoint an arbitrator and these shall jointly select a third. The decision of any two of the three arbitrators shall be final and binding upon the Parties, who covenant that their dispute shall be so decided by arbitration alone, and not by recourse to any court or other action of law. If the two arbitrators appointed by the parties do not agree upon a third, or a Party who has been notified of a dispute fails to appoint an arbitrator, then the third arbitrator and/or the arbitrator to represent the Party in default shall be appointed by a judge of the Court of Queen's Bench at the Judicial Centre of Saskatoon. The Arbitration Act of the Province of Saskatchewan shall apply to any arbitration hereunder, and the costs of any such arbitration shall be apportioned equally between the parties hereto.

15. NOTICE

Except as otherwise provided herein, any notice or communication required or permitted to be given by one Party to the other shall be in writing and shall be deemed to have been sufficiently and effectually given if personally delivered or if posted registered mail, postage pre-paid, addressed as follows:

a) In the case of North Prairie:
North Prairie Developments Ltd.
100-319 Wellman Lane
SASKATOON, SK. S7T 0J1

b) In the case of Intervalley Water:
Intervalley Water Inc.
PO Box 160
301 Centennial Drive North
MARTENSVILLE, SK. S0K 2T0

16. TIME OF THE ESSENCE

Time shall be of the essence in all matters relating to this Agreement.

17. AGREEMENT TO ENURE

This Agreement shall be binding upon and shall inure to the benefit of the parties hereto and their respective heirs, executors, administrators, successors and assigns.

18. ENTIRE AGREEMENT

a) This Agreement shall form the entire agreement between the parties hereto and may be amended in writing from time to time as matters arise, by mutual consent.
b) The headings in this Agreement are for convenience only and shall not add to or alter the content of this Agreement in any way.
c) The preamble to this Agreement shall be considered a part thereof.

IN WITNESS WHEREOF the Parties have hereto affixed their signature and seals duly attested by the hands of their proper offices in that behalf, the 19 day of May, 2015.

NORTH PRAIRIE DEVELOPMENTS LTD.

Seal

President

INTERVALLEY WATER INC.

Seal

Chairman

Secretary

AGREEMENT

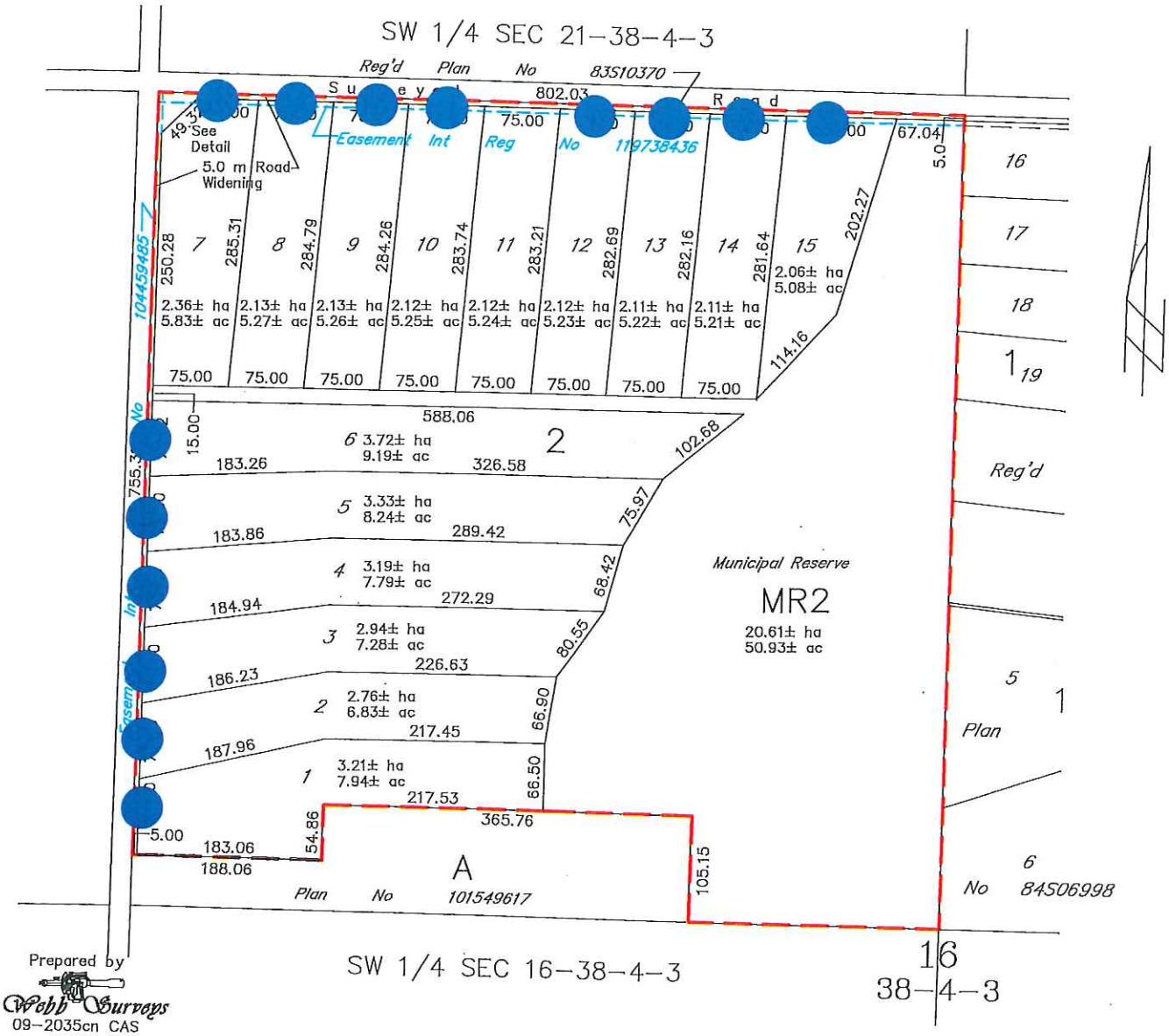
BETWEEN: Intervalley Water Inc. hereinafter referred to as "Intervalley Water";

AND: North Prairie Developments Ltd. hereinafter referred to as "North Prairie".

DATED: This 19th day of August, 2015.

SCHEDULE "A"

Water Service Connection Construction



Saskatchewan

Ministry of Parks,
Culture and Sport

Heritage Conservation Branch
2nd Floor, 3211 Albert Street
Regina, Saskatchewan
S4S 5W6

(306) 787-2848
jennifer.thompson@gov.sk.ca

March 3, 2015

Our File: 15-285

Mr. Mike Pawluski
Associated Engineering
1 – 2225 Northridge Drive
SASKATOON SK S7L 6X6

Dear Mr. Pawluski:

RE: North Prairie Developments Ltd. – Whisper River Estates Phase II:
NW 16-38-4-W3M;
HERITAGE RESOURCE REVIEW

Thank you for referring this subdivision to our office for review.

In determining the need for, and scope of, heritage resource impact assessment (HRIA) pursuant to S. 63 of *The Heritage Property Act*, the following factors were considered: the presence of previously recorded heritage sites, the area's overall heritage resource potential, the extent of previous land disturbance, and the scope of new proposed land development.

There are no recorded heritage sites located in conflict with the proposed subdivision. While there is native prairie located within the project area, this portion of the development area will be part of the municipal reserve and will not be impacted by construction activities. As such, the potential for heritage sites to be adversely affected by this development is low. Our office has no concerns with the subdivision proceeding as planned.

If you have any questions, please do not hesitate to contact me.

Sincerely,

Jennifer Thompson.

Dr. Jennifer A. Thompson
Archaeologist/GIS Specialist
Archaeological Resource Management

Mike Pawluski

From: Nicholls, Andrew HI <Andrew.Nicholls@gov.sk.ca>
Sent: Thursday, February 26, 2015 9:38 AM
To: Mike Pawluski
Subject: NW 16-38-04-W3M - 20134390.00.U.01.00

Categories: AE FILED EMAIL

Mike,

At this time the Ministry has no comments regarding this proposed subdivision.
If you have any questions contact me.
Thank you,

Andrew Nicholls
Government of Saskatchewan
Roadside Technician
Asset Management, Ministry of Highways and Infrastructure

18-3603 Millar Avenue
Saskatoon SK S7P 0B2

Bus: 306-933-5801
Cell: 306-291-4504

Mike Pawluski

From:	Mike Pawluski
Sent:	Friday, February 20, 2015 3:51 PM
To:	Andrew Nicholls (Andrew.Nicholls@gov.sk.ca)
Subject:	Proposed Country Residential Subdivision NW 16-38-4-W3M
Attachments:	4390_pps_feb 18 2015.pdf

Good Afternoon Andrew,

We represent a client who is preparing a comprehensive development review (CDR) in support of a multi-lot country residential development north of Cathedral Bluffs on the NW 16-38-4-W3M.

As part of the CDR, one of the consultation requirements the RM of Corman Park asks for is with the Ministry of Highways and Infrastructure.

- Does the Ministry have any comments regarding this proposed development?

Attached is a draft plan of proposed subdivision for your review.

If you need any additional information, please feel free to contact me.

Regards,

Mike Pawluski
Project Planner

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

1 - 2225 Northridge Drive
Saskatoon, SK, Canada S7L 6X6

Tel: 306.653.4969
Fax: 306.242.4904
www.ae.ca

CANADA'S BEST MANAGED COMPANIES

Mike Pawluski

From: Lori Jeschke <lori.jeschke@spiritsd.ca>
Sent: Friday, February 20, 2015 8:47 AM
To: Mike Pawluski
Subject: Warman School capacity - 20134390.00.U.02.00

Categories: AE FILED EMAIL

Thank you for your call Mike.
This email is to confirm our conversation regarding the capacity of the schools in Warman regarding a multi-lot development north of Cathedral Bluffs. Thank you for making us aware and including us with the information. The number of potential students for our Warman Schools because of this new development will not pose any issue for us in terms of capacity. This would not be a concern for us.

Enjoy your day!

Lori Jeschke

Learning Superintendent
Box 809, 121 Klassen St. E.
Warman, SK. S0K 4S0
Phone:(306) 683-2870
Fax:(306) 934-8221
Cell: 220-2985
lori.jeschke@spiritsd.ca

Loraas Disposal Services Ltd.

Associated Engineering
1-2225 Northridge Dr
Saskatoon, SK S7L6X6

February 24,015

Attn: Mike Pawluski

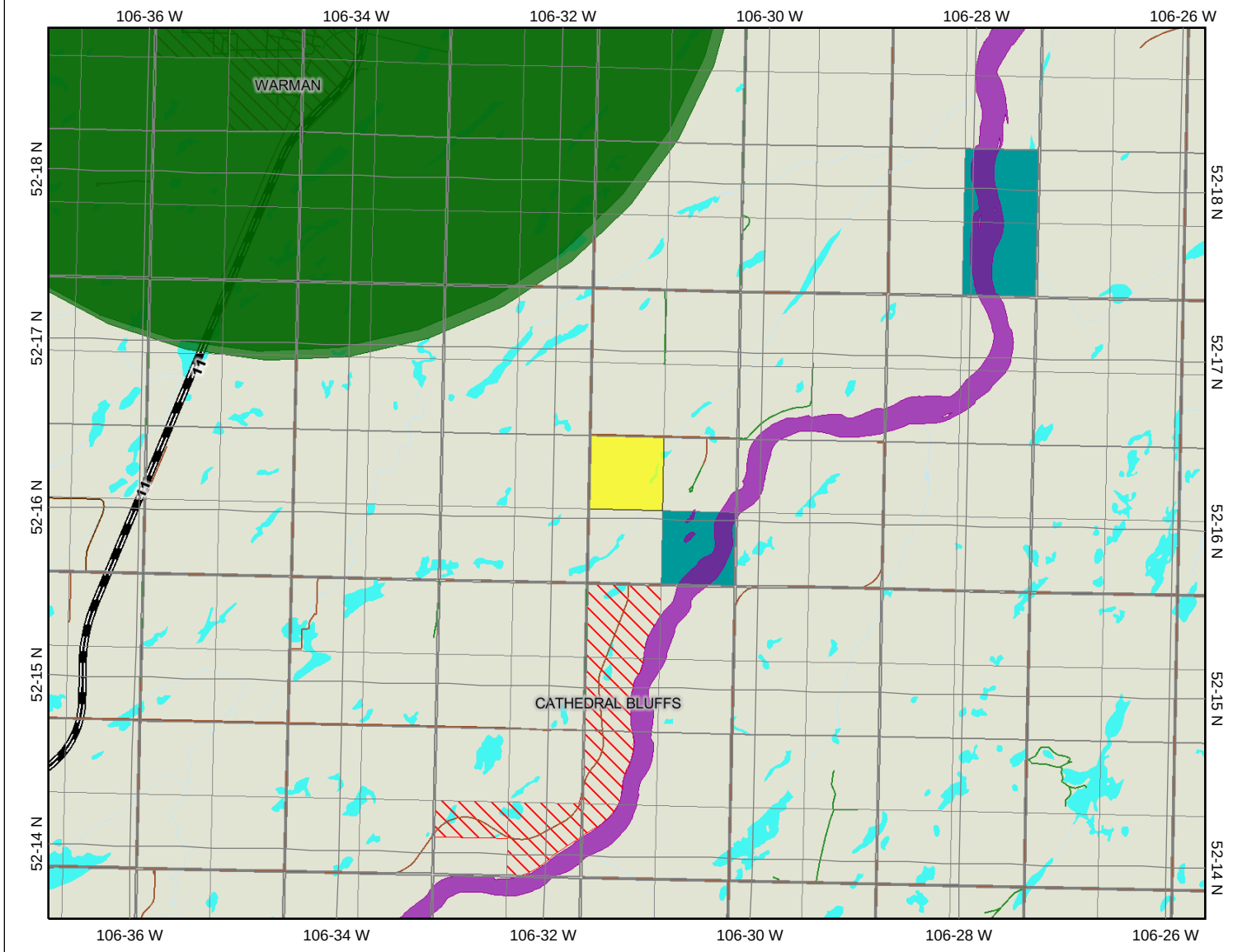
Please accept this letter of confirmation in providing Waste Removal Services in future for the proposed Whisper Ridge Estates. NW 16-38-4-W3.

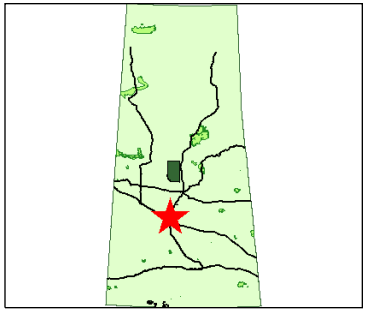
Any further questions please feel free in contacting us.

Thank you,

Jan Magnuson l Customer Care l Inside Sales Loraas Disposal

SaskCDC Desktop Review





Legend

- Sask Outline
- Sask Mask
- Sections
- Quarter Sections

Rare and Endangered Species

- Animal
- Community
- Invertebrate
- Other
- Plant

- Fish and Wildlife Development Fund Lands
- Wildlife Habitat Protection
- Agricultural Crown Land

SURN Roads

- Local / Street
- Resource / Recreation
- Collector
- Urban Municipalities
- SURN Highways

Lakes 50k

- Intermittent Water
- Permanent Water
- Flooded Area
- Irrigation Canal

- Rivers 50k
- PFRA Community Pastures
- Ramsar Wetland
- Protected Areas
- Bird Sanctuary

N

Scale: 1:68,534

Map center: 52° 16' 16" N, 106° 31' 17" W

From: Destiny Henderson [mailto:dmhenderson@saskpower.com]
Sent: Monday, June 22, 2015 12:27 PM
To: admin@webbsurveys.ca
Cc: Phil Ratzlaff
Subject: Proposed Subdivision; R.M. of Corman Park No. 344; CP File: R231-15S; Surveyor 09-2035cn; Our File: 14333108

Good afternoon,

SaskPower maintains right-of-way for existing facilities; current overhead facilities within quarter section are to be salvaged under Order No. 20172405.

Accordingly we hereby consent to the proposed subdivision within LSD 11, 16-38-4 W3, Ext. 61, LSD 12, 16-38-4 W3, Ext. 62, LSD 13, 16-38-4 W3, Ext. 59 and LSD 14, 16-38-4 W3, Ext. 60 in the R.M. of Corman Park No. 344.

No consent to Community Planning required as the Certificate of Approval has been received.

Have a great day!

Destiny Henderson
SaskPower | Corporate Land Analyst/Land Department, Regina
p. 306-566-3002 | dmhenderson@saskpower.com | www.saskpower.com
f. 306-566-3022
12SE – 2025 Victoria Avenue
Regina, SK S4P 0S1

Loraas Disposal Services Ltd.

Associated Engineering
1-2225 Northridge Dr
Saskatoon, SK S7L6X6

February 24,015

Attn: Mike Pawluski

Please accept this letter of confirmation in providing Waste Removal Services in future for the proposed Whisper Ridge Estates. NW 16-38-4-W3.

Any further questions please feel free in contacting us.

Thank you,

Jan Magnuson l Customer Care l Inside Sales Loraas Disposal

From: Engele-Carter, Kari SktnHR [mailto:Kari.Engele-Carter@saskatoonhealthregion.ca]
Sent: Thursday, October 29, 2015 8:46 AM
To: Dukart, Shawn MA
Subject: R231-15S Subdivision Review - RM 344, LSD 11 to 14 inclusive, 16-38-04 W3M

We have reviewed this document for R231-15S at RM 344, LSD 11 to 14 inclusive, 16-38-04 W3M and would recommend the following:

- This report does not provide a nitrate assessment. It indicates *the near surface groundwater at the site is considered unsuitable for human consumption and the lower aquifers in the region are isolated form the site*. Expansion on these interpretations, including discussions on retention times, would be recommended to defend the conclusion of the isolated aquifer as per 3.3.1 of the Guidance Document.
- This report does not specifically qualify the site as unsuitable except for holding tanks/severe limitations/moderate limitations/well suited for OWTS. It does indicate that *OWTS, specifically septic tanks, Type I/II mounds and/or chamber systems, are suitable to be used at the proposed development*. Considering information collected in the Level 1 Assessment, the report should classify subdivision/development's suitability for the proposed type of OWTS.

Based on the above review and comments, we would advise that community planning accept the report provided that the findings and recommendations of the hydrogeological study are adhered either by:

a) Community Planning Branch discusses the need for a servicing agreement between the municipality and the developer that will incorporate the findings of the report. This servicing agreement should be registered on the individual parcels.

b) The RM registers the report to Information Services Corporation (ISC) for all proposed parcels. This information must be available to any purchaser though ISC.

The installation of any new plumbing and sewage systems shall be permitted, inspected and approved by our department. Permit applications and related information can be found on our website at www.saskatoonhealthregion.ca (search: sewage).

Kari Engele-Carter
Senior Public Health Inspector
Environmental Public Health Department
Population and Public Health Services
Saskatoon Health Region | 306-655-4459 phone | 306-682-4155 phone | 306-682-7134 fax

APPENDIX C: PHASE 1 ESA

Town of Langham Proposed Lagoon Site:

Reasons for considering the current location:

1. **A new lagoon site is required and essential for the community to meet provincial regulations and accommodate growth –** the current site fails to meet current separation distances from the Town and surrounding residential developments. The facility is insufficient to meet projected community demands and because of its non-conforming location is not capable of being altered (expanded).

2. **The land is available for purchase -** The Town must be able to acquire the land from a local property owner in order to consider the construction of the new facility. There is no guarantee that other locations will be available for purchase.

3. **The proposed site meets current residential setback regulations -** The current RM regulation requires a minimum separation distance of 600 metres from a residence to the facility. The proposed location satisfies this condition.

4. **The proposed site is of sufficient size to accommodate its potential expansion to the west towards the river valley without infringing upon existing residences –** This site not only meets current setbacks, it is sufficiently sized to accommodate future expansion. Potential future expansion on the ¼ section would extend the separation distance to the west along the riverbank and not impact lands east of the river.

5. **The site has soil conditions which are conducive for the proposed use –** one of the reasons why a new location is being sought is that the local soil conditions at the current site no longer meet provincial guidelines. The preliminary geotechnical analysis for the proposed site supports the new location as appropriate.

6. **The site is directly adjacent and accessible to an existing sewer line originating at the Town of Dalmeny. This sewer line extends to an existing river discharge point –** being able to connect the new facility to an existing sewer line provides efficiencies both in terms of infrastructure construction, but also eliminates any new downstream impacts associated with a new line and a new river discharge point.

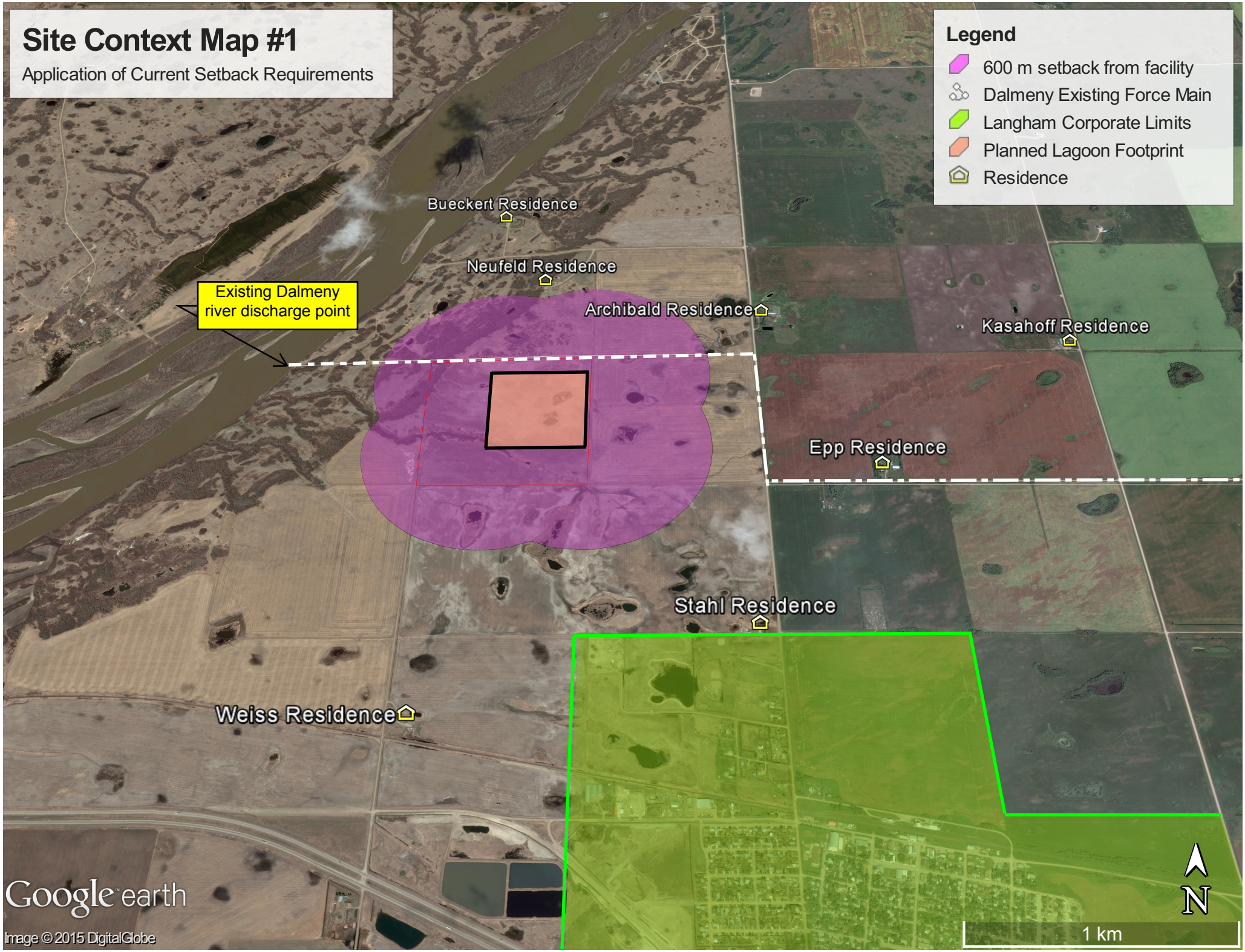
7. **The site is does not impede residential development on adjacent undeveloped ¼ sections –** the application of the RMs 600 metre separation distance does not preclude subdivision or development on adjacent undeveloped ¼ sections. It will influence the location of this development but does not absolutely preclude it.

8. **The site is located a reasonable distance from the Town in terms of connecting a pipeline from the current Town corporate limits to the new facility –** lagoons need to be constructed in relatively close proximity to the Town in order for the cost of construction of linear infrastructure and supporting pumping facilities to be feasible.

The RM has indicated that it would consider supporting another location and encouraged the Town to undertake pre-consultations in advance of an application.

- Attached Context Map #2 illustrates the application of the RMs current 600 m separation distance based upon existing residential development in the area. It is clear that there are few if any lands in the vicinity of the Town which are better situated or large enough to accommodate the new facility.
- There is no certainty that the Town would be able to purchase suitable lands in an alternate location.
- These facilities are essential for urban centres and are never popular – it is not clear what would be accomplished through further consultations. Experience would suggest that it is highly unlikely

that the Town would be able to locate an alternative site which is any more acceptable to surrounding land owners as the current site.


Site Context Map #1
Application of Current Setback Requirements
Legend
600 m setback from facility
Dalmeny Existing Force Main
Langham Corporate Limits
Planned Lagoon Footprint
Residence
Bueckert Residence
Neufeld Residence
Existing Dalmeny river discharge point
Archibald Residence
Kasahoff Residence
Epp Residence
Stahl Residence
Weiss Residence
Google earth
Image © 2015 DigitalGlobe
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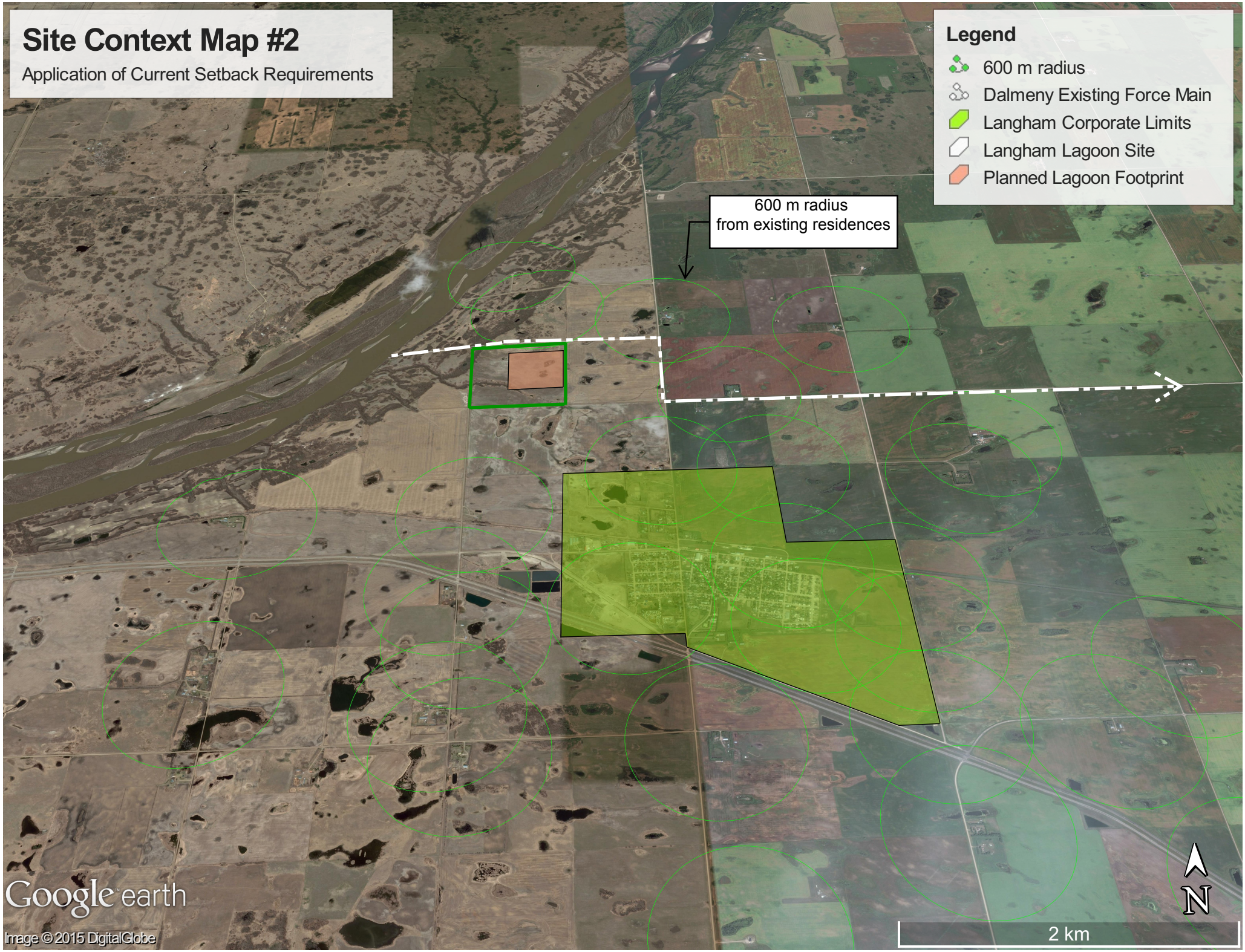
Site Context Map #2
Application of Current Setback Requirements
Legend
600 m radius
Dalmeny Existing Force Main
Langham Corporate Limits
Langham Lagoon Site
Planned Lagoon Footprint
600 m radius
from existing residences
Google earth
Image © 2015 DigitalGlobe
N
2 km

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- Concrete Testing
- Asphalt Testing

PHASE I ENVIRONMENTAL SITE ASSESSMENT
WHISPER RIVER ESTATES PHASE 2
RURAL RESIDENTIAL SUBDIVISION
R.M. OF CORMAN PARK NO. 344, SASKATCHEWAN
PMEL FILE NO. 9980
FEBRUARY 17, 2015

LSD 11 to 14, INCLUSIVE, 16-38-04-W3M,
R.M. OF CORMAN PARK NO. 344, SASKATCHEWAN

PREPARED FOR:

NORTH PRAIRIE DEVELOPMENTS LTD.
1 – 319 WELLMAN LANE
SASKATOON, SK
S7T 0J1

ATTENTION: MR. PHIL RATZLAFF,
LAND DIVISION MANAGER

PRIVILEGED AND CONFIDENTIAL

EXECUTIVE SUMMARY

A Phase I Environmental Site Assessment (ESA) was conducted for the property legally described as:

- *Legal Subdivisions (LSDs) 11 to 14, inclusive, Section 16, Township 38, Range 4, West of the Third Meridian (16-38-04-W3M), Rural Municipality (R.M.) of Corman Park No. 344, Saskatchewan.*

The subject property is located at the southeast intersection of Range Road No. 3044 and Township Road No. 383, approximately 10 km to the northeast of the City of Saskatoon, in the R.M. of Corman Park No. 344, Saskatchewan.

In accordance with the Canadian Standards Association (CSA Z768-01 (R2012)) Standards for Phase I Environmental Site Assessments, the Phase I ESA consisted of a review of available background and historical information; a visual site review; and a report of our findings. The purpose of the Phase I ESA was to determine the potential existence of contaminants and/or environmental concerns on the subject property.

Site History/ Description

The subject property, which is currently vacant and undeveloped (i.e., no buildings), is predominantly cultivated farmland and/or pasture land. A relict meltwater channel cuts runs diagonally from near the middle of the site towards the northeast corner of the site. A small farmyard is located (offsite) along the southern property boundary, while an acreage is located (offsite) across Township Road No. 383 proximate the northwest corner of the subject property.

Environmental Hazard Potential

Based on the information reviewed, and the observations made during the visual site review, the subject property is considered to have a low environmental hazard potential and no further investigation (i.e., Phase II ESA) is warranted at this time.

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LIST OF DRAWINGS

LIST OF APPENDICES

1.0 INTRODUCTION

A Phase I Environmental Site Assessment (ESA) was conducted for the property legally described as:

- *Legal Subdivisions (LSDs) 11 to 14, inclusive, Section 16, Township 38, Range 4, West of the Third Meridian (16-38-04-W3M), Rural Municipality (R.M.) of Corman Park No. 344, Saskatchewan.*

The subject property is located at the southeast intersection of Range Road No. 3044 and Township Road No. 383, approximately 10 km to the northeast of the City of Saskatoon, in the R.M. of Corman Park No. 344, Saskatchewan.

The Terms of Reference for this investigation were presented in PMEL Proposal No. 9980, dated January 21, 2015. Written authorization (Purchase Order No. 44854, dated January 27, 2015) to perform this Phase I ESA was provided by Mr. Phil Ratzlaff, Land Division Manager, North Prairie Developments, on January 27, 2015. A visual site review of the subject property was conducted on February 2, 2015.

In accordance with the Canadian Standards Association (CSA Z768-01 (R2012)) Standards for Phase I Environmental Site Assessments, the Phase I ESA consisted of a review of available background and historical information; a visual site review; and a report of our findings. The purpose of the Phase I ESA was to determine the potential existence of contaminants and/or environmental concerns on the subject property.

2.0 REVIEW OF BACKGROUND AND HISTORICAL INFORMATION

Historical information available for the subject property was reviewed to identify potential environmental concerns, which may not be evident, based on current site conditions. Information sources available and reviewed for the subject property included: aerial (stereo pair) photographs; Land Titles records; zoning records; fire department records; and an environmental file search of Saskatchewan Environments files.

In addition to the above, a review of general background information for the site and area was conducted. Items collected and reviewed included topographic and geologic maps and hydrogeological studies.

2.1 Site Description

The layout of the site at the time of investigation is shown on the Key Plan and Surrounding Land Use Drawing No. 9980-1. The subject property, which is currently vacant and undeveloped (i.e., no buildings), is predominantly cultivated farmland and/or pasture land. A relict meltwater channel cuts runs diagonally from near the middle of the site towards the northeast corner of the site. A small farmyard is located (offsite) along the southern property boundary, while an acreage is located (offsite) across Township Road No. 383 proximate the northwest corner of the subject property.

2.2 Background Information

2.2.1 Physiography and Regional Geology

A review of published physiography and regional geological information (Action et al. 1960, Christiansen, 1967) revealed the following:

1. The subject property lies in the physiographic region known as the Saskatchewan Rivers Plain.
2. The Saskatchewan Rivers Plain is characterized as gently undulating to rolling glacial lacustrine-alluvial (glacial lake) plains, aeolian plains (dunes) and till plains.
3. The surficial soil deposits consist of variable textured lacustrine and alluvial sands, silts and clays, aeolian sands, glacial till and local bedrock exposures in the South Saskatchewan River.
4. The bedrock deposits at this site consisted of approximately 90 m of glacial till and stratified drift (sand, silt and clay) underlain by the noncalcareous silt and clay of the Lea-Park Formation-Upper Colorado.

A review of Google Earth (cited February 10, 2015) revealed that the land surface elevation at the site was approximately 493 m (Geodetic) and slopes gradually downward to approximate elevation 470 m at the South Saskatchewan River, located at its nearest point approximately 800 m to the southeast.

2.2.2 Hydrogeology

An examination of hydrogeological data (Christiansen, 1967, Meneley, 1982) for this region revealed the following observations:

1. The primary source of water in this region is drift aquifers above or between glacial till strata and the Empress Group (Tyner Valley Aquifer) between the base of the glacial till and the surface of the bedrock.

2. The Tyner Valley Aquifer system (Empress Group) is the most extensive and potentially productive aquifer in the Saskatoon region. The Tyner Valley Aquifer is utilized for dairy and stock raising operations.
3. The South Saskatchewan River is a discharge receptor for many of the aquifer systems in the Saskatoon area. The inferred regional groundwater flow would be in a southeasterly direction towards the South Saskatchewan River.
4. The closest major surface water body to the site is the South Saskatchewan River, located approximately 800 m west of the subject property.
5. The subject property is located in a region of groundwater recharge.
6. It is unlikely that a good supply of potable groundwater is located beneath the subject property.
7. The base of groundwater exploration is the bedrock surface which is expected to be located at depth of approximately 100 m below grade.
8. Potential water bearing zones at the site would include sand beds in the Floral Formation at a depth of 15 to 25 m and sand beds in the Empress Group just above the bedrock surface.
9. The water in these potential aquifers is generally too mineralized to be used for municipal water supply purposes.

2.2.3 Water and Sewer

There is currently no water supply at the site. A search of the Water Security Agency (WSA) water well database (gis.wsask.ca, cited January 28, 2015) revealed that a registered groundwater well is located on the same quarter section as the subject property (i.e., NW-16-38-4-W3M). The well use is listed as domestic and the completion depth is 55 m below grade.

2.3 Air Photograph Review

Historical aerial photographs dated 1966, 1974, 1985, 2002 and 2014 were obtained for the site and examined to identify site specific land-use which may have resulted in environmental concerns on and/or adjacent to the site. Select aerial photographs have been included in Appendix A. A summary of observations made has been presented below.

1966: The subject property and surrounding land use appear to be predominantly cultivated farmland. A farmyard is located along the south property line.

1974: Relatively consistent with 1966 observations. Range Road No. 3044 is visible adjacent to the west property line of the site.

1985: Township Road No. 383 has been extended along the north side of the subject property. A farmyard is now visible (offsite) to the north of the northwest corner of the subject property. A road (cul-de-sac) has been constructed for development of residential area and is visible to the distant east of the site.

2002: Relatively consistent with 1985 observations. New houses have been constructed at the residential area located to the east of the subject property.

2014: Relatively consistent with 2002 observations and with the current level of development.

2.4 Zoning

The subject property is zoned as Agricultural.

2.5 Street Directories

No street directories (e.g. Henderson Directory Listings) were available for the R.M. of Corman Park.

2.6 Land Titles Search

Review of the land titles for the site revealed that the current owner of the subject property is 101152283 Saskatchewan Ltd. A summary of the Chain of Title is presented in Appendix B. Review of the Chain of Title did not reveal any potential environmental concerns for the subject property.

2.7 Fire Insurance Plans

No fire insurance plans were available for the R.M. of Corman Park No. 344.

2.8 Saskatchewan Assessment Management Agency (SAMA)

A search of the SAMA tax records for the subject property revealed that the site is listed as agricultural land and no development (i.e., buildings) is located on the property. A copy of the search is presented in Appendix C.

2.9 Saskatchewan Environment File Search

A search of the Saskatchewan Ministry of Environment (SKMoE) files for the subject properties revealed the following:

1. The subject property is not registered pursuant to the Hazardous Substances and Waste Dangerous Goods Regulations; and
2. There were no reported spills pursuant to the Environmental Spill Control Regulations.

2.10 R.M. of Corman Park No. 344 Building Permits

A file search conducted by the R.M. of Corman Park No. 344 revealed that no building permits have been issued for the subject property.

2.11 ERIS ECOLOG Database Report

An ERIS ECOLOG database report search was conducted for the subject property. The database report provides the search results of various Federal, Provincial and Private Source databases for a 250 m radius surrounding the subject property. Review of the report did not reveal any environmental concerns associated with or located near the subject property. The report identified that five wells are located within an approximately 500 m radius of the subject property. A copy of the search is presented in Appendix D.

2.12 Interviews

A solicited interview, conducted on February 10, 2015, with Mr. Phil Ratzlaff, Land Division Manager, North Prairie Developments Ltd. revealed the following:

1. Mr. Ratzlaff has been loosely associated with the property for 6 years.
2. The subject property is vacant (i.e., no buildings).
3. The subject property consists of approximately one-third of ravine habitat and two-thirds of cultivated farmland.
4. Nothing is buried or burned at the site.
5. There are no air quality concerns.
6. There is no wood preserving/treating on the subject property.
7. Nothing is buried or burned at the site.
8. There are no air quality concerns.
9. There is no wood preserving/treating on the subject property.
10. No other environmental reports have been completed for the subject property.
11. There are no environmental concerns (i.e., spills) for the subject property.
12. No underground and aboveground storage tanks are known to exist at the subject property.

2.13 Previous Investigations

AGRA Earth & Environmental Limited (AGRA) conducted a geotechnical and hydrogeological study at the site (refer to AGRA Report No. SX-02099, dated December 21, 1995). The scope of this study did not include environmental considerations.

3.0 VISUAL SITE REVIEW

PMEL personnel conducted a visual site review of the subject property and surrounding area on February 2, 2015. Select photographs taken of the subject property have been included in Appendix E, while brief summaries of the observations made during the visual site review are presented in the following sub-sections.

3.1 Property

1. The subject property is currently vacant (no buildings) and predominantly cultivated farmland.
2. A slough is located offsite, to the east of the subject property.
3. Overhead utility lines border the west side of the site.
4. Farmyards are present (offsite) to the north and south of the subject property.
5. The subject property was snow covered at the time of investigation.

3.2 Surrounding Land Use

As shown on Drawing No. 9980-1, surrounding land use in the vicinity of the site includes the following:

North: A gravel road (Township Road 383), followed by land under agricultural cultivation.

South: A farmyard followed by land under agricultural cultivation.

East: A rural residential development.

West: A gravel road (Range Road 3044) followed by land under agricultural cultivation.

3.3 Waste Management

3.3.1 Liquid Waste

No liquid waste is currently generated at the subject property.

3.3.2 Solid Waste

No solid waste is currently generated at the subject property.

3.3.3 Hazardous Substances and Waste Dangerous Goods

No hazardous substances or waste dangerous goods exist on the subject property.

3.4 Storage Tanks

No Aboveground Storage Tanks (ASTs) or visible evidence of Underground Storage Tanks (USTs) (i.e., pump islands, vent pipes etc.) were apparent at the site during the visual site review.

3.5 Surface Staining/Stressed Vegetation and Soil Fill

The subject property was snow covered at the time of the visual site review. As such, no stressed vegetation, surficial staining or soil fill were evident at the time of the site investigation.

3.6 Radon Potential

Radon is a naturally occurring radioactive gas originating from degradation of naturally occurring uranium in the soil. Radon gas can enter buildings by seeping through cracks in the foundation walls and floors. Since there are no buildings on the subject property, the potential for radon gas accumulation appears low.

3.7 Building Materials

Since there are no buildings located on the subject property, potentially hazardous building materials such as asbestos, Urea Formaldehyde Foam Insulation, PCB containing equipment, ozone depleting substances, lead paint, mercury, etc. are not likely to exist on the subject property.

3.8 Air Emissions

No obvious sources of adverse air emissions were present at the time of the visual site review.

3.9 Heating, Ventilation and Air-Conditioning (HVAC)

Since there are no buildings on the subject property, no HVAC equipment is present at the site.

3.10 Noise and Vibration

Aside from traffic, no obvious sources of adverse noise and/or vibration were apparent at the time of the visual site review.

3.11 Electromagnetic Fields (EMFs)

No high-tension transmission lines with the potential to generate significant Electromagnetic Fields (EMFs) were identified on the subject property.

3.12 Radioactive Materials/Radiation Sources

No radioactive sources requiring special licensing were apparent during the visual site review.

3.13 Neighbouring Properties

Based on historical information and observations made at the time of the visual site review, the risks associated with the properties surrounding the subject property appear low. It should be recognized that the precise nature of the activities carried out on the surrounding sites and their potential impacts to the subject site are outside the scope of this report. Potential contamination associated with surrounding land use cannot be confirmed without further investigation including detailed inspections of the surrounding properties.

4.0 ENVIRONMENTAL HAZARD POTENTIAL

Based on the information reviewed, and the observations made during the visual site review, the subject property is considered to have a low environmental hazard potential and no further investigation (i.e., Phase II ESA) is warranted at this time.

5.0 CLOSURE

A Phase I Environmental Site Assessment (ESA) was conducted for the property legally described as:

- *LSD 11 to 14, inclusive, 16-38-04-W3M, Rural Municipality (R.M.) of Corman Park No. 344, Saskatchewan.*

The subject property is located at the southeast intersection of Range Road No. 3044 and Township Road No. 383, approximately 10 km to the northeast of the City of Saskatoon, in the Rural Municipality of Corman Park No. 344, Saskatchewan.

The ESA consisted of a review of sequential aerial photographs, historical records, Provincial Land Titles, a visual site review, interviews and file searches conducted by the R.M. of Corman Park No. 344. If additional information becomes available regarding the environmental hazard potential of this site, our report and recommendations should be reviewed in the light of any new information.

The Phase I ESA report has been prepared for North Prairie Developments Ltd., and their agents for specific application to the above referenced site in the R.M. of Corman Park No. 344, Saskatchewan. It has been prepared in accordance with generally accepted geoenvironmental engineering practices and no other warranty, express or implied, is made.

Any uses which a Third Party makes of this report, or any reliance on decisions to be made based on it, are the responsibility of such Third Parties. P. Machibroda Engineering Ltd. and/or it's employees, servants and agents accepts no responsibility for damages, if any, suffered by any Third Party as a result of decisions made or actions based on this report.

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

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

P. MACHIBRODA ENGINEERING LTD.

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
Geoenvironmental 6687
15-02-17

Tomasz Korbas, M.Sc., Engineer In Training

Ray Machibroda, P. Eng., M.Sc.

TK:RM:zz

6.0 REFERENCES

Acton, D. F., Clayton, J. S., Ellis, J. G., Christiansen, E. A., and Kupsch, W. O. 1960. Physiographic Divisions of Saskatchewan. Saskatchewan Research Council, Map No. 1.

Christiansen, E. A., 1967. Geology and Groundwater Resources of the Saskatoon Area (73-B), Saskatchewan, Saskatchewan Research Council, Geology Division, Saskatoon, Canada, Map No. 7.

Meneley, W.A., 1982. Groundwater Availability NE16-38-4-W3. W.A. Meneley Consultants Ltd., April 22, 1982.

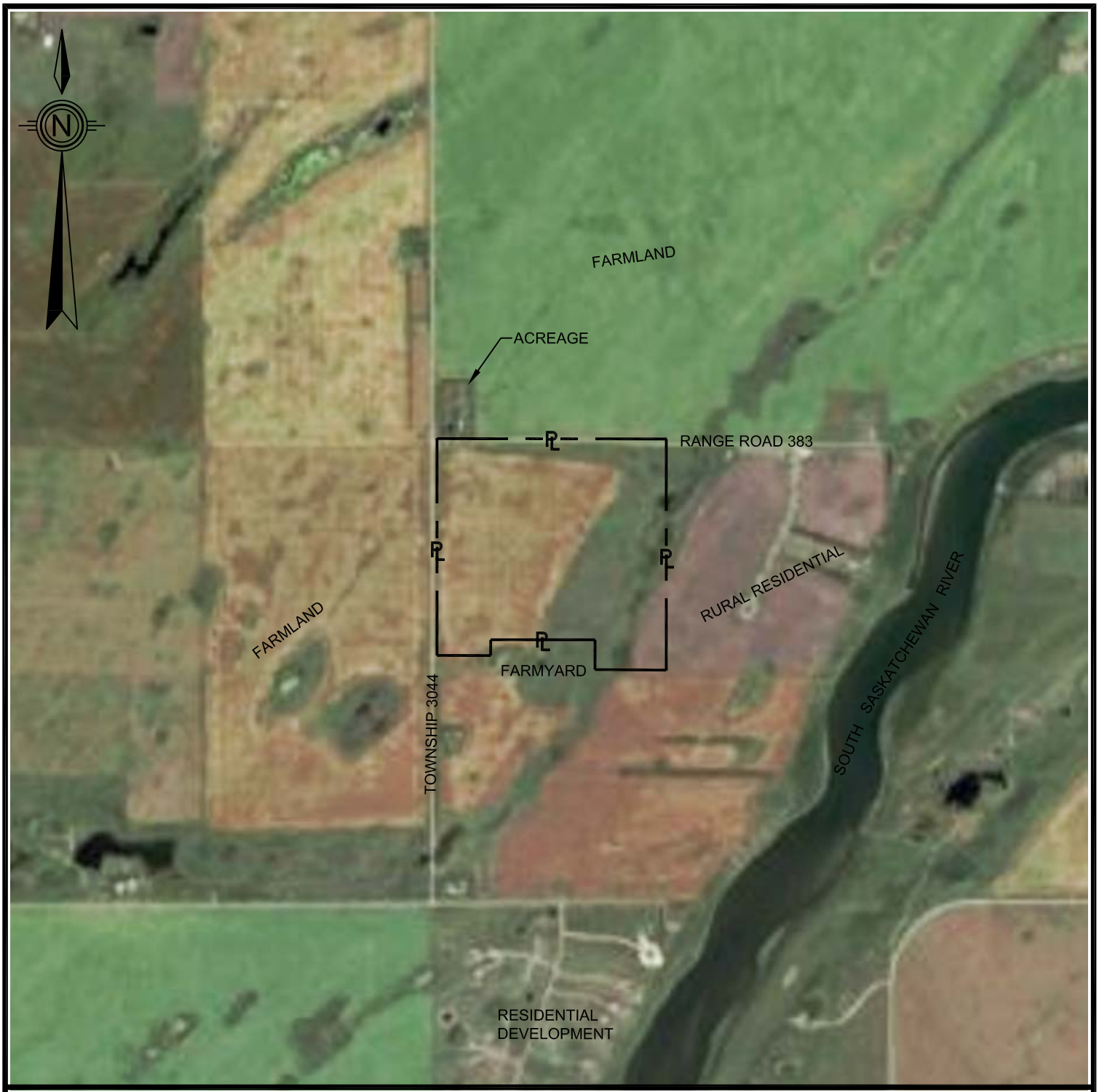
7.0 QUALIFICATIONS OF ASSESSORS

Tomasz Korbas, Engineer-in-Training, has a Master Degree in Civil Engineering from the University of Saskatchewan. He has conducted Phase I Environmental Site Assessments at both residential and commercial properties. He also has experience with Phase II Assessments and remediation of petroleum hydrocarbon and metal impacted sites.

Ray Machibroda, P. Eng, M.Sc. is a senior geoenvironmental engineer with over 20 years of experience. He has conducted hundreds of Environmental Site Assessments and is experienced in both assessment and remediation of sites including industrial, commercial and residential properties. His experience also includes assessment of landfills and sewage lagoons, risk assessments, and Brownfield redevelopment.

P. MACHIBRODA
ENGINEERING LTD.
CONSULTING
GEOTECHNICAL/GEOENVIRONMENTAL
ENGINEERS

DRAWINGS



NOTE:
1. THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.
2. THIS DRAWING WAS COMPILED FROM GOOGLE EARTH PRO ©2015, IMAGE ©2015 DIGITALGLOBE, (IMAGERY DATE: 8/17/14).

LEGEND	PL – PROPERTY LINE

CONSULTING
GEOENVIRONMENTAL
GEOTECHNICAL
ENGINEERS

P. MACHIBRODA ENGINEERING LTD.

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

DRAWING TITLE:

KEY PLAN AND SURROUNDING LAND USE

PROJECT:

PHASE I - ENVIRONMENTAL SITE ASSESSMENT
WHISPER RIVER ESTATES PHASE II, WITHIN NW-16-38-14-W3M, SK

APPROVED BY:	DRAWN BY:	DRAWING NUMBER:
TK	TP	9980-1
DATE: FEBRUARY, 2015	SCALE: NOT TO SCALE	

APPENDIX A
Aerial Photographs

NOTE:
1. THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.
2. THIS DRAWING WAS COMPILED FROM GOOGLE EARTH PRO ©2015, IMAGE ©2015 DIGITALGLOBE, (IMAGERY DATE: 08/17/14).

LEGEND	PL – PROPERTY LINE

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GEOTECHNICAL
ENGINEERS

P. MACHIBRODA ENGINEERING LTD.

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

DRAWING TITLE:

AERIAL PHOTOGRAPH(2014)

PROJECT:

PHASE I - ENVIRONMENTAL SITE ASSESSMENT
WHISPER RIVER ESTATES PHASE II WITHIN NW-16-38-04-W3M, SK

APPROVED BY:	DRAWN BY:	DRAWING NUMBER:
TK	TP	9980-2014
DATE:	SCALE:	
FEBRUARY, 2015	NOT TO SCALE	

NOTE:
1. THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.
2. THIS DRAWING WAS COMPILED FROM GOOGLE EARTH PRO ©2015, IMAGE ©2015 DIGITALGLOBE, (IMAGERY DATE: 09/20/02).

LEGEND	PL – PROPERTY LINE

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GEOTECHNICAL
ENGINEERS

P. MACHIBRODA ENGINEERING LTD.

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

DRAWING TITLE:

AERIAL PHOTOGRAPH(2002)

PROJECT:

PHASE I - ENVIRONMENTAL SITE ASSESSMENT
WHISPER RIVER ESTATES PHASE II, WITHIN NW-16-38-04-W3M, SK

APPROVED BY:	DRAWN BY:	DRAWING NUMBER:
TK	TP	9980-2002
DATE: FEBRUARY, 2015	SCALE: NOT TO SCALE	

NOTE:
1. THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.
2. THIS DRAWING WAS COMPILED FROM EMR AERIAL PHOTOGRAPH: A26677-115.

LEGEND	PL – PROPERTY LINE

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GEOTECHNICAL
ENGINEERS

P. MACHIBRODA ENGINEERING LTD.

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

DRAWING TITLE:

AERIAL PHOTOGRAPH(1985)

PROJECT:

PHASE I - ENVIRONMENTAL SITE ASSESSMENT
WHISPER RIVER ESTATES PHASE II, WITHIN NW-16-38-04-W3M, SK

APPROVED BY:	DRAWN BY:	DRAWING NUMBER:
TK	TP	9980-1985
DATE: FEBRUARY, 2015	SCALE: NOT TO SCALE	

NOTE:
1. THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.
2. THIS DRAWING WAS COMPILED FROM AERIAL PHOTOGRAPH: BR74365-129.

LEGEND	PL – PROPERTY LINE

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

DRAWING TITLE:

AERIAL PHOTOGRAPH(1974)

PROJECT:

PHASE I - ENVIRONMENTAL SITE ASSESSMENT
WHISPER RIVER ESTATES PHASE II, WITHIN NW-16-38-04-W3M, SK

APPROVED BY:	DRAWN BY:	DRAWING NUMBER:
TK	TP	9980-1974
DATE: FEBRUARY, 2015	SCALE: NOT TO SCALE	

NOTE:
1. THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.
2. THIS DRAWING WAS COMPILED FROM AERIAL PHOTOGRAPH: A19795-1.

LEGEND	PL – PROPERTY LINE

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ENGINEERS

P. MACHIBRODA ENGINEERING LTD.

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

DRAWING TITLE:

AERIAL PHOTOGRAPH(1966)

PROJECT:

PHASE I - ENVIRONMENTAL SITE ASSESSMENT
WHISPER RIVER ESTATES PHASE II, WITHIN NW-16-38-04-W3M, SK

APPROVED BY:	DRAWN BY:	DRAWING NUMBER:
TK	TP	9980-1966
DATE: FEBRUARY, 2015	SCALE: NOT TO SCALE	

APPENDIX B
Land Titles

Legal Description: LSD 11, Ext. 61, 12, Ext. 62, 13, Ext. 59, 14, Ext. 60, in the NW-1638-4-W3M, RM of Corman Park No. 344, Saskatchewan

Date	Certificate of Title	Remarks
November 17, 2009	101152283 Saskatchewan Ltd.	LSD 11 to 14
July 30, 2002	624098 Saskatchewan Ltd.	LSD 11 to 14
December 17, 1998	624098 Saskatchewan Ltd.	LSD 11 to 14
October 30, 1995	Marksview Farms Ltd.	LSD 13 & 14
July 28, 1993	Marksview Farms Ltd.	LSD 11 & 12
September 18, 1991	Victor D. Unruh	LSD 11 & 12
May 5, 1978	Robert Grenville Murdock	LSD 13 & 14
May 3, 1978	Victor D. Unruh	LSD 11 & 12
December 31, 1976	Jacob Unruh	LSD 11 to 14
December 1960	Jacob Unruh	NW-16-38-4-W3M
May 20, 1941	Lena Nasserden	W1/2-16-38-4-W3M
December 1, 1925	Abdul Haddu Nasserden (farmer)	NW-16-38-4-W3M
May 5, 1892	The Temperance Colonization Society Limited	NW-16-38-4-W3M
Grant November 27, 1891	The Temperance Colonization Society Limited	NW-16-38-4-W3M

APPENDIX C

SAMA

Tax Assessment Sheets

sama View

1/28/2015

Map

N

LEGEND

PROPERTY
- Non-SAMA
- SAMA

PROVINCIAL BOUNDARY

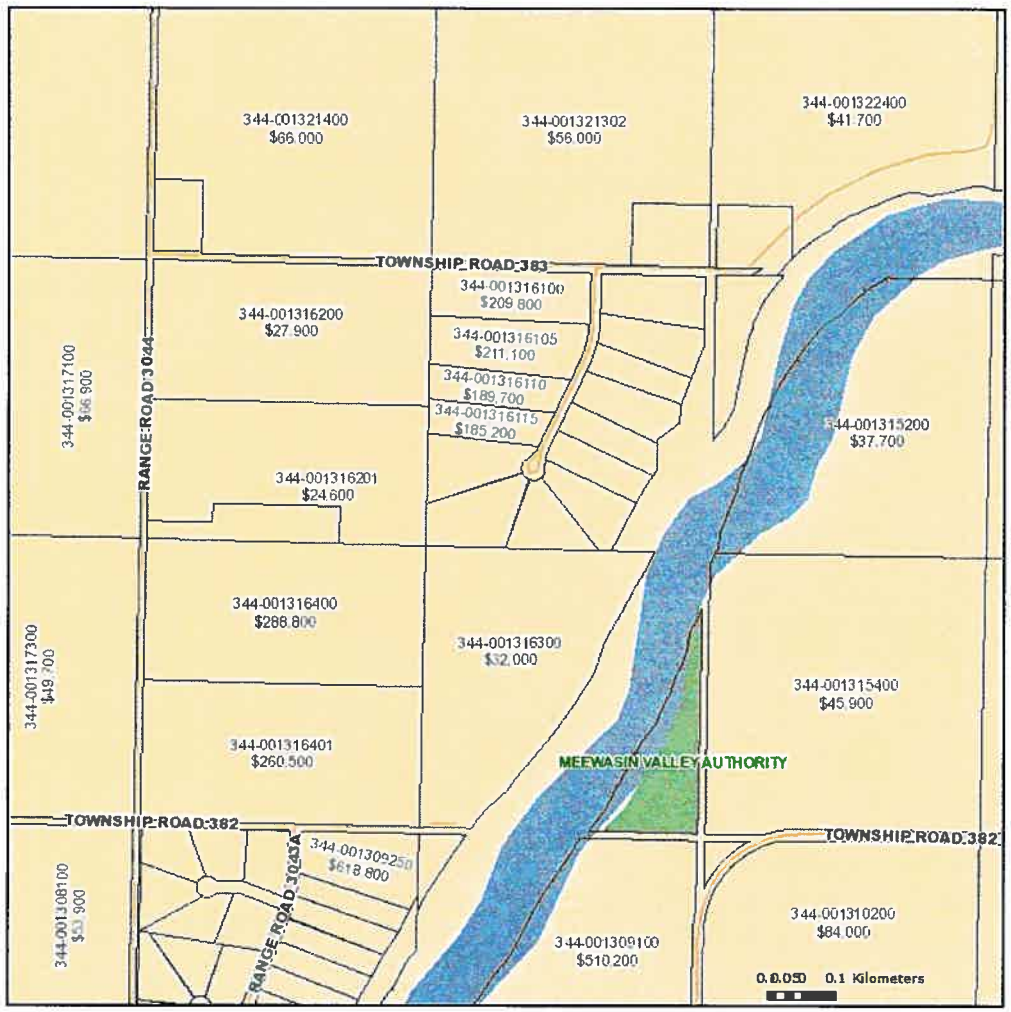
STREETS_AND_ROADS
- 3
- 2
- 1

WATERBODY

PARK

INDIAN RESERVE

PROVINCIAL BOUNDARY



Details Report

Print

Today's Date: Wednesday, January 28, 2015

PROPERTY INFORMATION

Parcel I.D.: **203613237** Assessment ID Number: **344-001316200**

Please click the link **Property Report** for more detailed property information.

Note: If you find any data discrepancies on this page, please go to the Contact Us page to report them to the local office.

Property Information

Address:	
Municipality:	**CORMAN PARK (RM)**
Roll Status:	**2014 - Balanced**
Last Updated:	**Tuesday, January 06, 2015**
Property Last Updated:	**Monday, August 24, 1998**
Neighbourhood:	**140**
Legal Land Description (LLD):	**Qtr N 1/2 NW Sec 16 Tp 38 Rg 04 W 3 Sup**
Tax Class and Percentage Adjustment:	**Other Agricultural**
Predominant Use:	**Arable Land**
Valuation Method:	**Cost Approach**
100% Assessed Value:	**$27,900**

Value Information

Component	Liability Sub-division	100% Assessed Value	Tax Class and Percentage Adjustment	Total Assessed Value after % Adjustment	Taxable Assessed Value	Exempt Assessed Value	Over-Ride Reason
Land	1	$27,900	Other Agricultural 55%	$15,345	$15,345	$0	
Total		$27,900		$15,345	$15,345	$0	

Property Report

Property Use: Arable Land

Print Date: 28-Jan-2015

Municipality Name: CORMAN PARK (RM)

Assessment ID Number: 344-001316200 **PID:** 203613237

Civic Address:

Legal Location: Qtr N 1/2 NW Sec 16 Tp 38 Rg 04 W 3 Sup

Supplementary:

School Division:	206	**Inspected Date:**	24-Aug-1998
Neighborhood:	140	**Change Reason:**	
Title Acres:	80.000	**Year / Frozen ID:**	2014/-80
Puse Code:	Arable Land	**Call Back Year:**	
Predom Code:		**Method_in_use:**	C.A.M.A. - Cost

Assessed & Taxable/Exempt Values (Summary)

Description	Assessed Values	Liability Subdivision	Tax Class	Percentage of value	Taxable	Exempt	VA	Tax Status
Agricultural	27,900	1	Other Agricultural	55%	15,345			Taxable
Total of Assessed Values	27,900			Total of Taxable/Exempt Values:	15,345			

AGRICULTURAL ARABLE LAND

Acres	Land Use
45	K - [CULTIVATED] FIELD CROP PRODUCTN

Productivity Determining Factors	
Soil assocation 1	BG - [BIGGAR]
Soil texture 1	SL - [SANDY LOAM]
Soil profile 1	OR8 - [CHERN-ORTH (CA 7-9)]
Soil assocation 2	ME - [MEOTA]
Soil texture 3	SL - [SANDY LOAM]
Soil texture 4	
Soil profile 2	OR10 - [CHERN-ORTH (CA 9-12)]
Top soil depth	ER25
	ER10

Economic and Physical Factors	
Topography	T1: Level to nearly level
Stones (qualities)	S1: None to few
Natural hazard	DW: Shallow Draw Rate: 0.98

Rating	
$/ACRE	406.36
Final	41.59

Data Source: Govern_Prod

AGRICULTURAL PASTURE LAND

Acres	Land Use	Productivity Determining Factors		Productivity Determining Factors		Rating	
5	ASP - [ASPEN PASTURE]	Soil assocation 1	BG - [BIGGAR]	Range site	SY: SANDY	$/ACRE	127.65
	NATIVE RANGELAND	Soil texture 1	SL - [SANDY LOAM]	Pasture Type	N - [Native]		
		Soil texture 2		Pasture Topography	T1: Level 0-2.5% Slopes		
				Grazing water source	Y: Yes		
				Pasture Tree Cover	ASP - [ASPEN]		
		Soil assocation 2	ME - [MEOTA]				
		Soil texture 3	SL - [SANDY LOAM]				
		Soil texture 4					
30	NG - [NATIVE GRASS]	Soil assocation 1	BG - [BIGGAR]	Range site	SY: SANDY	$/ACRE	297.85
	NATIVE RANGELAND	Soil texture 1	SL - [SANDY LOAM]	Pasture Type	N - [Native]		
		Soil texture 2		Pasture Topography	T1: Level 0-2.5% Slopes		
				Grazing water source	Y: Yes		
				Pasture Tree Cover	NO - [NO]		
		Soil assocation 2	ME - [MEOTA]				
		Soil texture 3	SL - [SANDY LOAM]				
		Soil texture 4					

Details Report

Print

Today's Date: Wednesday, January 28, 2015

PROPERTY INFORMATION

Parcel I.D.: **203613245** Assessment ID Number: **344-001316201**

Please click the link **Property Report** for more detailed property information.

Note: If you find any data discrepancies on this page, please go to the Contact Us page to report them to the local office.

Property Information

Address:	
Municipality:	**CORMAN PARK (RM)**
Roll Status:	**2014 - Balanced**
Last Updated:	**Tuesday, January 06, 2015**
Property Last Updated:	**Thursday, August 27, 1998**
Neighbourhood:	**140**
Legal Land Description (LLD):	**Qtr S 1/2 NW Sec 16 Tp 38 Rg 04 W 3 Sup 01**
Tax Class and Percentage Adjustment:	**Other Agricultural**
Predominant Use:	**Arable Land**
Valuation Method:	**Cost Approach**
100% Assessed Value:	**$24,600**

Value Information

Component	Liability Sub-division	100% Assessed Value	Tax Class and Percentage Adjustment	Total Assessed Value after % Adjustment	Taxable Assessed Value	Exempt Assessed Value	Over-Ride Reason
Land	1	$24,600	Other Agricultural 55%	$13,530	$13,530	$0	
Total		$24,600		$13,530	$13,530	$0	

SASKATCHEWAN ASSESSMENT MANAGEMENT AGENCY

Property Report

Property Use: Arable Land

Print Date: 28-Jan-2015

Municipality Name: CORMAN PARK (RM)

Assessment ID Number: 344-001316201 **PID:** 203613245

Civic Address:

Legal Location: Qtr S 1/2 NW Sec 16 Tp 38 Rg 04 W 3 Sup 01

Supplementary: EXCEPT: 11.84 AC

School Division: 206
Neighborhood: 140
Title Acres: 68.160
Puse Code: Arable Land
Predom Code:

Inspected Date: 27-Aug-1998
Change Reason:
Year / Frozen ID: 2014/-80
Call Back Year:
Method_in_use: C.A.M.A. - Cost

Assessed & Taxable/Exempt Values (Summary)

Description	Assessed Values	Liability Subdivision	Tax Class	Percentage of value	Taxable	Exempt	VA	Tax Status
Agricultural	24,600	1	Other Agricultural	55%	13,530			Taxable
Total of Assessed Values	24,600			Total of Taxable/Exempt Values:	13,530			

AGRICULTURAL ARABLE LAND

Acres	Land Use
40	K - [CULTIVATED]
	FIELD CROP PRODUCTN

Productivity Determining Factors	
Soil assocation 1	BG - [BIGGAR]
Soil texture 1	SL - [SANDY LOAM]
Soil profile 1	OR8 - [CHERN-ORTH (CA 7-9)]
Soil assocation 2	ME - [MEOTA]
Soil texture 3	SL - [SANDY LOAM]
Soil texture 4	
Soil profile 2	OR10 - [CHERN-ORTH (CA 9-12)]
Top soil depth	ER25
	ER10

Economic and Physical Factors	
Topography	T1: Level to nearly level
Stones (qualities)	S1: None to few
Natural hazard	DW: Shallow Draw Rate: 0.98

Rating	
$/ACRE	406.36
Final	41.59

AGRICULTURAL PASTURE LAND

Acres	Land Use
28	NG - [NATIVE GRASS]
	NATIVE RANGELAND

Productivity Determining Factors	
Soil assocation 1	BG - [BIGGAR]
Soil texture 1	SL - [SANDY LOAM]
Soil texture 2	
Soil assocation 2	ME - [MEOTA]
Soil texture 3	SL - [SANDY LOAM]
Soil texture 4	

Productivity Determining Factors	
Range site	SY: SANDY
Pasture Type	N - [Native]
Pasture Topography	T1: Level 0-2.5% Slopes
Grazing water source	Y: Yes
Pasture Tree Cover	NO - [NO]

Rating	
$/ACRE	297.85

Data Source: Govern_Prod

APPENDIX D

ERIS ECOLOG Database Search

ENVIRONMENTAL RISK INFORMATION SERVICE

DATABASE REPORT

Project Property:	*Whisper River Estates - Phase II* *Nw-16-38-4-W3m* *Rm Of Corman Park No. 344 SK*
P.O. Number	*464*
Report Type:	*Quote - Custom-Build Your Own Report*
Order #:	*20150129028*
Requested by:	*P. Machibroda Engineering Ltd.*
Date:	*February 3, 2015*

Ecolog ERIS Ltd.
Environmental Risk Information Service Ltd. (ERIS)
A division of Glacier Media Inc.
P: 1.866.517.5204
E: info@erisinfo.com

www.erisinfo.com

Table of Contents

Executive Summary

Property Information:

Project Property:	*Whisper River Estates - Phase II* *Nw-16-38-4-W3m Rm Of Corman Park No. 344 SK*
P.O. Number:	*464*

Order Information:

Order No.:	*20150129028*
Date Requested:	*04/02/2015*
Requested by:	*P. Machibroda Engineering Ltd.*
Report Type:	*Quote - Custom-Build Your Own Report*

Additional Products:

Executive Summary: Report Summary

Database	Name	Searched	Project Property	Boundary to 0.50km	Total
AUWR	Automobile Wrecking & Supplies	Y	0	0	0
CHEM	Chemical Register	Y	0	0	0
CONV	Convictions	Y	0	0	0
DIS	Wastewater Dischargers	Y	0	0	0
EEM	Environmental Effects Monitoring	Y	0	0	0
EHS	ERIS Historical Searches	Y	0	0	0
EIIS	Environmental Issues Inventory System	Y	0	0	0
ES	Environmental Spills	Y	0	0	0
FCON	Federal Convictions	Y	0	0	0
FCS	Contaminated Sites on Federal Land	Y	0	0	0
HMS	Hazardous Material Storage	Y	0	0	0
HORW	Horizontal Wells	Y	0	0	0
HSSS	Hazardous Substance Storage Sites	Y	0	0	0
HSST	Hazardous Substance Storage Tanks	Y	0	0	0
IAFT	Indian & Northern Affairs Fuel Tanks	Y	0	0	0
ILOA	Intensive Livestock Operation Approvals	Y	0	0	0
MINE	Canadian Mine Locations	Y	0	0	0
MNR	Mineral Occurences	Y	0	0	0
NATE	National Analysis of Trends in Emergencies System (NATES)	Y	0	0	0
NDFT	National Defence & Canadian Forces Fuel Tanks	Y	0	0	0
NDSP	National Defence & Canadian Forces Spills	Y	0	0	0
NDWD	National Defence & Canadian Forces Waste Disposal Sites	Y	0	0	0
NEES	National Environmental Emergencies System (NEES)	Y	0	0	0
NPCB	National PCB Inventory	Y	0	0	0
NPRI	National Pollutant Release Inventory	Y	0	0	0
OGS	Upstream Oil & Gas Site Spills	Y	0	0	0
OGW	Oil and Gas Wells	Y	0	0	0
PAP	Canadian Pulp and Paper	Y	0	0	0
PCFT	Parks Canada Fuel Storage Tanks	Y	0	0	0
PES	Pesticide Register	Y	0	0	0
RST	Retail Fuel Storage Tanks	Y	0	0	0
SCT	Scott's Manufacturing Directory	Y	0	0	0
WDS	Waste Disposal Site Inventory	Y	0	0	0
WWIS	Water Well Information System	Y	1	5	6
	Total:		1	5	6

Executive Summary: Site Report Summary - Project Property

Map Key	DB	Company/Site Name	Address	Dir/Dist m	Elev diff m	Page Number
1	WWIS		SK	-/0.0	491.80	9

Executive Summary: Site Report Summary - Surrounding *Properties*

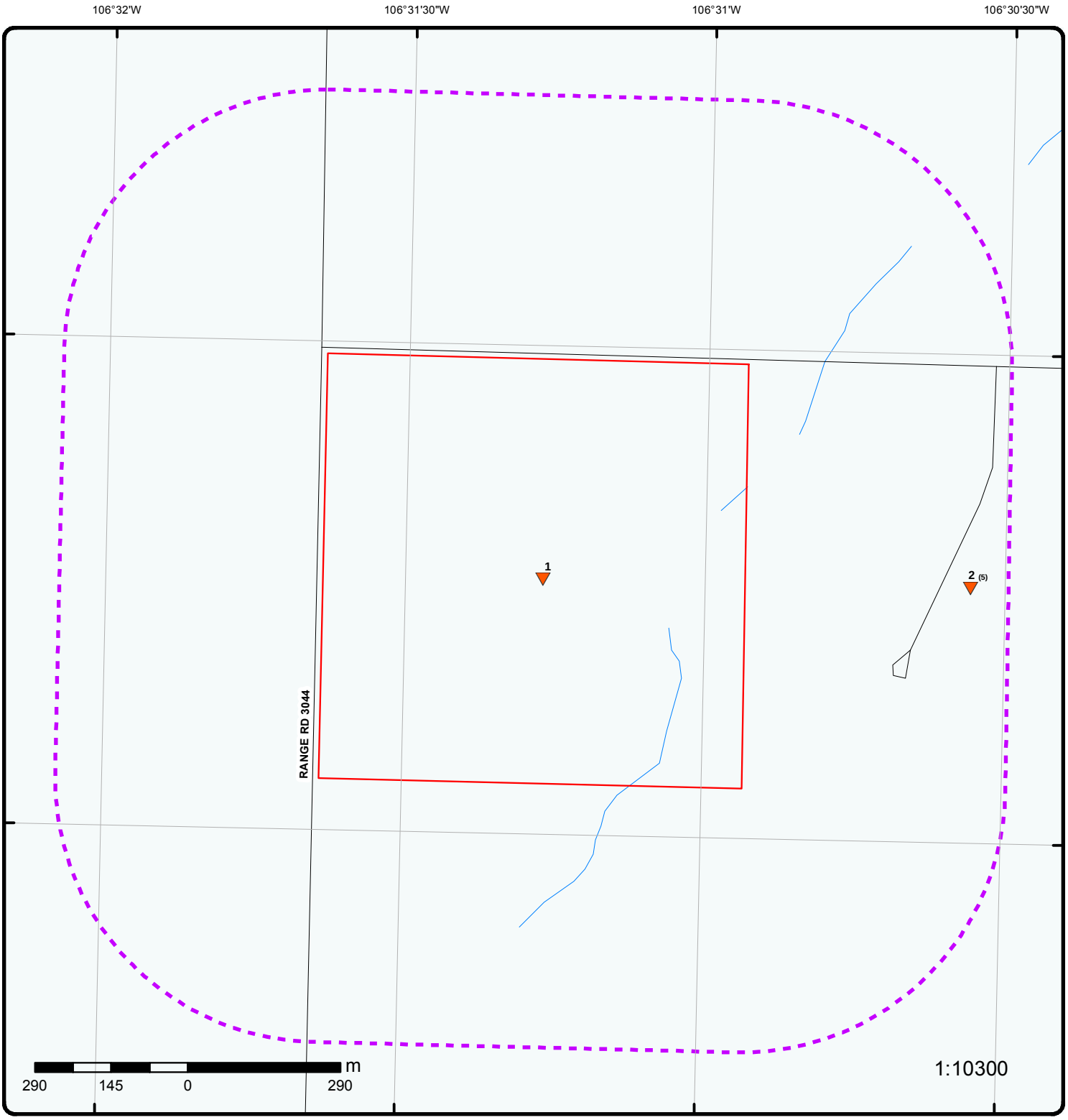
Map Key	DB	Company/Site Name	Address	Dir/Dist m	Elev diff m	Page Number
2	WWIS		SK	E/428.4	490.86	9
2	WWIS		SK	E/428.4	490.86	10
2	WWIS		SK	E/428.4	490.86	11
2	WWIS		SK	E/428.4	490.86	11
2	WWIS		SK	E/428.4	490.86	12

Executive Summary: Summary By Data Source

WWIS - Water Well Information System

A search of the WWIS database, dated 1900-Jun 2010 has found that there are 6 WWIS site(s) within approximately 0.50 kilometers of the project property.

Site	Address	Distance m	Map Key
	SK	0.0	1
	SK	428.4	2
	SK	428.4	2
	SK	428.4	2
	SK	428.4	2
	SK	428.4	2



Map

Order No: 20150129028

Address: Nw-16-38-4-W3m, Rm Of Corman Park No. 344, SK

- Project Property
- Buffer Outline
- Eris Sites with Higher Elevation
- Eris Sites with Same Elevation
- Eris Sites with Lower Elevation
- Eris Sites with Unknown Elevation
- Expressway
- Principal Highway
- Secondary Highway
- Major Road
- Local road
- Trail
- Proposed Road
- Ferry Route/Ice Road
- Industrial and Resource - Regions
- Main Line
- Sidetrack
- Transit Line
- Abandoned Line
- National Park
- Provincial or Territorial Park
- Other Park
- Golf Course or Driving Range
- Park or Sports Field
- Other Recreation Area

Aerial

Order No: 20150129028

Address: Nw-16-38-4-W3m, Rm Of Corman Park No. 344, SK

Source: ESRI World Imagery, Updated October 2014

Detail Report

Map Key	Number of Records	Direction/ Distance m	Elevation m	Site	DB
1	1 of 1	-/0.0	491.8	SK	WWIS

Driller Report #: 074054
Depth (ft): 180
Water Use: Domestic
Method Well Developed: Drilled
Municipality:
Completed Date: 2/7/1983
Elevation (ft): 1625
Well Use: Water Test Hole
DLS Coordinates: NW1/4-16-38-04-3

--- Details ---

Depth (ft):	1	*Colour:*	Unknown
Material:	Topsoil	*Description:*	Unknown
+			
Depth (ft):	2	*Colour:*	White
Material:	Clay	*Description:*	Silty
+			
Depth (ft):	5	*Colour:*	Brown
Material:	Sand & Gravel	*Description:*	Unknown
+			
Depth (ft):	10	*Colour:*	Brown
Material:	Clay	*Description:*	Till Streaks
+			
Depth (ft):	140	*Colour:*	Grey
Material:	Clay	*Description:*	Cemented
+			
Depth (ft):	153	*Colour:*	Grey
Material:	Sand	*Description:*	Silty
+			
Depth (ft):	180	*Colour:*	Grey
Material:	Clay	*Description:*	Cemented

Map Key	Number of Records	Direction/ Distance m	Elevation m	Site	DB
2	1 of 5	E/428.4	490.9	SK	WWIS

Driller Report #: 073985
Depth (ft): 160
Water Use: Domestic
Method Well Developed: Drilled
Municipality:
Completed Date: 1/19/1983
Elevation (ft): 1625
Well Use: Water Test Hole
DLS Coordinates: NE1/4-16-38-04-3

--- Details ---

Depth (ft):	5	*Colour:*	Brown
Material:	Till	*Description:*	Sandy
+			
Depth (ft):	10	*Colour:*	Brown
Material:	Sand	*Description:*	Clayey
+			

Map Key	Number of Records	Direction/ Distance m	Elevation m	Site	DB

Depth (ft):	14	*Colour:*	Brown
Material:	Till	*Description:*	Boulders
+			
Depth (ft):	140	*Colour:*	Grey
Material:	Till	*Description:*	Boulders
+			
Depth (ft):	142	*Colour:*	Grey
Material:	Sand	*Description:*	Fine
+			
Depth (ft):	160	*Colour:*	Grey
Material:	Till	*Description:*	Boulders

2 **2 of 5** **E/428.4** **490.9** **SK** **WWIS**

Driller Report #:	116811	*Completed Date:*	8/24/1983
Depth (ft):	380	*Elevation (ft):*	1634
Water Use:	Research	*Well Use:*	Soil Test Hole
Method Well Developed:	Drilled	*DLS Coordinates:*	NE1/4-16-38-04-3
Municipality:	CORMAN PARK RM OF		

--- Details ---

Depth (ft):	10	*Colour:*	Grey
Material:	Silt	*Description:*	Clayey
+			
Depth (ft):	13	*Colour:*	Unknown
Material:	Sand & Gravel	*Description:*	Silty
+			
Depth (ft):	23	*Colour:*	Grey
Material:	Till	*Description:*	Sandy
+			
Depth (ft):	85	*Colour:*	Grey
Material:	Till	*Description:*	Clayey
+			
Depth (ft):	175	*Colour:*	Grey
Material:	Till	*Description:*	Sand Streaks
+			
Depth (ft):	220	*Colour:*	Grey
Material:	Till	*Description:*	Calcareous
+			
Depth (ft):	233	*Colour:*	Unknown
Material:	Till	*Description:*	Sand Streaks
+			
Depth (ft):	243	*Colour:*	Grey
Material:	Till	*Description:*	Calcareous
+			
Depth (ft):	334	*Colour:*	Grey
Material:	Sand	*Description:*	Medium-coarse
+			
Depth (ft):	360	*Colour:*	Grey

Map Key	Number of Records	Direction/ Distance m	Elevation m	Site	DB

Material:	Silt	*Description:*	Sandy
+			
Depth (ft):	377	*Colour:*	Grey
Material:	Silt	*Description:*	Clayey
+			
Depth (ft):	380	*Colour:*	Grey
Material:	Silty Clay	*Description:*	Noncalcareous

---

2 **3 of 5** **E/428.4** **490.9** **SK** **WWIS**

Driller Report #:	073987	*Completed Date:*	1/27/1983
Depth (ft):	180	*Elevation (ft):*	1625
Water Use:	Domestic	*Well Use:*	Water Test Hole
Method Well Developed:	Drilled	*DLS Coordinates:*	NE1/4-16-38-04-3
Municipality:			

--- Details ---

Depth (ft):	1	*Colour:*	Unknown
Material:	Topsoil	*Description:*	Unknown
+			
Depth (ft):	7	*Colour:*	Brown
Material:	Sand	*Description:*	Medium
+			
Depth (ft):	14	*Colour:*	Brown
Material:	Till	*Description:*	Oxidized
+			
Depth (ft):	140	*Colour:*	Grey
Material:	Till	*Description:*	Cobblestones
+			
Depth (ft):	160	*Colour:*	Grey
Material:	Till	*Description:*	Sandy
+			
Depth (ft):	180	*Colour:*	Grey
Material:	Till	*Description:*	Hard

---

2 **4 of 5** **E/428.4** **490.9** **SK** **WWIS**

Driller Report #:	073986	*Completed Date:*	1/22/1983
Depth (ft):	160	*Elevation (ft):*	1625
Water Use:	Domestic	*Well Use:*	Water Test Hole
Method Well Developed:	Drilled	*DLS Coordinates:*	NE1/4-16-38-04-3
Municipality:			

--- Details ---

Depth (ft):	12	*Colour:*	Brown
Material:	Till	*Description:*	Oxidized
+			
Depth (ft):	139	*Colour:*	Grey

Map Key	Number of Records	Direction/ Distance m	Elevation m	Site	DB

Material:	Till	*Description:*	Hard
+			
Depth (ft):	145	*Colour:*	Grey
Material:	Sand	*Description:*	Silty
+			
Depth (ft):	147	*Colour:*	Grey
Material:	Till	*Description:*	Hard
+			
Depth (ft):	148	*Colour:*	Unknown
Material:	Sand	*Description:*	Fine-medium
+			
Depth (ft):	155	*Colour:*	Grey
Material:	Till	*Description:*	Hard
+			
Depth (ft):	156	*Colour:*	Unknown
Material:	Sand & Gravel	*Description:*	Coarse
+			
Depth (ft):	160	*Colour:*	Grey
Material:	Till	*Description:*	Sandy

2 **5 of 5** **E/428.4** **490.9** **SK** **WWIS**

Driller Report #:	116814	*Completed Date:*	8/29/1983
Depth (ft):	177	*Elevation (ft):*	1634
Water Use:	Research	*Well Use:*	Soil Test Hole
Method Well Developed:	Drilled	*DLS Coordinates:*	NE1/4-16-38-04-3
Municipality:	CORMAN PARK RM OF		

--- Details ---

Depth (ft):	12	*Colour:*	Grey
Material:	Till	*Description:*	Sandy
+			
Depth (ft):	20	*Colour:*	Brown
Material:	Till	*Description:*	Hard
+			
Depth (ft):	26	*Colour:*	Grey
Material:	Till	*Description:*	Sandy
+			
Depth (ft):	85	*Colour:*	Grey
Material:	Till	*Description:*	Clayey
+			
Depth (ft):	88	*Colour:*	Grey
Material:	Sand	*Description:*	Medium-coarse
+			
Depth (ft):	162	*Colour:*	Grey
Material:	Till	*Description:*	Sandy
+			
Depth (ft):	170	*Colour:*	Grey
Material:	Gravel	*Description:*	Sandy

Map Key	Number of Records	Direction/ Distance m	Elevation m	Site	DB
+					
Depth (ft):	177			*Colour:* Grey	
Material:	Till			*Description:* Sandy	

Unplottable Summary

DB	Company Name/Site Name	Address	City	Postal

No unplottable records were found that may be relevant for the search criteria.

Unplottable Report

No unplottable records were found that may be relevant for the search criteria.

Appendix: Database Descriptions

Ecolog Environmental Risk Information Services Ltd can search the following databases. The extent of Historical information varies with each database and current information is determined by what is publicly available to Ecolog ERIS at the time of update. ***Note:*** *Databases denoted with " * " indicates that the database will no longer be updated. See the individual database description for more information.*

Automobile Wrecking & Supplies: Private AUWR

This database provides an inventory of all known locations that are involved in the scrap metal, automobile wrecking/recycling, and automobile parts & supplies industry. Information is provided on the company name, location and business type.

Government Publication Date: 2001-Jul 2014

Chemical Register: Private CHEM

This database includes a listing of locations of facilities within the Province or Territory that either manufacture and/or distributes chemicals.

Government Publication Date: 1999-Jul 2014

Convictions: Provincial CONV

This database summarizes the penalties and convictions handed down by the Saskatchewan courts. Companies and individuals that have been found guilty of environmental offenses under Saskatchewan's Environmental Protection Legislation are listed in this database. The records in this database are associated with the City the offense took place and are not plotted.

Government Publication Date: 1995-Mar 2012

Wastewater Dischargers: Provincial DIS

This database is maintained by SERM and supplies the locations of the wastewater dischargers in the province. The geographic coordinates have been provided in DLS (Dominion Land Survey) format but do not contain offsets that are necessary to pinpoint a specific location. Therefore, locations will be accurate to the LSD or Quarter section only.

Government Publication Date: 2000-Apr 2012

Environmental Effects Monitoring: Federal EEM

The Environmental Effects Monitoring program assesses the effects of effluent from industrial or other sources on fish, fish habitat and human usage of fisheries resources. Since 1992, pulp and paper mills have been required to conduct EEM studies under the Pulp and Paper Effluent Regulations. This database provides information on the mill name, geographical location and sub-lethal toxicity data.

Government Publication Date: 1992-2007*

ERIS Historical Searches: Private EHS

EcoLog ERIS has compiled a database of all environmental risk reports completed since March 1999. Available fields for this database include: site location, date of report, type of report, and search radius. As per all other databases, the ERIS database can be referenced on both the map and "Statistical Profile" page.

Government Publication Date: 1999-Aug 2014

Environmental Issues Inventory System: Federal EIIS

The Environmental Issues Inventory System was developed through the implementation of the Environmental Issues and Remediation Plan. This plan was established to determine the location and severity of contaminated sites on inhabited First Nation reserves, and where necessary, to remediate those that posed a risk to health and safety; and to prevent future environmental problems. The EIIS provides information on the reserve under investigation, inventory number, name of site, environmental issue, site action (Remediation, Site Assessment), and date investigation completed.

Government Publication Date: 1992-2001*

Environmental Spills: Provincial ES

This database includes an inventory of known spills that occurred throughout the province and that are reported under regulation R.R.S. c. D-14, Reg. 1. Some of the geographic coordinates have been provided in DLS (Dominion Land Survey) format but do not contain offsets that are necessary to pinpoint a specific location. Therefore, locations will be accurate to the LSD or Quarter section only.

Government Publication Date: 1977-Jun 2013

Federal Convictions: Federal FCON

Environment Canada maintains a database referred to as the "Environmental Registry" that details prosecutions under the Canadian Environmental Protection Act (CEPA) and the Fisheries Act (FA). Information is provided on the company name, location, charge date, offence and penalty.

Government Publication Date: 1988-Jun 2007*

Contaminated Sites on Federal Land: Federal FCS

The Federal Contaminated Sites Inventory includes information on all known federal contaminated sites under the custodianship of departments, agencies and consolidated Crown corporations as well as those that are being or have been investigated to determine whether they have contamination arising from past use that could pose a risk to human health or the environment. The inventory also includes non-federal contaminated sites for which the Government of Canada has accepted some or all financial responsibility. It does not include sites where contamination has been caused by, and which are under the control of, enterprise Crown corporations, private individuals, firms or other levels of government.

Government Publication Date: June 2000-Sep 2014

Hazardous Material Storage: Provincial HMS

The Saskatchewan Hazardous Materials Storage Program collects this information. With the approval of the Ministry of Environment, hazardous substances and waste dangerous goods can be stored in underground storage tanks, above-ground storage tanks, outdoor storage site and warehouse/indoor storage sites. A hazardous substance/waste is defined as a substance/waste that because of its quantity, concentration or physical, chemical or infectious characteristics, either individually or in combination with other substances, is an existing or potential threat to the environment or human health. This inventory includes information on operator ID, operation name, address, legal land description and operation status.

Government Publication Date: 1980-Aug 2013

Horizontal Wells: Provincial HORW

Saskatchewan Industry and Resources maintains an inventory of all horizontal wells drilled in the province. The database provides detailed information in regard to well name, owner name, status, licence no., initial and final drilling date, well type, horizon name and pool name.

Government Publication Date: Aug 1987-Jun 2007*

Hazardous Substance Storage Sites: Provincial HSSS

This is an inventory of hazardous substance storage sites that must be registered under regulation 25/92, S. 3. The database is a catalog of information on the location of outdoor and warehouse sites, housing hazardous products used by companies in the agricultural, chemical, farming, warehousing, trucking, waste recycling, distribution, service stations/repair shops, bulk stations, autobody, mining, and manufacturing industry. Information is provided on the type of product(s) stored, application date, company name, location, and the type of business service operated on site. For current information, please refer to the HMS database.

Government Publication Date: 1989-Feb 2006*

Hazardous Substance Storage Tanks: Provincial HSST

This is an inventory of hazardous substance storage tanks that must be registered under regulation 25/92, S. 3. The database is a compilation of information on aboveground and underground storage tanks that hold substances such as gasoline, diesel, chemicals, heating oil, kerosene and alcohol blended products. Information is provided on the contents and capacity of the tank, company name, location, and the type of business service operated on site. For current information, please refer to the HMS database.

Government Publication Date: 1989-Feb 2006*

Indian & Northern Affairs Fuel Tanks: Federal IAFT

The Department of Indian & Northern Affairs Canada (INAC) maintains an inventory of all aboveground & underground fuel storage tanks located on both federal and crown land. Our inventory provides information on the reserve name, location, facility type, site/facility name, tank type, material & ID number, tank contents & capacity, and date of tank installation.

Government Publication Date: 1950-Aug 2003*

Intensive Livestock Operation Approvals: Provincial ILOA

Under the Agricultural Operations Act, certain types of intensive livestock operations are required to obtain plan approval. Approvals are subject to the size of operation and their proximity to a water source. Those requiring plan approval must submit documentation regarding manure storage, utilization of manure nutrients and disposal method for dead animals. Sask. Agriculture, Food and Rural Revitalization maintains a database of approvals issued over the last three decades, for operations that may or may not be currently operational. An ILO plan approval may have been issued to an intensive livestock operation but never been constructed, been approved and not constructed yet, or it may have been constructed and later discontinued. There is no distinction in the database between operational and non-operational sites. Please note that the value "Sum of Animal Units" is a calculation used to compare different types of livestock operations (each type of animal is rated on a scale). Geographic coordinates were provided in DLS (Dominion Land Survey) format but do not contain offsets that are necessary to pinpoint a specific location. Therefore, locations will be accurate to the Quarter section only.

Government Publication Date: 1971-Apr 2012

Canadian Mine Locations: Private MINE

This information is collected from the Canadian & American Mines Handbook. The Mines database is a national database that provides over 290 listings on mines (listed as public companies) dealing primarily with precious metals and hard rocks. Listed are mines that are currently in operation, closed, suspended, or are still being developed (advanced projects). Their locations are provided as geographic coordinates (x, y and/or longitude, latitude). As of 2002, data pertaining to Canadian smelters and refineries has been appended to this database.

Government Publication Date: 1998-2009*

Mineral Occurences: Provincial MNR

Saskatchewan Energy and Mines maintains an inventory of 2890 separate mineral occurrences in the "Saskatchewan Mineral Deposit Index" regarding metallic, industrial mineral and coal deposits. Information within the database pertains to the SMDI No., showing name, location, commodity, deposit type, status, classification and geographical reference data. For additional information regarding geological data and exploration history, please contact the office and quote the SMDI No.

Government Publication Date: 1981-2009

National Analysis of Trends in Emergencies System (NATES): Federal NATE

In 1974 Environment Canada established the National Analysis of Trends in Emergencies System (NATES) database, for the voluntary reporting of significant spill incidents. The data was to be used to assist in directing the work of the emergencies program. NATES ran from 1974 to 1994. Extensive information is available within this database including company names, place where the spill occurred, date of spill, cause, reason and source of spill, damage incurred, and amount, concentration, and volume of materials released.

Government Publication Date: 1974-1994*

National Defence & Canadian Forces Fuel Tanks: Federal NDFT

The Department of National Defence and the Canadian Forces maintains an inventory of all aboveground & underground fuel storage tanks located on DND lands. Our inventory provides information on the base name, location, tank type & capacity, tank contents, tank class, date of tank installation, date tank last used, and status of tank as of May 2001. This database will no longer be updated due to the new National Security protocols which have prohibited any release of this database.

Government Publication Date: Up to May 2001*

National Defence & Canadian Forces Spills: Federal NDSP

The Department of National Defence and the Canadian Forces maintains an inventory of spills to land and water. All spill sites have been classified under the "Transportation of Dangerous Goods Act - 1992". Our inventory provides information on the facility name, location, spill ID #, spill date, type of spill, as well as the quantity of substance spilled & recovered.

Government Publication Date: Mar 1999-Aug 2010

National Defence & Canadian Forces Waste Disposal Sites: Federal NDWD

The Department of National Defence and the Canadian Forces maintains an inventory of waste disposal sites located on DND lands. Where available, our inventory provides information on the base name, location, type of waste received, area of site, depth of site, year site opened/closed and status.

Government Publication Date: 2001-Apr 2007*

National Environmental Emergencies System (NEES): Federal NEES

In 2000, the Emergencies program implemented NEES, a reporting system for spills of hazardous substances. For the most part, this system only captured data from the Atlantic Provinces, some from Quebec and Ontario and a portion from British Columbia. Data for Alberta, Saskatchewan, Manitoba and the Territories was not captured. However, NEES is also a repository for all previous Environment Canada spill datasets. NEES is composed of the historic datasets ' or Trends ' which dates from approximately 1974 to present. NEES Trends is a compilation of historic databases, which were merged and includes data from NATES (National Analysis of Trends in Emergencies System), ARTS (Atlantic Regional Trends System), and NEES. In 2001, the Emergencies Program determined that variations in reporting regimes and requirements between federal and provincial agencies made national spill reporting and trend analysis difficult to achieve. As a consequence, the department has focused efforts on capturing data on spills of substances which fall under its legislative authority only (CEPA and FA). As such, the NEES database will be decommissioned in December 2004.

Government Publication Date: 1974-2003*

National PCB Inventory: Federal NPCB

Environment Canada's National PCB inventory includes information on in-use PCB containing equipment in Canada including federal, provincial and private facilities. All federal out-of-service PCB containing equipment and all PCB waste owned by the federal government or by federally regulated industries such as airlines, railway companies, broadcasting companies, telephone and telecommunications companies, pipeline companies, etc. are also listed. Although it is not Environment Canada's mandate to collect data on non-federal PCB waste, the National PCB inventory includes some information on provincial and private PCB waste and storage sites. Some addresses provided may be Head Office addresses and are not necessarily the location of where the waste is being used or stored.

Government Publication Date: 1988-2008*

National Pollutant Release Inventory: Federal NPRI

Environment Canada has defined the National Pollutant Release Inventory ("NPRI") as a federal government initiative designed to collect comprehensive national data regarding releases to air, water, or land, and waste transfers for recycling for more than 300 listed substances.

Government Publication Date: 1993-2013

Upstream Oil & Gas Site Spills: Provincial OGS

Saskatchewan Industry and Resource compiles spill information pertaining to crude oil, produced water and spills on upstream oil and gas facilities. Information includes location, date of spill, substance spilled, total amount spilled and source.

Government Publication Date: 1990-Apr 2013

Oil and Gas Wells: Private OGW

The Nickle's Energy Group (publisher of the Daily Oil Bulletin) collects information on drilling activity including operator and well statistics. The well information database includes name, location, class, status and depth. The main Nickle's database is updated on a daily basis, however, this database is updated on a monthly basis. More information is available at www.nickles.com.

Government Publication Date: 1988-2014

Canadian Pulp and Paper: Private PAP

This information is part of the Pulp and Paper Canada Directory. The Directory provides a comprehensive listing of the locations of pulp and paper mills and the products that they produce.

Government Publication Date: 1999, 2002, 2004, 2005, 2009

Parks Canada Fuel Storage Tanks: Federal PCFT

Canadian Heritage maintains an inventory of all known fuel storage tanks operated by Parks Canada, in both National Parks and at National Historic Sites. The database details information on site name, location, tank install/removal date, capacity, fuel type, facility type, tank design and owner/operator.

Government Publication Date: 1920-Jan 2005*

Pesticide Register: Provincial PES

Saskatchewan Agriculture and Food maintains a database of all vendors of registered pesticides.

Government Publication Date: 1998-Apr 2010

Retail Fuel Storage Tanks: Private RST

This database includes an inventory of retail fuel outlet locations (including marinas) that have on their property gasoline, oil, waste oil, natural gas and / or propane storage tanks.

Government Publication Date: 1999-Jul 2014

Scott's Manufacturing Directory: Private SCT

Scott's Directories is a data bank containing information on over 200,000 manufacturers across Canada. Even though Scott's listings are voluntary, it is the most comprehensive database of Canadian manufacturers available. Information concerning a company's address, plant size, and main products are included in this database.

Government Publication Date: 1992-Mar 2011

Waste Disposal Site Inventory: Provincial WDS

This inventory pertains to registered waste disposal sites within the province of Saskatchewan. Specific dates as to when the waste disposal site was activated are not available. The geographic coordinates have been provided in DLS (Dominion Land Survey) format but do not contain offsets that are necessary to pinpoint a specific location. Therefore, locations will be accurate to the LSD or Quarter section only.

Government Publication Date: 2000-Apr 2012

Water Well Information System: Provincial WWIS

This database was collected from Saskatchewan Water, Water Resource Administration and contains over 100,000 records. The geographic coordinates have been provided in DLS (Dominion Land Survey) format but do not contain offsets that are necessary to pinpoint a specific location. Therefore, locations will be accurate to the LSD or Quarter section only.

Government Publication Date: 1900-Jun 2010

Definitions

Database Descriptions: This section provides a detailed explanation for each database including: source, information available, time coverage, and acronyms used. They are listed in alphabetic order.

Detail Report: This is the section of the report which provides the most detail for each individual record. Records are summarized by location, starting with the project property followed by records in closest proximity.

Distance: The distance value is the distance between plotted points, not necessarily the distance between the sites' boundaries". All values are an approximation.

Direction: The direction value is the compass direction of the site in respect to the project property and/or center point of the report.

Elevation: The elevation value is taken from the location at which the records for the site address have been plotted. All values are an approximation. Source: Google Elevation API.

Executive Summary: This portion of the report is divided into 3 sections:

'Report Summary'- Displays a chart indicating how many records fall on the project property and, within the report search radii.

'Site Report Summary'-Project Property'- This section lists all the records which fall on the project property. For more details, see the 'Detail Report' section.

'Site Report Summary-Surrounding Properties'- This section summarizes all records on adjacent properties, listing them in order of proximity from the project property. For more details, see the 'Detail Report' section.

Map Key: The map key number is assigned according to closest proximity from the project property. Map Key numbers always start at #1. The project property will always have a map key of '1' if records are available. If there is a number in brackets beside the main number, this will indicate the number of records on that specific property. If there is no number in brackets, there is only one record for that property.

The symbol and colour used indicates 'elevation': the red inverted triangle will dictate 'ERIS Sites with Lower Elevation', the yellow triangle will dictate 'ERIS Sites with Higher Elevation' and the orange square will dictate 'ERIS Sites with Same Elevation.'

Unplottables: These are records that could not be mapped due to various reasons, including limited geographic information. These records may or may not be in your study area, and were included as reference.

APPENDIX E

Photographs

PHOTOGRAPH NO. 9980-01 **Panoramic photograph taken proximate the northeast corner of the subject property, looking south to west.**

PHOTOGRAPH NO. 9980-02 **Panoramic photograph taken near the northwest corner of the subject property, looking east to south.**

PHOTOGRAPH NO. 9980-03 **Panoramic photograph taken proximate the east side of the subject property, looking south to north.**

PHOTOGRAPH NO. 9980-04 **Panoramic photograph taken proximate the north side of the subject property, looking east to west.**

PHOTOGRAPH NO. 9980-05 **Panoramic photograph taken proximate the southwest corner of the subject property, looking north to east.**

PHOTOGRAPH NO. 9980-06 **Panoramic photograph taken proximate the south side of the subject property, looking west to east.**

PHOTOGRAPH NO. 9980-07 **Farmyard and debris stored (offsite) proximate the southeast corner of the subject property.**

PHOTOGRAPH NO. 9980-8 **Southern property line facing east.**

APPENDIX D: PRELIMINARY GEOTECHNICAL REPORT

P. MACHIBRODA ENGINEERING LTD.

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- Asphalt Testing

PRELIMINARY GEOTECHNICAL INVESTIGATION
PROPOSED RURAL SUBDIVISION
WHISPER RIVER ESTATES PHASE II
NW-1/2-16-38-4-W3M
R.M. OF CORMAN PARK (NO. 344), SASKATCHEWAN
PMEL FILE NO. 9978
APRIL 9, 2015

PREPARED FOR:

NORTH PRARIE DEVELOPMENTS
BOX 109
SASKATOON, SASKATCHEWAN
S7K 3K1

ATTENTION: MR. PHIL RATZLAFF, LAND DIVISION MANAGER

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1.0 INTRODUCTION

The following report has been prepared to present the results of a preliminary geotechnical investigation conducted at the site of the proposed Rural Subdivision – Whisper River Estates Phase II to be constructed within NW-1/2-16-38-04-W3M within the Rural Municipality of Corman Park (No. 344), Saskatchewan.

Authorization to proceed with this investigation was provided on January 27, 2015 via North Prairie Developments Ltd. Purchase Order No. 44449. The terms of reference for this investigation were presented in P. Machibroda Engineering Ltd. (PMEL) Proposal No. 9978, dated January 21, 2015. The field test drilling and soil sampling were conducted on February 18 and 19, 2015. Groundwater monitoring was conducted on March 10, 2015 and April 8, 2015.

This report has been prepared to provide general geotechnical recommendations for the construction of single family homes. If the site conditions vary significantly than what is presented in this report, PMEL should be contacted immediately to reassess our recommendations.

A hydrogeological report is being prepared for the subject site and will be submitted as a separate report.

2.0 FIELD INVESTIGATION

Nine test holes, located as shown on the Site Plan, Drawing No. 9978-1, were dry drilled using our truck-mounted, continuous flight, solid stem auger drill rig. The test holes were 150 mm in diameter and extended to a depths of 7.2 to 10.5 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.

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 (N-index), utilizing a safety hammer with automatic trip, were performed during test drilling.

Standpipe piezometers were installed in Test Hole Nos. 15-2, 15-3, 15-5, 15-6 and 15-5 at the completion of test drilling. The standpipe piezometers consisted of 50 mm diameter, Schedule 40 machine slotted screen connected to a solid riser pipe. The piezometer screen was backfilled with clean, free-draining sand.

The plan location and surface elevation of the Test Holes was surveyed using hand held Global Positioning Equipment (Trimble, Model No. GeoXH 6000).

3.0 FIELD DRILL LOGS

The field drill logs recorded during test drilling are shown plotted on Drawing Nos. 9978-2 to 10, inclusive

The plan location and surface elevation of the Test Holes was surveyed using hand held Global Positioning Equipment (Trimble, Model No. GeoXH 6000).

3.1 Soil Profile

The general soil profile consisted of a thin layer of topsoil followed by glacial till, which extended to a depth of at least 10.5 metres, the maximum depth penetrated with our Test Holes at this site. Inter till sand layers/lenses were encountered throughout the glacial till stratum. A sand layer was encountered to approximately 1.77 metres below existing grade in Test Hole No. 15-4.

3.2 Groundwater Conditions, Sloughing

Groundwater seepage and sloughing conditions were encountered during test drilling. The depths at which groundwater seepage and sloughing conditions were encountered have been shown on the field drill logs, Drawing Nos. 9978-2 to 10, inclusive. Piezometers were installed in select Test Holes for the purpose of monitoring the existing groundwater table. The results of groundwater monitoring have been presented in Table I.

TABLE I. RECORDED GROUNDWATER LEVELS

Test Hole No.	Ground Surface Elevation (metres)	Piezometer Rim Elevation (metres)	Recorded Groundwater Elevation (metres)	
			March 10, 2015	April 8, 2015
15-2	501.3	502.5	497.7	498.3
15-3	497.7	498.7	494.7	494.9
15-5	500.9	501.9	NR*	498.6
15-6	500.6	501.6	497.2	497.2
15-8	500.0	501.0	497.1	497.2

*NM – Not Recorded

An examination of Table I revealed that the groundwater level was measured at about 2.8 to 3.4 metres below existing grade on April 8, 2015. Higher groundwater conditions should be encountered, particularly during or after periods of precipitation or spring thaw. The groundwater conditions will fluctuate seasonally.

3.3 Cobblestones and Boulders

Cobblestones and/or boulders were encountered during test drilling. The depths at which cobblestones and/or boulders were encountered have been shown on Drawing Nos. 9978-2 to 10, inclusive. Auger refusal was encountered in Test Hole No. 15-1 at a depth of approximately 7.2 metres below existing grade on suspected boulders.

The glacial till consisted of a heterogeneous mixture of gravel, sand, silt and clay-sized particles. The glacial till strata also contained sorted deposits of the above particle sizes. In addition to the sorted deposits, a random distribution of larger particle sizes in the cobblestone range (60 to 200 mm) and boulder-sized range (larger than 200 mm) should be expected at the subject site.

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

4.0 LABORATORY ANALYSIS

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

The results of the soil classification and index tests conducted on representative samples of soil have been plotted on the drill logs alongside the corresponding depths at which the samples were recovered, as shown on Drawing Nos. 9978-2 to 10, inclusive.

The results of the grain size distribution analyses have been enclosed in Appendix B.

5.0 DESIGN RECOMMENDATIONS

The purpose of this investigation was to evaluate the existing subsurface soil and groundwater conditions for the potential site development and provide general geotechnical recommendations for the construction of single family homes

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

5.1 Design Considerations

It is understood single family homes will be constructed on the proposed lots.

The subsurface soil conditions consisted of topsoil followed by an extensive depth of glacial till. A sand layer was encountered above the glacial till in Test Hole No. 15-4. The subgrade soils are frost susceptible. The average depth of frost penetration for the R.M. of Corman Park area would be in the order of 1.8 metres for heated structures (2.2 metres for unheated structures).

Groundwater seepage and sloughing conditions were encountered during test drilling. The groundwater level recorded in the piezometers installed at the subject site was measured at 2.9 to 3.4 metres below existing grade on March 10, 2015. Higher water levels should be expected during or following spring snowmelt and/or periods of precipitation.

A shallow footing foundation based in the glacial till deposit or sand should perform satisfactorily as foundation support for the proposed residential homes. Drilled, cast-in-place concrete piles could perform satisfactorily as deck piles or foundation support for garages.

Recommendations have been prepared for site preparation; excavations and dewatering; utility construction; standard strip or spread footings; drilled, cast-in-place concrete piles; floor slabs; foundation walls; grade beams; and, foundation concrete.

5.2 Site Preparation

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

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

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

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

The site should be graded to ensure positive site drainage away from all structures.

5.3 Excavations and Dewatering

Depending on lateral constraints, excavations at this site may be 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 length of time that the excavation remains open and the consistency and structure (degree of fracturing, slickensiding, etc.) of the subgrade soils. The excavated soil should be removed from the excavation banks (and stockpiled) to minimize potential sloughing of the trench sidewalls due to the soil surcharge loading.

Excavations at this site should be made in accordance with current Saskatchewan Labour Occupational Health and Safety (OH&S) Guidelines. The subsurface conditions at this site may be classified as “Type 3” soils (i.e., the walls are sloped from the bottom of the excavation or trench with a slope at an angle not steeper than one horizontal to one vertical). Where saturated soils are encountered or where the excavation extends below the groundwater table, slope flattening may be required.

Based on the results of groundwater monitoring, the groundwater table at this site was was measured at about 2.8 to 3.4 metres below existing grade on March 10, 2015. Higher water levels should be expected during and/or following spring snowmelt and periods of precipitation. De-watering of the excavations may be required during construction below the groundwater table. De-watering should be conducted on an “as-required” basis over the time period for which the excavations are left open. A sump (or multiple sumps, if required) should be set up at the deepest excavation points and the floor of the excavation sloped to the sump(s) to handle groundwater seepage and precipitation runoff. A self-actuated sump pump(s) should be operated on a continuous basis and should be discharged well away from the excavations.

5.4 Utility Construction

The following design considerations and recommendations should be incorporated into the design and construction of underground service utility pipelines.

1. A minimum soil cover of 2.5 metres is recommended for pipeline construction (to provide protection against frost penetration). Rigid polystyrene insulation could be utilized to reduce the required depth (if this is more feasible). In this case, the Geotechnical Consultant should review the proposed insulation details.

2. It should be feasible to construct the majority of the proposed pipeline by open cutting the necessary trenches using conventional earth moving equipment. If some ravelling and earth slides can be tolerated, then the sideslopes for trench excavations should be excavated in accordance Section 5.3, Excavations and Dewatering. If potential ravelling and shallow localized caving cannot be tolerated, then the sideslopes would have to be flattened. The stability of the slope will be, to a large extent, time and weather dependent. Hence, prudent scheduling of the length of the trench open at any time is recommended.

3. Where excavations extend below the groundwater table, the subgrade soils may be wet/soft above the pipeline invert and will drain, slough and cave into an open excavation. Dewatering may be required, and should be performed on an “as-required” basis using surface drainage ditches drained to sump pits equipped with sump pumps.

4. An examination of the field drill logs revealed that the proposed pipelines would be founded on glacial till. Any soft, compressible soils encountered at the founding elevation should be over-excavated to a minimum depth of 300 mm below the founding elevation and replaced with clean, free-draining, non-frost susceptible, compacted granular material. Pipeline bedding should be specified in accordance with the manufacturer's recommendations for the particular pipe material being utilized.

5. All backfill above the pipeline should be placed in thin lifts not exceeding 300 mm and compacted to 96 percent of standard Proctor density at optimum moisture content. For backfill compacted in accordance with the above, it is recommended that the pipelines be designed on the basis of a soil overburden weight of 2,000 kg/m^3 for the compacted subgrade soils. Landscape fill should be placed and compacted to 90 percent of standard Proctor density at optimum moisture content.

6. Thrust blocks will be required along the length of the pipeline (pressure mains) where realignment or changes in direction are required. The lateral earth pressure distribution for thrust blocks is assumed to be a triangular distribution with the resultant acting at a point one third (1/3) of the height up from the bottom of the thrust block. The resultant force may be calculated as:

$$P = \frac{(K_p - K_a)\,\gamma\,H^2}{2}$$

Where:

K = Coefficient of soil pressure

γ = Unit weight of soil

H = Height of thrust block

The soil parameters presented in Table II may be utilized for design of the thrust blocks.

TABLE II. SOIL PARAMETERS FOR DESIGN

Soil Type	Effective Angle of Internal Friction	Earth Pressure Coefficients			Unit Weight (kN/m^3)	Submerged Unit Weight (kN/m^3)	Undrained Shear Strength (kPa)
		Active (K_a)	Passive (K_p)	At Rest (K_o)			
Glacial Till	25°	0.4	2.5	0.6	21.5	11.5	95

For pipes installed by directional drilling (boring) techniques, the total vertical and lateral pressure on the pipe is equivalent to the total unit weight of the overburden soil multiplied by the depth below ground surface. The submerged unit weight of the soil should be utilized below the groundwater table. The overburden pressure on the pipe should be calculated on the basis of the soil unit weights presented in Table II. Grouting of the annular space between the pipe and the surrounding soil will be required to provide uniform transference of the soil loading to the pipeline wall.

5.5 Standard Strip or Spread Footings

A footing foundation based within naturally deposited, undisturbed stiff to very stiff glacial till or sand should perform satisfactorily. If the foundation is constructed during freezing conditions, the subgrade soil at the design footing elevation must be protected from freezing. If it is not practical to keep the subgrade from freezing then a deep foundation system should be constructed.

The following minimum recommendations should be incorporated into the design of a footing foundation.

1. For a continually heated building with a heated basement, the footings should be founded on naturally deposited, undisturbed soil at a minimum depth of 1.8 metres below finished ground surface. Footings may be based a minimum depth of 1.2 metres below existing grade if protected with strategically placed rigid polystyrene insulation to avoid the detrimental impacts of frost. In this case, a continuous layer of rigid polystyrene insulation should be placed over the exterior face of the foundation wall, extending vertically a minimum of 300 mm above grade and laterally a minimum distance of 1.2 metres away from the foundation. The insulation should be a minimum of 50 mm in thickness and should be positively sloped away from the foundation to promote drainage. The insulation should be based a minimum of 300 mm below finished grade (to protect against damage).

2. Footings not protected with an interior heat source should be based a minimum of 2.2 metres below grade to provide protection from frost.

3. Footings based on naturally deposited, undisturbed, glacial till, may be designed to exert an ultimate bearing pressure of 750 kPa (Ultimate Limits State – ULS). The Serviceability Limit State (SLS) bearing pressure equivalent to 25 mm of foundation settlement is 150 kPa (see Section 5.7, Limit States Resistance Factors and Serviceability for assumed settlement criteria and maximum footing dimension).

4. The soil may be bulk excavated to within 150 mm of the foundation design elevation. The remaining 150 mm should be carefully excavated to minimize disturbance of the subgrade soils.

5. If constructing footings on sand, it is recommended that a mud slab be placed as soon as practical after cleaning to minimize the potential for disturbance of the sand subgrade soils.

6. A representative of the Geotechnical Consultant should inspect the footing excavations prior to construction of the footings to verify that adequate soil conditions exist.

7. A minimum strip footing width of 500 mm is recommended. A minimum dimension of 1,000 mm is recommended for square and rectangular footings. If the subgrade soil at the design footing elevation consists of soft, wet soil, the width of the footing should be increased by fifty (50) percent.

8. If the subgrade soil is disturbed during excavation below the design depth, then the disturbed soil should be removed to an undisturbed, level surface. Fill, required to raise the subgrade elevation to the underside of the footings, should be concrete.

9. Footings should not be constructed on desiccated, frozen or wet subgrade soil. Frost should not be allowed to penetrate beneath the footings prior to, during or after construction.

10. The finished grade should be landscaped to provide for positive site drainage away from the proposed Building.

5.6 Drilled, Cast-In-Place Concrete Piles

A deep foundation consisting of drilled, cast-in-place concrete piles could be utilized as a foundation system for garages and decks at this site. Drilled, cast-in-place, straight shaft concrete piles should be designed on the basis of skin friction only.

The ultimate skin friction bearing pressures of the undisturbed soil are as follows:

TABLE III. SKIN FRICTION BEARING PRESSURES (DRILLED PILES)

Zone (metres)	Ultimate Skin Friction Bearing Pressure (kPa)
0 to 2	0
2 to 6	85
Below 6	100

Notes:

1. To minimize frost heave potential, skin friction piles should be extended to a minimum depth of 6 metres below finished ground surface. The use of a sono-tube form for the uppermost 2 metres of the pile shaft is recommended for external piles, as it would significantly reduce the potential for frost-heaving of the straight shaft concrete piles. The sono-tube should be at least 50 mm in diameter smaller than the drilled hole.

2. Piles should be reinforced.

3. A minimum pile diameter of 300 mm is recommended for the primary structural loads. Larger pile diameters may be required to allow for the removal of cobbles and boulders in some pile holes.

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

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

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

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

5.7 Limit States Resistance Factors & Serviceability

As per the National Building Code of Canada - NBCC (2010), the following resistance factors (Φ) may be applied to the ultimate bearing pressures presented in previous sections of the report:

- Shallow foundations:
  - Compressive Resistance, Φ = 0.5
- Deep foundations:
  - Compressive Resistance, Φ = 0.4

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

With respect to footing foundations at this site, the SLS bearing capacity is typically defined as the bearing capacity required for a foundation settlement of 25 mm. In this case, a maximum footing size of 2 metres for square and rectangular footings and 1 metre for strip footings was assumed in our analysis. If the foundation is designed with a larger footing size than that stated above, PMEL should re-evaluate the recommended SLS bearing capacity.

With respect to SLS and deep foundation design, provided the foundation is designed using the appropriate resistance factors presented above, the amount of settlement at the design load will be small and within tolerable limits (typically less than 8 mm). Hence, settlement typically does not govern in the majority of cases of deep foundation design.

5.8 Floor Slabs

The near surface subgrade soil conditions consisted of glacial till and/or sand. Grade-supported floor slabs should perform satisfactorily at this site.

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

1. Prepare the site in accordance with Section 5.2, Site Preparation. For floor slabs constructed at existing grade (i.e., garage floor slabs), provide a minimum of 150 mm of granular base course fill under the floor slab.

2. For basement floor slabs, provide a minimum of 200 mm of clean, free-draining granular fill (in accordance with the aggregate gradation requirements in Section 5.9, Foundation Walls) beneath the underside of the floor slab. The subgrade should be sloped to promote drainage of any accumulated water to a sump pit equipped with a sump pump. The sump pit should be perforated to allow the groundwater to enter. Alternately, weeping tile could be set in the drainage layer to convey water to the sump pit.

3. Subgrade fill, if required, should preferably consist of granular material or non-expansive fine-grained soils, placed in thin lifts (maximum 150 mm loose) and compacted to 96 percent of standard Proctor density at optimum moisture content.

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

5. Separate the slab from the fill by means of a polyethylene vapour barrier.

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 proposed Residences.

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

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

In unheated structures (i.e., garage), frost heaving is a common cause of differential slab movement and cracking. Heating the area to about +5 ^{o} C with adequate air circulation would minimize the depth of frost penetration below the slab. Alternately, strategically placed rigid polystyrene insulation could be utilized to limit frost penetration below floor slabs.

5.9 Foundation Walls

Subsurface foundation walls should be designed to resist lateral earth pressure exerted by the backfill as well as the horizontal pressure induced by any surcharge loading. The lateral earth pressure may be calculated on the basis of an equivalent fluid pressure distribution of 10 kN/m^3 for walls backfilled with clean, free-draining backfill and a perforated drainage pipe drainage system. For walls backfilled with existing subgrade soils an equivalent fluid pressure distribution of 15.7 kN/m^3 should be used to calculate lateral earth pressure. The surcharge loading should be calculated on the basis of actual loads.

The lateral earth pressure loading of 10 kN/m^3 assumes that the backfill will be free-draining, uniformly placed around the structure and lightly compacted, and, a perforated drainage pipe will be installed alongside the foundation walls with the invert elevation at or below the base of the foundation. The perforated drainage pipe should be at least 100 mm in diameter and installed on non-woven geotextile capable of transmitting a flow of not less than 50 litres per second per square metre (ASTM D-4491). The geotextile should be placed on naturally deposited, undisturbed soil or free-draining sand as may be required for levelling. The geotextile should be used to encapsulate at least 350 mm of clean, granular drainage aggregate above the invert of the drainage pipe.

The clean drainage aggregate should meet the following aggregate gradation requirements.

TABLE IV. CLEAN, GRANULAR DRAINAGE AGGREGATE

Sieve Designation (mm)	Percent Passing
25.0	100
9.5	60 – 100
5.0	44 – 90
2.0	20 – 80
0.850	0 – 53
0.425	0 – 32
0.150	0 – 10
0.071	0 – 3

In the zone 350 mm above the invert of the drainage pipe and extending to within 500 mm of ground surface, clean, free-draining granular material with less than 5 percent material finer than the 0.071 mm sieve size should be used. The uppermost 500 mm should consist of clay or other low permeability material.

5.10 Grade Beams

The grade beams should be reinforced at both top and bottom throughout their entire length. Grade beams should be constructed to allow for a minimum of 100 mm of net void space between the underside of the grade beam and the subgrade soil.

5.11 Foundation Concrete

Water-soluble sulphate concentrations for the soils encountered at this site have been presented in Table V.

TABLE V. WATER SOLUBLE SULPHATE CONCENTRATIONS

Test Hole No.	Depth (metres)	Soil Description	Water Soluble Sulphate in soil sample (%)	Class of Exposure	Potential Degree of Sulphate Attack
15-4	2.0	Glacial Till	0.01	--	Negligible
15-4	4.5	Glacial Till	0.08	--	Negligible
15-9	2.0	Glacial Till	1.34	S-2	Severe

An examination of Table V revealed that the measured sulphate contents were 0.01 0.08, and 1.34 percent, respectively, which is considered negligible to severe in terms of potential degree of sulphate attack (Class of Exposure S-2).

Based on the test results, sulphate resistant cement (Type HS or HSb) should be used for all foundation concrete in contact with the soil. All concrete at this site should be manufactured in accordance with current CSA standards. General Use (Type GU) may be used for concrete that is in contact with imported granular fill and not the on-site clay soils.

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

6.0 LIMITATIONS

The presentation of the summary of the field drill logs and preliminary design recommendations has been completed as authorized. Nine, 150 mm diameter test holes were dry drilled using our continuous flight auger drill rig. 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.

Variations in the subsurface conditions from that shown on the drill logs at locations other than the exact Test Hole 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 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 North Prairie Developments and their agents for specific application to the proposed Rural Subdivision – Whisper River Estates Phase II to be constructed within NW-1/2-16-38-04-W3M within the R.M. of Corman Park (No. 344), 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 recommendations presented in this report are for preliminary purposes only. A detailed, specific geotechnical investigation is recommended once the building details and locations have been finalized. PMEL will not accept responsibility on this project for any unsatisfactory performance if the preliminary recommendations presented in this report are utilized for the final building design in lieu of conducting a detailed, specific geotechnical investigation.

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

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

P. MACHIBRODA ENGINEERING LTD.

Jason Bast, Engineer-in-Training.

PROFESSIONAL ENGINEER
G.A.A. BAXTER
MEMBER 15402
2015 04 09
YR. MN. DAY
SASKATCHEWAN

Graham Baxter, P.Eng.
JB/GB/ldw

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	15402	2015-04-09

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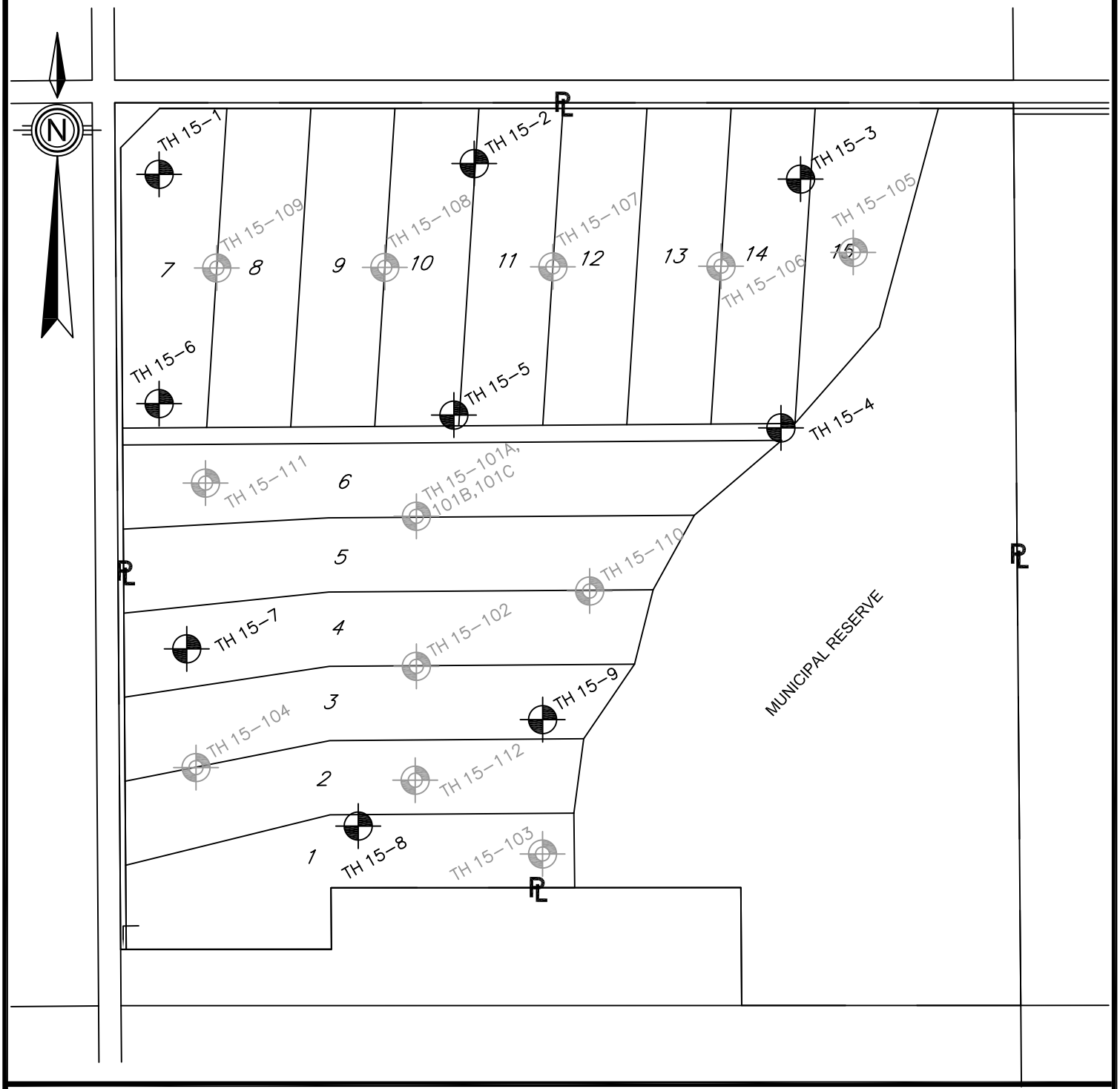
CONSULTING
GEOTECHNICAL/GEOENVIRONMENTAL
ENGINEERS

DRAWINGS



NOTE:
1. THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.
2. THIS DRAWING WAS COMPILED FROM AN AUTOCAD DRAWING PROVIDED BY WEBB SURVEYS. DRAWING NO. 09-2035 CN.

LEGEND	–PMEL TEST HOLE	–PMEL TEST HOLE (PIEZOMETER INSTALLED)	–PMEL TEST HOLE FROM REPORT No. 9995	–PROPERTY LINE

CONSULTING
GEOENVIRONMENTAL
GEOTECHNICAL
ENGINEERS

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

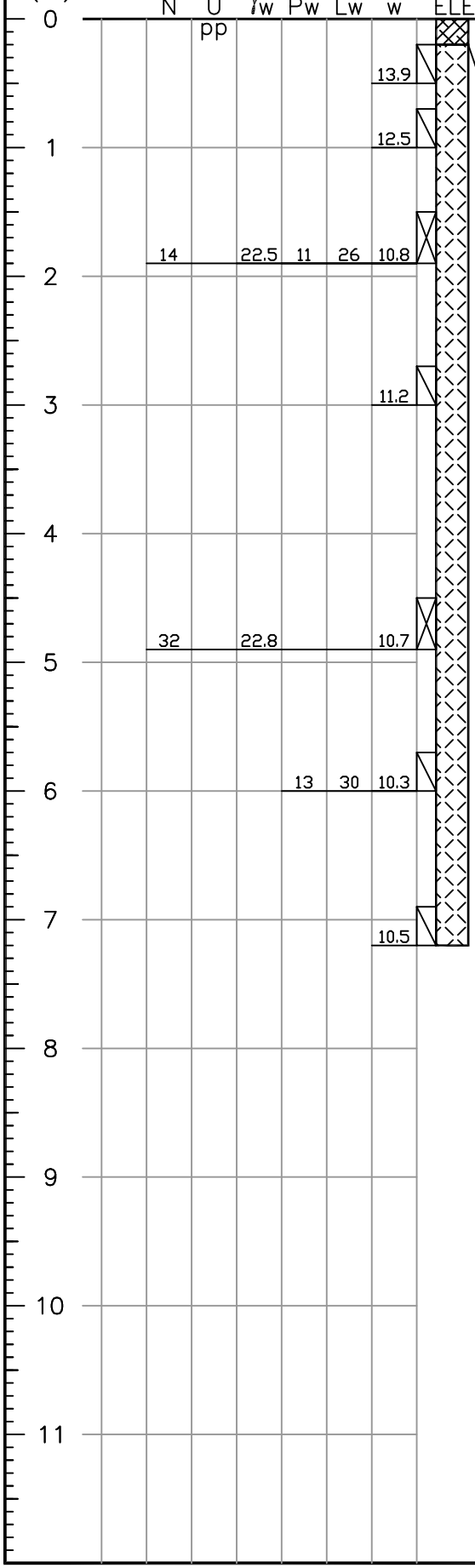
DRAWING TITLE:

SITE PLAN - TEST HOLE LOCATIONS

PROJECT:
PROPOSED RURAL SUBDIVISION - WHISPER RIVER ESTATES PHASE II
WITHIN, NW-16-38-04-W3M, R.M. OF CORMAN PARK NO. 344, SK

APPROVED BY:	DRAWN BY:	DRAWING NUMBER:
GB	SD	9978
DATE: MARCH, 2015	SCALE: NOT TO SCALE	

TEST HOLE 15-1



TOPSOIL, organic, black, rootlets, frozen.

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

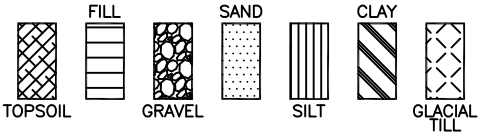
–frozen to 1.3 m.
–stiff below 1.3 m.

–very stiff below 2.5 m.

–cobbles and boulders below 5.6 m.

NOTE:
1. Test Hole open to 7.2 m and dry I.A.D.
2. Auger refusal on suspected boulders at 7.2 m.

LEGEND:



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

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γ_w...WET UNIT WEIGHT (kN/m^3)

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

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

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

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

P200...% PASSING No. 200 SIEVE

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

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

▼...RECORDED WATER LEVEL (PIEZO)

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

P. MACHIBRODA ENGINEERING LTD.

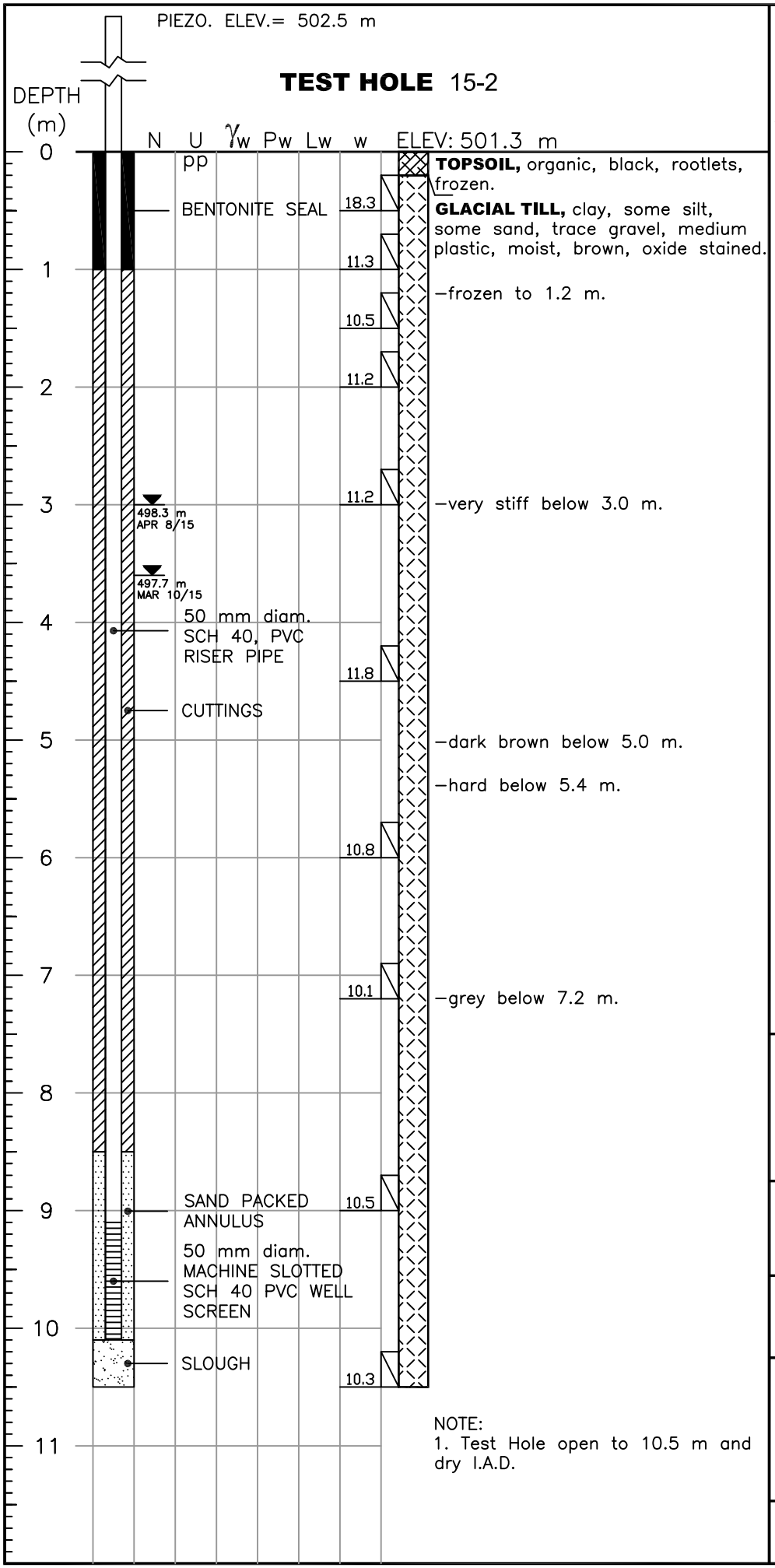
FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT:
WHISPER RIVER ESTATE PHASE 2

LOCATION:
WITHIN NW-16-38-04-W3M
RM OF CORMAN PARK

NORTHING: **EASTING:**

DATE DRILLED:	**DRAWING NUMBER:**
FEB 18/15	9978-2



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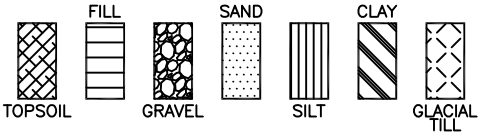


w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γ_w...WET UNIT WEIGHT (kN/m^3)

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

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

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

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

P200...% PASSING No. 200 SIEVE

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

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

▼...RECORDED WATER LEVEL (PIEZO)

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

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT:
WHISPER RIVER ESTATE PHASE 2

LOCATION:
WITHIN NW-16-38-04-W3M
RM OF CORMAN PARK

NORTHING: **EASTING:**

DATE DRILLED:	**DRAWING NUMBER:**
FEB 18/15	9978-3

PIEZO. ELEV.= 498.7 m

TEST HOLE 15-3

ELEV: 497.7 m

DEPTH (m)	N	U	γ_w	Pw	Lw	w	
0		pp					**TOPSOIL,** organic, black, rootlets, frozen.
						11.6	**GLACIAL TILL,** clay, some silt, some sand, trace gravel, medium plastic, moist, brown, oxide stained.
1						11.3	
						10.0	–frozen to 1.2 m.
							–very stiff below 1.2 m.
2						10.6	
3							494.7 m MAR 10/15
494.5 m APR 8/15	21		22.0			10.3	
4							50 mm diam. SCH 40, PVC RISER PIPE
						12.1	
5							CUTTINGS –grey, no oxide staining, below 5.0 m. –hard, gypsum crystals below 5.4 m.
6	34		23.0			9.8	
7						9.7	
8							
9							SAND PACKED ANNULUS
	41					10.2	
							50 mm diam. MACHINE SLOTTED SCH 40 PVC WELL SCREEN
10							SLOUGH
						9.9	
11							

NOTE:
1. Test Hole open to 10.5 m and dry I.A.D.

LEGEND:

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

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

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γ_w...WET UNIT WEIGHT (kN/m^3)

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

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

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

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

P200...% PASSING No. 200 SIEVE

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

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

▼...RECORDED WATER LEVEL (PIEZO)

SHELBY TUBE, SPLIT SPOON, CUTTINGS

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

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

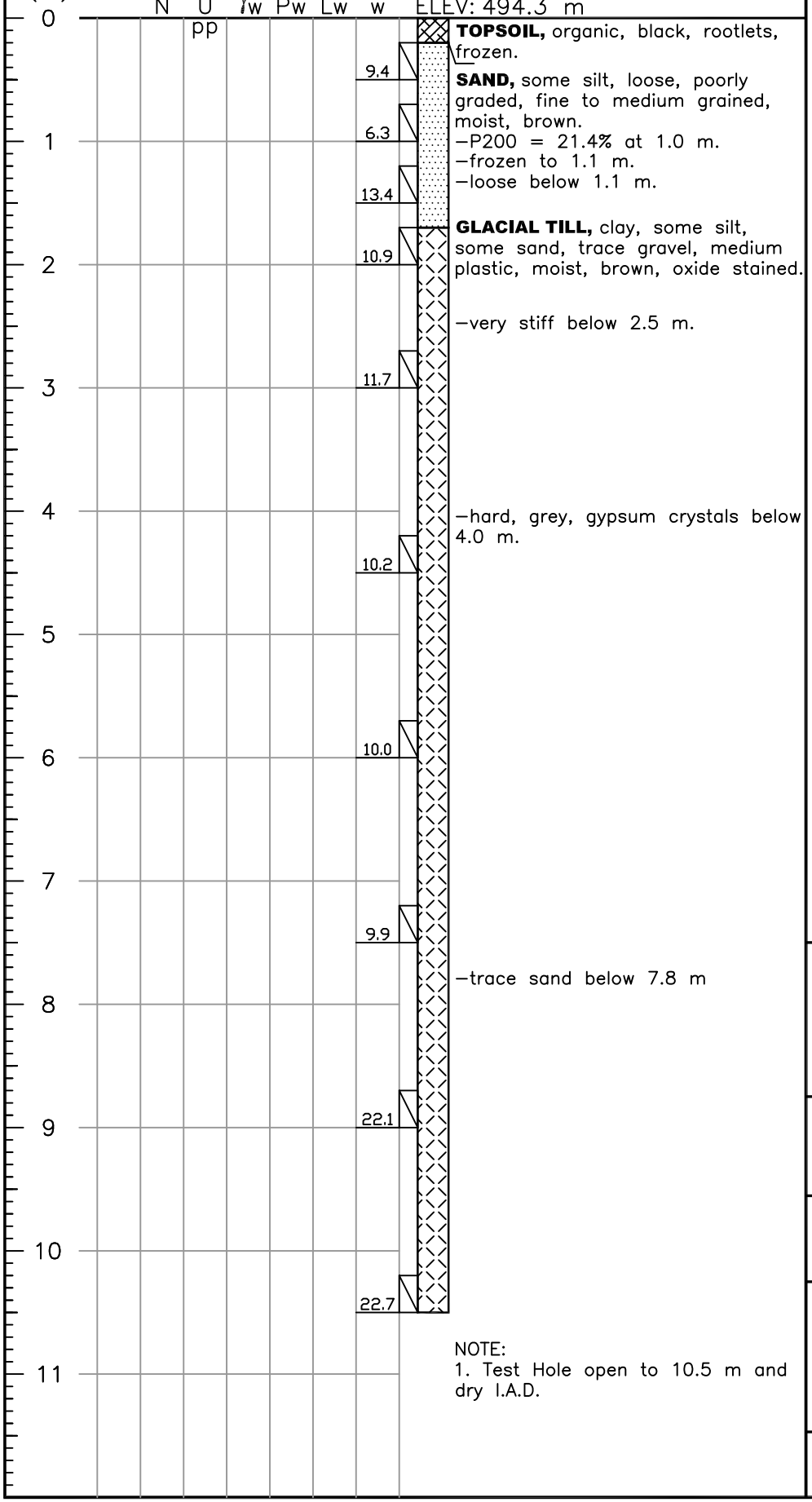
PROJECT:
WHISPER RIVER ESTATE PHASE 2

LOCATION:
WITHIN NW-16-38-04-W3M
RM OF CORMAN PARK

NORTHING: **EASTING:**

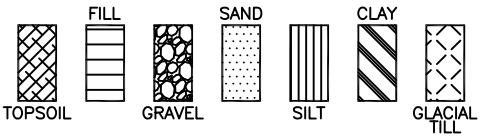
DATE DRILLED:	**DRAWING NUMBER:**
FEB 18/15	9978-4

TEST HOLE 15-4



NOTE:
1. Test Hole open to 10.5 m and dry I.A.D.

LEGEND:



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

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γ_w...WET UNIT WEIGHT (kN/m^3)

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

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

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

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

P200...% PASSING No. 200 SIEVE

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

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

▼...RECORDED WATER LEVEL (PIEZO)

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

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT:
WHISPER RIVER ESTATE PHASE 2

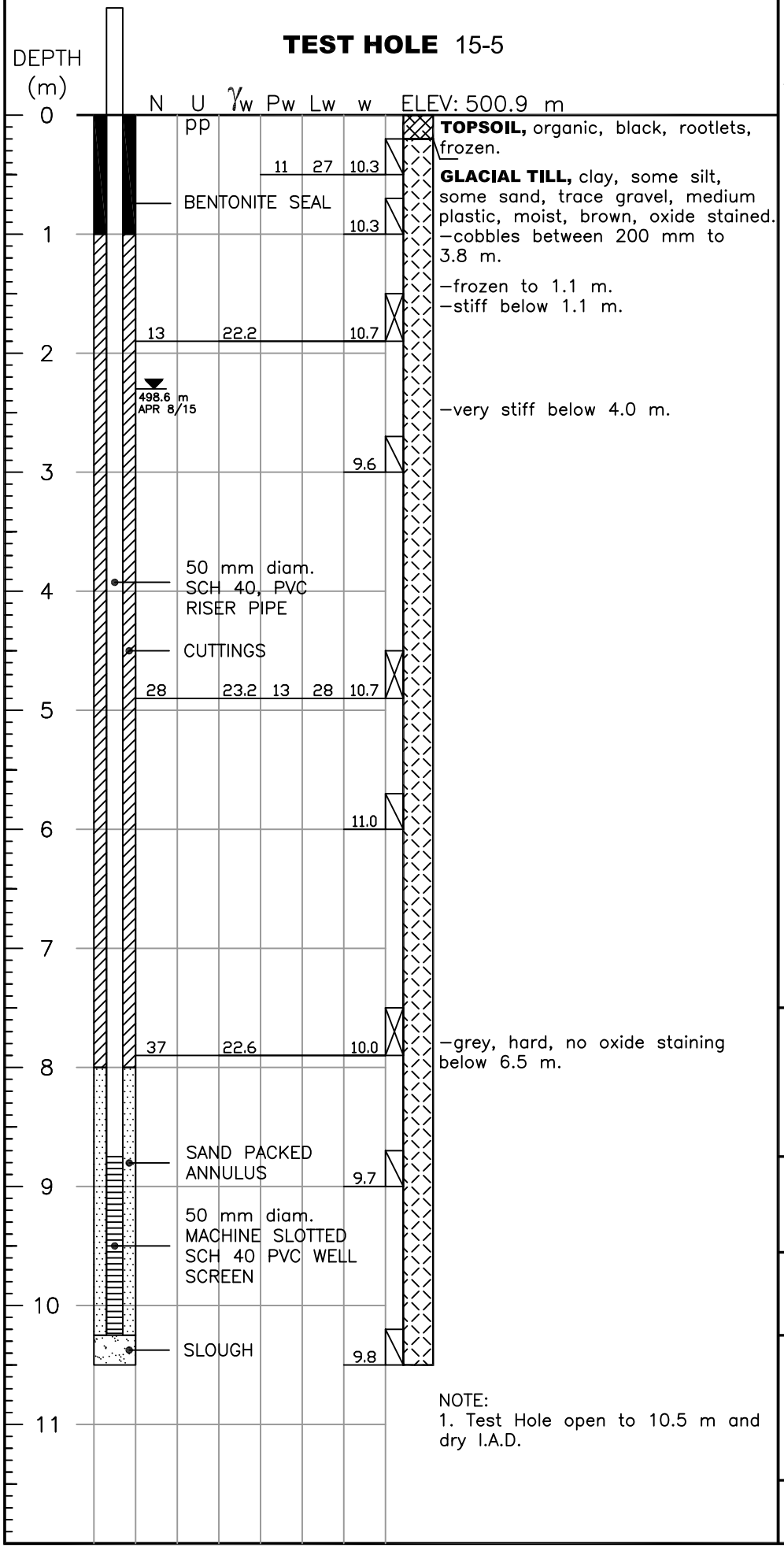
LOCATION:
WITHIN NW-16-38-04-W3M
RM OF CORMAN PARK

NORTHING: 5792434 **EASTING:** 396341

DATE DRILLED:	**DRAWING NUMBER:**
FEB 18/15	9978-5

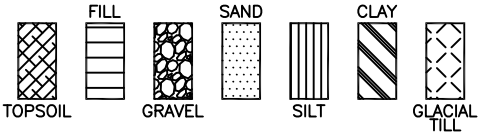
PIEZO. ELEV.= 501.9 m

TEST HOLE 15-5



NOTE:
1. Test Hole open to 10.5 m and dry I.A.D.

LEGEND:



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

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γ_w...WET UNIT WEIGHT (kN/m^3)

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

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

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

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

P200...% PASSING No. 200 SIEVE

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

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

▼...RECORDED WATER LEVEL (PIEZO)

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

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT:
WHISPER RIVER ESTATE PHASE 2

LOCATION:
WITHIN NW-16-38-04-W3M
RM OF CORMAN PARK

NORTHING: 5792427 **EASTING:** 396101

DATE DRILLED:	**DRAWING NUMBER:**
FEB 19/15	9978-6

PIEZO. ELEV.= 501.6 m

TEST HOLE 15-6

ELEV: 500.6 m

DEPTH (m)	N	U	γ_w	Pw	Lw	w	
0		pp				11.7	**TOPSOIL,** organic, black, rootlets, frozen.
							BENTONITE SEAL
							GLACIAL TILL, clay, some silt, some sand, trace gravel, medium plastic, moist, brown, oxide stained.
1						10.9	
							—frozen to 1.2 m.
						10.3	—stiff below 1.2 m.
							—some silt below 1.7 m.
2						11.5	
							—very stiff below 2.6 m.
						11.9	
3							50 mm diam. SCH 40, PVC RISER PIPE
							497.2 m APR 8/15
							CUTTINGS
4						10.6	
5							
							SAND, trace gravel, compact, well graded, fine to coarse, wet, brown, seepage, sloughing.
6						17.5	
							GLACIAL TILL, clay, some silt, some sand, trace gravel, hard, medium plastic, moist, grey.
7						12.8	
							SAND PACKED ANNULUS
8							50 mm diam. MACHINE SLOTTED SCH 40 PVC WELL SCREEN
9						15.8	
							SLOUGH
10						12.8	
11							

NOTE:
1. Test Hole open to 10.5 m and dry I.A.D.

LEGEND:

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

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

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γ_w...WET UNIT WEIGHT (kN/m^3)

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

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

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

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

P200...% PASSING No. 200 SIEVE

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

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

▼...RECORDED WATER LEVEL (PIEZO)

SHELBY TUBE, SPLIT SPOON, CUTTINGS

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

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

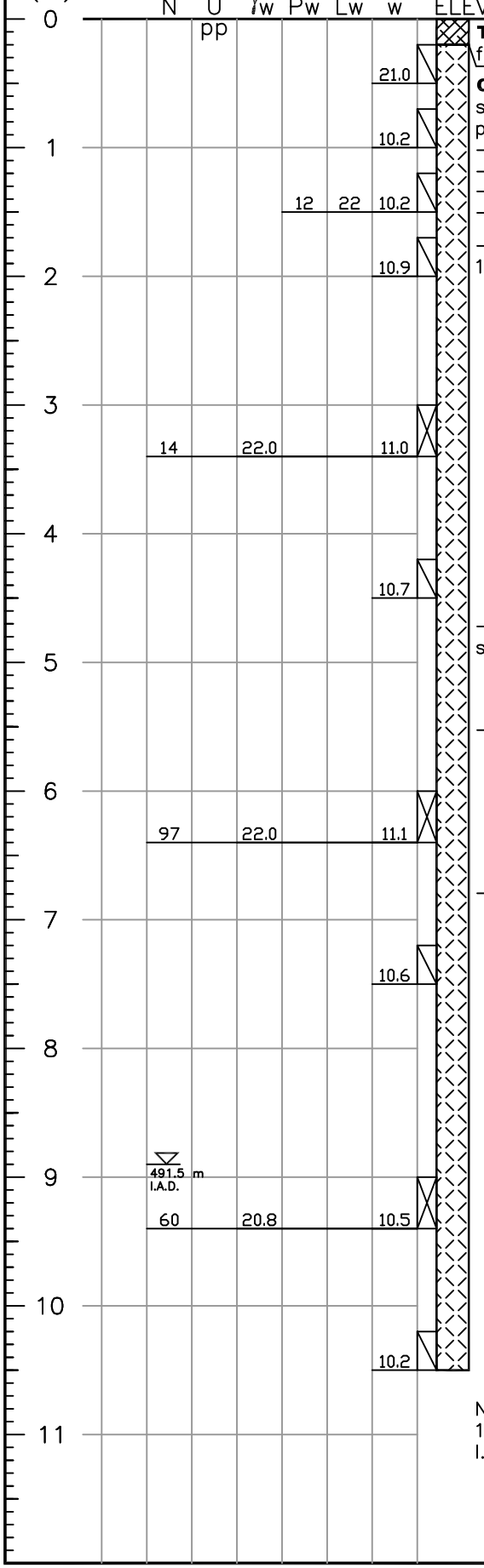
PROJECT:
WHISPER RIVER ESTATE PHASE 2

LOCATION:
WITHIN NW-16-38-04-W3M
RM OF CORMAN PARK

NORTHING: 5792442 **EASTING:** 395831

DATE DRILLED:	DRAWING NUMBER:
FEB 19/15	9978-7

TEST HOLE 15-7



TOPSOIL, organic, black, rootlets, frozen.

GLACIAL TILL, clay, some silt, some sand, trace gravel, medium plastic, moist, brown, oxide stained.
–P200 = 57.0% at 500 mm.
–cobbles from 600 mm to 6.8 m.
–frozen to 1.2 m.
–stiff below 1.2 m.

–some silt, some sand below 1.7 m.

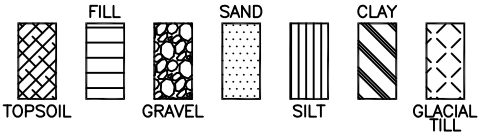
–sand lense, wet, seepage, sloughing at 4.7 m.

–hard below 5.5 m.

–grey below 6.8 m.

NOTE:
1. Test Hole sloughed to 8.5 m I.A.D.

LEGEND:



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

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γ_w...WET UNIT WEIGHT (kN/m^3)

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

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

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

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

P200...% PASSING No. 200 SIEVE

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

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

▼...RECORDED WATER LEVEL (PIEZO)

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

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT:
WHISPER RIVER ESTATE PHASE 2

LOCATION:
WITHIN NW-16-38-04-W3M
RM OF CORMAN PARK

NORTHING: 5792227 **EASTING:** 395856

DATE DRILLED:	**DRAWING NUMBER:**
FEB 19/15	9978-8

PIEZO. ELEV.= 501.0 m

TEST HOLE 15-8

ELEV: 500.0 m

DEPTH (m)	N	U	γ_w	Pw	Lw	w	
0		pp					**TOPSOIL,** organic, black, rootlets, frozen.
						16.5	BENTONITE SEAL
1						10.9	**GLACIAL TILL,** clay, some silt, some sand, trace gravel, medium plastic, moist, brown, oxide stained.
							—frozen to 1.2 m.
							—stiff below 1.2 m.
							—very stiff below 1.5 m.
2	21		22.4			9.9	
							497.2 m APR 8/15
3						10.8	—hard below 3.0 m.
							50 mm diam. SCH 40, PVC RISER PIPE
4							CUTTINGS
5	43		22.4			11.1	
6						20.7	
7							—grey below 6.8 m.
							SAND PACKED ANNULUS
8	58		22.9			10.1	
							50 mm diam. MACHINE SLOTTED SCH 40 PVC WELL SCREEN
9						10.7	
							SLOUGH
10						10.7	
11							

NOTE:
1. Test Hole open to 10.5 m and dry I.A.D.

LEGEND:

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

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

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γ_w...WET UNIT WEIGHT (kN/m^3)

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

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

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

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

P200...% PASSING No. 200 SIEVE

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

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

▼...RECORDED WATER LEVEL (PIEZO)

SHELBY TUBE, SPLIT SPOON, CUTTINGS

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

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

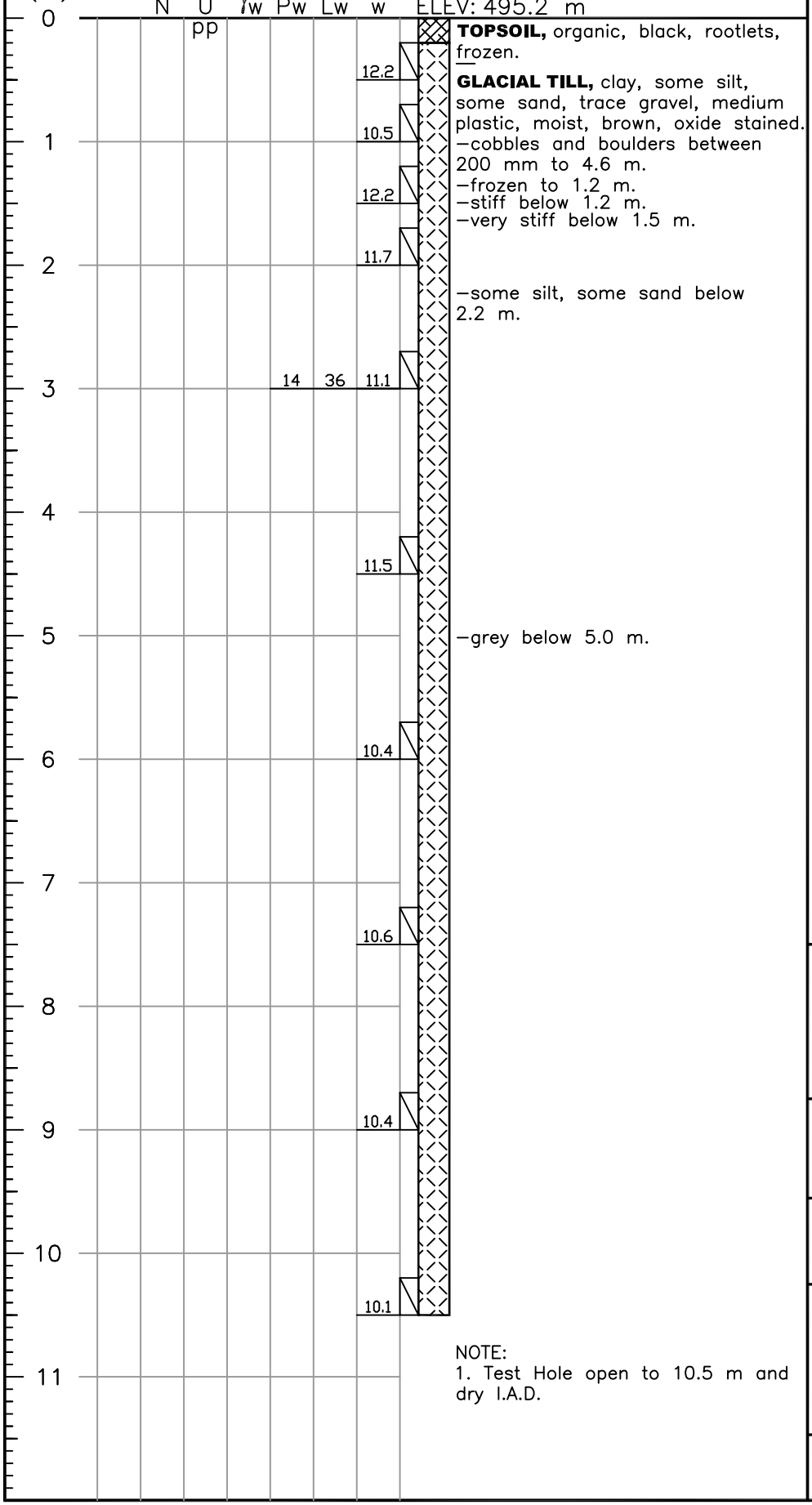
PROJECT:
WHISPER RIVER ESTATE PHASE 2

LOCATION:
WITHIN NW-16-38-04-W3M
RM OF CORMAN PARK

NORTHING: 5791972 **EASTING:** 395902

DATE DRILLED:	DRAWING NUMBER:
FEB 19/15	9978-9

TEST HOLE 15-9



TOPSOIL, organic, black, rootlets, frozen.

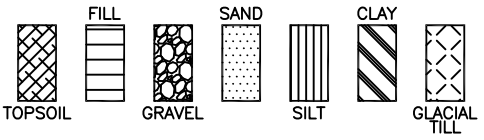
GLACIAL TILL, clay, some silt, some sand, trace gravel, medium plastic, moist, brown, oxide stained.
–cobbles and boulders between 200 mm to 4.6 m.
–frozen to 1.2 m.
–stiff below 1.2 m.
–very stiff below 1.5 m.

–some silt, some sand below 2.2 m.

–grey below 5.0 m.

NOTE:
1. Test Hole open to 10.5 m and dry I.A.D.

LEGEND:



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

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γ_w...WET UNIT WEIGHT (kN/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])

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

P200...% PASSING No. 200 SIEVE

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

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

▼...RECORDED WATER LEVEL (PIEZO)

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

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT:
WHISPER RIVER ESTATE PHASE 2

LOCATION:
WITHIN NW-16-38-04-W3M
RM OF CORMAN PARK

NORTHING: 5792159 **EASTING:** 396167

DATE DRILLED:	**DRAWING NUMBER:**
FEB 19/15	9978-10

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.

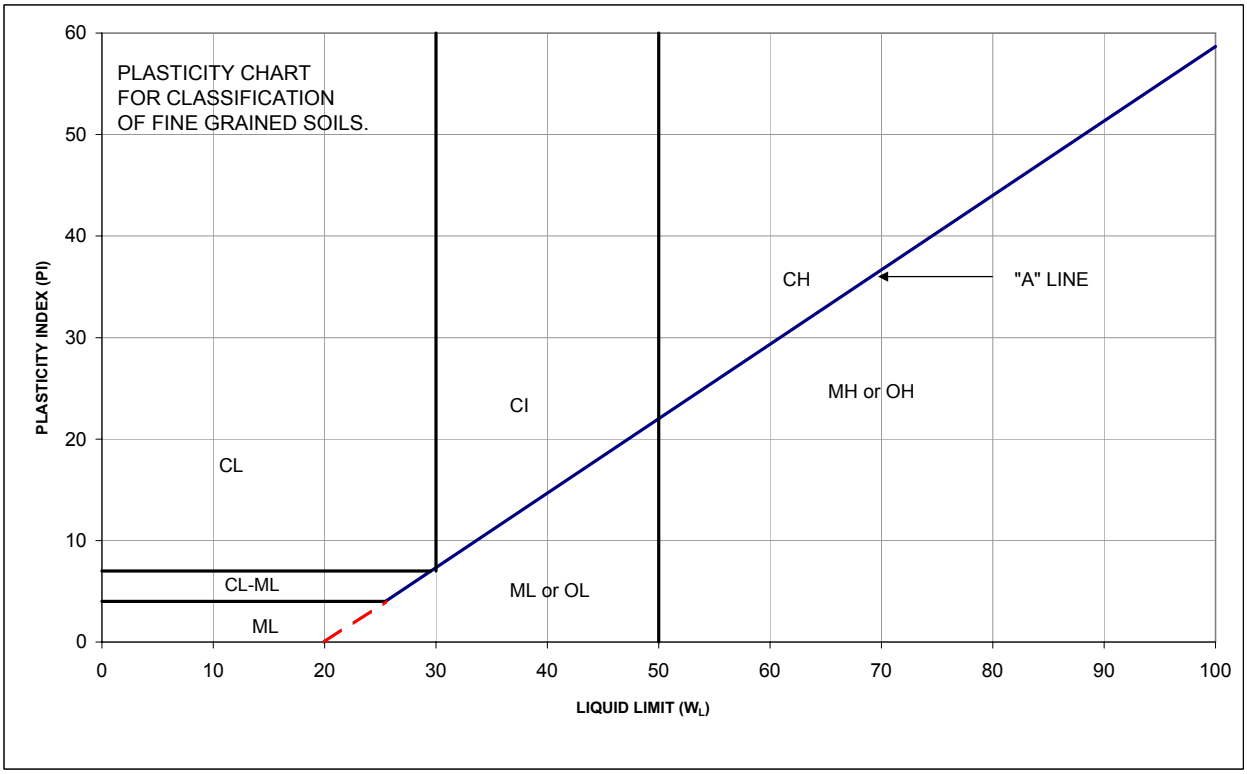
Organic Soils: Readily identified by colour, odour, spongy feel and frequently by fibrous texture.

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	$C_u = \frac{D_{60}}{D_{10}} > 4 \quad C_c = \frac{(D_{30})^2}{D_{60} \times D_{10}} = 1 \text{ to } 3$
			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	$C_u = \frac{D_{60}}{D_{10}} > 6 \quad C_c = \frac{(D_{30})^2}{D_{60} \times D_{10}} = 1 \text{ to } 3$
			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	$W_L > 50$



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APPENDIX B
LABORATORY TEST RESULTS

ASTM D422: GRAIN SIZE ANALYSIS OF SOIL

Project: PROPOSED RURAL SUBDIVISION - WHISPER RIVER ESTATES PHASE II
NW-16-38-4-W3M, R.M. OF CORMAN PARK (NO. 344), SASKATCHEWAN

Project No.: 9978

Date Tested: March 2, 2015

Test Hole No.: 15-1

Sample No.: 3

Depth (m): 1.5-1.9

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	98
# 10	2	97
# 20	0.85	92
# 40	0.425	85.3
#60	0.25	75.2
# 100	0.15	65.6
# 200	0.075	52.0

Hydrometer Analysis:

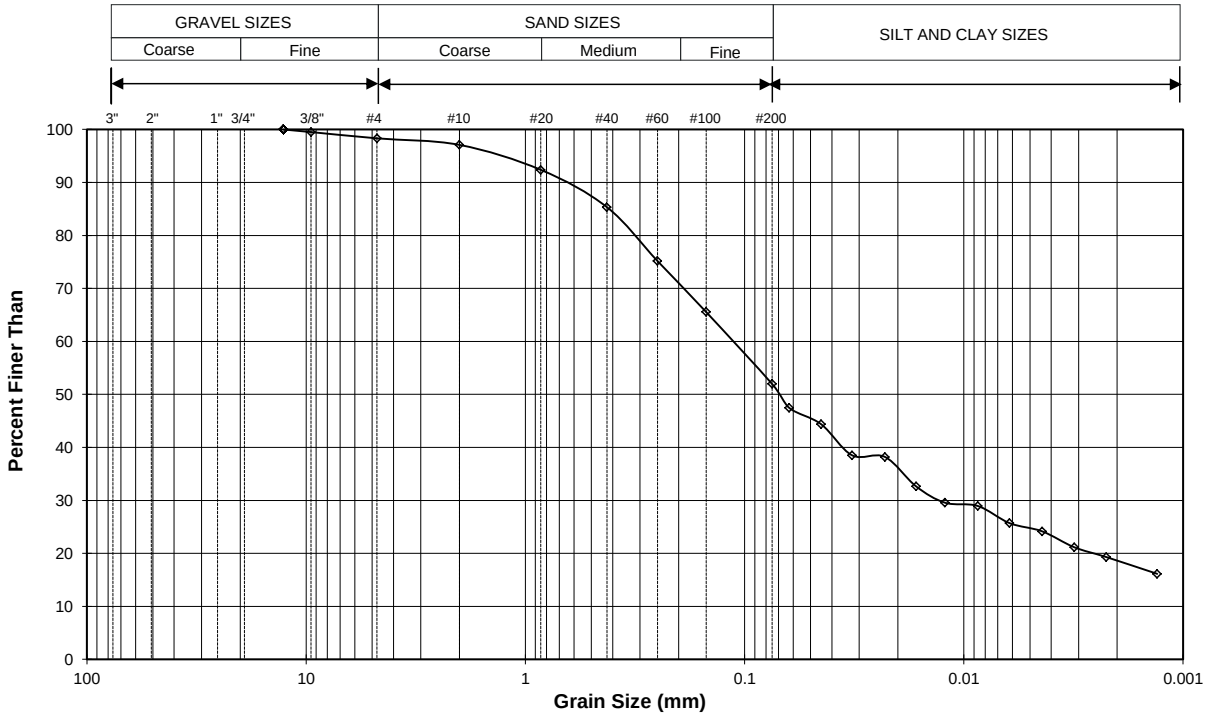
Dispersing Agent:
Sodium Hexametaphosphate

Diameter mm	% Finer
0.0626	47.5
0.0448	44.4
0.0324	38.5
0.0229	38.2
0.0165	32.7
0.0122	29.6
0.0086	28.9
0.0062	25.7
0.0044	24.2
0.0031	21.2
0.0022	19.3
0.0013	16.1

Material Description:

% Gravel Sizes	% Sand Sizes	% Silt Sizes	% Clay Sizes
2	46	33	19

Remarks:



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DRAWING NO.

APPENDIX B-1

ASTM D422: GRAIN SIZE ANALYSIS OF SOIL

Project: PROPOSED RURAL SUBDIVISION - WHISPER RIVER ESTATES PHASE II
NW-16-38-4-W3M, R.M. OF CORMAN PARK (NO. 344), SASKATCHEWAN

Project No.: 9978

Date Tested: March 2, 2015

Test Hole No.: 15-7

Sample No.: 59

Depth (m): 1.5

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	99
# 4	4.75	99
# 10	2	98
# 20	0.85	93
# 40	0.425	86.4
#60	0.25	75.6
# 100	0.15	63.8
# 200	0.075	50.2

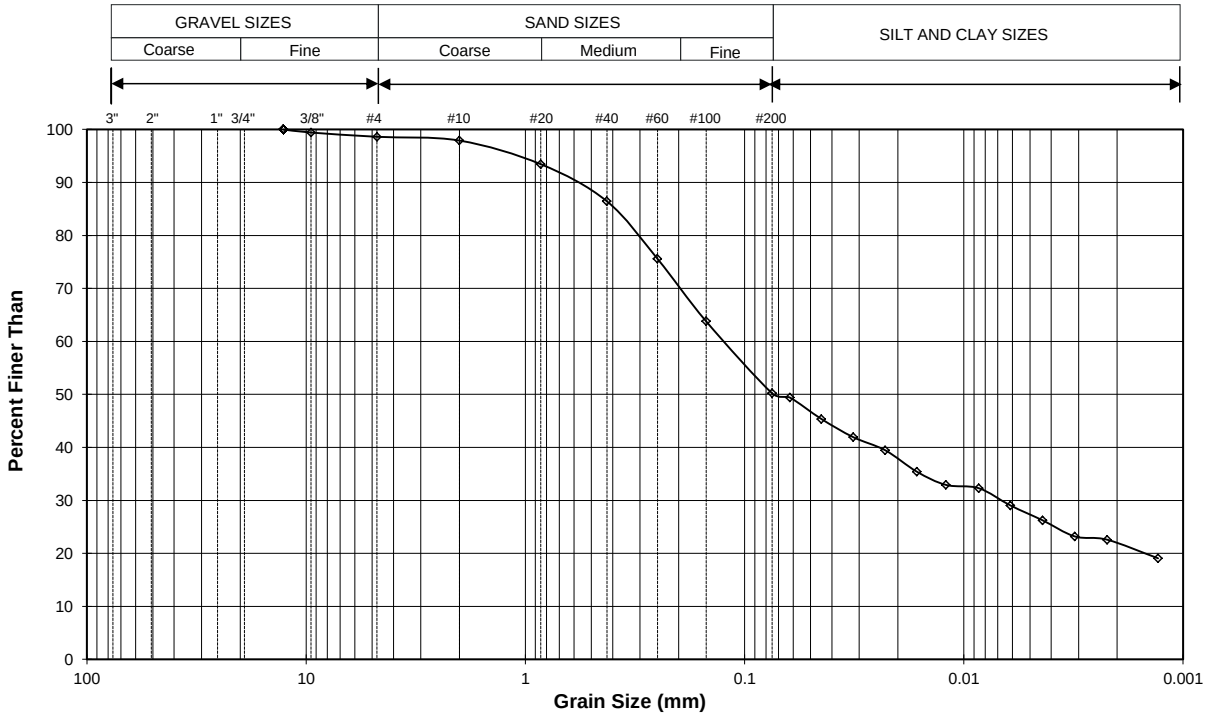
Hydrometer Analysis:

	Diameter mm	% Finer
Dispersing Agent:	0.0622	49.4
Sodium Hexametaphosphate	0.0447	45.4
	0.0320	41.9
	0.0228	39.5
	0.0164	35.4
	0.0121	32.9
	0.0086	32.3
	0.0061	29.0
	0.0044	26.2
	0.0031	23.2
	0.0022	22.6
	0.0013	19.1

Material Description:

% Gravel Sizes	% Sand Sizes	% Silt Sizes	% Clay Sizes
1	48	28	22

Remarks:



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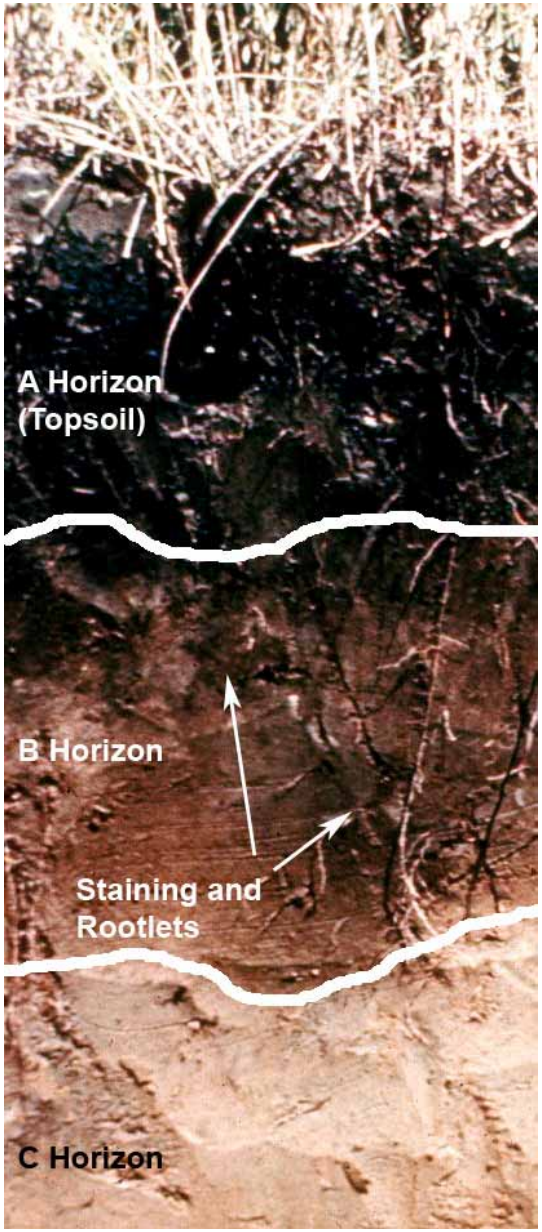
DRAWING NO.

APPENDIX B-2

APPENDIX C

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 E: HYDROGEOLOGICAL REPORT

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HYDROGEOLOGICAL REPORT
WHISPER RIVER ESTATES PHASE II
PROPOSED RURAL SUBDIVISION
LSD 11 to 14, INCLUSIVE, 16-38-04-W3M,
R.M. OF CORMAN PARK NO. 344, SASKATCHEWAN
PMEL FILE NO. 9995
MAY 12, 2015

PREPARED FOR:

NORTH PRAIRIE DEVELOPMENTS LTD.
1 – 319 WELLMAN LANE
SASKATOON, SK
S7T 0J1

ATTENTION: MR. PHIL RATZLAFF,
LAND DIVISION MANAGER

EXECUTIVE SUMMARY

Based on the information reviewed and the results of this investigation, PMEL is of the opinion that Onsite Wastewater Treatment Systems (OWTS), specifically septic tanks, Type I/II mounds and/or chamber systems, are suitable to be used at the proposed development. However, since the soils located across the majority of the site are relatively impermeable, Type II mounds would be the preferred type of OWTS. Mounds sizes may have to be increased to account for the low flow properties of the surficial soils at the site. Improper mound sizing could result in soil erosion and/or surficial pooling of effluent on lawns.

The proposed OWTS will release nitrates to the subsurface. However, the near surface groundwater at the site is considered unsuitable for human consumption and the lower aquifers in the region are isolated from the site. As such, nitrates released from proposed OWTS to be constructed at the site are considered to represent a low risk of adverse impact towards human health and/or the environment. In light of the above, a nitrate assessment was not conducted for this investigation.

The information presented in this report has been provided to give a general indication of the suitability of the existing soils and groundwater conditions for satisfactorily treating sanitary effluent. It is recommended that further assessments be undertaken for each lot once the lot plan and location of the OWTS have been finalized. Site specific soil samples should be gathered at the proposed septic field locations and design and construction of the septic treatment system should be undertaken by qualified personnel in accordance with Saskatchewan Health specifications and recommendations.

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1.0 INTRODUCTION

The following report presents the results of a hydrogeological study prepared for the proposed residential subdivision (study site) to be constructed on the property legally described as:

- *Legal Subdivision (LSD) 11 to 14, inclusive, 16-38-04-W3M, R.M. of Corman Park No. 344, Saskatchewan.*

The terms of reference for this investigation were presented in PMEL Proposal No. 9978, dated January 21, 2015. Written authorization (Purchase Order No. 44449) to perform this investigation was provided by Mr. Phil Ratzlaff, Land Division Manager, North Prairie Developments Ltd. on January 27, 2015.

This is the third in investigation conducted by P. Machibroda Engineering Ltd. (PMEL) at the subject property. Results of the Phase I ESA were presented in PMEL Report No. 9980, dated, February 17, 2015 while the results of a geotechnical investigation were presented in PMEL Report No. 9996, dated March 13, 2015. Where applicable, information contained in these previous reports will be used to supplement this report.

Field work, including field test drilling and soil sampling, was conducted on February 19, 20 and 27, 2015. Groundwater monitoring and sampling were performed at the site on March 9, 10 and 17, 2015.

The objective of this investigation was to determine if the study site is suitable for use of Onsite Wastewater Treatment Systems (OWTS).

2.0 SITE CHARACTERIZATION

2.1 Site Description

The layout of the proposed subdivision is shown on the Site Plan, Drawing No. 9995-1. The subject site is located at the southeast intersection of Range Road No. 3044 and Township Road No. 383, approximately 10 km to the northeast of the City of Saskatoon, in the R.M. of Corman Park No. 344, Saskatchewan.

The subject property, which is currently vacant and undeveloped (i.e., no buildings), is predominantly cultivated farmland and/or pasture land. A relict meltwater channel cuts run diagonally from near the middle of the site towards the northeast corner of the site.

A small farmyard is located (offsite) along the southern property boundary, while an acreage is located (offsite) across Township Road No. 383 proximate the northwest corner of the subject property. The South Saskatchewan River is located approximately 1 km to the southeast while the City of Saskatoon is located approximately 4 km to the southwest of the site.

2.2 Topography

Based on Google Earth (cited April 10, 2015), the ground surface elevation at the subject property ranges from approximately 498 m geodetic, proximate the northwest corner of the site, to approximately 490 m geodetic proximate the southeast corner of the site. Regionally, the ground surface in the area slopes southeast towards the South Saskatchewan River (467 m geodetic) which is located approximately 1 km to the southeast of the subject property.

2.3 Subdivision Density

The proposed residential subdivision will consist of 15 residential lots ranging in size from 2 to 3.6 ha (5 to 9 acres) with an average lot size of 2.5 ha (6.2 acres).

Since the average parcel size of the proposed subdivision is less than 4 ha (10 acres) the subdivision is considered to be a “Medium Density Area” as defined by the *Guidance Documents for Developments and Subdivisions Where Onsite Wastewater Treatment Systems are Proposed* (Government of Saskatchewan, 2012).

2.4 Physiography/Geology

A review of published physiography and regional geological information (Action et al. 1960, Christiansen, 1967) revealed the following:

1. The subject property lies in the physiographic region known as the Saskatchewan Rivers Plain.
2. The Saskatchewan Rivers Plain is characterized as gently undulating to rolling glacial lacustrine-alluvial (glacial lake) plains, aeolian plains (dunes) and till plains.
3. The surficial soil deposits consist of variable textured lacustrine and alluvial sands, silts and clays, aeolian sands, glacial till and local bedrock exposures in the South Saskatchewan River.
4. The bedrock deposits at this site consisted of approximately 90 m of glacial till and stratified drift (sand, silt and clay) underlain by the noncalcareous silt and clay of the Lea-Park Formation-Upper Colorado.

2.5 Regional Hydrogeology

An examination of hydrogeological data (Christiansen, 1967 and MDH, 2011) for this region revealed the following observations:

1. The study site overlies an Empress Group aquifer. The surface of this aquifer is located at a depth of approximately 74 m below grade while the aquifer is reported to be approximately 13 m thick in the vicinity of the subject property.

2. The subject property overlies Upper and Lower Dundurn Formation aquifers. The Upper Dundurn Aquifer is located at a depth of approximately 49 m below grade and is approximately 2.4 m thick. The Lower Dundurn Aquifer is reportedly located at a depth of approximately 67 m below grade and is approximately 4 metres thick in the vicinity of the subject property
3. The subject property also overlies a portion of the Warman Formation Aquifer which is located at a depth of approximately 24 m below grade and is approximately 7 m thick.
4. No Surficial Stratified Deposits, Battleford, Mennon, Judith River, Lower and Upper Floral, and Bearpaw aquifers are known to exist proximate the subject property.
5. The closest surface water body to the site is the South Saskatchewan River, which is located approximately 1 km southeast of the subject property.

2.6 Groundwater Wells

A search of the Saskatchewan Watershed Authority (SWA) Groundwater Well Database (https://gis.swa.ca/, cited March 5, 2015) was conducted for the study site and surrounding area. Detailed Saskatchewan Water Corporation (SaskWater) Water Well records have been included in Appendix A.

Review of the water well search revealed the following:

1. A groundwater well registered for domestic use is located on the same quarter section (i.e., NW 16-38-04-W3M). This well was completed at depth of approximately 55 m (180 ft) below grade.
2. Four (4) registered groundwater wells may also be located within a 1.0 km radius of the subject property. These wells are completed at depths ranging from approximately 46 to 55 m (160 to 180 ft) below grade.

2.7 Surface Water

The South Saskatchewan River is located approximately 1 km southeast of the subject site. In addition, a relict meltwater channel cuts run diagonally from near the middle of the site towards the northeast corner of the site.

2.8 Water Supply

It is proposed that potable water for each lot of the subdivision be supplied via a piped distribution system with its intake located (upgradient) in the South Saskatchewan River over 10 km to the south of the subject property.

2.9 Waste Water

It is proposed that each lot be equipped with an Onsite Waste Treatment System (OWTS).

3.0 FIELD INVESTIGATION

3.1 Test Hole Drilling

Thirteen test holes, located as shown on the Site Plan, Drawing No. 9995-1 were dry drilled using our truck-mounted, continuous flight, solid stem auger drill rig. The test holes were 150 mm in diameter and extended to depths ranging from approximately 4.5 to 15 m below the existing ground surface. The locations and elevations of the test holes were established using a Trimble Geoexplorer 6000 global positioning system.

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. Disturbed samples of auger cuttings were collected during test drilling and sealed in plastic bags to minimize moisture loss. The soil samples were taken to PMEL's materials testing laboratory for analysis.

3.2 Monitoring Well Installation

Monitoring wells (i.e., piezometers) were installed in each Test Hole. Each monitoring well consisted of a 50 mm diameter, Schedule 40, PVC machine slotted screen with a solid riser pipe. The annular spaces around the slotted screens were filled with silica sand and bentonite seals were placed around the solid riser pipe.

3.3 Hydraulic Conductivity Testing

Bail response tests were performed on March 9, 17 and/or April 8, 2015 in the monitoring wells installed in Test Hole Nos. 15-101C, 15-102, 15-104, 15-105 and 15-111 to determine the bulk saturated hydraulic conductivity of the in-situ soil. These monitoring wells were selected since the remaining monitoring wells were dry (i.e., no water). Each test consisted of removing a known volume of water to produce a decrease or increase in the hydraulic head within the monitoring wells. The water levels within the monitoring wells were then allowed to recover and the response was measured with respect to time. The recorded data was used to estimate the saturated, bulk hydraulic conductivity of the adjacent soil unit.

3.4 Groundwater Sampling

On March 9, 10 and 17, 2015, following hydraulic conductivity testing, groundwater samples were collected from the monitoring wells installed in Test Hole Nos. 15-101A, 15-101C, 15-104, 15-108, 15-109 and 15-111. Groundwater samples were not recovered from the remaining monitoring wells since they were dry at the time of sampling.

The collected samples were placed in laboratory supplied jars with appropriate preservatives and submitted to ALS for analysis of routine parameters including: pH; conductivity; Total Dissolved Solids (TDS); major ions; Hardness; Nitrate-Nitrogen; Nitrite-Nitrogen; alkalinity.

4.0 RESULTS OF INVESTIGATION

4.1 Ground Surface and Monitoring Well Elevations

The ground surface and monitoring well elevations at each Test Hole location are presented on the Test Hole Logs, Drawing Nos. 9995-2 to 14, inclusive.

4.2 Soil Profile

Detailed descriptions of the site stratigraphy are presented on the Test Hole Logs, Drawing Nos. 9995-2 to 14, inclusive while stratigraphic cross-sections of the site are presented on Drawing Nos. 9995-27 and 28.

In general the soil profile consisted of approximately 50 to 200 mm of topsoil underlain by glacial till which extended to a depth of at least 15 m below grade, the maximum depth explored with our Test Holes at this site. Sand deposits, extending to depths of up to 1.1 m below grade, were encountered at the glacial till surface in Test Hole No. 15-103, 15-105, 15-106, 15-107 and 15-110. Inter/intra till sand deposits were encountered in Test Hole Nos. 15-101A, 15-101B and 15-101C at depths ranging approximately 3.2 to 4.2 m below grade.

4.3 Groundwater Conditions, Sloughing

The depths at which groundwater seepage and sloughing conditions were encountered during drilling have been shown plotted on the Test Hole Logs, Drawing Nos. 9995-2 to 14, inclusive.

A summary of the groundwater levels recorded in the monitoring wells on April 8, 2015 has been presented in Table I.

TABLE I. RECORDED GROUNDWATER ELEVATIONS

Test Hole Number	Elevation (meters)		Recorded Groundwater Elevation (metres)
	Piezometer Rim	Ground Surface	08-Apr-15
15-101A	501.3	500.2	496.9
15-101B	501.2	500.1	dry
15-101C	500.5	500.4	495.5
15-102	500.5	499.4	dry
15-103	494.5	493.5	dry
15-104	499.8	498.8	495.2
15-105	494.3	493.3	dry
15-106	498.9	497.9	dry
15-107	501.6	500.6	dry
15-108	502.1	501.1	497.7
15-109	501.3	500.3	496.4
15-110	496.1	495.1	491.7
15-111	502.1	501.1	497.2

Review of the results presented in Table I revealed the following:

1. The depth to groundwater on April 8, 2015 ranged from approximately 3.4 to 4.0 m below grade while the apparent direction of groundwater flow was towards the southeast at an average gradient of 0.01.
2. No groundwater was present (i.e., monitoring wells were dry) on April 8, 2015 in the monitoring wells installed in Test Hole Nos. 15-101B, 15-102, 15-103, 15-106 and 15-107.
3. Review of the nested monitoring wells (i.e., Test Hole Nos. 15-101A, 15-101B and 15-101C) revealed that the deeper the monitoring well screen the higher the groundwater elevation in the well. This suggests that the near surface groundwater at the site is unlikely to flow downward into the lower aquifers.
4. The apparent upward vertical groundwater gradient, determined on the basis of the groundwater elevations measured at the site on April 8, 2015 in the monitoring wells installed in Test Hole Nos. 15-101A and 15-101C was 0.07.
5. The recorded groundwater levels may not have achieved static equilibrium. Higher static water levels should be expected following piezometer equilibration and/or during following spring snowmelt or periods of precipitation.

4.4 Cobblestones and Boulders

Cobblestones and/or boulders were encountered during test drilling. The depths at which cobblestones and/or boulders were encountered during drilling have been shown on Drawing Nos. 9995-2 to 14, inclusive.

The glacial till consisted of a heterogeneous mixture of gravel, sand, silt and clay-sized particles. The glacial till strata also contained sorted deposits of the above particle sizes. In addition to the sorted deposits, a random distribution of larger particle sizes in the cobblestone range (60 to 200 mm) and boulder-sized range (larger than 200 mm) were encountered during test drilling. The statistical probability of encountering cobblestones and/or boulders in the thirteen small diameter test holes drilled at this site was low.

Intertill deposits of cobblestones, boulders, boulder pavements and isolated deposits of saturated sand or gravel should be anticipated. The frequency of encountering such deposits will increase proportionately with the volume of soil excavated and/or the number of piles installed.

4.5 Soil Classification

The soil classification consisted of a visual classification of the soil. The results of the soil classification conducted on representative samples of soil recovered from this site have been plotted on the drill logs alongside the corresponding depths at which the samples were recovered as shown on Drawing Nos. 9995-2 to 14, inclusive.

4.6 CSC Soil Classification

The results of the grain size distribution analyses conducted on select samples are summarized in Table II. Review of the results presented in Table II revealed that the surficial (i.e., upper 1.5 metres) fill/sand and/or glacial till soils at the site are classified as “loam,” “silt loam,” “sandy loam” and/or “clay loam.” In accordance with SaskHealth (2009) all of these soil types are considered suitable for development of an OWTS.

TABLE II. CSC SOIL CLASSIFICATION

Test Hole Number	Depth (metres)	Grain Size Distribution Analysis (percent)			Saskatchewan Health Soil Texture Classification
		Sand	Silt	Clay	
15-101A	0.9	50	30	16	Loam
15-102	0.6	45	23	15	Loam
15-103	0.3	64	19	1	Sandy Loam
15-104	0.9	35	28	14	Silt Loam
15-105	1.2	44	23	16	Loam
15-106	0.9	42	26	21	Loam
15-107	0.6	45	29	15	Loam
15-108	0.3	41	28	31	Clay Loam
15-109	1.2	41	32	18	Loam
15-110	0.6	66	21	13	Sandy Loam
15-111	1.5	45	33	13	Loam
15-112	1.0	37	26	15	Silt Loam

4.7 Hydraulic Conductivity Testing

The bulk saturated hydraulic conductivities of the subsurface soils, calculated (refer to Appendix B) using the Hvorslev (1951) method, are summarized in Table III. The maximum bulk saturated hydraulic conductivity of the subsurface soils, calculated using the Hvorslev (1951) method, was 9×10^{-8} m/s for the bail response tests conducted in the monitoring wells installed in Test Hole No. TH15-105.

TABLE III. SUMMARY OF HYDRAULIC CONDUCTIVITY TEST RESULTS

Test Hole No.	Depth (m)	Hydraulic Conductivity (m/s)	Soil Type
15-101C	3 to 4.5	2×10^{-8}	Glacial Till
15-102	3 to 4.5	3×10^{-8}	Glacial Till
15-104	3 to 4.5	2×10^{-8}	Glacial Till
15-105	3 to 4.5	9×10^{-8}	Glacial Till
15-108	3 to 4.5	2×10^{-8}	Glacial Till
15-111	3 to 4.5	2×10^{-8}	Glacial Till/Sand

4.8 Groundwater Yield

Based on groundwater monitoring, the near surface groundwater is located approximately 3.4 m to 4 m below grade (refer to Section 4.3). The surficial soils at the site are comprised of predominantly glacial till extending to a depth of at least 15 m below grade. Other than thin (i.e., approximately 1 m thick), discontinuous sand seams, no potential aquifers were present in the surficial (upper 15 m) soils at the site. Assuming that the upper surface of the glacial till is fractured to a depth of approximately 12 m below grade, and the groundwater is located at an average depth of 3 m below grade, the saturated thickness of the unconfined aquifer would not be expected to extend beyond 10 m.

The maximum saturated hydraulic conductivity (K) of the surficial soils at the site measured on the basis of bail response testing (refer to Section 4.7) was 9×10^{-8} m/s.

In consideration of the above, the theoretical long-term (20 year) yield (i.e., Q_{20}) of the near surface groundwater was calculated using the Farvolden Method (AENV, 2010) as follows:

$Q_{20} = (0.68) \times (T) \times (HA) \times (0.7)$

Where:

Q20 = sustainable yield for a 20-year period (in m^3/day)
HA = available head (in metres) = 2/3 x 10 m = 6.7 m
T = transmissivity (m^2/day) = (10 m) (9×10^{-8} m/s) (86,400 s/day) = 0.08 m^2/day
0.7 = 70 % safety factor

Q_{20} = (0.68) x (0.08 m^2/day) x (6.7 m) x (0.7) = 0.255 m^3/day = 255 Liters/Day

An aquifer is not considered suitable for domestic supply unless it has a bulk hydraulic conductivity of greater than 10^{-6} m/s and is capable of supporting a 20 year sustained yield of 1,094 L/Day (AENV, 2010). In consideration of the above the near surface aquifer at the site is not considered suitable for development as a domestic water supply.

4.9 Laboratory Chemical Analysis - Groundwater

The results of the laboratory chemical analysis for major ions and routine parameters are summarized in Table IV along with the Health Canada (2014) Guidelines for Canadian Drinking Water Quality. Detailed laboratory reports, including a listing of the laboratory methods, are presented in Appendix C.

Review of the results presented in Table IV revealed the following:

1. The Total Alkalinity and Chloride concentrations measured in the groundwater samples recovered from the monitoring well installed in Test Hole No. 15-104 exceeded the referenced criterion.
2. TDS, at concentrations exceeding the referenced criterion, was present in groundwater samples recovered from each monitoring well sampled.
3. Nitrate-N, at a concentration exceeding the referenced criterion, was present in the groundwater sample recovered from the monitoring well in Test Hole No. TH15-101A.
4. Sodium and Sulphate, at concentrations exceeding the referenced criteria, were present in the groundwater samples recovered from the monitoring wells installed each test hole analyzed, except 15-109.

TABLE IV. RESULTS OF LABORATORY CHEMICAL ANALYSIS

Monitoring Well No.	15-101A		15-101C	15-104		15-108	15-109	15-111	Health Canada (2014) Guidelines for Canadian Drinking Water
Sample No.	101A	101D*	101C	104	110*	108	109	111	
Date Sampled	17/03/15	17/03/15	17/03/15	17/03/15	17/03/15	17/03/15	17/03/15	17/03/15	
PARAMETER									
Conductivity (EC)	6620	6640	8810	16400	16400	9250	1870	8240	No Criterion
pH	7.53	7.53	7.57	7.43	7.44	7.47	7.53	7.5	6.5-8.5
Alkalinity, Total (as CaCO3)	338	331	267	**663**	**663**	416	266	384	500
Bicarbonate (HCO3)	412	403	326	809	809	508	324	468	No Criterion
Carbonate (CO3)	<10	<10	<10	<10	<10	<10	<10	<10	No Criterion
Chloride (Cl)	102	101	142	**272**	**284**	92	239	82.8	250
Hardness (as CaCO3)	3920	4050	6250	13400	13100	6720	877	5740	No Criterion
Hydroxide (OH)	<10	<10	<10.	<10.	<10.	<10	<10.	<10.	No Criterion
Nitrate+Nitrite-N	16.6	16.4	7.41	8.07	8.13	3.83	2.54	4.25	No Criterion
Nitrate-N	**16.6**	**16.4**	7.25	7.47	7.64	3.82	2.35	4.12	10
Nitrite-N	<0.050	<0.050	0.161	0.597	0.492	<0.050	0.19	0.123	1
TDS (Calculated)	**6810**	**6910**	**9470**	**19700**	**19900**	**10500**	**1220**	**8740**	500
Calcium (Ca) Dissolved	525	541	476	438	430	481	232	450	No Criterion
Magnesium (Mg) Dissolved	634	656	1230	2980	2930	1340	72.4	1120	No Criterion
Potassium (K) Dissolved	32	33	26	<30	<30	33	14	21	No Criterion
Sodium (Na) Dissolved	**599**	**608**	**668**	**1420**	**1410**	**824**	72.5	**615**	200
Sulphate (as SO4) Dissolved	**4640**	**4700**	**6730**	**14200**	**14400**	**7460**	421	**6200**	500

Units expressed in mg/L except EC which is in uS/cm, pH which is unitless.

Health Canada, 2014. Guidelines for Canadian Drinking Water Quality Guidelines. Summary Table. http://www.hc-sc.gc.ca/ewh-semt/alt_formats/pdf/pubs/water-eau/2012-sum_guide-res_recom/2012-sum_guide-res_recom-eng.pdf. Cited March 26, 2015.

* - Sample No. 101D is a field "blind duplicate" of Sample No. 101A and Sample No. 110 is a "blind duplicate" of Sample No. 104.

< - Result is less than the detection limit.

Concentration exceeds referenced criteria.

4.10 Groundwater Velocity

4.10.1 Horizontal

The maximum hydraulic conductivity of the glacial till measured at the site during this investigation was 9×10^{-8} m/s. Assuming a porosity of 0.3, and, based on the April 8, 2015 groundwater monitoring, a horizontal gradient of 0.01, the horizontal groundwater velocity through the glacial till can be calculated as follows:

$V = (K)(i/n)$

Where:

V = groundwater velocity
K = hydraulic conductivity
i = vertical gradient
n = soil porosity

Therefore:

$V = (9 \times 10^{-8}\ m/s)(0.01)/(0.3)$
$= 3 \times 10^{-9}$ m/s
$= 95$ mm/year

4.10.2 Vertical

The maximum hydraulic conductivity of the glacial till measured at the site was 9×10^{-8} m/s. Assuming a porosity of 0.3, and, based on the April 8, 2015 groundwater monitoring, a vertical gradient of 0.07, the vertical groundwater velocity through the glacial till can be calculated as follows:

$V = (K)(i/n)$

Where:

V = groundwater velocity
K = hydraulic conductivity
i = vertical gradient
n = soil porosity

Therefore:

$V = (9 \times 10^{-8}\ m/s)(0.07)/(0.3)$
$= 2 \times 10^{-8}$ m/s
$= 630$ mm/year

5.0 CONCEPTUAL HYDROGEOLOGICAL MODEL

As shown on Drawing Nos. 9995-2 to 14, inclusive, and the cross-sections presented on Drawing Nos. 9995-27 and 28, the general soil profile consisted of 50 to 200 mm of topsoil overlying glacial till which extended to a depth of at least 15 m below grade, the maximum depth explored with our Test Holes at this site. Surficial sand deposits were present beneath the topsoil. As well, variable discontinuous inter/intra till sand deposits were present within the glacial till stratum.

The upper part of the glacial till layer has been damaged by freeze-thaw cycles and wetting-drying cycles. As a result, this upper part of the glacial till has a secondary porosity due to the presence of micro cracks and bio-channels. These features increase the saturated hydraulic conductivity of the soil, forming an unconfined aquifer in the upper portion of the glacial till.

Based on the results of the groundwater monitoring on April 8, 2015, the bulk saturated average hydraulic conductivity of the upper (4.5 m) of damaged glacial till was approximately 9×10^{-8} m/s. It is expected that the fracture spacing and density would decrease with depth, eventually causing the glacial till to form an aquitard which acts as a barrier to vertical flow. Based on published information (Maathuis, 1992), the vertical hydraulic conductivity of the lower, undamaged glacial till would be in the order of 10^{-10} to 10^{-11} m/s in the Saskatoon area.

In consideration of the above, Nitrate-Nitrogen (NO_3-N) released from an OWTS is expected to travel vertically until it reaches the groundwater table. From there, the NO_3-N is expected to flow horizontally towards the southeast along the surface of the groundwater table, at an average velocity of less than 0.5 m per year

Although wells are located within a 1 km radius of the site, all of the wells are relatively deep (i.e., 46 to 55 m) and completed in upper or lower Floral aquifers.

Based on groundwater monitoring conducted on April 8, 2015, there is an upward vertical gradient at the site. In other words, groundwater from deeper formations is moving upwards and recharging shallower groundwater. This upward groundwater flow, the presence of relatively impermeable soils above the lower aquifers, and that the NO_3-N released from the site will remain in the near surface groundwater, suggests that NO_3-N released from OWTS represents a low risk of impact to groundwater resources in the vicinity of the site. In other words the lower aquifers at the site are considered to be hydraulically isolated from the site.

6.0 ONSITE WASTE WATER TREATMENT SYSTEMS

6.1 Sewage Volumes

Assuming a single family dwelling with three bedrooms is constructed on each lot in the proposed subdivision the expected volume of sewage per day is calculated as follows:

$V = (V_p) \times (P_B) \times (B)$

Where:

V = expected sewage volume (L/day)
V_p = volume of sewage generated per person per day = 340 L/person/day
P_B = Persons per bedroom = 1.5 persons/bedroom
B = No. of Bedrooms = 3

V = (340 L/person/day) x (1.5 persons/bedroom) x (3 bedrooms) = 1,530 L/Day

6.2 Holding Tanks

The subject property is considered suitable for use of holding tanks to store sewage and wastewater until it can be transported to a final point of disposal.

6.3 Lagoons

The proposed lot sizes at the subject property range from 2 to 3.6 ha (4.9 to 8.9 acres). Since lagoons require a minimum lot size of 4 ha, they are not considered an acceptable OWTS for the proposed development (SKMoE, 2009).

6.4 Septic Tanks

6.4.1 Jet Type Disposal Systems

Jet type disposal systems require a minimum parcel/lot size of 4 ha. As such, Jet disposal systems are not considered an acceptable system for the proposed development (SKMoE, 2009).

6.4.2 Type I/II Mounds

Type I/II Mounds are considered an acceptable system for the proposed subdivision. Construction of Mounds and associated works should be performed in accordance with Saskatchewan Ministry of Health (2009). Site selection of the specific location of proposed Type I/II Mounds will be contingent on groundwater conditions and soil stratigraphy. Further investigation (i.e., Test Pits, Test Borings, etc.) should be performed at the specific site of the proposed Type I/II Mounds prior to installation to optimize the site selection and confirm site suitability. The surficial soils at the site have relatively low flow rates. As such, mounds sizes may have to be increased to account for the low flow properties of the soils at the site. Improper mound sizing could result in soil erosion and/or surficial pooling of effluent on lawns.

6.4.3 Chamber Systems and Adsorption Field Systems

Sanitary effluent collected in an adequately constructed septic tank can be transmitted into the soil using a Chamber System. Construction of Chamber Systems and associated works should be performed in accordance with Saskatchewan Ministry of Health (2009).

The base of each Chamber System will require a separation distance of at least 1.5 m from the high groundwater table. As such, site selection of the specific location of proposed Chamber System will be contingent on groundwater conditions and soil stratigraphy. Further investigation (i.e., Test Pits, Test Borings, etc.) should be performed at the specific site of the proposed Chamber System prior to installation to optimize the site selection and site suitability.

7.0 NITRATE ASSESSMENT

The near surface aquifer is not suitable for domestic water supply and domestic use aquifers in the area are considered to be isolated from the OWTS. Further, the water supply for the proposed subdivision will be provided by a piped distribution system with its intake located in the South Saskatchewan River, over 10 km to the south of the site. In light of the above, a nitrate assessment was not performed nor deemed necessary for the site.

8.0 DISCUSSION OF RESULTS

Based on the results of the investigation, Holding Tanks, Chamber Systems and Type I/II Mounds are considered suitable for wastewater treatment at the site. However, since the soils located across the majority of the site are relatively impermeable, Type II mounds would be the preferred type of OWTS. Mounds sizes may have to be increased to account for the low flow properties of the surficial soils at the site. Improper mound sizing could result in soil erosion and/or surficial pooling of effluent on lawns.

The information presented in this report has been provided to give a general indication of the suitability of the existing soils and groundwater conditions for satisfactorily treating sanitary effluent. It is recommended that further assessments be undertaken for each lot once the lot plan and location of the OWTS have been finalized. Site specific soil samples should be gathered at the proposed septic field locations and design and construction of the septic treatment system should be undertaken by qualified personnel in accordance with Saskatchewan Health specifications and recommendations.

9.0 LIMITATIONS

The presentation of the summary of the field drill logs and design recommendations has been completed as authorized. Thirteen, 150 mm diameter test holes were dry drilled using our continuous flight auger drill rig. 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.

Variations in the subsurface conditions from that shown on the drill logs at locations other than the exact Test Hole 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.

No identifiable evidence (i.e. odour or visual) 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 North Prairie Developments Ltd. and their agents for specific application to the proposed Rural Subdivision to be constructed within LSD 11 to 14, inclusive, 16-38-04-W3M, R.M. of Corman Park No. 344, 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 jurisdiction with respect to this development and/or construction of the facilities described herein have full jurisdiction with respect to the described development. Any other unspecified subsequent development would be considered Third Party and would, therefore, require prior review by PMEL. PMEL accepts no responsibility for damages, if any, suffered by any Third Party as a result of decisions made or actions based on this report.

The acceptance of responsibility for the design/construction recommendations presented in this report is contingent on adequate and/or full time inspection (as required, based on site conditions at the time of construction) by a representative of the Geotechnical Consultant. PMEL will not accept any responsibility on this project for any unsatisfactory performance if adequate and/or full time inspection is not performed by a representative of PMEL.

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

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

P. MACHIBRODA ENGINEERING LTD.

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	6687	

Tomasz Korbas, M.Sc., Engineer-In-Training

PROFESSIONAL ENGINEER SASKATCHEWAN
R.T. Machibroda
Member 06687
150511
YR. MO. DAY

Ray Machibroda, P. Eng., M. Sc.

TK/RM/zz

10.0 REFERENCES

Acton, D. F., Clayton, J. S., Ellis, J. G., Christiansen, E. A., and Kupsch, W. O. 1960. Physiographic Divisions of Saskatchewan. Saskatchewan Research Council, Map No. 1.

Christiansen, E. A., 1967. Geology and Groundwater Resources of the Saskatoon Area (73-B), Saskatchewan, Saskatchewan Research Council, Geology Division, Saskatoon, Canada, Map No. 7.

Froese, et al., 2009 On-Site Wastewater Treatment Systems in Subdivisions. Project No. SH/SWA H01-2009 Final Report, September 29, 2009.

Health Canada, 2014. Guidelines for Canadian Drinking Water Quality Summary Table. http://www.hc-sc.gc.ca/ewh-semt/alt_formats/pdf/pubs/water-eau/sum_guide-res_recom/sum_guide-res_recom-eng.pdf Cited, April 2, 2015

Hyder, Z., J.J. Butler, Jr., C.D. McElwee and W. Liu, 1994. Slug tests in partially penetrating wells, Water Resources Research, vol. 30, no. 11, pp. 2945-2957.

Maathius, H., 1992. Quaternary Aquifers and Aquitards, 2009 in Notes for One Day Seminar, Engineering Geology of Glacial Deposits, December 10, 1992, University of Saskatchewan, Saskatoon Saskatchewan, Sponsored by Saskatoon Geotechnical Group, Saskatchewan Research Council and Department of Civil Engineering, University of Saskatchewan.

MDH (MDH Engineered Solutions), 2011. Hydrogeology Mapping of NTS Mapsheet Saskatoon 73B. Prepared for Saskatchewan Watershed Authority. M1890-1030109, April, 2011.

MDEQ (Montana Department of Environmental Quality). 2005. How to perform a Nondegradation Analysis for Subsurface Wastewater Treatment Systems (SWTS), 2005.

Saskatchewan Ministry of Health. 2009. Saskatchewan Onsite Wastewater Disposal Guide, 169 pp

Hvorslev, M.J., 1951. Time Lag and Soil Permeability in Ground-Water Observations, Bull. No. 36, Waterways Exper. Sta. Corps of Engrs, U.S. Army, Vicksburg, Mississippi, pp. 1-50.

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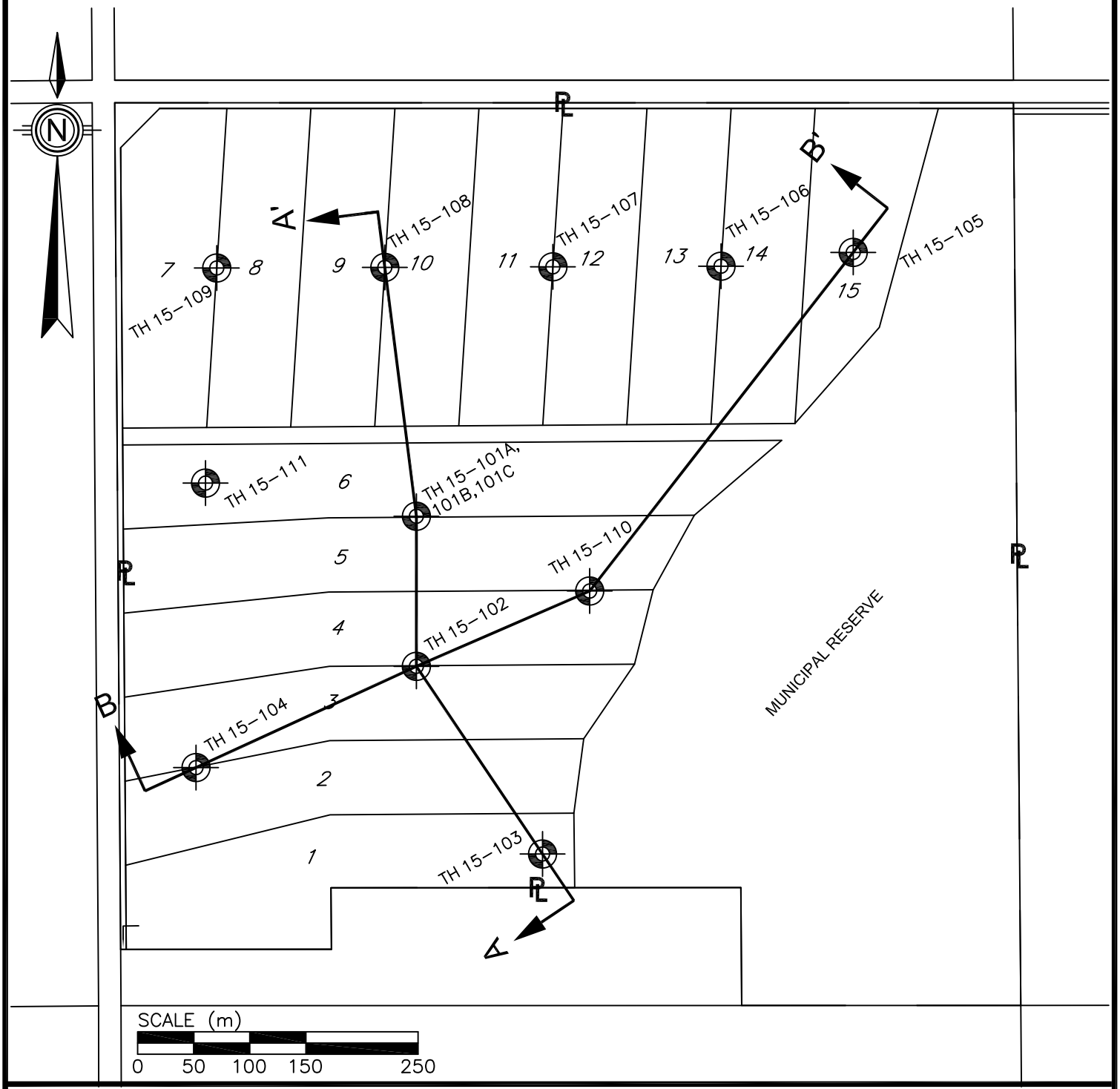
GEOTECHNICAL/GEOENVIRONMENTAL
ENGINEERS

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 FROM AN AUTOCAD DRAWING PROVIDED BY WEBB SURVEYS. DRAWING NO. 09-2035 CN.

LEGEND	–PMEL TEST HOLE (PIEZOMETER INSTALLED)	PL –PROPERTY LINE

CONSULTING
GEOENVIRONMENTAL
GEOTECHNICAL
ENGINEERS

P. MACHIBRODA ENGINEERING LTD.

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

DRAWING TITLE:

SITE PLAN - TEST HOLE LOCATIONS

PROJECT:

HYDROGEOLOGICAL STUDY - WHISPER RIVER ESTATES, NW-16-38-04-W3M, R.M. OF CORMAN PARK NO. 344, SK

APPROVED BY:	DRAWN BY:	DRAWING NUMBER:
TK	TP	9995-1
DATE: MARCH, 2015	SCALE: NOT TO SCALE	

P. MACHIBRODA ENGINEERING LTD.

TEST HOLE 15-101A

DRAWING NUMBER: 9995-2

PROJECT:
HYDROGEOLOGICAL STUDY

LOCATION:
WHISPER RIVER ESTATES, NW-16-38-04-W3M, R.M. OF CORMAN PARK NO.344, SASKATOON, SK

DATE DRILLED:	LOGGED BY:	NORTHING (m):	EASTING (m):	GROUND SURFACE ELEVATION (m):	PIEZOMETER ELEVATION (m):
FEB 20/15	CS	5792326	396040	500.2	501.3

☒ SPLIT SPOON ■ SHELBY ☒ CUTTINGS ▽ WATER LEVEL

DEPTH (m)	SOIL VAPOUR CONCENTRATION LOWER EXPLOSIVE LIMIT – (% LEL) 20 40 60 80	% LEL	SAMPLE NO.	SAMPLE TYPE	STRATIGRAPHY	SOIL DESCRIPTION	PIEZOMETER INSTALLATION
0			1			**TOPSOIL,** organic, black, rootlets, frozen.	
			2			**GLACIAL TILL,** clay, silty, sandy, trace gravel, low plastic, moist, brown, oxide stained.	
			3				
1			4			–frozen to 1.1 m.	
			5			–stiff below 1.1 m.	
2			6			–some silt, some sand, medium plastic below 2.4 m.	
			7				
3			8			**SAND,** silty, some clay, some gravel, compact, well graded, fine to coarse grained, wet, brown, seepage.	▽ 496.9 m APR 08/15
4			9			**GLACIAL TILL,** clay, some silt, some sand, trace gravel, very stiff, medium plastic, moist, dark brown, oxide stained.	
5							
			10				
6						–grey, no oxide staining below 6.6 m.	
7			11			–cobbles and boulders below 7.4 n to 12.4 m.	
8							
			12				
9							

P. MACHIBRODA ENGINEERING LTD.

TEST HOLE 15-101A

DRAWING NUMBER: 9995-2A

PROJECT:
HYDROGEOLOGICAL STUDY

LOCATION:
WHISPER RIVER ESTATES, NW-16-38-04-W3M, R.M. OF CORMAN PARK NO.344, SASKATOON, SK

DATE DRILLED:	LOGGED BY:	NORTHING (m):	EASTING (m):	GROUND SURFACE ELEVATION (m):	PIEZOMETER ELEVATION (m):
FEB 20/15	CS	5792326	396040	500.2	502.3

☒ SPLIT SPOON ■ SHELBY ▨ CUTTINGS ▽ WATER LEVEL

DEPTH (m)	SOIL VAPOUR CONCENTRATION LOWER EXPLOSIVE LIMIT – (% LEL) 20 40 60 80	% LEL	SAMPLE NO.	SAMPLE TYPE	STRATIGRAPHY	SOIL DESCRIPTION	PIEZOMETER INSTALLATION
10			13			**GLACIAL TILL,** clay, some silt, some sand, trace gravel, very stiff, medium plastic, moist, dark brown, oxide stained.	
11							
12			14				
13						–trace sand below 12.8 m.	
14			15				
15			16				
16							
17							
18							
19							

NOTE:
1. Test Hole open to 15.0 m and dry Immediately After Drilling.

LEGEND
- road box
- ø50 mm PVC pipe
- ø50 mm slotted PVC pipe
- bentonite seal
- clean silica sand backfill
- sloughed sand
- drilled cuttings

P. MACHIBRODA ENGINEERING LTD.

TEST HOLE 15-101B

DRAWING NUMBER: 9995-3

PROJECT:
HYDROGEOLOGICAL STUDY

LOCATION:
WHISPER RIVER ESTATES, NW-16-38-04-W3M, R.M. OF CORMAN PARK NO.344, SASKATOON, SK

DATE DRILLED:	LOGGED BY:	NORTHING (m):	EASTING (m):	GROUND SURFACE ELEVATION (m):	PIEZOMETER ELEVATION (m):
FEB 20/15	CS	5792324	396039	500.2	501.2

☒ SPLIT SPOON ■ SHELBY ☒ CUTTINGS ▽ WATER LEVEL

DEPTH (m)	SOIL VAPOUR CONCENTRATION LOWER EXPLOSIVE LIMIT – (% LEL) 20 40 60 80	% LEL	SAMPLE NO.	SAMPLE TYPE	STRATIGRAPHY	SOIL DESCRIPTION	PIEZOMETER INSTALLATION
0						**TOPSOIL,** organic, black, rootlets, frozen.	
						GLACIAL TILL, clay, silty, sandy, trace gravel, low plastic, moist, brown, oxide stained.	
1						–frozen to 1.1 m. –stiff below 1.1 m.	
2						–some silt, some sand, medium plastic below 2.4 m.	
3						**GLACIAL TILL,** sand, silty, some clay, some gravel, compact, well graded, fine to coarse grained, wet, brown, seepage.	
4						**GLACIAL TILL,** clay, some silt, some sand, trace gravel, very stiff, medium plastic, moist, dark brown, oxide stained.	
5							
6						–grey, no oxide staining below 6.6 m.	
7						–cobbles and boulders below 7.4 n to 12.4 m.	
8							
9							

DRY
APR 8/15

P. MACHIBRODA ENGINEERING LTD.

TEST HOLE 15-101B

DRAWING NUMBER: 9995-3A

PROJECT:
HYDROGEOLOGICAL STUDY

LOCATION:
WHISPER RIVER ESTATES, NW-16-38-04-W3M, R.M. OF CORMAN PARK NO.344, SASKATOON, SK

DATE DRILLED:	LOGGED BY:	NORTHING (m):	EASTING (m):	GROUND SURFACE ELEVATION (m):	PIEZOMETER ELEVATION (m):
FEB 20/15	CS	5792324	396039	500.2	501.2

☒ SPLIT SPOON ■ SHELBY ▨ CUTTINGS ▼ WATER LEVEL

DEPTH (m)	SOIL VAPOUR CONCENTRATION LOWER EXPLOSIVE LIMIT – (% LEL) 20 40 60 80	% LEL	SAMPLE NO.	SAMPLE TYPE	STRATIGRAPHY	SOIL DESCRIPTION	PIEZOMETER INSTALLATION
10					▨	**GLACIAL TILL,** clay, some silt, some sand, trace gravel, very stiff, medium plastic, moist, dark brown, oxide stained.	DRY ▽ APR 08/15
11						NOTE: 1. Test Hole open to 10.5 m and dry Immediately After Drilling.	
12							
13							
14							
15							
16							
17							
18							
19							

LEGEND

- road box
- ø50 mm PVC pipe
- ø50 mm slotted PVC pipe
- bentonite seal
- clean silica sand backfill
- sloughed sand
- drilled cuttings

P. MACHIBRODA ENGINEERING LTD.

TEST HOLE 15-101C

DRAWING NUMBER: 9995-4

PROJECT:
HYDROGEOLOGICAL STUDY

LOCATION:
WHISPER RIVER ESTATES, NW-16-38-04-W3M, R.M. OF CORMAN PARK NO.344, SASKATOON, SK

DATE DRILLED:	LOGGED BY:	NORTHING (m):	EASTING (m):	GROUND SURFACE ELEVATION (m):	PIEZOMETER ELEVATION (m):
FEB 20/15	CS	5792322	396039	500.5	501.5

☒ SPLIT SPOON ■ SHELBY ☒ CUTTINGS ▽ WATER LEVEL

DEPTH (m)	SOIL VAPOUR CONCENTRATION LOWER EXPLOSIVE LIMIT – (% LEL) 20 40 60 80	% LEL	SAMPLE NO.	SAMPLE TYPE	STRATIGRAPHY	SOIL DESCRIPTION	PIEZOMETER INSTALLATION
0						**TOPSOIL,** organic, black, rootlets, frozen.	
1						**GLACIAL TILL,** clay, silty, sandy, trace gravel, low plastic, moist, brown, oxide stained. –frozen to 1.1 m. –stiff below 1.1 m.	
2							
3						–some silt, some sand, medium plastic below 2.4 m.	
4						**SAND,** silty, some clay, some gravel, compact, well graded, fine to coarse grained, wet, brown, seepage.	▽ 496.50 m APR 08/15
5						**GLACIAL TILL,** clay, some silt, some sand, trace gravel, very stiff, medium plastic, moist, dark brown, oxide stained.	
6						NOTE: 1. Test Hole open to 5.6 m and dry Immediately After Drilling.	
7							
8							
9							

P. MACHIBRODA ENGINEERING LTD.

TEST HOLE 15-102

DRAWING NUMBER: 9995-5

PROJECT:
HYDROGEOLOGICAL STUDY

LOCATION:
WHISPER RIVER ESTATES, NW-16-38-04-W3M, R.M. OF CORMAN PARK NO.344, SASKATOON, SK

DATE DRILLED:	LOGGED BY:	NORTHING (m):	EASTING (m):	GROUND SURFACE ELEVATION (m):	PIEZOMETER ELEVATION (m):
FEB 20/15	CS	5792209	396014	499.4	500.5

☒ SPLIT SPOON ■ SHELBY ▨ CUTTINGS ▽ WATER LEVEL

DEPTH (m)	SOIL VAPOUR CONCENTRATION LOWER EXPLOSIVE LIMIT – (% LEL) 20 40 60 80	% LEL	SAMPLE NO.	SAMPLE TYPE	STRATIGRAPHY	SOIL DESCRIPTION	PIEZOMETER INSTALLATION
0			17			**TOPSOIL,** organic, black, rootlets, frozen.	
1			18			**GLACIAL TILL,** clay, silty, sandy, trace gravel, low plastic, moist, brown, oxide stained.	
			19			–cobbles between 200 mm to 4.5 m.	
			20				
			21			–frozen to 1.3 m. –stiff below 1.3 m.	
2			22			–some silt, some sand, trace gravel, below 2.0 m.	
3			23				
4			24				DRY APR 08/15
5						NOTE: 1. Test Hole open to 4.5 m and dry Immediately After Drilling.	
6							
7							
8							
9							

P. MACHIBRODA ENGINEERING LTD.

TEST HOLE 15-103

DRAWING NUMBER: 9995-6

PROJECT:
HYDROGEOLOGICAL STUDY

LOCATION:
WHISPER RIVER ESTATES, NW-16-38-04-W3M, R.M. OF CORMAN PARK NO.344, SASKATOON, SK

DATE DRILLED:	LOGGED BY:	NORTHING (m):	EASTING (m):	GROUND SURFACE ELEVATION (m):	PIEZOMETER ELEVATION (m):
FEB 27/15	CS	5791993	396137	493.5	494.5

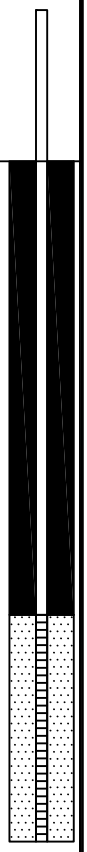
☒ SPLIT SPOON ■ SHELBY ▨ CUTTINGS ▽ WATER LEVEL

DEPTH (m)	SOIL VAPOUR CONCENTRATION LOWER EXPLOSIVE LIMIT – (% LEL) 20 40 60 80	% LEL	SAMPLE NO.	SAMPLE TYPE	STRATIGRAPHY	SOIL DESCRIPTION
0			25			**TOPSOIL,** organic, moist, black, rootlets, frozen.
			26			**SAND,** some gravel, trace silt, compact, well graded, fine to coarse grained, moist, brown, frozen.
1			27			
			28			**GLACIAL TILL,** clay, some silt, some sand, trace gravel, medium plastic, moist, brown. –frozen to 1.0 m.
			29			
2			30			–very stiff below 2.0 m.
			31			–grey below 3.3 m.
3						
4			32			
5						
6						
7						
8						
9						

NOTE:
1. Test Hole open to 4.5 m and dry Immediately After Drilling.

PIEZOMETER INSTALLATION

DRY
APR 08/15



LEGEND

- road box
- ø50 mm PVC pipe
- ø50 mm slotted PVC pipe
- bentonite seal
- clean silica sand backfill
- sloughed sand
- drilled cuttings

P. MACHIBRODA ENGINEERING LTD.

TEST HOLE 15-104

DRAWING NUMBER: 9995-7

PROJECT:
HYDROGEOLOGICAL STUDY

LOCATION:
WHISPER RIVER ESTATES, NW-16-38-04-W3M, R.M. OF CORMAN PARK NO.344, SASKATOON, SK

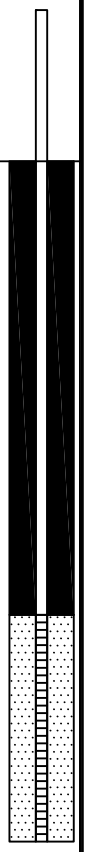
DATE DRILLED:	LOGGED BY:	NORTHING (m):	EASTING (m):	GROUND SURFACE ELEVATION (m):	PIEZOMETER ELEVATION (m):
FEB 27/15	CS	5792105	395833	498.8	499.8

☒ SPLIT SPOON ■ SHELBY ☒ CUTTINGS ▽ WATER LEVEL

DEPTH (m)	SOIL VAPOUR CONCENTRATION LOWER EXPLOSIVE LIMIT – (% LEL) 20 40 60 80	% LEL	SAMPLE NO.	SAMPLE TYPE	STRATIGRAPHY	SOIL DESCRIPTION
0			33			**TOPSOIL,** organic, moist, black, rootlets, frozen.
			34			**GLACIAL TILL,** clay, some silt, some sand, trace gravel, medium plastic, moist, brown.
			35			–frozen to 800 mm.
1			36			–stiff below 800 mm.
			37			–cobbles and boulders at 1.0 m.
2			38			
3			39			
4			40			
5						
6						
7						
8						
9						

NOTE:
1. Test Hole open to 4.5 m and dry Immediately After Drilling.

PIEZOMETER INSTALLATION



▽ 495.2 m
APR 08/15

LEGEND

- road box
- ø50 mm PVC pipe
- ø50 mm slotted PVC pipe
- bentonite seal
- clean silica sand backfill
- sloughed sand
- drilled cuttings

P. MACHIBRODA ENGINEERING LTD.

TEST HOLE 15-105

DRAWING NUMBER: 9995-8

PROJECT:
HYDROGEOLOGICAL STUDY

LOCATION:
WHISPER RIVER ESTATES, NW-16-38-04-W3M, R.M. OF CORMAN PARK NO.344, SASKATOON, SK

DATE DRILLED:	LOGGED BY:	NORTHING (m):	EASTING (m):	GROUND SURFACE ELEVATION (m):	PIEZOMETER ELEVATION (m):
FEB 27/15	CS	5792532	396436	493.3	494.3

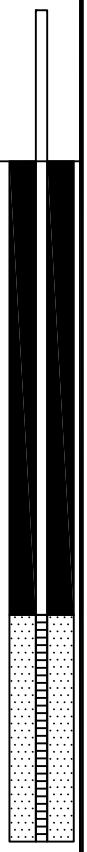
☒ SPLIT SPOON ■ SHELBY ▨ CUTTINGS ▽ WATER LEVEL

DEPTH (m)	SOIL VAPOUR CONCENTRATION LOWER EXPLOSIVE LIMIT – (% LEL) 20 40 60 80	% LEL	SAMPLE NO.	SAMPLE TYPE	STRATIGRAPHY	SOIL DESCRIPTION
0			57			**TOPSOIL,** organic, moist, black, rootlets, frozen.
			58			**SAND,** some silt, trace gravel, compact, well graded, fine to coarse grained, moist, brown, frozen.
1			59			
			60			
			61			**GLACIAL TILL,** clay, some silt, some sand, trace gravel, very stiff, medium plastic, moist, brown.
2			62			
			63			–grey below 3.1 m.
3						
4			64			
5						
6						
7						
8						
9						

NOTE:
1. Test Hole open to 4.5 m and dry Immediately After Drilling.

PIEZOMETER INSTALLATION

DRY
APR 08/15



LEGEND

- road box
- ø50 mm PVC pipe
- ø50 mm slotted PVC pipe
- bentonite seal
- clean silica sand backfill
- sloughed sand
- drilled cuttings

P. MACHIBRODA ENGINEERING LTD.

TEST HOLE 15-106

DRAWING NUMBER: 9995-9

PROJECT:
HYDROGEOLOGICAL STUDY

LOCATION:
WHISPER RIVER ESTATES, NW-16-38-04-W3M, R.M. OF CORMAN PARK NO.344, SASKATOON, SK

DATE DRILLED:	LOGGED BY:	NORTHING (m):	EASTING (m):	GROUND SURFACE ELEVATION (m):	PIEZOMETER ELEVATION (m):
FEB 27/15	CS	5792531	396338	497.9	498.9

☒ SPLIT SPOON ■ SHELBY ▨ CUTTINGS ▽ WATER LEVEL

DEPTH (m)	SOIL VAPOUR CONCENTRATION LOWER EXPLOSIVE LIMIT – (% LEL) 20 40 60 80	% LEL	SAMPLE NO.	SAMPLE TYPE	STRATIGRAPHY	SOIL DESCRIPTION
0			65			**TOPSOIL,** organic, moist, black, rootlets, frozen.
			66			**SAND,** some silt, loose, poorly graded, fine grained, moist, brown, frozen.
1			67			
			68			**GLACIAL TILL,** clay, some silt, some sand, trace gravel, medium plastic, moist, brown.
			69			–frozen to 1.0 m.
						–stiff below 1.0 m.
2			70			
3			71			
4			72			
5						
6						
7						
8						
9						

NOTE:
1. Test Hole open to 4.5 m and dry Immediately After Drilling.

PIEZOMETER INSTALLATION

DRY
APR 08/15

LEGEND

- road box
- ø50 mm PVC pipe
- ø50 mm slotted PVC pipe
- bentonite seal
- clean silica sand backfill
- sloughed sand
- drilled cuttings

P. MACHIBRODA ENGINEERING LTD.

TEST HOLE 15-107

DRAWING NUMBER: 9995-10

PROJECT:
HYDROGEOLOGICAL STUDY

LOCATION:
WHISPER RIVER ESTATES, NW-16-38-04-W3M, R.M. OF CORMAN PARK NO.344, SASKATOON, SK

DATE DRILLED:	LOGGED BY:	NORTHING (m):	EASTING (m):	GROUND SURFACE ELEVATION (m):	PIEZOMETER ELEVATION (m):
FEB 27/15	CS	5792540	396190	500.1	501.1

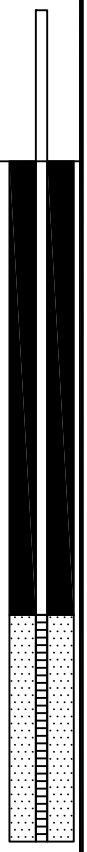
☒ SPLIT SPOON ■ SHELBY ▨ CUTTINGS ▽ WATER LEVEL

DEPTH (m)	SOIL VAPOUR CONCENTRATION LOWER EXPLOSIVE LIMIT – (% LEL) 20 40 60 80	% LEL	SAMPLE NO.	SAMPLE TYPE	STRATIGRAPHY	SOIL DESCRIPTION
0			73			**TOPSOIL,** organic, moist, black, rootlets, frozen.
			74			**SAND,** some silt, trace gravel, loose, well graded, fine to coarse grain, moist, brown, frozen.
			75			
1			76			**GLACIAL TILL,** clay, some silt, some sand, trace gravel, medium plastic, moist, brown.
			77			–frozen to 700 mm.
						–stiff below 700 mm.
2			77			
3			78			
4			80			
5						
6						
7						
8						
9						

NOTE:
1. Test Hole open to 4.5 m and dry Immediately After Drilling.

PIEZOMETER INSTALLATION

DRY
APR 08/15



LEGEND

- road box
- ø50 mm PVC pipe
- ø50 mm slotted PVC pipe
- bentonite seal
- clean silica sand backfill
- sloughed sand
- drilled cuttings

P. MACHIBRODA ENGINEERING LTD.

TEST HOLE 15-108

DRAWING NUMBER: 9995-11

PROJECT:
HYDROGEOLOGICAL STUDY

LOCATION:
WHISPER RIVER ESTATES, NW-16-38-04-W3M, R.M. OF CORMAN PARK NO.344, SASKATOON, SK

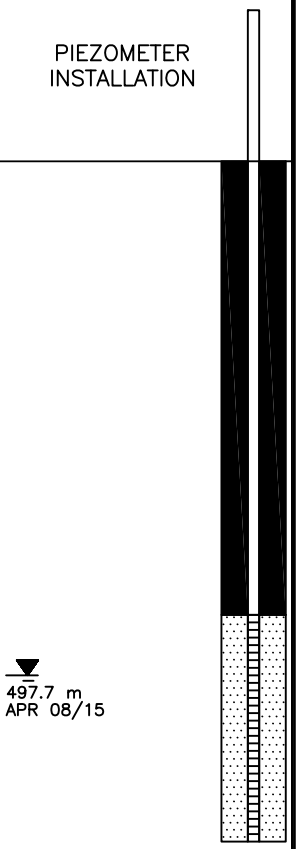
DATE DRILLED:	LOGGED BY:	NORTHING (m):	EASTING (m):	GROUND SURFACE ELEVATION (m):	PIEZOMETER ELEVATION (m):
FEB 27/15	CS	5792548	396032	501.1	502.1

☒ SPLIT SPOON ■ SHELBY ☒ CUTTINGS ▽ WATER LEVEL

DEPTH (m)	SOIL VAPOUR CONCENTRATION LOWER EXPLOSIVE LIMIT – (% LEL) 20 40 60 80	% LEL	SAMPLE NO.	SAMPLE TYPE	STRATIGRAPHY	SOIL DESCRIPTION
0			81			**TOPSOIL,** organic, moist, black, rootlets, frozen.
			82			**GLACIAL TILL,** clay, some silt, some sand, trace gravel, medium plastic, moist, brown.
			83			–frozen to 800 mm.
1			84			–stiff below 800 mm.
			85			
2			86			
3			87			
4			88			
5						
6						
7						
8						
9						

NOTE:
1. Test Hole open to 4.5 m and dry Immediately After Drilling.

PIEZOMETER INSTALLATION



LEGEND

- road box
- ø50 mm PVC pipe
- ø50 mm slotted PVC pipe
- bentonite seal
- clean silica sand backfill
- sloughed sand
- drilled cuttings

P. MACHIBRODA ENGINEERING LTD.

TEST HOLE 15-109

DRAWING NUMBER: 9995-12

PROJECT:
HYDROGEOLOGICAL STUDY

LOCATION:
WHISPER RIVER ESTATES, NW-16-38-04-W3M, R.M. OF CORMAN PARK NO.344, SASKATOON, SK

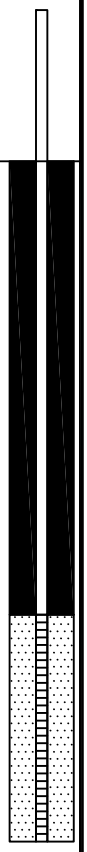
DATE DRILLED:	LOGGED BY:	NORTHING (m):	EASTING (m):	GROUND SURFACE ELEVATION (m):	PIEZOMETER ELEVATION (m):
FEB 27/15	CS	5792562	395860	500.3	501.3

☒ SPLIT SPOON ■ SHELBY ▨ CUTTINGS ▽ WATER LEVEL

DEPTH (m)	SOIL VAPOUR CONCENTRATION LOWER EXPLOSIVE LIMIT – (% LEL) 20 40 60 80	% LEL	SAMPLE NO.	SAMPLE TYPE	STRATIGRAPHY	SOIL DESCRIPTION
0			89			**TOPSOIL,** organic, moist, black, rootlets, frozen.
			90			**GLACIAL TILL,** clay, some silt, some sand, trace gravel, medium plastic, moist, brown.
			91			–frozen to 700 mm.
1			92			–very stiff below 700 mm.
			93			
2			94			
3			95			
4			96			
5						
6						
7						
8						
9						

NOTE:
1. Test Hole open to 4.5 m and dry Immediately After Drilling.

PIEZOMETER INSTALLATION



▽ 496.5 m
APR 08/15

LEGEND

- road box
- ø50 mm PVC pipe
- ø50 mm slotted PVC pipe
- bentonite seal
- clean silica sand backfill
- sloughed sand
- drilled cuttings

P. MACHIBRODA ENGINEERING LTD.

TEST HOLE 15-110

DRAWING NUMBER: 9995-13

PROJECT:
HYDROGEOLOGICAL STUDY

LOCATION:
WHISPER RIVER ESTATES, NW-16-38-04-W3M, R.M. OF CORMAN PARK NO.344, SASKATOON, SK

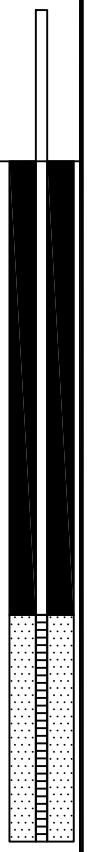
DATE DRILLED:	LOGGED BY:	NORTHING (m):	EASTING (m):	GROUND SURFACE ELEVATION (m):	PIEZOMETER ELEVATION (m):
FEB 27/15	CS	5792251	396220	495.1	496.1

☒ SPLIT SPOON ■ SHELBY ☒ CUTTINGS ▽ WATER LEVEL

DEPTH (m)	SOIL VAPOUR CONCENTRATION LOWER EXPLOSIVE LIMIT – (% LEL) 20 40 60 80	% LEL	SAMPLE NO.	SAMPLE TYPE	STRATIGRAPHY	SOIL DESCRIPTION
0			49			**TOPSOIL,** organic, moist, black, rootlets, frozen.
			50			**SAND,** some silt, compact, poorly graded, fine grained, moist, brown, frozen.
1			51			
			52			**GLACIAL TILL,** clay, some silt, some sand, trace gravel, stiff, medium plastic, moist, brown.
			53			
2						–very stiff below 1.8 m.
			54			
3			55			
						–grey below 3.5 m.
4			56			
5						NOTE: 1. Test Hole open to 4.5 m and dry Immediately After Drilling.
6						
7						
8						
9						

PIEZOMETER INSTALLATION

▽ 491.7 m
APR 08/15



LEGEND

- road box
- ø50 mm PVC pipe
- ø50 mm slotted PVC pipe
- bentonite seal
- clean silica sand backfill
- sloughed sand
- drilled cuttings

P. MACHIBRODA ENGINEERING LTD.

TEST HOLE 15-111

DRAWING NUMBER: 9995-14

PROJECT:
HYDROGEOLOGICAL STUDY

LOCATION:
WHISPER RIVER ESTATES, NW-16-38-04-W3M, R.M. OF CORMAN PARK NO.344, SASKATOON, SK

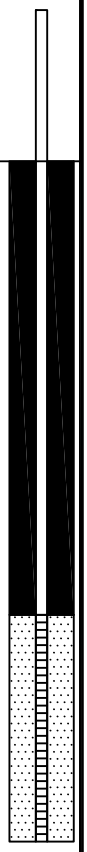
DATE DRILLED:	LOGGED BY:	NORTHING (m):	EASTING (m):	GROUND SURFACE ELEVATION (m):	PIEZOMETER ELEVATION (m):
FEB 27/15	CS	5792366	395849	501.1	502.1

☒ SPLIT SPOON ■ SHELBY ▨ CUTTINGS ▽ WATER LEVEL

DEPTH (m)	SOIL VAPOUR CONCENTRATION LOWER EXPLOSIVE LIMIT – (% LEL) 20 40 60 80	% LEL	SAMPLE NO.	SAMPLE TYPE	STRATIGRAPHY	SOIL DESCRIPTION
0			41			**TOPSOIL,** organic, moist, black, rootlets, frozen.
			42			**GLACIAL TILL,** clay, some silt, some sand, trace gravel, stiff, medium plastic, moist, brown.
			43			–frozen to 800 mm.
1			44			–stiff below 800 mm.
			45			–cobbles and boulders at 1.0 m.
2			46			
3			47			
4			48			
5						
6						
7						
8						
9						

NOTE:
1. Test Hole open to 4.5 m and dry Immediately After Drilling.

PIEZOMETER INSTALLATION



497.2 m
APR 08/15

LEGEND

- road box
- ø50 mm PVC pipe
- ø50 mm slotted PVC pipe
- bentonite seal
- clean silica sand backfill
- sloughed sand
- drilled cuttings

ASTM D422: GRAIN SIZE ANALYSIS OF SOIL

Project: Hydrological Study
RM of Corman Park

Project No.: 9995

Date Tested: March 9, 2015

Test Hole No.: 1001A

Sample No.: 3

Depth (m): 0.9

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	95
# 10	2	84
# 20	0.85	77
# 40	0.425	70.4
#60	0.25	63.0
# 100	0.15	55.2
# 200	0.075	45.6

Hydrometer Analysis:

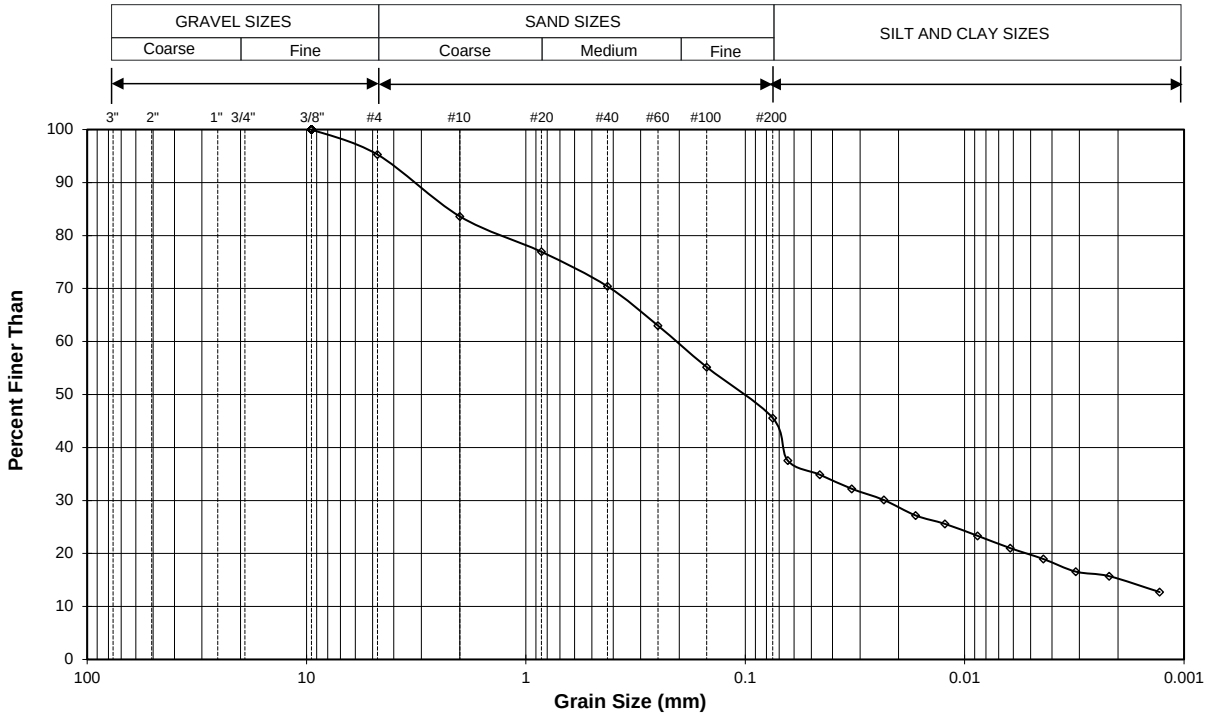
Dispersing Agent:
Sodium Hexametaphosphate

Diameter mm	% Finer
0.0640	37.5
0.0458	34.9
0.0328	32.2
0.0234	30.1
0.0167	27.2
0.0123	25.6
0.0087	23.3
0.0062	21.0
0.0044	19.0
0.0031	16.6
0.0022	15.7
0.0013	12.7

Material Description:

% Gravel Sizes	% Sand Sizes	% Silt Sizes	% Clay Sizes
5	50	30	16

Remarks:



P. MACHIBRODA ENGINEERING LTD.

DRAWING NO.

9995-15

ASTM D422: GRAIN SIZE ANALYSIS OF SOIL

Project: Hydrological Study
RM of Corman Park

Project No.: 9995

Date Tested: March 9, 2015

Test Hole No.: 102

Sample No.: 18

Depth (m): 0.6

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	96
# 4	4.75	82
# 10	2	67
# 20	0.85	64
# 40	0.425	59.5
#60	0.25	53.1
# 100	0.15	46.1
# 200	0.075	37.7

Hydrometer Analysis:

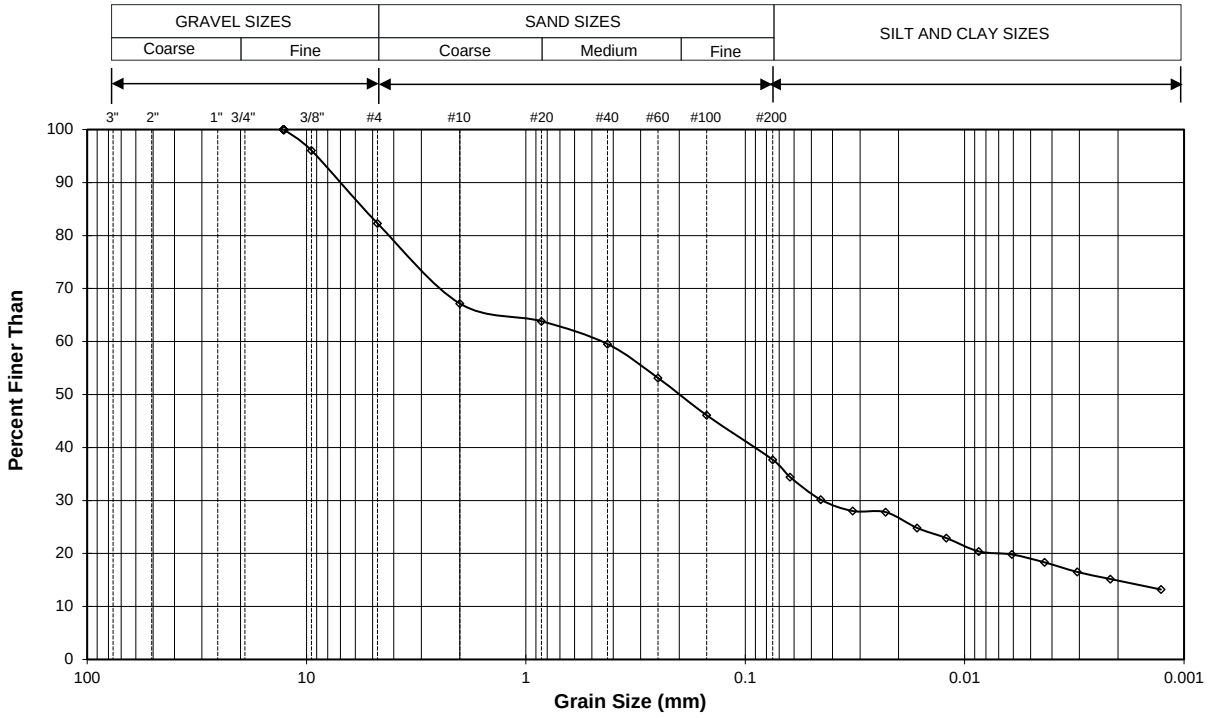
Dispersing Agent:
Sodium Hexametaphosphate

Diameter mm	% Finer
0.0625	34.4
0.0453	30.2
0.0324	28.0
0.0229	27.8
0.0165	24.8
0.0121	22.9
0.0086	20.4
0.0061	19.8
0.0043	18.3
0.0031	16.5
0.0022	15.2
0.0013	13.2

Material Description:

% Gravel Sizes	% Sand Sizes	% Silt Sizes	% Clay Sizes
18	45	23	15

Remarks:



P. MACHIBRODA ENGINEERING LTD.

DRAWING NO.

9995-16

ASTM D422: GRAIN SIZE ANALYSIS OF SOIL

Project: Hydrological Study
RM of Corman Park

Project No.: 9995

Date Tested: March 3, 2015

Test Hole No.: 103

Sample No.: 25

Depth (m): 0.3

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	93
# 4	4.75	84
# 10	2	77
# 20	0.85	72
# 40	0.425	63.9
#60	0.25	50.9
# 100	0.15	35.1
# 200	0.075	20.0

Hydrometer Analysis:

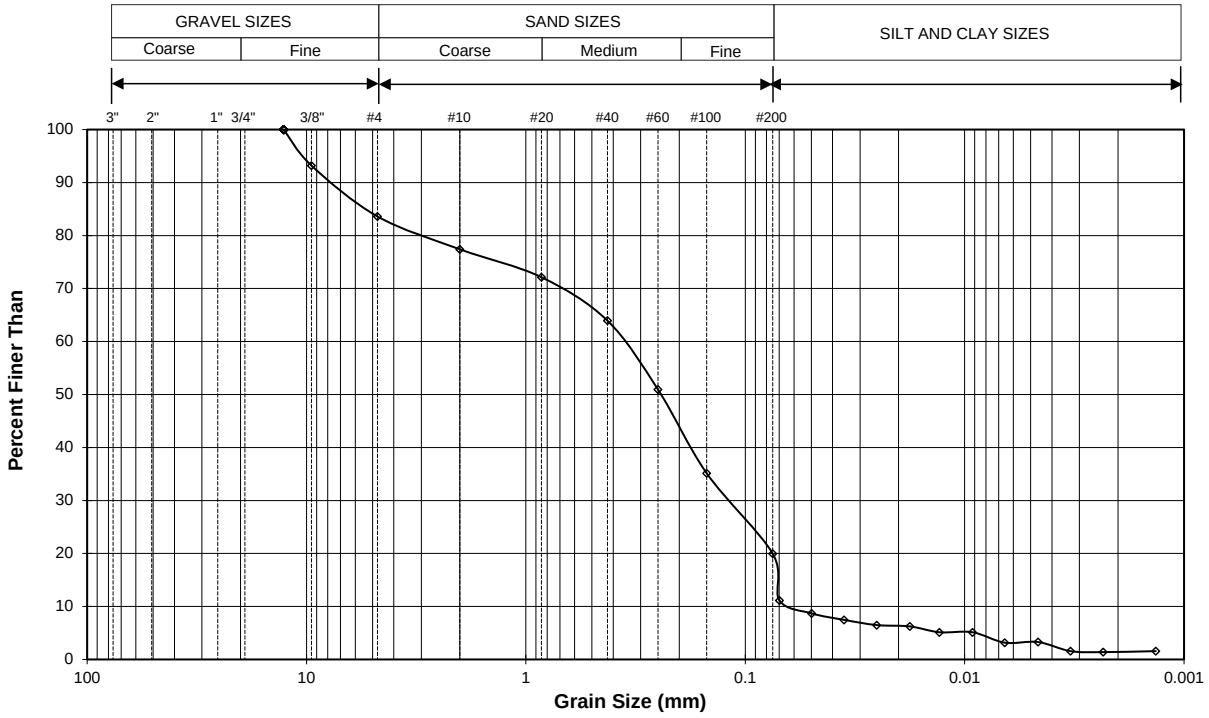
Dispersing Agent:
Sodium Hexametaphosphate

Diameter mm	% Finer
0.0699	11.2
0.0499	8.7
0.0354	7.5
0.0252	6.5
0.0178	6.2
0.0130	5.1
0.0092	5.1
0.0066	3.2
0.0046	3.3
0.0033	1.6
0.0023	1.4
0.0013	1.6

Material Description:

% Gravel Sizes	% Sand Sizes	% Silt Sizes	% Clay Sizes
16	64	19	1

Remarks:



P. MACHIBRODA ENGINEERING LTD.

DRAWING NO.

9995-17

ASTM D422: GRAIN SIZE ANALYSIS OF SOIL

Project: Hydrological Study
RM of Corman Park

Project No.: 9995

Date Tested: March 9, 2015

Test Hole No.: 104

Sample No.: 35

Depth (m): 0.9

Sieve Analysis:

Sieve	Diameter mm	% Finer
1.5"	38.1	100
1"	25.4	100
3/4"	19.1	100
1/2"	12.7	86
3/8"	9.5	86
# 4	4.75	77
# 10	2	73
# 20	0.85	71
# 40	0.425	65.8
#60	0.25	59.0
# 100	0.15	51.5
# 200	0.075	42.2

Hydrometer Analysis:

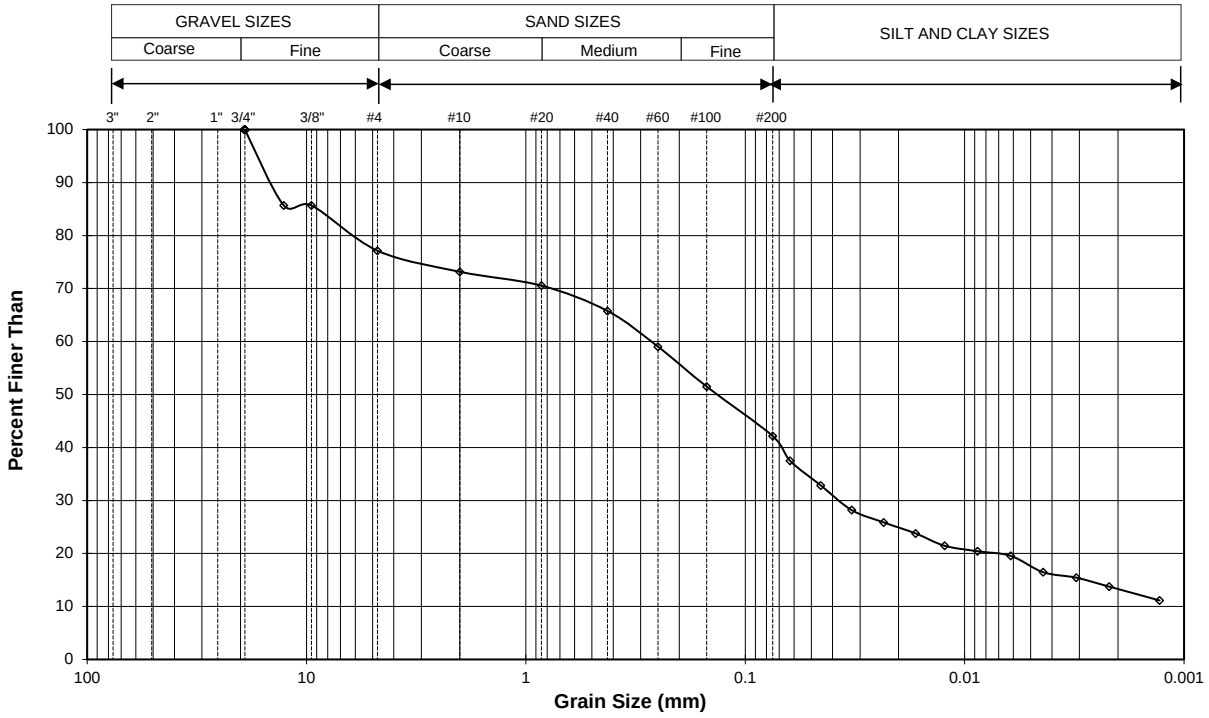
Dispersing Agent:
Sodium Hexametaphosphate

Diameter mm	% Finer
0.0625	37.5
0.0453	32.8
0.0328	28.2
0.0234	25.9
0.0167	23.8
0.0124	21.5
0.0087	20.4
0.0062	19.5
0.0044	16.5
0.0031	15.4
0.0022	13.8
0.0013	11.1

Material Description:

% Gravel Sizes	% Sand Sizes	% Silt Sizes	% Clay Sizes
23	35	28	14

Remarks:



P. MACHIBRODA ENGINEERING LTD.

DRAWING NO.

9995-18

ASTM D422: GRAIN SIZE ANALYSIS OF SOIL

Project: Hydrological Study
RM of Corman Park

Project No.: 9995

Date Tested: March 9, 2015

Test Hole No.: 111

Sample No.: 45

Depth (m): 1.5

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	96
# 4	4.75	91
# 10	2	85
# 20	0.85	80
# 40	0.425	74.1
#60	0.25	66.0
# 100	0.15	57.2
# 200	0.075	46.5

Hydrometer Analysis:

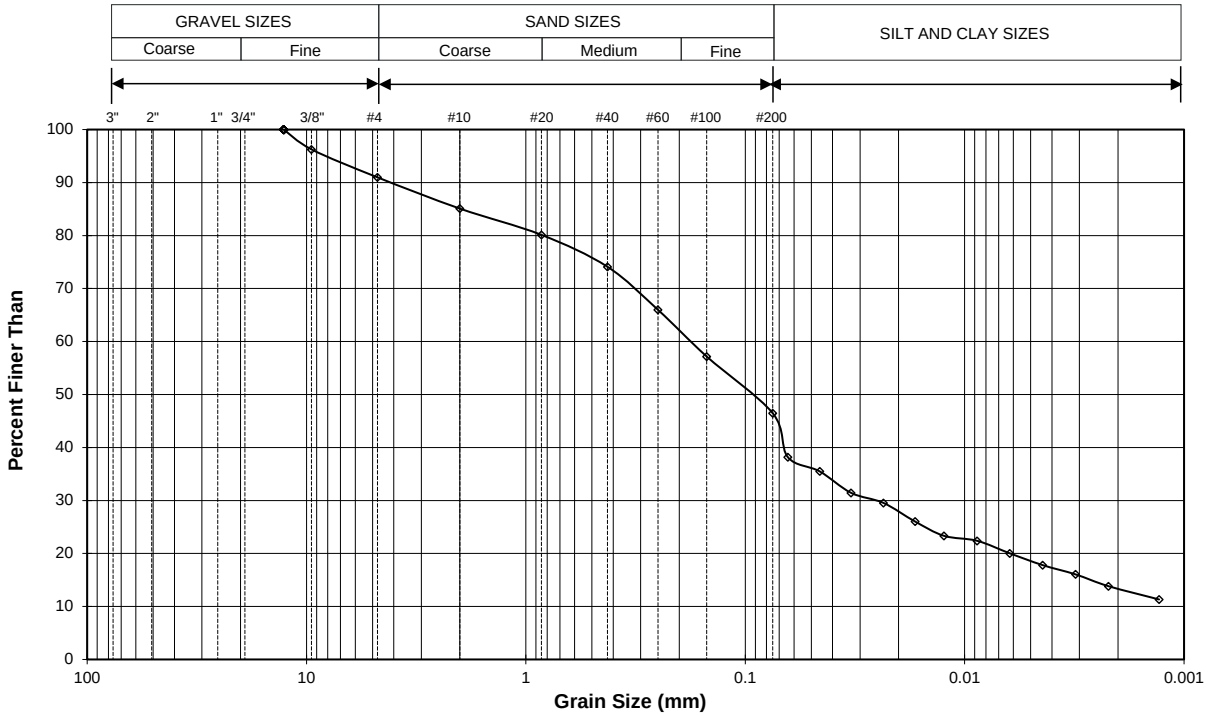
Dispersing Agent:
Sodium Hexametaphosphate

Diameter mm	% Finer
0.0640	38.2
0.0458	35.5
0.0330	31.4
0.0235	29.5
0.0168	26.0
0.0124	23.3
0.0088	22.4
0.0062	20.0
0.0044	17.8
0.0031	16.1
0.0022	13.8
0.0013	11.3

Material Description:

% Gravel Sizes	% Sand Sizes	% Silt Sizes	% Clay Sizes
9	45	33	13

Remarks:



P. MACHIBRODA ENGINEERING LTD.

DRAWING NO.

9995-19

ASTM D422: GRAIN SIZE ANALYSIS OF SOIL

Project: Hydrological Study
RM of Corman Park

Project No.: 9995

Date Tested: March 9, 2015

Test Hole No.: 110

Sample No.: 50

Depth (m): 0.6

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	99
# 40	0.425	96.8
#60	0.25	90.0
# 100	0.15	69.7
# 200	0.075	33.8

Hydrometer Analysis:

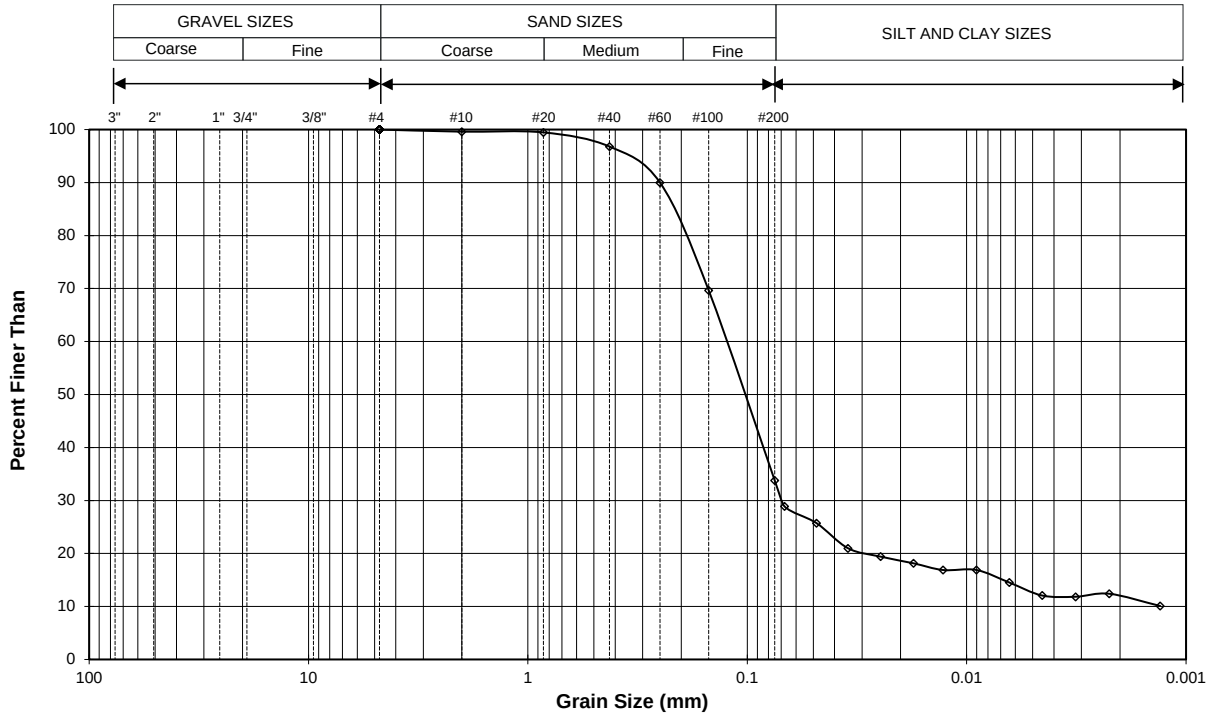
Dispersing Agent:
Sodium Hexametaphosphate

Diameter mm	% Finer
0.0677	28.9
0.0484	25.7
0.0347	21.0
0.0247	19.4
0.0175	18.1
0.0128	16.9
0.0090	16.9
0.0064	14.5
0.0045	12.1
0.0032	11.8
0.0022	12.4
0.0013	10.1

Material Description:

% Gravel Sizes	% Sand Sizes	% Silt Sizes	% Clay Sizes
0	66	21	13

Remarks:



P. MACHIBRODA ENGINEERING LTD.

DRAWING NO.

9995-20

ASTM D422: GRAIN SIZE ANALYSIS OF SOIL

Project: Hydrological Study
RM of Corman Park

Project No.: 9995

Date Tested: March 5, 2015

Test Hole No.: 105

Sample No.: 60

Depth (m): 1.2

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	97
# 4	4.75	83
# 10	2	68
# 20	0.85	64
# 40	0.425	57.8
#60	0.25	51.5
# 100	0.15	45.7
# 200	0.075	38.6

Hydrometer Analysis:

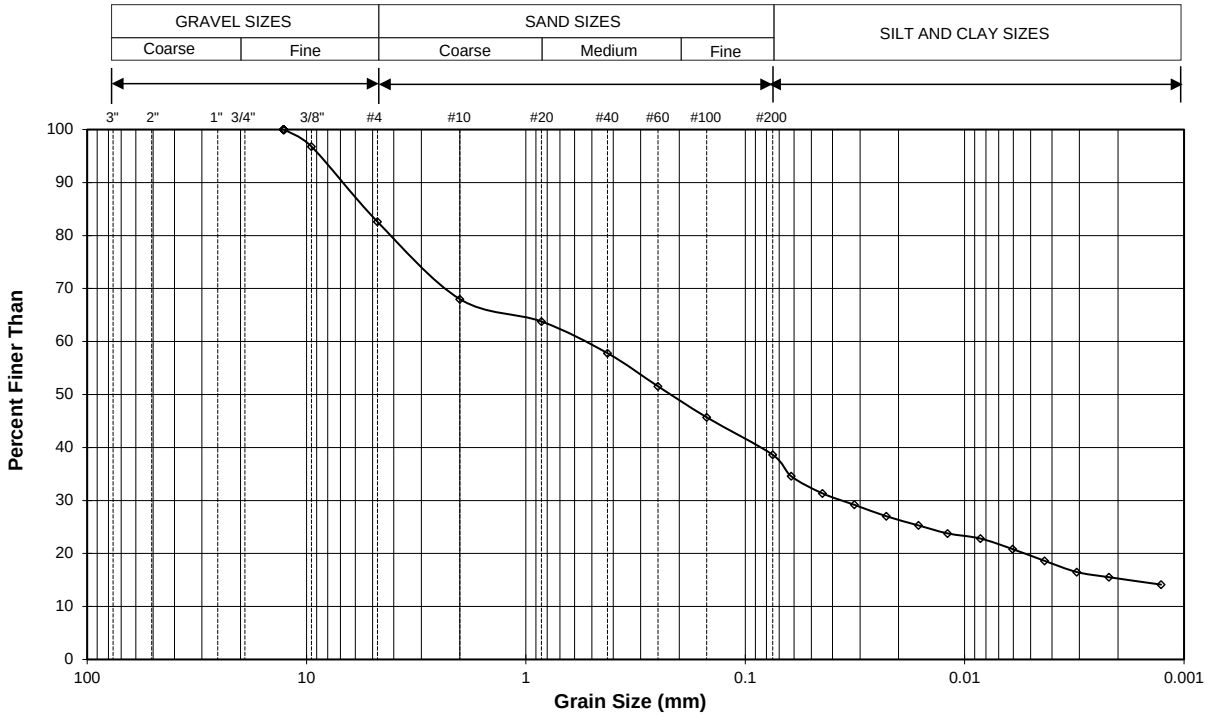
Dispersing Agent:
Sodium Hexametaphosphate

Diameter mm	% Finer
0.0618	34.6
0.0445	31.3
0.0318	29.2
0.0228	27.0
0.0162	25.3
0.0120	23.8
0.0085	22.8
0.0060	20.8
0.0043	18.6
0.0031	16.5
0.0022	15.5
0.0013	14.1

Material Description:

% Gravel Sizes	% Sand Sizes	% Silt Sizes	% Clay Sizes
17	44	23	16

Remarks:



P. MACHIBRODA ENGINEERING LTD.

DRAWING NO.

9995-21

ASTM D422: GRAIN SIZE ANALYSIS OF SOIL

Project: Hydrological Study
RM of Corman Park

Project No.: 9995

Date Tested: March 5, 2015

Test Hole No.: 106

Sample No.: 67

Depth (m): 0.9

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	93
# 4	4.75	88
# 10	2	80
# 20	0.85	77
# 40	0.425	72.2
#60	0.25	64.8
# 100	0.15	56.0
# 200	0.075	46.8

Hydrometer Analysis:

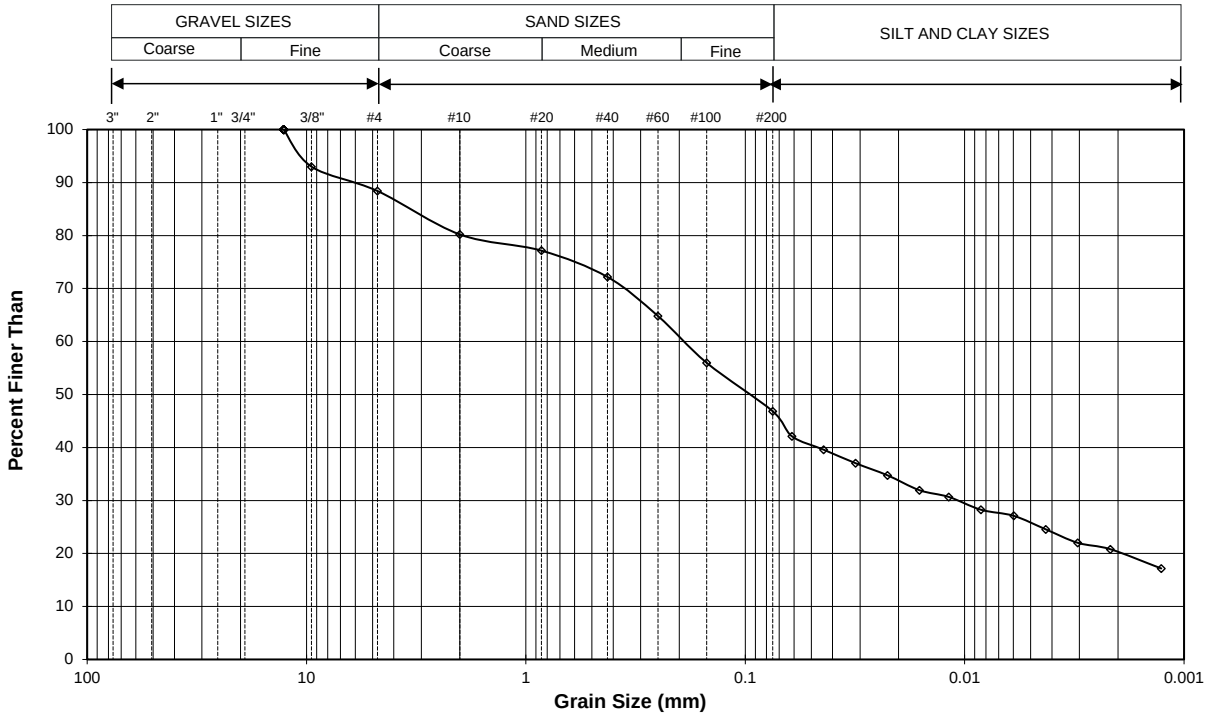
Dispersing Agent:
Sodium Hexametaphosphate

Diameter mm	% Finer
0.0614	42.1
0.0439	39.6
0.0314	37.0
0.0225	34.7
0.0161	31.9
0.0118	30.7
0.0084	28.3
0.0060	27.1
0.0043	24.6
0.0031	22.0
0.0022	20.8
0.0013	17.2

Material Description:

% Gravel Sizes	% Sand Sizes	% Silt Sizes	% Clay Sizes
12	42	26	21

Remarks:



P. MACHIBRODA ENGINEERING LTD.

DRAWING NO.

9995-22

ASTM D422: GRAIN SIZE ANALYSIS OF SOIL

Project: Hydrological Study
RM of Corman Park

Project No.: 9995

Date Tested: March 5, 2015

Test Hole No.: 112

Sample No.: 68

Depth (m): 1.0

Sieve Analysis:

Sieve	Diameter mm	% Finer
1.5"	38.1	100
1"	25.4	100
3/4"	19.1	100
1/2"	12.7	86
3/8"	9.5	83
# 4	4.75	77
# 10	2	69
# 20	0.85	66
# 40	0.425	61.4
#60	0.25	55.2
# 100	0.15	48.4
# 200	0.075	40.7

Hydrometer Analysis:

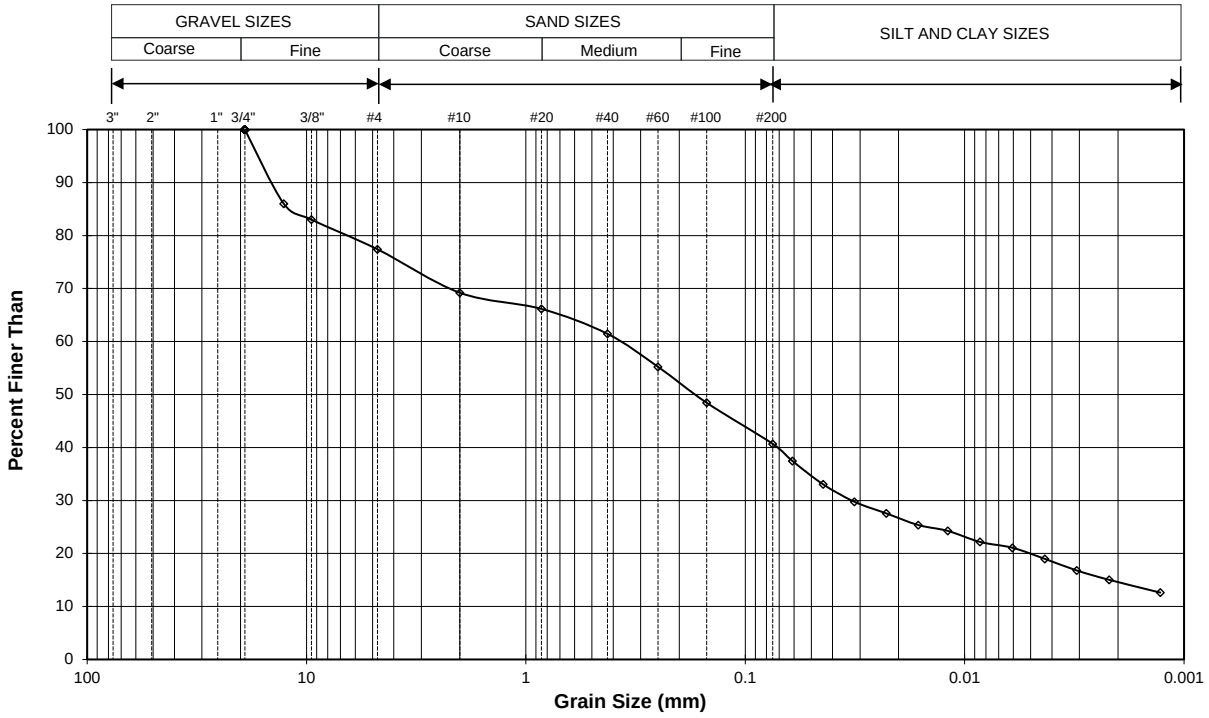
Dispersing Agent:
Sodium Hexametaphosphate

Diameter mm	% Finer
0.0610	37.5
0.0442	33.1
0.0318	29.8
0.0227	27.6
0.0163	25.4
0.0119	24.3
0.0085	22.2
0.0061	21.1
0.0043	19.0
0.0031	16.8
0.0022	15.0
0.0013	12.6

Material Description:

% Gravel Sizes	% Sand Sizes	% Silt Sizes	% Clay Sizes
23	37	26	15

Remarks:



P. MACHIBRODA ENGINEERING LTD.

DRAWING NO.

9995-23

ASTM D422: GRAIN SIZE ANALYSIS OF SOIL

Project: Hydrological Study
RM of Corman Park

Project No.: 9995

Date Tested: March 5, 2015

Test Hole No.: 107

Sample No.: 74

Depth (m): 0.6

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	89
# 10	2	79
# 20	0.85	76
# 40	0.425	71.0
#60	0.25	62.7
# 100	0.15	54.2
# 200	0.075	44.0

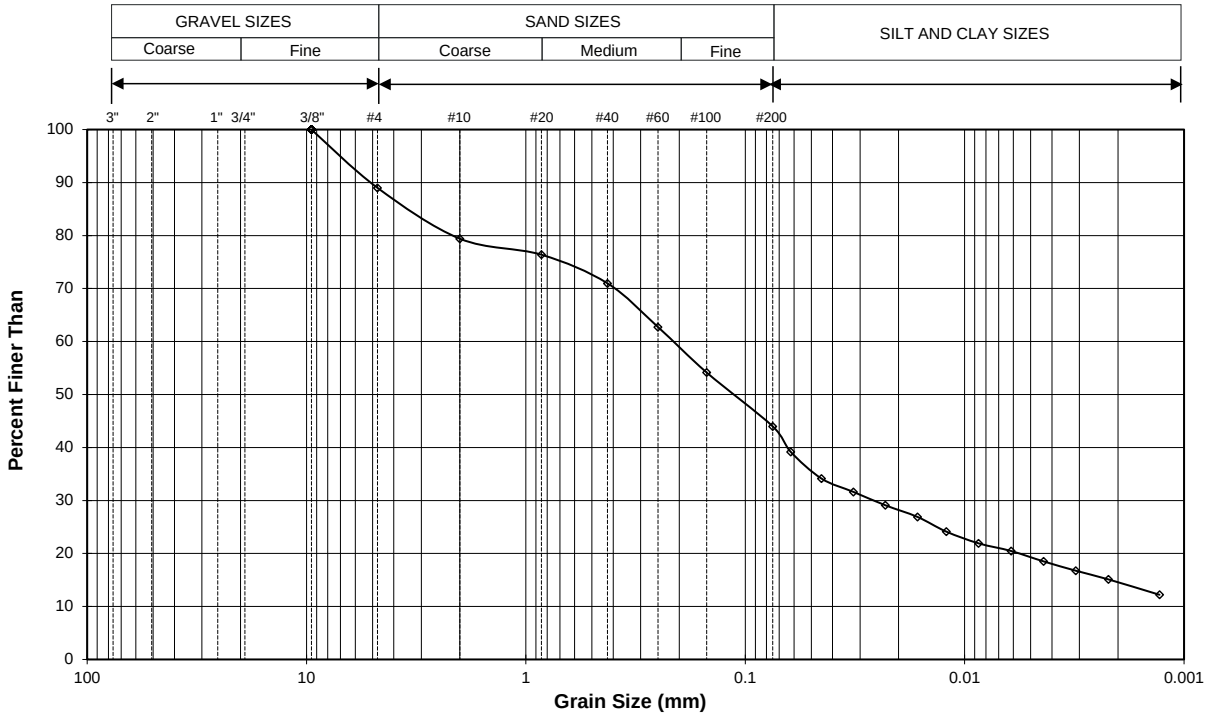
Hydrometer Analysis:

	Diameter mm	% Finer
Dispersing Agent:	0.0621	39.2
Sodium Hexametaphosphate	0.0450	34.1
	0.0322	31.6
	0.0230	29.1
	0.0164	26.9
	0.0121	24.1
	0.0086	21.9
	0.0061	20.5
	0.0044	18.5
	0.0031	16.7
	0.0022	15.1
	0.0013	12.2

Material Description:

% Gravel Sizes	% Sand Sizes	% Silt Sizes	% Clay Sizes
11	45	29	15

Remarks:



P. MACHIBRODA ENGINEERING LTD.

DRAWING NO.

9995-24

ASTM D422: GRAIN SIZE ANALYSIS OF SOIL

Project: Hydrological Study
RM of Corman Park

Project No.: 9995

Date Tested: March 5, 2015

Test Hole No.: 108

Sample No.: 81

Depth (m): 0.3

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	99
# 10	2	98
# 20	0.85	95
# 40	0.425	90.0
#60	0.25	80.4
# 100	0.15	70.3
# 200	0.075	58.8

Hydrometer Analysis:

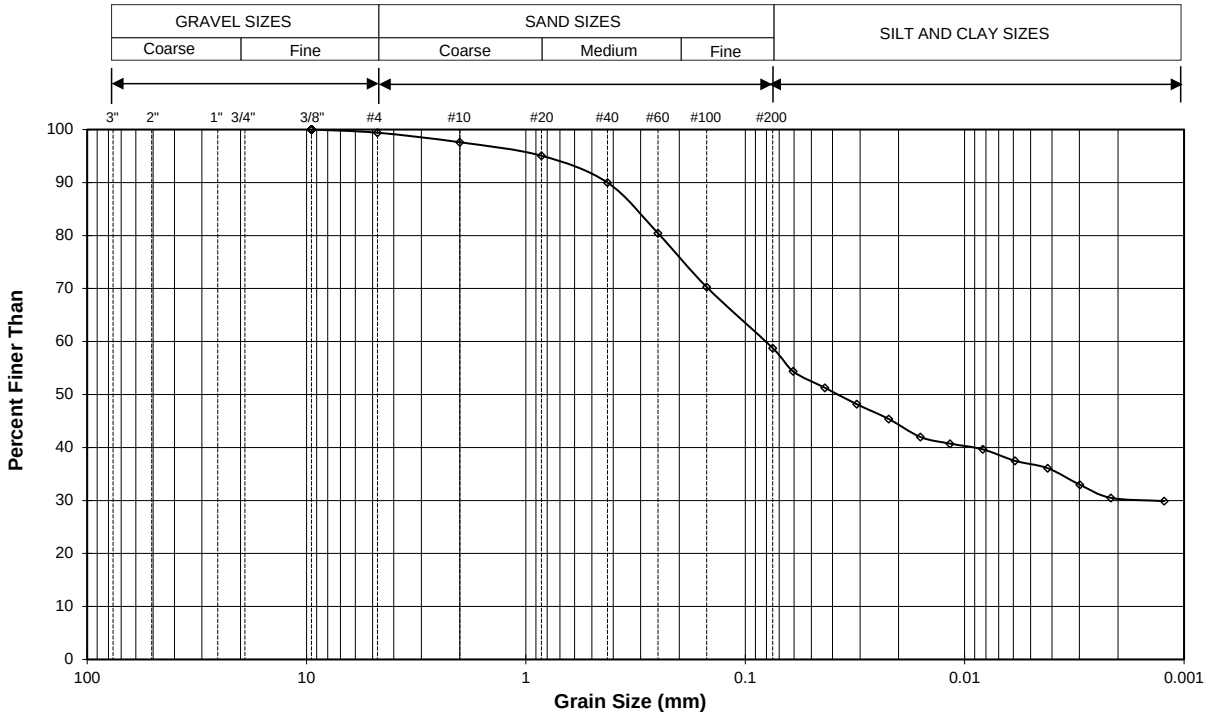
Dispersing Agent:
Sodium Hexametaphosphate

Diameter mm	% Finer
0.0606	54.4
0.0434	51.3
0.0311	48.2
0.0222	45.4
0.0159	42.0
0.0117	40.7
0.0083	39.7
0.0059	37.5
0.0042	36.1
0.0030	33.0
0.0022	30.5
0.0012	29.9

Material Description:

% Gravel Sizes	% Sand Sizes	% Silt Sizes	% Clay Sizes
1	41	28	31

Remarks:



P. MACHIBRODA ENGINEERING LTD.

DRAWING NO.

9995-25

ASTM D422: GRAIN SIZE ANALYSIS OF SOIL

Project: Hydrological Study
RM of Corman Park

Project No.: 9995

Date Tested: March 9, 2015

Test Hole No.: 109

Sample No.: 92

Depth (m): 1.2

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	97
# 4	4.75	91
# 10	2	87
# 20	0.85	84
# 40	0.425	78.2
#60	0.25	70.0
# 100	0.15	60.8
# 200	0.075	49.7

Hydrometer Analysis:

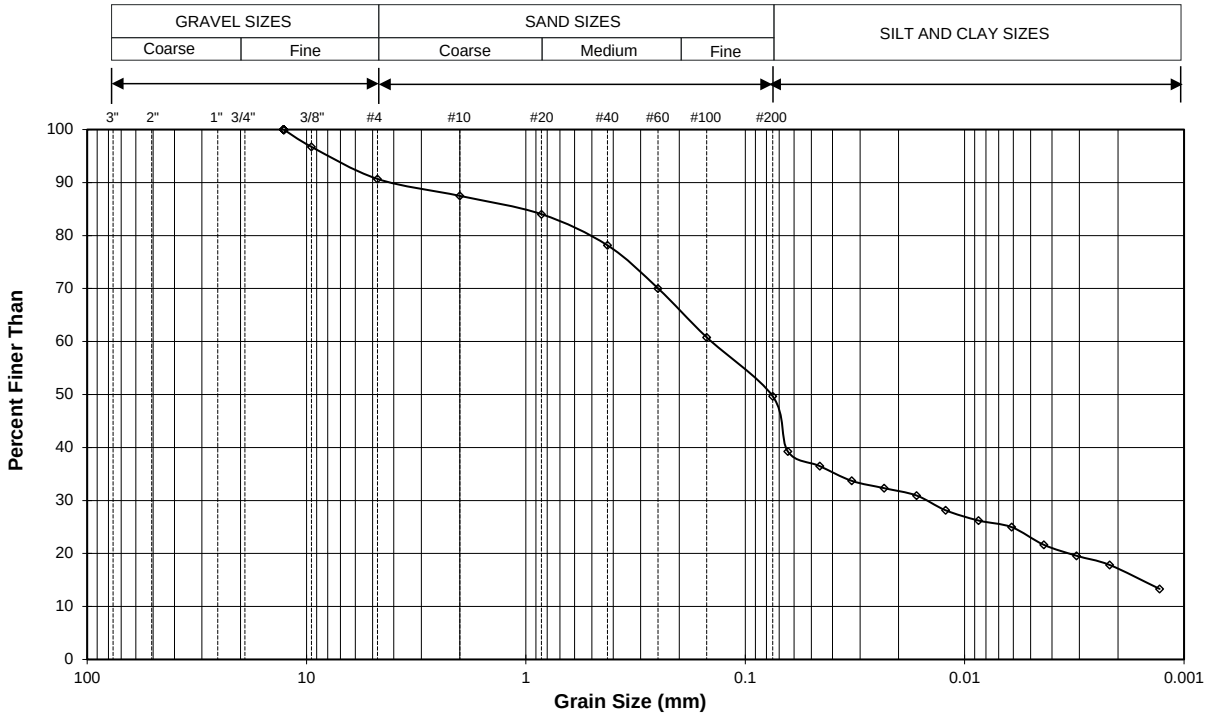
Dispersing Agent:
Sodium Hexametaphosphate

Diameter mm	% Finer
0.0640	39.3
0.0458	36.5
0.0328	33.7
0.0233	32.3
0.0166	30.9
0.0122	28.2
0.0087	26.2
0.0061	25.0
0.0044	21.6
0.0031	19.6
0.0022	17.8
0.0013	13.3

Material Description:

% Gravel Sizes	% Sand Sizes	% Silt Sizes	% Clay Sizes
9	41	32	18

Remarks:

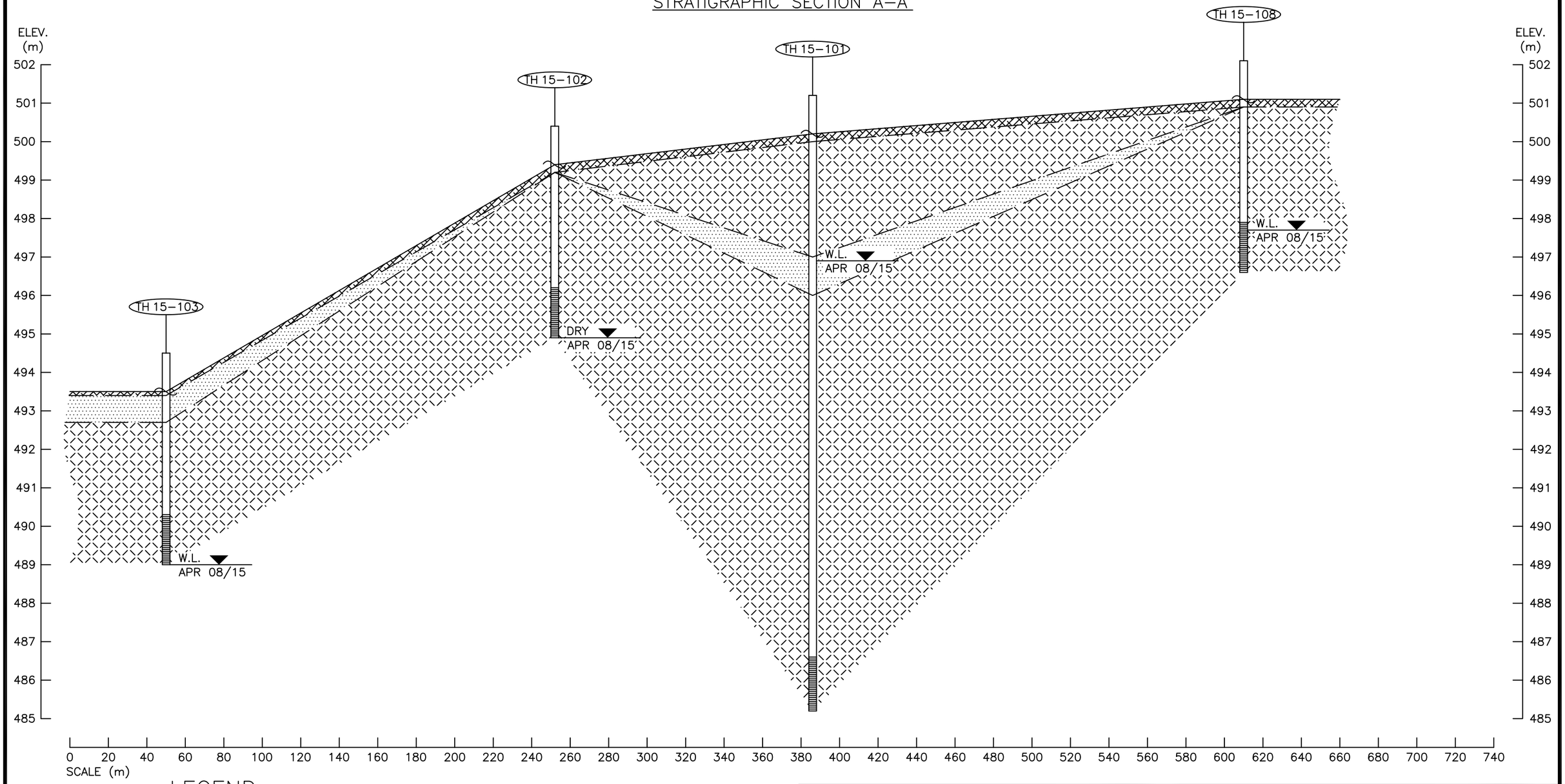


P. MACHIBRODA ENGINEERING LTD.

DRAWING NO.

9995-26

STRATIGRAPHIC SECTION A–A'



LEGEND

- TOPSOIL
- SAND
- GLACIAL TILL
- FILL
- SILT
- W.L. JAN XX/10 — RECORDED WATER LEVEL
- GRAVEL
- CLAY

LIMITATIONS

THIS STRATIGRAPHIC SECTION IS A SUMMARY OF SUBSURFACE FIELD CONDITIONS INFERRED FROM DATA ENCOUNTERED AT SPECIFIC TEST HOLE LOCATIONS AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS AND, IN TIME, MAY CHANGE AT THE SPECIFIC LOCATION OF ANY TEST HOLE.

P. MACHIBRODA ENGINEERING LTD.

CONSULTING
GEOENVIRONMENTAL
GEOTECHNICAL
ENGINEERS

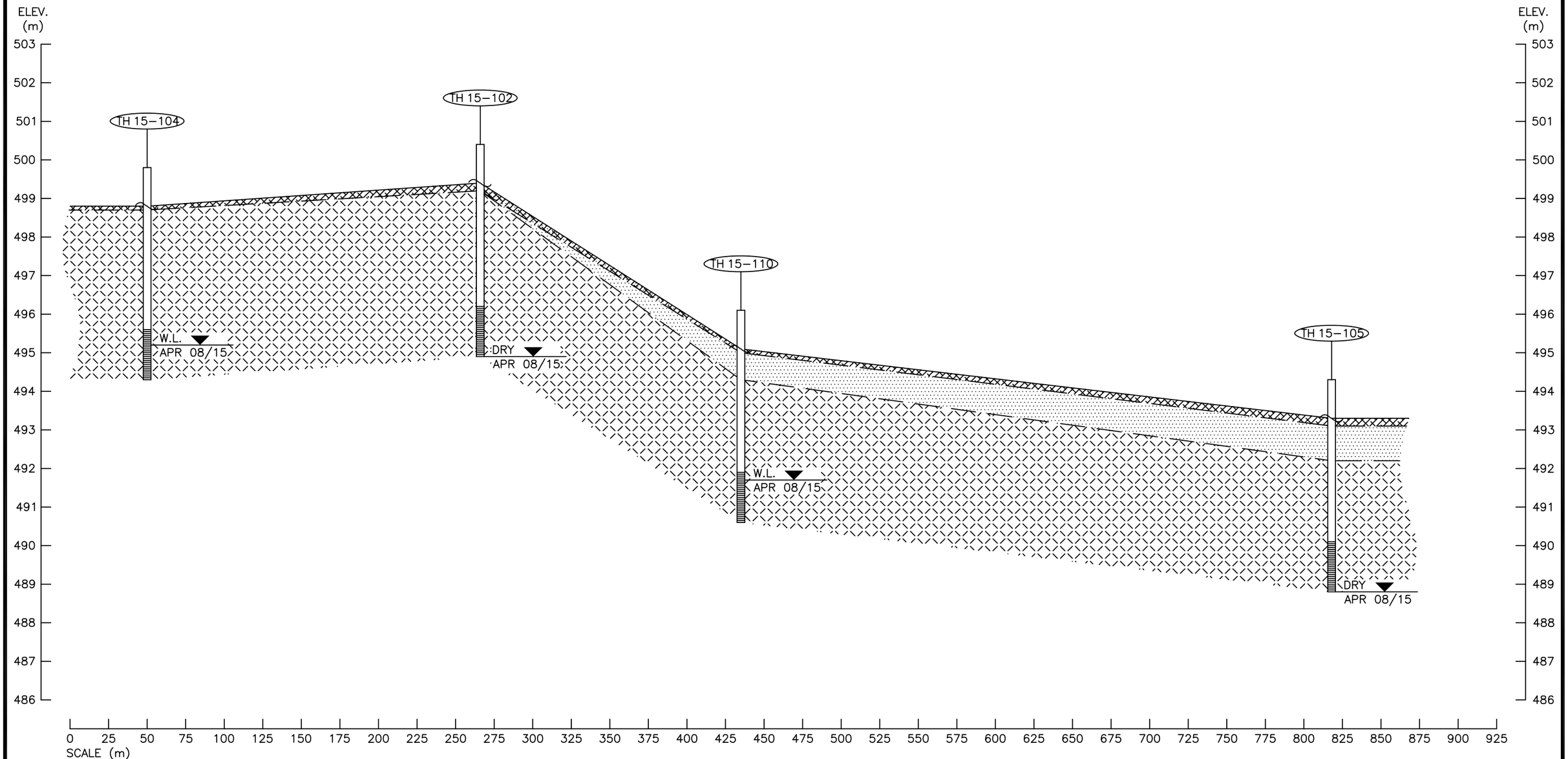
806 – 48th STREET EAST
SASKATOON, SK
S7K 3Y4

DRAWING TITLE:
STRATIGRAPHIC SECTION
A - A'

PROJECT:
WHISPER RIVER ESTATES
NW-16-38-04-W3M
R.M. OF CORMAN PARK No. 344, SK

APPROVED BY:	DRAWN BY:
TK	SD
DATE: APRIL, 2015	DRAWING NUMBER: 9995-27
SCALE: AS SHOWN	

STRATIGRAPHIC SECTION B–B'



LEGEND

- TOPSOIL
- SAND
- GLACIAL TILL
- FILL
- SILT
- W.L. JAN XX/10 — RECORDED WATER LEVEL
- GRAVEL
- CLAY

LIMITATIONS

THIS STRATIGRAPHIC SECTION IS A SUMMARY OF SUBSURFACE FIELD CONDITIONS INFERRED FROM DATA ENCOUNTERED AT SPECIFIC TEST HOLE LOCATIONS AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS AND, IN TIME, MAY CHANGE AT THE SPECIFIC LOCATION OF ANY TEST HOLE.

P. MACHIBRODA ENGINEERING LTD.

CONSULTING
GEOENVIRONMENTAL
GEOTECHNICAL
ENGINEERS

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

DRAWING TITLE: STRATIGRAPHIC SECTION B - B'	
PROJECT: WHISPER RIVER ESTATES NW-16-38-04-W3M R.M. OF CORMAN PARK No. 344, SK	
APPROVED BY: TK	DRAWN BY: SD
DATE: APRIL, 2015	DRAWING NUMBER: 9995-28
SCALE: AS SHOWN	

APPENDIX A

SASKWATER GROUNDWATER WELL RECORDS

Water Security Agency

Water Well Driller's Report

MURDOCK, BOB

Completion **02/07/1983**

RM
Major Basin **06**
SubBasin **30**
NTS Map **73B00**

WWDR# **074054**

Well Location

LSD	Quarter	Section	Township	Range	Meridian	Reserve	Riverlot
00	**NW**	**16**	**038**	**04**	**3**		

Zone	Easting	Northing	Source	Accuracy

Location of Well (in Quarter)
800.00 ft from N/S Boundary **N**
1,000.00 ft from E/W Boundary **E**

Well Information

Driller # **D. SCHMIDT DRILLING**
Water Use **Domestic**
Hole # **0R5**
Well Use **Water Test Hole**
Installation Method **Drilled**
Depth **180.00**
Water Level **55.00**
Bit **4.50**
Flowing Head **0.00**

Well Casings

Length (ft)	Btm (ft)	Dia (in)	Description
143.00	**142.00**	**5.00**	**Steel**
0.00	**0.00**	**0.00**	
0.00	**0.00**	**0.00**	

Screens

Length (ft)	Btm (ft)	Dia (in)	Slot (in)	Description
10.00	**152.00**	**4.00**	**12.00**	**Stainless Steel**
0.00	**0.00**	**0.00**	**0.00**	
0.00	**0.00**	**0.00**	**0.00**	

Pump Test

Draw Down	**0.00** ft				
Duration	**0.00** hrs	Elevation	**1,625.00** ft	Aquifer	
Pumping Rate	**0.00** igpm	Rec. Pumping Rate	**0.00**	E-Log	**Yes**
Temp	**0.00** deg. F	Intake	**0.00**	Phys	**E03**

Lithology List

Depth (ft)	Material	Colour	Description
1.00	Topsoil	Unknown	Unknown
2.00	Clay	White	Silty
5.00	Sand & Gravel	Brown	Unknown
10.00	Clay	Brown	Till Streaks
140.00	Clay	Grey	Cemented
153.00	Sand	Grey	Silty
180.00	Clay	Grey	Cemented

Water Security Agency

Water Well Driller's Report

3/5/2015
WSaskWWDR01

SASK HIGHWAYS & TRAN

Completion **08/29/1983**

RM **344**
Major Basin **06**
SubBasin **30**
NTS Map **73B07**

WWDR# **116814**

Well Location

LSD	Quarter	Section	Township	Range	Meridian	Reserve	Riverlot
15	**NE**	**16**	**038**	**04**	**3**		

Zone	Easting	Northing	Source	Accuracy
13	**396850**	**5792350**	**GPS**	**Unknown**

Location of Well (in Quarter)
0.00 ft from N/S Boundary
0.00 ft from E/W Boundary

Well Information

Driller # **UNKNOWN**
Water Use **Research**
Hole # **064**
Well Use **Soil Test Hole**
Installation Method **Drilled**
Depth **177.00**
Water Level **0.00**
Bit **4.80**
Flowing Head **0.00**

Well Casings

Length (ft)	Btm (ft)	Dia (in)	Description
0.00	**0.00**	**0.00**	
0.00	**0.00**	**0.00**	
0.00	**0.00**	**0.00**	

Screens

Length (ft)	Btm (ft)	Dia (in)	Slot (in)	Description
0.00	**0.00**	**0.00**	**0.00**	
0.00	**0.00**	**0.00**	**0.00**	
0.00	**0.00**	**0.00**	**0.00**	

Pump Test

Draw Down **0.00** ft
Duration **0.00** hrs
Pumping Rate **0.00** igpm
Temp **0.00** deg. F

Elevation **1,634.00** ft
Rec. Pumping Rate **0.00**
Intake **0.00**

Aquifer
E-Log **SCANNED**
Phys **E03**

Lithology List

Depth (ft)	Material	Colour	Description
12.00	Till	Grey	Sandy
20.00	Till	Brown	Hard
26.00	Till	Grey	Sandy
85.00	Till	Grey	Clayey
88.00	Sand	Grey	Medium-coarse
162.00	Till	Grey	Sandy
170.00	Gravel	Grey	Sandy
177.00	Till	Grey	Sandy

Water Security Agency

Water Well Driller's Report

3/5/2015
WSaskWWDR01

MURDOCK, BOB

Completion **01/19/1983**

RM
Major Basin **06**
SubBasin **30**
NTS Map **73B00**

WWDR# **073985**

Well Location

LSD	Quarter	Section	Township	Range	Meridian	Reserve	Riverlot
00	**NE**	**16**	**038**	**04**	**3**		

Zone	Easting	Northing	Source	Accuracy

Location of Well (in Quarter)
1,000.00 ft from N/S Boundary **N**
15.00 ft from E/W Boundary **W**

Well Information

Driller # **D. SCHMIDT DRILLING**
Water Use **Domestic**
Hole # **0R2**
Well Use **Water Test Hole**
Installation Method **Drilled**
Depth **160.00**
Water Level **0.00**
Bit **4.50**
Flowing Head **0.00**

Well Casings

Length (ft)	Btm (ft)	Dia (in)	Description
0.00	**0.00**	**0.00**	
0.00	**0.00**	**0.00**	
0.00	**0.00**	**0.00**	

Screens

Length (ft)	Btm (ft)	Dia (in)	Slot (in)	Description
0.00	**0.00**	**0.00**	**0.00**	
0.00	**0.00**	**0.00**	**0.00**	
0.00	**0.00**	**0.00**	**0.00**	

Pump Test

Draw Down **0.00** ft
Duration **0.00** hrs
Pumping Rate **0.00** igpm
Temp **0.00** deg. F
Elevation **1,625.00** ft
Rec. Pumping Rate **0.00**
Intake **0.00**
Aquifer
E-Log **No**
Phys **E03**

Lithology List

Depth (ft)	Material	Colour	Description
5.00	Till	Brown	Sandy
10.00	Sand	Brown	Clayey
14.00	Till	Brown	Boulders
140.00	Till	Grey	Boulders
142.00	Sand	Grey	Fine
160.00	Till	Grey	Boulders

Water Security Agency

Water Well Driller's Report

MURDOCK, BOB Completion **01/22/1983**

RM
Major Basin **06**
SubBasin **30**
NTS Map **73B00**

WWDR# **073986**

Well Location

LSD	Quarter	Section	Township	Range	Meridian	Reserve	Riverlot
00	**NE**	**16**	**038**	**04**	**3**		

Zone	Easting	Northing	Source	Accuracy

Location of Well (in Quarter)
1,000.00 ft from N/S Boundary **N**
25.00 ft from E/W Boundary **W**

Well Information

Driller # **D. SCHMIDT DRILLING**
Water Use **Domestic**
Hole # **0R3**
Well Use **Water Test Hole**
Installation Method **Drilled**
Depth **160.00**
Water Level **40.00**
Bit **4.50**
Flowing Head **0.00**

Well Casings

Length (ft)	Btm (ft)	Dia (in)	Description
140.00	**139.00**	**5.00**	**Black Iron**
0.00	**0.00**	**0.00**	
0.00	**0.00**	**0.00**	

Screens

Length (ft)	Btm (ft)	Dia (in)	Slot (in)	Description
10.00	**149.00**	**4.00**	**12.00**	**Stainless Steel**
0.00	**0.00**	**0.00**	**0.00**	
0.00	**0.00**	**0.00**	**0.00**	

Pump Test

Draw Down **0.00** ft
Duration **0.00** hrs
Pumping Rate **0.00** igpm
Temp **0.00** deg. F

Elevation **1,625.00** ft
Rec. Pumping Rate **0.00**
Intake **0.00**

Aquifer
E-Log **Yes**
Phys **E03**

Lithology List

Depth (ft)	Material	Colour	Description
12.00	Till	Brown	Oxidized
139.00	Till	Grey	Hard
145.00	Sand	Grey	Silty
147.00	Till	Grey	Hard
148.00	Sand	Unknown	Fine-medium
155.00	Till	Grey	Hard
156.00	Sand & Gravel	Unknown	Coarse
160.00	Till	Grey	Sandy

Water Well Driller's Report

MURDOCK, BOB Completion **01/27/1983**

RM
Major Basin **06**
SubBasin **30**
NTS Map **73B00**

WWDR# **073987**

Well Location

LSD	Quarter	Section	Township	Range	Meridian	Reserve	Riverlot
00	**NE**	**16**	**038**	**04**	**3**		

Zone	Easting	Northing	Source	Accuracy

Location of Well (in Quarter)
1,000.00 ft from N/S Boundary **N**
0.00 ft from E/W Boundary **W**

Well Information

Driller # **D. SCHMIDT DRILLING**
Water Use **Domestic**
Hole # **0R4**
Well Use **Water Test Hole**
Installation Method **Drilled**
Depth **180.00**
Water Level **0.00**
Bit **4.50**
Flowing Head **0.00**

Well Casings

Length (ft)	Btm (ft)	Dia (in)	Description
0.00	**0.00**	**0.00**	
0.00	**0.00**	**0.00**	
0.00	**0.00**	**0.00**	

Screens

Length (ft)	Btm (ft)	Dia (in)	Slot (in)	Description
0.00	**0.00**	**0.00**	**0.00**	
0.00	**0.00**	**0.00**	**0.00**	
0.00	**0.00**	**0.00**	**0.00**	

Pump Test

Draw Down **0.00** ft
Duration **0.00** hrs
Pumping Rate **0.00** igpm
Temp **0.00** deg. F
Elevation **1,625.00** ft
Rec. Pumping Rate **0.00**
Intake **0.00**
Aquifer
E-Log **Yes**
Phys **E03**

Lithology List

Depth (ft)	Material	Colour	Description
1.00	Topsoil	Unknown	Unknown
7.00	Sand	Brown	Medium
14.00	Till	Brown	Oxidized
140.00	Till	Grey	Cobblestones
160.00	Till	Grey	Sandy
180.00	Till	Grey	Hard

APPENDIX B

HYDRAULIC CONDUCTIVITY TEST RESULTS

P. Machibroda Engineering Ltd.
806 - 48th Street East
Saskatoon, SK
S7K 3Y4
P: (306) 665 - 8444
F: (306) 652 - 2092

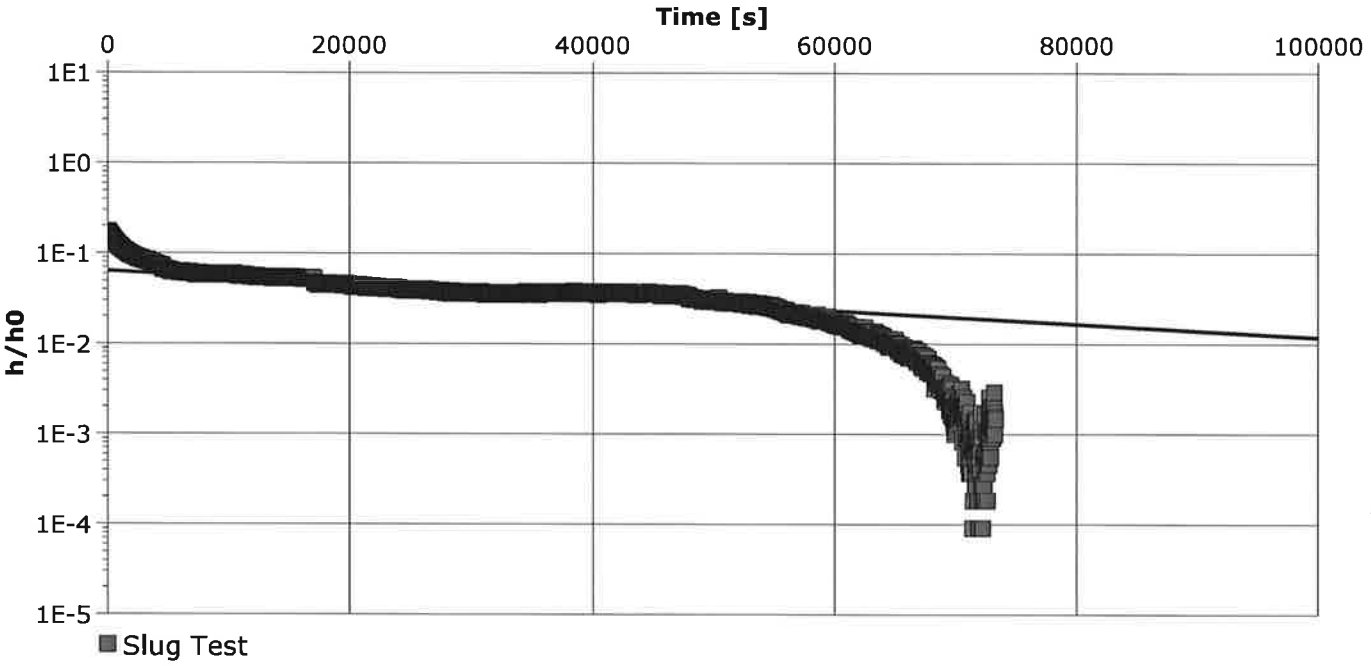
Slug Test Analysis Report

Project: Hydrogeological Study

Number: 9995

Client: Whisper Estates

Location: RM of Corman Park No. 344	Slug Test: Test Hole TH15-101C (SLUG TEST)	Test Well: Slug Test
Test Conducted by: T. Korbas		Test Date: 4/13/2015
Analysis Performed by: T. Korbas	Slug Test TH 15 - 101C	Analysis Date: 3/13/2015
Aquifer Thickness: 5.00 m		



Calculation after Hvorslev

Observation Well	Hydraulic Conductivity [m/s]
Slug Test	1.45×10^{-8}

P. Machibroda Engineering Ltd.
806 - 48th Street East
Saskatoon, SK
S7K 3Y4
P: (306) 665 - 8444
F: (306) 652 - 2092

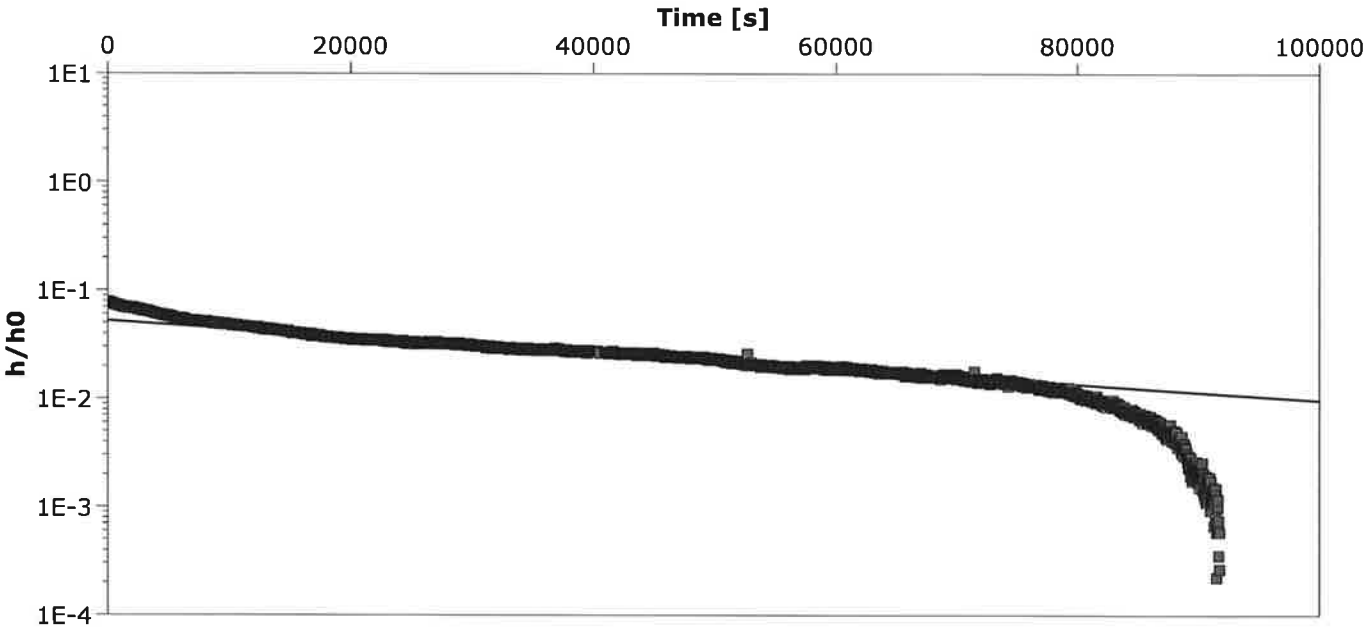
Slug Test Analysis Report

Project: Hydrogeological Study

Number: 9995

Client: Whisper Estates

Location: RM of Corman Park No. 344	Slug Test: TH15-102	Test Well: Slug Test
Test Conducted by:		Test Date: 3/27/2015
Analysis Performed by: T.Korbas	New analysis 1	Analysis Date: 3/27/2015
Aquifer Thickness: 10.00 m		



Calculation after Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
Slug Test	1.45×10^{-8}	

P. Machibroda Engineering Ltd.
806 - 48th Street East
Saskatoon, SK
S7K 3Y4
P: (306) 665 - 8444
F: (306) 652 - 2092

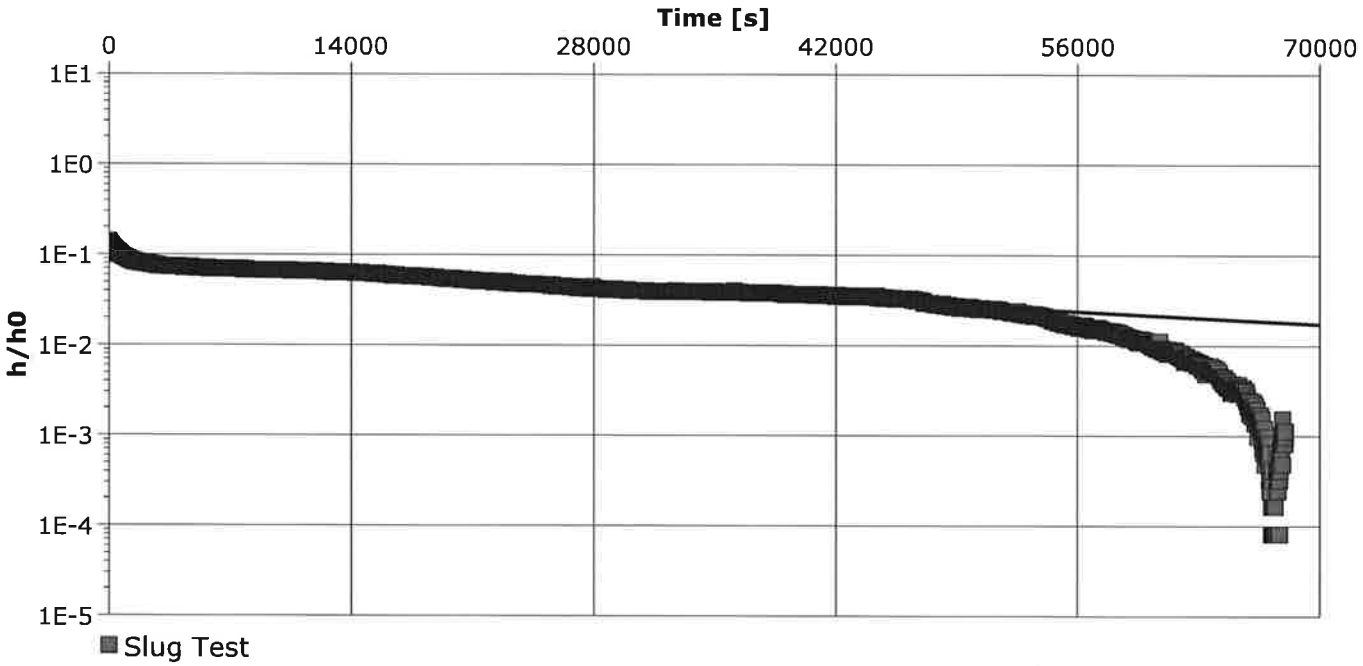
Slug Test Analysis Report

Project: Hydrogeological Study

Number: 9995

Client: Whisper Estates

Location: RM of Corman Park No. 344	Slug Test: Test Hole TH15-104 (SLUG TEST)	Test Well: Slug Test
Test Conducted by: T. Korbas		Test Date: 4/13/2015
Analysis Performed by: T. Korbas	Slug Test TH 15 - 104	Analysis Date: 3/13/2015
Aquifer Thickness: 5.00 m		



Calculation after Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
Slug Test	1.95×10^{-8}	

P. Machibroda Engineering Ltd.
806 - 48th Street East
Saskatoon, SK
S7K 3Y4
P: (306) 665 - 8444
F: (306) 652 - 2092

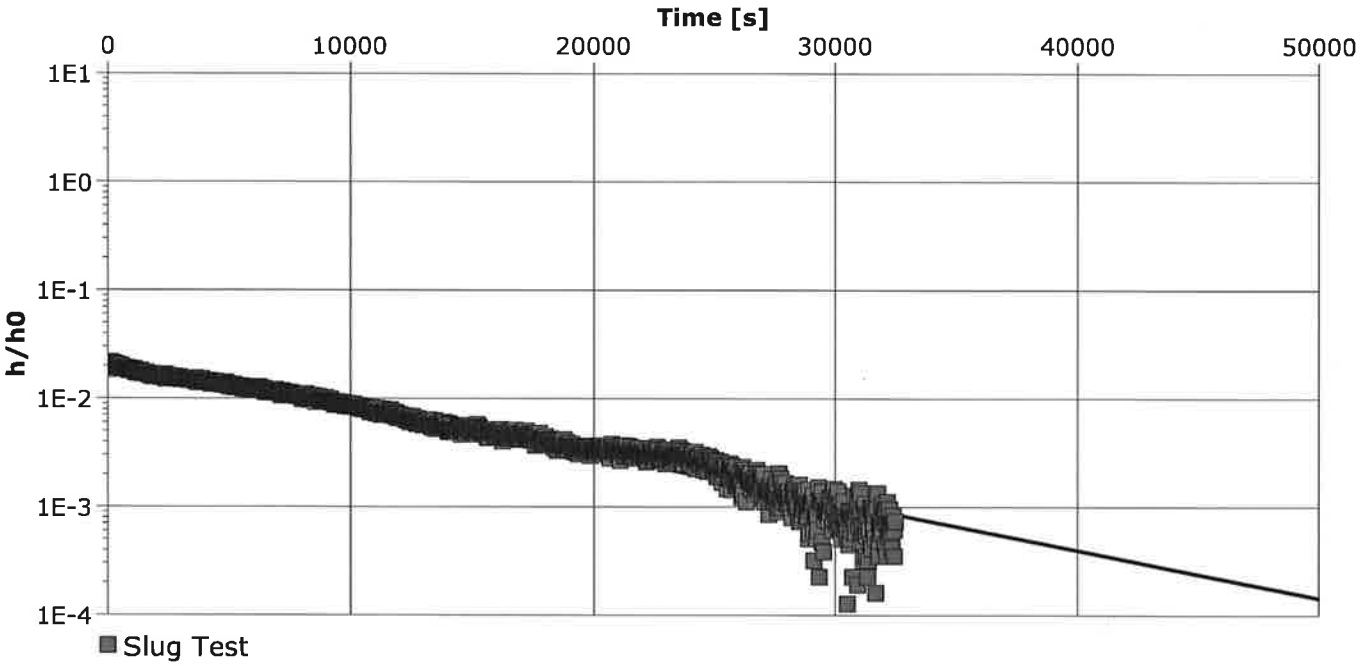
Slug Test Analysis Report

Project: Hydrogeological Study

Number: 9995

Client: Whisper Estates

Location: RM of Corman Park No. 344	Slug Test: SLUG TEST TH15-105	Test Well: Slug Test
Test Conducted by: T.Korbas		Test Date: 3/27/2015
Analysis Performed by: T.Korbas	Slug Test TH15-105	Analysis Date: 3/27/2015
Aquifer Thickness: 10.00 m		



Calculation after Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
Slug Test	8.70×10^{-8}	

P. Machibroda Engineering Ltd.
806 - 48th Street East
Saskatoon, SK
S7K 3Y4
P: (306) 665 - 8444
F: (306) 652 - 2092

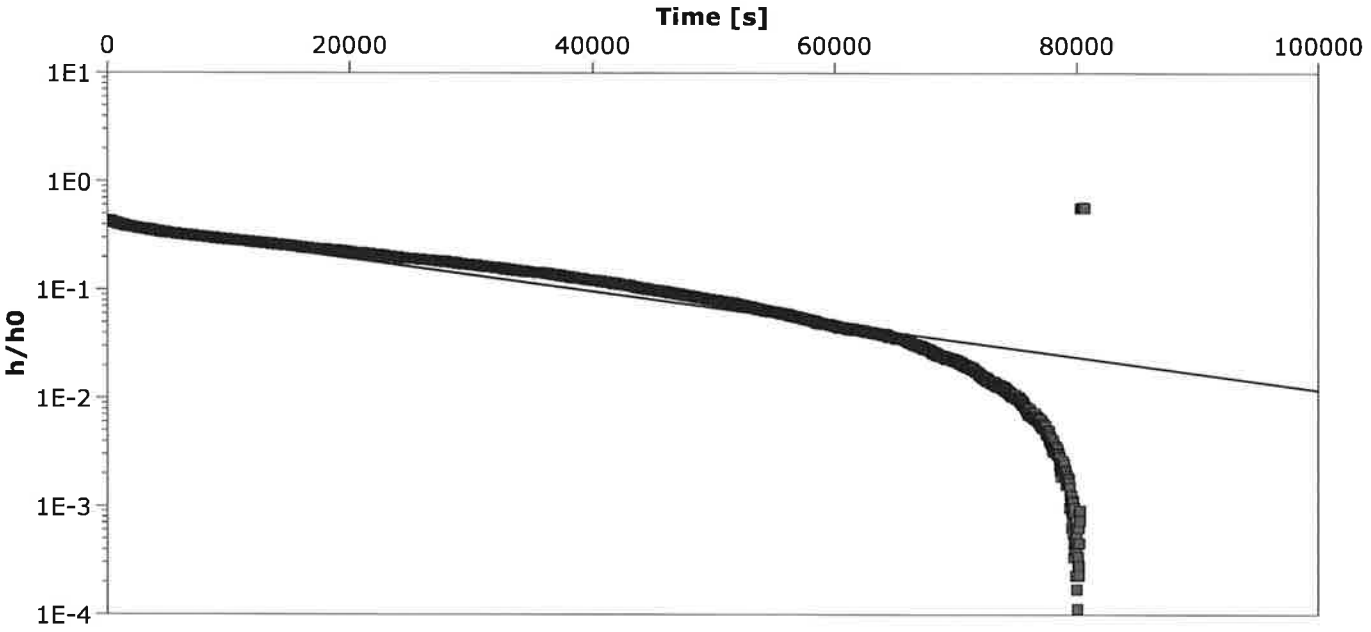
Slug Test Analysis Report

Project: Hydrogeological Study

Number: 9995

Client: Whisper Estates

Location: RM of Corman Park No. 344	Slug Test: Slug Test 2	Test Well: Slug Test
Test Conducted by:		Test Date: 3/13/2015
Analysis Performed by:	New analysis 1	Analysis Date: 3/13/2015
Aquifer Thickness: 10.00 m		



Calculation after Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
Slug Test	3.00×10^{-8}	

P. Machibroda Engineering Ltd.
806 - 48th Street East
Saskatoon, SK
S7K 3Y4
P: (306) 665 - 8444
F: (306) 652 - 2092

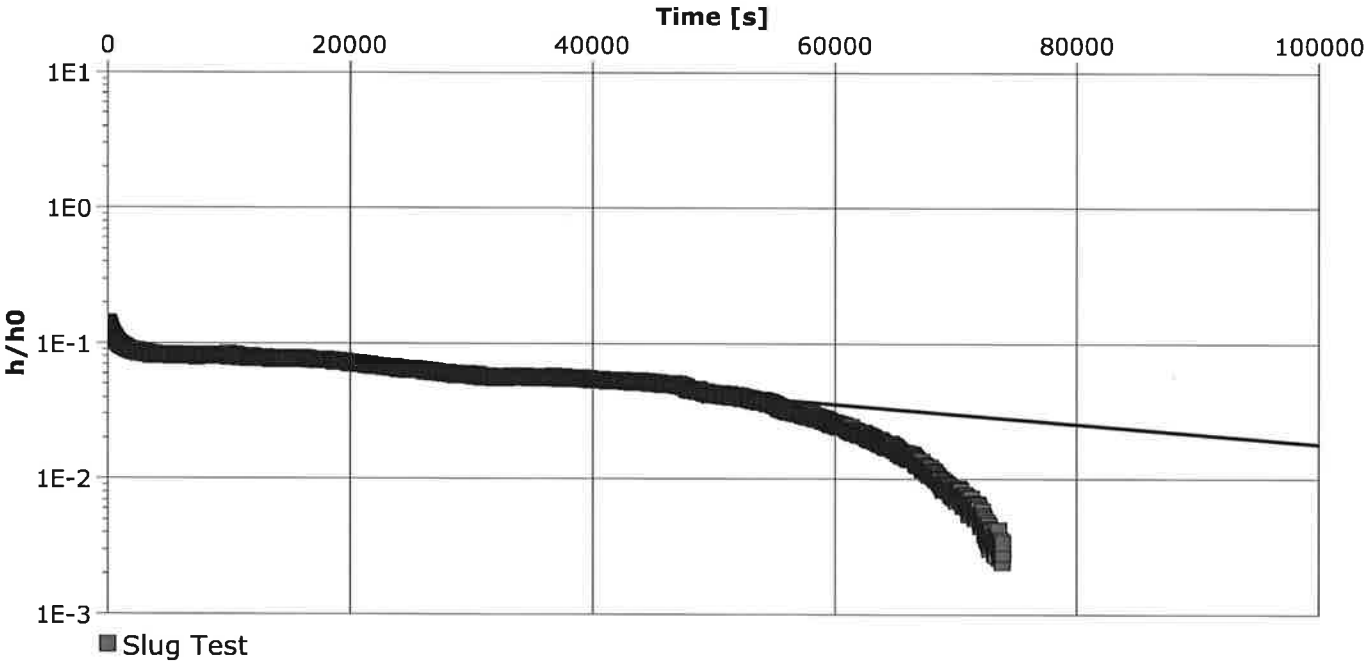
Slug Test Analysis Report

Project: Hydrogeological Study

Number: 9995

Client: Whisper Estates

Location: RM of Corman Park No. 344	Slug Test: Test Hole TH15-111 (SLUG TEST)	Test Well: Slug Test
Test Conducted by: T. Korbas		Test Date: 4/13/2015
Analysis Performed by: T. Korbas	Slug Test TH 15 - 111	Analysis Date: 4/13/2015
Aquifer Thickness: 5.00 m		



Calculation after Hvorslev

Observation Well	Hydraulic Conductivity [m/s]
Slug Test	1.45×10^{-8}

APPENDIX C

LABORATORY CHEMICAL ANALYSIS

P.MACHIBRODA ENGINEERING LTD
ATTN: Tomasz Korbas
806-48th STREET EAST
SASKATOON SK S7K 3Y4

Date Received: 17-MAR-15
Report Date: 24-MAR-15 12:04 (MT)
Version: FINAL

Client Phone: 306-665-8444

Certificate of Analysis

Lab Work Order #: L1588532

Project P.O. #: NOT SUBMITTED
Job Reference: 9995 WATER SAMPLING
C of C Numbers:
Legal Site Desc:

Brian Morgan
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1588532-1 101							
Sampled By: THEO on 17-MAR-15							
Matrix: WATER							
Routine Water Analysis							
Alkalinity by Auto. Titration							
Bicarbonate (HCO3)	326.		20	mg/L		17-MAR-15	R3161172
Hydroxide (OH)	<10.		10	mg/L		17-MAR-15	R3161172
Carbonate (CO3)	<10.		10	mg/L		17-MAR-15	R3161172
Alkalinity, Total (as CaCO3)	267		20	mg/L		17-MAR-15	R3161172
Chloride (Cl)							
Chloride (Cl)	142	DLA	5.0	mg/L	20-MAR-15	20-MAR-15	R3162505
Conductivity (Automated)							
Conductivity	8810		10	uS/cm		17-MAR-15	R3161172
ICP Cations							
Calcium (Ca)	476	DLA	20	mg/L	18-MAR-15	18-MAR-15	R3161268
Potassium (K)	26	DLA	20	mg/L	18-MAR-15	18-MAR-15	R3161268
Magnesium (Mg)	1230	DLA	20	mg/L	18-MAR-15	18-MAR-15	R3161268
Sodium (Na)	668	DLA	40	mg/L	18-MAR-15	18-MAR-15	R3161268
Sulfur (as SO4)	6730	DLA	60	mg/L	18-MAR-15	18-MAR-15	R3161268
Ion Balance Calculation							
Cation - Anion Balance	1.5			%		20-MAR-15	
TDS (Calculated)	9470			mg/L		20-MAR-15	
Hardness (as CaCO3)	6250			mg/L		20-MAR-15	
Nitrate, Nitrite and Nitrate+Nitrite-N							
Nitrate-N	7.25		0.50	mg/L	17-MAR-15	17-MAR-15	R3161349
Nitrite-N	0.161		0.050	mg/L	17-MAR-15	17-MAR-15	R3161349
Nitrate+Nitrite-N	7.41		0.50	mg/L	17-MAR-15	17-MAR-15	R3161349
pH by Meter (Automated)							
pH	7.57		0.10	pH		17-MAR-15	R3161172
L1588532-2 111							
Sampled By: THEO on 17-MAR-15							
Matrix: WATER							
Routine Water Analysis							
Alkalinity by Auto. Titration							
Bicarbonate (HCO3)	468.		20	mg/L		17-MAR-15	R3161172
Hydroxide (OH)	<10.		10	mg/L		17-MAR-15	R3161172
Carbonate (CO3)	<10.		10	mg/L		17-MAR-15	R3161172
Alkalinity, Total (as CaCO3)	384		20	mg/L		17-MAR-15	R3161172
Chloride (Cl)							
Chloride (Cl)	82.8	DLA	5.0	mg/L	20-MAR-15	20-MAR-15	R3162505
Conductivity (Automated)							
Conductivity	8240		10	uS/cm		17-MAR-15	R3161172
ICP Cations							
Calcium (Ca)	450	DLA	20	mg/L	18-MAR-15	18-MAR-15	R3161268
Potassium (K)	21	DLA	20	mg/L	18-MAR-15	18-MAR-15	R3161268
Magnesium (Mg)	1120	DLA	20	mg/L	18-MAR-15	18-MAR-15	R3161268
Sodium (Na)	615	DLA	40	mg/L	18-MAR-15	18-MAR-15	R3161268
Sulfur (as SO4)	6200	DLA	60	mg/L	18-MAR-15	18-MAR-15	R3161268
Ion Balance Calculation							
Cation - Anion Balance	0.9			%		20-MAR-15	
TDS (Calculated)	8740			mg/L		20-MAR-15	
Hardness (as CaCO3)	5740			mg/L		20-MAR-15	
Nitrate, Nitrite and Nitrate+Nitrite-N							
Nitrate-N	4.12		0.50	mg/L	17-MAR-15	17-MAR-15	R3161349

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1588532-2 111							
Sampled By: THEO on 17-MAR-15							
Matrix: WATER							
Nitrate, Nitrite and Nitrate+Nitrite-N							
Nitrite-N	0.123		0.050	mg/L	17-MAR-15	17-MAR-15	R3161349
Nitrate+Nitrite-N	4.25		0.50	mg/L	17-MAR-15	17-MAR-15	R3161349
pH by Meter (Automated)							
pH	7.50		0.10	pH		17-MAR-15	R3161172
L1588532-3 110							
Sampled By: THEO on 17-MAR-15							
Matrix: WATER							
Routine Water Analysis							
Alkalinity by Auto. Titration							
Bicarbonate (HCO3)	809.		20	mg/L		17-MAR-15	R3161172
Hydroxide (OH)	<10.		10	mg/L		17-MAR-15	R3161172
Carbonate (CO3)	<10.		10	mg/L		17-MAR-15	R3161172
Alkalinity, Total (as CaCO3)	663		20	mg/L		17-MAR-15	R3161172
Chloride (Cl)							
Chloride (Cl)	284	DLA	30	mg/L	20-MAR-15	20-MAR-15	R3162505
Conductivity (Automated)							
Conductivity	16400		10	uS/cm		17-MAR-15	R3161172
ICP Cations							
Calcium (Ca)	430	DLA	30	mg/L	18-MAR-15	18-MAR-15	R3161268
Potassium (K)	<30	DLA	30	mg/L	18-MAR-15	18-MAR-15	R3161268
Magnesium (Mg)	2930	DLA	30	mg/L	18-MAR-15	18-MAR-15	R3161268
Sodium (Na)	1410	DLA	60	mg/L	18-MAR-15	18-MAR-15	R3161268
Sulfur (as SO4)	14400	DLA	90	mg/L	18-MAR-15	18-MAR-15	R3161268
Ion Balance Calculation							
Cation - Anion Balance	0.4			%		20-MAR-15	
TDS (Calculated)	19900			mg/L		20-MAR-15	
Hardness (as CaCO3)	13100			mg/L		20-MAR-15	
Nitrate, Nitrite and Nitrate+Nitrite-N							
Nitrate-N	7.64		0.50	mg/L	17-MAR-15	17-MAR-15	R3161349
Nitrite-N	0.492		0.050	mg/L	17-MAR-15	17-MAR-15	R3161349
Nitrate+Nitrite-N	8.13		0.50	mg/L	17-MAR-15	17-MAR-15	R3161349
pH by Meter (Automated)							
pH	7.44		0.10	pH		17-MAR-15	R3161172
L1588532-4 104							
Sampled By: THEO on 17-MAR-15							
Matrix: WATER							
Routine Water Analysis							
Alkalinity by Auto. Titration							
Bicarbonate (HCO3)	809.		20	mg/L		17-MAR-15	R3161172
Hydroxide (OH)	<10.		10	mg/L		17-MAR-15	R3161172
Carbonate (CO3)	<10.		10	mg/L		17-MAR-15	R3161172
Alkalinity, Total (as CaCO3)	663		20	mg/L		17-MAR-15	R3161172
Chloride (Cl)							
Chloride (Cl)	272	DLA	30	mg/L	20-MAR-15	20-MAR-15	R3162505
Conductivity (Automated)							
Conductivity	16400		10	uS/cm		17-MAR-15	R3161172
ICP Cations							
Calcium (Ca)	438	DLA	30	mg/L	18-MAR-15	18-MAR-15	R3161268
Potassium (K)	<30	DLA	30	mg/L	18-MAR-15	18-MAR-15	R3161268

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1588532-4 104							
Sampled By: THEO on 17-MAR-15							
Matrix: WATER							
ICP Cations							
Magnesium (Mg)	2980	DLA	30	mg/L	18-MAR-15	18-MAR-15	R3161268
Sodium (Na)	1420	DLA	60	mg/L	18-MAR-15	18-MAR-15	R3161268
Sulfur (as SO4)	14200	DLA	90	mg/L	18-MAR-15	18-MAR-15	R3161268
Ion Balance Calculation							
Cation - Anion Balance	1.8			%		20-MAR-15	
TDS (Calculated)	19700			mg/L		20-MAR-15	
Hardness (as CaCO3)	13400			mg/L		20-MAR-15	
Nitrate, Nitrite and Nitrate+Nitrite-N							
Nitrate-N	7.47		0.50	mg/L	17-MAR-15	17-MAR-15	R3161349
Nitrite-N	0.597		0.050	mg/L	17-MAR-15	17-MAR-15	R3161349
Nitrate+Nitrite-N	8.07		0.50	mg/L	17-MAR-15	17-MAR-15	R3161349
pH by Meter (Automated)							
pH	7.43		0.10	pH		17-MAR-15	R3161172
L1588532-5 109							
Sampled By: THEO on 17-MAR-15							
Matrix: WATER							
Routine Water Analysis							
Alkalinity by Auto. Titration							
Bicarbonate (HCO3)	324.		20	mg/L		17-MAR-15	R3161172
Hydroxide (OH)	<10.		10	mg/L		17-MAR-15	R3161172
Carbonate (CO3)	<10.		10	mg/L		17-MAR-15	R3161172
Alkalinity, Total (as CaCO3)	266		20	mg/L		17-MAR-15	R3161172
Chloride (Cl)							
Chloride (Cl)	239	DLA	5.0	mg/L	20-MAR-15	20-MAR-15	R3162505
Conductivity (Automated)							
Conductivity	1870		10	uS/cm		17-MAR-15	R3161172
ICP Cations							
Calcium (Ca)	232	DLA	2.0	mg/L	18-MAR-15	18-MAR-15	R3161268
Potassium (K)	14.0	DLA	2.0	mg/L	18-MAR-15	18-MAR-15	R3161268
Magnesium (Mg)	72.4	DLA	2.0	mg/L	18-MAR-15	18-MAR-15	R3161268
Sodium (Na)	72.5	DLA	4.0	mg/L	18-MAR-15	18-MAR-15	R3161268
Sulfur (as SO4)	421	DLA	6.0	mg/L	18-MAR-15	18-MAR-15	R3161268
Ion Balance Calculation							
Cation - Anion Balance	0.1			%		20-MAR-15	
TDS (Calculated)	1220			mg/L		20-MAR-15	
Hardness (as CaCO3)	877			mg/L		20-MAR-15	
Nitrate, Nitrite and Nitrate+Nitrite-N							
Nitrate-N	2.35		0.50	mg/L	17-MAR-15	17-MAR-15	R3161349
Nitrite-N	0.190		0.050	mg/L	17-MAR-15	17-MAR-15	R3161349
Nitrate+Nitrite-N	2.54		0.50	mg/L	17-MAR-15	17-MAR-15	R3161349
pH by Meter (Automated)							
pH	7.53		0.10	pH		17-MAR-15	R3161172

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Sample Parameter Qualifier Key:

Qualifier	Description
DLA	Detection Limit adjusted for required dilution

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-PCT-SK	Water	Alkalinity by Auto. Titration	APHA 2320 Alkalinity

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

CL-COL-SK	Water	Chloride (Cl)	APHA 4500-CL E

Chloride in aqueous matrices is determined colorimetrically by auto-analyzer.

EC-PCT-SK	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

ETL-ROUTINE-ICP-SK	Water	ICP Cations	APHA 3120 B-ICP-OES-ROU

These ions are determined directly y ICP-OES.

Reference
Greenberg, Arnold E., Cleseri, Lenore S., Eaton, Andrew D., Standard Methods For The Examination of Water and Wastewater, 18th Edition, 1992, Method 3120B.

IONBALANCE-OP03-SK	Water	Ion Balance Calculation	APHA 1030-E
N2/N3-SK	Water	Nitrate, Nitrite and Nitrate+Nitrite-N	APHA 4500 NO3F

Nitrate is quantitatively reduced to nitrite by passage of the sample through a copperized cadmium column. The nitrite (reduced nitrate plus original nitrite) is then determined by diazotizing with sulfanilamide followed by coupling with N-(1-naphthyl)ethylenediamine dihydrochloride. The resulting water-soluble dye has a magenta color, which is measured at 520nm. Original nitrite can also be determined by removing the cadmium column and following the same procedure. Nitrate-N, Nitrite-N and NO3+NO2-N are reported.

Reference
Greenberg, Arnold E., Cleseri, Lenore S., Eaton, Andrew D., Standard Methods For The Examination of Water and Wastewater, 18th Edition, 1992, Method 4500NO3-F.

PH-PCT-SK	Water	pH by Meter (Automated)	APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA

Chain of Custody Numbers:

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L1588532 Report Date: 24-MAR-15

Client: P.MACHIBRODA ENGINEERING LTD
806-48th STREET EAST
SASKATOON SK S7K 3Y4
Contact: Tomasz Korbas

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ALK-PCT-SK	**Water**							
Batch R3161172								
WG2055808-1 DUP		**L1588532-3**						
Alkalinity, Total (as CaCO3)		663	665		mg/L	0.3	20	17-MAR-15
WG2055808-2 LCS								
Alkalinity, Total (as CaCO3)			103.6		%		85-115	17-MAR-15
WG2055808-3 MB								
Alkalinity, Total (as CaCO3)			<20		mg/L		20	17-MAR-15
CL-COL-SK	**Water**							
Batch R3162505								
WG2055842-2 DUP		**L1588532-1**						
Chloride (Cl)		142	143		mg/L	0.5	20	20-MAR-15
WG2055842-4 LCS								
Chloride (Cl)			102.9		%		85-115	20-MAR-15
WG2055842-1 MB								
Chloride (Cl)			<1.0		mg/L		1	20-MAR-15
EC-PCT-SK	**Water**							
Batch R3161172								
WG2055808-1 DUP		**L1588532-3**						
Conductivity		16400	16200		uS/cm	0.7	20	17-MAR-15
WG2055808-2 LCS								
Conductivity			100.5		%		90-110	17-MAR-15
WG2055808-3 MB								
Conductivity			<10		uS/cm		10	17-MAR-15
ETL-ROUTINE-ICP-SK	**Water**							
Batch R3161268								
WG2055191-2 DUP		**L1587788-2**						
Calcium (Ca)		121	121		mg/L	0.0	20	18-MAR-15
Potassium (K)		6.6	6.6		mg/L	0.5	20	18-MAR-15
Magnesium (Mg)		37.3	37.1		mg/L	0.5	20	18-MAR-15
Sodium (Na)		57.9	58.3		mg/L	0.7	20	18-MAR-15
Sulfur (as SO4)		242	245		mg/L	1.3	20	18-MAR-15
WG2055191-3 LCS								
Calcium (Ca)			103.5		%		80-120	18-MAR-15
Potassium (K)			98.4		%		80-120	18-MAR-15
Magnesium (Mg)			102.5		%		80-120	18-MAR-15
Sodium (Na)			99.7		%		80-120	18-MAR-15
Sulfur (as SO4)			100.0		%		90-110	18-MAR-15

Quality Control Report

Client: P.MACHIBRODA ENGINEERING LTD
806-48th STREET EAST
SASKATOON SK S7K 3Y4
Contact: Tomasz Korbas

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ETL-ROUTINE-ICP-SK	**Water**							
Batch R3161268								
WG2055191-1 MB								
Calcium (Ca)			<1.0		mg/L		1	18-MAR-15
Potassium (K)			<1.0		mg/L		1	18-MAR-15
Magnesium (Mg)			<1.0		mg/L		1	18-MAR-15
Sodium (Na)			<2.0		mg/L		2	18-MAR-15
Sulfur (as SO4)			<3.0		mg/L		3	18-MAR-15
N2/N3-SK	**Water**							
Batch R3161349								
WG2055814-1 DUP		**L1588532-4**						
Nitrate-N		7.47	7.50		mg/L	0.4	20	17-MAR-15
Nitrite-N		0.597	0.609		mg/L	2.0	25	17-MAR-15
Nitrate+Nitrite-N		8.07	8.11		mg/L	0.5	20	17-MAR-15
WG2055814-3 LCS								
Nitrate-N			2.90		mg/L		2.55-3.45	17-MAR-15
Nitrite-N			0.485		mg/L		0.425-0.575	17-MAR-15
Nitrate+Nitrite-N			3.39		mg/L		3-4	17-MAR-15
WG2055814-2 MB								
Nitrate-N			<0.50		mg/L		0.5	17-MAR-15
Nitrite-N			<0.050		mg/L		0.05	17-MAR-15
Nitrate+Nitrite-N			<0.50		mg/L		0.5	17-MAR-15
PH-PCT-SK	**Water**							
Batch R3161172								
WG2055808-1 DUP		**L1588532-3**						
pH		7.44	7.41	J	pH	0.02	0.2	17-MAR-15
WG2055808-2 LCS								
pH			6.85		pH		6.76-6.96	17-MAR-15

Quality Control Report

Workorder: L1588532 Report Date: 24-MAR-15

Client: P.MACHIBRODA ENGINEERING LTD
806-48th STREET EAST
SASKATOON SK S7K 3Y4
Contact: Tomasz Korbas

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
DLA	Detection Limit adjusted for required dilution
J	Duplicate results and limits are expressed in terms of absolute difference.

Quality Control Report

Workorder: L1588532 Report Date: 24-MAR-15

Client: P.MACHIBRODA ENGINEERING LTD
806-48th STREET EAST
SASKATOON SK S7K 3Y4
Contact: Tomasz Korbas

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
pH by Meter (Automated)							
	1	17-MAR-15	17-MAR-15 17:00	0.25	5.0	hours	EHTR-FM
	2	17-MAR-15	17-MAR-15 17:00	0.25	5.0	hours	EHTR-FM
	3	17-MAR-15	17-MAR-15 17:00	0.25	5.0	hours	EHTR-FM
	4	17-MAR-15	17-MAR-15 17:00	0.25	5.0	hours	EHTR-FM
	5	17-MAR-15	17-MAR-15 17:00	0.25	5.0	hours	EHTR-FM

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1588532 were received on 17-MAR-15 16:02.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

P.MACHIBRODA ENGINEERING LTD
ATTN: Tomasz Korbas
806-48th STREET EAST
SASKATOON SK S7K 3Y4

Date Received: 10-MAR-15
Report Date: 16-MAR-15 11:10 (MT)
Version: FINAL

Client Phone: 306-665-8444

Certificate of Analysis

Lab Work Order #: L1585659

Project P.O. #: NOT SUBMITTED
Job Reference: 9995
C of C Numbers:
Legal Site Desc:

Brian Morgan
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1585659-1 101A							
Sampled By: CLIENT on 10-MAR-15							
Matrix: WATER							
Routine Water Analysis							
Alkalinity by Auto. Titration							
Bicarbonate (HCO3)	412.		20	mg/L		11-MAR-15	R3157856
Hydroxide (OH)	<10.		10	mg/L		11-MAR-15	R3157856
Carbonate (CO3)	<10.		10	mg/L		11-MAR-15	R3157856
Alkalinity, Total (as CaCO3)	338		20	mg/L		11-MAR-15	R3157856
Chloride (Cl)							
Chloride (Cl)	102	DLA	10	mg/L	12-MAR-15	12-MAR-15	R3159059
Conductivity (Automated)							
Conductivity	6620		10	uS/cm		11-MAR-15	R3157856
ICP Cations							
Calcium (Ca)	525	DLA	10	mg/L	11-MAR-15	11-MAR-15	R3157943
Potassium (K)	32	DLA	10	mg/L	11-MAR-15	11-MAR-15	R3157943
Magnesium (Mg)	634	DLA	10	mg/L	11-MAR-15	11-MAR-15	R3157943
Sodium (Na)	599	DLA	20	mg/L	11-MAR-15	11-MAR-15	R3157943
Sulfur (as SO4)	4640	DLA	30	mg/L	11-MAR-15	11-MAR-15	R3157943
Ion Balance Calculation							
Cation - Anion Balance	-1.0			%		13-MAR-15	
TDS (Calculated)	6810			mg/L		13-MAR-15	
Hardness (as CaCO3)	3920			mg/L		13-MAR-15	
Nitrate, Nitrite and Nitrate+Nitrite-N							
Nitrate-N	16.6		0.50	mg/L	10-MAR-15	10-MAR-15	R3158825
Nitrite-N	<0.050		0.050	mg/L	10-MAR-15	10-MAR-15	R3158825
Nitrate+Nitrite-N	16.6		0.50	mg/L	10-MAR-15	10-MAR-15	R3158825
pH by Meter (Automated)							
pH	7.53		0.10	pH		11-MAR-15	R3157856
L1585659-2 101D							
Sampled By: CLIENT on 10-MAR-15							
Matrix: WATER							
Routine Water Analysis							
Alkalinity by Auto. Titration							
Bicarbonate (HCO3)	403.		20	mg/L		11-MAR-15	R3157856
Hydroxide (OH)	<10.		10	mg/L		11-MAR-15	R3157856
Carbonate (CO3)	<10.		10	mg/L		11-MAR-15	R3157856
Alkalinity, Total (as CaCO3)	331		20	mg/L		11-MAR-15	R3157856
Chloride (Cl)							
Chloride (Cl)	101	DLA	10	mg/L	12-MAR-15	12-MAR-15	R3159059
Conductivity (Automated)							
Conductivity	6640		10	uS/cm		11-MAR-15	R3157856
ICP Cations							
Calcium (Ca)	541	DLA	10	mg/L	11-MAR-15	11-MAR-15	R3157943
Potassium (K)	33	DLA	10	mg/L	11-MAR-15	11-MAR-15	R3157943
Magnesium (Mg)	656	DLA	10	mg/L	11-MAR-15	11-MAR-15	R3157943
Sodium (Na)	608	DLA	20	mg/L	11-MAR-15	11-MAR-15	R3157943
Sulfur (as SO4)	4700	DLA	30	mg/L	11-MAR-15	11-MAR-15	R3157943
Ion Balance Calculation							
Cation - Anion Balance	-0.1			%		13-MAR-15	
TDS (Calculated)	6910			mg/L		13-MAR-15	
Hardness (as CaCO3)	4050			mg/L		13-MAR-15	
Nitrate, Nitrite and Nitrate+Nitrite-N							
Nitrate-N	16.4		0.50	mg/L	10-MAR-15	10-MAR-15	R3158825

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1585659-2 101D							
Sampled By: CLIENT on 10-MAR-15							
Matrix: WATER							
Nitrate, Nitrite and Nitrate+Nitrite-N							
Nitrite-N	<0.050		0.050	mg/L	10-MAR-15	10-MAR-15	R3158825
Nitrate+Nitrite-N	16.4		0.50	mg/L	10-MAR-15	10-MAR-15	R3158825
pH by Meter (Automated)							
pH	7.53		0.10	pH		11-MAR-15	R3157856

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Sample Parameter Qualifier Key:

Qualifier	Description
DLA	Detection Limit adjusted for required dilution

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-PCT-SK	Water	Alkalinity by Auto. Titration	APHA 2320 Alkalinity

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

CL-COL-SK	Water	Chloride (Cl)	APHA 4500-CL E

Chloride in aqueous matrices is determined colorimetrically by auto-analyzer.

EC-PCT-SK	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

ETL-ROUTINE-ICP-SK	Water	ICP Cations	APHA 3120 B-ICP-OES-ROU

These ions are determined directly y ICP-OES.

Reference
Greenberg, Arnold E., Cleseri, Lenore S., Eaton, Andrew D., Standard Methods For The Examination of Water and Wastewater, 18th Edition, 1992, Method 3120B.

IONBALANCE-OP03-SK	Water	Ion Balance Calculation	APHA 1030-E
N2/N3-SK	Water	Nitrate, Nitrite and Nitrate+Nitrite-N	APHA 4500 NO3F

Nitrate is quantitatively reduced to nitrite by passage of the sample through a copperized cadmium column. The nitrite (reduced nitrate plus original nitrite) is then determined by diazotizing with sulfanilamide followed by coupling with N-(1-naphthyl)ethylenediamine dihydrochloride. The resulting water-soluble dye has a magenta color, which is measured at 520nm. Original nitrite can also be determined by removing the cadmium column and following the same procedure. Nitrate-N, Nitrite-N and NO3+NO2-N are reported.

Reference
Greenberg, Arnold E., Cleseri, Lenore S., Eaton, Andrew D., Standard Methods For The Examination of Water and Wastewater, 18th Edition, 1992, Method 4500NO3-F.

PH-PCT-SK	Water	pH by Meter (Automated)	APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA

Chain of Custody Numbers:

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L1585659 Report Date: 16-MAR-15

Client: P.MACHIBRODA ENGINEERING LTD
806-48th STREET EAST
SASKATOON SK S7K 3Y4
Contact: Tomasz Korbas

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ALK-PCT-SK	**Water**							
Batch R3157856								
WG2052177-1 DUP		**L1585626-2**						
Alkalinity, Total (as CaCO3)		273	274		mg/L	0.4	20	11-MAR-15
WG2052177-2 LCS								
Alkalinity, Total (as CaCO3)			106.9		%		85-115	11-MAR-15
WG2052177-3 MB								
Alkalinity, Total (as CaCO3)			<20		mg/L		20	11-MAR-15
CL-COL-SK	**Water**							
Batch R3159059								
WG2053206-2 DUP		**L1585652-1**						
Chloride (Cl)		349	355		mg/L	1.7	20	12-MAR-15
WG2053206-4 LCS								
Chloride (Cl)			105.6		%		85-115	12-MAR-15
WG2053206-1 MB								
Chloride (Cl)			<1.0		mg/L		1	12-MAR-15
EC-PCT-SK	**Water**							
Batch R3157856								
WG2052177-1 DUP		**L1585626-2**						
Conductivity		745	736		uS/cm	1.2	20	11-MAR-15
WG2052177-2 LCS								
Conductivity			100.4		%		90-110	11-MAR-15
WG2052177-3 MB								
Conductivity			<10		uS/cm		10	11-MAR-15
ETL-ROUTINE-ICP-SK	**Water**							
Batch R3157943								
WG2052122-2 DUP		**L1585659-1**						
Calcium (Ca)		525	534		mg/L	1.7	20	11-MAR-15
Potassium (K)		32	33		mg/L	1.9	20	11-MAR-15
Magnesium (Mg)		634	644		mg/L	1.5	20	11-MAR-15
Sodium (Na)		599	613		mg/L	2.3	20	11-MAR-15
Sulfur (as SO4)		4640	4760		mg/L	2.6	20	11-MAR-15
WG2052122-3 LCS								
Calcium (Ca)			102.9		%		80-120	11-MAR-15
Potassium (K)			101.6		%		80-120	11-MAR-15
Magnesium (Mg)			103.6		%		80-120	11-MAR-15
Sodium (Na)			101.8		%		80-120	11-MAR-15
Sulfur (as SO4)			103.7		%		90-110	11-MAR-15

Quality Control Report

Client: P.MACHIBRODA ENGINEERING LTD
806-48th STREET EAST
SASKATOON SK S7K 3Y4
Contact: Tomasz Korbas

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ETL-ROUTINE-ICP-SK	**Water**							
Batch R3157943								
WG2052122-1 MB								
Calcium (Ca)			<1.0		mg/L		1	11-MAR-15
Potassium (K)			<1.0		mg/L		1	11-MAR-15
Magnesium (Mg)			<1.0		mg/L		1	11-MAR-15
Sodium (Na)			<2.0		mg/L		2	11-MAR-15
Sulfur (as SO4)			<3.0		mg/L		3	11-MAR-15
N2/N3-SK	**Water**							
Batch R3158825								
WG2052237-1 DUP		**L1585659-2**						
Nitrate-N		16.4	16.3		mg/L	0.7	20	10-MAR-15
Nitrite-N		<0.050	<0.050	RPD-NA	mg/L	N/A	25	10-MAR-15
Nitrate+Nitrite-N		16.4	16.3		mg/L	0.7	20	10-MAR-15
WG2052237-3 LCS								
Nitrate-N			2.88		mg/L		2.55-3.45	10-MAR-15
Nitrite-N			0.491		mg/L		0.425-0.575	10-MAR-15
Nitrate+Nitrite-N			3.37		mg/L		3-4	10-MAR-15
WG2052237-2 MB								
Nitrate-N			<0.50		mg/L		0.5	10-MAR-15
Nitrite-N			<0.050		mg/L		0.05	10-MAR-15
Nitrate+Nitrite-N			<0.50		mg/L		0.5	10-MAR-15
PH-PCT-SK	**Water**							
Batch R3157856								
WG2052177-1 DUP		**L1585626-2**						
pH		7.85	7.81	J	pH	0.04	0.2	11-MAR-15
WG2052177-2 LCS								
pH			6.85		pH		6.76-6.96	11-MAR-15

Quality Control Report

Workorder: L1585659 Report Date: 16-MAR-15

Client: P.MACHIBRODA ENGINEERING LTD
806-48th STREET EAST
SASKATOON SK S7K 3Y4
Contact: Tomasz Korbas

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
DLA	Detection Limit adjusted for required dilution
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Workorder: L1585659 Report Date: 16-MAR-15

Client: P.MACHIBRODA ENGINEERING LTD
806-48th STREET EAST
SASKATOON SK S7K 3Y4
Contact: Tomasz Korbas

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
pH by Meter (Automated)							
	1	10-MAR-15	11-MAR-15 10:36	0.25	23	hours	EHTR-FM
	2	10-MAR-15	11-MAR-15 10:36	0.25	23	hours	EHTR-FM

Legend & Qualifier Definitions:

EHTR-FM:	Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR:	Exceeded ALS recommended hold time prior to sample receipt.
EHTL:	Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT:	Exceeded ALS recommended hold time prior to analysis.
Rec. HT:	ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1585659 were received on 10-MAR-15 11:15.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

P.MACHIBRODA ENGINEERING LTD
ATTN: Tomasz Korbas
806-48th STREET EAST
SASKATOON SK S7K 3Y4

Date Received: 09-MAR-15
Report Date: 13-MAR-15 11:36 (MT)
Version: FINAL

Client Phone: 306-665-8444

Certificate of Analysis

Lab Work Order #: L1585375

Project P.O. #: NOT SUBMITTED
Job Reference: 9995 HYDRO - STUDY
C of C Numbers:
Legal Site Desc:

Brian Morgan
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1585375-1 108							
Sampled By: TK on 09-MAR-15							
Matrix: WATER							
Routine Water Analysis							
Alkalinity by Auto. Titration							
Bicarbonate (HCO3)	508.		20	mg/L		10-MAR-15	R3157156
Hydroxide (OH)	<10.		10	mg/L		10-MAR-15	R3157156
Carbonate (CO3)	<10.		10	mg/L		10-MAR-15	R3157156
Alkalinity, Total (as CaCO3)	416		20	mg/L		10-MAR-15	R3157156
Chloride (Cl)							
Chloride (Cl)	92	DLA	20	mg/L	09-MAR-15	09-MAR-15	R3157200
Conductivity (Automated)							
Conductivity	9250		10	uS/cm		10-MAR-15	R3157156
ICP Cations							
Calcium (Ca)	481	DLA	20	mg/L	10-MAR-15	10-MAR-15	R3157396
Potassium (K)	33	DLA	20	mg/L	10-MAR-15	10-MAR-15	R3157396
Magnesium (Mg)	1340	DLA	20	mg/L	10-MAR-15	10-MAR-15	R3157396
Sodium (Na)	824	DLA	40	mg/L	10-MAR-15	10-MAR-15	R3157396
Sulfur (as SO4)	7460	DLA	60	mg/L	10-MAR-15	10-MAR-15	R3157396
Ion Balance Calculation							
Cation - Anion Balance	1.3			%		10-MAR-15	
TDS (Calculated)	10500			mg/L		10-MAR-15	
Hardness (as CaCO3)	6720			mg/L		10-MAR-15	
Nitrate, Nitrite and Nitrate+Nitrite-N							
Nitrate-N	3.82		0.50	mg/L	09-MAR-15	09-MAR-15	R3157205
Nitrite-N	<0.050		0.050	mg/L	09-MAR-15	09-MAR-15	R3157205
Nitrate+Nitrite-N	3.83		0.50	mg/L	09-MAR-15	09-MAR-15	R3157205
pH by Meter (Automated)							
pH	7.47		0.10	pH		10-MAR-15	R3157156

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Sample Parameter Qualifier Key:

Qualifier	Description
DLA	Detection Limit adjusted for required dilution

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-PCT-SK	Water	Alkalinity by Auto. Titration	APHA 2320 Alkalinity

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

CL-COL-SK	Water	Chloride (Cl)	APHA 4500-CL E

Chloride in aqueous matrices is determined colorimetrically by auto-analyzer.

EC-PCT-SK	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

ETL-ROUTINE-ICP-SK	Water	ICP Cations	APHA 3120 B-ICP-OES-ROU

These ions are determined directly y ICP-OES.

Reference
Greenberg, Arnold E., Cleseri, Lenore S., Eaton, Andrew D., Standard Methods For The Examination of Water and Wastewater, 18th Edition, 1992, Method 3120B.

IONBALANCE-OP03-SK	Water	Ion Balance Calculation	APHA 1030-E
N2/N3-SK	Water	Nitrate, Nitrite and Nitrate+Nitrite-N	APHA 4500 NO3F

Nitrate is quantitatively reduced to nitrite by passage of the sample through a copperized cadmium column. The nitrite (reduced nitrate plus original nitrite) is then determined by diazotizing with sulfanilamide followed by coupling with N-(1-naphthyl)ethylenediamine dihydrochloride. The resulting water-soluble dye has a magenta color, which is measured at 520nm. Original nitrite can also be determined by removing the cadmium column and following the same procedure. Nitrate-N, Nitrite-N and NO3+NO2-N are reported.

Reference
Greenberg, Arnold E., Cleseri, Lenore S., Eaton, Andrew D., Standard Methods For The Examination of Water and Wastewater, 18th Edition, 1992, Method 4500NO3-F.

PH-PCT-SK	Water	pH by Meter (Automated)	APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA

Chain of Custody Numbers:

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L1585375 Report Date: 13-MAR-15

Client: P.MACHIBRODA ENGINEERING LTD
806-48th STREET EAST
SASKATOON SK S7K 3Y4
Contact: Tomasz Korbas

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ALK-PCT-SK	**Water**							
Batch R3157156								
WG2051549-1 DUP		**L1585370-3**						
Alkalinity, Total (as CaCO3)		289	278		mg/L	3.9	20	10-MAR-15
WG2051549-2 LCS								
Alkalinity, Total (as CaCO3)			109.0		%		85-115	10-MAR-15
WG2051549-3 MB								
Alkalinity, Total (as CaCO3)			<20		mg/L		20	10-MAR-15
CL-COL-SK	**Water**							
Batch R3157200								
WG2051552-2 DUP		**L1585370-3**						
Chloride (Cl)		85.0	86.4		mg/L	1.6	20	09-MAR-15
WG2051552-4 LCS								
Chloride (Cl)			101.3		%		85-115	09-MAR-15
WG2051552-1 MB								
Chloride (Cl)			<1.0		mg/L		1	09-MAR-15
EC-PCT-SK	**Water**							
Batch R3157156								
WG2051549-1 DUP		**L1585370-3**						
Conductivity		1560	1530		uS/cm	1.9	20	10-MAR-15
WG2051549-2 LCS								
Conductivity			99.9		%		90-110	10-MAR-15
WG2051549-3 MB								
Conductivity			<10		uS/cm		10	10-MAR-15
ETL-ROUTINE-ICP-SK	**Water**							
Batch R3157396								
WG2050631-2 DUP		**L1581227-1**						
Calcium (Ca)		182	180		mg/L	1.1	20	10-MAR-15
Potassium (K)		5.1	5.0		mg/L	1.4	20	10-MAR-15
Magnesium (Mg)		46.9	46.1		mg/L	1.8	20	10-MAR-15
Sodium (Na)		36.6	36.1		mg/L	1.5	20	10-MAR-15
Sulfur (as SO4)		217	216		mg/L	0.3	20	10-MAR-15
WG2050631-3 LCS								
Calcium (Ca)			102.0		%		80-120	10-MAR-15
Potassium (K)			100.6		%		80-120	10-MAR-15
Magnesium (Mg)			102.2		%		80-120	10-MAR-15
Sodium (Na)			101.3		%		80-120	10-MAR-15
Sulfur (as SO4)			99.96		%		90-110	10-MAR-15

Quality Control Report

Client: P.MACHIBRODA ENGINEERING LTD
806-48th STREET EAST
SASKATOON SK S7K 3Y4
Contact: Tomasz Korbas

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ETL-ROUTINE-ICP-SK	**Water**							
Batch R3157396								
WG2050631-1 MB								
Calcium (Ca)			<1.0		mg/L		1	10-MAR-15
Potassium (K)			<1.0		mg/L		1	10-MAR-15
Magnesium (Mg)			<1.0		mg/L		1	10-MAR-15
Sodium (Na)			<2.0		mg/L		2	10-MAR-15
Sulfur (as SO4)			<3.0		mg/L		3	10-MAR-15
N2/N3-SK	**Water**							
Batch R3157205								
WG2051551-1 DUP		**L1585370-3**						
Nitrate-N		<0.50	<0.50	RPD-NA	mg/L	N/A	20	09-MAR-15
Nitrite-N		<0.050	<0.050	RPD-NA	mg/L	N/A	25	09-MAR-15
Nitrate+Nitrite-N		<0.50	<0.50	RPD-NA	mg/L	N/A	20	09-MAR-15
WG2051551-3 LCS								
Nitrate-N			3.01		mg/L		2.55-3.45	09-MAR-15
Nitrite-N			0.463		mg/L		0.425-0.575	09-MAR-15
Nitrate+Nitrite-N			3.47		mg/L		3-4	09-MAR-15
WG2051551-2 MB								
Nitrate-N			<0.50		mg/L		0.5	09-MAR-15
Nitrite-N			<0.050		mg/L		0.05	09-MAR-15
Nitrate+Nitrite-N			<0.50		mg/L		0.5	09-MAR-15
PH-PCT-SK	**Water**							
Batch R3157156								
WG2051549-1 DUP		**L1585370-3**						
pH		8.30	8.27	J	pH	0.02	0.2	10-MAR-15
WG2051549-2 LCS								
pH			6.85		pH		6.76-6.96	10-MAR-15

Quality Control Report

Workorder: L1585375 Report Date: 13-MAR-15

Client: P.MACHIBRODA ENGINEERING LTD
806-48th STREET EAST
SASKATOON SK S7K 3Y4
Contact: Tomasz Korbas

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Workorder: L1585375 Report Date: 13-MAR-15

Client: P.MACHIBRODA ENGINEERING LTD
806-48th STREET EAST
SASKATOON SK S7K 3Y4
Contact: Tomasz Korbas

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
pH by Meter (Automated)							
	1	09-MAR-15	10-MAR-15 09:14	0.25	21	hours	EHTR-FM

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1585375 were received on 09-MAR-15 15:25.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

APPENDIX F: APPLICATION TO OPERATE DRAINAGE WORKS

Water Security Agency

April 15, 2015

Mr. Doug Ramage
North Prairie Developments Ltd.
1 – 2225 Northridge Drive
SASKATOON SK S7L 6X6

306.446.7457

Project No. 20134390
E5/River Song Estates

Dear Mr. Ramage:

Re: Application to Construct and Operate Drainage Works - River Song Estates

The Water Security Agency (WSA) received the above application on April 9, 2015.

I reviewed the proposal and assessed it for any regulatory requirements under *The Water Security Agency Act*. Site development and proposed on/off site drainage management will not require an Approval from WSA. Land levelling and landscaping for the development of building sites is exempted from approval under *The Drainage Control Regulations*.

If there are any questions please call me at 306.446.7457.

Sincerely,

Ron S. Crush, A.Sc.T.
Supervisor, Regional Services
Integrated Water Services Division

RSC/ch
Enclosure (Cheque #306)

Application for Approval to Construct and Operate Drainage Works under *The Water Security Agency Act*

WSA File: _____

PLEASE READ THE INSTRUCTIONS (RG-108D) BEFORE COMPLETING THIS APPLICATION.

PLEASE PRINT BELOW:

1. Name of Applicant(s): Doug Ramage *on behalf of* North Prairie Developments Ltd.
   (surname) (first name and initials)

   Mailing Address: 1 - 2225 Northridge Drive

   Saskatoon, Saskatchewan Postal Code: S7L 6X6

   E-mail Address: ramaged@ae.ca

   Telephone No.: (306) 653.4969 Cellular No.: (306) 361.0264

2. Brief description of what the works will consist of: Ditch improvements to support a 15 lot country residential development. Improvements will be to the south ditch of Township 383 beginning at the intersection of Range Road 3044 directed towards the existing coulee. Additional improvements include a 15m wide municipal buffer to provide a drainage route through the middle of the development towards the existing coulee. The existing coulee is expected to act as an adequate discharge.

3. Works will be constructed on [X] or exist on [ ] and affect the following lands or areas:

Land Description	Registered Owner	Applicant's Interest in Said Land
NW 16-38-04-W3	North Prairie Developments Ltd.	Proposed subdivision

Note: The Water Security Agency (WSA) will be registering notices on lands where the works are located and certificates on land affected by the works. WSA must recover charges applied by the Information Services Corporation (ISC) for registering the notices/certificates on the land and titles.

4. Drainage
   (a) Approximate length of works 1100 m
   (b) Approximate size of area drained 38.5 ha (hectares/acres)
   (c) Description of outlet where works will discharge To existing coulee east of the property.

5. Fees payable in support of this Application *(Refer to the schedule in Item 5 of the Instructions)*
   (a) Application Fee – Approval to Construct and Operate Works $ 25
   (b) ISC (Land Titles) – Registration Charges $_____
   Total Fees Payable $_____

   NOTE: All fees are to be made payable to the Water Security Agency.

I/We certify that the information contained in this application is complete and accurate.

I/We acknowledge and accept that this application will be subject to a registration fee payable to the Water Security Agency for the cost to register notices and/or certificates with ISC.

I/We acknowledge any information submitted in support of this application will be subject to disclosure under the Freedom of Information and Protection of Privacy Legislation. If supporting information contains a confidentiality provision, the Applicant must provide a letter from the author of the information acknowledging the information is being provided to WSA and authorizing it to be made public.

Dated at _____, Saskatchewan, this _____ day of _____ 20___.

Print Name of Applicant	Applicant's Signature
Print Name of Applicant	Applicant's Signature
Print Name of Applicant	Applicant's Signature

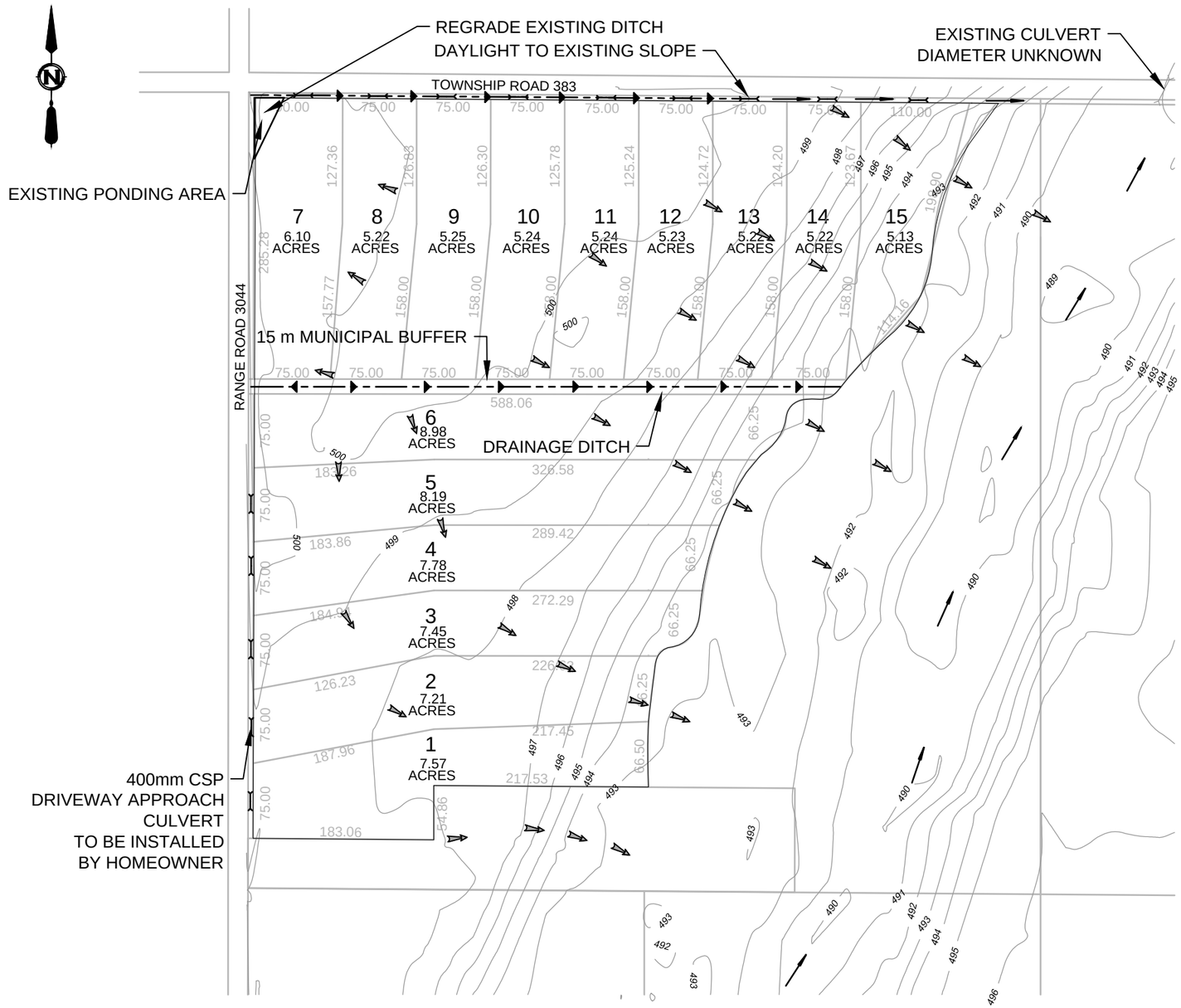
Water Security Agency Use Only

Approved as the application filed with the Water Security Agency dated

_____, 20____

Publication of Notice is Required / Waived

_____
for Water Security Agency



1 - PLAN 1:5000
PHASE II

DRAINAGE FLOW CALCULATIONS:

1. CHECK TWO SCENARIOS FOR CITY OF SASKATOON RECORDS 1:100yr STORM OF 2hr DURATION AND JUNE 24, 1983 RECORD.

2. AREA DESCRIPTION
   PRE-DEVELOPMENT
   - NATIVE AND DISTURBED GRASSLAND (SCS SOIL TYPE C)
   - SAND/GRAVEL AND SILT/CLAY AREAS OVER GLACIAL CLAY TILL
   - RUNOFF COEFFICIENT C = 0.30 (COS STANDARD)

   POST-DEVELOPMENT
   - RANGELAND, COUNTRY RESIDENTIAL BUILDINGS, GRAVEL ROADS + LOTS (SCS SOIL TYPE C)
   - ESTIMATED 10% IMPERVIOUS SITE COVERAGE
   - RUNOFF COEFFICIENT C = 0.40

3. RUNOFF CALCULATIONS
   USING THE RATIONAL METHOD AND THE SOIL CONSERVATION SERVICE (SCS) CURVE SYSTEM

   JUNE 24, 1983 DATASET
   1:100yr STORM (2hr)

   PRE-DEVELOPMENT
   V = 17616 m^3, Q = 2.45 m^3/s
   POST-DEVELOPMENT
   V = 23488 m^3, Q = 3.26 m^3/s

   STORAGE CAPACITY FOR POST-DEVELOPMENT IS:

USE WORST CASE SCENARIO OF 1:100yr 2hr STORM AND PROVIDE RUNOFF STORAGE FOR 5872m^3 OF STORMWATER. EXISTING COULEE TO PROVIDE STORAGE AND ACT AS AN ADEQUATE DISCHARGE POINT.

NOTES:

1. INDIVIDUAL LOT GRADING RESPONSIBILITY OF LOT OWNERS AND NOT TO BLOCK NATURAL DRAINAGE PATHS.
2. LOTS 1 - 6 TO ENCOURAGE DRAINAGE TO COULEE.
3. LOTS 7 - 15 TO ENCOURAGE DRAINAGE TO SPLIT DRAINAGE TO THE NORTH & SOUTH OF THE PROPERTY.
4. CULVERT LOCATIONS SHOWN AT THE APPROXIMATE LOCATION OF DRIVEWAYS TO BE INSTALLED BY HOMEOWNER.

LEGEND:

500.00	ELEVATION
	CATCHMENT AREA
	DRAINAGE IMPROVEMENTS
	DIRECTION OF EXISTING DRAINAGE
	DIRECTION OF OVERLAND FLOW
	CULVERT
	EXISTING CULVERT

Associated Engineering

AE PROJECT No.	20134390-00
SCALE	AS SHOWN
APPROVED	B. DELAINEY
DATE	2015FEB25
REV	1
DESCRIPTION	DRAINAGE PATTERNS

DRAFT

FIGURE No.1

NORTH PRAIRIE DEVELOPMENTS LTD.
WHISPER RIVER PHASE II

CIVIL
DRAINAGE PATTERNS
NW 16-38-4-W3 R.M. CORMAN PARK

DWG No. 4390-00-C-701

P:\20134390\00_rvr_sonq_estates\Urban_Planning\01.00_Background_Data_Collection\Working_Dwgs\100_Civil\4390-00-c-701.dwg
DATE: 2015-03-18, Doug Ramage

APPENDIX G: MUNICIPAL ROAD STANDARDS

Summary of Property Servicing

RM OF
CORMAN PARK
#344

Development Name: WHISPER RIVER ESTATES PHASE II

Developer Name: North Prairie Developments Ltd

Legal Land Location: NW 16-38-4-W3

The purpose of these worksheets is twofold. Firstly, the worksheets are intended to provide the Municipality with a summary of the various services which are being constructed included any technical specifications. The second reason for these worksheets is to aid the developer in itemizing the various costs of servicing the development for the purpose of calculating the amount of financial security to be provided to the Municipality.

Summary of Property Servicing
Worksheet 1: Roadways

To be submitted by an applicant for the purposes of summarizing the design standards for a development and calculation of financial security. ***Complete a separate worksheet for each type of roadway being constructed or upgraded for the development.***

1. Type of roadway:

- ☐ Residential internal subdivision road
- ☐ Municipal road – main farm access
- ☐ Primary haul road
- ☐ Industrial/Commercial internal subdivision road

2. Specifications:

a. length of road to be constructed or upgraded: _____ metres

b. right of way width _____ metres

c. road sub-grade width: _____ metres

d. road top width: _____ metres

e. back slope : _____

f. side slope: _____

g. ditch width: _____ metres

h. method of erosion control: _____

i. anticipated design speed _____ km/hr

j. estimated road lifespan: _____ years

k. culvert locations (attach site plan) and sizes:

number: _____ type: _____ size:_____ mm

number: _____ type: _____ size:_____ mm

number: _____ type: _____ size:_____ mm

number: _____ type: _____ size:_____ mm

number: _____ type: _____ size:_____ mm

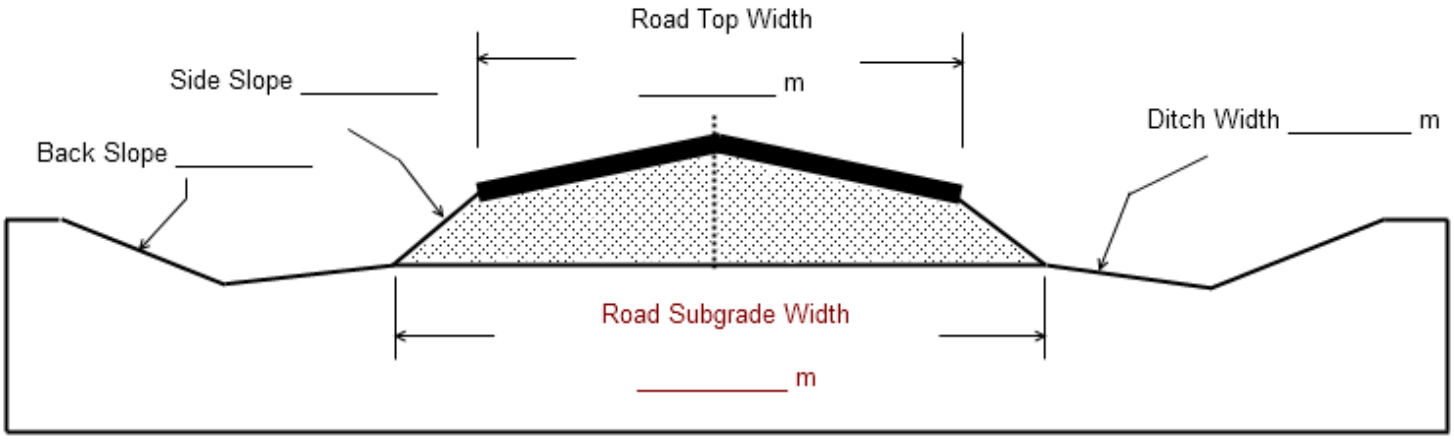
Comments: _____

_____

l. road surfacing:

☐ Gravel ☐ Chip seal ☐ Asphalt ☐ Other

surface thickness: _____ m^3/km



3. **Cost estimates:** Provide cost estimate for each component of construction attaching quotes and contracts where necessary to verify estimates.

a.	land acquisition	$_____
b.	Design and engineering	_____
c.	preliminary earthwork & sub grade construction	_____
d.	road construction	_____
e.	surfacing	_____
f.	culverts	_____
g.	signage	_____
h.	line painting, curbing etc...	_____
i.	re-vegetation and erosion controls	_____
	TOTAL ESTIMATED COST	$_____

For Office Use Only:

Date of receipt of preliminary construction plans: _____/_____/_____ (d/m/y)

Date of approval of preliminary construction plans: _____/_____/_____ (d/m/y)

Date of receipt of as-built drawings: _____/_____/_____ (d/m/y)

Date of final inspection: _____/_____/_____ (d/m/y)

Summary of Property Servicing
Worksheet 2: Water Supply Lines

To be submitted by an applicant for the purposes of summarizing the design standards for a development and calculation of financial security. ***Complete a separate worksheet for each type of waterline being constructed or upgraded for the development.***

4. Type of waterline:

☒ Potable ☐ Non potable ☐ Fire suppression

5. Specifications:

a. length of water supply line constructed: _____ metres
b. water supply line diameter: _____ mm
c. depth of line: _____ metres
d. water supply line material : _____
e. # fire hydrants: _____
f. # curb stops: 14 metres
g. minimum water supply line depth: _____ metres

6. **Cost estimates:** Provide cost estimate for each component of construction attaching quotes and contracts where necessary to verify estimates.

a. land acquisition and /or easements $ N/A
b. Design and engineering _____
c. materials & labour _____
d. trenching and or drilling _____
e. installation included in mat. & lab
f. backfill and re-vegetation included in mat. & labor
g. hydrants and pump stations N/A
TOTAL ESTIMATED COST $ 28,000

For Office Use Only:

Date of receipt of preliminary construction plans: _____/_____/_____ (d/m/y)
Date of approval of preliminary construction plans: _____/_____/_____ (d/m/y)
Date of receipt of as-built drawings: _____/_____/_____ (d/m/y)
Date of final inspection: _____/_____/_____ (d/m/y)

Summary of Property Servicing
Worksheet 3: Shallow Utilities & Public Amenities

To be submitted by an applicant for the purposes of summarizing the design standards for a development and calculation of financial security.

7. **Shallow Utilities:** Provide cost estimate for each utility attaching quotes and contracts where necessary to verify estimates.

		Estimate Supplied
a. Natural Gas	$ 85,000	☒
i. Service Capacity		
b. Electricity	150,000	☐
i. Service Capacity		
c. Telephone	N/A	☐
d. Other:		
_____		☐
TOTAL ESTIMATED COST UTILITIES	$ 235,000	

8. **Public Amenities:** List and provide a cost estimate for each public facility as well as the costs of developing public lands within the development.

a. Engineering and design	$ NA
b. Site Grading and Landscaping	NA
c. Lighting	NA
d. Recreational Facilities	NA
e. Fencing	NA
f. Other:	
_____	
_____	
_____	
TOTAL ESTIMATED COST PUBLIC AMENITIES	$

9. **Other:** Include relevant statement and contracts to verify estimates

a. Legal	$
b. Survey	
c. Storm water retention system	
d. _____	
e. _____	
TOTAL ESTIMATED COST OTHER	$

Summary of Property Servicing
Worksheet 4: Drainage Works

To be submitted by an applicant for the purposes of summarizing the design standards for a development and calculation of financial security.

10. Drainage Works: Provide a cost estimate for the construction of drainage works for the development attaching quotes and contracts where necessary to verify estimates.

a.	Design and Engineering	$_____
b.	Site grading and excavation	_____
c.	Culverts and drainage channels/swales	_____
d.	Re-vegetation	---
e.	Pump	---
f.	Other control structures	
	i. _____	_____
	ii. _____	_____
	iii. _____	_____

TOTAL ESTIMATED COST DRAINAGE WORKS $ 25,000

11. Storm Pond Design Specifications:

a.	Pond Type:	☐ Wet pond	☐ Dry Pond
b.	Pond depth:	_____ m	
c.	Water holding capacity	_____ m^3	

Summary of Estimated Costs

Roadways:	$	n/a
Waterlines:		28,000
Shallow Utilities:		235,000
Drainage Works/Lot Preparation:		25,000
Other:		n/a
Total Estimated Costs:		$ 288,000

Main Farm Access Road Program	Required Construction Standards
	Subject: Main Farm Access Road - Gravel

SUMMARY OF BASIC STANDARDS

Right-of-way width = 30 meters (purchased).

Full width of right-of-way to be cleared.

The standard basic finished top width for main farm access roads is 7.0 meters.
Top width for curves = 7.6 meters.

Sideslopes = 3:1
- fills 2 – 3 meters = 7.6 m top width
- fills over 3 meters = 8.0 m top width

Backslopes
- 5:1, with maximum of 3:1
- 5:1 backslope is to be maintained until top of backslope reaches the edge of right-of-way. The backslope will remain at the edge of the right-of-way to a maximum of 3:1.

Snowclearance – When shoulder grade elevation is 0.3 meters or less above natural surface at 15.0 meters to 20.0 meters from center line then the backslope must be flattened using a variable slope of 5:1 to a maximum of 3:1.

Maximum gradient – 9%. In unusual circumstances – 11%.

Stopping sight distance – 85 meters minimum.

Clear vision at road intersection – minimum of 85 meters from the point of intersection on municipal roads and grid intersections and to a maximum of 140 meters on main farm access roads using 60 km/h design speed.

Main Farm Access Road Program	
Required Construction Standards	Subject: Main Farm Access Road - Gravel

1. Shall include the installation of all necessary drainage structures and construction of drainage ditches. Culverts should be designed for at least a Q^{15} flow, with a minimum culvert size of 500 mm diameter. Riprap only where

necessary to avoid undue erosion. All culverts will be constructed of metal unless approved by the Municipality prior to construction.

2. Construction shall include all road connections and approaches. See attached plan – Standard Approach.

3. The average shoulder elevation of the road surface to be approximately 0.5 meters above the adjacent ground surface, except in cuts.

4. Objectionable organic material shall be subcut where the fill is less than 0.3 meters in depth.

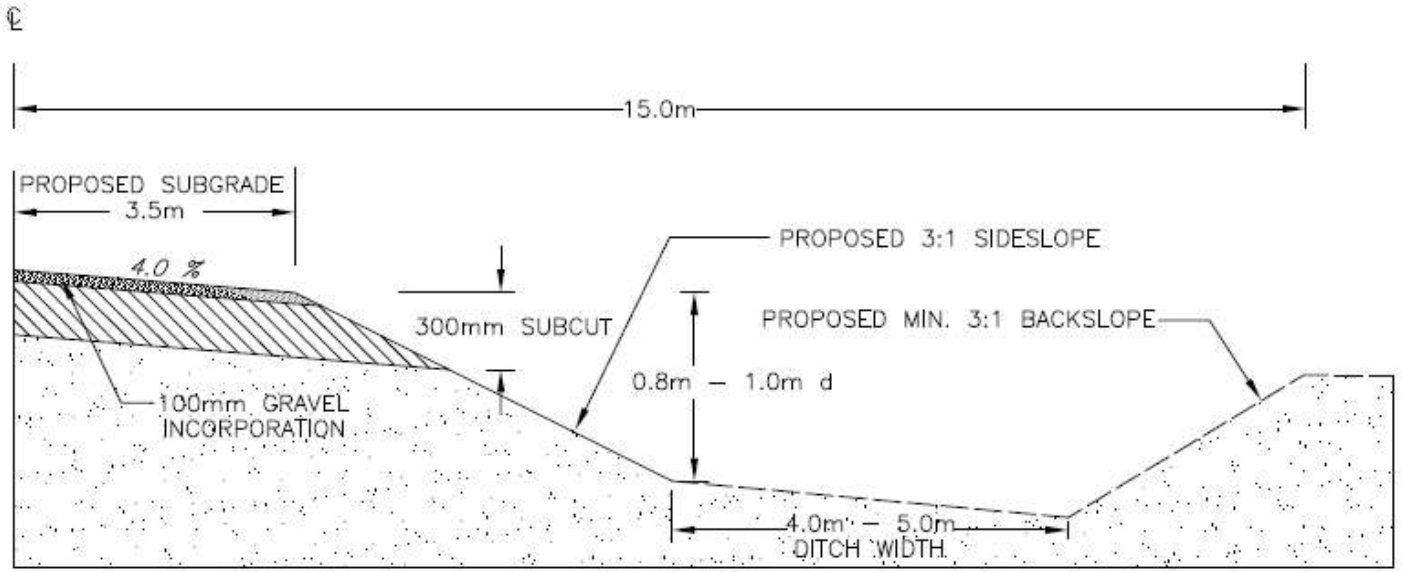
5. The subgrade surface shall not be less than 1.0 meters above high water level on the ground water table. (ie: level to which free water would rise in a hole sunk in the ground).

6. Road surface, sideslopes, ditches and backslopes shall be bladed smooth to conform to the typical cross-section.

7. Where necessary to provide a smooth, stable driving surface, the road shall be capped with a layer of clay material. The depth of clay cap shall be a minimum of 0.3 meters. Gravel shall be incorporated in the top 100 mm of the subgrade prior to traffic gravel being applied. Gravel incorporation shall be done according to the Municipal Specification attached. The gravel specification for incorporation is Type 103 or 104.

8. Gravel surfacing for the subgrade required at the rate of 180 m^3/km for the first application, 150 m^3/km for the year following construction and additional applications as required. The required gravel specification for traffic gravel is Type 106 or 108.

9. Alignment – curves must be constructed with the proper super-elevation using 80 km/hr design speed and emax = 0.08.
   – minimum radius of curvature = 250 m, preferred radius = 300 m.



RM OF
CORMAN PARK
#344

PUBLIC WORKS
MAIN FARM ACCESS - TYPICAL CROSS SECTION SUBGRADE

DATE: 2011	SCALE: NTS	DRAWN BY: AMEC E & E

APPENDIX H: SERVICING SUMMARY WORKSHEET