REPORT

Falcon Holdings Ltd.

Korpan Industrial Park
Comprehensive Development Review

MAY 2022

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1 INTRODUCTION

This Comprehensive Development Review (CDR) has been prepared to support an application to rezone approximately 60.95 hectares (150 acres) within SE 25-37-6-W3M for industrial purposes and to illustrate and demonstrate the potential future subdivision and servicing of the lands. The Saskatoon North Partnership for Growth District Official Community Plan defines the long-term intent of the area as urban commercial/industrial within the City of Saskatoon. This document demonstrates how the proposed development will successfully transition from rural development in the RM of Corman Park to an urban form of development in the City of Saskatoon. In addition to addressing matters of land use integration, this CDR is intended to assess the capacity of the supportive municipal and provincial infrastructure as it relates to the demand created by the proposed development.

2 PLAN CONTEXT

2.1 Current Land Ownership

Lands within SE 25-37-6-W3M are subject to the following ownership:

Parcel Number	Registered Owner	Area (ha)
120868241	Elizabeth & Mark Summach	2.537
164142075	Falcon Holding Ltd.	29.207
203410101	Falcon Holdings Ltd.	23.654
203410112	102011255 Saskatchewan Ltd.	8.089

Table 2-1
Land Ownership

For this report, the subject property includes all lands within the ¼ section except for Parcel 120868241 which is an existing country residential subdivision situated in the southwest corner of the host parcel. Although this parcel is not formally included in the development described by this CDR, this report considers the potential incorporation of this existing country residential parcel into the industrial development in the future if the situation changes.

Figure 2-1 illustrates the current distribution of ownership within the ¼ section.

2.2 Plan Location

The subject property is in the RM of Corman Park No. 344 and within the jurisdiction of the District OCP. The site is located along the north side of Township Road 374 (Auction Mart Road) approximately 800 m west of Highway No. 16.

2.3 Adjacent and Nearby Land Uses

Non-agricultural land uses within a 1.6-kilometre radius of the subject property include:

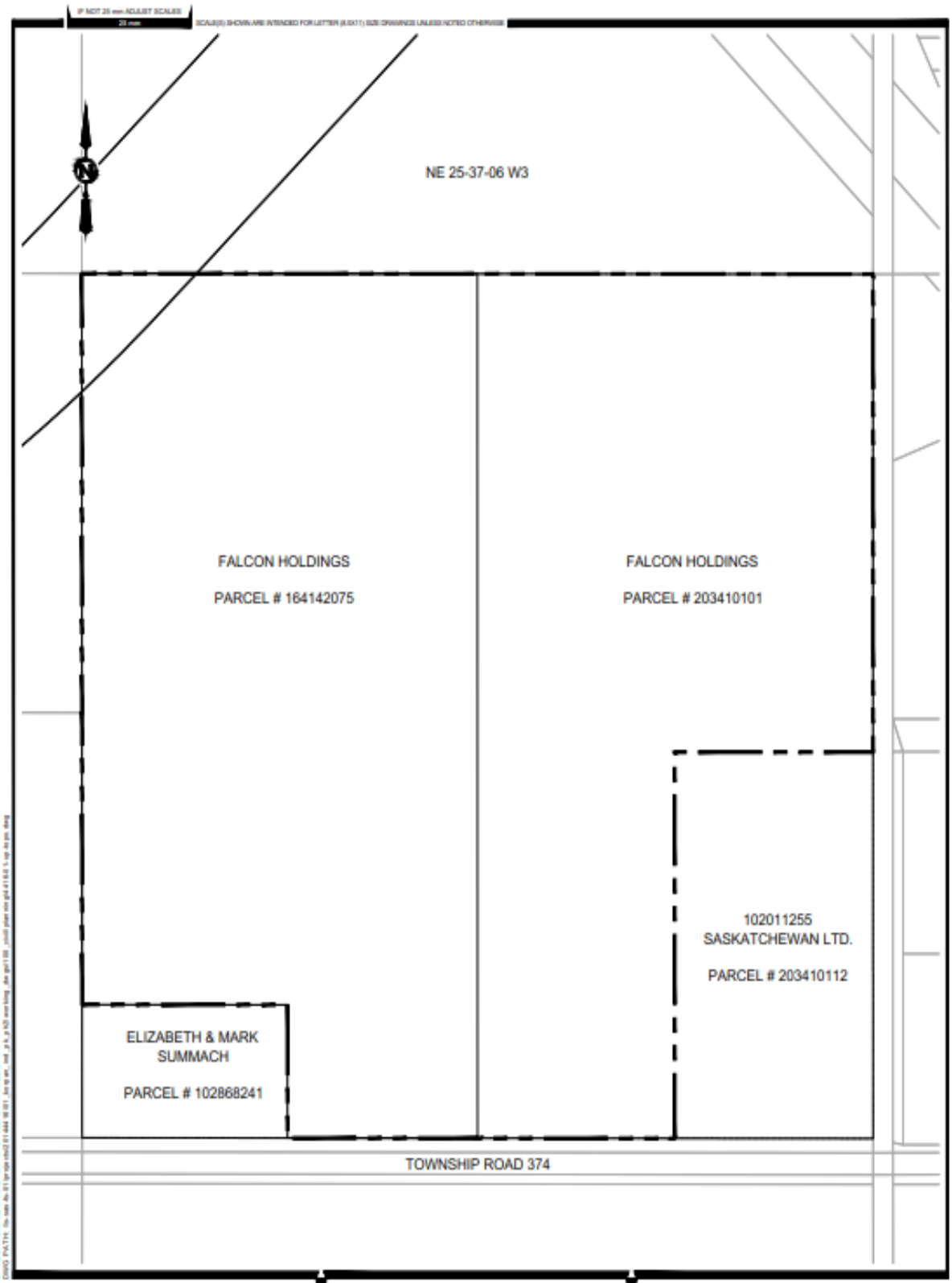
Legal Land Description	Description	Distance
SW 30-37-5-W3M	Yellowhead Industrial Park	Adjacent
SW 30-37-5-W3M	Redhead Equipment	~ 800 m
SE 30-37-5-W3M	Saskatoon 16 West RV Park	~ 800 m
NW 30-37-5-W3M	Cervus Equipment John Deere	~800 m
NW 30-37-5-W3M	Saskatoon Co-op Agro Centre	~ 900 m
NW 30-37-5-W3M	Acreage – B. Schedlosky	~ 1100 m
SE 31-37-5-W3M	Acreage – G. Elder	~ 1400 m
NE 25-37-6-W3M	Acreage – S. Schedlosky	~ 800 m
SW 36-37-6-W3M	Acreage – A. Janzen	~ 1400 m
SE 25-37-6-W3M	Acreage – E. Summach	Adjacent
SW 25-37-6-W3M	Acreage – K. Burkevitch	~ 400 m
SW 25-37-6-W3M	Acreage – B. Machnee	~ 800 m
SE 26-37-6-W3M	Acreage – B. Natt	~ 1000 m
NE 23-37-6-W3M	Acreage – Lamon Holdings	~ 1200 m
NE 23-37-6-W3M	Acreage – R. Marcel	~ 1100 m
NW 19-37-5-W3M	Saskatoon Auction Mart	~ 600 m
NE, SW & SE 19-37-5-W3M	BizHub Industrial Park	~ 1000 m
NE 19-37-5-W3M	Flaman Sales and Rentals	~ 1400 m

Table 2-2
Adjacent and Nearby Land Uses

Figure 2-2 illustrates the location of the subject property and existing development in the vicinity of the subject property.

The subject property is situated in an area predominated by light industrial and highway commercial developments situated to take advantage of access and visibility from the provincial highway network. The Yellowhead Industrial Park accommodates a mixture of industrial businesses related to warehousing, freight and logistics, manufacturing, construction, as well as industries providing direct support to the agricultural and natural resource sector. Businesses within the neighbouring BizHub Industrial Park share a similar composition.

Other notable existing and planned developments in the vicinity of the subject property includes the planned Saskatoon Freeway route which lies directly north of the property and the John G. Diefenbaker International Airport which is located approximately 3.5 km south.



Associated Engineering

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SCALE	1:5000
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FIGURE 2-1

FALCON HOLDINGS LTD.
LAND OWNERSHIP SE 25-37-6-W3M

The Ministry of Highways (MoH) has established an 800 m control radius around the location of the future interchange at Highway No.16 north of the site. This control radius is intended to protect lands that may be needed for the construction of a future interchange. MOH regulates land use in this control radius where temporary forms of development such as outdoor storage may be considered acceptable use. As the freeway project progresses through the next phases of design the functional footprint of the interchange will be refined enabling the potential reduction in the spatial extent of the control radius.

Influence on the Plan:

- The design and standards for development within the proposed industrial development will need to mitigate any offsite impacts which may reduce the use and enjoyment of nearby non-industrial properties.
- The site layout will need to consider the future land requirements associated with the Saskatoon Freeway project.
- The design and layout of the site will need to mitigate any impacts on the safe operation of the Saskatoon Airport.

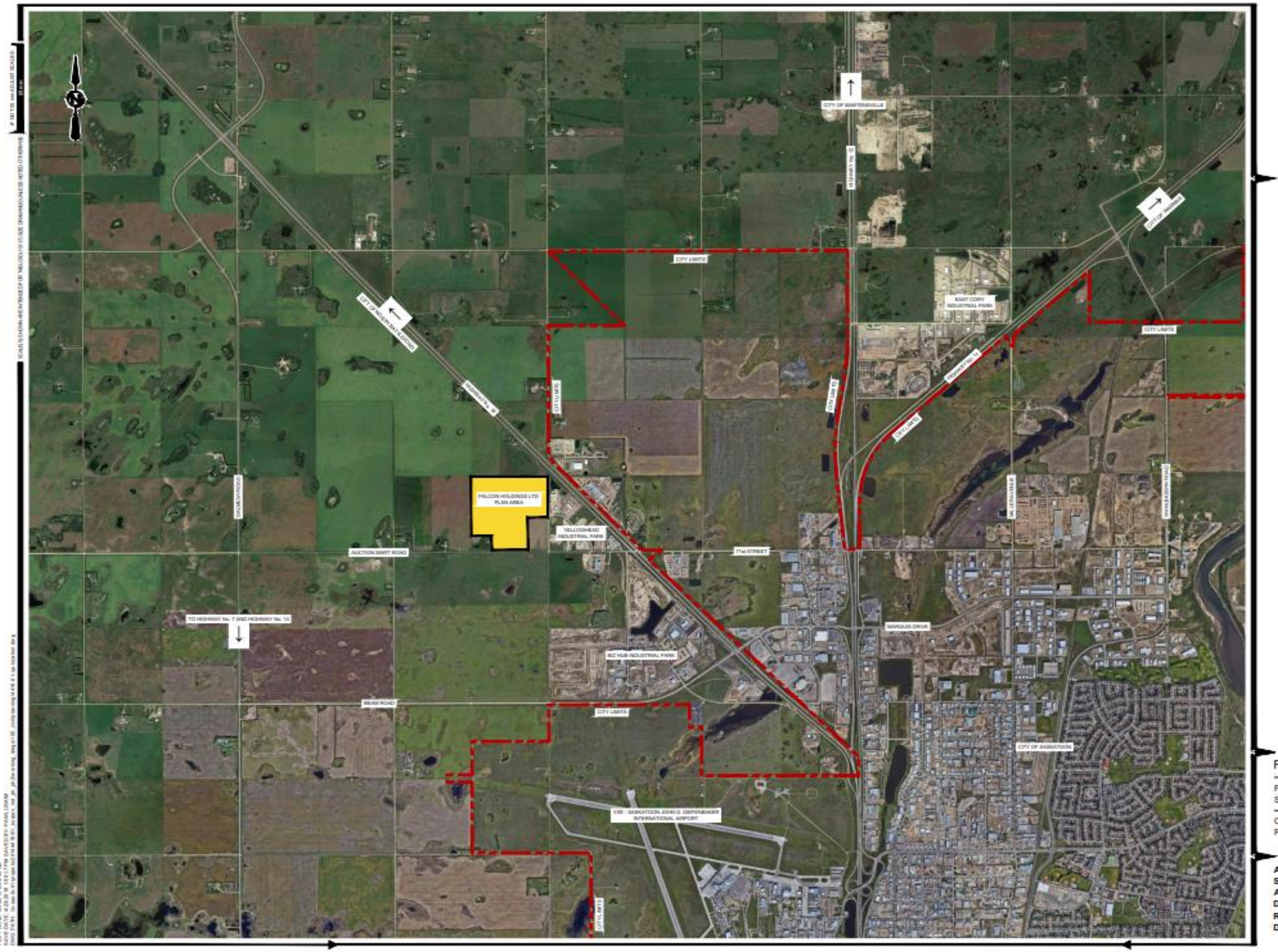

FIGURE 2-2

FALCON HOLDINGS LTD.
SITE LOCATION

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2.4 Physical Site Conditions

The subject property is relatively flat with very little natural slope. The height of the land is situated in the northwest corner of the ¼ section which lies at an elevation of 506.8 MASL. The southwest corner of the ¼ section represents the lowest surveyed point on the property which is situated at an elevation of 505.2 MASL. Although the land naturally slopes to the southwest corner of the ¼ section, the lands along Auction Mart Road have experienced seasonal drainage-related issues due to a lack of grade and a lack of a clear path for storm discharge in the area.

The existing site topography is illustrated in Figure 2-3.

Local soils are considered Class 3 according to the Canada Land Inventory Soil Classification Index. Class 3 soils are considered to have moderate to severe limitations for agricultural activity. A geotechnical investigation was performed by SNC-Lavalin in February 2015 to determine the suitability of the site for industrial development based on local soil conditions and groundwater elevations. A total of 18 test holes were drilled throughout the site to depths ranging between 3.1 m and 19.1 m. Piezometers were installed in six of the test holes to measure groundwater levels and the drill profiles were transported to a laboratory and examined to determine local soil profiles.

An examination of the drill profiles indicated that the general soil profile consisted of a thin layer of organic topsoil overlying glacial till. The drill profiles did identify sporadic and discontinuous layers of sand and inter/intra till sand deposits at various depths throughout the site. Cobbles and boulders were encountered during drilling at depths of 0.2 m, 0.3 m and 1.0 m and should be anticipated during construction.

Groundwater conditions on the site are considered to be relatively high ranging in depth between 1.8 m and 2.64 m below grade. The high-water table is expected to impact excavation and construction on the site, and development sites will likely require dewatering during the construction process.

Based on the preliminary geotechnical investigation report, the site is considered suitable for industrial development. Site-specific geotechnical investigations will be required for the design and construction of any proposed structures within the future development area of the proposed industrial development. The report can be reviewed in Appendix B.

Influence on the Plan:

- The conceptual grading and drainage plan for the site will need to be designed in consultation with the Water Security Agency to collect and convey run-off to a retention area situated in the northeast corner of the property to avoid adding additional run-off to Auction Mart Road.
- The Ministry of Highways and Infrastructure will need to be consulted regarding the location of the pond and planned off-site discharge concerning existing and planned highway facilities.
- The plan needs to acknowledge and communicate the recommendation to complete a site-specific geotechnical investigation on each site in conjunction with property development.

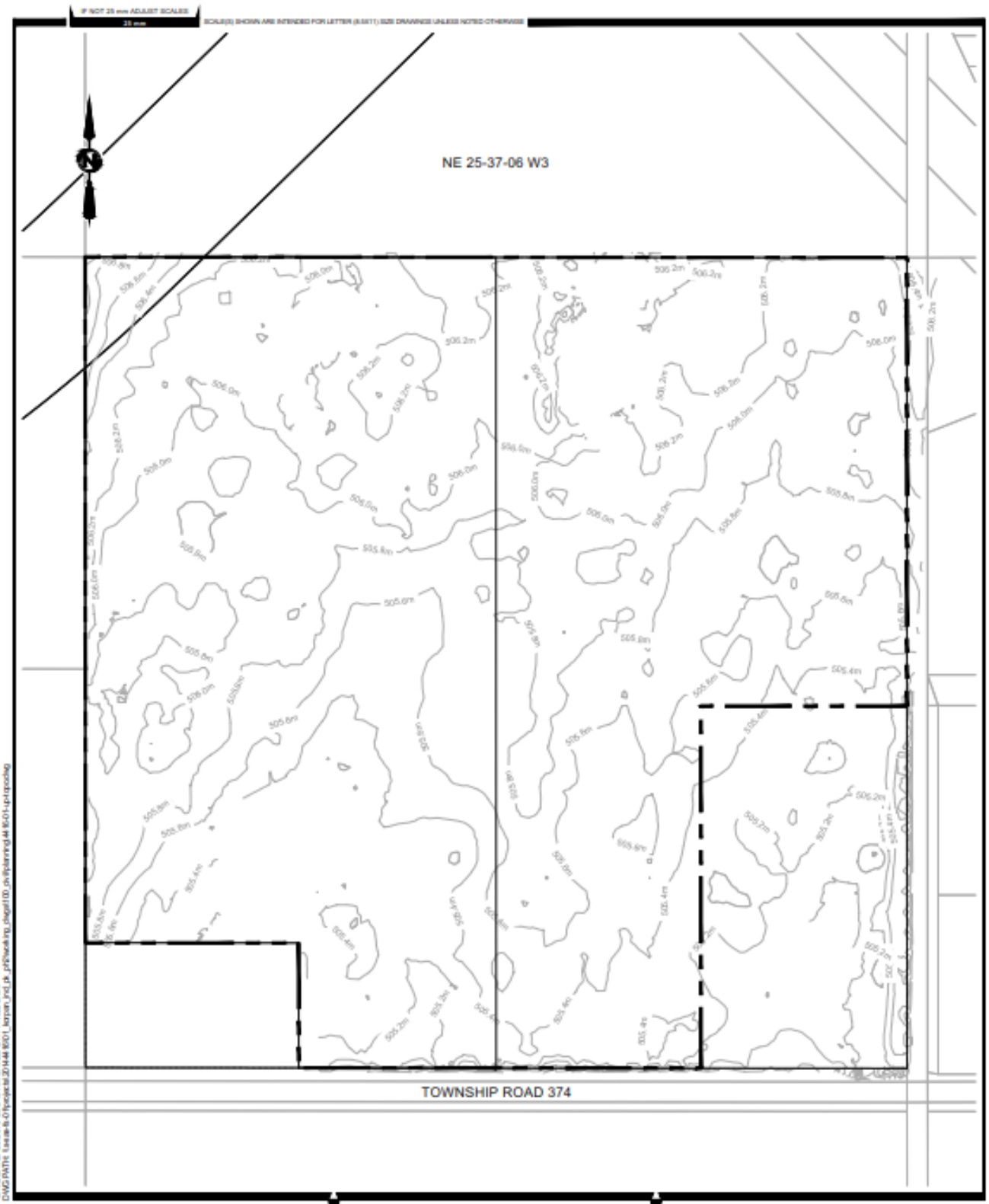

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FIGURE 2-3

FALCON HOLDINGS LTD.
SITE TOPOGRAPHY

2.5 Natural and Heritage Conditions

An environmental and heritage screening was completed for the subject property to identify the potential environmental and heritage sensitivity of the site. This screening included an online query of the Hunting, Angling and Biodiversity Saskatchewan (HABISask) database supplemented by a field assessment. The online screening identified the potential observance of Englemann's spike-rush in the general vicinity of the subject property. The Englemann's spike-rush is an endangered vascular plant species typically located along pond edges and within wet depressions. The field investigation confirmed that there is no rare or endangered species present within the site including Englemann's spike-rush. The lack of permanent water on the site combined with regular cultivation offers little opportunity for native grasses to exist on the site.

The Heritage Conservation Branch provides an online searchable database that can be used to determine the potential existence of archeological or heritage-sensitive resources. A query for the subject property confirmed that the subject property is not considered heritage sensitive and that no further investigation is required to proceed with development.

A copy of the screening report is attached as Appendix C.

Influence on the Plan:

- None identified

2.6 Built Features and Legal Encumbrances

There are presently no buildings or related improvements on the property. A three-phase transmission line extends from the east along Auction Mart Road to the southeast corner of the property. At this point, the transmission line is redirected to the south along the west side of the Range Road 3060 right-of-way.

SaskEnergy operates gas lines along the northeast and southwest corners of the subject property. A SaskTel fibre optic line extends along Auction Mart Road.

A review of the land titles did not identify any registered easements through the property.

Auction Mart road is a two-lane paved roadway that serves as a major municipal transportation corridor in this area. We note that a 13 m dedication was previously provided along the north side of Auction Mart Road to support future road expansion. Improvements have also been made to the intersection of Auction Mart Road at Highway No. 16 including the construction of turning lanes, lighting and signalization. Range Road 3060 extending along the east side of the subject property is a gravel-surfaced municipal grid constructed within a 20 m right-of-way. Range Road 3060 currently extends approximately 400 m north of Auction Mart Road, acting as a secondary point of access/egress for the Yellowhead Industrial Park.

Influence on the Plan:

- The design and layout of the property will need to provide appropriate corridors to support the extension of electrical, natural gas and telecommunication infrastructure and consider the increase in demand resulting from the future transition to urban development.
- Internal roadways and a segment of Range Road 3060 will need to be constructed to current municipal road standards.

3 POLICY CONTEXT

The subject property is situated in an area where land use and development are jointly managed by the RM of Corman Park and its municipal partners making up the Saskatoon North Partnership through the application of the District OCP and Zoning Bylaw.

The following sections outline the pertinent policies associated with the above noted governing documents and their implications for development within the subject property.

3.1 Saskatoon North Partnership for Growth District Official Community Plan

The District Plan identifies the subject property as a Future Urban Commercial/Industrial area. Future urban growth areas within the region are broken into two categories based on the anticipated timing for development. The subject property is included in lands anticipated to be developed over the longer term in association with regional populations approaching 1 million.

Urban Commercial/Industrial areas are intended to accommodate future general commercial and industrial uses including office, retail, and industrial areas that are connected to urban servicing. The Regional Plan recognizes the long-term nature of urban development in this area and its implication on lands considered to have a current demand for development by accommodating interim use of these lands.

The Regional Plan establishes a series of policies to guide interim development which includes the following:

- Uses in future urban growth areas shall use development standards that consider the standards used in the adjacent urban municipality.
- Site planning is required to be coordinated with the urban municipality to allow for these developments to be integrated with the urban municipality in the future.
- Interim development is required to be consistent with any long-term planning completed for the area.
- Interim development must be planned and designed to minimize property fragmentation, enable future subdivision to urban-sized parcels and transition to future urban servicing.

A full assessment of the proposed development concerning the presiding policies and regulations is provided in Section 7.

Influence on the Plan:

- Given the long-term intention for urban expansion into this area, development and services within the subject property need to consider and accommodate the eventual transition to a full-service urban industrial area.
- The conceptual stormwater plan for the site needs to consider and accommodate both minor and major events through the provision of onsite storage and controlled discharge.
- Planning and design for the site should be completed in direct consultation with the City of Saskatoon (COS) to ensure that interim development on the subject property does not prejudice further subdivision and the extension of urban services in the area.

4 DESIGN OBJECTIVES

Based upon an examination of the existing conditions on and around the subject property and the presiding policies, the following planning and design objectives have been identified:

1. To provide for the rural serviced light industrial development as an interim use within the subject property.
2. To plan for development that minimizes its impact on natural systems and the use and enjoyment of adjacent and nearby properties.
3. To provide a rural level of service which is consistent with the intended interim industrial use of land-based upon current municipal standards.
4. To plan for the eventual transition of the subject property to a full-service urban industrial subdivision in the future.

5 LAND USE CONCEPT

The following section is intended to describe how the subject property could be subdivided and serviced initially as a rural industrial park and define the basis for transitioning to a full-service urban-industrial development in the future as the property is incorporated into the City of Saskatoon. The information presented in this section assumes that the subject property would be subdivided as illustrated in Figure 5-1. Any significant deviation from this layout may require revisions to the servicing strategy described herein. Although this report anticipates a single rural phase of subdivision, the subject property is capable of being subdivided in phases following the general description of servicing established by this report.

5.1 Phase 1 Rural Development

The subject property is intended to be zoned to a D-Light Industrial 1 District with development within the park being characterized as:

- accommodating developments which have moderate potential for conflicts with adjacent land uses and are less dependent on exposure to high traffic areas;
- permitting a variety of industrial uses, including but not limited to manufacturing, assembly and repair, warehousing, wholesale distribution, and limited retailing as an accessory use.
- permitting limited outdoor storage of raw materials subject to screening to the satisfaction of Corman Park and overall quality of site development that is superior to heavy industrial areas; and
- a buffer or transitional area between more intensive uses and incompatible uses, such as residential areas.

The types of uses attracted to this development would be similar to the profile of uses supported in the neighbouring Yellowhead and BizHub Industrial Park subdivisions and may include any of the permitted or discretionary forms of development enabled by the District Zoning Bylaw.

Interim subdivision and development on the site are expected to comprise a total of eight lots and an adjustment in the boundaries of Parcel No. 203410112 situated at the corner of Auction Mart Road and Range Road 3060 which was approved in 2017. The size of the new industrial lots will range in size between 3.96 hectares (9.79 acres) and 9.10 hectares (22.49 acres) with an overall average lot size of 5.39 hectares (13.32 acres). In comparison, lots within the neighbouring BizHub and Yellowhead Industrial Parks average approximately 2.0 and 3.5 hectares respectively.

Promoting larger lot sizes within the subject property is deliberate to offer a means of differentiating this development in the market and a direct response to the Regional Plan policy of limiting the fragmentation of the parcel.

The resubdivision of Parcel No. 203410112 was intended to enable the relocation of Nordic Fencing into the RM due to a need for a larger site. Development on this site has been limited to rough grading with building development being deferred to allow consideration of this application to enable a cooperative approach to site access and drainage management between the two properties.

A financial feasibility assessment was completed for the project estimating the development costs and potential sales revenues to determine if the returns on investment associated with the interim larger lot rural development were suitable to proceed with the development. Based upon a rural servicing profile, the assessment concluded that promotion of the proposed lot sizes and configuration would be viable.

The gross development area on the site is 60.95 hectares which includes 24.62 hectares situated within the 800 m control radius associated with the proposed Saskatoon Freeway. MOH was consulted and offered an opportunity to offer their comments related to the potential impact of the freeway project on development within the north half of the subject property. MOH indicated that several design options are being prepared for this segment of the freeway. Based on the current options being considered the most robust design would impact the most northerly 100 m of the subject property. The most conservative design for the freeway would only impact development in the northwest corner of the ¼ section as illustrated in Figure 5-1 – Rural Land Use Concept. MOH expressed no concerns with the location of the planned storm retention pond. Overall, the design and construction of the Saskatoon Freeway will have no significant implications for interim rural development on the site.

Based upon a net developable area of 44.63 hectares, the 5% municipal reserve dedication required by *The Planning and Development Act, 2007* is estimated to be 2.23 hectares. In determining the net development area for the site, the gross developable area is discounted by the land dedicated as a municipal utility parcel for storm retention as well as the 8.09 hectares represented within Parcel No. 203410112 as it was previously subject to a cash-in-lieu municipal reserve payment. It is the developer's opinion that the dedication of land for public recreation within the site is undesirable and as such intends to provide a cash-in-lieu payment to satisfy the municipal reserve requirement.

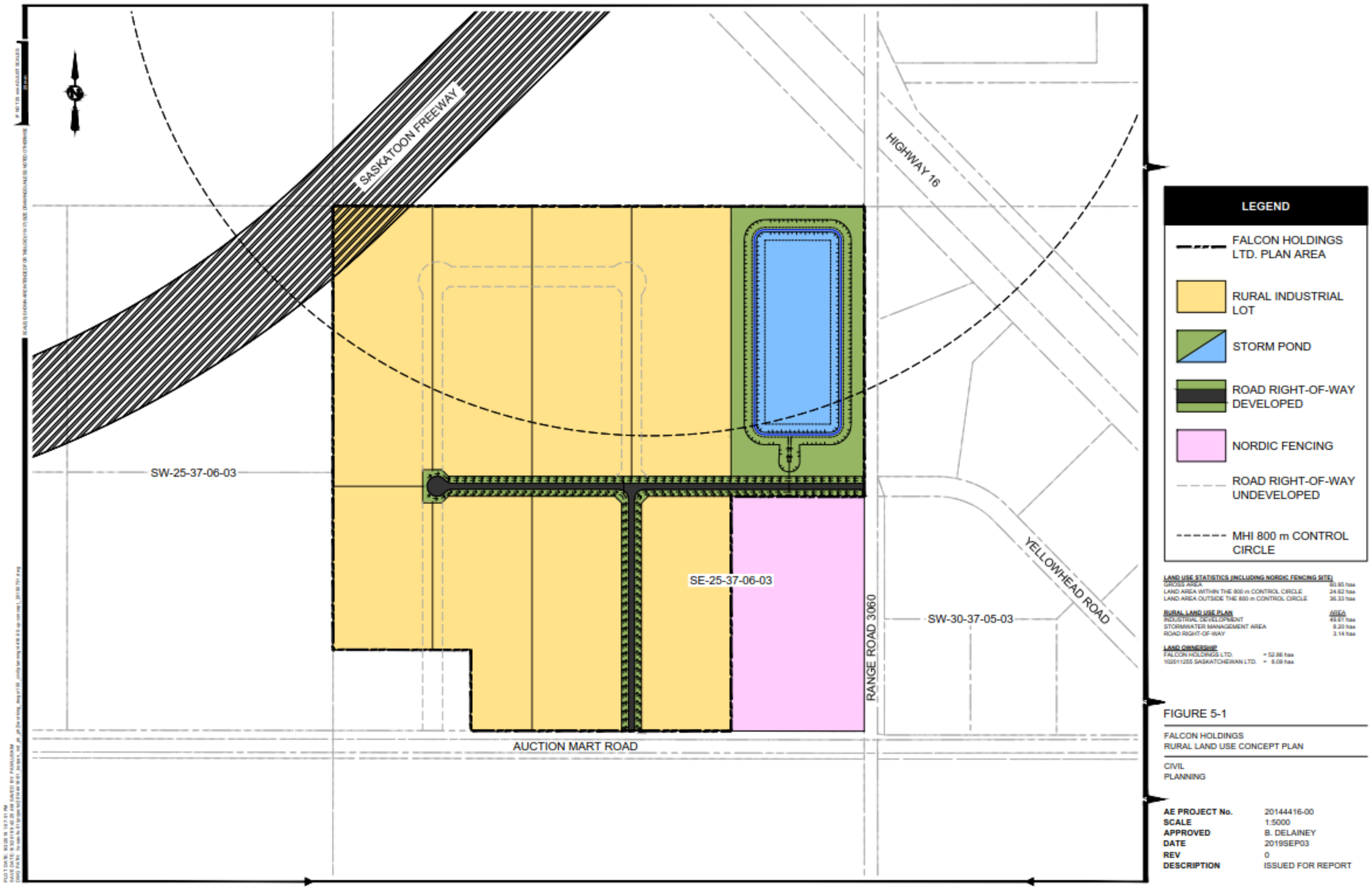

FIGURE 5-1

FALCON HOLDINGS
RURAL LAND USE CONCEPT PLAN

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AE PROJECT No.	20144416-00
SCALE	1:5000
APPROVED	B. DELAINEY
DATE	2019SEP03
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5.1.1 Rural Land Use Compatibility

Although the plan area has been designated to host future commercial/industrial development, the initial subdivision and development of the site need to appropriately consider the surrounding non-industrial sites and incorporate design considerations aimed at preserving the use and enjoyment of these adjacent and nearby properties.

Perceived and potential land-use conflicts associated with the development of the plan area may include:

- Increased traffic congestion
- Noise, dust and odours generated by industrial activities
- Increased ambient light pollution associated with industrial development
- Soil, ground and surface water contamination

The intensity of activity associated with industrial businesses offers the greatest conflict to rural residential development. There are currently five, country residences situated within 1000 m of the plan area with the closest situated directly adjacent to the plan area within the same ¼ section.

Industrial development has a propensity to generate noise, dust and odour which has the potential to negatively impact the use and enjoyment of these properties. Reducing land use conflict between different uses is generally achieved through distance separation and physical buffering or some combination of both. During the stakeholder engagements, adjacent landowners indicated a preference to see a berm constructed along the common interface between the properties which would include a shelterbelt planting. In the opinion of existing residents, this would help to minimize the noise and light pollution and provide a visual buffer between the potentially incompatible uses.

It is expected that a condition for the removal of the holding provision and subdivision of the property would include a requirement to establish a perimeter shelterbelt planting along the west boundary of the plan area to provide a visual barrier and to assist in sound attenuation for residential properties to the west of the site. This shelterbelt would situate entirely on private property within any site fencing and would be the responsibility of future property owners to maintain. The required 5-metre fire break would then extend from the eastern extent of this landscaped into the industrial site. Given that the south, north and eastern boundaries of the plan area abut an existing or planned roadway, the extension of this shelterbelt along these boundaries is not anticipated. Further investigation is required to determine the impacts of a perimeter berm on drainage management.

As with other similar industrial subdivisions including the neighbouring BizHub Industrial Park, the interim rural phase of the subdivision will not include any street lighting. Lighting within the development will be limited to yard lighting provided by lot owners; defined during the development and building permit process.

The amount of additional traffic generated by the subdivision and development of eight industrial properties will depend upon the types of businesses that situate within the plan area. The additional traffic generated by this phase of development is anticipated to be minor in relation to the capacity of this roadway and the recently improved and signalized intersection. Access to Auction Mart Road from the plan area will be controlled through the erection of stop signs, allowing free movement along this roadway. It is not expected that any improvements are required along this corridor to facilitate development. During the stakeholder engagements, adjacent landowners expressed concerns about providing direct property access onto Auction Mart Road.

The initial rural phase of development provides for the construction of a centrally located internal roadway with a single connection provided to Auction Mart Road approximately 350 m west of Range Road 3060. As industrial

properties will not be able to gain direct access to Auction Mart Road, site development within the industrial properties will be orientated along the planned internal roadway network; maximizing the separation of buildings and industrial activities from country residences to the west.

The centreline of the planned internal road is located approximately 250 m north of the closest common country residential site line. Where the rear yard of either industrial property is intended to be used for outdoor storage or processing, the property owner will be required to submit a landscape plan describing the type and location of these outdoor activities relative to the potentially impacted residential properties and the basis for mitigating any off-site impacts.

Septic holding tanks are intended to be used to manage domestic wastewater disposal for each of the properties, eliminating any potential soil or water contamination. Each business established within the plan area will be responsible to operate its businesses in compliance with the various provincial acts and regulations intended to protect the environment including but not limited to *The Clean Air Act*, *The Environmental Management and Protection Act* and associated regulations.

5.2 Phase 2 Urban Development

The internal road layout and configuration and orientation of the interim rural lots have been planned to allow for further subdivision to occur in the future as the development transitions to urban industrial development in COS as anticipated by the Regional Plan.

Figure 5-2 illustrates the potential resubdivision of the rural lots; creating up to 48 developable parcels with an average lot size of 0.84 hectares which is consistent with similar industrial developments within COS. It is noted that the lot configuration illustrated in Figure 5-2 is conceptual only and the exact number and sizing of the future urban lots will be determined by the property owners based on their future land needs and market conditions. The primary purpose of Figure 5-2 is to define the future internal road network which in turn provides a basis for the planned extension of urban level water distribution, sanitary collection and stormwater management facilities into the area.

The future reconfiguration of development within the plan area requires the expansion of the internal road network to include a crescent within the northern half of the plan area reflecting the inability to provide a direct road connection to the proposed Saskatoon Freeway route. The conceptual land use plan represents the potential extension of a second internal road extending through the existing country residential parcel and connecting to Auction Mart Road. As this property is independently owned, the configuration of this roadway may be subject to change in the future.

Redevelopment of the new sites is expected to reflect the range of uses and property development regulations provided by the IL1-General Light Industrial District or similar light industrial zoning in place at the time of transition.

As municipal reserve will be dedicated during the rural phase of subdivision, no further dedication is anticipated to be required as a result of the resubdivision and transition of the properties to an urban standard.

5.2.1 Development Regulation and Land Use Transition

Initial rural development within the plan area will be required to comply with the site and use regulations represented by the D-Light Industrial 1 District (DM1). As the plan area changes jurisdiction, land use is expected to comply with the site and land use regulations represented in the IL1-General Light Industrial District or similar light industrial zoning in place at the time of transition. The list of permitted and discretionary uses provided in the DM1 District are

considered capable with the uses permitted within the IL1 District, so no land-use conflicts are anticipated to be created by the change in jurisdiction.

Site development within the DM1 District will consider the minimum yard requirements:

Site Area	Frontage	Front Yard	Side Yard	Rear Yard	Flanking Yard
0.8 ha	30 m	45 m	8 m	8 m	30 m

As these properties transition into the IL1 District, the following new site regulations would apply:

Site Area	Frontage	Front Yard	Side Yard	Rear Yard	Flanking Yard
0.02 ha	7.5 m	6 m	0 m	0 m	1.5 m

The rural site regulations are more stringent than their urban counterpart. The elimination of a rear and side yard setback within the IL1 District offers sufficient flexibility to accommodate future resubdivision of the sites without having to control the placement of buildings during the initial rural development phase. Rural industrial development often places a priority on maintaining large undeveloped areas within a site to support outdoor storage and processing. Urban industrial development is often more building intensive. The propensity to retain a larger proportion of the rural site in an undeveloped state should also support the eventual resubdivision and intensification of development associated with the transition to urban.

Given the likelihood of the COS assessing offsite charges on a frontage basis, there will be a natural pressure placed on rural lots to reduce their operational footprint and seek to re-subdivide their properties to broaden the base of funding for new urban services. It is anticipated that the re-subdivision of the rural lots will be initially focused on reducing the undeveloped outdoor areas on each lot. The further subdivision of existing rural building complexes will be dictated by the orientation of the buildings to one another and the needs of the business.

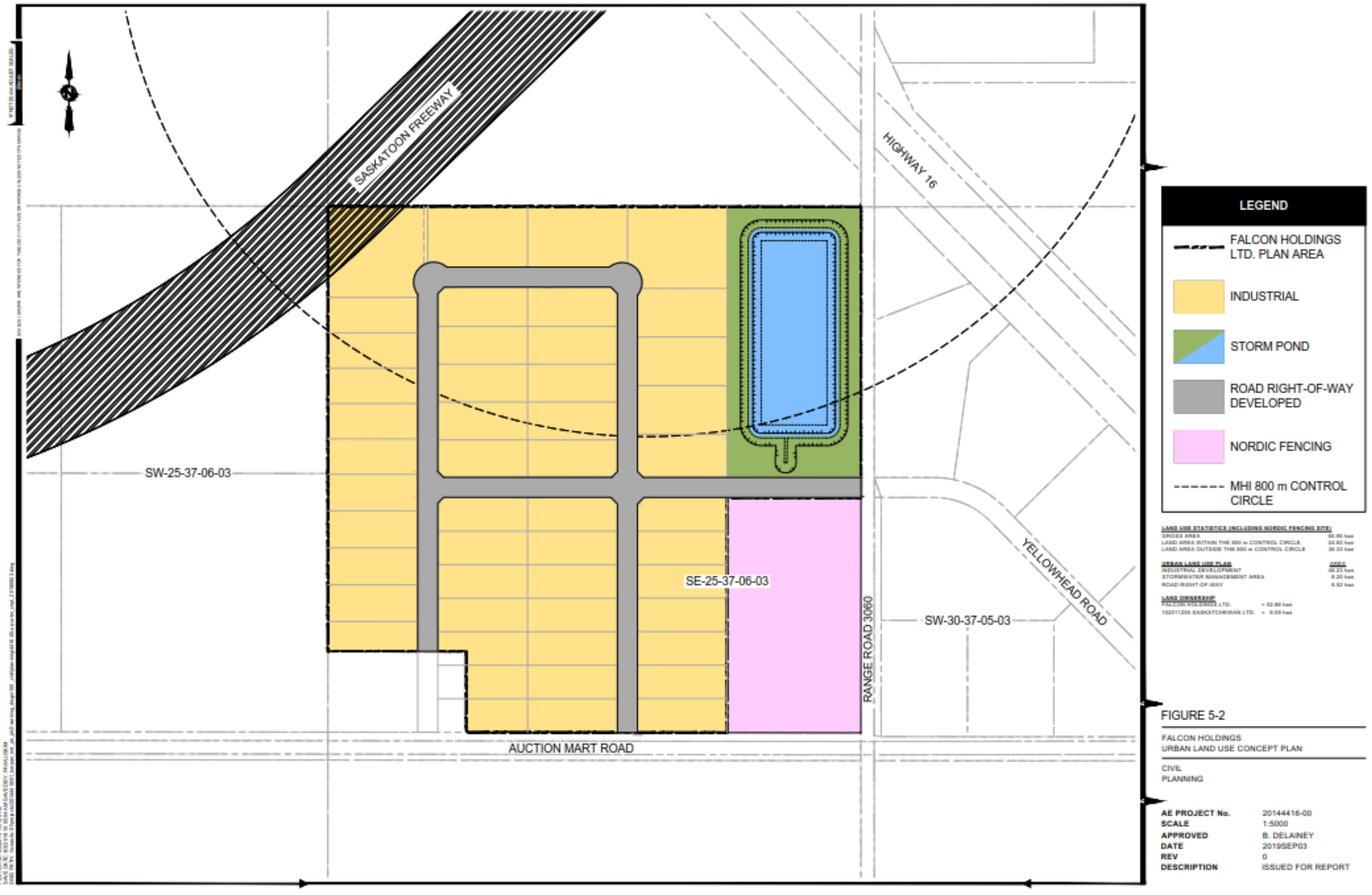

FIGURE 5-2

FALCON HOLDINGS
URBAN LAND USE CONCEPT PLAN

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Saskatchewan has adopted the National Building Code as the minimum standard for the construction and renovation of buildings throughout the province. The National Fire Code is adopted as the minimum standard for the fire safe operation of buildings and facilities. Any future subdivision that creates a legal separation between existing buildings will need to consider the provision of adequate fire separations to ensure continued compliance with the codes.

To offer greater certainty that buildings and activities will be situated on the properties in a manner that supports the potential resubdivision; the RM of Corman Park may consider the adoption of a transitional industrial zoning overlay that would apply the specific site and building regulations designed to accommodate the eventual transition from a rural to an urban form of development. For example, these regulations could direct rural buildings to be situated within the rural lot to enable consideration for the future resubdivision as generally described in Figure 5-2.

The transitional zoning regulations could also offer a corresponding reduction in the rural yard setbacks applied to compensate for the need for building clusters and to better reflect the future site configuration provided by the IL1 District. Other specific site requirements including landscaping and signage could be applied to correspond with the IL1 District and reduce the likelihood of nonconforming development following a change in jurisdiction. It is anticipated that any reduction in yard setbacks would be limited to site lines not abutting non-industrial properties.

6 CONCEPTUAL SERVICING PLAN

6.1 Roadway Design

6.1.1 Rural Road Design

Access to the plan area is intended to be provided from two new property accesses along Range Road 3060 and Auction Mart Road. Minimal new internal roadways are required to provide direct access to the proposed rural lots within the plan area.

Range Road 3060 is a gravel-surfaced municipal grid that is currently developed north of Auction Mart Road to its intersection at Yellowhead Road. The carriageway along the developed segment of 3060 is estimated to be 9 metres wide and constructed within a 30 m right-of-way. It is anticipated that this segment of the municipal roadway and all new internal roadways will be required to be upgraded to an industrial paved standard as described in Appendix E. As the rural road standard includes ditches, there is no intention to provide an internal pathway or sidewalk within the plan area.

The eventual transition from large lot rural to small lot urban development will necessitate the eventual expansion of the internal road network. To protect future road corridors, the initial rural subdivision plan will provide for the dedication of these rights-of-way which will remain undeveloped until the transition occurs.

Auction Mart Road is a higher volume two-lane paved municipal grid constructed in a 42 m right-of-way. Auction Mart Road is considered to be fully developed and no improvements are anticipated to be required in association with the rural phase of development. As a higher volume roadway, it is anticipated that no direct property access will be authorized from Auction Mart Road. All proposed properties will be accessed from the planned internal roadway network. Control of property access will be administrated through the RM's Approach Construction Application process.

Initial rural development within the plan area is not anticipated to significantly increase traffic volumes along Auction Mart; eliminating the need for the construction of turning lanes or intersection delineation lighting. It is expected that stop control signage will be placed along the southbound leg of the planned new internal subdivision roadway where it intersects with Auction Mart Road. We note that a stop sign currently exists in the same location at the Auction Mart/Range Road 3060 intersection.

6.1.2 Urban Road Design

The future transition of development within the plan area from rural to urban will trigger the full reconstruction of the internal roadways to the COS's urban standard following the installation of water, wastewater, and stormwater services as described in the sections following. In addition to this reconstruction, additional internal roadways will be constructed as illustrated in Figure 5-2 to provide the additional frontage needed to facilitate further subdivision into smaller lots as described in the previous section.

Following initial consultations with representatives from the COS, a 30 m wide roadway dedication was requested to accommodate a future industrial road right-of-way. Although the City's industrial road standards are likely to evolve by the time this area sees urban redevelopment, it is anticipated this 30 m roadway dedication will sufficiently accommodate the anticipated cross-sectional elements including 4 m through lanes, 3.5 m parking/storage lanes for right turns, 1.5 m separated sidewalks on both sides and landscaped boulevard.

An overlay of the proposed rural and urban road cross-sections is shown in Figure 6-1 and will include a combination of right-of-way dedication and easements to enable both the initial and future requirements.

The 30 m right-of-way dedication will secure the roadway required for future urban redevelopment. To accommodate the initial rural roadways, a 2.0 m wide easement along each side of the 30 m right-of-way dedication is required to provide additional room for the ditches and back slopes. These easements will be released upon the transition from the rural to urban cross-section and can be credited towards the provision of a 4.5 m vegetated buffer/boulevard as required in the City's IL1 Zoning District.

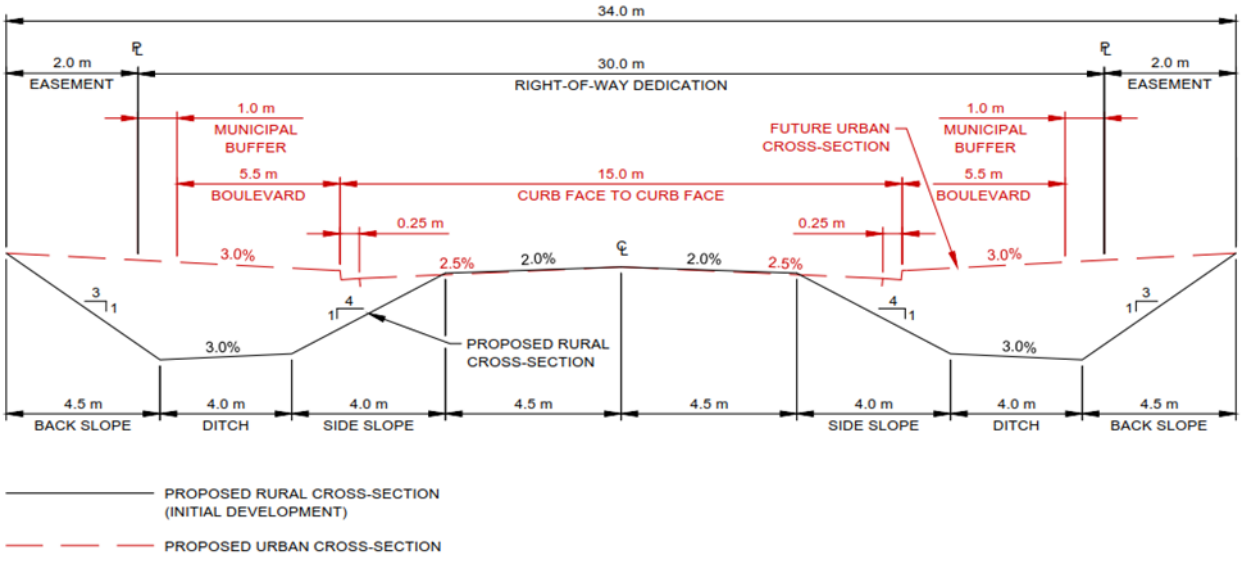


Figure 6-1
Proposed Rural and Urban Road Cross Sections

6.2 Drainage Design

6.2.1 Major System (Rural)

Appendix D describes the proposed conceptual grading plan for the initial rural development.

The existing topography of the site is generally flat and slopes very gradually from north to south. The elevations along the north boundary range from approximately 506 m to 507 m at the northwest corner. Along the south boundary, the existing elevations range between 505 m to 506 m. The Saskatchewan Water Security Agency has stated that no runoff shall be directed to Auction Mart Road. Therefore, it is proposed that all runoff be directed to ditches alongside the Yellowhead Road extension to a planned stormwater management facility located in the northeast corner of the site.

The Stormwater Management Facility (SWMF) is proposed to be a retention pond, constructed to the COS "Wet Pond" standards from the outset and sized to detain a 1:100 year 24-hour return design event. The total active storage required is estimated at 47,600 m^3 calculated to be 33,000 m^3 using the Modified Rational Method. A listing of all design criteria and assumptions for the conceptual SWMF design is shown in Table 6-1.

Item	Value
Overall Catchment Area	63.49 ha
Design Storm Event	1:100 year, 24-hour
Pre-Development Runoff Coefficient	0.30
Pre-Development Time of Concentration (FAA Airport Method)	137.27 min
Pre-Development Peak Release Rate	1.31 m^3/s
Pre-Development Average Release Rate	0.201 m^3/s
Post-Development Runoff Coefficient C (1:2 year) for future urban Industrial Area	0.60
Post-Development Runoff Coefficient C x 25% (1:100 year)	0.75
Post-Development Time of Concentration (FAA Airport Method)	169.22 min
Initial Active Volume (Modified Rational Method)	33,000 m^3
Initial Active Volume (COS estimate method)	47,600 m^3 (750 x 63.49 ha)

Table 6-1
SWMF Design Criteria

The facility will require mechanical pumping to discharge into an existing pond immediately to the east, which subsequently releases the water to the ditch along Highway No. 16. A typical cross-section of the proposed SWMF Retention Pond is shown in Figure 6-2. The proposed pond elevations have been developed to provide a minimum 1.85 m depth of pipe cover for a future minor storm system required for the urban redevelopment.

The proposed SWMF is located outside of the Secondary Hazard Zone as defined by the Saskatoon Airport Zoning Regulations. TP 1247 E – Land Use in the Vicinity of Aerodromes provides a comprehensive list of land uses and their associated risk to the safe operation of airport facilities. We note that this publication considers stormwater management facilities to be low potential risks and acceptable uses within Secondary Hazard Zones. The Saskatoon Airport Authority was consulted during previous planning completed for the site. A copy of this correspondence is attached in Appendix A.

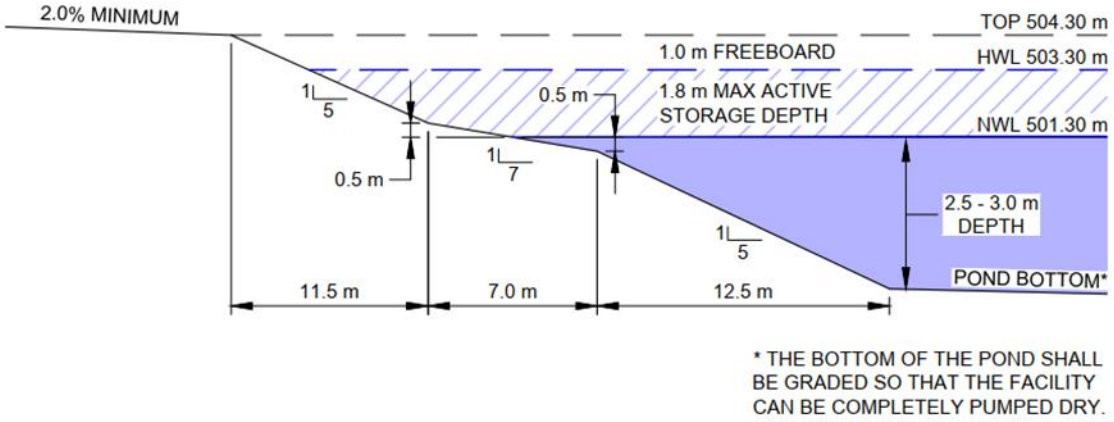


Figure 6-2
Typical SWMF Cross Section

6.2.2 Major System (Urban)

The transition from rural to urban development will require some adjustments to the surface grades along the roadways to provide a minimum 0.50% slope along the curb and gutters. The creation of “low points” and a minor stormwater collection system will be required to provide an increase to the road surface slopes while maintaining the overall major system. Figure 6-3 illustrates how this transition will occur.

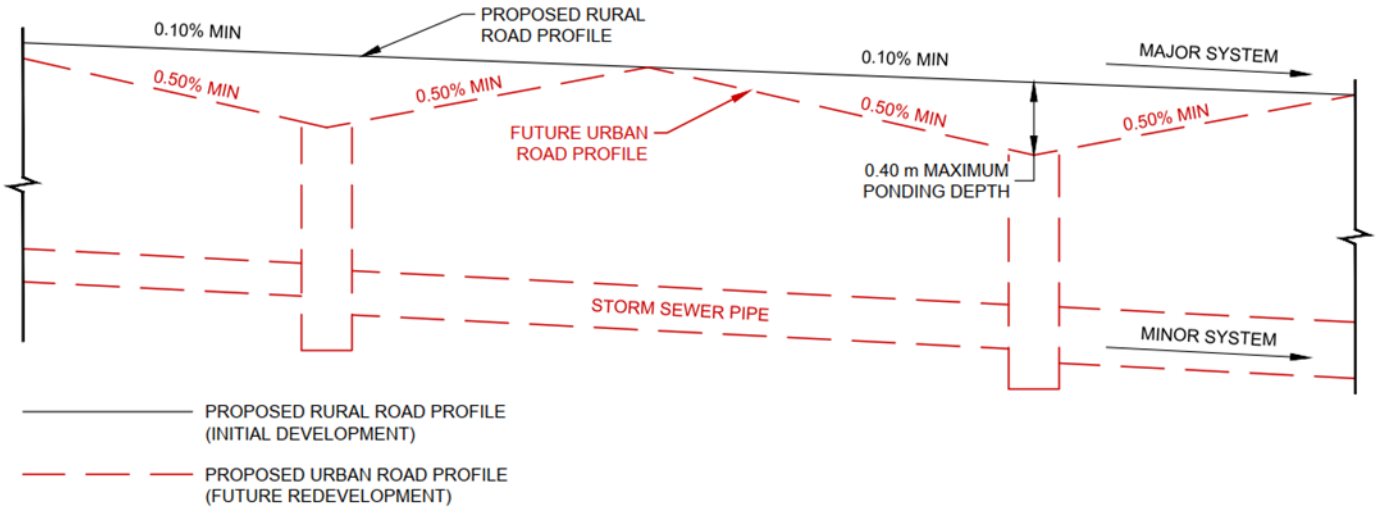


Figure 6-3
Proposed Rural to Urban Road Profile Transition

6.2.3 Minor System (Urban)

It is anticipated a minor stormwater collection system will be installed in conjunction with the other servicing and road reconstruction with the road rights-of-way as the development transitions from rural to urban. As per COS standards, the minor system is proposed to accommodate a 1:2-year event and include services in the lots so they can provide on-site stormwater management. For each site with a 1500 sq.m or greater paved area, an oil/grit separator will be required to be installed at the interface of the connection to the COS storm network. For the conceptual sizing of the storm pipes, an aggregate runoff coefficient C (2 years) of 0.64 was calculated for the urban industrial development based on a coefficient of 0.60 for the developable industrial areas and 0.95 for road rights-of-way.

Refer to Figure 3 in Appendix D showing the proposed conceptual minor stormwater collection system for the future urban redevelopment.

The conceptual drainage system presented for the future urban redevelopment is based on the current COS standards. Similar to the redevelopment of the roadways and other underground services, it is anticipated the COS standards will evolve by the time this transition from rural to urban infrastructure occurs. Therefore, the design of any storm services included in the future urban redevelopment will need to be updated to reflect the future design and development requirements.

6.3 Water Distribution

6.3.1 Water System (Rural)

Refer to Figure 4 in Appendix D showing the proposed water services for the initial rural development.

A 100 mm low-pressure service line will be extended from the Yellowhead Industrial Park water utility to provide water services to the initial rural development. This system will not be capable of providing fire flows to the parcels. The developers of each site will be responsible for constructing private reservoirs and pressure systems if desired or required for their operations. This low-pressure line is proposed to be installed along the roadway within one of the 2

m easements. This will facilitate easy access to the line for future service connections without having to excavate within the paved roadway.

6.3.2 Water System (Urban)

Refer to Figure 5 in Appendix D showing the proposed water services for the future urban redevelopment.

The proposed future urban redevelopment will include the installation of a full-pressure water distribution system to the COS's standards. The proposed water mains will be located within the road right-of-way and installed in conjunction with the reconstruction of the roadway to an urban cross-section. The COS suggested the most likely connections the City's distribution system will be to future primary water mains planned along Highway No. 16 and the proposed Saskatoon Freeway. The COS anticipated that these future connections will provide the volumes and pressures required for urban industrial redevelopment and that a local reservoir or new pressure zone will not need to be established within the development.

The conceptual design criteria and assumptions for the water distribution system proposed for the future urban redevelopment are listed in Table 6-2. The design population, operating pressures, fire flow requirements, estimated water consumption, maximum daily, and peak hourly flow rates will all need to be developed in consultation with the COS at the time of urban redevelopment. Using the current COS standards and assuming the redevelopment is predominantly classified as a Mixed Industrial use, the water main sizing is expected to be a minimum of 300 mm or 250 mm, if looped, to meet demands and provide the minimum 150 L/s fire flow within acceptable pipe velocities. All interconnections to the City's primary water main and any other external looping connections are planned to be 300 mm in size.

Item	Value
Industrial Area (Net)	46.96 ha
Equivalent Population	130 p/ha (Mixed Industrial)
Design Population	6105 people
Estimated Water Consumption	290 L/person/day
Average Day Demand (ADD)	20.5 L/s
Maximum Daily Demand (2.26 x ADD)	40.3 L/s
Peak Hourly Demand (3.30 x ADD)	67.6 L/s
Operating Pressure	275-690 kPa
Fire Flow	150 L/s (140 kPa min pressure) for Light Industrial

Table 6-2
Water System Design Criteria

The conceptual water distribution system presented for the future urban redevelopment is based on the current COS standards. Similar to the redevelopment of the roadways and other underground services, it is anticipated the COS standards will evolve by the time this transition from rural to urban infrastructure occurs. Therefore, the design of any water services included in the future urban redevelopment will need to be updated to reflect the future design and development requirements.

6.4 Wastewater Collection and Disposal

6.4.1 Wastewater System (Rural)

The initial rural development of the industrial park will require the individual site developers to install private septic holding tanks to manage all wastewater flows generated within each property. Each property owner will be individually responsible for contracting the services of a licensed septic hauler to evacuate the holding tank and dispose of the waste as a licenced disposal facility.

6.4.2 Wastewater System (Urban)

Refer to Figure 6 in Appendix D showing the proposed wastewater collection system for future urban redevelopment.

In conjunction with the other services and road reconstruction, a gravity wastewater collection system is proposed to be installed during the urban redevelopment of the industrial park. The sanitary sewer mains will be installed within the road rights-of-way and following the surface grading, direct wastewater flows down along Yellowhead Road to the east boundary of the site to either a connection to the City's future gravity collection system or a potential lift station situated within the dedicated open space housing the stormwater management facility. The conceptual design criteria and assumptions for the wastewater collection system proposed for the future urban redevelopment are listed in Table 6-3.

Item	Value
Industrial Area (Net)	46.96 ha
Equivalent Population	130 p/ha (Mixed Industrial)
Design Population	6105 people
Estimated Wastewater Generation	290 L/person/day
Infiltration Allowance	0.17 L/s/ha
Weeping Tile Flow allowance	0 L/s
Average Dry Weather Flow	20.5 L/s
Peaking Factor (using Harmon Formula)	3.16
Inflow & Infiltration (I&I)	7.98 L/s
Peak Design Flow	72.8 L/s

Table 6-3
Wastewater System Design Criteria

The conceptual wastewater collection system presented for the future urban redevelopment is based on the current COS standards. Similar to the redevelopment of the roadways and other underground services, it is anticipated the COS standards will evolve by the time this transition from rural to urban infrastructure occurs. Therefore, the design of any wastewater services included in the future urban redevelopment will need to be updated to reflect the future design and development requirements.

6.5 Other Supportive Services

6.5.1 Fire and Protective Services

The City of Saskatoon Fire Department will provide the development with fire protective services, based upon the agreement between the RM of Corman Park and the City of Saskatoon. The Saskatoon Fire Department confirmed that No. 7 and No. 4 Fire Halls would respond to this location with two fire trucks, a 4X4 pick-up truck, and a 3000-gallon Tanker Truck coming from Fire Hall No. 2. In the event a larger than expected fire takes place, the City Fire Department will respond with as much equipment as possible which includes additional fire trucks, a second 3000-gallon tanker truck and additional 4000-gallon tanks. In the event they run out of water during the firefighting process, the Fire Department can access a City of Saskatoon fire system at the SaskTel Centre. Refill time is estimated to be 10 – 15 minutes and depending on the size of the fire, they could run a shuttle system where they are constantly filling and dropping off the water. They confirmed that response times depend on the City's status/availability at the time of the emergency. Based on our conversation with Mr. Rempel, this meets the City FireDepartments' requirements for a fire suppression system.

As the development transitions into the COS, full fire protection infrastructure will be constructed as is found in other urban industrial areas with the COS fire department continuing to service the area.

Police services will be provided by the Corman Park Police Service and the Saskatoon Detachment of the RCMP, transitioning into the jurisdiction of the City of Saskatoon Police Services in the future.

The City of Saskatoon Fire Department and the Corman Park Police Service were contacted regarding the development and there were no concerns expressed about extending emergency services to the area. Correspondence from the City of Saskatoon Fire Department is attached as Appendix A.

6.5.2 Solid Waste Disposal

Domestic solid waste disposal in the RM of Corman Park is provided at the Loraas Landfill. Each property owner will be required to contract one of several licenced haulers to collect and dispose of solid waste at one of several landfills in the region. These same contracted services will remain as the development is incorporated into the COS.

7 POLICY COMPLIANCE

7.1 Saskatoon North Partnership for Growth District OCP

Section 2.4: Strategic Direction

2.4.3 Settlement Patterns and Complete Communities
The P4G municipalities will meet the needs for future growth through efficient and well organized development. Existing and planned infrastructure, as well as life-cycle impacts, will be considered in development which will also meet the diverse needs and growth requirements for all communities as defined by consistent growth projections. Where possible, development will be clustered in contiguous areas, corridors, and nodes. Interim uses may also be permitted where they will not impact future urban growth needs or development potential.

The proposed site is located in an existing industrial area planned for future industrial growth. The rezoning of this property supports this policy by providing for development that will be clustered in contiguous areas, corridors, and nodes along Highway 16.

Section 6.3.5: Impacts to Natural and Heritage Resources

Subdivisions and development must be designed and constructed to ensure that alterations to the landscape or other natural conditions avoid or mitigate on and offsite impacts to natural and heritage resources.

Historically, the site has been cultivated and actively farmed, and therefore, no significant natural features exist. A query for the subject property using the online heritage resource database confirmed that the subject property is not considered heritage sensitive and that no further investigation is required to proceed with development.

Section 6.3.6: Integration of Natural Features

Development should integrate and complement natural features and landscapes including the incorporation of natural vegetation and conserved wetlands.

Historically, the site has been cultivated and actively farmed, and therefore, no significant natural habitat or features exist within the property that require specific conservation.

Section 8.3.1: Source Water Protection

Development shall not restrict the use of groundwater or surface water, or alter the flow of surface water in a way that detrimentally affects other property or the ecology of the drainage system.

Interim rural development within the property is anticipated to utilize septic holding tanks to manage wastewater. The conceptual drainage plan was prepared in direct consultation with the Water Security Agency and the City of Saskatoon Engineering Department to prevent the development of the property from adding to existing drainage issues along Auction Mart Road.

Section 8.3.2: Runoff from Site Development
Untreated stormwater runoff from a multi-parcel development should be directed to a retention pond or similar feature to reduce sediment and pollutants inputs into surface water and wetlands.
Please refer to Section 6.2 of this report.

Section 10.3.1: Land Use Compatibility
Development shall be compatible with surrounding uses.
Please refer to Section 5.1.1 of this report.

Section 10.3.3: Future Urban Growth Areas
Areas identified for future urban growth are identified in Schedule C – Future Urban Growth Areas Map. This map includes: a) Future Urban Growth Areas required to accommodate a regional population of 700,000; and b) Future Urban Growth Areas required to accommodate a regional population of 1 million.
The subject property is located in the growth to 1,000,000 areas as identified on the Schedule C – Future Urban Growth Areas Map.

Section 10.3.4: Intent of the Land Use Designations
The major land use designations included in Schedule B – District Land Use Map are identified as follows: e) Urban Commercial/Industrial accommodates future general commercial and industrial uses including office, retail, and industrial areas that are connected to urban servicing. These areas shall be further designated as Urban Commercial and Urban Industrial areas through more detailed planning;
The subject property is located in an area designated for future urban commercial/industrial land use. The applicant proposes to rezone the site to a DM1 – Light Industrial District which is consistent with the land use designation.

Section 15.3.7: Interim Uses in Future Urban Growth Areas
Interim uses on lands identified as Future Urban Growth Areas may be allowed prior to urban development, subject to consideration of: a) Whether the interim use has the potential to become permanent; b) Whether the interim use is for single parcel development or multi parcel development; c) Whether the interim use is inside or outside the 700,000 growth area; d) Whether the interim use has rural or urban densities, form, and servicing; e) The recovery of the cost of current and future infrastructure; f) The compatibility of current and future land uses; and g) Traffic effects on existing and future road networks.
Please refer to Sections 5 and 6 of this report.

15.3.9 Multi Parcel Interim Land Use in Future Urban Growth Areas

A multi parcel interim use may be permitted in Future Urban Growth Areas provided that:
a) The proposal is consistent with more detailed planning for the area;
b) Where detailed planning has not been completed for the area, the proposal aligns with the projected future urban land use identified by the adjacent urban municipality;
c) It is designed to transition to future urban servicing;
d) A site design that limits fragmentation of the parcel is provided; and
e) A subdivision design that allows for re-subdivision to urban-sized parcels is provided.

This CDR presents a plan for how rural industrial development can successfully transition to a rural service level and density.

15.3.10 Development Standards for Interim Uses

Development standards for interim uses in the Future Urban Growth Areas shall conform as closely as possible to the development standards used in the adjacent urban municipality to allow for integration with the urban municipality in the future with consideration for the type of use proposed.

See Section 6 of this report.

15.3.16 Dedication of Reserves in Future Urban Growth Areas

In determining the recommended dedication of municipal reserve land or cash-in-lieu for subdivisions for interim uses in Future Urban Growth Areas, Corman Park shall consider:
a) Current and future land use planning and development standards for the area;
b) The potential for significant public amenities, including open space recreational opportunities, integrated trail systems, and continuous pedestrian linkages; and
c) The costs to Corman Park and the adjacent urban municipality.

The adjacent urban municipality shall be consulted regarding dedication of municipal reserve and any necessary transfer of dedicated land or cash-in-lieu.

See Section 5 of this report for a discussion concerning the approach to MR dedication.

15.3.22 Designation on Schedule B – District Land Use Map

Areas designated as Urban Commercial/Industrial on Schedule B – District Land Use Map shall be further designated as Urban Commercial areas or Urban Industrial areas through Concept Plans or other detailed planning acceptable to the adjacent urban municipality. Urban Commercial development and Urban Industrial development must be located in the areas designated as such on Schedule B – District Land Use Map.

Based upon consultations with the RM and City of Saskatoon, it is our understanding that this area is expected to host urban-industrial expansion.

15.3.25 Detailed Planning for Multi Parcel Interim Commercial and Industrial Development

Detailed planning for multi parcel interim uses in Urban Commercial/Industrial areas shall be required and developed to the satisfaction of Corman Park and the adjacent urban municipality, and may include:
a) Subdivision and site design that facilitates a transition to urban development;
b) Roadway and other infrastructure planning that facilitates a transition to urban development;
c) The proposed water, wastewater and stormwater management systems, and the alignment with existing and future systems;
d) Consideration of the location, type and timing of future urban development;
e) A transportation impact assessment where the use may result in a significant impact on existing and future road networks;
f) A phasing plan;
g) Analysis of infrastructure costs; and
h) Area grading plan that enables a transition to future urban development.

This CDR report reflects the detailed planning for this site.

23.3.2 Coordination of Development and Infrastructure Planning

Subdivisions and developments must be designed and constructed to respect the planned extensions of infrastructure as detailed in Concept Plans and regional servicing plans.

The subdivision and servicing plans represented in this report were developed in direct consultation with the City of Saskatoon Engineering Department.

23.3.3 Services Provided at Developer Expense

The proponent will be responsible for all costs associated with providing the infrastructure and services required for a development. Servicing agreements may be required to address these costs.

It is expected that a servicing agreement will be required as a condition of approval for a future subdivision application.

26.3.9 Stormwater Management Plans in Future Urban Growth Areas

Stormwater management plans will be required as part of Concept Plans or Comprehensive Development Reviews, or at the site development stage, whichever comes first, that detail stormwater control facilities and related improvements, and demonstrate that water quality and quantity impacts from development have been minimized.

See Section 6.2 of this report.

26.3.10 "No Net Impact" Standard

On-site stormwater management controls for site development will be encouraged to meet a "no net impact" standard, 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.

26.3.10 "No Net Impact" Standard
See Section 6.2 of this report.

27.3.3 Roadway Access
Development must meet all municipal and provincial regulations respecting access to and from provincial highways and municipal roads.
See Section 6.1 of this report.

27.3.4 Minimize New Roadway Construction
To make the most efficient use of existing roadway facilities, residential, commercial, and industrial subdivisions and developments will be encouraged to locate adjacent to existing roads that have been designed and constructed to accommodate them.
The site is located along Auction Mart Road to the south and Range Road 3060 to the east. Both of these roads currently accommodate heavy industrial traffic and are all-weather roads. Range Road 3060 and the portion of Auction Mart Road to the east of the site are both primary weight roads. Auction Mart Road connects Highway No.16, at an improved intersection that includes traffic lights.

27.3.5 Access Requirements for Developments
Residential, commercial, industrial, recreational, and regional infrastructure and institutional developments shall have year-round, legal, all weather physical access to a municipally maintained roadway.
The site is located along Auction Mart Road to the south and Range Road 3060 to the east. Both of these roads currently accommodate heavy industrial traffic and are all-weather roads. Range Road 3060 and the portion of Auction Mart Road to the east of the site are both primary weight roads. Auction Mart Road connects Highway No.16, at an improved intersection that includes traffic lights.

27.3.6 Safe Access and Egress
Developments must include safe access and egress from adjacent roadways without disruption of the roadway function. The type and number of access points provided onto municipal roadways may be limited through shared points of access along shared driveways or service roads where applicable.
Auction Mart Road is a higher volume two-lane paved municipal grid constructed in a 42 m right-of-way. Auction Mart Road is considered to be fully developed and no improvements are anticipated to be required in association with the rural phase of development. As a higher volume roadway, it is anticipated that no direct property access will be authorized from Auction Mart Road. All proposed properties will be accessed from the planned internal roadway network. Control of property access will be administrated through the RM's Approach Construction Application process.

27.3.7 Access to Uses Provided at Developer

Where subdivision or development requires year-round, all weather access, the expansion or upgrade of the roadway to such a standard will be provided at the developer's expense.

Initial rural development within the plan area is not anticipated to significantly increase traffic volumes along Auction Mart; eliminating the need for the construction of turning lanes or intersection delineation lighting. It is expected that stop control signage will be placed along the southbound leg of the planned new internal subdivision roadway where it intersects with Auction Mart Road. We note that a stop sign currently exists in the same location at the Auction Mart/Range Road 3060 intersection.

29.3.3 Intermunicipal Agreements for Interim Development in Future Urban Growth Areas

Intermunicipal agreements addressing interim development in Urban Commercial/ Industrial areas will include consideration for future cost recovery for urban infrastructure. The level of detail provided in the agreement will take into consideration:
a) Current land uses and/or current allowable parcel sizes;
b) Future land uses and/or future allowable parcel sizes;
c) Expected timing of boundary alteration and urban development; and
d) Relevant infrastructure and servicing planning.

It is expected that a servicing agreement will be required as a condition of approval for a future subdivision application.

31.3.19 Consultation with Public Utilities

The applicant must consult with public utility companies and provide the findings within the Comprehensive Development Review to protect existing and provide for future utility easements and to ensure new development is located in a way that will not compromise the long-term operation or future expansion of the utility.

The Yellowhead Water Utility board was engaged to confirm their willingness to extend low-pressure rural water services to properties within the plan area. Wastewater management associated with the interim rural development will be managed through the use of private septic holding tanks in the same way as other rural industrial developments in Corman Park. The proposed development is located in an area where shallow utilities are readily available.

31.3.20 Provisions for Public Engagement

Special provisions for public engagement may be required that are appropriate to the nature and scope of the planning matter being addressed, to ensure that the public is engaged in a timely manner regarding planning and development processes.

A summary of consultations associated with the development of this property is attached as Section 8.

7.2 Saskatoon North Partnership for Growth District Zoning Bylaw

2. General Administration

23. Servicing Agreements:
Where there is a proposed subdivision of land, the Municipality may require an applicant to enter into a servicing agreement to provide services and facilities that directly or indirectly serve the subdivision in accordance with the provisions of the Act.

It is expected that a servicing agreement will be required as a condition of approval for a future subdivision application.

3. General Regulations

10. Drainage
1. Where development may alter site drainage potentially affecting adjacent, upstream or downstream properties, or the stability of the land, the applicant shall be required to construct engineered drainage works incorporating sufficient capacity to accommodate the surficial 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 grading and levelling.

Please refer to Section 6.2 of this report.

21. Property Approaches
1. A development permit shall not be issued for development on any site unless an approach to a public roadway has been approved by the Municipality.

The municipality will be consulted regarding the location and approval of approaches.

22 Public Roadways
2. All development shall have frontage onto and direct physical and legal access to a maintained public roadway, except for: a) agricultural operations; b) development internal to a condominium plan containing private roadways; and c) development internal to a dwelling group or multi-use development containing internal roadways as approved by the Development Officer.

Please refer to Section 6.4 for details concerning roadway design and construction.

30. Private Wastewater Treatment Systems:
1. Where a development requires a means of sewage disposal or treatment, the developer shall be required to install a sewage disposal system in accordance with municipal and provincial requirements. The Development Officer, in. conjunction with appropriate provincial regulatory agencies, shall determine the suitability of a site to accommodate a private wastewater treatment system.

Interim development is intended to utilize septic holding tanks as the sole means of managing wastewater collection and disposal. Once the area transitions into an urban jurisdiction, the City would extend underground sewer service to the site.

31. Water Supply:
1. No development or use of land shall be allowed where the proposal will adversely affect domestic or municipal water supplies, or where a suitable, potable water supply cannot be furnished.

3. General Regulations
Please refer to Section 6.3 for details concerning water system design and construction.

8 CONSULTATIONS

8.1 Landowner

A project brief was printed and distributed by direct mail to all properties within 1.6 km of the proposed development. A total of 42 notices were distributed providing a summary of the proposed development and offering recipients access to the draft CDR report. A letter was received from several neighbouring property owners identifying their concerns with the introduction of industrial development in the area. A meeting was subsequently held on Friday, May 27th and included the residents, the owners and an RM Councilor. A copy of the letter received is attached in its entirety in Appendix A. The following represents a summary of the discussions at the meeting:

1. **DRAINAGE/COMPREHENSIVE DRAINAGE STUDY: Does the drainage study done by Associated Engineering for Falcon Holdings Ltd. address the drainage issues below, including water flowing west down Auction Mart Road in heavy rain events? If not, why? This has been an issue for decades and will likely be exacerbated by this development. This issue has been thoroughly documented with the Rural Municipality of Corman Park (RM), the Water Security Agency (WSA), and the Saskatoon North Partnership for Growth (P4G). We feel a Comprehensive Drainage Study will also address the blocked natural waterway, the Saskatoon Airport expansion, and building of the Saskatoon Freeway as outlined below.**

Developer's Response: We are fully aware of the issues related to drainage management along Auction Mart Road and share all the same concerns that you have stated in your letter. These existing issues have provided some challenges to site design given that the natural direction of flow of this site is to the south based upon existing topography. Given previous communications from WSA prohibiting any additional discharges to the south, the developer is forced to fill and regrade the site to force run-off to flow to the northeast and against the natural gradient which substantially impacts the cost of development.

The developer would support the request for a Comprehensive Drainage Study to be prepared for the broader area as it would probably benefit the subject property as it moves into future stages of development.

2. **HOLDING POND SIZE: Given that some dugouts in the area are now full even though last year was a dry year, and that the water table is high, is the holding pond on Highway No. 16 of adequate capacity in wet years for both a 1:500 year rain event and a 1:1000 year rain event, given the impact that climate change is having on the severity and unpredictability of weather?**

Developer's Response: The triangular dugout directly north of the Yellowhead Industrial Park is not considered to provide any run-off storage for the subject property but rather acts as a receiving body or a pass-through for run-off designed to enter the highway ROW. The proposed development of the subject property provides for the construction of a 21-acre stormwater management facility which has been designed to comply with the current City of Saskatoon design standards to effectively manage a 1:100-year storm event and ensure offsite discharges occur at the predevelopment rate. The current stormwater management facility constructed on the property has been constructed to support the development of the Nordic Industries lot. This facility was designed by a qualified civil engineer and

approved by both WSA and the RM of Corman Park. The pond represents a fraction of the size of the pond needed to support future subdivision and development on the balance of the land.

3. **HARD SURFACING: Does the Falcon Holdings Ltd. study address what happens to drainage in the event that many or all lots within the proposed park become hard topped including the internal roadways?**

Developer's Response: It is our understanding that the RM's current practice is for the roads to be paved immediately and the developer is required to provide appropriate erosion controls during road construction to protect adjacent surface water bodies. The conceptual drainage plan and more specifically the pond area calculations assume that the land cover and its associated imperviousness will increase as a result of development.

4. **TRAFFIC SAFETY: To maximize safety, we would like access to the development to be limited to Range Road 3060 to prevent traffic accidents and ensure heavy truck traffic on Auction Mart Road is limited.**

Developer's Response: The lot and road layout represented in the CDR has been reviewed by the RM and City of Saskatoon staff. The intention to have a road connection along Auction Mart Road (no direct property access) met the RM of Corman Park's and City of Saskatoon's intersection spacing requirements.

As this application does not anticipate subdivision, the lot configuration represented in the CDR is not confirmed and could change if desired by a future owner (developer). The road network will need to comply with the standards of the presiding jurisdiction at the time of subdivision or development.

5. **HOURS OF OPERATION: We would like the hours of operation of the park to be consistent with other businesses in the area and not 24/7 during construction or after the development is completed.**

Developer's Response: There is no ability to control the hours of business operations at this stage of the approval process. Individual businesses will need to submit development and building permit applications for their respective lots and demonstrate compliance with applicable municipal bylaws and regulations.

6. **BUFFER: It is a requirement of the P4G that there be a buffer between the park and the existing property which the park abuts on the east and north side and where the development is viewed from adjacent roadways, to reduce the negative effect on the adjacent land due to conflicts with noise, vibration, smoke, dust, odour, or potential environmental contamination, including light pollution. We ask that the buffer consist of a berm including a layer of topsoil that can be seeded with grass, as is standard practice for developments in and around Saskatoon, that is equivalent in height to these standard berms, and that is accompanied with two rows of coniferous trees which are irrigated to ensure survival.**

Developer's Response: The developer acknowledges the need to construct a physical barrier between the planned industrial and adjacent acreages to mitigate visual and noise impacts as described in the CDR. We anticipate that Corman Park will consider the specific mitigation measures requested and may require that a landscaping proposal is included with a future submission to verify how the buffering will be provided as a condition for removing the holding provision.

7. **SAFETY OF PERSONS AND PROPERTY: Due to the frequent break-ins taking place at businesses in the area, the business park next to the existing acreage puts the property and owners at risk, therefore a chain link fence surrounding the development, is necessary to inhibit crime and protect the adjacent property from access through the development.**

Developer's Response: It is not typical for industrial development to include a full perimeter fence. It is assumed that future businesses situated in the development will erect fences to enclose their respective lots for the same security reasons expressed by the adjacent landowners.

8. **RECOURSE AND LAND USE CONFLICTS: We have serious concerns about land use conflicts. We understand that Falcon Holdings Ltd. plans to sell the land, but we want our concerns addressed now, which we understand is an obligation of Falcon Holdings Ltd. It is very time consuming for all property owners in the area to deal with a new purchaser or multiple purchasers, therefore addressing these concerns now will save time and prevent problems in the future. By addressing this now with this CDR, we prevent future problems for all parties involved, and so future purchasers are aware of and can be held accountable to these standards.**

Developer's Response: It is our understanding that the information provided by the adjacent landowners will be considered by the RM in defining the conditions for the removal of the holding provision and the future subdivision and development of the property. We note that the conditions established by the RM will need to be consistent with their published policies and regulations that are in place at the time of a future application.

9. **PROPERTY VALUES: We have concerns about depreciating property values caused by being adjacent to a business park and all the problems it causes existing property owners, including water issues.**

Developer's Response: The proposed development of the subject property is consistent with the long-term plan for development in this area which anticipates the expansion of industrial development. As subdivision and development occur, the new development will need to consider and account for the continued use and enjoyment of neighbouring residential development through the use of landscaping and buffering.

8.2 Ministry of Highways and Infrastructure

Associated Engineering representatives met with the Ministry of Highways and Infrastructure (MOH) on June 26th, 2019 to discuss the Saskatoon Freeway and Highway 16 interchange regarding impacts to the KIP. At that time, MOH was in the early stages of the interchange layout. The MOH shared several options being considered and explained how each option would impact the proponent's site.

Based on the shared footprints, the impacts to development are anticipated to be minimal and directed to the far northern boundary of the site. The northwest corner will be impacted; however, the extent of the impact will be determined as the freeway project progresses through subsequent phases of design. The worst-case scenario represented by the MOH was that a bypass lane may be required to extend across the north boundary of the site which would consume approximately the top 1 – 2 future City sized lots along the north boundary.

The MOH was not offended by the representation of 8 large lots and based upon the findings at the meeting, all 8 lots will have ample space to be developed with the ability to subdivide the properties for additional development in the future.

A record of the meeting and confirmation email from the MOH can be reviewed in Appendix A.

8.3 Heritage Conservation Branch of the Ministry of Parks, Culture and Sport

The Developers' Online Screening Tool indicates that the proposed development is not located in a heritage-sensitive area. There are no further concerns from a heritage sensitivity perspective.

8.4 Ministry of Environment

The HABISask provides an interactive map for viewing rare and endangered element occurrences across the province. A review of the HABISask data indicates there are no rare or endangered elements within the proposed development area.

8.5 Water Security Agency

The conceptual stormwater management plan was shared with the Water Security Agency and confirmed to be suitable.

8.6 Saskatoon Airport Authority

The Saskatoon Airport Authority was contacted regarding the proposed subdivision. They confirmed the proposed subdivision will meet the intent of both the existing and proposed Saskatoon Airport Zoning Regulations. The correspondence from the Saskatoon Airport Authority can be found in Appendix A.

CLOSURE

The services provided by Associated Engineering (Sask.) Ltd. in the preparation of this report was conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty expressed or implied is made.

Respectfully submitted,
Associated Engineering (Sask.) Ltd.

Bill Delainey
Project Manager

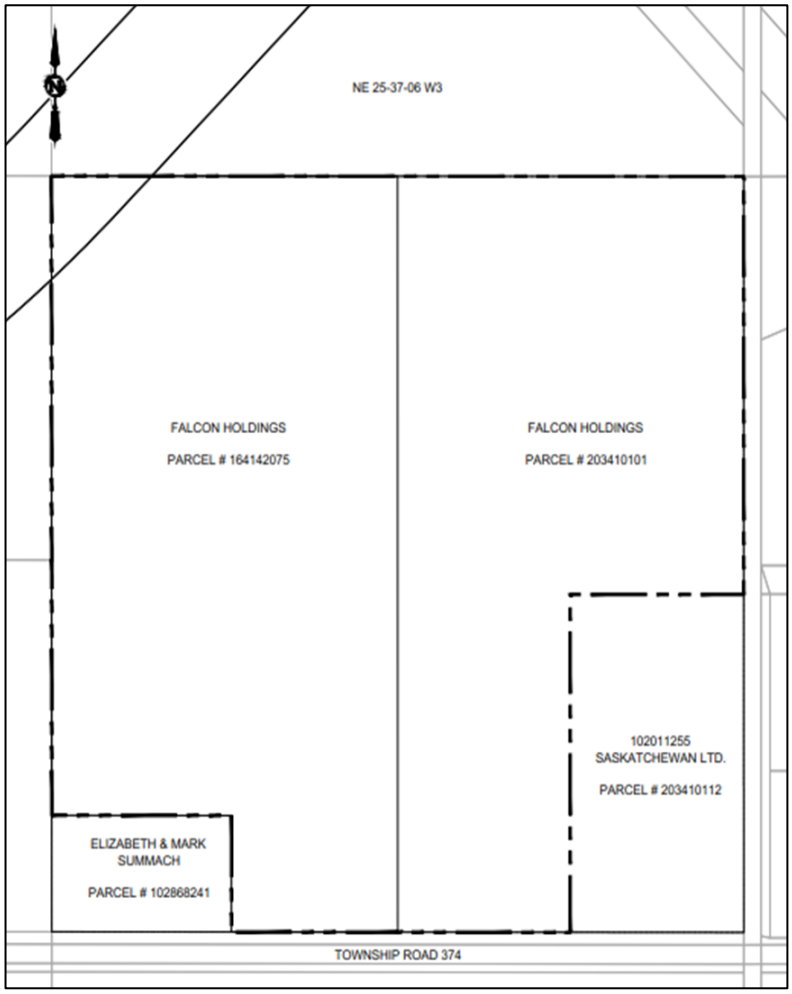
APPENDIX A - RECORD OF CONSULTATION

April 1, 2022
File: AE File 2014-4416

Re: REZONING APPLICATION - FALCON HOLDINGS INC.
SE 25-37-6-W3M
DAG1 TO DM1

Dear Property Owner:

This letter is to inform you of an application submitted by Falcon Holdings Ltd. proposing to rezone land within SE 25-37-6-W3M from D-Agricultural 1 District (DAG1) to D-Light Industrial 1 District (DM1) as illustrated below.



The current application does not anticipate subdivision or development on the lands at this time and as such a holding provision is anticipated to accompany any municipal approval. A holding provision is a legal instrument defined by the *Planning and Development Act, 2007* that allows Council to pre-zone an area based on a concept plan but to restrict development until conditions are right to allow development to proceed. It is anticipated that Council's resolution will define the requirements or conditions for the release of this restriction to development.

A Comprehensive Development Review report has been prepared to support the rezoning application and to illustrate and demonstrate the potential future subdivision and servicing strategy for the property. Currently, there are no immediate plans to subdivide or develop these lands. A separate application will need to be submitted in the future to the Community Planning Branch of the Ministry of Government Relations to initiate any land subdivision.

A copy of the Comprehensive Development Review report may be accessed by download from the following site by scanning the QR code using your mobile device:

https://bit.ly/FalconCDR

Please direct any questions or comments regarding this communication to:

Bill Delainey c/o Associated Engineering Ltd.
1 - 2225 Northridge Drive
Saskatoon, SK S7L 6X6
Cell: 306.261.9612 | Office: 306.808.3047
Email: delaineyb@ae.ca

Yours truly,

Bill Delainey
Project Manager

Concerns of Existing Property Owners
Re: Rezoning Application – Falcon Holdings Inc.

May 27, 2022

Thank you for providing an opportunity to voice our concerns and for you to address our questions regarding the Falcon Holdings Inc. Rezoning Application. Please note the following:

1. **DRAINAGE/COMPREHENSIVE DRAINAGE STUDY: Does the drainage study done by Associated Engineering for Falcon Holdings Ltd. address the drainage issues below, including water flowing west down Auction Mart Road in heavy rain events? If not, why? This has been an issue for decades and will likely be exacerbated by this development. This issue has been thoroughly documented with the Rural Municipality of Corman Park (RM), the Water Security Agency (WSA), and the Saskatoon North Partnership for Growth (P4G). We feel a Comprehensive Drainage Study will also address the blocked natural waterway, the Saskatoon Airport expansion, and building of the Saskatoon Freeway as outlined below.**

The drainage problems in the area are not only an inconvenience and expense, but they can significantly affect property values. Given that there are water drainage problems when the land is zoned as Agriculture, the rezoning to Light Industrial and hard surfacing will cause even more problems. We want to ensure that these problems are addressed prior to rezoning and before any development takes place.

We were informed over four years ago by the RM, that we would be part of a drainage study, but to date this has not happened and to our knowledge, no specific date has been set to complete a drainage study in this area. We have several unanswered questions that a drainage study would address, including to ensure that an effective flood mitigation plan can and will be put in place.

According to the Water Security Agency and the current bylaws, new development cannot add to the existing runoff in any way. As stated in the Falcon Holdings Ltd. Comprehensive Development Review (CDR) with respect to dealing with runoff, “The facility will require mechanical pumping to discharge into an existing pond immediately to the east, which subsequently releases the water to the ditch along Highway No. 16.” Pumping to this existing pond (triangular in shape), is of major concern to the residents along Auction Mart Road, because in our experience, the water flows west from Highway No. 16 towards the existing properties, and has done this since the road was widened. We are greatly concerned that this will add to our drainage problems. We have provided photographs and videos to the RM, the WSA and the P4G, demonstrating this. We feel this needs to be addressed in the Comprehensive Drainage Study, and corrected before any more rezoning or development can take place, to ensure that water drained from the triangular pond on Highway No. 16 does not flow west on Auction Mart Road.

Aerial photographs taken prior to development, show that the natural waterway for the area was blocked by the development that has taken place on the east side of Highway No. 16, including the Sasktel Center, and we have been told that this contributes to the drainage problems of existing property owners. The blockage of the natural waterway needs to also be considered and addressed in the Comprehensive Drainage Study. Some of our questions to be answered by a comprehensive drainage study include:

- How will the flow of water be corrected so that water drains east on Auction Mart Road, away from the properties of the current property owners?
- Who will be responsible for the expense of correcting this, given that it may involve changing the grade of the road/ditches, changing culvert placement and size, expanding the size of the main triangular holding pond currently depended on in this area for drainage, which Falcon Holdings Ltd proposes to also use?
- If this pond was to be emptied, where would the water flow, particularly in a wet year?

There is also a planned expansion of the Saskatoon Airport which will affect the properties of the current land owners in this area who already experience drainage problems. This too must be taken into consideration when a Comprehensive Drainage Study is performed in the area, and I expect would be a priority before any other additional development is done. The Comprehensive Drainage Study would of course address the allowable size of holding ponds within a 4 km radius of the Saskatoon Airport to limit attracting water fowl. We would certainly want the expansion of the Saskatoon Airport taken into consideration before further rezoning and development takes place, considering that it would involve the hard surfacing of runways, and would adjust the 4 km radius must be adjusted considering the expansion.

In addition to the Saskatoon Airport expansion affecting the drainage, there is the proposed development of the Saskatoon Freeway. The Comprehensive Drainage Study also needs to address how the Saskatoon Freeway will affect drainage in the area.

Further questions to be addressed by the Comprehensive Drainage Study include:

- How will the expansion of the Saskatoon Airport affect existing drainage in the area?
- How will the building of the Saskatoon Freeway affect existing drainage in the area?
- How will additional development, such as proposed by Falcon Holdings Ltd., affect existing drainage in the area?
- How will additional development, such as the Biz Hub, affect existing drainage in the area?
- How will all drainage in the area be minimally maintained and/or improved for existing property owners with all these proposed developments, prior to any rezoning or construction work being started?

2. **HOLDING POND SIZE: Given that some dugouts in the area are now full even though last year was a dry year, and that the water table is high, is the holding pond on Highway No. 16 of adequate capacity in wet years for both a 1:500 year rain event and a 1:1000 year rain event, given the impact that climate change is having on the severity and unpredictability of weather?**

Regarding holding pond size, we note that an aerial photograph reveals that the size of the holding ponds located in Biz Hub and the pond by Brandt Industries are significantly larger than the triangular holding pond located on Highway No. 16 regarding the area it is servicing. With the addition of the 150 plus acres of development proposed by Falcon Holdings Ltd., pumping into this very small pond in a 1:100 year event, let alone a 1:500 year event, is sure to overflow and any pumping of water from this pond can/will cause water to flow west down Auction Mart Road, adding to flooding problems for the existing property owners. Will the holding pond on Highway No. 16 be enlarged, using some of the Falcon Holding Ltd. land, so it is an appropriate size to service the businesses and area with respect to a 1:500 emergency flood event?

It must be noted that this year was a comparatively dry year, but the dugout of Mark and Anne Summach was over ¾ full this spring, and the dugout of Ken and Mary Burkevitch was full to the point of overflowing. As the Falcon Holding Ltd. report states, the water table is high, even after a very dry year in 2021. How does a high water table affect drainage in the area, and how will it be addressed when there is so much proposed development in the area? The Falcon Holdings Ltd. CDR document development states that dewatering will be required during the construction process.

The following is a statement regarding weather and climate change:

Statement: New research raises the uncomfortable possibility that **climate change will not only make weather more severe but also harder to predict**, potentially giving us less time to prepare for extreme floods, storms and heat waves in the years to come. January 25, 2022
https://www.google.ca/search?q=is+weather+more+difficult+to+predict+now&ie=UTF-8&oe=UTF-8&hl=en-ca&client=safari

This begs the question that we should plan for a 1:1000 emergency flood event, given all the proposed new development in the area. An additional consideration could be the provision of berms around the existing properties (Ken and Mary Burkevitch, Ben and Lois Machnee, etc), including heightening the berm around the property of Mark and Anne Summach located next to the development.

3. **HARD SURFACING: Does the Falcon Holdings Ltd. study address what happens to drainage in the event that many or all lots within the proposed park become hard topped including the internal roadways?**

We understand that it is a requirement of the RM of Corman Park that roads within developments must be paved within two years. It also must be noted that there are wells in the area, therefore no drainage of chemicals, oil, gas, grease, etc is acceptable during or after development.

4. **TRAFFIC SAFETY: To maximize safety, we would like access to the development to be limited to Range Road 3060 to prevent traffic accidents and ensure heavy truck traffic on Auction Mart Road is limited.**

Due to Auction Mart Road already being an very busy road with traffic including commuters, semi-trucks, farm equipment, construction equipment, etc, access to the Falcon Holdings Ltd. development should only be onto Range Road 3060 with no direct access onto Auction Mart Road, to ensure the maximum level of safety possible. To add another direct access onto Auction Mart Road when current accesses are located so close together, is an unnecessary safety hazard to the local residents and businesses, as well as to the many commuters, truckers and farmers who currently use this road. In addition, the proposed access roads onto Auction Mart Road are at the highway speed of 90 km/hr, which would certainly result in decreased safety for drivers. The development proposal is for potentially 8 to 48 businesses to be added to the area, resulting in a substantial increase in traffic, including construction equipment, etc while development is taking place. Installation of a traffic light at the juncture of Range Road 3060 with Auction Mart Road would also help with the transition from the

highway speed of 90 km/hr to the substantially slower speed of 60 km/hr with the increase in traffic, as would paving Beam Road to help direct traffic flow to it, instead of Auction Mart Road.

5. **HOURS OF OPERATION: We would like the hours of operation of the park to be consistent with other businesses in the area and not 24/7 during construction or after the development is completed.**

It is important that the hours of operation for both during development and at all times, are reflective of regular business hours such as with Biz Hub and the current businesses along Auction Mart Road, therefore between the typical 9:00 am and 5:00 pm, and not 24/7.

6. **BUFFER: It is a requirement of the P4G that there be a buffer between the park and the existing property which the park abuts on the east and north side and where the development is viewed from adjacent roadways, to reduce the negative effect on the adjacent land due to conflicts with noise, vibration, smoke, dust, odour, or potential environmental contamination, including light pollution. We ask that the buffer consist of a berm including a layer of topsoil that can be seeded with grass, as is standard practice for developments in and around Saskatoon, that is equivalent in height to these standard berms, and that is accompanied with two rows of coniferous trees which are irrigated to ensure survival.**

In addition to this being a collective problem for property owners in the area, it is specifically a problem for Mark and Anne Summach who live next to the development. Hard surfacing of lots can cause stormwater to run directly onto their property which could contain pollutants such as oil, gas, diesel, chemicals, grease and other pollutants. Correct sloping is essential with over 150 acres of roads and lots proposed to abut their property on the north and east sides. Even the development to date of the Nordic Fencing lot has resulted in dust, and tumbleweed thistles in our yard. Development closer to our yard will only compound these problems. Current bylaws state that our use and enjoyment of our property should not be affected by this development. Our concerns with regards to this include eyesore sights as development takes place and after development, light pollution during and after development, noise pollution during and after development, dirt and dust affecting breathing, sight and taste during development and after, if lots are not hard surfaced or gravelled, and safety including increased traffic of both regular and construction vehicles during development, as well as various other vehicles depending on the businesses that eventually occupy the development.

It is our understanding that the RM of Corman Park has a bylaw requirement for landscaping with regards to a buffer between an existing property and a new development. We understand that a reasonable buffer would consist of two rows of coniferous trees (minimum 8 feet tall), which are irrigated by Falcon Holdings Ltd. to ensure survival. Due to there being a lot of dust and thistle in our yard from the land work done to date on the Falcon Holding Ltd. quarter of land, a berm the height equivalent to those in Saskatoon, constructed in the earlier stages of development would help reduce the dust and noise during construction work that is being done on the 8 to 48 proposed parcels, and provide a visual screen.

The berm and trees would help minimize the light pollution, noise pollution and eyesore views affecting the use and enjoyment of the owners of their existing property. Light pollution is a serious concern and must be minimized with no lights pointing directly toward any of the existing properties, and that the lights not exceed the general height of the buffer.

7. **SAFETY OF PERSONS AND PROPERTY: Due to the frequent break-ins taking place at businesses in the area, the business park next to the existing acreage puts the property and owners at risk, therefore a chain link fence surrounding the development, is necessary to inhibit crime and protect the adjacent property from access through the development.**

The buffer also needs to include a six foot chain link fence with barbed wire across the top to surround the property of Mark and Anne Summach and where development is visible from the roadway, due to the regular and frequent break-ins and vandalism that are taking place in the area, including the businesses of Full Line Ag, John Deere, Liquid Waste Disposal Facility, other businesses in the Biz Hub, G.E. Environmental, and the old Auction Mart buildings which were stripped of copper wire throughout the building. This will help to not transfer this problem to the private property already in existence, and will help preserve property values. This proposed buffer of a berm and two rows of trees, including a 5-metre fire break, meets the requirement for a landscaping plan for an industrial park.

8. **RECOURSE AND LAND USE CONFLICTS: We have serious concerns about land use conflicts.**

It must be noted that these are not just properties – these are our homes, and they are in settings that we chose which are Agricultural – one house per 80 acres as specified by the P4G. There is no gain to existing property owners that these developments take place. Quite the contrary – we are losing enjoyment and value of our homes. Who will be responsible for monitoring and assuring that the development is done correctly?

We wish to be apprised of all feedback, including: What is the feedback from the Ministry of Highways? What is the feedback from the Saskatoon Airport Authority? What is the feedback from the P4G of Corman Park? What is the feedback from the P4G? We appreciate being kept apprised of the feedback coming from all these sources, as well as from other property owners, including businesses in the area. QMP experienced extremely wet conditions during the last wet years. How can the concerns of all property owners be addressed in a cohesive way to mitigate the concerns we have raised?

We understand that Falcon Holdings Ltd. plans to sell the land, but we want our concerns addressed now, which we understand is an obligation of Falcon Holdings Ltd. It is very time consuming for all property owners in the area to deal with a new purchaser or multiple purchasers, therefore addressing these concerns now will save time and prevent problems in the future. By addressing this now with this CDR, we prevent future problems for all parties involved, and so future purchasers are aware of and can be held accountable to these standards.

9. **PROPERTY VALUES: We have concerns about depreciating property values caused by being adjacent to a business park and all the problems it causes existing property owners, including water issues.**

What recourse do we have if any of these concerns are not addressed? Can a lien be put against the property regarding damage that the current property owners incur? Can the developer indemnify the current property owners so they do not suffer financial loss due to damage as a result of theft, flooding, water quality, enjoyment of property, etc and reduction in property values due to this development?

We acknowledge that you want to make money on your investment, but under no conditions should that be at the expense of the existing property owners. If problems arise during development, current property owners should not suffer in any way.

We also reserve the right to raise other concerns and questions as they arise. With the development involving a number of operators, new purchasers, etc, who ultimately will be holding all these involved parties to the standard of the CDR? Will this involve the Water Security Agency, the RM of Corman Park, the P4G, and others? Who will be legally responsible for any negative effects on existing properties?

To ensure existing property owners do not suffer a loss due to this development, we request that some form of the following statements be included in an agreement with Falcon Holdings Ltd.:

1. Falcon Holdings Ltd. agrees to indemnify and save harmless existing property Owners with regards to financial loss caused by damage as a result of the development of Korpan Industrial Park.
2. In event of a breach of this Agreement by any party hereto the other or others shall be entitled to institute proceedings for full and adequate relief from the consequences of such breach. The unsuccessful party in any event shall pay reasonable legal fees on a solicitor-client basis to the successful party.
3. Falcon Holdings Ltd. acknowledges that the existing Owners of existing properties shall have the right to register an interest on the Lands of Falcon Holdings Ltd. in order to protect the Owners' interests with respect to the development. Any interest registered by the existing Owners shall not be challenged or discharged as it relates to the Lands.
4. This agreement shall remain in force until the development is completed and is in operation for a period of five years.
5. The signing of any agreement does not inhibit the ability of the Owners to raise concerns to the RM, P4G, WSA, Ministry of Environment, Saskatoon Airport Authority, Ministry of Highways and any other provincial agency with jurisdiction.

We thank you for the opportunity to raise our concerns and address our questions, and look forward to the results of the Comprehensive Drainage Study to be carried out in the area. We will notify you of other concerns as they arise.

Mark and Anne Summach

Ken and Mary Burkevitch

Ben and Lois Machnee

Mike Pawluski

From: Meinert, Geoffrey HI <Geoffrey.Meinert@gov.sk.ca>
Sent: Wednesday, June 26, 2019 4:14 PM
To: Mike Pawluski
Subject: RE: Falcon Holdings - Record of Meeting - 20144416.01.A.04.00

Categories: AE FILED EMAIL

Mike,

That was an accurate description of the discussions.

Thanks,

Geoff

From: Mike Pawluski <pawluskim@ae.ca>
Sent: Wednesday, June 26, 2019 3:27 PM
To: Meinert, Geoffrey HI <Geoffrey.Meinert@gov.sk.ca>
Subject: Falcon Holdings - Record of Meeting

Good afternoon Geoffrey,

Thank you for taking the time this morning to meet me regarding our clients property. I found the meeting very useful and informative in regards to our project.

I have put together a brief record of meeting with what we discussed this morning. Can you please review the record of meeting and just send me a email response back if you agree with my representation of our meeting or let me know if you think I have misinterpreted something from the meeting.

Thanks,

Mike Pawluski, RPP
Project Planner
Associated Engineering (Sask.) Ltd.
1 - 2225 Northridge Drive, Saskatoon, SK S7L 6X6
Tel: 306.653.4969

You may unsubscribe from Associated's electronic communications at any time.

From:	Rumpel, Dave (Fire)
To:	Mike Pawluski
Subject:	FW: Servicing Capability for Proposed Development
Date:	Tuesday, June 24, 2014 3:12:42 PM
Attachments:	image001.gif image002.gif image003.gif image004.gif image005.gif option3_20140611.pdf

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Mr. Pawluski

This email confirms that we provide fire protection to this particular property in accordance with our service agreement with the RM of Corman Park. Our response is dependent on the availability of our resources. Contact the RM if you require more information on the terms of the agreement.

Dave Rumpel I tel 306.975.2520
Deputy Chief, Saskatoon Fire Department
125 Idywlyd Drive So, Saskatoon, Sk S7M 1L4
dave.rumpel@saskatoon.ca

From: Web E-mail - Saskatoon Fire Department
Sent: Tuesday, June 24, 2014 10:32 AM
To: Rumpel, Dave (Fire); Hackl, Morgan (Fire)
Subject: FW: Servicing Capability for Proposed Development

Barb Sasse | tel 306.975.2575
Administrative Assistant to the Fire Chief
Saskatoon Fire Department
125 Idylwyld Drive South | Saskatoon, SK S7M 1L4
barb.sasse@saskatoon.ca
www.saskatoon.ca

From: Mike Pawluski [mailto:pawluskim@ae.ca]
Sent: Monday, June 23, 2014 2:00 PM
To: Web E-mail - Saskatoon Fire Department
Subject: Servicing Capability for Proposed Development

Hello,

We represent a client who has asked us to complete a Comprehensive Development Review (CDR) for the RM of Corman Park. One of the requirements for the CDR is consultation with protective service agencies to confirm they have the capability/capacity to service the proposed development.

Our development is located on the SE 25-37-6-W3M (adjacent to the west side of the Yellowhead Industrial Park) which falls within the Corman Park – Saskatoon Planning District. This location lies within the Saskatoon Fire District.

Can you pleases confirm if the Saskatoon Fire Department has the capability/capacity to service our clients proposed development within this location?

Attached is one of the concept plan designs for the proposed development.

If you have any questions or comments please feel free to contact us.

Regards,

Mike Pawluski
Project Planner

1 - 2225 Northridge Drive
Saskatoon, SK, Canada S7L 6X6
Tel: 306.653.4969
Fax: 306.242.4904
www.ae.ca

From: Sgt J. Garnet
To: Mike Pawluski
Subject: RE: Servicing Capability for Proposed Industrial Development
Date: Monday, July 7, 2014 2:40:19 PM
Attachments: image001.gif
image002.gif
image003.gif
image004.gif
image005.gif

Good Afternoon Mike,

The RM of Corman Park has two levels of policing. Corman Park, like all RM's on the province, pays for the policing of the RCMP and then the services of Corman Park Police. The RCMP are primarily responsible for criminal matters, alarm response, accident with injuries and most major events. The mandate of the Corman Park Police is to enforce all provincial statutes, municipal bylaws and assist the RCMP and other police agencies within our jurisdiction where possible.

As the Chief of Corman Park Police I do not see an appreciable increase in our work load as a result of your proposed development - so the answer to your question is "yes - we have the capacity to service your clients". I would anticipate that with our primary mandate being the enforcement of provincial statute and municipal bylaws we would see an increase in traffic and perhaps require increased violator enforcement - that would likely fall within our "day to day" patrols. We would also be involved in EMO should the need arise.

The RCMP could be asked the same question to determine to determine if they anticipate an increase in alarm response, criminal activity response, after hours patrols or emergency services.

thank you

John Garnet 30
Corman Park Police

From: Corman Park Police Service
Sent: Wednesday, June 25, 2014 9:59 AM
To: Sgt J. Garnet
Subject: FW: Servicing Capability for Proposed Industrial Development

From: Mike Pawluski [mailto:pawluskim@ae.ca]
Sent: June-25-14 9:56 AM
To: Corman Park Police Service
Subject: Servicing Capability for Proposed Industrial Development

Good Morning,

We represent a client who has asked us to complete a Comprehensive Development Review (CDR) for the RM of Corman Park. One of the requirements for the CDR is consultation with protective service agencies to confirm they have the capability/capacity to service the proposed development. Our development is located on the NE 10-36-4-W3M along Highway No. 394 (the Patience Lake Road).

Can you pleases confirm if the Corman Park Police Service has the capability/capacity to service our clients proposed development within this location?

Attached is one of the concept plan designs for the proposed development.

If you have any questions or comments please feel free to contact us.

Regards,

Mike Pawluski
Project Planner

1 - 2225 Northridge Drive
Saskatoon, SK, Canada S7L 6X6
Tel: 306.653.4969
Fax: 306.242.4904
www.ae.ca

From:	Clive Stromberg
To:	Mike Pawluski
Cc:	Richard Jasieniuk
Subject:	RE: Proposed Development within the Aerodrome Reference Point
Date:	Thursday, June 26, 2014 10:42:19 AM
Attachments:	image001.gif image002.gif image003.gif image004.gif image005.gif

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Mike,

The proposed subdivision as described below will meet the intent of both the existing and proposed Saskatoon Airport Zoning Regulations.

You should be aware that although not in force yet, the proposed regulations allow for the development of an open water reservior providing the owner or occupier

a) takes all reasonable measures to prevent the attraction of birds that create a hazard to aviation safety;
b) ensures that the open water storage reservoir is designed and constructed in accordance with applicable municipal specifications; and
c) files the design of the open water storage reservoir and its location plan with the Saskatoon Airport Authority.

For your information please note that the existing reguations do not support land development within 4km of the airport which is to be used for the disposal of waste that is edible by or attractive to birds.

If you have any further questions please give me a call.

Thanks

Clive Stromberg
Environment/Compliance
Public Safety and Risk
Saskatoon Airport Authority

Ph 306 975 6465
Fx 306 975 4233
email clivestromberg@yxe.ca

From: Mike Pawluski [mailto:pawluskim@ae.ca]
Sent: June 16, 2014 2:12 PM
To: Clive Stromberg
Subject: Proposed Development within the Aerodrome Reference Point

Hi Clive,

As discussed earlier today, we represent a client who is planning an industrial subdivision on the SE 25-37-6-W3M which abuts the Yellowhead Industrial Park on the west. This proposed subdivision lies within the 4 kilometre aerodrome reference point which requires our clients site to comply with the Airport Zoning Regulations.

Attached you will find a concept plan drawing which illustrates one of the proposed lot layouts and the set location for a storm water management facility (labelled as the 4.9 acre land area as environmental reserve). It is important to note the storm water management facility is proposed to be designed as a dry pond where water may be stored for no longer than a 24hr period.

Could you please review the concept plan drawing and confirm if the storm water management facility is acceptable or confirm if there are any procedures or implications we must consider. I would like to have a follow- up conversation with you next Wednesday June 25 if you are available.

Regards,

Mike Pawluski
Project Planner

1 - 2225 Northridge Drive
Saskatoon, SK, Canada S7L 6X6
Tel: 306.653.4969
Fax: 306.242.4904
www.ae.ca

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

RECORD OF MEETING

Date:	June 26, 2019	File No.:	2014-4416.01.A.04
Time:	10:00 am - 10:20 am	Location:	Ministry of Highways and Infrastructures (MHI) Office
Client:	Falcon Holdings Ltd.	Project Name:	Korpan Industrial Park Phase 2
Subject:	Saskatoon Freeway	Project Number:	2014-4416
Present:	Mike Pawluski – AE	Geoffrey Meinert – MHI	
Distribution:	Those Present		

This Record of Meeting is considered to be complete and correct. Please advise the writer within one week of any errors or omissions, otherwise this Record of Meeting will be considered to be an accurate record of the discussions

Action by	Discussion:	
Mike	1	IMPACTS ON FALCON HOLDINGS PROPERTY

Its have been a long time since AE has met with the MHI regarding the Falcon Holdings property southwest of Highway 16 and the impacts of the future Saskatoon Freeway. Ultimately, AE wanted to meet to make sure the latest plan is not offensive to what the MHI has planned for the interchange at the Saskatoon Freeway and Highway 16 intersection considering there is currently an 800 m control radius which infringes on the Falcon Holdings property.

Geoffrey	2	PRESENTATION OF FIVE PROPOSED IDEA / OPTION INTERCHANGES

Geoffrey presented various options the MHI are currently working through to show Mike how the various styles of interchanges would work and where Falcon Holdings property has the potential to be impacted in the future. Ultimately, the northwest corner will be impacted 100 %, the MHI just cannot confirm what that looks like now. The northeast corner may also be impacted subject to the selection of an interchange layout.

Geoffrey also stated the interchange may need to slide out and take a bit more land as a worse case scenario which may impact the very north end of the Falcon Holdings property. Geoffrey had no idea what this would look like now but did state if that was the case, it would be to accommodate a bypass lane.

Mike	3	THE PLAN FOR THE LOTS

Mike provided a brief overview of the lots and Falcon Holdings intentions of developing 8 large lots which would transition in the future to the City of Saskatoon and be further subdivided for smaller size industrial lots. Based on what was represented, Geoffrey did not have any objections to the plan as represented but confirmed the MHI still has some work to do regarding the impacts to the various landowners. However, Falcon Holdings property is anticipated to be impacted 1 of 3 ways as follows:

June 26, 2019

Falcon Holdings Ltd.

Action by	Discussion:

- Worst case scenario would be losing some land on the full extent of the north end (based on the latest land use plan 1 – 2 city lots deep) to accommodate the Saskatoon Freeway and bypass lanes for the future interchange;
- 2nd best case would be both the northwest and northeast corners are impacted slightly by the Saskatoon Freeway and future interchange; and
- Best case scenario is the northwest corner is only required for the Saskatoon Freeway.

Both 4 NEXT STEPS

Geoffrey had mentioned the MHI is planning on having five interchange options prepared to share with the public towards the end of September. When that happens, the MHI will contact the various landowners to share what the different options look like and how they impact their land holdings including Falcon Holdings. Geoffrey confirmed the landowners will be consulted in advance of sharing the interchange footprints at a public open house.

Mike asked Geoffrey to keep AE informed of when the MHI has the interchanges decided upon and when the open house events are planned for.

Rural Municipality of Corman Park No. 344

Discretionary Use Comment Sheet

"Discretionary uses" are uses of land that require the approval of the R.M. of Corman Park Council in accordance with the *Planning and Development Act, 2007*. As part of the discretionary use application process property owners within 1.6 km (1 mile) of the proposed use can submit written comments. All comments received by the deadline become public record and are considered by the R.M. Council in an open Council meeting. The applicant will know your views. As an alternative or supplement to a written submission you may attend the Council meeting to express your views directly. Please complete this comment form and return it to the ***R.M. Office at 111 Pinehouse Drive, Saskatoon, SK S7K 5W1 (or by fax 306-242-6965).***

Description of Proposed Discretionary Use:

Name: **Associated Engineering for Korpan Tractor (Contact: Mike Pawluski, 306-653-4969)**

Legal Land Description of Property: **Parcel 'C' SE 25-37-6-W3**

Description of Proposed Use:

Application has been made for a Discretionary Use – Agricultural Support Service for Korpan Tractor. The applicant supplies heavy equipment solutions for agricultural and construction industries which may involve equipment parts, rentals, sales and servicing.

Hours of operation are as follows:

- Monday to Friday from 8:00 am to 5:00 pm; and
- Saturdays from 9:00 am to 12:00 pm.

Traffic to the site is estimated at 80-90 vehicles per day, and is broken down as follows:

- Approximately 15 heavy haul trucks delivering parts and machinery to and from site;
- Approximately 20 – 30 customer visits per day, mostly comprising of passenger vehicles; and
- Approximately 30 – 40 employee vehicles.

Access to the site will be from Range Road 3060 and Auction Mart Road which currently service the Yellowhead Industrial Park.

Deadline for comments: **Tuesday September 15, 2015**

Comments on Proposed Discretionary Use: (by the Landowner)

The Applicant's proposal will utilize roads which are being built by BizHub Developments Ltd. or to which BizHub has contributed (Range Road 3060 & Auction Mart Rd/ 71st Street). To what extent will BizHub be compensated for the Applicant's use of the aforementioned roadways? Has the Applicant completed a Traffic Impact Assessment?

☐ Have no concerns ☒ Have concerns Please Contact Me: ☒ Yes ☐ No

I am willing to discuss my views with the applicant before the Council meeting. ☒ Yes ☐ No

Name(s): (please print) Kirk Cherry Phone [redacted] Cell: _____

Signature(s): K Cherry Legal land description: Sec 19-37-5-W3

Administration Contact: Kelby Unseth – kunseth@rmcormanpark.ca – 306-978-6450

Rural Municipality of Corman Park No. 344

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Deadline for comments: **Tuesday September 15, 2015**

RECEIVED SEP 15 2015

Comments on Proposed Discretionary Use: (by the Landowner)

We are opposed to a large company like Korpan moving in to the neighbourhood. The level of noise and traffic proposed here will clearly disrupt what little peace we still have. The road is already dealing with alot more traffic and slow moving large equipment will increase the safety hazard by our road. There is no shortage of other commercial properties in the BIZ-HUB or across (east) of #16 on 71st where there are no longer any residential acreages. For this reason I see no need for the RM council to approve this proposed use of the land. They (Korpan) can still be in this commercial

area but not near any residence. We do not have problems with small businesses in the area where the quiet (what's left) and traffic flow are not disturbed. We strongly request that the RM NOT approve this application!

☐ Have no concerns ☒ Have concerns Please Contact Me: ☐ Yes ☐ No

I am willing to discuss my views with the applicant before the Council meeting. ☒ Yes ☐ No

Name(s): (please print) Ben + Lois Machnee Phone: [redacted]

Signature(s): Lois Machnee Legal land description: Part of SW 25-37-6 W of 3rd

Administration Contact: Kelby Unseth – kunseth@rmcormanpark.ca – 306-978-6450

Rural Municipality of Corman Park No. 344

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Deadline for comments: **Tuesday September 15, 2015**

Comments on Proposed Discretionary Use: (by the Landowner) RECEIVED SEP 0 2 2015

Not interested in the extra traffic
Get this area rezoned as commercial and I'm all in.

☐ Have no concerns ☑ Have concerns Please Contact Me: ☐ Yes ☑ No

I am willing to discuss my views with the applicant before the Council meeting. ☐ Yes ☑ No

Name(s): (please print) KEN + MARY BURKEVITCH Phone [redacted] Cell: _____

Signature(s): _____ Legal land description: LSD 03 06 SEC 25 TWP. 37 RNG 6 MER W3

Administration Contact: Kelby Unseth – kunseth@rmcormanpark.ca – 306-978-6450

Kelby Unseth

RM OF CORMAN PARK #344

Rural Municipality of Corman Park No. 344

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- Approximately 30 – 40 employee vehicles.

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Deadline for comments: **Tuesday September 15, 2015**

Comments on Proposed Discretionary Use: (by the Landowner)

I, Anne Summach and my husband, Mark Summach, are opposed to this building site taking place. Please see the attached letter, outlining our concerns.

☐ Have no concerns ☒ Have concerns Please Contact Me: ☒ Yes ☐ No

I am willing to discuss my views with the applicant before the Council meeting. ☒ Yes ☐ No

Name(s): (please print) Mark Percy Summach Elizabeth Anne Summach Phone: [redacted]

Signature(s): _____ Legal land description: Plan 101346207 A SE 25 37 6 W3

Administration Contact: Kelby Unseth – kunseth@rmcormanpark.ca – 306-978-6450

Mark Summach and Anne Summach
Comp 25 Site 207 RR 2
Saskatoon SK S7K 3J5
Plan: 101346207, A SE 24 37 6 W3

September 28, 2015

Attention:
Adam Tittemore, Administrator of RM of Corman Park
Kelby Unseth, Planner and Administration Contact
RM of Corman Park Office
111 Pinehouse Drive
Saskatoon SK S7K 5W1

Dear Adam and Kelby:

We wish to address the Discretionary Use – Agricultural Support Service proposal distributed by the RM of Corman Park on behalf of Korpan Tractor. We have serious concerns that a proposal of this nature is even being considered by the RM of Corman Park and the City of Saskatoon at this time, when there are so many obvious deficiencies in the area that have not been addressed, which would be compounded by a building site/153 acre property development of this nature to the detriment – including life threatening – to so many RM of Corman Park residents and commuters from surrounding areas.

1. **Increased Drainage and Flooding Problems**

   Drainage is a huge problem along Township Road 374/Auction Mart Road, and as well on the other side of Highway 16 on 71st Street, requiring constant use of pumps to prevent flooding of homes, buildings and property. Alteration in drainage, landscape or other natural conditions is a major concern and the "Corman Park – Saskatoon Planning District Official Community Plan" states that, "Flood prone lands will generally be limited to agricultural, park and open space recreational uses, and requires consultation with the Water Security Agency (formerly the Saskatchewan Watershed Authority).

   The "Corman Park – Saskatoon Planning District Official Community Plan" also states that floodplain policies shall not be limited to the areas identified by the attached maps and may be applied to areas of Corman Park deemed to be susceptible to regular flooding based upon historical data, high water marks, photographs of past flooding and in consultation with the Water Security Agency. (10.2 b.1-2)

   The document also states that the subdivision of land for non-agricultural purposes within a flood fringe shall be limited to the creation of up to two building sites per quarter section. (10.2 – c.1), and that applicants for the subdivision of flood prone lands must enter into an agreement with Corman Park acknowledging the terms of the approval including requirements for flood proofing. (10.2 – a.7-8)

There are several Flood Fringe Construction Policies included in “10.2 d.” of the “Corman Park – Saskatoon Planning District Official Community Plan”, including that a development will not divert or obstruct the flow of water, and everything associated with it shall require flood proofing, and will require a 2-stage permit. (10.2d)

Is the RM of Corman Park and/or City of Saskatoon financially responsible for resulting flooding that takes place on surrounding acreages due to their approval of a building site/153 acre property development such as this, before the drainage problem in the area is addressed? We understand that a complaint can be filed with the Water Security Agency which we will do, to ensure that the interests of all those involved are taken into consideration, and given the authority of the Water Security Agency over water in Saskatchewan, that a legally binding solution can be reached.

Is the Administrator and Staff of the RM of Corman Park responsible for ensuring that this problem is effectively addressed before building in this area occurs? Does the RM of Corman Park oversee the plans and construction and final efficacy of the drainage solutions that are presented and ultimately used? If this building site/153 acre property development is built without addressing the existing drainage problems, the surrounding acreages will experience increased flooding. Is the RM of Corman Park responsible for problems experienced by their current residents due to this going forward when they have not addressed current problems?

2. Retention Pond to be Built Around Our Acreage and All Drainage Directed to It

In the attached report, on Page A-1: Appendix A – Concept Plan, is a map (19th page of the document), that provides an outline of the proposed development. In the southwest corner of the map is an “empty rectangle” with a Retention Pond surrounding it. In no place in the report does it acknowledge that this “empty rectangle” is an acreage owned by Mark and Anne Summach which has a house, detached garage, two sheds and a dugout on site. The existence of a retention pond around a property greatly reduces its value, and a retention pond surrounding our property will add to the already high water table and our yard will be under water. It states that the retention pond will be pumped into the ditch every 24 hours. From our yard, water flows to the west, to the other acreages along Auction Mart Road, and floods them. Water must be at a very high level before any water flows in the ditch toward Highway 16.

We also want to have a clear understanding of how Korpan Tractor proposes to not directly or indirectly affect our current site drainage, and the drainage of our three neighbours. Does the RM of Corman Park have a better proposal for our ditch drainage situation? We have had issues since our possession almost a decade ago. The current ditch cannot handle a 1:10 year rain, so surmising that a 1:100 year rain will be gone in 24 hours is not even remotely possible. We request to see the supporting research for this.

And to have a retention pond around our acreage is completely unacceptable. Ray Korpan approached us in the spring/summer of 2014, and told us that he was going to be building around us, that it would be dusty, dirty and noisy, so we should move, but implied that he was not willing to adequately compensate us for our acreage. The retention pond is an act of a bully, who is trying to drop the value of our property and force us to sell. There is no reason that this cannot be handled in a civil manner and a solution negotiated that is fair to all parties.

3. Specific Concerns/Errors in the Report

We have a number of concerns with the report including the following:

1. The report states that it is a draft and that the findings were "at the time of the report", and therefore they are not responsible for errors or omissions. If they are not accountable, then who is?

2. Item 9 on pages 7 and 8 indicate that the "retention pond" must be drained within 24 hrs of rain as per code by the Airport Authority. This is similar to the Biz Hub retention pond, which is never empty, and it is my understanding that they cannot keep up with emptying it, plus the City of Saskatoon, does not want the water pumped further. Where does their plan propose "dumping" all this drainage water from a 153 acre parcel at the rate of 1:100 year flood? And in 24 hours? The ditch as it exists currently, cannot handle 1:10 rain so certainly cannot be added to in any way or all acreages to the west will be flooded.

3. Item 7 on page 7 is not correct. Saskatchewan Water does not operate the water line. It is operated by the Yellowhead Industrial Water Corporation. Yellowhead Industrial Water Corporation owns the line from the building by SaskTel Centre (formerly Sask Place), to the pump house at the corner of Highway 16 and Auction Mart Road, and to all the curb stops they supply.

4. Item 11 on Page 4 refers to Fire Protective Services but it is our understanding that it falls under the rural fire protection code, not the city code, so MuniCode Services Ltd must assess the fire protection services, and they will probably require a sprinkler system with a 40,000 sq ft building, and therefore they will require back up water for the sprinkler system which is a minimum of 30,000 gallons.

5. We wish to go over in detail with you, items 14 and 15 on pages 6-12 in regard to the prerequisites and zoning requirements of the RM of Corman Park, to make sure that something is not overlooked or not followed.

6. As mentioned above, we want to have a clear understanding of how they propose to not directly or indirectly affect our current site drainage, and the drainage of our three neighbours when the current ditch cannot handle a 1:10 year rain, including providing us access to the research backing this up.

4. Intersection of Highway 16 and Township Road 374

The intersection of Highway 16 and Township Road 374 is one of the most dangerous corners in the RM of Corman Park and within the limits of the City of Saskatoon. The corner is not at a right angle, resulting in awkward access to the highway, making it difficult to judge and navigate the double-laned highway, whether you are trying to cross the highway or pull into oncoming highway traffic. This, compounded with the sheer volume of traffic that already exists in the area is a recipe for disaster. There are accidents at this crossing on a weekly basis. An unacceptable number of people have experienced accidents, sustained temporary or permanent injuries, or have died in these accidents. To consider adding more traffic of the nature of slow-moving, vision-blocking, heavy equipment in the form of rock trucks, wiggle wagons, graders, etc to this already unacceptable

crossing, in a province that has high populations of elderly people and new immigrants, who are not as familiar or confident with the rules of the road, minimally requires addressing the foundation of the problem, and not adding to the often life-threatening conditions in the meantime. This intersection at minimum needs to be addressed before any more traffic is added. It is my understanding that employers and employees in the area have or are considering approaching Occupational Health & Safety about this intersection being a safety hazard for employees and employers to get to and from their workplaces.

In addition to the danger this intersection poses for truckers, commuters and the people who live in the area, it is costing businesses, insurance companies and the province a fortune in healthcare costs, vehicle damage and reputation. The City of Saskatoon has dropped significantly in its ratings as a preferred and safe place to live, and has failed to provide commuters with safe, convenient or even available public transportation options to most industrial areas of the city where people work, particularly in more remote areas such as this. We have even had extremely upset commuters drive into our yard, looking for a vehicle that has almost caused an accident at the intersection of Highway 16 and Township Road 374, and we have talked to new immigrants who say it is impossible to function in the City of Saskatoon without a vehicle in order to get to their workplaces in many areas of the city, especially if they are working longer shifts.

The intentions of the owner(s) of this land (Satinder Waranch Et Al/Korpan Tractor), according to this report, is to add multiple businesses to the approximately 153 acres, again requiring that extensive work be done prior to this even being a consideration, to make travel in the area safe once again.

Korpan Tractor is not without options. A heavy equipment machinery business such as this, is very well suited to be part of the business hub that already exists on Highway 16, further north on Highway 16, or between the already designated business area that exists between Highway 16 and Idylwyld Drive along 71st Street, which the City of Saskatoon is currently developing, until the existing problems in the area can be addressed.

5. Guise of an "Agricultural Support Service"

A search of the website of Korpan Tractor for the word "agriculture" comes up with the message:

"Nothing matched your search criteria. Please search again."

No where on the website of Korpan Tractor does the word "agriculture" appear, nor is agricultural equipment included. In contrast, if you go on the website of the business, "Moody's", they have a clearly defined Agricultural Equipment section including combines, swathers, headers, tractors, seed drills, sprayers, etc. They also have a separate "Construction Equipment" section, that includes the same type of equipment as Korpan Tractor, but Korpan Tractor does not have a section of Agricultural Equipment, and therefore does not qualify as an "Agricultural Support Service".
I also understand that the report that I have included with this letter would not necessarily be included with the Discretionary Use Application for the 20 acre proposal, therefore I request that the full Korpan Tractor Discretionary Use Application Report consisting of 138 pages, be included with my letter when it is given to councillors or used in any reporting about this matter.

6. Bylaw No. 26/13 – The Nuisance Abatement Bylaw

As mentioned before, Ray Korpan approached us in the spring/summer of 2014, and told us that he was going to be building around us, that it would be dusty, dirty and noisy, so we should move, but implied that he was not willing to adequately compensate us for our acreage. He himself admitted that this business or businesses would break Bylaw No. 26/13 – The Nuisance Abatement Bylaw, seriously affecting our enjoyment of our property.

There are existing acreages along Township Road 374. Bylaw No. 26/13 states: "The purpose of this Bylaw is to provide for the abatement of nuisances, including property, activities, or things that adversely affect: a) the safety, health or welfare of people in the neighbourhood; b) people's use and enjoyment of their property; or c) the amenity of a neighbourhood. It is completely unacceptable to locate a business of this size next to an existing residence.

Again, Korpan Tractor has options to relocate elsewhere, to an area that is more suitable for their operation and does not adversely affect the safety, health and welfare, the use and enjoyment of property, and the amenity of the existing acreage owners and community, or negotiate a solution(s) that work for everyone. Asking existing acreage owners to accommodate a business of heavy equipment next to their current dwelling that would involve excessive dust, diesel fumes, noise, safety hazards and environmental damage is unacceptable.

The "Corman Park – Saskatoon Planning District Official Community Plan" states that no amendments to the Future Land Use Map will be considered unless a Concept Plan for the area has been adopted by the municipal Councils, and any amendment to the Future Land Use Map will be consistent with the adopted Concept Plans (exception noted in 12.2 – 3-4). Also a Zoning Bylaw must be adopted by Council in conjunction with the Official Community Plan to ensure that land-use conflicts are avoided, that development will meet minimum standards to maintain the amenity of Corman Park, and be consistent with physical characteristics of the land (12.5 – 1).

I understand that the enforcement of this bylaw is the responsibility of the Administrator for the RM of Corman Park No. 344, and that the Municipality may give notice of an existing nuisance by registering an interest against the title to the land, and as well that civil action in court can be taken, and that fines in the case of a corporation can be as much as $25,000, and if there is a continuing offence, daily fines can be issued of $2,500 per day.

7. Environmental Hazard

Korpan Tractor also poses an environmental hazard due to contamination of the soil with grease, oil and diesel fuel, and contamination of the air quality with diesel fumes, smoke and other odors, and also noise, etc.

8. Other Questions and Concerns

The land is kitty-corner to Moosomin First Nation land. **Have the First Nations and Metis Communities been consulted** about this proposed development, considering the potential for contamination of soil and air quality? There is other First Nations land in the area that is environmentally protected. What is different about this situation and have the Moosomin First Nation people been contacted about this proposal?

At what point does the **City of Saskatoon landlock** itself in certain directions, preventing future expansion and appropriate use of land? To focus the building of businesses on Highway 16, allows flexibility in the future for both the RM of Corman Park and the City of Saskatoon.

Other points that I wish to discuss in more detail with you and other governing bodies include the following from the "Corman Park – Saskatoon Planning District Official Community Plan":

- there must be **adequate compensation** (2.2 – 4.f)
- it is policy to **keep better agricultural land in production until needed for efficient urban expansion** (2.2 – 5)
- there is **no indication of "Future Industrial Areas" on the "Future Land Use Map"** included in this document
- it is **policy to minimize land use conflicts** (3.0 – 4)
- it is **policy to protect ecological systems** (3.0 – 5)
- it would **require amendment of the Future Land Use Map, a Concept Plan, and a Comprehensive Development Review** (3.1)
- it **does not provide a significant economic benefit to the Saskatoon Region** (3.1 – 3.a)
- it states that **industrial use of land is to be limited to industrial parks** (3.1 – 4)
- they **must provide adequate buffering from non industrial use of land through the use of distance separation, landscaping, providing a buffer (visual and noise) from potentially impacted properties** (3.1 – 6; 3.8 – 1.d.; 3.8 – 2.d)
- **industrial development is not permitted within 1 km of country residential development** (3.1 – 7)
- **the Comprehensive Development Review at minimum shall encompass all adjacent properties** (3.2)
- **Council may apply a holding provision on a property to restrict the timing and conditions of development** (12.5 – 4)
- **Council may request that Servicing Agreements provide assurances to performance** (12.5 – 5)
- **3.8 – 3.b: …land uses and processes that may potentially create land use conflicts with regard to noise, vibration, dust, smoke (diesel fumes), aesthetics or odour**

- Does 4.4 – 2 and 4.4 – 4 regarding **Agricultural Diversification Policies apply?**

- **Regarding Environmental Stewardship Policies**, does 4.5-2 apply, such as with diesel fuel and oil getting into the water? There are cattle across the road drinking from sloughs, and an environmental specialist confirmed that it is definitely a risk.

- 4.0 – 1: **minimize land use conflict**

- 4.2 – 1: **minimum unit of land is 80 acres**?

- 4.2 – 2: **Zoning Bylaw** – land use compatability, agricultural viability and ***enjoyment of property***

- 4.5 – 2: The effect they will have on drainage.

- 4.6 – 1.b and 1.d: Does a **maximum of 2 building sites per quarter section** apply?

- 4.6 – 2: Will this **limit him for now from building more than one business on the quarter section**? The land would first have to be **rezoned**?

- 5.3 – 5.d: **No dwelling can be located within 1 km of an industrial park** – can this apply to us?

- 5.4: It is on **agriculturally viable land**.

- 5.10 – 1.a-e: Does this section apply regarding **subdividing**?

- 7.0: Does this section on **Commercial Development** apply as well?

- 8.2 – 2: With regards to **General Transportation Policies** and a road maintenance agreement.

- 8.2 – 3: **Road safety** is definitely an issue

- 9.3 – 8: Bylaw 49/13 Approved January 24, 2014

We would also like it noted that there were neighbours in the area who did not receive the paperwork and therefore have not had a chance to respond by the date of September 15, 2015. I understand that you have sent paperwork to Baljit Natt [redacted]. Thank you. We will provide you with additional information by October 14, 2015.

We appreciate your consideration of the above concerns and look forward to presenting further information about them at the RM of Corman Park Council Meeting on October 19, 2015. We look forward to finding a solution that meets the needs of everyone involved.

Sincerely,

_____

Mark Summach

_____

Anne Summach

APPENDIX B - PRELIMINARY GEOTECHNICAL REPORT

SNC·LAVALIN

DRAFT REPORT

GEOTECHNICAL INVESTIGATION PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT SITE – SE¼-25-37-6-W3M WEST OF SASKATOON, SASKATCHEWAN

Associated Engineering

SNC-LAVALIN INC.

March 5, 2015
DRAFT REPORT
Project No.: 626523

NOTICE TO READER

This report has been prepared and the work referred to in this report has been undertaken by SNC-Lavalin Inc. (SNC-Lavalin), for the exclusive use of Associated Engineering (the Client), who has been party to the development of the scope of work and understands its limitations. The methodology, findings, conclusions and recommendations in this report are based solely upon the scope of work and subject to the time and budgetary considerations described in the proposal and/or contract pursuant to which this report was issued. Any use, reliance on, or decision made by a third party based on this report is the sole responsibility of such third party. SNC-Lavalin accepts no liability or responsibility for any damages that may be suffered or incurred by any third party as a result of the use of, reliance on, or any decision made based on this report.

The findings, conclusions and recommendations in this report (i) have been developed in a manner consistent with the level of skill normally exercised by professionals currently practicing under similar conditions in the area, and (ii) reflect SNC-Lavalin's best judgment based on information available at the time of preparation of this report. No other warranties, either expressed or implied, are made with respect to the professional services provided to Client or the findings, conclusions and recommendations contained in this report. The findings and conclusions contained in this report are valid only as of the date of this report and may be based, in part, upon information provided by others. If any of the information is inaccurate, new information is discovered or project parameters change, modifications to this report may be necessary.

This report must be read as a whole, as sections taken out of context may be misleading. If discrepancies occur between the preliminary (draft) and final version of this report, it is the final version that takes precedence. Nothing in this report is intended to constitute or provide a legal opinion.

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1 INTRODUCTION

This report presents the results of the geotechnical investigation conducted by SNC-Lavalin for the proposed Falcon Holdings Industrial Development to be constructed west of Saskatoon, Saskatchewan within SE¼-25-37-6-W3M. The geotechnical investigation included the drilling program, field and laboratory soil testing and a report that provides geotechnical recommendations for design and construction of the proposed development.

The scope of work for this report was presented in SNC-Lavalin Proposal 625361-015, dated 04 February 2015.

It is understood that the proposed industrial development area will encompass 150 acres of land. The proposed development will reportedly include 20 acres for a new Korpan Tractor site (immediate development), with the remaining 130 acres to be subdivided into smaller lots (4.3 to 6.2 acres) for proposed future development. It is anticipated that the proposed buildings will consist predominantly of at-grade structures with pile/grade beam foundation systems and grade-supported concrete floor slabs. It is also anticipated that parking/staging and roadway areas will be constructed as part of the development.

A comprehensive geotechnical investigation was undertaken to provide information required for detailed design of the proposed Korpan Tractor facility, while a preliminary geotechnical investigation was completed to facilitate municipal re-zoning and subdivision approval for the remainder of the site (site specific geotechnical investigations will be required for the design and construction of any proposed structures within the proposed future development area).

2 SITE LOCATION AND DESCRIPTION

The proposed development site is located within SE¼-25-37-6-W3M, west of Saskatoon, Saskatchewan. The site is located north of Auction Mart Road, west/south of Provincial Highway 16 and immediately adjacent to existing developments to the east. The site is currently utilized as farmland and is relatively flat-lying to gently undulating in topography. A residence is located at the extreme south-west corner of the proposed future development area. The topography was generally flat-lying and the site was snow covered at the time of drilling. A site plan showing the location of the proposed Korpan Tractor development area as well as the proposed future development area is shown as Figure I.1, Appendix I. A 'proposed highways control circle' has also been shown on the site plan to represent lands which are currently 'undetermined' in terms of potential future usage.

3 SCOPE OF WORK

The objective of the geotechnical investigation was to conduct a field investigation at the proposed development site and provide geotechnical recommendations to support design of the development. The following scope of work was completed:

- Field investigation for the proposed Korpan Tractor site consisting of:
  - Fourteen boreholes drilled to depths of 3.1 to 18.9 m below ground level (mbgl);
  - Three piezometers installed to depths of 3.1 to 15.5 mbgl;
  - Groundwater monitoring of piezometers;
  - Geotechnical field tests, logging of soils and collection of soil samples for laboratory testing;
- Field investigation for the proposed future development area site consisting of:
  - Four boreholes drilled to depths of 12.1 to 19.1 m below ground level (mbgl);
  - Four piezometers installed to depths of 11.8 to 15.2 mbgl;
  - Groundwater monitoring of piezometers;
  - Geotechnical field tests, logging of soils and collection of soil samples for laboratory testing;
- Laboratory testing of select soil samples obtained from borehole, including water contents, Atterberg limits, grain size distribution analysis; SaskHighways group index/soaked CBR determination and bulk unit weights;
- Preparation of a detailed report summarizing the field investigation and providing comprehensive geotechnical recommendations for development of the Korpan Tractor site; and,
- Preparation of a preliminary report summarizing the field investigation and providing preliminary geotechnical recommendations for development of the future development areas.

4 GEOTECHNICAL INVESTIGATION DETAILS

4.1 Drilling Investigation

The SNC-Lavalin field investigation was conducted between 11 and 14 February 2015. Mobile Augers and Research from Saskatoon, Saskatchewan utilized a truck-mounted M-10 drill rig equipped with continuous flight, solid stem augers to drill the boreholes.

A total of eighteen boreholes were drilled to depths of 3.1 to 19.1 mbgl. A site plan showing the location of the boreholes is presented as Figure I.1, Appendix I.

The borehole coordinates were determined using handheld GPS equipment. The relative elevation of the boreholes was determined using a laser level and a local site benchmark (top of plastic cap at the top of a metal post marking a high pressure gas line); a datum elevation of 100.00 m was assumed for the local site benchmark.

Disturbed soil samples were collected from the auger cuttings (grab samples) and from the split spoon sampler (SPT). All soil samples were transported to the SNC-Lavalin soil testing laboratory in Saskatoon, Saskatchewan. The soil samples were stored in a humidity-controlled room at the SNC-Lavalin laboratory to prevent drying prior to testing. Soil samples collected for each borehole are shown on the borehole logs in Appendix II.

Field testing included pocket penetrometer tests (PP's) conducted on all cohesive samples collected and SPT's conducted at selected depths. The results of field tests are presented on the borehole logs in Appendix II. Terms and Symbols used on the borehole logs are provided in Appendix II preceding the borehole logs.

All boreholes were backfilled with bentonite chips to the extent possible.

4.2 Geotechnical Laboratory Testing

Geotechnical laboratory tests were conducted on soil samples obtained from the boreholes. The laboratory analyses included water contents, grain size distribution analysis, Atterberg limits, SaskHighways group index/soaked CBR determination and bulk unit weights.

The detailed laboratory test results are provided in Appendix III. Select laboratory test results are also annotated on the borehole logs presented in Appendix II.

5 SUBSURFACE CONDITIONS

5.1 Soil Profile

5.1.1 Korpan Tractor Site (Boreholes 626523-02 to 15, inclusive)

The general soil profile consisted of a thin layer of organic topsoil overlying glacial till. Sand was encountered overlying the glacial till (to depths of about 0.4 to 2.5 mbgl) in boreholes 626523-07, 09, 13 and 14. Sand (Upper Floral Dalmeny Aquifer) was encountered underlying the glacial till below a depth of approximately 16.2 mbgl in borehole 626523-11. Inter/intra till sand deposits were encountered in all deep boreholes at various depths.

The glacial till was generally very stiff to hard, low plasticity and moist. The surficial sand deposits (where encountered) were typically loose to compact, moist (wet below a depth of about 1.5 mbgl in borehole 626523-14) and contained cobbles/boulders. The inter/intra till sand deposits were dense to very dense and saturated (groundwater seepage/sloughing zones). The Dalmeny Aquifer deposits were dense and saturated (severe groundwater seepage/sloughing conditions).

A summary of the (raw/uncorrected) SPT results conducted during the field investigation has been presented in Figure 5.1.

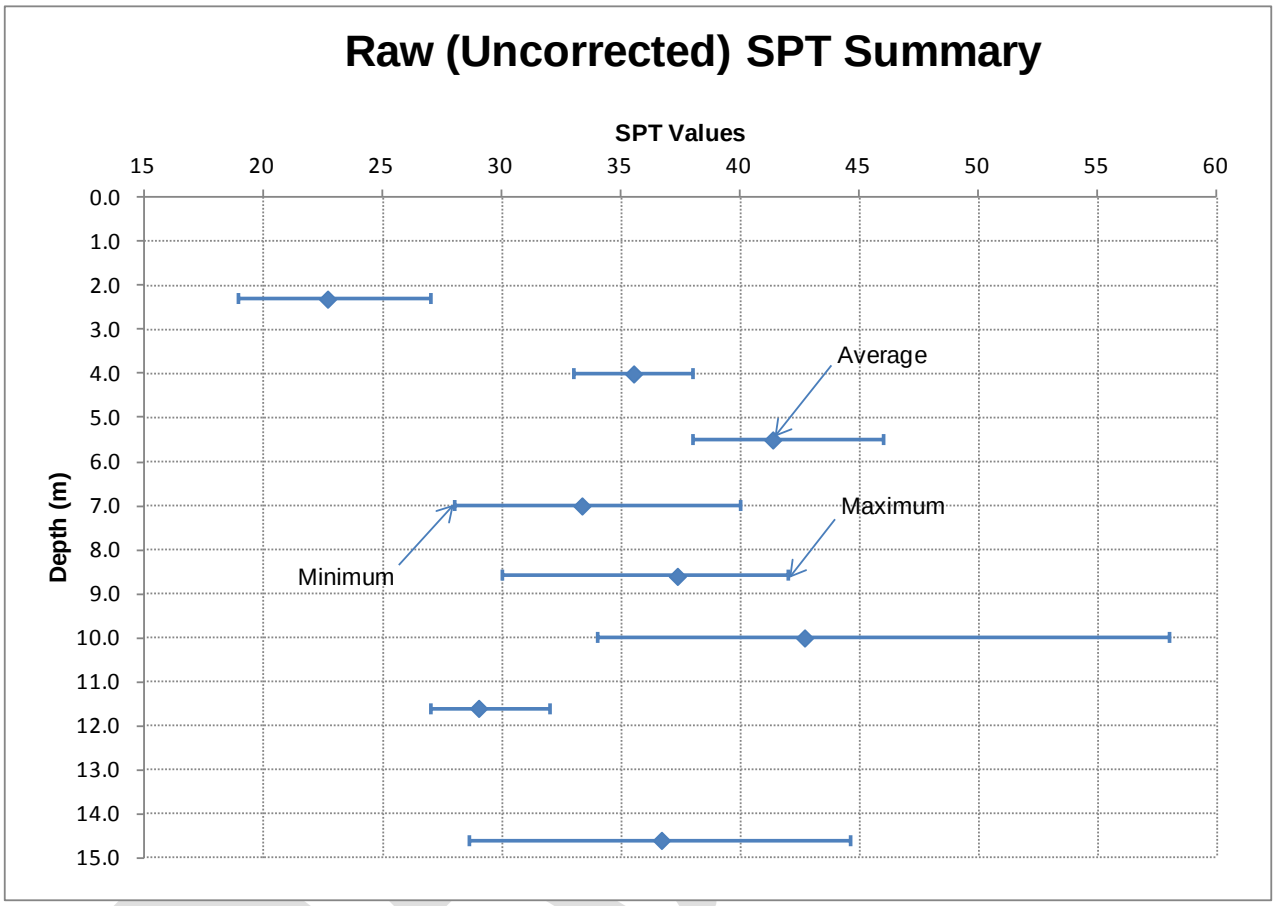

Figure 5.1 – SPT summary (Korpan Tractor site).

5.1.2 Future Development Area (Boreholes 626523-01, 16, 17 and 18)

The general soil profile consisted of a thin layer of organic topsoil overlying glacial till. The Upper Floral Dalmeny Aquifer (sand) was encountered underlying the glacial till below a depth of approximately 14.2 to 15.3 mbgl in boreholes 626523-01, 16 and 18 (borehole 616523-17 was terminated above the aquifer). Inter/intra till sand deposits were encountered in boreholes 626523-01, 16 and 18 at various depths.

The glacial till was generally very stiff to hard, low plasticity and moist. The inter/intra till sand deposits were compact to very dense and saturated (groundwater seepage/sloughing zones). The Dalmeny Aquifer deposits were compact to very dense and saturated (severe groundwater seepage/sloughing conditions).

5.2 Groundwater Seepage and Sloughing

Standpipe piezometers were installed in boreholes 626523-01, 02, 06, 16, 17 and 18. The location of the piezometers has been shown on Figure I.1, Appendix I. The piezometers were constructed using ~ 1 m of horizontally slotted (10 slot), 50 mm diameter PVC screen attached to 50 mm diameter PVC riser pipe. The annular space surrounding the piezometer screen was filled with filter sand/sloughed sand material. The annular space above the sand pack/sloughed sand material consisted of bentonite chips, which extended to ground surface. The piezometer installation details are presented in Appendix II following the corresponding borehole logs.

The groundwater levels recorded during this investigation have been presented in Table 5.1.

Table 5.1 – Groundwater monitoring results.

Piezometer ID	Ground Elevation (m)	Piezometer Rim Elevation (m)	Piezometer Tip Elevation (m)	Measured Date	Groundwater Depth (mbgl)	Groundwater Elevation (m)
626523-01	98.93	100.30	87.12	26-Feb-15	2.13	96.80
626523-02	99.37	100.88	96.27	26-Feb-15	2.40	96.97
626523-06	99.37	100.54	96.27	26-Feb-15	2.64	96.73
626523-16	99.37	100.48	84.26	26-Feb-15	2.05	97.32
626523-17	98.89	99.96	85.99	26-Feb-15	1.87	97.02
626523-18	98.24	99.31	83.10	26-Feb-15	1.80	96.44

Groundwater seepage and sloughing conditions were encountered within saturated inter/intra till sand deposits and within the Dalmeny Aquifer deposits during drilling; seepage was also noted within the surficial sand deposits below a depth of 1.5 mbgl in borehole 626523-14. The depths at which groundwater seepage and sloughing conditions were encountered have been shown on the borehole logs in Appendix II. It is noted that higher and potentially perched groundwater levels should be expected during or following spring thaw or periods of precipitation, and that the groundwater levels will fluctuate seasonally.

5.3 Cobbles and Boulders

Cobbles and boulders were encountered during drilling. Auger refusal was encountered on cobbles/boulders at depths of 0.2, 0.3 and 1.0 mbgl in borehole 626523-13, 01 and 09, respectively on the first attempt. The depths at which cobbles and boulders were encountered have been shown on the drill logs in Appendix II.

Glacial till is comprised of a heterogeneous mixture of clay, silt, sand and gravel-sized particles. Due to the nature of formation and deposition, glacial till also inherently contains larger particle sizes (cobbles and boulders). Cobbles and boulders are often located randomly within glacial till deposits but can also form sorted layers, such as boulder pavements. The actual location and frequency of cobbles and boulders varies and the probability of encountering such deposits increases with the number of holes drilled, volume of soil excavated, number of piles installed, etc. Considering this, cobbles and boulders should be anticipated during construction.

6 GEOTECHNICAL RECOMMENDATIONS

6.1 Geotechnical Considerations

It is anticipated that the proposed buildings will consist predominantly of at-grade structures with pile/grade beam foundation systems and grade-supported concrete floor slabs. It is also anticipated that parking/staging and roadway areas will be constructed as part of the development.

A deep foundation system consisting of conventional drilled, cast-in-place concrete piles and/or belled piles would perform satisfactorily and would likely be the most economical foundation alternative at this site. Construction difficulties should be anticipated at some locations due to the presence of saturated inter/intra till sand deposits; the probability of encountering such deposits will increase as pile lengths are increased. Cobbles/boulders are also anticipated to cause construction difficulties at some locations. Conventional drilled piles should not extend into the Dalmeny Aquifer which is anticipated below a depth of about 15 mbgl (severe groundwater seepage/sloughing conditions and the aquifer is anticipated to be relatively thick).

It is noted that shallow foundations could be considered but may be less practical/economical as compared to piles for the anticipated structures; recommendations for shallow foundations can be prepared upon request.

Alternate pile types, including continuous flight auger (CFA), cast-in-place concrete piles, helical screw piles, or driven steel piles are also common in the Saskatoon area and could be considered. Recommendations for alternate pile types can be prepared upon request.

For the Korpan Tractor site, detailed design recommendations have been presented for frost action; seismic site classification; site preparation; fill materials, placement and compaction; foundations; grade supported concrete slabs; foundations concrete; and, asphalt concrete pavement structures.

6.2 Frost Action

The near surface subgrade soils are susceptible to frost heaving if provided access to water. According to U.S. Corps of Engineers (USACE) Frost Design Soil Classification, the soil types encountered in this area can be classified as F3 to F4 (ie, moderately to highly frost susceptible).

The estimated frost depth of the subgrade soils was calculated using the modified Berggren equation provided in the Canadian Foundation Engineering Manual (CFEM) under various surface covers. The estimated frost penetration depths are summarized in Table 6.1.

Table 6.1 – Estimated frost penetration depth under various surface covers.

Surface Cover	Design Return Period		
	Normal	10 Year Extreme	50 Year Extreme
	Estimated Frost Penetration Depth (m)		
Gravel/Asphalt	2.5	2.6	3.0
Vegetated	1.9	2.0	2.3
Concrete	2.4	2.5	2.8

Frost penetration depths were based on the assumption that cohesive material (ie glacial till) would be the primary soil near surface. However, surficial sand deposits were encountered in some boreholes and should be anticipated at some locations. In these areas, the frost penetration depth could be even deeper.

6.2.1 Procedures to Mitigate Frost Action in Buried Utilities

The native soil near ground surface is considered to be frost susceptible. SNC-Lavalin recommends that buried utilities that are frost sensitive should have a minimum soil cover of 3 m (preferably 3.5 m). Frost sensitive utilities buried with less than the recommended soil cover should be protected with rigid polystyrene insulation to avoid frost effects that may cause damage to the utility pipes. Rigid insulation placed under areas subject to vehicular wheel loads should be provided with a minimum cover of 600 mm of compacted granular base and/or pavement. The design of the insulation system (depth, extent, thickness, etc) will depend on several factors and should be determined in consultation with SNC-Lavalin.

6.2.2 Frost Action and Foundations

The volume increase that occurs when water changes to ice is one of the causes of frost heave. However it is also recognized that a phenomenon known as ice segregation is the predominant mechanism: Water is drawn from unfrozen soil to the freezing zone where it accumulates to form layers of ice, forcing soil particles apart and causing the soil surface to heave. The magnitude of frost heave due to ice segregation can be much more severe than that of a simple state change in the soil porewater. As such, movement sensitive foundations should be founded below the depth of frost penetration. Alternatively, measures to prevent ice segregation must be taken (ie, dewatering, insulation, heating the area, replacement of frost prone soil with stable fill, etc). Such measures (if required) should be designed in consultation with SNC-Lavalin.

A different form of frost action, called ‘adfreezing’, occurs when soil freezes to the surface of a foundation. Heaving pressures developing at the base of the freezing zone are transmitted through the adfreezing bond to the foundation, producing uplift forces capable of appreciable vertical displacements. Relatively little is known of the magnitude of the forces that may be generated, but bond strengths of adfreezing in the order of 100 kPa for steel surfaces and 70 kPa for wood and concrete have been measured. Providing a bond breaker between the foundation and the soil can reduce the potential for foundation movements due to adfreezing forces.

6.3 Seismic Site Classification

Seismic site classification according to the National Building Code of Canada (NBCC) requires an assessment of the upper 30 m of the soil profile. It is noted that the maximum borehole depth was 19.1 mbgl. However, based on previous experience and on knowledge of the geologic history of the area , the strength of the deposits is not anticipated to decrease to a depth of 30 mbgl. In accordance with the NBCC, the site is classified as Site Class C for seismic design purposes.

6.4 Site Preparation

6.4.1 General

Excess water should be drained from the work areas as quickly as possible both during and after construction. Initial grading operations should be focused on providing surface drainage, such that precipitation and surface run-off is directed away from work areas.

Following stripping of topsoil and excavation to design subgrade elevation, the exposed subgrade should be inspected by qualified SNC-Lavalin personnel to verify the removal of unsuitable materials and to provide additional recommendations, as appropriate. Unsuitable materials include topsoil (if any), organic matter (if any), vegetation (if any), oversized material and other deleterious materials. The lateral extent of all excavations and removals should be at least 1.5 m from beyond the edge of all structures. Topsoil (if any) may be stockpiled and re-used for non-structural areas only, such as landscaping.

As a minimum (unless otherwise stated), all exposed subgrade soil within the proposed development areas should be scarified to a minimum depth of 200 mm, moisture conditioned (wetted or dried) to within ± 2% of optimum moisture content, and compacted to at least 98% of Standard Proctor Maximum Dry Density (SPMDD) tested in accordance with ASTM Method D 698. If weak soil conditions are encountered and scarification/compaction is not practical, subgrade stabilization techniques will be required (as discussed in the following section).

6.4.2 Proof Rolling

Upon completion of initial site preparation activities (as discussed above), proof rolling of the subgrade should be conducted to verify that competent and uniform soil subgrade support conditions have been achieved. Proof rolling should not be conducted during or shortly following precipitation events, and heavy equipment shall not be allowed to travel on wet/soft subgrade soils until adequate drying has occurred. Proof rolling should be performed by two passes of a dual-wheel truck (or comparable equipment) with a minimum of 80 kN single axle load. Soils which display rutting or appreciable deflections upon proof-rolling should be over excavated to expose more competent soil and replaced with suitable engineered fill. Alternately, the use of geosynthetics (woven geotextile, geogrid in conjunction with non woven geotextile, or, combination geotextile/geogrid products), possibly in conjunction with some over excavation, may be an alternative.

If geosynthetics are utilized, it is recommended that granular fill materials be placed directly over the geosynthetics. The geosynthetics should be placed in accordance with the manufacturer's recommendations. Construction techniques should be designed to minimize the potential for damage to the geosynthetics and underlying subgrade soils (ie, end-dump and spread methods, use of long reach and/or low contact pressure equipment, etc). SNC-Lavalin should be retained to provide guidance with respect to subgrade improvement measures.

Following efforts to stabilize the soil, proof rolling should be repeated. All proof rolling and compaction efforts should include documentation detailing the findings, including photographs where possible. All finished subgrades should be protected from construction traffic and erosion as soon as possible.

6.4.3 Roadways and Parking Areas

For subgrade support of the roadway and parking areas, a uniformly smooth subgrade surface should be prepared, containing no ruts, pot holes, loose soils, or any imperfections that can retain water on the surface. Isolated pockets of unsuitable material should be removed and replaced with similar material adjoining the excavation to allow for uniform performance. As a minimum, the soils in all areas supporting vehicle traffic should be sub cut below design subgrade elevations and recompacted to provide a uniform bearing condition. The following soil subgrade recommendations should be followed, depending on whether the design soil subgrade is above or below the existing grade. The prepared subgrade should be crowned or cross-sloped to facilitate the flow of surface water off the roadway/parking area. A minimum of 3% cross-slope is recommended.

Subgrades under paved surfaces tend to wet up over time due to capillary rise and coupled heat and moisture vapour flow. As such, sub-surface drainage systems are recommended to control the moisture profile within the subgrade soils and to improve the longterm performance of the structures.

6.4.3.1 *Fill Sections*

If the exposed subgrade surface is more than 300 mm below the design subgrade elevation, the subgrade should only be prepared by scarifying to a minimum depth of 200 mm, moisture conditioning (wetted or dried) to within ± 2% of optimum moisture content, and compacting to 100% of SPMDD.

If the exposed subgrade surface is less than 300 mm below the design subgrade elevation, the subgrade should be over excavated to a minimum depth of 300 mm below the design subgrade surface. The lateral extent of over-excavation, beyond the edge of the slab/building, should be at least 1.5 m, or equal to the depth of over-excavation, whichever is greater. The exposed subgrade should then be scarified and compacted as outlined above. All fill soils placed to raise the subgrade elevation to design grade should be placed in loose lifts, moisture conditioned, and compacted as outlined above.

6.4.3.2 *Excavation Sections*

If the design subgrade elevation requires excavation, the subgrade should be over excavated to a minimum depth of 300 mm below the design subgrade surface. The lateral extent of over-excavation should be at least 1.5 m, or equal to the depth of over-excavation, whichever is greater. The exposed soil subgrade should then be scarified and compacted as outlined above.

Subgrade preparation should not be performed on very soft, loose or wet subgrade as construction equipment may further weaken the subgrade. Subsequent to scarification and compaction, the prepared subgrade should be proof rolled as discussed in section 6.4.2 to confirm a uniform bearing condition and firm even surface. Recommendations to stabilize saturated, yielding or pumping subgrade conditions, should they be encountered, should be determined in consultation with SNC-Lavalin If any problems are encountered during the subgrade preparation, or if the site conditions deviate from those indicated by the boreholes, qualified SNC-Lavalin personnel should be notified to provide additional recommendations.

6.4.4 Temporary Excavations and Dewatering

The temporary slope angle of the excavations shall follow the recommendation stated in the Occupation Health and Safety Regulations, 1996 (OH&S). Soil types were classified according to subsections (3) and (4) of part 260 of the OH&S Regulations. Within the anticipated depth of excavation, the glacial till soils would be classified as Type 2 soils while the surficial sand soils (where encountered) would be classified as Type 3 soils (above the groundwater table) or Type 4 soils (below the groundwater table).

The maximum slope angle for temporary excavations in Type 2 soils shall be 1H:1V (45°) with a maximum 1.2 m vertical wall at the base of excavation. The maximum slope angle for Type 3 soils shall be 1H:1V (45°), while the maximum slope angle for Type 4 soils shall be 3H:1V (18.4°). Shallower side slopes may be required if loose and/or saturated soil conditions are encountered. Variability in surface soils exists, and it is recommended that qualified SNC-Lavalin personnel conduct an inspection of any excavations prior to workers entering the excavated area, and written records of the inspections be maintained. The excavation slopes should be checked regularly for signs of spalling, cracking, tension cracks at crest, etc, particularly after periods of rain. Local flattening of the excavation slopes may be required if instabilities of the cut slopes are observed. For temporary excavations, equipment, spoil piles, rocks and construction materials should be kept at least 1 m from the edge of the excavation as stated in OH&S Regulations part 260(1). For excavations that will remain open for a relatively long duration of time, it is recommended that the stockpiling distance from the crest of the excavation should be equal to or greater than the depth of excavation.

Drainage trenches with periodic low points for standard sump pumps should be sufficient for dewatering shallow excavations at this site. As it is difficult to estimate the amount of water that will be encountered, close monitoring of groundwater ingress into the excavations is recommended. Other dewatering methods may be required if conventional methods prove to be insufficient. Surface drainage should be directed away from the crest of any excavation, particularly where workers and equipment will be present.

For permanent excavations (ie, ditches), the required slope angle will vary. For glacial till or sand soils, ditch sideslopes should be no steeper than 2.5H:1V (21.8°), with 3H:1V (18.4°) sideslopes being preferred.

Excavations that are made close to and beneath the level or elevation of existing footings, structures or utilities should be avoided if possible (if applicable). Where such excavations are unavoidable, the temporary excavation should be cut as outlined above, extending from a point at least 0.5 m away from the base of the existing footing/structure/utility. No vertical unsupported cuts shall be made. Shoring systems may be required in some areas. The design of the shoring system and all excavations adjacent to existing footings, structures or utilities should be reviewed and monitored by SNC-Lavalin.

6.5 Fill Materials, Placement and Compaction

6.5.1 General

All proposed fill material should comply with the recommendations provided in this report and should be approved by SNC-Lavalin prior to use. All fill soils should be free of appreciable amounts of deleterious and/or organic materials, large particle sizes and contaminants. Fill soils should not be placed in a frozen state, or placed on a frozen subgrade. All lumps of materials should be broken down during placement.

Prior to placement of fill material, representative bulk samples (about 25 kg) should be taken of the proposed fill soils and laboratory tests should be conducted to determine (as applicable) Atterberg limits, natural moisture content, grain size distribution and standard Proctor moisture density relationship. These test results will be necessary for the proper control of construction for the engineered fill.

Prior to placing any fill, the exposed subgrade surface should be prepared in accordance with the preceding sections. It is important that the fill soils be compacted uniformly in order to maintain uniformity and minimize the potential of subsequent differential vertical movements.

6.5.2 Subgrade Fill

Subgrade fill, if required to achieve a uniformly level subgrade surface, should be placed in loose lifts (150 mm thickness, maximum), moisture conditioned (wetted or dried) to within ± 2% of optimum moisture content, and compacted to at least 98% of SPMDD tested in accordance with ASTM Method D 698. Subgrade fill, if required, should consist of soil free of unsuitable materials (topsoil, organic matter, vegetation, oversized material and other deleterious materials).

6.5.3 Structural Fill

Well-graded granular material is preferred as structural fill at this site due to the relative ease of compaction and more uniform/rapid settlement response (as compared to poorly graded granular soils or fine grained soils). If the use of well graded granular fill is cost prohibitive, then the use of locally available glacial till soils may be permissible. It should be noted that the settlement response of non-granular materials or poorly graded granular materials will be less uniform and will take longer to develop as compared to well graded granular materials. Additional time and effort will also be required to moisture condition and place these materials. Beneath hard-surfaced, grade-supported structures, a nominal thickness of structural granular fill (base course and sub-base course materials) will be required.

All structural fill should be placed in thin lifts (150 mm thickness, maximum), moisture conditioned (wetted or dried) to within ± 2% of optimum moisture content, and uniformly compacted to at least 100% of SPMDD tested in accordance with ASTM Method D 698. Where not contained by grade beams or suitable curbs, the structural fill should extend laterally 1 m or equal to the full depth of fill (whichever is the greater) beyond the footprint of grade-supported structures (asphalt surfacing, concrete slabs etc).

The recommended gradation requirements for base course and sub-base course material have been presented in Table 6.2. Alternate gradations may be acceptable but should be approved by SNC-Lavalin prior to use.

For granular sub-base course material, the uppermost 300 mm of the fill should meet the gradation requirements presented above. For lower levels of sub-base fill, over-sized particles may be incorporated. For quality control testing of fill material containing over-sized particles, the gradation should be determined on samples with all oversized materials (ie, greater than 50 mm) removed.

Table 6.2 – Base and sub base gradation specifications.

Sieve Size		Percent Passing by Weight	
		Base Course Type 33	Sub-Base Type 6
50	mm		100
18	mm	100	
12.5	mm	75 -100	
5	mm	50 - 75	
2	mm	32 - 52	0 - 80
900	µm	20 - 35	
400	µm	15 - 25	0 - 45
160	µm	8 - 15	0 - 20
71	µm	6 - 11	0 - 6
Plasticity Index		0 - 6	0 - 6
Fractured Face %		Min 50	
Lightweight pieces %		Max 5	

Note: Adopted from Saskatchewan Highway and Transportation Design Manual.

6.5.4 Utility Trench Backfill

Utility bedding materials will vary depending on the type of utility. Utility bedding material gradation, placement, thickness, compaction, etc, should be in accordance with the utility manufacturer's specifications and recommendations. Care must be taken to ensure damage does not occur to the utilities as a result of placement/compaction of the bedding material and overlying fill materials.

Below buildings/structures and concrete surfaced areas, the use of well graded granular fill is recommended above the bedding material (as discussed above) as this type of material will settle less and more uniformly as compared to common fill (ie, locally excavated soil). Within all other areas (where some potential settlement of the excavation backfill material may be permissible), the use of locally excavated soil as backfill should be suitable. In areas where there will be no surface cover (asphalt, concrete, etc), it is recommended that the excavations be capped with low hydraulic conductivity soils to limit surface water ingress into the utility trench. In areas where there will be a permeable surface cover (ie, graveled areas, landscape areas, etc). The drainage adjacent to the utility trench should provide for positive drainage away from the trench.

6.5.5 Fill Settlement

Fill materials will tend to settle due to self weight and any imposed loading. The amount of settlement is unpredictable due to a number of variables associated with the properties of the fill material and the placement history of the fill. The settlement of fill materials can be reduced by adhering to strict placement and compaction specifications for the entire fill thickness (ie, utilizing thin uniform lifts, maintaining moisture content near optimum, compacting to a uniform, high density condition). Maintaining a uniform fill thickness will also serve to minimize differential movements across the fill area. The estimated settlements of cohesive and non cohesive fill materials as a function of compaction level have been presented in Table 6.3.

Table 6.3 – Estimated fill settlement versus compaction level.

Compaction Level (%SPMMD)	Estimated Fill Settlement (% of Fill Thickness)	
	Cohesive Soils	Non-cohesive Soils
100	0.5	< 0.5
98 – 100	1.0	0.5
95 – 98	1.5	1.0
90 – 95	4.0	3.0
< 90	> 4.0	> 3.0

SPMDD = Standard Proctor Maximum Dry Density (± 2% of optimum moisture content).

The above settlement estimates are for fill materials placed during non freezing conditions. The self weight induced settlement will be significantly higher than shown in Table 6.3 if frozen fill materials are utilized (particularly for cohesive fill materials).

6.6 Foundations

6.6.1 Limit States Design

6.6.1.1 *General*

As per limits states design principles presented in the Canadian Foundation Engineering Manual (4th ed., 2006), foundation design must consider both ultimate limit states (ULS) and serviceability limit states (SLS).

ULS are primarily concerned with collapse mechanisms of the structure, and hence, safety. For foundation design, ULS consist of:

- Exceed the load carrying ability of the ground that supports the foundation (i.e., ultimate bearing capacity);
- Sliding;
- Uplift;
- Overturning;
- Large deformation of the foundation subgrade that leads to an ULS being introduced in the structure; and,
- Loss of overall stability.

SLS represent conditions or mechanisms that restrict or constrain the intended use, function or occupancy of the structure under expected service or working loads. SLS are usually associated with movements or deformations that interrupt or hinder the function (i.e., serviceability) of the structure. For foundation design, SLS generally consist of:

- Excessive movements (e.g., settlement, differential settlement, heave, lateral movement, cracking, tilt);
- Unacceptable vibrations; and,
- Local damage and deterioration.

During the design process, the structural engineer will need to consider both ULS and SLS geotechnical parameters. Factored (ULS) structural loads will need to be compared to factored (ULS) geotechnical parameters. Likewise, working structural loads will need to be compared to SLS geotechnical parameters.

6.6.1.2 *ULS Geotechnical Resistance Factors*

For the purposes of this report, ultimate geotechnical design parameters have been presented. To determine factored parameters (limit states design), the ultimate parameters should be multiplied by the applicable geotechnical resistance factors (ϕ) as per the National Building Code of Canada 2010 (NBCC). The recommended geotechnical resistance factors (ϕ) as per the National Building Code of Canada 2010 (NBCC) are as follows:

1. Shallow Foundations
   (a) Vertical bearing resistance from semi empirical analysis using laboratory and in situ test data (ϕ = 0.5)
   (b) Sliding
      (i) based on friction [c = 0] (ϕ = 0.8)
      (ii) based on cohesion/adhesion [tan Ø = 0] (ϕ = 0.6)

2. Deep Foundations
   (a) Resistance to axial load
      (i) Semi empirical analysis using laboratory and in situ test data (ϕ = 0.4)
   (ii) analysis using static loading test results (ϕ = 0.6)
      (iii) analysis using dynamic monitoring results (ϕ = 0.5)
      (iv) uplift resistance by semi empirical analysis (ϕ = 0.3)
      (v) uplift resistance using loading test results (ϕ = 0.4)
   (b) Horizontal load resistance (ϕ = 0.5)

Ultimate geotechnical resistances to axial loads for deep foundations were calculated using semi empirical analysis using laboratory and in situ test data.

6.6.2 Drilled, Cast in Place Concrete Piles and/or Belled Piles

Construction difficulties should be anticipated at some locations due to the presence of saturated inter/intra till sand deposits; the probability of encountering such deposits will increase as pile lengths are increased. Temporary casing will be required to complete the installation of drilled piles at some locations. Cobbles/boulders are also anticipated to cause construction difficulties at some locations. Conventional drilled piles should not extend into the Dalmeny Aquifer which is anticipated below a depth of about 15 mbgl (severe groundwater seepage/sloughing conditions and the aquifer is anticipated to be relatively thick).

Conventional piling equipment utilized in western Canada for typical straight shaft drilled piles is not meant to clean the base of the pile hole. As such (for SLS design), drilled straight shaft, cast in place concrete piles may be designed on the basis of shaft resistance only. If end bearing contribution is required for SLS design, then end bearing resistance may be considered provided that appropriate equipment/tooling is available to adequately clean the base of the drilled hole, and provided that adequate inspection is conducted during pile installation. If end bearing is to be considered for the SLS design of conventional drilled piles, SNC-Lavalin must be consulted prior to finalizing the pile design.

The shaft resistance values of the subgrade soils are presented in Table 6.4.

Table 6.4 – Shaft resistance (drilled piles).

Depth (m)	ULS Shaft Resistance (kPa)	SLS Shaft Resistance (kPa)	
		Compression	Tension
0 to 2	0	0	0
2 to 5	100	40	30
5 to 10.5	120	50	38
10.5 to 14	100	40	30
Below 14	NR	NR	NR

NR = not recommended.

For drilled straight shaft, cast in place concrete piles, the end bearing resistance values of the subgrade soils are as follows:

Table 6.5 – End bearing resistance (drilled piles).

Depth (m)	ULS End Bearing Resistance (kPa)	SLS End Bearing Resistance (kPa)
6 to 10.5	810	NA
10.5 to 14	645	NR
Below 14	NR	NR

NA = not applicable unless approved in consultation with SNC-Lavalin, NR = not recommended.

The following recommendations should be considered in the design of drilled, cast in place concrete piles:

1. To minimize frost heave potential, drilled straight shaft concrete piles should be extended to a minimum depth of 6 m below finished ground surface. Pile reinforcement must be adequate to withstand all vertical, lateral and tensile forces within the pile. The potential for frost heave of the piles can be reduced by using a sonotube form for the uppermost 2 m (below ground surface) of the pile shaft. The diameter of the sonotube form should be a minimum of 50 mm smaller than the diameter of the drilled hole. It is noted that the use of a sonotube form may not be practical for piles subject to significant lateral loads, as the sonotube portion of the pile will not provide any lateral capacity.
2. A minimum pile diameter of 400 mm is recommended. Larger pile diameters may be required to allow for the removal of cobbles and boulders in some pile holes.
3. A minimum centre to centre pile spacing of three pile diameters is recommended.
4. Groundwater seepage and sloughing conditions were encountered during test drilling. Casing will be required where groundwater seepage and sloughing conditions are encountered to maintain the pile holes open and dry for placement of the reinforcing steel and concrete. The annular space between the casing and drilled hole must be filled with concrete. As the casing is extracted, concrete in the casing must have adequate head to displace all water in the annular space. Water which accumulates on top of the pile upon removal of the casing must be removed to ensure the integrity of the concrete is not compromised.
5. Pile holes should be filled with concrete as soon as possible after drilling to reduce the risk of groundwater seepage and/or sloughing soil. Excess water should not be allowed to collect within the drilled hole. If excess water collects in the drilled hole, it will be necessary to remove the water (by pumping or bailing) prior to placing reinforcing steel and concrete. Vibration of the concrete in the upper 3 m of the pile shaft is required to produce uniform strength concrete.

6. Concrete shall be fed to the bottom of the drilled shaft by pumping and filled from bottom up or, using the free fall method or, another method approved by the structural engineer. If the free fall method is used, the concrete must be poured through a centering chute, making it fall down at the centre of the hole, and minimize the fresh concrete hitting the reinforcing steel or the side of the shaft.
7. Due to the hard nature of some of the subgrade soils, high powered piling equipment is recommended.
8. Continuous monitoring by SNC-Lavalin during pile installation is recommended to document the installation of each drilled, straight shaft concrete pile installed at this site.

Belled piles may be designed on the basis of shaft resistance and end bearing resistance. For belled piles, the end bearing resistance values of the subgrade soils are as follows:

Table 6.6 – End bearing resistance (belled piles).

*Depth (m)	ULS End Bearing Resistance (kPa)	SLS End Bearing Resistance (kPa)	
		Compression	Tension
5 to 10	2,000	550	415
10 to 14	1,600	430	325
Below 14	NR	NR	NR

* Actual belling depth will vary depending on the position of seepage, sloughing, cobbles and boulders. Bells must be constructed an adequate depth below the underside of any sloughing deposits (if encountered).
NR = not recommended.

The following additional recommendations should be considered in the design of drilled, cast in place concrete belled piles:

1. Belled piles should have a minimum D/B ratio of 2 (where D = depth and B = bell diameter).
2. For determination of the shaft resistance component of the pile capacity, the effective shaft length for belled piles may be taken as the embedded pile length (to the base of the bell), minus one (1) bell diameter (ie, the bottom most portion of the pile shaft is neglected to account for interaction with the bell).
3. To prevent softening of the bearing strata, water should not be allowed to accumulate at the base of the belled hole.
4. Belled piles may be belled to a maximum of three times the pile shaft diameter. Bells should be constructed with a sideslope not less than 60° from horizontal. The base of the bells should be excavated vertically a minimum of 200 mm to allow adequate load transfer to the foundation soils.
5. If belled pile groups are utilized, the clear space between the bells should not be less than half of the bell diameter or a minimum 0.6 m.

6. Continuous monitoring by SNC-Lavalin during pile installation is recommended to confirm that bells are based within suitable soil and to document the installation of each belled pile installed at this site. The use of a downhole camera is suggested to assess the soil conditions within the bell and to confirm the removal of loose, disturbed soil at the base of the bell.

6.6.3 Pile Settlement and Pile Group Effects

The estimated settlement for individual straight shaft piles is not anticipated to exceed 10 mm. For individual belled piles, pile settlement is not expected to exceed 25 mm. Differential settlement between piles is anticipated to be about half the total settlement of a single pile. Pile group settlement will be larger than for individual piles, and will depend on the pile group size/geometry, pile type, pile depth, etc. Estimates of pile group settlement can be provided once the pile group configurations and loads have been finalized.

If pile groups are required to achieve the required structural capacity, the minimum centre to centre pile spacing should be three times the pile diameter. A reduction in pile capacity will not be required for pile groups where the centre to centre pile spacing is at least three pile diameters. For pile groups with a centre to centre spacing of less than three pile diameters, a capacity reduction may need to be applied. In this case, SNC-Lavalin should be contacted to reassess the pile group capacity (will be affected by the number of piles, the pile layout and pile diameters).

6.6.4 Lateral and Tension Forces

It is anticipated that the foundations may be required to withstand vertical compressive loading, tensile loading, and lateral loading.

For straight shaft, drilled, cast-in-place concrete piles, the vertical tensile capacity can be determined using the shaft resistance values presented in Table 6.4. Concrete piles must be adequately reinforced to withstand the vertical tensile forces within the pile.

For belled piles, the vertical tensile capacity can be determined using the shaft component of the pile (as described above) as well as the bearing resistance of the roof of the bell. Due to the interaction between the bell and the pile shaft, the uplift resistance along the pile shaft should be neglected for a distance equal to two (2) bell diameters from the base of the bell. The vertical tensile capacity of the bell component of the pile can be determined using the bearing resistance presented in Table 6.6, applied to the effective area of the bell (bell area minus shaft area). Belled piles designed to resist uplift loading should have a minimum D/B ratio of four (where D = depth to base of bell and B = diameter of bell). For belled piles installed to a shallower depth, the uplift capacity should be reviewed by SNC-Lavalin.

If the piles designed to support the vertical loading conditions are inadequate to support the lateral loading conditions, it may be necessary to increase the pile diameter, utilize pile groups or incline (batter) the piles.

The response of a pile to lateral loads is highly nonlinear and methods that assume linear behaviour (ie, horizontal subgrade reaction theory) are only applicable where pile deflections are small, loading is static and pile material is linear. In most practical applications, one or more of these conditions are not met and methods that can model the soil and pile non-linearity are required. Considering this, analysis of lateral pile response by p-y methods is strongly recommended. The p-y method is widely accepted for predicting pile response, and is readily accomplished using computer programs such as LPILE, Allpile etc. The following input parameters may be used for lateral pile response modeling:

Table 6.7 – Input parameters for lateral pile response (p-y method).

Zone (mbgl)	Total Unit Weight (ɣ) (kN/m^3)	Submerged Unit Weight (ɣ') (kN/m^3)	Undrained Shear Strength (kPa)	E_{50} (Strain Factor)	Effective Angle of Internal Friction	Initial p-y Modulus (k) (MN/m^3)
0 to 2	19.0	9.2	--	--	30°	24.4
2 to 5	21.5	11.7	200	0.004	--	--
5 to 10.5	21.5	11.7	270	0.004	--	--
10.5 to 14	21.5	11.7	215	0.004	--	--

SNC-Lavalin can conduct p-y analysis as part of the design process. Specific pile/pile group details will be required, including vertical and lateral pile loads, type of pile, diameter of pile, length/embedment of pile, pile cap/pile connection details, pile spacing, etc.

6.6.5 Grade Beams and Pile Caps

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 (compressible void form). The finished grade adjacent to each grade beam should be capped with hard surfacing or well compacted, low permeable material and should be positively drained away from the grade beam so that surface runoff is not allowed to infiltrate and collect in the void space. If water is allowed to accumulate in the void space, the beneficial effect will be negated and frost heaving may occur.

Exterior pile caps exposed to freezing conditions should be based below the potential depth of frost penetration or protected against frost action. Pile caps based above the frost penetration depth should be constructed to allow for a minimum of 100 mm of net void space between the underside of the pile cap and the subgrade soil (compressible void form). As with grade beams, the finished grade adjacent the pile cap should be positively drained away from the pile cap so that surface runoff is not allowed to infiltrate and collect in the void space. Alternatively, the pile caps may be protected from frost action by strategically located, rigid polystyrene insulation. Further insulation recommendations can be provided upon request.

The use of bond breakers between the foundation and the soil can reduce the potential for foundation movements due to adfreezing forces, and is recommended.

6.7 Grade Supported Concrete Floor Slabs

Grade-supported concrete slabs should perform satisfactorily provided that some floor slab movements can be tolerated and the recommendations presented in Sections 6.4 and 6.5 are adhered to. If some differential movements/floor cracking cannot be tolerated, then a structural slab should be constructed. For continually heated areas, the following recommendations should be incorporated into the design of reinforced, grade supported, cast in place concrete slabs at this site:

1. Prepare the site in accordance with Sections 6.4 and 6.5.
2. Conduct site grading, as required, to allow for the placement of a uniform thickness of compacted structural fill between the underside of the grade supported slab and the prepared subgrade surface. A minimum structural fill thickness of 300 mm is recommended. The uppermost 150 mm of the fill should consist of crushed, granular base course material. Lower lifts of fill may consist of granular sub base material or approved fine grained soils. All structural fill should be placed in thin lifts (150 mm thickness, maximum), moisture conditioned (wetted or dried) to within ± 2% of optimum moisture content, and uniformly compacted to at least 100% of SPMDD tested in accordance with ASTM Method D 698.
3. Separation joints should be used to isolate the slab from foundation walls, columns, etc
4. Reinforce the concrete slab and provide control joints at regular intervals to provide for controlled cracking.
5. The finished grade should be landscaped to provide for positive site drainage away from the structure.
6. Concrete slabs should not be constructed on loose, softened, desiccated, frozen or wet soil.
7. Frost should not be allowed to penetrate beneath the concrete slab just prior to, during or after construction.

8. Continuous quality control inspection by SNC-Lavalin should be provided during fill placement.

To minimize the potential for water collection below grade supported concrete slabs, the finished grade must be landscaped to provide for positive site drainage away from the building. Where thick layers of granular fill are placed below the slab (potential receptor for water) and where potentially active soils exist, proper exterior drainage is critical. In these cases (depending on the actual slab elevation and final exterior grades), it may be preferable to utilize a greater thickness of approved fine grained soils as structural fill and/or provide a drainage system to provide controlled collection and discharge of water that might accumulate below the slab. Many drainage system configurations are possible, but would generally consist of sloping the sub grade surface to collection points (ie, sump pits) and/or utilizing perforated drainage pipe (weeping tile) to convey water to the collection points. The drainage system should be positively drained to sump pits equipped with automatic sump pumps and discharged in accordance with local regulations.

6.7.1 Unheated Slabs

Grade supported concrete slabs exposed to freezing conditions will be subject to differential movements associated with frost action. The potential for differential movements associated with frost action can be minimized by over excavating and replacing a greater thickness of subgrade soil with low frost susceptible granular fill (in the order of 1,000 to 1,500 mm is recommended), by placing sub-horizontal rigid polystyrene insulation below the slabs and/or by providing minimal heat (5 degrees Celsius minimum) and air circulation within the building during freezing conditions (if applicable). If insulation is to be utilized, the insulation should have a minimum thickness of 100 mm and should extend below the slab and sub-horizontally away from the outer edges of the slab a minimum distance of 2.4 m. The insulation should be covered with a minimum of 300 mm of soil cover to provide protection against damage, and should be positively sloped away from the slab.

If differential movements cannot be tolerated, the slab should be constructed as a structural slab (ie, pile supported) over a compressible void form.

6.7.2 Sub Floor Drainage System

A sub floor drainage system is recommended below all sub-surface floors (if applicable) to allow for collection and controlled discharge of water which may enter or accumulate below the floor. The subfloor drainage system should consist of a series of perforated drainage pipes, spaced at a maximum of 4 m on centre, with the invert placed at the base of a continuous layer of clean, free-draining granular material (minimum of 350 mm below the underside of the floor slab). The thickness of the free draining granular layer should be at least twice the height of the drainage pipe.

The subgrade surface/perforated drainage pipes should be positively sloped to promote drainage toward sump pits. The granular drainage layer should be separated from the underlying subgrade soil with a continuous layer of high permeability, non woven geotextile, capable of transmitting a flow of not less than 50 litres per second per square metre (ASTM D-4491). The clean, free draining granular material should consist of well graded material with less than 3% fines (silt and clay sized particles).

Alternately, the perforated drainage pipes could be installed in trenches. In this case, the drainage pipe invert elevation should be situated a minimum of 750 mm below the underside of the floor slab. The drainage pipe and clean drainage aggregate should be fully encapsulated in high permeability, non woven geotextile, as described above.

The sub floor drainage system should be positively drained to sump pits equipped with automatic sump pumps and discharged in accordance with local regulations. A drawing showing the conceptual sub floor drainage system is presented as Figure 1.8 for reference.

6.7.3 Modulus of Subgrade Reaction, K_s

The modulus of subgrade reaction is a conceptual relationship between soil pressure and deflection (ie, imposed pressure divided by the corresponding deflection), and varies with the intensity of the pressure, size of the loaded area and the thickness/properties of the supporting soils (sub slab granular fill as well as the underlying native soils). For the preliminary design of grade supported floor slabs at this site, a modulus of subgrade reaction in the order of 54 MN/m^3 (200 pci) may be utilized. This preliminary modulus of subgrade reaction is considered applicable to small load contact areas, such as storage rack posts or wheel loads. For larger contact areas, the modulus of subgrade reaction will differ and should be determined in consultation with SNC-Lavalin. For a more accurate estimate of K_s, additional information will be required including the imposed load/pressure, size of loaded area and the thickness/type/density of sub slab granular fill. If a more accurate determination of K_s is required, then a plate bearing test is recommended.

6.8 Foundation Concrete

Water-soluble sulphates (gypsum crystals) are common in the glacial till deposits in this area and were encountered during test drilling. Sulphate resistant cement is recommended for all foundation concrete in direct contact with the naturally occurring subgrade soils at this site. If imported fill material is utilized, it is recommended that the fill soil be tested for sulphate content to determine whether the above stated recommendations remain valid. It should be noted that most fine grained soils encountered in Saskatchewan contain concentrations of sulphates.

The recommendations stated above for the subsurface concrete at this site may require further additions and/or modifications due to structural, durability, service life or other considerations which are beyond the geotechnical scope. A designer competent in concrete mix design should complete the specifications for the concrete mix.

6.9 Asphalt Concrete Pavement Structures

The following recommendations should be considered in the design of the asphalt concrete pavement structures:

1. Prepare the site in accordance with Section 6.4 and Section 6.5.
2. The soaked CBR (California Bearing Ratio) rating of the compacted glacial till is estimated to be at least 5. Based on the estimated soaked CBR rating, the following preliminary pavement structures have been presented.

Table 6.8 – Proposed pavement design thickness.

Structure	Light Traffic	Medium Traffic	Heavy Traffic
	Axle load ~35 kN	Axle load ~55 kN	Axle Load ~80 kN
Asphalt Concrete (mm)	60	90	120
Base Course (mm)	140	150	190
Sub Base Course (mm)	125	175	190
Geosynthetic	Recommended	Recommended	Recommended
Total Structure (mm)	325	415	500

3. The granular base and sub base course material should meet the aggregate gradation requirements presented in Table 6.2.
4. The asphalt concrete used for the paved structure should consist of a dense graded mix with a minimum 75 blow Marshall Stability of 9,000 Newtons and 3% to 5% air voids.
5. Positive surface drainage is recommended to reduce the potential for moisture infiltration through the pavement structure. A minimum cross-slope of 3% is recommended.
6. It is assumed that a subdivision grading/drainage plan will be prepared by others. To enhance the performance of roadway and parking structures, maintaining adequate drainage at all time will be critical. Adequate maintenance of culverts, ditches etc. will be required to ensure that the drainage systems are functioning as intended.

7. The subgrade surface should be graded to promote drainage to the outer edges of the roadway/parking areas. If possible, the roadway/parking lot grades should be designed such that the granular sub-base course material can freely discharge into ditches or into a sub-surface drainage system along the side of the road, thereby providing a capillary break to maintain an unsaturated condition in the overlying traffic structure (this will be particularly important in low-lying/wetland areas).
8. Surface water should be prevented from seeping back under the outer edges of the pavement structure. The asphalt surface should also be shaped to prevent the accumulation of standing, ponded water.
9. Traffic areas should be separated on the basis of traffic loading (ie, light, medium, heavy). If heavier traffic is allowed to travel on lighter traffic structures, premature distress/failure of the lighter traffic structures will occur.
10. Periodic maintenance such as crack sealing will be required.
11. It is recommended that the roadway grades should be maintained at least 600 mm above the surrounding terrain to minimize snow accumulation on the roads, and that the shoulder of the road should be at least 1.2 m above the ditch bottom.
    Geosynthetics are recommended to provide material separation, subgrade stabilization, uniform structure thickness and extended/improved performance of the structure. Site specific geosythetic design details should be determined in consultation with SNC-Lavalin (intended application, type of geosythetic, location within structure, depth of soil subcut required, etc). Depending on the geosynthetic design details chosen, the actual pavement structure may vary from what is presented in Table 6.8.
12. Sub surface drainage systems are recommended to control the moisture profile within the subgrade soils and to improve the longterm performance of the pavement structure. The surface of the subgrade should be sloped to provide drainage toward collection points (ie, catch basins). If concrete catch basins are installed, a series of small diameter holes (25 mm diameter minimum) should be drilled through the catch basin to allow for drainage of free water which may collect adjacent to the catch basin. If this is done, a continuous layer of non woven geotextile must be used to encapsulate the catch basin and the surrounding (free draining) backfill material to prevent clogging of the drainage holes and migration of fines into the catch basin. Provisions for lowering the catch basin rim should be also provided in the event that the backfill soil around the catch basin settles (surface water will tend to collect around the catch basin if this occurs).
13. If granular surfaced structures are constructed instead of asphalt concrete surfaced structures, a gravel to asphalt equivalency of 2:1 may be utilized (ie, a 200 mm thickness of granular fill would be equivalent to a 100 mm thickness of asphalt concrete). The granular surface should be graded to provide a smooth riding surface. Periodic maintenance (grading, placement of additional fill etc) will be needed to maintain the desired riding surface.

7 FUTURE DEVELOPMENT AREA

The detailed geotechnical design recommendations presented in this report are applicable to the proposed Korpan Tractor site only. The current (preliminary) level of investigation within the proposed future development area was intended to facilitate municipal re-zoning and subdivision approval for the remainder of the site. Based on the preliminary work completed, the proposed future development area is considered suitable for industrial development. Site specific geotechnical investigations will be required for the design and construction of any proposed structures within the proposed industrial development.

8 CONSTRUCTION CONTROL AND MONITORING

The recommendations presented in this report are based on the premise that full time inspection, monitoring, and control testing are provided by qualified SNC-Lavalin personnel during site development and construction. Hence, quality control should be provided as follows:

- Inspection during site grading, clearing/excavation and proof rolling to verify the removal of unsuitable materials.
- In-situ density and moisture content testing during subgrade preparation and placement of fill/backfill.
- Inspection during pile installation.
- Materials and concrete laboratory testing during construction.

9 DISCLOSURE OF INFORMATION OR CLOSURE

The Client hereby agrees that any information provided in this report, even if it is identified as being supplied in confidence, may be disclosed where required by law or if required by order of a court. The proponent hereby consents to the disclosure, on a confidential basis, of this report by SNC-Lavalin Inc. to the Client's advisers retained for the purpose of evaluating or participating in the evaluation of this report.

We trust that this Report meets your requirements. Should you have any questions or comments please contact us at +1.306.668.6800.

Geotechnical Investigation
Proposed Falcon Holdings Industrial Development
SE¼-25-37-6-W2M – Saskatoon, Saskatchewan
(Reference Number 626523) 05 March 2015

Submitted by:

SNC-LAVALIN INC.
Association of Professional Engineers *ENVIRONMENT & WATER* and Geoscientists of Saskatchewan
Certificate of Authorization Number 662

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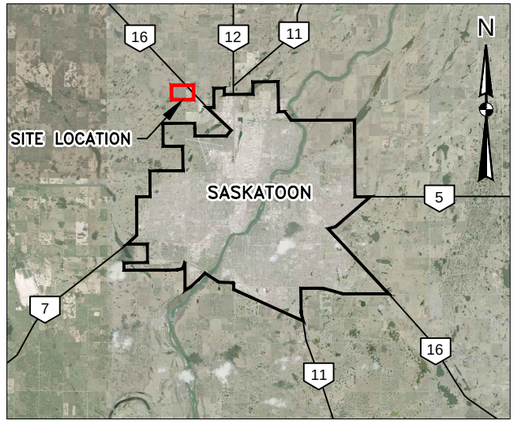
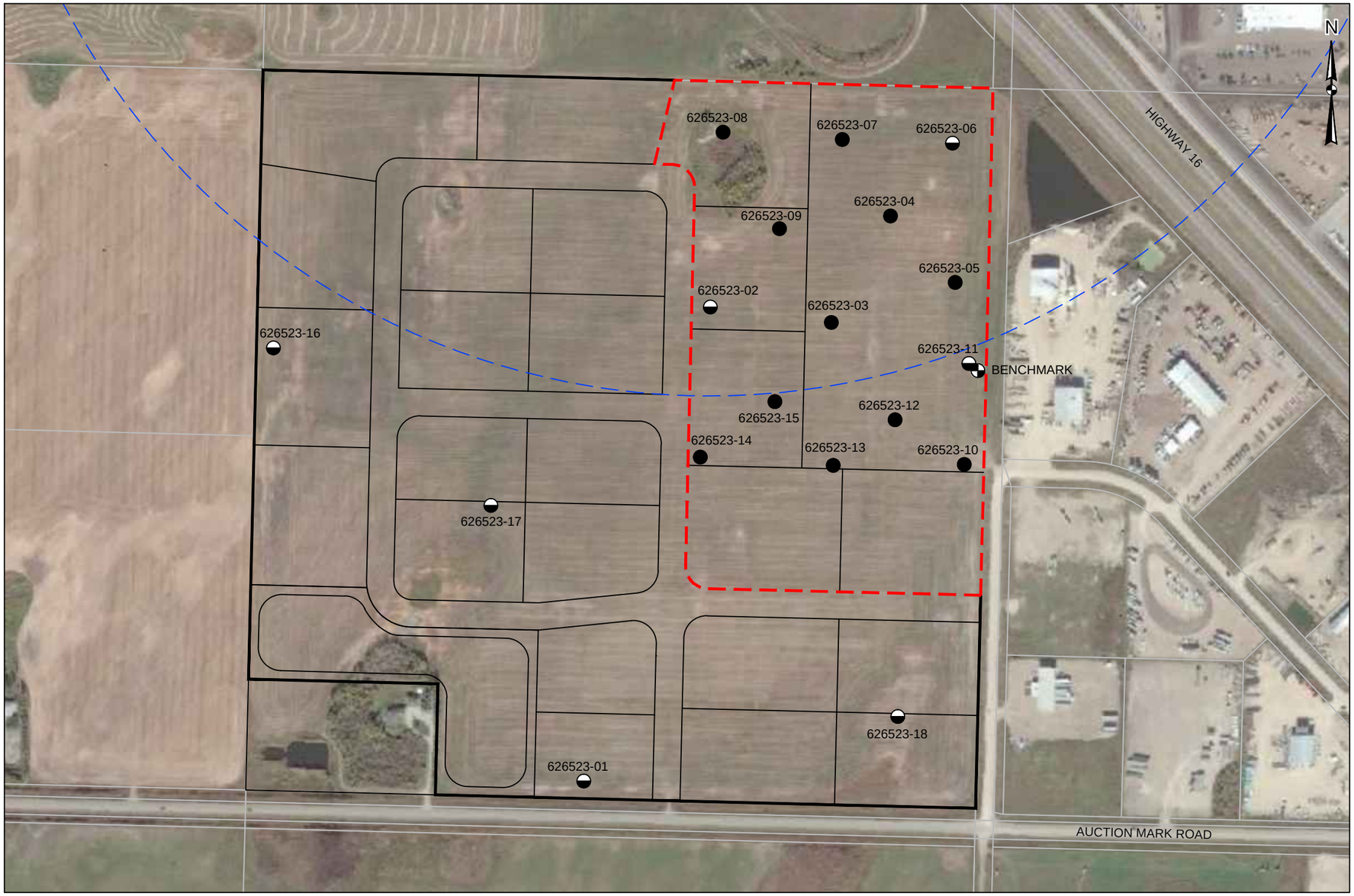
Geotechnical Project Engineer

APPENDIX I

Site Plan – Borehole Locations



LOCATION PLAN
SCALE: 1:400,000



SITE PLAN
SCALE: 1:5,000

LEGEND

- BOREHOLE
- PIEZOMETER
- BENCHMARK: TOP OF PLASTIC CAP AT TOP OF METAL POST MARKING HIGH PRESSURE GAS LINE; ASSUMED DATUM ELEVATION = 100.00 m
- PROPOSED KORPAN TRACTOR DEVELOPMENT
- PROPOSED HIGHWAYS CONTROL CIRCLE
- PROPOSED FUTURE DEVELOPMENT

NOTES

1. AIR PHOTO TAKEN FROM GOOGLE EARTH.

REFERENCE DRAWINGS

DWG No	DESCRIPTION
option3_20140728_REV1	ASSOCIATED ENGINEERING

REVISIONS

REV	DATE	DESCRIPTION	DRN	APP
-	-	-	-	-

STATUS

STATUS	APP BY	DATE
DESIGN REPORT		
APPROVED FOR TENDER		
APPROVED FOR CONSTRUCTION		
RECORD OF CONSTRUCTION		

1:5,000 0 50 100 150 200 m

1:400,000 0 5 10 15 20 km

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CLIENT
ASSOCIATED ENGINEERING

PROJECT LOCATION
PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT SITE

TITLE
SITE PLAN - BOREHOLE LOCATIONS

DES BY	CZ	**DRN BY**	EO	**DATE**	2015 02 19	**FIG No** I.1	**REV**
CHK BY	CG	**APP BY**	CZ	**DWG No**	626523-61-1		11X17

P:\Associated Engineering\626523 Proposed Falcon Holdings Industrial Development Site\4.0 Execution\4.5 GIS And Drawings\626523-61-1.dwg

APPENDIX II

Terms and Symbols, Borehole Logs

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A soil description for geotechnical applications includes a description of the following properties:

1) Lithology/ Texture
2) Colour and Oxidation
3) Consistency and Condition
4) Moisture Condition
5) Primary and Secondary Structure

1) LITHOLOGY/TEXTURE

The soil texture refers to the size, size distribution and shape of the individual soil particles which comprise the soil. The Unified Soil Classification System (ASTM D2487) is a quantitative method of describing the soil texture. The basis of this system is presented overleaf. The following terms are commonly used to describe the soil texture.

Particle Size (ASTM D2487)

Boulder	**> 300 mm**
Cobble	**75 - 300 mm**
Gravel	**4.75 - 75 mm**
Coarse	19 - 75 mm
Fine	4.75 - 19 mm
Sand	**0.075 - 4.75 mm**
Coarse	2 - 4.75 mm
Medium	0.425 - 2 mm
Fine	0.075 - 0.425 mm
Silt and Clay	**Smaller than 0.075 mm**

Relative Proportions (CFEM 4th Edition. 2006)

Gravel, Sand, Silt, Clay	>35% and main fraction
and	>35%
Gravelly, Sandy, Silty, Clayey	20 - 35%
some	10 - 20%
trace	<10%

Gradation

Well Graded	Having a wide range of grain sizes and substantial amount of all intermediate sizes
Uniform or Poorly	Possessing particles of predominantly one size
Gap Graded	Possessing particles of two distinct sizes

Particle Shape

Angular	Sharp edges and relatively plane sides with unpolished surfaces
Subangular	Similar to 'angular' but have rounded edges
Rounded	No edges and smoothly curved surfaces

Also may be flat, elongated or both

Glacial Till: Glacial till is comprised of a heterogeneous mixture of clay, silt, sand and gravel-sized particles. Due to the nature of formation and deposition, glacial till also inherently contains larger particle sizes (cobbles and boulders).

2) COLOUR AND OXIDATION

A soils colour may be described either qualitatively in the field at the soils natural moisture content using common colours (eg., light grey, light brown, dark grey, etc.), or quantitatively using the Munsell Book of Colour (eg. 5Y 3/1). The Munsell notation combines three variables, hue, value, and chroma to describe the soil colour. The hue indicates its relation to red, yellow, green, blue, and purple. The value indicates its lightness. The chroma indicates its strength of departure from a neutral of the same lightness. Quantitative determination of colour using the Munsell Book of Colours is completed after the soil has been allowed to dry at a low temperature.

Departure of the soil colour from a neutral colour indicates the soil has been oxidized. Oxidation of a soil occurs in a oxygen rich environment where most commonly metallic iron, oxidizes and turns a neutral coloured soil 'rusty' or reddish brown. Oxidized manganese gives a purplish tinge to the soil. Oxidation may occur throughout the entire soil mass or on fracture/joint/fissure surfaces. "Mottled" refers to a soil that is spotted, blotched or streaked with different shades or colours.

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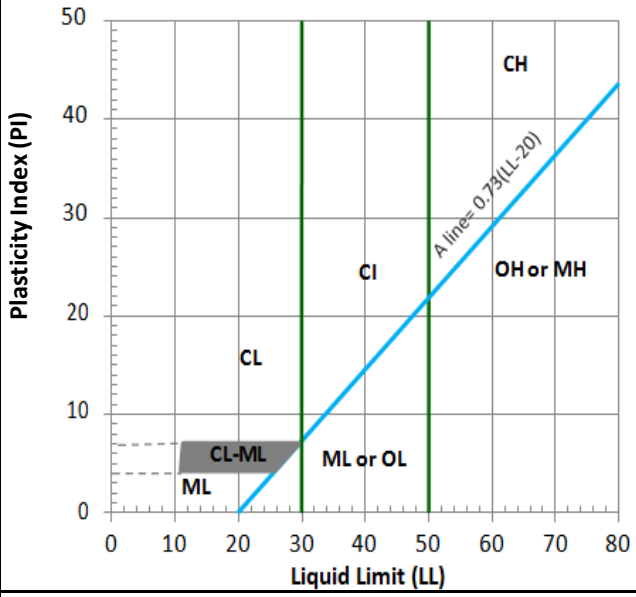
Classification of Soils for Engineering Purposes
(Including Identification and Description)
As Adopted by P.F.R.A.

Major Divisions		Group Symbols	Typical Names	Classification Criteria	
Coarse-grained soils More than 50% retained on No. 200 sieve (>0.075 mm)	Clean gravel (<5% fines)	GW	Well-graded gravels, gravel sand mixtures	Classification on basis of percentage of fines Less than 5% pass No.200 sieve… GW, GP, SW, SP More than 12% pass No. 200 sieve… GM, GC, SM, SC 5-12% pass No. 200 sieve…Borderline classifications requiring use of dual symbols	$C_u=D_{60}/D_{10}$ must be > 4; and, $C_c=(D_{30})^2/(D_{10}xD_{60})$ between 1 and 3
		GP	Poorly-graded gravels, gravel - sand mixtures		Not meeting both above criteria for GW
	Gravel with fines (>12% fines)	GM	Silty gravel, gravel - sand - silt mixtures		Atterberg limits below "A" line or PI <4
		GC	Clayey gravel, gravel - sand - clay mixtures		Atterberg limits on/above "A" line with PI >7
	Clean sand (<5% fines)	SW	Well-graded sand, gravelly sands		$C_u=D_{60}/D_{10}$ must be > 6; and, $C_c=(D_{30})^2/(D_{10}xD_{60})$ between 1 and 3
		SP	Poorly-graded sand, gravelly sands		Not meeting both above criteria for SW
	Sand with fines (>12% fines)	SM	Silty sands, sand - silt mixtures		Atterberg limits below "A" line or PI <4
		SC	Clayey sands, sand - clay mixtures		Atterberg limits on/above "A" line with PI >7
Fine-grained soils 50% or more passes No. 200 sieve (≤0.075 mm)	Inorganic	ML	Silts, silty or clayey fine sands or clayey silts with slight plasticity	**Plasticity Chart**	
		CL	Clays of low plasticity		
	Organic	OL	Organic silts or clay of low plasticity		
	Inorganic	CI	Silts or clays of medium plasticity		
	Inorganic	MH	Micaceous or diatomaceous fine sandy or silty soils, elastic silts		
		CH	Silts or clays of high plasticity		
	Organic	OH	Organic clays or silts of high plasticity		
		PT	Peat, muck and other highly organic soils	Boundary classification: Soils possessing characteristics of two groups are designated by combinations of group symbols. For example GW - GC, well graded gravel - sand mixture with clay binder	



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3) CONSISTENCY AND CONDITION

The consistency of a cohesive soil is a qualitative description of its resistance to deformation and can be correlated with the undrained shear strength of the soil. Undrained shear strength can be estimated based on field identification methods (resistance to fist/thumb/fingernail penetration), pocket penetrometer test or standard penetration resistance (SPT N-index, ASTM D1586).

The condition of a coarse grained soil qualitatively describes the soil compactness and can be correlated with the SPT N-index.

The standard penetration resistance 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 to 0.45 m) with a 63.5 kg weight having a free fall of 0.76 m.

a) Consistency and Plasticity of Cohesive Soils

Consistency	*SPT N-Index	Undrained Shear Strength (kPa) (CFEM 4th Ed., 2006)	Pocket Penetrometer (kg/cm^2)	Field Identification (ASTM D2488)
Very Soft	0 – 2	<12	<0.25	Easily penetrated several cm by fist
Soft	2 – 4	12 – 25	0.25 – 0.5	Easily penetrated several cm by thumb
Firm	4 – 8	25 – 50	0.5 – 1.0	Can be penetrated several cm by the thumb with moderate effort
Stiff	8 – 15	50 – 100	1.0 – 2.0	Readily indented by thumb but penetrated only with great effort
Very Stiff	15 – 30	100 – 200	2.0 – 4.0	Readily indented by thumbnail
Hard	>30	>200	>4.0	Indented with difficulty by thumbnail

* uncorrected

The plasticity of cohesive soils is a measure of the soils ability to deform without rupture. The plasticity should be estimated in the field as low (liquid limit <30), medium (liquid limit between 30 and 50) or high (liquid limit >50). The plasticity can be confirmed in the laboratory through Atterberg limits testing.

b) Compactness Condition of Coarse Grained Soils

Compactness Condition	*SPT N-Index
Very Loose	0 – 4
Loose	4 – 10
Compact	10 – 30
Dense	30 – 50
Very Dense	>50

* uncorrected

4) MOISTURE CONDITION

Moisture Condition	Description
Dry	No moisture, dusty, dry to touch
Moist	Damp but contains no visible water
Wet	Visible, free water, usually soil is below piezometric surface

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5) PRIMARY AND SECONDARY STRUCTURE

(a) Primary Soil Structure (Depositional)

Geometry

Stratum	A single sedimentary unit which is visibly separable from other strata by a discrete change in lithology and/or sharp physical break
Homogeneous	Uniform in nature
Stratified	Consisting of a sequence of layers which are generally different in texture or colour
Thinly Laminated	Stratified with layer thickness < 2 mm
Laminated	Stratified with layer thickness between 2 – 10 mm
Bedded	Stratified with layer thickness >10 mm
Very Thinly Bedded	Stratified with layer thickness between 10 – 50 mm
Thinly Bedded	Stratified with layer thickness between 50 – 600 mm
Thickly Bedded	Stratified with layer thickness between 600 – 1,200 mm
Massive	Stratified with layer thickness >1,200 mm
Lenses	Inclusions of small pockets of different soils

Bedding Structures

Cross bedding	Internal bedding inclined to the general bedding plane
Ripple bedding	Internal wavy bedding
Graded bedding	Internal gradation of grain size from coarse at base of bed to finer at top of bed (or vice versa)
Horizontal bedded	Internal bedding parallel and flat lying

(b) Secondary Soil Structure (Post Depositional)

Accretionary Structures (Includes nodules, concretions, crystal deposits, veins, colour banding)

Cementation	Chemically precipitated material (commonly calcite) which binds soil grains together
Salt Crystals	Groundwater flowing through soils often precipitates residual salts in the soil structure. Common salt precipitates are gypsum, calcite and glauber salts.

Fracture Structures

Fracture	A break or discontinuity in the soil caused by stress exceeding the material strength
Joint	A fracture along which no displacement has occurred
Blocky	A cohesive soil that can be broken down into small pieces which resist further breakdown, typically resulting from soil fracture patterns
Slickensided	Fractures that are slick and glossy (plane of weakness), typically associated with shear displacement of soils
Brecciated	Containing randomly oriented angular fragments in a finer mass, typically associated with shear displacement of soils

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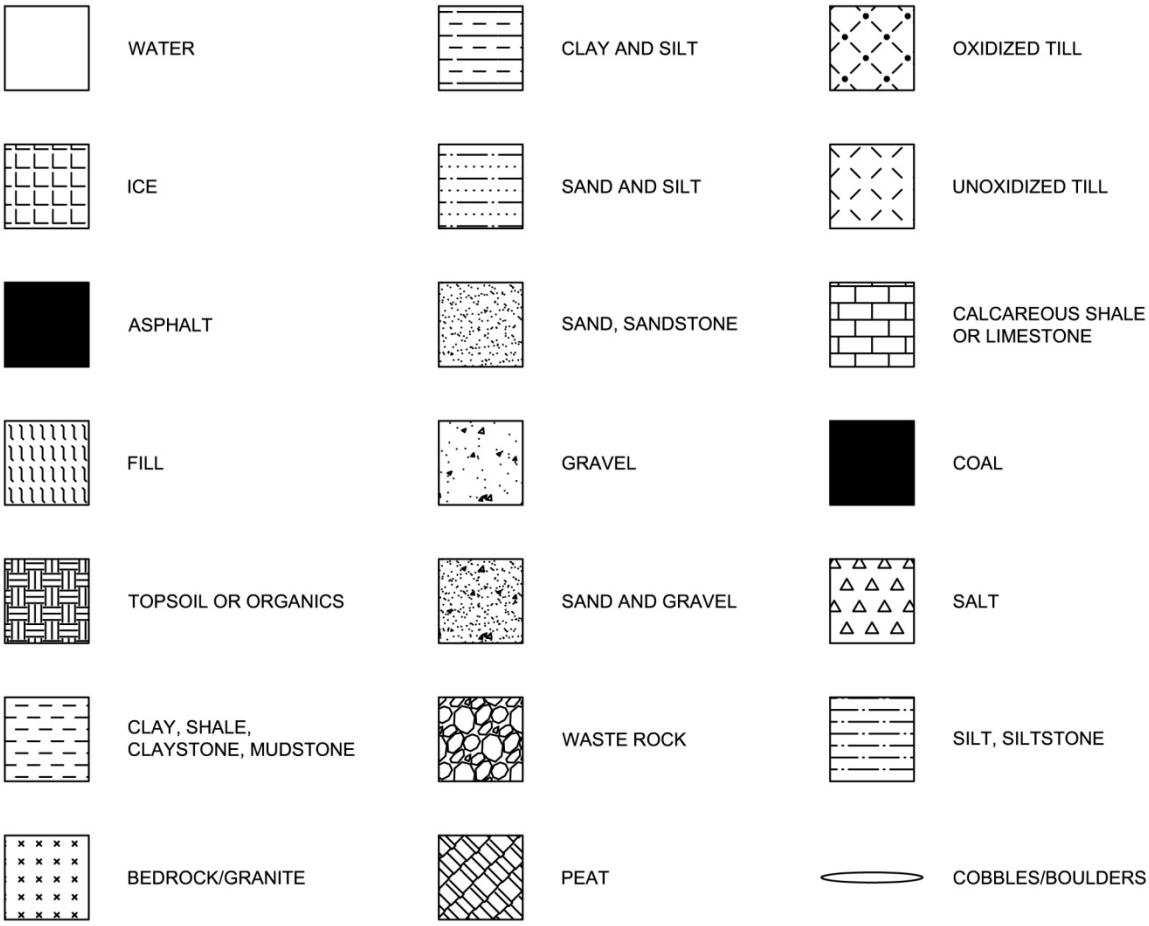
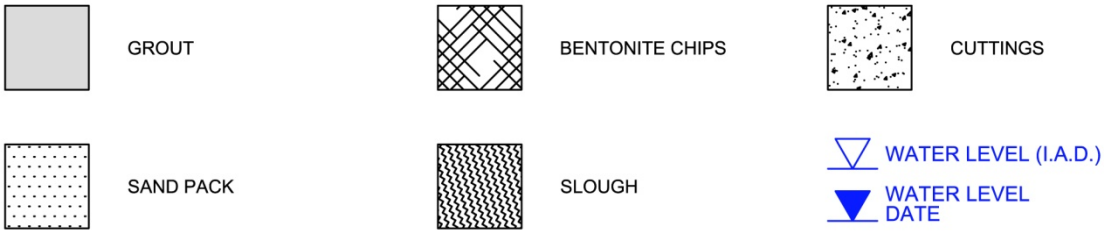
Symbols Used on Borehole Logs



Sampling

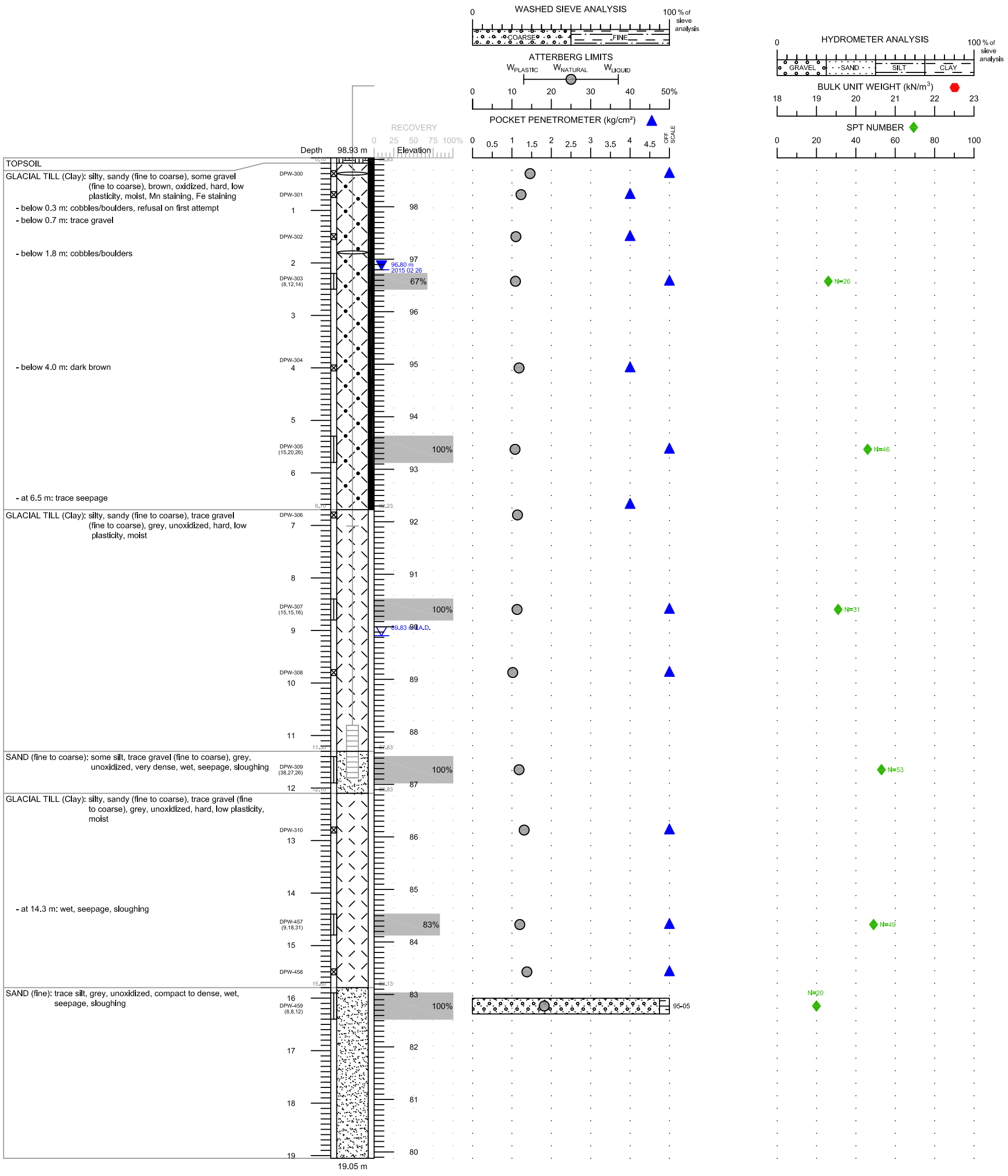
Soil Oxidation

Piezometer and Borehole Completion Symbols



BOREHOLE 626523-01
ASSOCIATED ENGINEERING
PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
2015

5784960 N 382167 E
NAD 83 ZONE 13
SE1/4-25-37-06-W3M
73B/2



FUTURE DEVELOPMENT

REFERENCE DRAWINGS	
DWG No	DESCRIPTION

NOTES

1. Borehole sloughed to 9.1 m immediately after drilling (I.A.D.), groundwater at 9.1 m I.A.D.
2. Hole backfilled with bentonite chips.
3. Standard Penetration Tests (SPT) conducted with 63.5 kg (140 lb) automatic trip hammer falling 762 mm (30 inches).
4. (#,#,#) denotes SPT blows per 152 mm (6.0 inches).
5. Depths are in metres (m).
6. Elevations are in metres with respect to a local benchmark.
7. Coordinates and elevations from handheld GPS.

CONTRACTOR	MOBILE AUGERS	**SUPERVISOR**	D. WRIGHT
OPERATOR	L. SCHAFER	**LOGGED BY**	D. WRIGHT
TYPE OF DRILL RIG	M-10	**DRILLED DATE**	2015 02 14
ABANDONMENT	BENTONITE CHIPS	**INSTALLATION DATE**	2015 02 14

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CLIENT	ASSOCIATED ENGINEERING
PROJECT LOCATION	PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
APPROVED BY	C. ZUBROWSKI, P.Eng.
DRAWN BY	E. OVCINA
PROJECT No.	626523
SCALE	1:75
DATE	2015 02 19

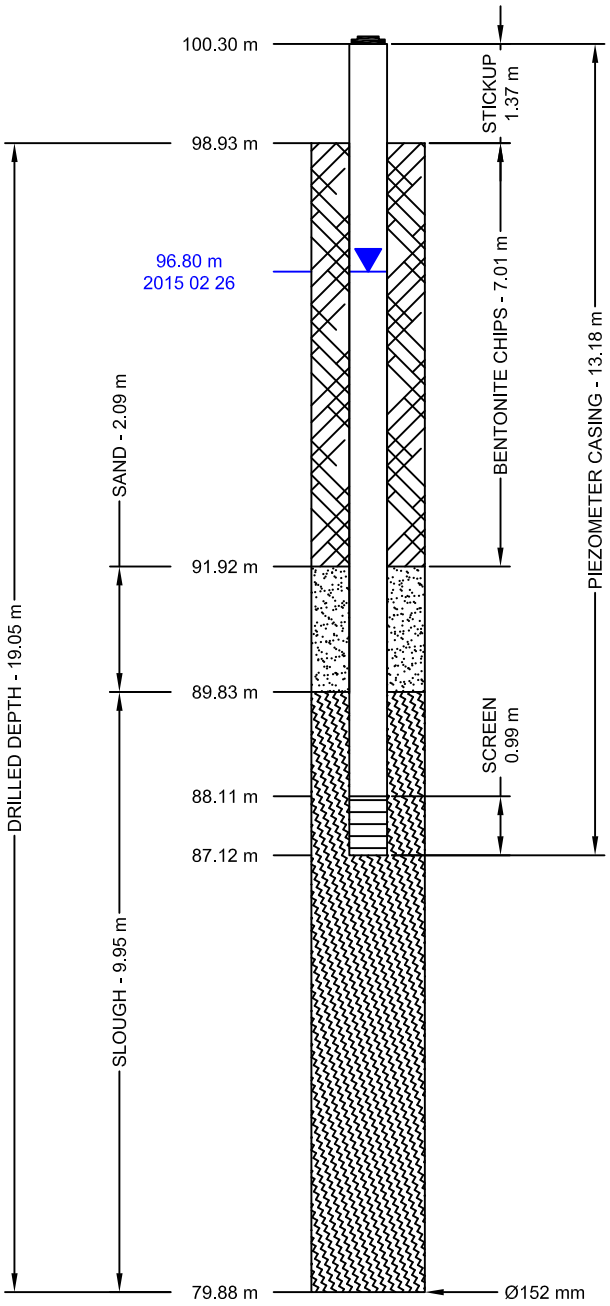
LIMITATION

This drill log is a summary of the conditions estimated by the field personnel at the specific location at the time of drilling. The conditions and properties described above will vary between locations and may vary with time.

P:\Associated Engineering\626523 Proposed Falcon Holdings Industrial Development Site\4.0 Execution\4.5 GIS And Drawings\BH-626523-01.dwg

PIEZOMETER 626523-01
ASSOCIATED ENGINEERING
PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
2015

5784960 N 382167 E
NAD 83 ZONE 13
SE1/4-25-37-06-W3M
73B/2



SCREEN SPECIFICATIONS:
- 2 inch 10 slot Schedule 80 PVC
- PVC cap at bottom of piezometer

CASING SPECIFICATIONS:
- 2 Inch Schedule 80 PVC
- threaded with o-ring seal

FUTURE DEVELOPMENT

NOTES

1. Depths and elevations are in metres (m).
2. Coordinates from handeld GPS.
3. Elevations are in metres with respect to a local benchmark.

SUPERVISOR	D. WRIGHT
CONTRACTOR	MOBILE AUGERS
OPERATOR	L. SCHAFER
DRILL RIG TYPE	M-10
DATE INSTALLED	2015 02 14
APPROVED BY	C. ZUBROWSKI, P.Eng.
DRAWN BY	E. OVCINA
PROJECT No.	626523
SCALE NOT TO SCALE	**DATE** 2015 02 20

SNC·LAVALIN

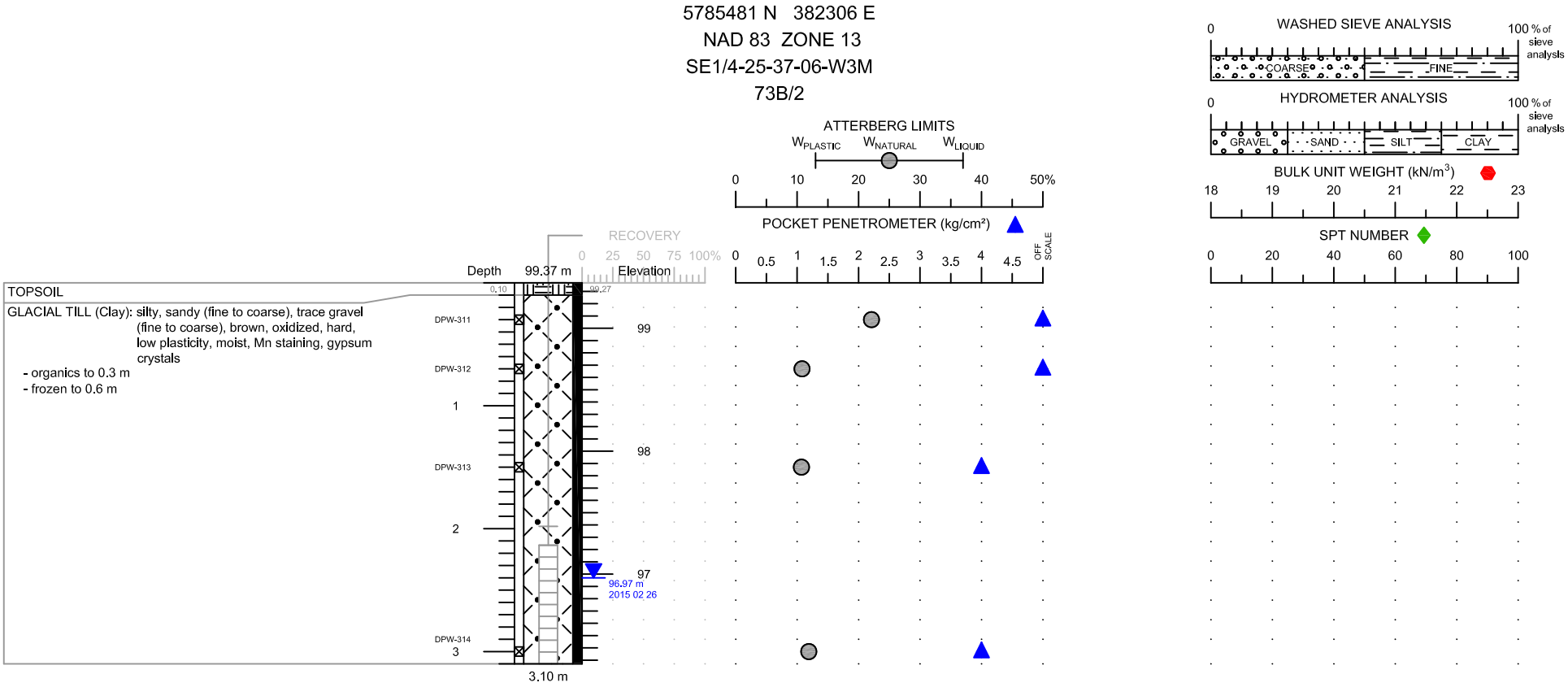
CLIENT
ASSOCIATED ENGINEERING

PROJECT LOCATION
PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT

P:\Associated Engineering\626523 Proposed Falcon Holdings Industrial Development Site\4.0 Execution\4.5 GIS And Drawings\PS-626523-01.dwg

BOREHOLE 626523-02
ASSOCIATED ENGINEERING
PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
2015

5785481 N 382306 E
NAD 83 ZONE 13
SE1/4-25-37-06-W3M
73B/2



BOREHOLE 626523-03
ASSOCIATED ENGINEERING
PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
2015

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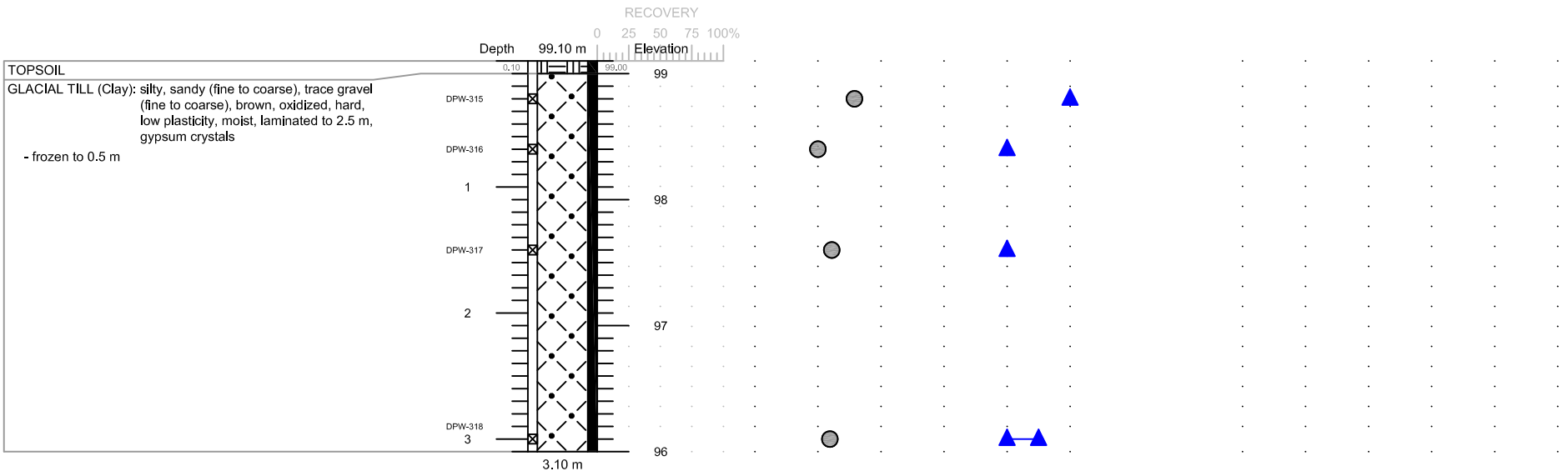
SE1/4-25-37-06-W3M
73B/2



BOREHOLE 626523-04
ASSOCIATED ENGINEERING
PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
2015

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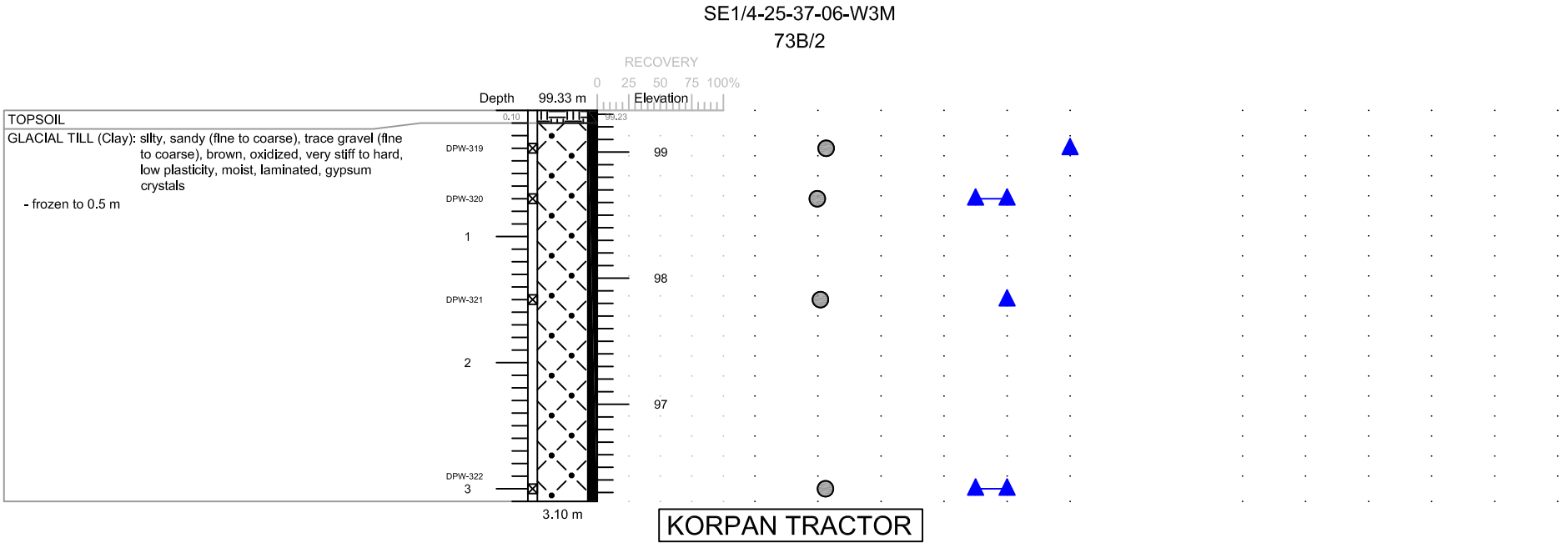
NAD 83 ZONE 13
SE1/4-25-37-06-W3M
73B/2



KORPAN TRACTOR

REFERENCE DRAWINGS	
DWG No	**DESCRIPTION**

NOTES

1. Boreholes open and dry immediately after drilling (I.A.D.).
2. Hole backfilled with bentonite chips.
3. Depths are in metres (m).
4. Elevations are in metres with respect to a local benchmark.
5. Coordinates and elevations from handheld GPS.

CONTRACTOR	MOBILE AUGERS	**SUPERVISOR**	D. WRIGHT
OPERATOR	L. SCHAFER	**LOGGED BY**	D. WRIGHT
TYPE OF DRILL RIG	M-10	**DRILLED DATE**	2015 02 11
ABANDONMENT	BENTONITE CHIPS	**INSTALLATION DATE**	2015 02 11

SNC·LAVALIN

CLIENT	**PROJECT LOCATION**
ASSOCIATED ENGINEERING	PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
APPROVED BY	C. ZUBROWSKI, P.Eng.
DRAWN BY	E. OVCINA
PROJECT No.	626523
SCALE 1:50	**DATE** 2015 02 19

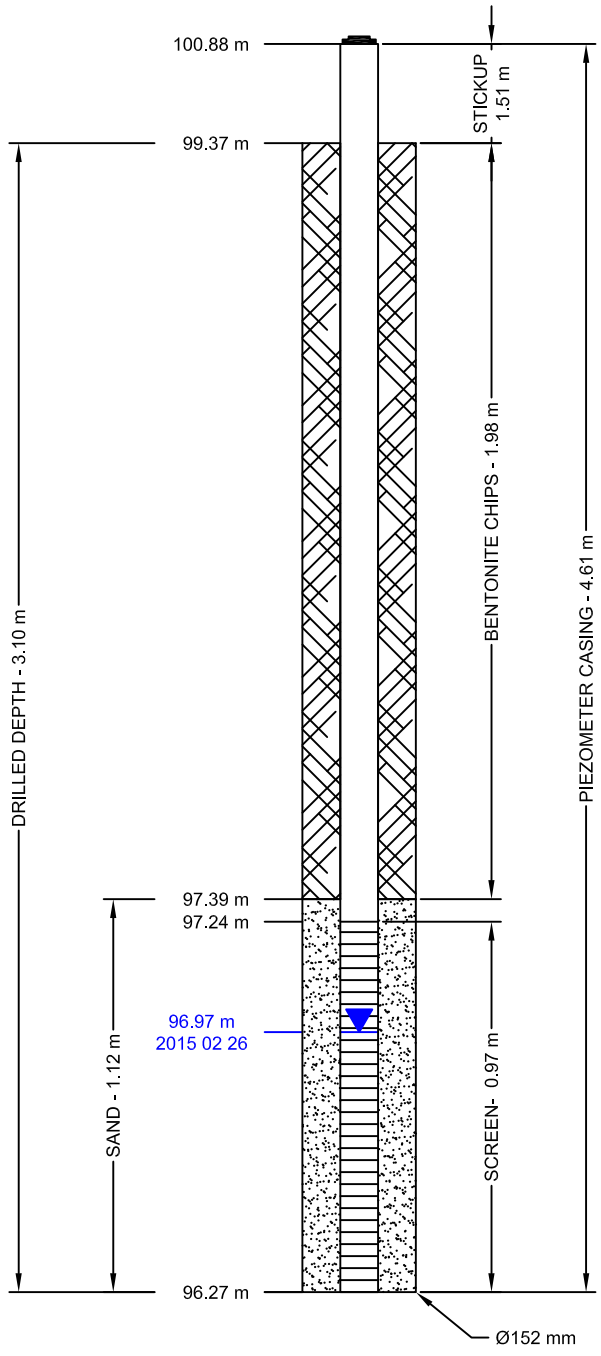
LIMITATION

This drill log is a summary of the conditions estimated by the field personnel at the specific location at the time of drilling. The conditions and properties described above will vary between locations and may vary with time.

P:\Associated Engineering\626523 Proposed Falcon Holdings Industrial Development Site\4.0 Execution\4.5 GIS And Drawings\BH-626523-02,03,04.dwg

PIEZOMETER 626523-02
ASSOCIATED ENGINEERING
PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
2015

5785481 N 382306 E
NAD 83 ZONE 13
SE1/4-25-37-06-W3M
73B/2



SCREEN SPECIFICATIONS:
- 2 inch 10 slot Schedule 80 PVC
- PVC cap at bottom of piezometer

CASING SPECIFICATIONS:
- 2 Inch Schedule 80 PVC
- threaded with o-ring seal

KORPAN TRACTOR

NOTES

1. Depths and elevations are in metres (m).
2. Coordinates from handeld GPS.
3. Elevations are in metres with respect to a local benchmark.

SUPERVISOR	D. WRIGHT
CONTRACTOR	MOBILE AUGERS
OPERATOR	L. SCHAFER
DRILL RIG TYPE	M-10
DATE INSTALLED	2015 02 11
APPROVED BY	C. ZUBROWSKI, P.Eng.
DRAWN BY	E. OVCINA
PROJECT No.	626523
SCALE NOT TO SCALE	**DATE** 2015 02 20

SNC·LAVALIN

CLIENT
ASSOCIATED ENGINEERING

PROJECT LOCATION
PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT

P:\Associated Engineering\626523 Proposed Falcon Holdings Industrial Development Site\4.0 Execution\4.5 GIS And Drawings\PS-626523-02.dwg

BOREHOLE 626523-05
ASSOCIATED ENGINEERING
PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
2015

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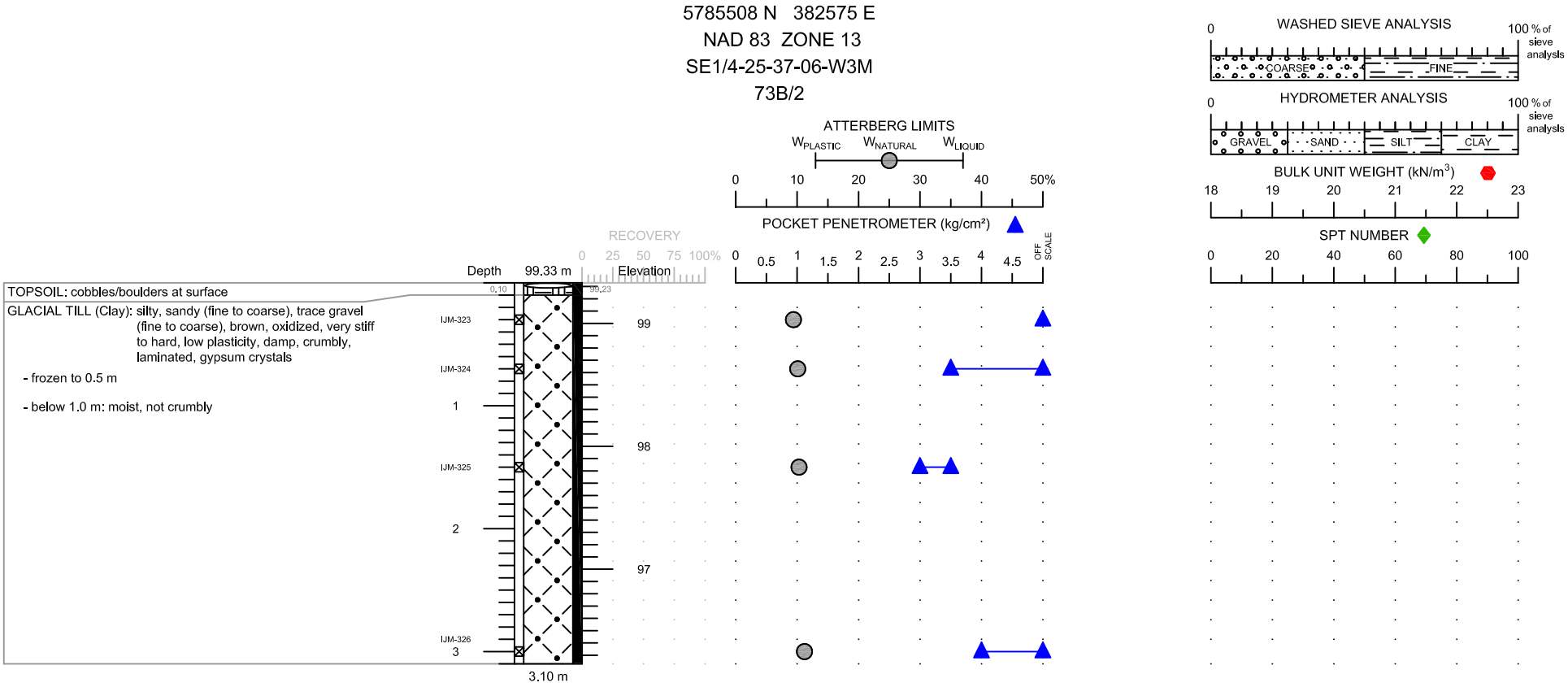
NAD 83 ZONE 13
SE1/4-25-37-06-W3M
73B/2



BOREHOLE 626523-06
ASSOCIATED ENGINEERING
PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
2015

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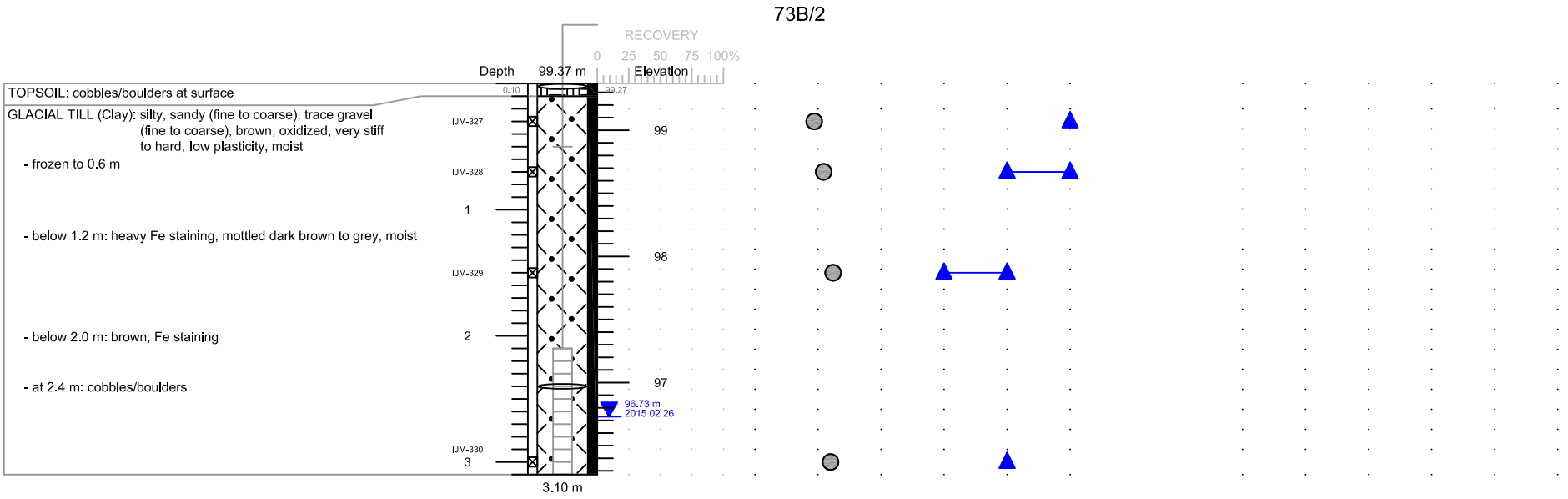
SE1/4-25-37-06-W3M
73B/2



BOREHOLE 626523-07
ASSOCIATED ENGINEERING
PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
2015

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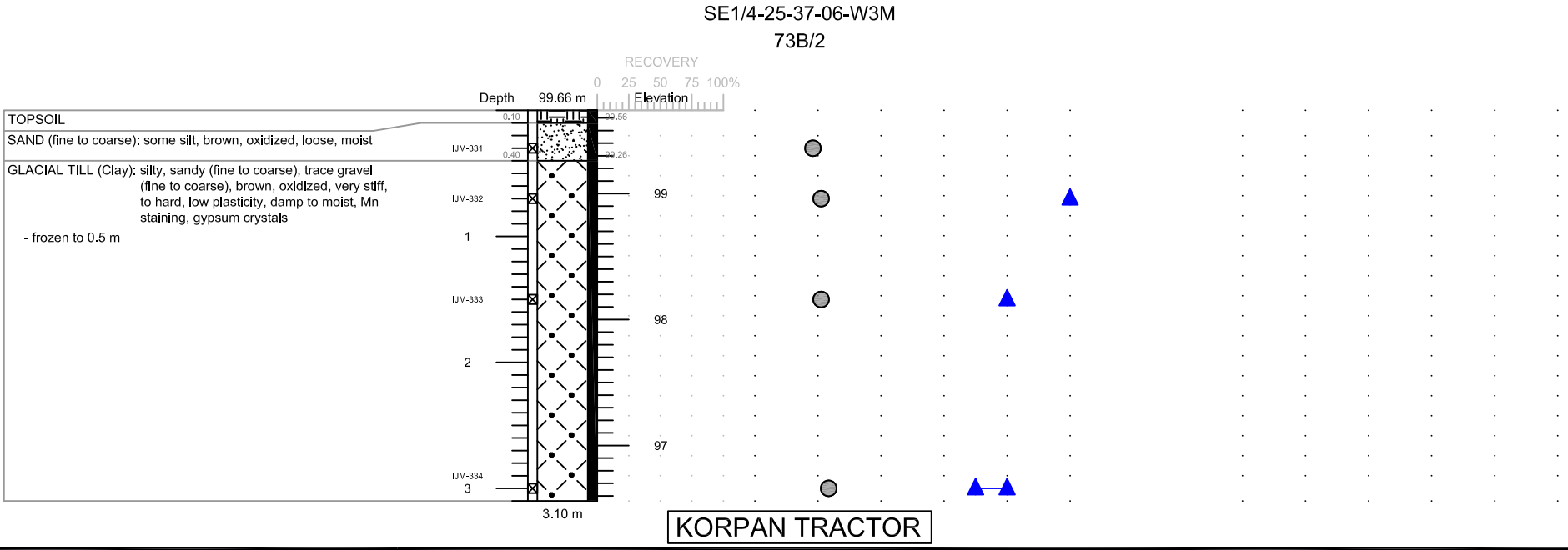
SE1/4-25-37-06-W3M
73B/2



KORPAN TRACTOR

REFERENCE DRAWINGS	
DWG No	DESCRIPTION

NOTES

1. Boreholes open and dry immediately after drilling (I.A.D.).
2. Hole backfilled with bentonite chips.
3. Depths are in metres (m).
4. Elevations are in metres with respect to a local benchmark.
5. Coordinates and elevations from handheld GPS.

CONTRACTOR	MOBILE AUGERS	SUPERVISOR	D. WRIGHT
OPERATOR	L. SCHAFER	LOGGED BY	D. WRIGHT
TYPE OF DRILL RIG	M-10	DRILLED DATE	2015 02 11/12
ABANDONMENT	BENTONITE CHIPS	INSTALLATION DATE	2015 02 11

SNC·LAVALIN

CLIENT	PROJECT LOCATION
ASSOCIATED ENGINEERING	PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT

APPROVED BY	C. ZUBROWSKI, P.Eng.		
DRAWN BY	E. OVCINA		
PROJECT No.	626523		
SCALE	1:50	DATE	2015 02 19

LIMITATION

This drill log is a summary of the conditions estimated by the field personnel at the specific location at the time of drilling. The conditions and properties described above will vary between locations and may vary with time.

P:\Associated Engineering\626523 Proposed Falcon Holdings Industrial Development Site\4.0 Execution\4.5 GIS And Drawings\BH-626523-05,06,07.dwg

PIEZOMETER 626523-06
ASSOCIATED ENGINEERING
PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
2015

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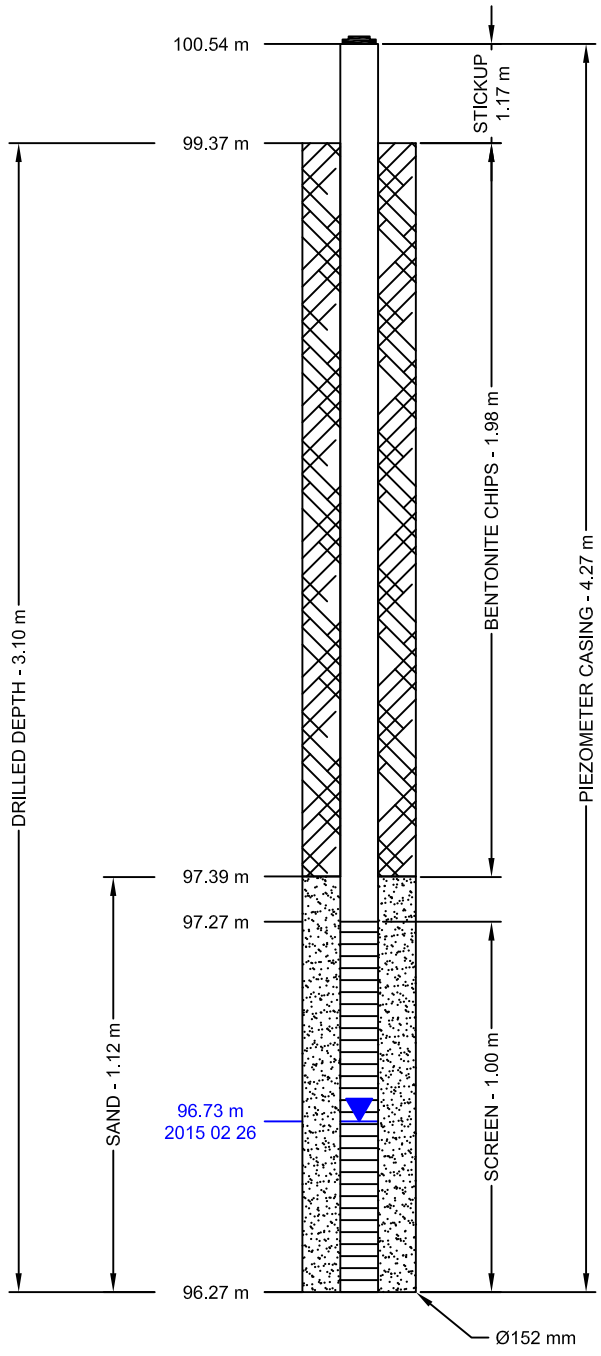
NAD 83 ZONE 13
SE1/4-25-37-06-W3M
73B/2



SCREEN SPECIFICATIONS:
- 2 inch 10 slot Schedule 80 PVC
- PVC cap at bottom of piezometer

CASING SPECIFICATIONS:
- 2 Inch Schedule 80 PVC
- threaded with o-ring seal

KORPAN TRACTOR

NOTES

1. Depths and elevations are in metres (m).
2. Coordinates from handeld GPS.
3. Elevations are in metres with respect to a local benchmark.

SUPERVISOR	D. WRIGHT
CONTRACTOR	MOBILE AUGERS
OPERATOR	L. SCHAFER
DRILL RIG TYPE	M-10
DATE INSTALLED	2015 02 11
APPROVED BY	C. ZUBROWSKI, P.Eng.
DRAWN BY	E. OVCINA
PROJECT No.	626523
SCALE NOT TO SCALE	**DATE** 2015 02 20

SNC·LAVALIN

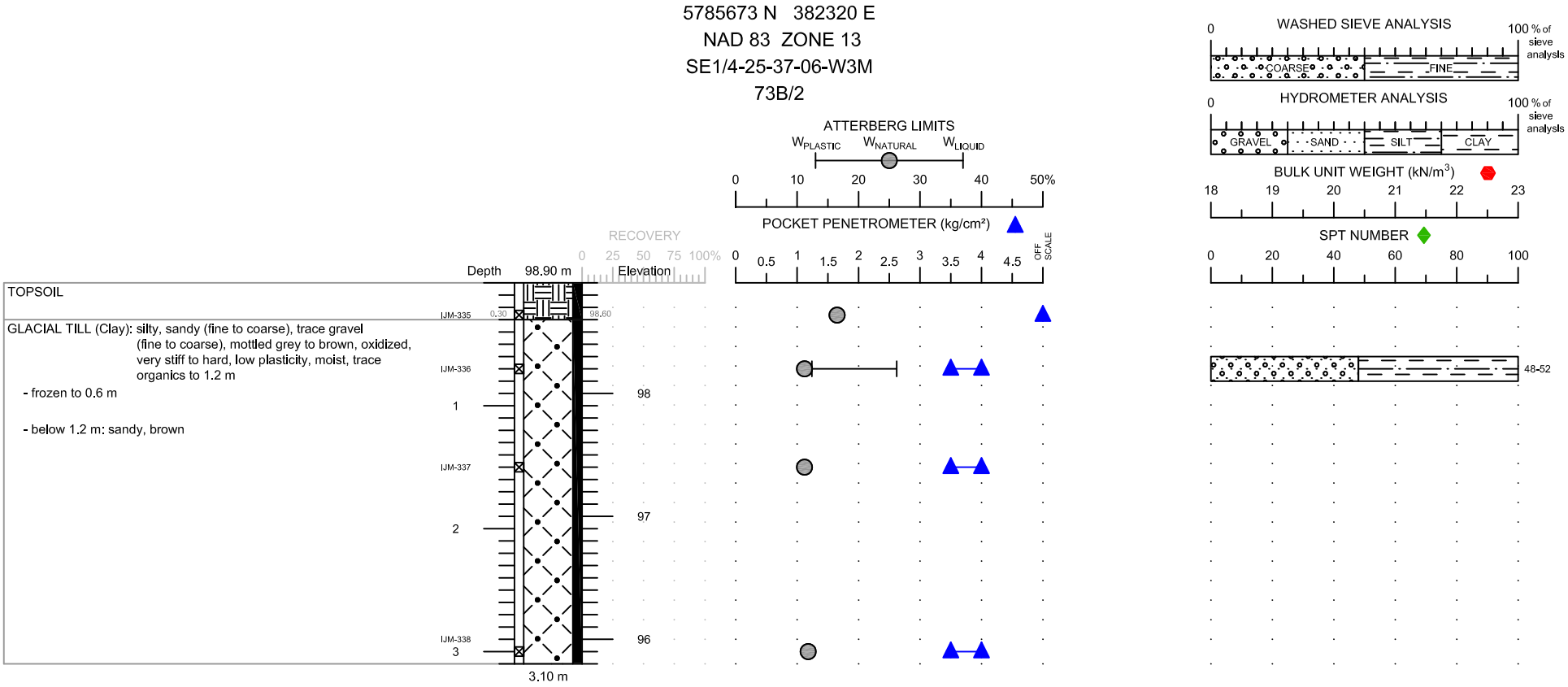
CLIENT
ASSOCIATED ENGINEERING

PROJECT LOCATION
PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT

P:\Associated Engineering\626523 Proposed Falcon Holdings Industrial Development Site\4.0 Execution\4.5 GIS And Drawings\PS-626523-06.dwg

BOREHOLE 626523-08
ASSOCIATED ENGINEERING
PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
2015

5785673 N 382320 E
NAD 83 ZONE 13
SE1/4-25-37-06-W3M
73B/2



BOREHOLE 626523-09
ASSOCIATED ENGINEERING
PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
2015

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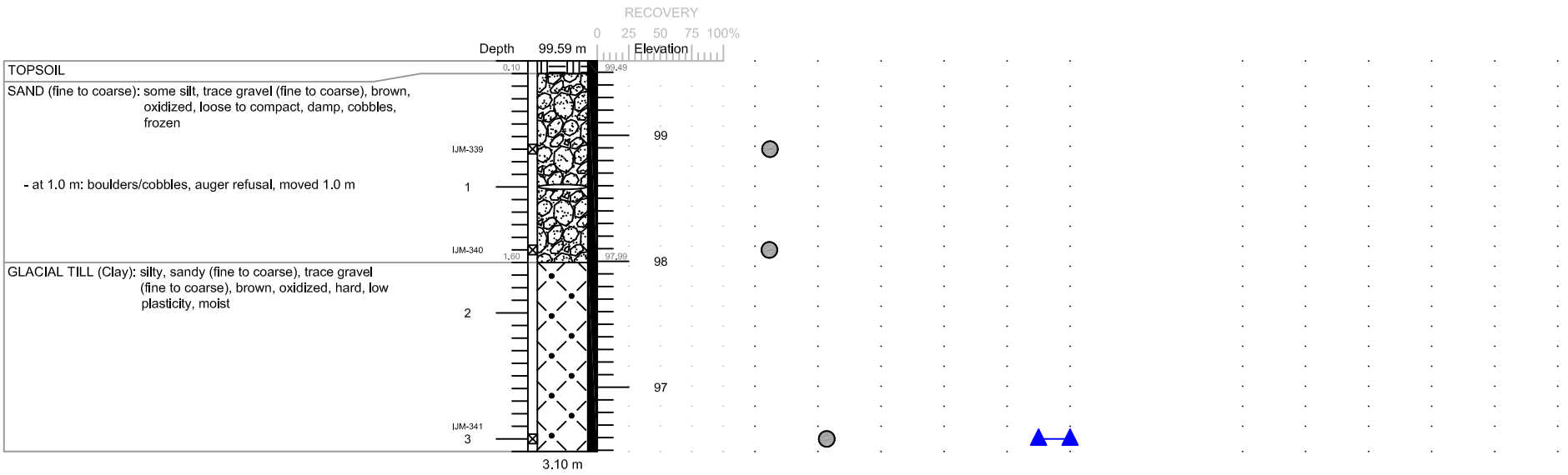
NAD 83 ZONE 13
SE1/4-25-37-06-W3M
73B/2



KORPAN TRACTOR

REFERENCE DRAWINGS	
DWG No	DESCRIPTION

NOTES

1. Boreholes open and dry immediately after drilling (I.A.D.).
2. Hole backfilled with bentonite chips.
3. Depths are in metres (m).
4. Elevations are in metres with respect to a local benchmark.
5. Coordinates and elevations from handheld GPS.

CONTRACTOR	MOBILE AUGERS	**SUPERVISOR**	D. WRIGHT
OPERATOR	L. SCHAFER	**LOGGED BY**	D. WRIGHT
TYPE OF DRILL RIG	M-10	**DRILLED DATE**	2015 02 11
ABANDONMENT	BENTONITE CHIPS	**INSTALLATION DATE**	N/A

SNC·LAVALIN

CLIENT ASSOCIATED ENGINEERING	**PROJECT LOCATION** PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
APPROVED BY	C. ZUBROWSKI, P.Eng.
DRAWN BY	E. OVCINA
PROJECT No.	626523
SCALE 1:50	**DATE** 2015 02 19

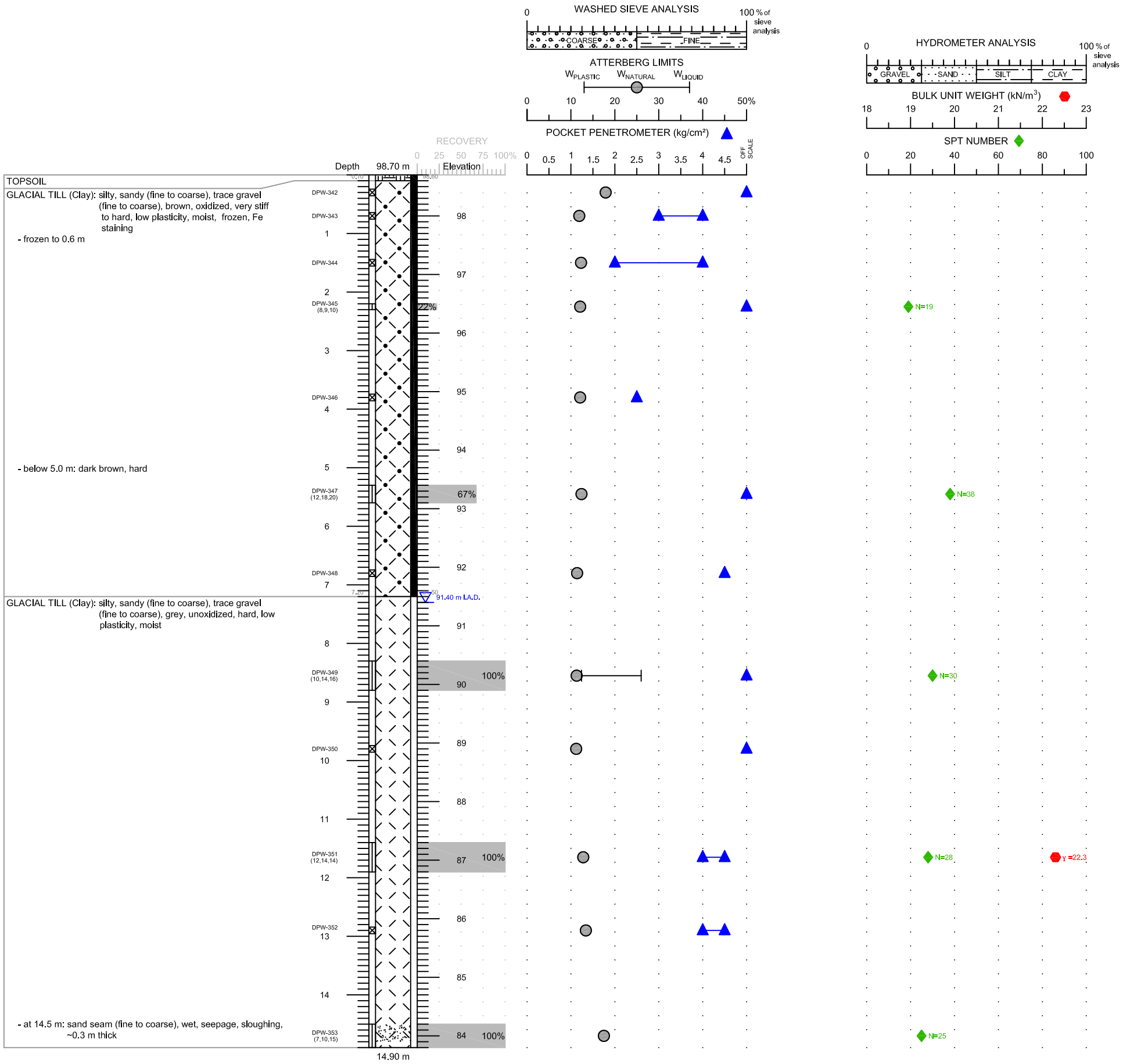
LIMITATION

This drill log is a summary of the conditions estimated by the field personnel at the specific location at the time of drilling. The conditions and properties described above will vary between locations and may vary with time.

P:\Associated Engineering\626523 Proposed Falcon Holdings Industrial Development Site\4.0 Execution\4.5 GIS And Drawings\BH-626523-08,09.dwg

BOREHOLE 626523-10
ASSOCIATED ENGINEERING
PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
2015

5785308 N 382585 E
NAD 83 ZONE 13
SE1/4-25-37-06-W3M
73B/2



KORPAN TRACTOR

REFERENCE DRAWINGS	
DWG No	DESCRIPTION

NOTES

1. Borehole open immediately after drilling (I.A.D.), groundwater at 7.3 m I.A.D.
2. Hole backfilled with bentonite chips.
3. Standard Penetration Tests (SPT) conducted with 63.5 kg (140 lb) automatic trip hammer falling 762 mm (30 inches).
4. (#,#,#) denotes SPT blows per 152 mm (6.0 inches).
5. Depths are in metres (m).
6. Elevations are in metres with respect to a local benchmark.
7. Coordinates and elevations from handheld GPS.

CONTRACTOR	MOBILE AUGERS	**SUPERVISOR**	D. WRIGHT
OPERATOR	L. SCHAFER	**LOGGED BY**	D. WRIGHT
TYPE OF DRILL RIG	M-10	**DRILLED DATE**	2015 02 12
ABANDONMENT	BENTONITE CHIPS	**INSTALLATION DATE**	N/A

SNC·LAVALIN

CLIENT	ASSOCIATED ENGINEERING
PROJECT LOCATION	PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
APPROVED BY	C. ZUBROWSKI, P.Eng.
DRAWN BY	E. OVCINA
PROJECT No.	626523
SCALE	1:75
DATE	2015 02 19

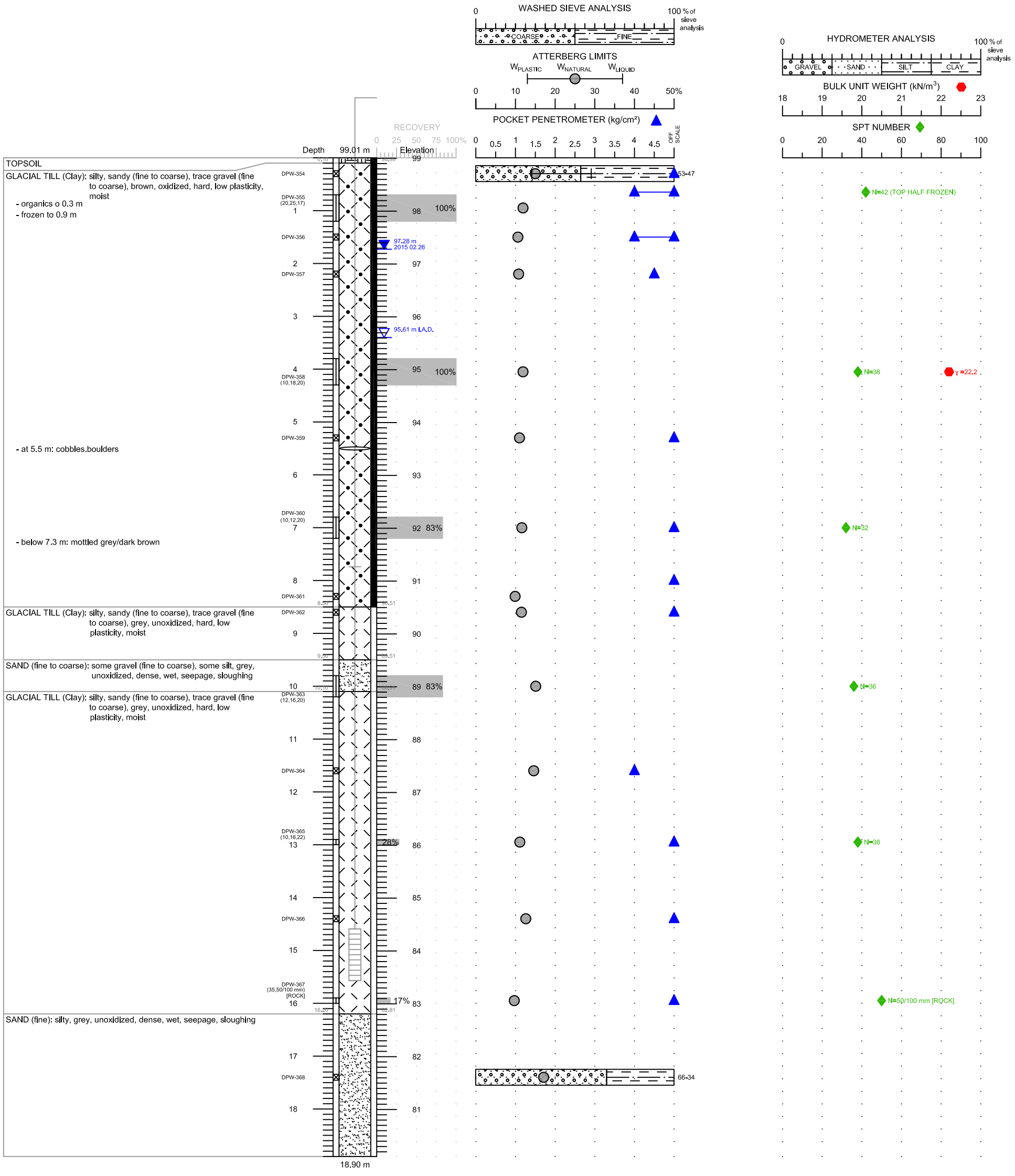
LIMITATION

This drill log is a summary of the conditions estimated by the field personnel at the specific location at the time of drilling. The conditions and properties described above will vary between locations and may vary with time.

P:\Associated Engineering\626523 Proposed Falcon Holdings Industrial Development Site\4.0 Execution\4.5 GIS And Drawings\BH-626523-10.dwg

BOREHOLE 626523-11
ASSOCIATED ENGINEERING
PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
2015

5785419 N 382590 E
NAD 83 ZONE 13
SE1/4-25-37-06-W3M
73B/2



KORPAN TRACTOR

REFERENCE DRAWINGS	
DWG No	DESCRIPTION

NOTES

1. Borehole sloughed to 8.8 m immediately after drilling (I.A.D.), groundwater at 3.4 m I.A.D.
2. Hole backfilled with bentonite chips.
3. Standard Penetration Tests (SPT) conducted with 63.5 kg (140 lb) automatic trip hammer falling 762 mm (30 inches).
4. (#,#,#) denotes SPT blows per 152 mm (6.0 inches).
5. Depths are in metres (m).
6. Elevations are in metres with respect to a local benchmark.
7. Coordinates and elevations from handheld GPS.

CONTRACTOR	MOBILE AUGERS	**SUPERVISOR**	D. WRIGHT
OPERATOR	L. SCHAFER	**LOGGED BY**	D. WRIGHT
TYPE OF DRILL RIG	M-10	**DRILLED DATE**	2015 02 12
ABANDONMENT	BENTONITE CHIPS	**INSTALLATION DATE**	2015 02 12

SNC·LAVALIN

CLIENT	ASSOCIATED ENGINEERING
PROJECT LOCATION	PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
APPROVED BY	C. ZUBROWSKI, P.Eng.
DRAWN BY	E. OVCINA
PROJECT No.	626523
SCALE	1:75
DATE	2015 02 19

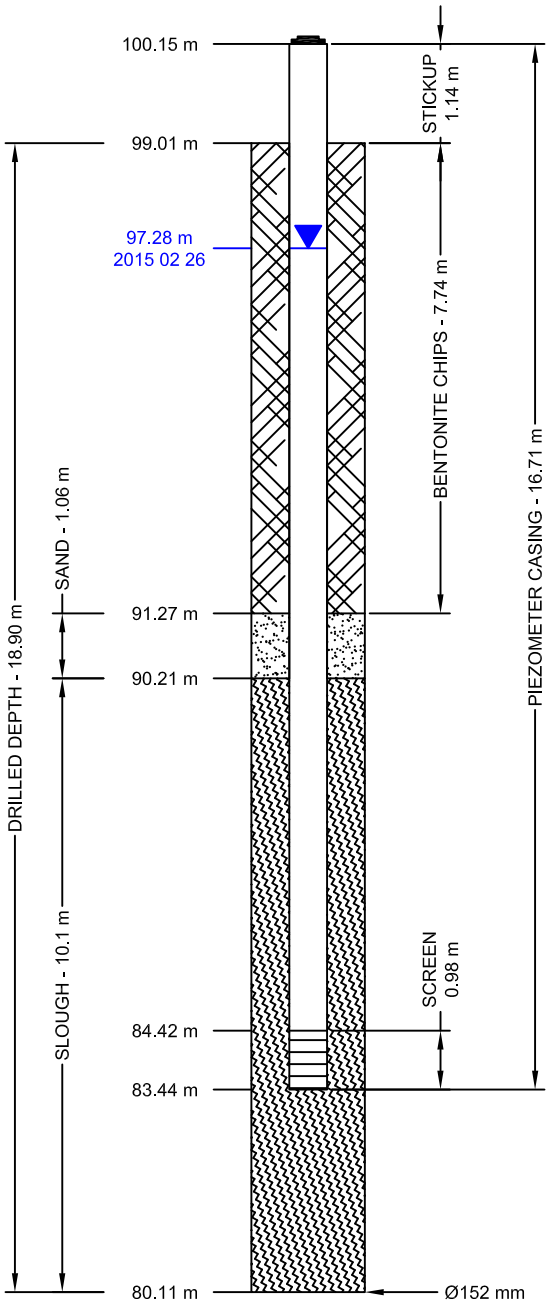
LIMITATION

This drill log is a summary of the conditions estimated by the field personnel at the specific location at the time of drilling. The conditions and properties described above will vary between locations and may vary with time.

P:\Associated Engineering\626523 Proposed Falcon Holdings Industrial Development Site\4.0 Execution\4.5 GIS And Drawings\BH-626523-11.dwg

PIEZOMETER 626523-11
ASSOCIATED ENGINEERING
PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
2015

5785419 N 382590 E
NAD 83 ZONE 13
SE1/4-25-37-06-W3M
73B/2



SCREEN SPECIFICATIONS:
- 2 inch 10 slot Schedule 80 PVC
- PVC cap at bottom of piezometer

CASING SPECIFICATIONS:
- 2 Inch Schedule 80 PVC
- threaded with o-ring seal

KORPAN TRACTOR

NOTES

1. Depths and elevations are in metres (m).
2. Coordinates from handeld GPS.
3. Elevations are in metres with respect to a local benchmark.

SUPERVISOR	D. WRIGHT
CONTRACTOR	MOBILE AUGERS
OPERATOR	L. SCHAFER
DRILL RIG TYPE	M-10
DATE INSTALLED	2015 02 12
APPROVED BY	C. ZUBROWSKI, P.Eng.
DRAWN BY	E. OVCINA
PROJECT No.	626523
SCALE NOT TO SCALE	**DATE** 2015 02 20

SNC·LAVALIN

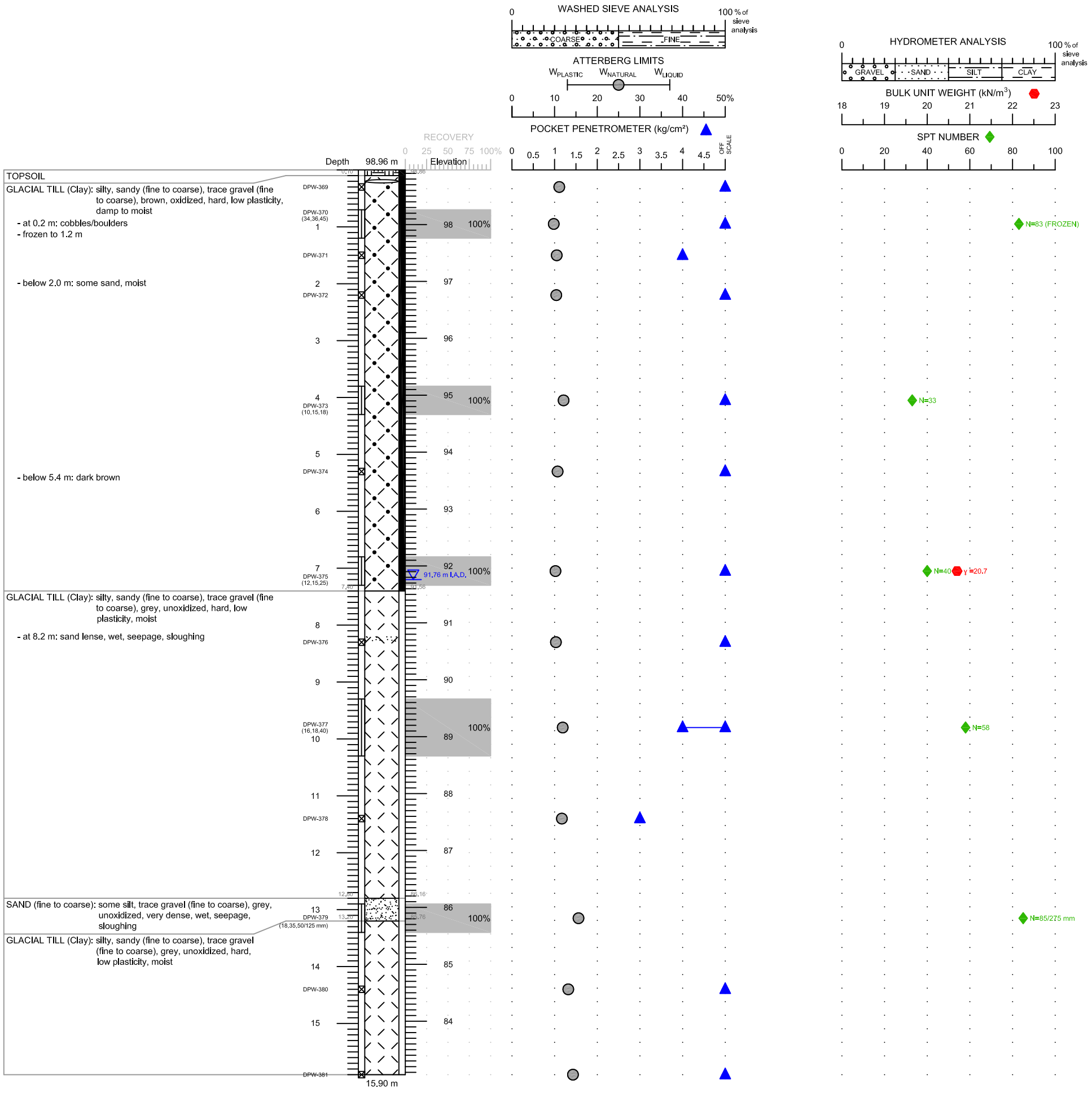
CLIENT
ASSOCIATED ENGINEERING

PROJECT LOCATION
PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT

P:\Associated Engineering\626523 Proposed Falcon Holdings Industrial Development Site\4.0 Execution\4.5 GIS And Drawings\PS-626523-11.dwg

BOREHOLE 626523-12
ASSOCIATED ENGINEERING
PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
2015

5785357 N 382509 E
NAD 83 ZONE 13
SE1/4-25-37-06-W3M
73B/2



KORPAN TRACTOR

REFERENCE DRAWINGS	
DWG No	DESCRIPTION

NOTES

1. Borehole open immediately after drilling (I.A.D.), groundwater at 7.3 m I.A.D.
2. Hole backfilled with bentonite chips.
3. Standard Penetration Tests (SPT) conducted with 63.5 kg (140 lb) automatic trip hammer falling 762 mm (30 inches).
4. (#,#,#) denotes SPT blows per 152 mm (6.0 inches).
5. Depths are in metres (m).
6. Elevations are in metres with respect to a local benchmark.
7. Coordinates and elevations from handheld GPS.

CONTRACTOR	MOBILE AUGERS	SUPERVISOR	D. WRIGHT
OPERATOR	L. SCHAFER	LOGGED BY	D. WRIGHT
TYPE OF DRILL RIG	M-10	DRILLED DATE	2015 02 12
ABANDONMENT	BENTONITE CHIPS	INSTALLATION DATE	N/A

SNC·LAVALIN

CLIENT	ASSOCIATED ENGINEERING
PROJECT LOCATION	PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
APPROVED BY	C. ZUBROWSKI, P.Eng.
DRAWN BY	E. OVCINA
PROJECT No.	626523
SCALE	1:75
DATE	2015 02 19

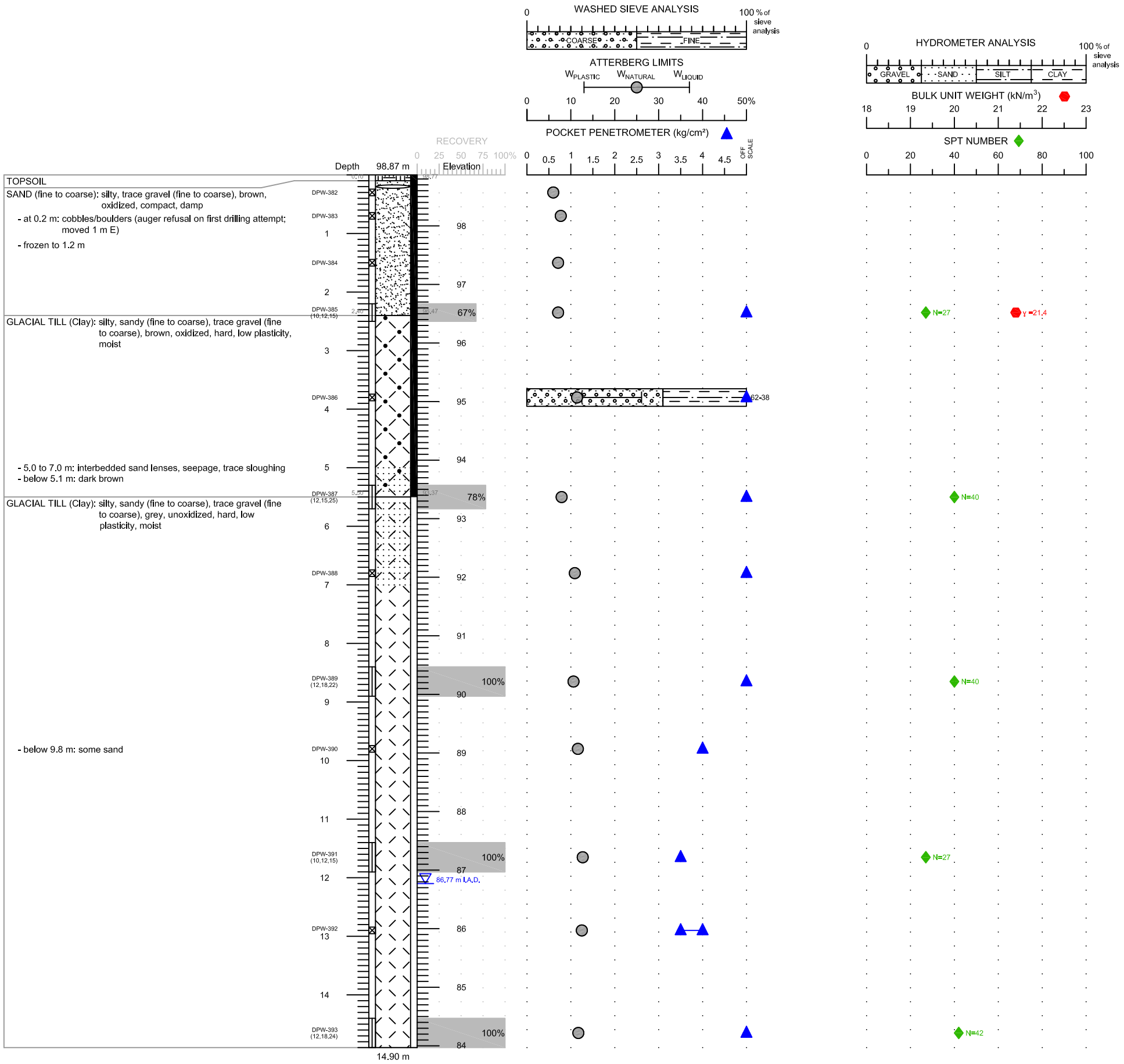
LIMITATION

This drill log is a summary of the conditions estimated by the field personnel at the specific location at the time of drilling. The conditions and properties described above will vary between locations and may vary with time.

P:\Associated Engineering\626523 Proposed Falcon Holdings Industrial Development Site\4.0 Execution\4.5 GIS And Drawings\BH-626523-12.dwg

BOREHOLE 626523-13
ASSOCIATED ENGINEERING
PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
2015

5785307 N 382441 E
NAD 83 ZONE 13
SE1/4-25-37-06-W3M
73B/2



KORPAN TRACTOR

REFERENCE DRAWINGS	
DWG No	DESCRIPTION

NOTES

1. Borehole open immediately after drilling (I.A.D.), groundwater at 12.1 m I.A.D.
2. Hole backfilled with bentonite chips.
3. Standard Penetration Tests (SPT) conducted with 63.5 kg (140 lb) automatic trip hammer falling 762 mm (30 inches).
4. (#,#,#) denotes SPT blows per 152 mm (6.0 inches).
5. Depths are in metres (m).
6. Elevations are in metres with respect to a local benchmark.
7. Coordinates and elevations from handheld GPS.

CONTRACTOR	MOBILE AUGERS	**SUPERVISOR**	D. WRIGHT
OPERATOR	L. SCHAFER	**LOGGED BY**	D. WRIGHT
TYPE OF DRILL RIG	M-10	**DRILLED DATE**	2015 02 12
ABANDONMENT	BENTONITE CHIPS	**INSTALLATION DATE**	N/A

SNC·LAVALIN

CLIENT ASSOCIATED ENGINEERING	**PROJECT LOCATION** PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
APPROVED BY	C. ZUBROWSKI, P.Eng.
DRAWN BY	E. OVCINA
PROJECT No.	626523
SCALE 1:75	**DATE** 2015 02 19

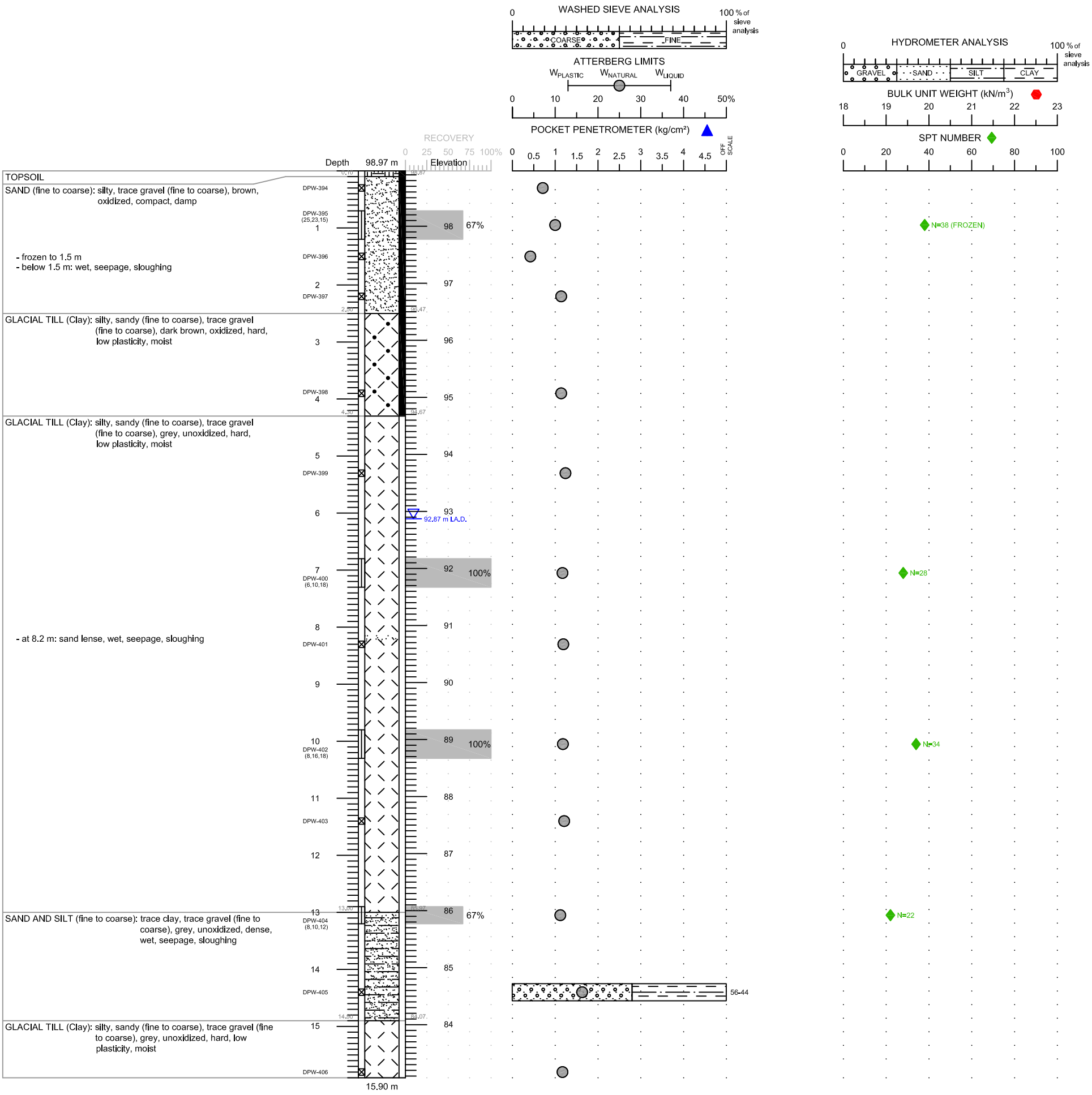
LIMITATION

This drill log is a summary of the conditions estimated by the field personnel at the specific location at the time of drilling. The conditions and properties described above will vary between locations and may vary with time.

P:\Associated Engineering\626523 Proposed Falcon Holdings Industrial Development Site\4.0 Execution\4.5 GIS And Drawings\BH-626523-13.dwg

BOREHOLE 626523-14
ASSOCIATED ENGINEERING
PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
2015

5785316 N 382295 E
NAD 83 ZONE 13
SE1/4-25-37-06-W3M
73B/2



KORPAN TRACTOR

REFERENCE DRAWINGS	
DWG No	DESCRIPTION

NOTES

1. Borehole sloughed to 6.1 m immediately after drilling (I.A.D.), groundwater at 6.1 m I.A.D.
2. Hole backfilled with bentonite chips.
3. Standard Penetration Tests (SPT) conducted with 63.5 kg (140 lb) automatic trip hammer falling 762 mm (30 inches).
4. (#,#,#) denotes SPT blows per 152 mm (6.0 inches).
5. Depths are in metres (m).
6. Elevations are in metres with respect to a local benchmark.
7. Coordinates and elevations from handheld GPS.

CONTRACTOR	MOBILE AUGERS	**SUPERVISOR**	D. WRIGHT
OPERATOR	L. SCHAFER	**LOGGED BY**	D. WRIGHT
TYPE OF DRILL RIG	M-10	**DRILLED DATE**	2015 02 13
ABANDONMENT	BENTONITE CHIPS	**INSTALLATION DATE**	N/A

SNC·LAVALIN

CLIENT ASSOCIATED ENGINEERING	**PROJECT LOCATION** PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
APPROVED BY	C. ZUBROWSKI, P.Eng.
DRAWN BY	E. OVCINA
PROJECT No.	626523
SCALE 1:75	**DATE** 2015 02 19

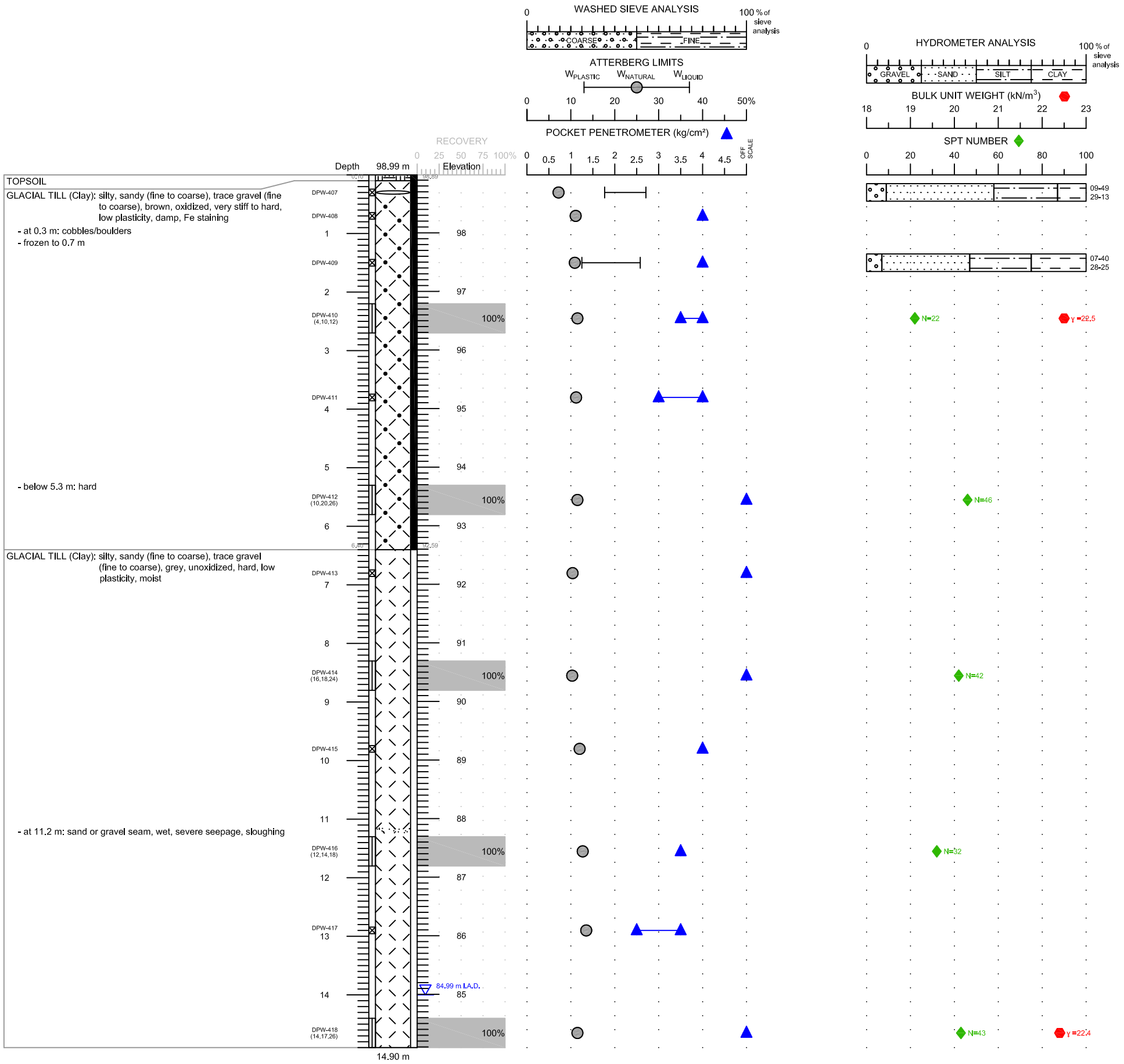
LIMITATION

This drill log is a summary of the conditions estimated by the field personnel at the specific location at the time of drilling. The conditions and properties described above will vary between locations and may vary with time.

P:\Associated Engineering\626523 Proposed Falcon Holdings Industrial Development Site\4.0 Execution\4.5 GIS And Drawings\BH-626523-14.dwg

BOREHOLE 626523-15
ASSOCIATED ENGINEERING
PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
2015

5785377 N 382377 E
NAD 83 ZONE 13
SE1/4-25-37-06-W3M
73B/2



KORPAN TRACTOR

REFERENCE DRAWINGS	
DWG No	DESCRIPTION

NOTES

1. Borehole open immediately after drilling (I.A.D.), groundwater at 14.0 m I.A.D.
2. Hole backfilled with bentonite chips.
3. Standard Penetration Tests (SPT) conducted with 63.5 kg (140 lb) automatic trip hammer falling 762 mm (30 inches).
4. (#,#,#) denotes SPT blows per 152 mm (6.0 inches).
5. Depths are in metres (m).
6. Elevations are in metres with respect to a local benchmark.
7. Coordinates and elevations from handheld GPS.

CONTRACTOR	MOBILE AUGERS	**SUPERVISOR**	D. WRIGHT
OPERATOR	L. SCHAFER	**LOGGED BY**	D. WRIGHT
TYPE OF DRILL RIG	M-10	**DRILLED DATE**	2015 02 13
ABANDONMENT	BENTONITE CHIPS	**INSTALLATION DATE**	N/A

SNC·LAVALIN

CLIENT ASSOCIATED ENGINEERING	**PROJECT LOCATION** PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
APPROVED BY	C. ZUBROWSKI, P.Eng.
DRAWN BY	E. OVCINA
PROJECT No.	626523
SCALE 1:75	**DATE** 2015 02 19

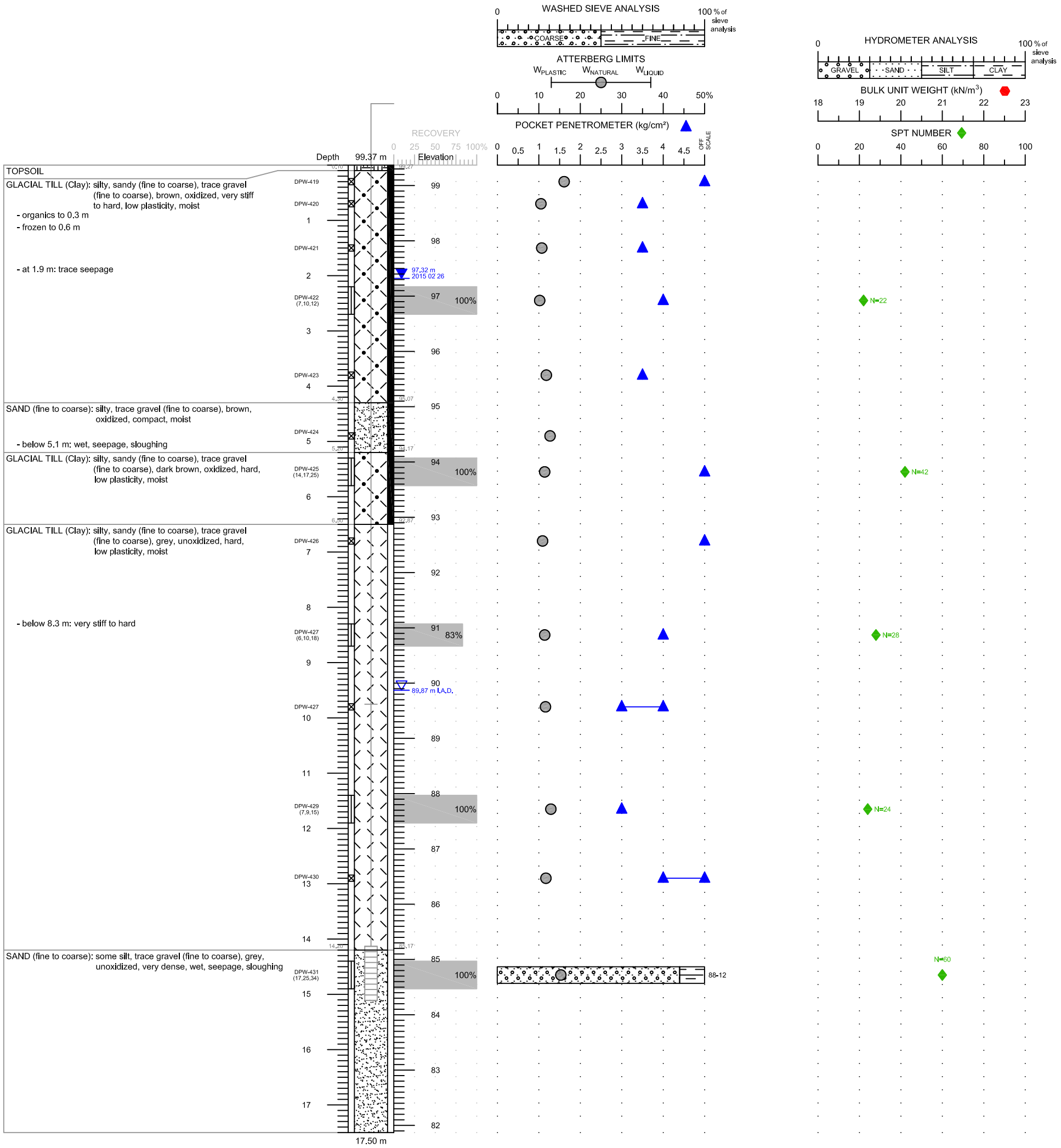
LIMITATION

This drill log is a summary of the conditions estimated by the field personnel at the specific location at the time of drilling. The conditions and properties described above will vary between locations and may vary with time.

P:\Associated Engineering\626523 Proposed Falcon Holdings Industrial Development Site\4.0 Execution\4.5 GIS And Drawings\BH-626523-15.dwg

BOREHOLE 626523-16
ASSOCIATED ENGINEERING
PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
2015

5785436 N 381826 E
NAD 83 ZONE 13
SE1/4-25-37-06-W3M
73B/2



FUTURE DEVELOPMENT

REFERENCE DRAWINGS	
DWG No	DESCRIPTION

NOTES

1. Borehole sloughed to 14.2 m immediately after drilling (I.A.D.), groundwater at 9.5 m I.A.D.
2. Hole backfilled with bentonite chips.
3. Standard Penetration Tests (SPT) conducted with 63.5 kg (140 lb) automatic trip hammer falling 762 mm (30 inches).
4. (#,#,#) denotes SPT blows per 152 mm (6.0 inches).
5. Depths are in metres (m).
6. Elevations are in metres with respect to a local benchmark.
7. Coordinates and elevations from handheld GPS.

CONTRACTOR	MOBILE AUGERS	**SUPERVISOR**	D. WRIGHT
OPERATOR	L. SCHAFER	**LOGGED BY**	D. WRIGHT
TYPE OF DRILL RIG	M-10	**DRILLED DATE**	2015 02 13
ABANDONMENT	BENTONITE CHIPS	**INSTALLATION DATE**	2015 02 13

SNC·LAVALIN

CLIENT ASSOCIATED ENGINEERING	**PROJECT LOCATION** PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
APPROVED BY	C. ZUBROWSKI, P.Eng.
DRAWN BY	E. OVCINA
PROJECT No.	626523
SCALE 1:75	**DATE** 2015 02 19

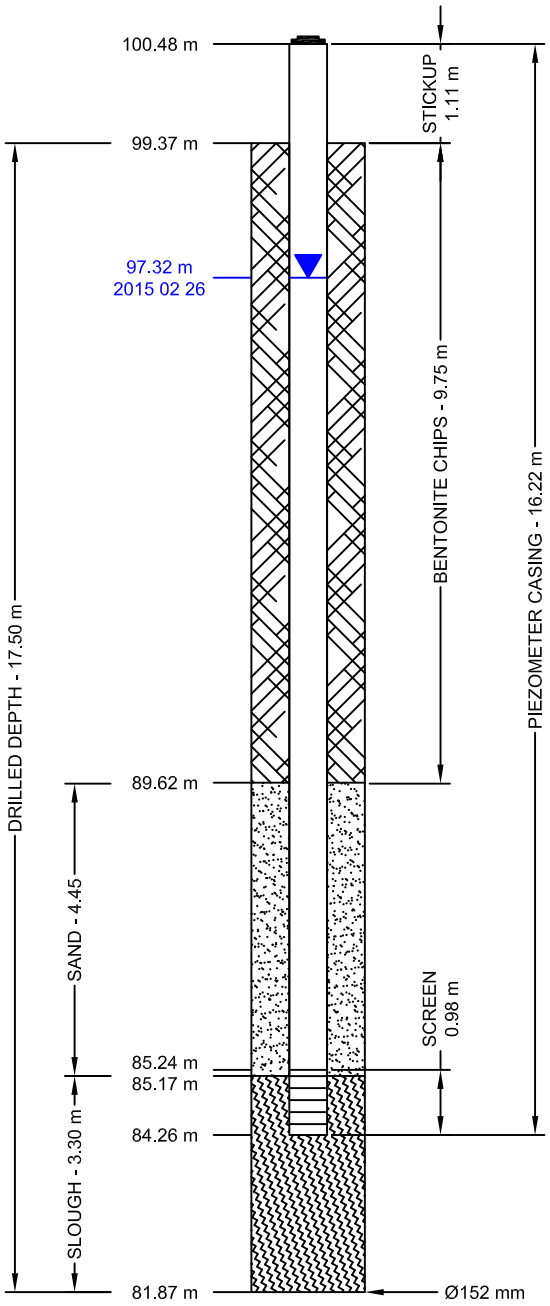
LIMITATION

This drill log is a summary of the conditions estimated by the field personnel at the specific location at the time of drilling. The conditions and properties described above will vary between locations and may vary with time.

P:\Associated Engineering\626523 Proposed Falcon Holdings Industrial Development Site\4.0 Execution\4.5 GIS And Drawings\BH-626523-16.dwg

PIEZOMETER 626523-16
ASSOCIATED ENGINEERING
PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
2015

5785436 N 381826 E
NAD 83 ZONE 13
SE1/4-25-37-06-W3M
73B/2



SCREEN SPECIFICATIONS:
- 2 inch 10 slot Schedule 80 PVC
- PVC cap at bottom of piezometer

CASING SPECIFICATIONS:
- 2 Inch Schedule 80 PVC
- threaded with o-ring seal

FUTURE DEVELOPMENT

NOTES

1. Depths and elevations are in metres (m).
2. Coordinates from handeld GPS.
3. Elevations are in metres with respect to a local benchmark.

SUPERVISOR	D. WRIGHT
CONTRACTOR	MOBILE AUGERS
OPERATOR	L. SCHAFER
DRILL RIG TYPE	M-10
DATE INSTALLED	2015 02 13
APPROVED BY	C. ZUBROWSKI, P.Eng.
DRAWN BY	E. OVCINA
PROJECT No.	626523
SCALE NOT TO SCALE	**DATE** 2015 02 20

SNC·LAVALIN

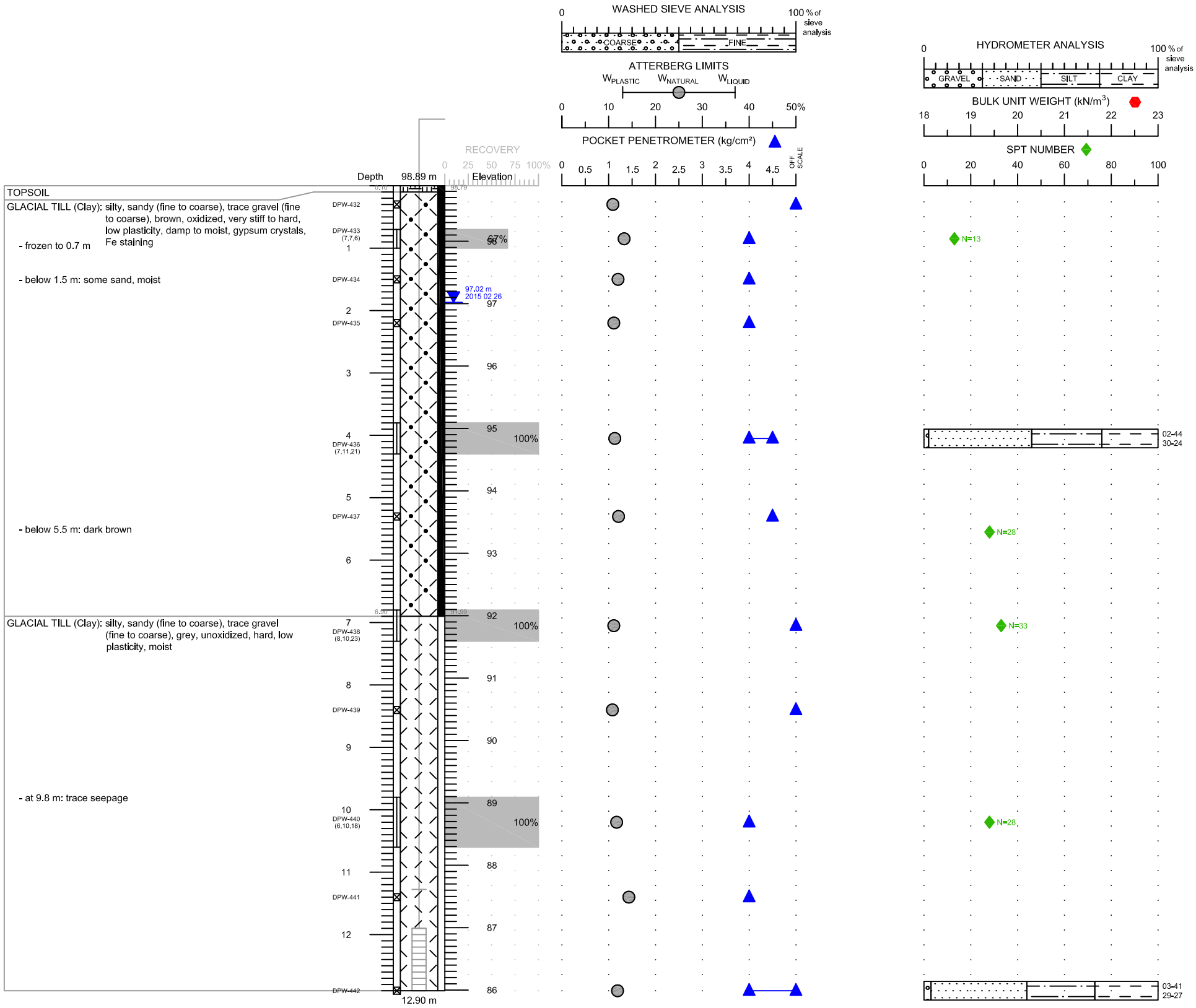
CLIENT
ASSOCIATED ENGINEERING

PROJECT LOCATION
PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT

P:\Associated Engineering\626523 Proposed Falcon Holdings Industrial Development Site\4.0 Execution\4.5 GIS And Drawings\PS-626523-16.dwg

BOREHOLE 626523-17
ASSOCIATED ENGINEERING
PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
2015

5785263 N 382065 E
NAD 83 ZONE 13
SE1/4-25-37-06-W3M
73B/2



FUTURE DEVELOPMENT

REFERENCE DRAWINGS	
DWG No	DESCRIPTION

NOTES

1. Borehole open and dry immediately after drilling (I.A.D.).
2. Hole backfilled with bentonite chips.
3. Standard Penetration Tests (SPT) conducted with 63.5 kg (140 lb) automatic trip hammer falling 762 mm (30 inches).
4. (#,#,#) denotes SPT blows per 152 mm (6.0 inches).
5. Depths are in metres (m).
6. Elevations are in metres with respect to a local benchmark.
7. Coordinates and elevations from handheld GPS.

CONTRACTOR	MOBILE AUGERS	**SUPERVISOR**	D. WRIGHT
OPERATOR	L. SCHAFER	**LOGGED BY**	D. WRIGHT
TYPE OF DRILL RIG	M-10	**DRILLED DATE**	2015 02 13
ABANDONMENT	BENTONITE CHIPS	**INSTALLATION DATE**	2015 02 13

SNC·LAVALIN

CLIENT ASSOCIATED ENGINEERING	**PROJECT LOCATION** PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
APPROVED BY	C. ZUBROWSKI, P.Eng.
DRAWN BY	E. OVCINA
PROJECT No.	626523
SCALE 1:75	**DATE** 2015 02 19

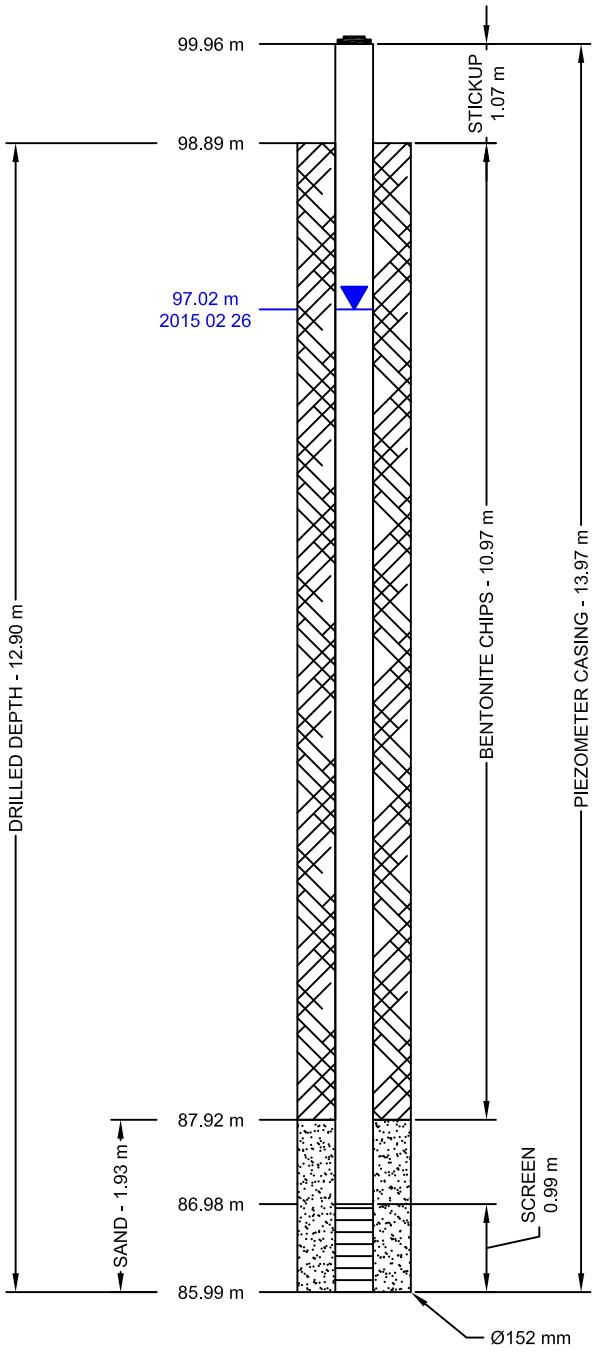
LIMITATION

This drill log is a summary of the conditions estimated by the field personnel at the specific location at the time of drilling. The conditions and properties described above will vary between locations and may vary with time.

P:\Associated Engineering\626523 Proposed Falcon Holdings Industrial Development Site\4.0 Execution\4.5 GIS And Drawings\BH-626523-17.dwg

PIEZOMETER 626523-17
ASSOCIATED ENGINEERING
PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
2015

5785263 N 382065 E
NAD 83 ZONE 13
SE1/4-25-37-06-W3M
73B/2



SCREEN SPECIFICATIONS:
- 2 inch 10 slot Schedule 80 PVC
- PVC cap at bottom of piezometer

CASING SPECIFICATIONS:
- 2 Inch Schedule 80 PVC
- threaded with o-ring seal

FUTURE DEVELOPMENT

NOTES

1. Depths and elevations are in metres (m).
2. Coordinates from handeld GPS.
3. Elevations are in metres with respect to a local benchmark.

SUPERVISOR	D. WRIGHT
CONTRACTOR	MOBILE AUGERS
OPERATOR	L. SCHAFER
DRILL RIG TYPE	M-10
DATE INSTALLED	2015 02 13
APPROVED BY	C. ZUBROWSKI, P.Eng.
DRAWN BY	E. OVCINA
PROJECT No.	626523
SCALE NOT TO SCALE	**DATE** 2015 02 20

SNC·LAVALIN

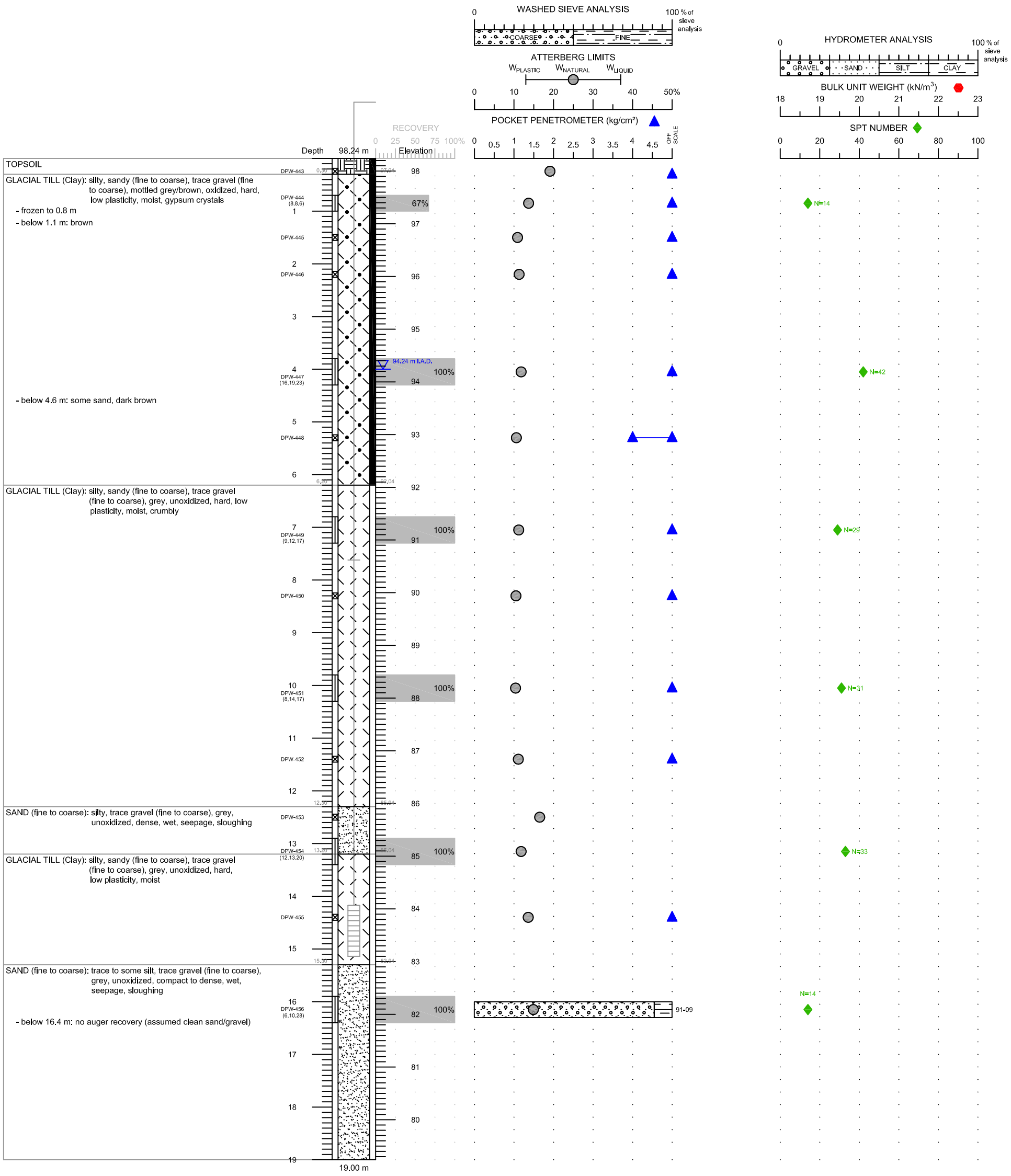
CLIENT
ASSOCIATED ENGINEERING

PROJECT LOCATION
PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT

P:\Associated Engineering\626523 Proposed Falcon Holdings Industrial Development Site\4.0 Execution\4.5 GIS And Drawings\PS-626523-17.dwg

BOREHOLE 626523-18
ASSOCIATED ENGINEERING
PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
2015

5785031 N 382512 E
NAD 83 ZONE 13
SE1/4-25-37-06-W3M
73B/2



FUTURE DEVELOPMENT

REFERENCE DRAWINGS	
DWG No	DESCRIPTION

NOTES

1. Borehole sloughed to 13.7 m immediately after drilling (I.A.D.), groundwater at 4.0 m I.A.D.
2. Hole backfilled with bentonite chips.
3. Standard Penetration Tests (SPT) conducted with 63.5 kg (140 lb) automatic trip hammer falling 762 mm (30 inches).
4. (#,#,#) denotes SPT blows per 152 mm (6.0 inches).
5. Depths are in metres (m).
6. Elevations are in metres with respect to a local benchmark.
7. Coordinates and elevations from handheld GPS.

CONTRACTOR	MOBILE AUGERS	**SUPERVISOR**	D. WRIGHT
OPERATOR	L. SCHAFER	**LOGGED BY**	D. WRIGHT
TYPE OF DRILL RIG	M-10	**DRILLED DATE**	2015 02 13
ABANDONMENT	BENTONITE CHIPS	**INSTALLATION DATE**	2015 02 13

SNC·LAVALIN

CLIENT ASSOCIATED ENGINEERING	**PROJECT LOCATION** PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
APPROVED BY	C. ZUBROWSKI, P.Eng.
DRAWN BY	E. OVCINA
PROJECT No.	626523
SCALE 1:75	**DATE** 2015 02 19

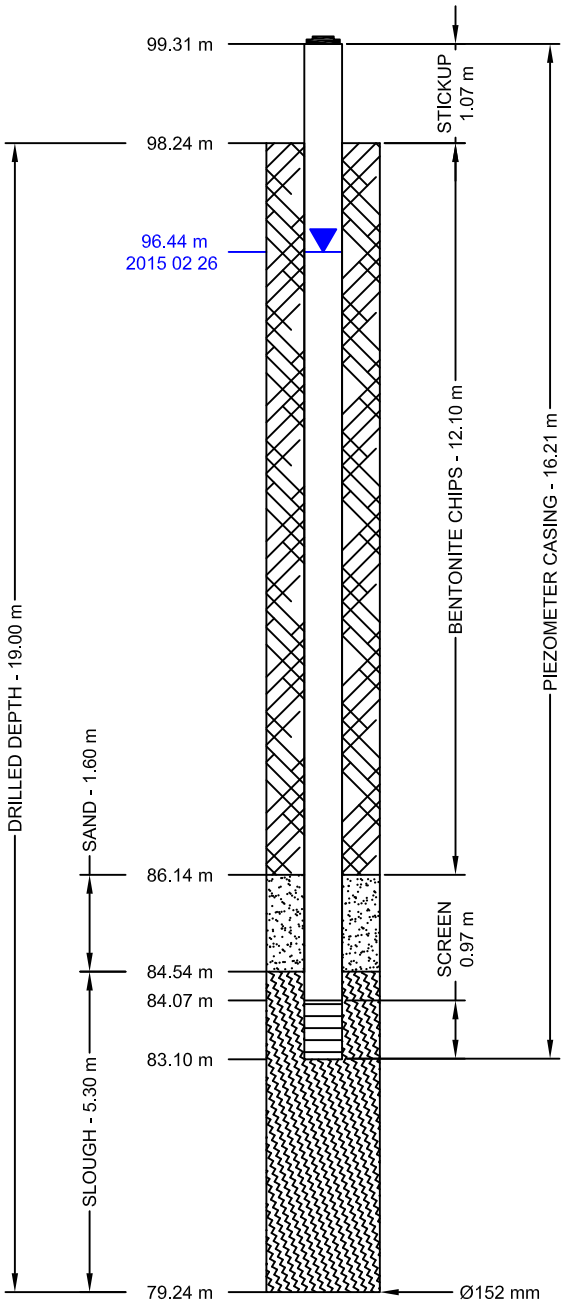
LIMITATION

This drill log is a summary of the conditions estimated by the field personnel at the specific location at the time of drilling. The conditions and properties described above will vary between locations and may vary with time.

P:\Associated Engineering\626523 Proposed Falcon Holdings Industrial Development Site\4.0 Execution\4.5 GIS And Drawings\BH-626523-18.dwg

PIEZOMETER 626523-18
ASSOCIATED ENGINEERING
PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT
2015

5785031 N 382512 E
NAD 83 ZONE 13
SE1/4-25-37-06-W3M
73B/2



SCREEN SPECIFICATIONS:
- 2 inch 10 slot Schedule 80 PVC
- PVC cap at bottom of piezometer

CASING SPECIFICATIONS:
- 2 Inch Schedule 80 PVC
- threaded with o-ring seal

FUTURE DEVELOPMENT

NOTES

1. Depths and elevations are in metres (m).
2. Coordinates from handeld GPS.
3. Elevations are in metres with respect to a local benchmark.

SUPERVISOR	D. WRIGHT
CONTRACTOR	MOBILE AUGERS
OPERATOR	L. SCHAFER
DRILL RIG TYPE	M-10
DATE INSTALLED	2015 02 13
APPROVED BY	C. ZUBROWSKI, P.Eng.
DRAWN BY	E. OVCINA
PROJECT No.	626523
SCALE NOT TO SCALE	**DATE** 2015 02 20

SNC·LAVALIN

CLIENT	**PROJECT LOCATION**
ASSOCIATED ENGINEERING	PROPOSED FALCON HOLDINGS INDUSTRIAL DEVELOPMENT

P:\Associated Engineering\626523 Proposed Falcon Holdings Industrial Development Site\4.0 Execution\4.5 GIS And Drawings\PS-626523-18.dwg

APPENDIX III

Laboratory Testing Results

WATER CONTENT TEST REPORT

Test Reference: ASTM D2216-05)

SNC·LAVALIN

Client:	Assoiciated Engineering
Project:	Falcon Holdings
Project #:	626523
Technician:	JA
Date:	23-Feb-15

Sample #	DPW-300	DPW-301	DPW-302	DPW-303	DPW-304	DPW-305
Test Hole #	01	01	01	01	01	01
Depth	0.3	0.7	1.5	2.2-2.5	4	5.3-5.8
Tare #						
Tare Mass (g)	37.66	39.23	37.61	38.23	38.55	37.68
Wet sample + tare (g)	188.11	157.79	161.82	157.09	161.59	163.12
Dry sample + tare (g)	168.94	144.87	149.56	145.39	148.64	150.86
Wt. Dry sample (g)	131.28	105.64	111.95	107.16	110.09	113.18
Water Content (%)	14.60	12.23	10.95	10.92	11.76	10.83

Sample #	DPW-306	DPW-307	DPW-308	DPW-309	DPW-310	DPW-457
Test Hole #	01	01	01	01	01	01
Depth	6.6	8.4-8.8	9.8	11.4-11.9	12.8	14.4-14.8
Tare #						
Tare Mass (g)	37.91	38.00	37.79	38.14	37.97	38.19
Wet sample + tare (g)	155.04	163.19	150.92	166.71	162.31	156.87
Dry sample + tare (g)	143.10	150.53	140.41	153.10	147.95	144.20
Wt. Dry sample (g)	105.19	112.53	102.62	114.96	109.98	106.01
Water Content (%)	11.35	11.25	10.24	11.84	13.06	11.95

Sample #	DPW-458	DPW-459	DPW-311	DPW-312	DPW-313	DPW-314
Test Hole #	01	01	02	02	02	02
Depth	15.5	15.9-16.4	0.3	0.7	1.5	3
Tare #						
Tare Mass (g)	31.00	31.20	30.88	31.16	31.21	31.11
Wet sample + tare (g)	126.82	130.70	130.39	125.79	122.69	122.22
Dry sample + tare (g)	115.19	115.37	112.39	116.54	113.86	112.50
Wt. Dry sample (g)	84.19	84.17	81.51	85.38	82.65	81.39
Water Content (%)	13.81	18.21	22.08	10.83	10.68	11.94

Comments:

WATER CONTENT TEST REPORT

Test Reference: ASTM D2216-05)

SNC·LAVALIN

Client:	Assoiciated Engineering
Project:	Falcon Holdings
Project #:	626523
Technician:	JA
Date:	23-Feb-15

Sample #	DPW-315	DPW-316	DPW-317	DPW-318	DPW-319	DPW-320
Test Hole #	03	03	03	03	04	04
Depth	0.3	0.7	1.5	3	0.3	0.7
Tare #						
Tare Mass (g)	37.69	37.43	37.90	38.22	31.13	31.31
Wet sample + tare (g)	154.73	151.79	151.00	154.83	124.91	124.40
Dry sample + tare (g)	138.79	141.40	138.70	142.40	115.37	116.00
Wt. Dry sample (g)	101.10	103.97	100.80	104.18	84.24	84.69
Water Content (%)	15.77	9.99	12.20	11.93	11.32	9.92

Sample #	DPW-321	DPW-322	DPW-323	DPW-324	DPW-325	DPW-326
Test Hole #	04	04	05	05	05	05
Depth	1.5	3	0.3	0.7	1.5	3
Tare #						
Tare Mass (g)	31.12	31.20	38.25	38.44	37.85	37.89
Wet sample + tare (g)	130.26	126.84	169.43	133.47	122.74	139.47
Dry sample + tare (g)	120.96	117.23	158.18	124.76	114.80	129.22
Wt. Dry sample (g)	89.84	86.03	119.93	86.32	76.95	91.33
Water Content (%)	10.35	11.17	9.38	10.09	10.32	11.22

Sample #	DPW-327	DPW-328	DPW-329	DPW-330	DPW-331	DPW-332
Test Hole #	06	06	06	06	07	07
Depth	0.3	0.7	1.5	3	0.3	0.7
Tare #						
Tare Mass (g)	30.91	31.22	31.32	30.83	31.10	45.91
Wet sample + tare (g)	104.34	105.77	114.83	129.02	147.84	159.01
Dry sample + tare (g)	98.04	98.47	105.63	118.47	138.04	148.29
Wt. Dry sample (g)	67.13	67.25	74.31	87.64	106.94	102.38
Water Content (%)	9.38	10.86	12.38	12.04	9.16	10.47

Comments:

WATER CONTENT TEST REPORT

Test Reference: ASTM D2216-05)

SNC·LAVALIN

Client:	Assoiciated Engineering
Project:	Falcon Holdings
Project #:	626523
Technician:	JA
Date:	23-Feb-15

Sample #	DPW-333	DPW-334	DPW-335	DPW-336	DPW-337	DPW-338
Test Hole #	07	07	08	08	08	08
Depth	1.5	3	0.3	0.7	1.5	3
Tare #						
Tare Mass (g)	38.14	31.38	37.82	38.09	31.24	31.06
Wet sample + tare (g)	163.06	115.04	144.23	158.78	119.95	123.81
Dry sample + tare (g)	151.20	106.28	129.15	146.64	111.02	113.99
Wt. Dry sample (g)	113.06	74.90	91.33	108.55	79.78	82.93
Water Content (%)	10.49	11.70	16.51	11.18	11.19	11.84
Sample #	DPW-339	DPW-340	DPW-341	DPW-342	DPW-343	DPW-344
Test Hole #	09	09	09	10	10	10
Depth	0.7	1.5	3	0.3	0.7	1.5
Tare #						
Tare Mass (g)	30.85	31.16	31.20	37.98	38.48	37.70
Wet sample + tare (g)	126.96	107.11	124.92	137.62	181.25	142.07
Dry sample + tare (g)	124.70	105.44	115.31	122.49	166.10	130.61
Wt. Dry sample (g)	93.85	74.28	84.11	84.51	127.62	92.91
Water Content (%)	2.41	2.25	11.43	17.90	11.87	12.33
Sample #	DPW-345	DPW-346	DPW-347	DPW-348	DPW-349	DPW-350
Test Hole #	10	10	10	10	10	10
Depth	2.2-2.3	3.8	5.3-5.6	6.8	8.3-8.8	9.8
Tare #						
Tare Mass (g)	31.06	31.10	31.32	37.59	31.17	63.39
Wet sample + tare (g)	97.07	134.75	114.83	148.27	116.60	147.60
Dry sample + tare (g)	89.94	123.53	105.63	136.99	107.95	139.15
Wt. Dry sample (g)	58.88	92.43	74.31	99.40	76.78	75.76
Water Content (%)	12.11	12.14	12.38	11.35	11.27	11.15

Comments:

WATER CONTENT TEST REPORT

Test Reference: ASTM D2216-05)

SNC·LAVALIN

Client:	Assoiciated Engineering
Project:	Falcon Holdings
Project #:	626523
Technician:	JA
Date:	23-Feb-15

Sample #	DPW-351	DPW-352	DPW-353	DPW-354	DPW-355	DPW-356
Test Hole #	10	10	10	11	11	11
Depth	11.4-11.9	12.9	14.5-14.9	0.3	0.7-1.2	1.5
Tare #						
Tare Mass (g)	38.52	37.74	37.14	38.26	38.35	38.08
Wet sample + tare (g)	169.06	177.18	185.94	144.42	141.08	166.03
Dry sample + tare (g)	154.27	160.69	163.76	130.54	130.16	153.81
Wt. Dry sample (g)	115.75	122.95	126.62	92.28	91.81	115.73
Water Content (%)	12.78	13.41	17.52	15.04	11.89	10.56

Sample #	DPW-357	DPW-358	DPW-359	DPW-360	DPW-361	DPW-362
Test Hole #	11	11	11	11	11	11
Depth	2.2	3.8-4.3	5.3	6.8-7.2	8.3	8.6
Tare #						
Tare Mass (g)	38.80	41.50	37.00	37.58	68.43	58.35
Wet sample + tare (g)	169.34	155.41	159.01	137.67	193.53	164.61
Dry sample + tare (g)	156.60	143.29	146.91	127.30	182.28	153.64
Wt. Dry sample (g)	117.80	101.79	109.91	89.72	113.85	95.29
Water Content (%)	10.81	11.91	11.01	11.56	9.88	11.51

Sample #	DPW-363	DPW-364	DPW-365	DPW-366	DPW-367	DPW-368
Test Hole #	11	11	11	11	11	11
Depth	9.8-10.2	11.6	12.9-13	14.4	15.4-16	17.4
Tare #						
Tare Mass (g)	38.55	38.16	60.41	54.44	37.96	38.23
Wet sample + tare (g)	194.78	161.75	147.59	155.67	167.29	190.60
Dry sample + tare (g)	174.26	146.04	138.86	144.38	155.82	168.40
Wt. Dry sample (g)	135.71	107.88	78.45	89.94	117.86	130.17
Water Content (%)	15.12	14.56	11.13	12.55	9.73	17.05

Comments:

WATER CONTENT TEST REPORT

Test Reference: ASTM D2216-05)

SNC·LAVALIN

Client:	Assoiciated Engineering
Project:	Falcon Holdings
Project #:	626523
Technician:	JA
Date:	23-Feb-15

Sample #	DPW-369	DPW-370	DPW-371	DPW-372	DPW-373	DPW-374
Test Hole #	12	12	12	12	12	12
Depth	0.3	0.7-1.2	1.5	2.2	3.8-4.3	5.3
Tare #						
Tare Mass (g)	59.36	53.15	47.62	43.09	43.63	43.33
Wet sample + tare (g)	171.38	172.12	160.45	146.12	157.53	166.08
Dry sample + tare (g)	160.17	161.52	149.76	136.43	145.21	154.22
Wt. Dry sample (g)	100.81	108.37	102.14	93.34	101.58	110.89
Water Content (%)	11.12	9.78	10.47	10.38	12.13	10.70

Sample #	DPW-375	DPW-376	DPW-377	DPW-378	DPW-379	DPW-380
Test Hole #	12	12	12	12	12	12
Depth	6.8-7.3	8.3	9.8-10.3	11.4	12.9-13.4	14.4
Tare #						
Tare Mass (g)	49.77	46.43	50.40	49.04	41.44	61.42
Wet sample + tare (g)	138.03	154.60	163.76	165.33	138.84	197.55
Dry sample + tare (g)	129.85	144.46	151.69	153.11	125.72	181.72
Wt. Dry sample (g)	80.08	98.03	101.29	104.07	84.28	120.30
Water Content (%)	10.21	10.34	11.92	11.74	15.57	13.16

Sample #	DPW-381	DPW-382	DPW-383	DPW-384	DPW-385	DPW-386
Test Hole #	12	13	13	13	13	13
Depth	15	0.3	0.7	1.5	2.2-2.5	3.8
Tare #						
Tare Mass (g)	45.04	59.38	57.48	41.31	43.23	59.92
Wet sample + tare (g)	158.62	167.05	185.51	119.04	116.83	169.81
Dry sample + tare (g)	144.44	160.99	176.41	113.87	111.94	158.60
Wt. Dry sample (g)	99.40	101.61	118.93	72.56	68.71	98.68
Water Content (%)	14.27	5.96	7.65	7.13	7.12	11.36

Comments:

WATER CONTENT TEST REPORT

Test Reference: ASTM D2216-05)

SNC·LAVALIN

Client:	Assoiciated Engineering
Project:	Falcon Holdings
Project #:	626523
Technician:	JA
Date:	23-Feb-15

Sample #	DPW-387	DPW-388	DPW-389	DPW-390	DPW-391	DPW-392
Test Hole #	13	13	13	13	13	13
Depth	5.3-5.7	6.8	8.4-8.9	9.8	11.4-11.9	12.9
Tare #						
Tare Mass (g)	41.66	45.03	63.50	59.80	51.52	65.57
Wet sample + tare (g)	138.92	145.62	193.03	191.67	150.77	193.59
Dry sample + tare (g)	131.80	135.75	180.64	177.97	139.56	179.35
Wt. Dry sample (g)	90.14	90.72	117.14	118.17	88.04	113.78
Water Content (%)	7.90	10.88	10.58	11.59	12.73	12.52

Sample #	DPW-393	DPW-394	DPW-395	DPW-396	DPW-397	DPW-398
Test Hole #	13	14	14	14	14	14
Depth	14.4-14.9	0.3	0.7-1.2	1.5	2.2	3.9
Tare #						
Tare Mass (g)	60.36	59.28	59.03	53.87	63.11	62.84
Wet sample + tare (g)	191.96	165.32	167.72	142.17	178.03	165.82
Dry sample + tare (g)	178.13	158.31	157.86	138.61	166.25	155.27
Wt. Dry sample (g)	117.77	99.03	98.83	84.74	103.14	92.43
Water Content (%)	11.74	7.08	9.98	4.20	11.42	11.41

Sample #	DPW-399	DPW-400	DPW-401	DPW-402	DPW-403	DPW-404
Test Hole #	14	14	14	14	14	14
Depth	5.3	6.8-7.3	8.3	9.8-10.3	11.4	12.9-13.2
Tare #						
Tare Mass (g)	64.65	64.12	59.85	63.61	59.43	58.88
Wet sample + tare (g)	187.47	161.73	158.51	165.10	169.42	174.36
Dry sample + tare (g)	173.93	151.54	148.05	154.43	157.55	162.78
Wt. Dry sample (g)	109.28	87.42	88.20	90.82	98.12	103.90
Water Content (%)	12.39	11.66	11.86	11.75	12.10	11.15

Comments:

WATER CONTENT TEST REPORT

Test Reference: ASTM D2216-05)

SNC·LAVALIN

Client:	Assoiciated Engineering
Project:	Falcon Holdings
Project #:	626523
Technician:	JA
Date:	23-Feb-15

Sample #	DPW-405	DPW-406	DPW-407	DPW-408	DPW-409	DPW-410
Test Hole #	14	14	15	15	15	15
Depth	14.4	15.8	0.3	0.7	1.5	2.2-2.7
Tare #						
Tare Mass (g)	60.61	64.20	38.09	38.41	38.19	36.66
Wet sample + tare (g)	196.43	187.70	142.87	194.91	198.97	192.13
Dry sample + tare (g)	177.39	174.80	135.80	179.22	183.14	176.05
Wt. Dry sample (g)	116.78	110.60	97.71	140.81	144.95	139.39
Water Content (%)	16.30	11.66	7.24	11.14	10.92	11.54

Sample #	DPW-411	DPW-412	DPW-413	DPW-414	DPW-415	DPW-416
Test Hole #	15	15	15	15	15	15
Depth	3.8	5.3-5.8	6.8	8.3-8.8	9.8	11.3-11.8
Tare #						
Tare Mass (g)	40.69	38.24	38.13	40.02	41.17	38.03
Wet sample + tare (g)	157.51	187.42	178.32	186.49	155.86	137.08
Dry sample + tare (g)	145.76	172.00	165.08	172.78	143.54	125.92
Wt. Dry sample (g)	105.07	133.76	126.95	132.76	102.37	87.89
Water Content (%)	11.18	11.53	10.43	10.33	12.03	12.70

Sample #	DPW-417	DPW-418	DPW-419	DPW-420	DPW-421	DPW-422
Test Hole #	15	15	16	16	16	16
Depth	12.9	14.4-14.9	0.3	0.7	1.5	2.2-2.7
Tare #						
Tare Mass (g)	39.13	40.65	41.83	38.59	38.48	39.48
Wet sample + tare (g)	176.86	185.26	129.52	165.04	192.85	196.31
Dry sample + tare (g)	160.47	170.31	117.36	152.98	177.97	181.79
Wt. Dry sample (g)	121.34	129.66	75.53	114.39	139.49	142.31
Water Content (%)	13.51	11.53	16.10	10.54	10.67	10.20

Comments:

WATER CONTENT TEST REPORT

Test Reference: ASTM D2216-05)

SNC·LAVALIN

Client:	Assoiciated Engineering
Project:	Falcon Holdings
Project #:	626523
Technician:	JA
Date:	23-Feb-15

Sample #	DPW-423	DPW-424	DPW-425	DPW-426	DPW-427	DPW-428
Test Hole #	16	16	16	16	16	16
Depth	3.8	4.9	5.3-5.8	6.8	8.3-8.7	9.8
Tare #						
Tare Mass (g)	39.11	37.94	38.48	37.92	40.36	41.00
Wet sample + tare (g)	152.08	138.76	175.09	181.92	193.68	173.23
Dry sample + tare (g)	140.12	127.37	161.10	167.72	178.00	159.49
Wt. Dry sample (g)	101.01	89.43	122.62	129.80	137.64	118.49
Water Content (%)	11.84	12.74	11.41	10.94	11.39	11.60

Sample #	DPW-429	DPW-430	DPW-431	DPW-432	DPW-433	DPW-434
Test Hole #	16	16	16	17	17	17
Depth	11.4-11.9	12.9	14.4-14.9	0.3	0.7	1.5
Tare #						
Tare Mass (g)	40.22	38.67	38.25	38.62	38.21	38.82
Wet sample + tare (g)	159.96	177.66	122.47	167.09	165.82	133.71
Dry sample + tare (g)	146.31	163.11	111.32	154.49	150.88	123.51
Wt. Dry sample (g)	106.09	124.44	73.07	115.87	112.67	84.69
Water Content (%)	12.87	11.69	15.26	10.87	13.26	12.04

Sample #	DPW-435	DPW-436	DPW-437	DPW-438	DPW-439	DPW-440
Test Hole #	17	17	17	17	17	17
Depth	2.2	3.8-4.3	5.3	6.8-7.3	8.4	9.8-10.6
Tare #						
Tare Mass (g)	37.70	39.89	38.87	38.25	38.12	37.85
Wet sample + tare (g)	185.50	195.72	187.02	172.23	198.59	166.89
Dry sample + tare (g)	170.69	179.89	170.98	158.90	182.99	153.37
Wt. Dry sample (g)	132.99	140.00	132.11	120.65	144.87	115.52
Water Content (%)	11.14	11.31	12.14	11.05	10.77	11.70

Comments:

WATER CONTENT TEST REPORT

Test Reference: ASTM D2216-05)

SNC·LAVALIN

Client:	Assoiciated Engineering
Project:	Falcon Holdings
Project #:	626523
Technician:	JA
Date:	23-Feb-15

Sample #	DPW-441	DPW-442	DPW-443	DPW-444	DPW-445	DPW-446
Test Hole #	17	17	18	18	18	18
Depth	11.4	12.9	0.3	0.7-1	1.5	2.2
Tare #						
Tare Mass (g)	37.09	40.33	37.55	38.24	38.41	40.13
Wet sample + tare (g)	171.00	157.22	130.60	142.12	160.61	152.96
Dry sample + tare (g)	154.25	144.79	115.69	129.62	148.63	141.49
Wt. Dry sample (g)	117.16	104.46	78.14	91.38	110.22	101.36
Water Content (%)	14.30	11.90	19.08	13.68	10.87	11.32

Sample #	DPW-447	DPW-448	DPW-449	DPW-450	DPW-451	DPW-452
Test Hole #	18	18	18	18	18	18
Depth	3.8-4.3	5.3	6.8-7.3	8.3	9.8-10.3	11.4
Tare #						
Tare Mass (g)	37.78	37.96	38.66	38.81	38.86	38.07
Wet sample + tare (g)	148.65	163.20	166.09	144.56	158.68	159.06
Dry sample + tare (g)	136.95	151.21	153.30	134.54	147.43	146.98
Wt. Dry sample (g)	99.17	113.25	114.64	95.73	108.57	108.91
Water Content (%)	11.80	10.59	11.16	10.47	10.36	11.09

Sample #	DPW-453	DPW-454	DPW-455	DPW-456		
Test Hole #	18	18	18	18		
Depth	12.5	12.9-13.4	14.4	15.9-16.4		
Tare #						
Tare Mass (g)	41.61	38.96	41.61	37.68		
Wet sample + tare (g)	158.76	174.24	182.00	178.31		
Dry sample + tare (g)	142.21	160.02	165.21	160.11		
Wt. Dry sample (g)	100.60	121.06	123.60	122.43		
Water Content (%)	16.45	11.75	13.58	14.87		

Comments:

ATTERBERG LIMITS REPORT

(Test Reference: S.T.P. 205-41 and ASTM D 4318)

SNC·LAVALIN

Client:	Assoiciated Engineering
Project	Falcon Holdings
Project #:	626523
Technician:	RJ
Date:	3-Mar-2015

Sample: DPW-336 BH 08 at 0.7m

-

Plastic Limit

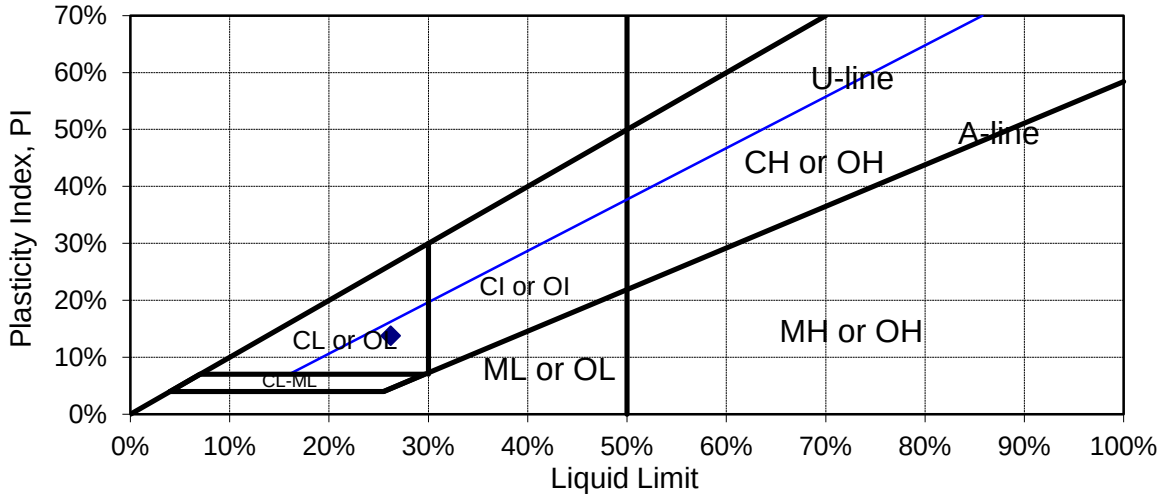
Tare #	-
Tare Wt, g	14.22
Wet + Tare, g	22.09
Dry + Tare, g	21.22
M%	12.4%

Liquid Limit (method B)

# of Blows	17	17	
Tare #	-	-	
Tare Wt, g	14.39	14.20	
Wet + tare, g	22.37	23.85	
Dry + tare, g	20.63	21.79	
Water content	27.9%	27.1%	AVERAGE
Adjusted W/C	26.6%	25.9%	26.2%

SUMMARY

Plastic Limit:	12.4%
Liquid Limit:	26.2%
Plasticity Index:	13.8%
Classification:	CL
Natural Water Content:	11.2%



Comments: -

The testing services reported here have been performed in accordance with accepted local industry standards.

The results presented are for the sole use of the designated client only.

This report constitutes a testing service only. It does not represent any interpretation or opinion regarding specification compliance or material suitability.

Engineering interpretation will be provided by SNC Lavalin upon request.

ATTERBERG LIMITS REPORT

(Test Reference: S.T.P. 205-41 and ASTM D 4318)

SNC·LAVALIN

Client:	Assoiciated Engineering
Project	Falcon Holdings
Project #:	626523
Technician:	RJ
Date:	3-Mar-2015

Sample: DPW-349 BH 10 at 8.3-8.8m

-

Plastic Limit

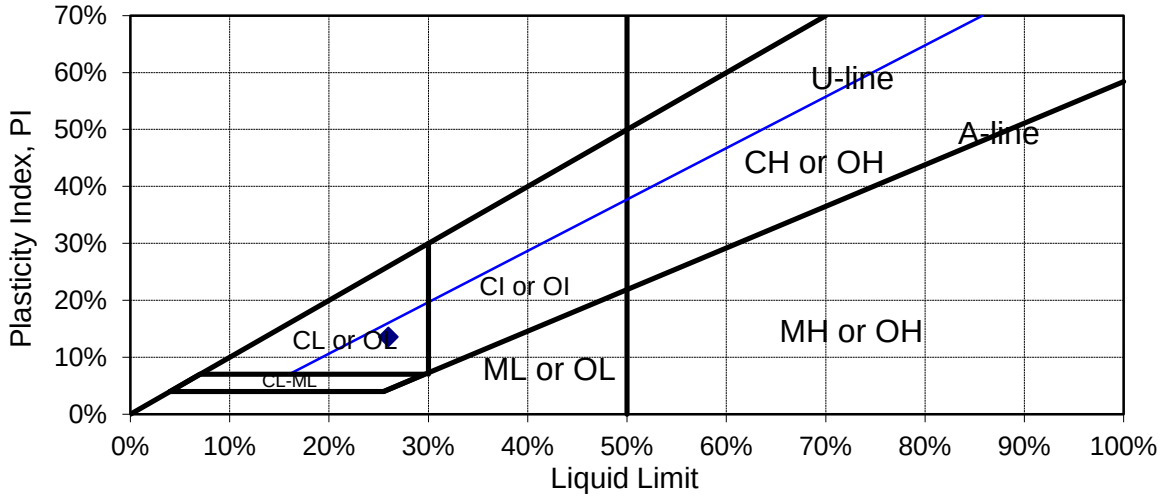
Tare #	-
Tare Wt, g	14.63
Wet + Tare, g	24.87
Dry + Tare, g	23.74
M%	12.4%

Liquid Limit (method B)

# of Blows	14	14	
Tare #	-	-	
Tare Wt, g	14.45	14.46	
Wet + tare, g	23.78	26.31	
Dry + tare, g	21.73	23.74	
Water content	28.2%	27.7%	AVERAGE
Adjusted W/C	26.2%	25.8%	26.0%

SUMMARY

Plastic Limit:	12.4%
Liquid Limit:	26.0%
Plasticity Index:	13.6%
Classification:	CL
Natural Water Content:	11.3%



Comments: -

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ATTERBERG LIMITS REPORT

(Test Reference: S.T.P. 205-41 and ASTM D 4318)

SNC·LAVALIN

Client:	Assoiciated Engineering
Project	Falcon Holdings
Project #:	626523
Technician:	RJ
Date:	3-Mar-2015

Sample: DPW-354 BH 11 at 0.3m

-

Plastic Limit

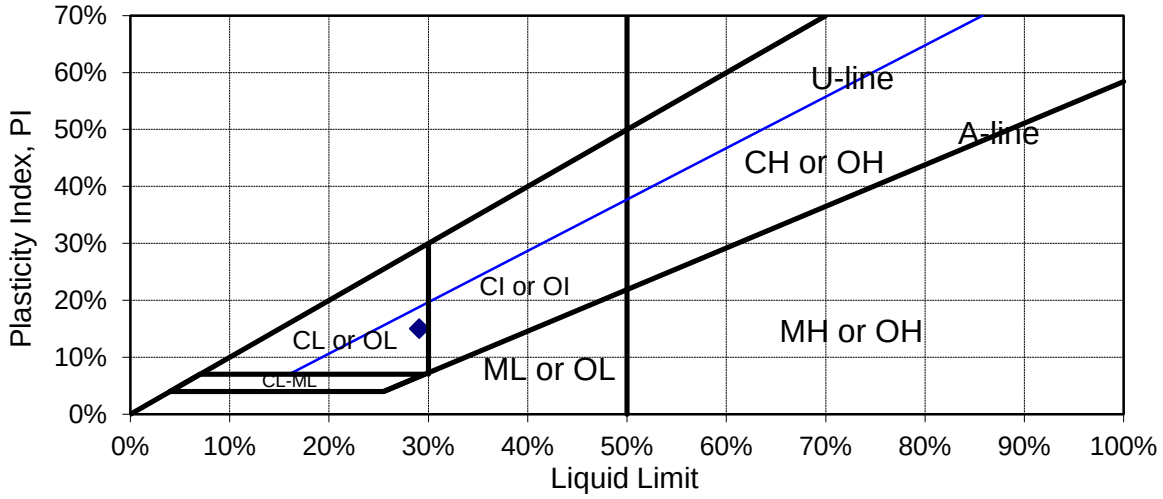
Tare #	-
Tare Wt, g	14.41
Wet + Tare, g	24.31
Dry + Tare, g	23.09
M%	14.1%

Liquid Limit (method B)

# of Blows	15	15	
Tare #	-	-	
Tare Wt, g	14.15	14.48	
Wet + tare, g	23.43	24.85	
Dry + tare, g	21.23	22.40	
Water content	31.1%	30.9%	AVERAGE
Adjusted W/C	29.1%	29.0%	29.1%

SUMMARY

Plastic Limit:	14.1%
Liquid Limit:	29.1%
Plasticity Index:	15.0%
Classification:	CL
Natural Water Content:	15.0%



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ATTERBERG LIMITS REPORT

(Test Reference: S.T.P. 205-41 and ASTM D 4318)

SNC·LAVALIN

Client:	Assoiciated Engineering
Project	Falcon Holdings
Project #:	626523
Technician:	RJ
Date:	3-Mar-2015

Sample: DPW-386 BH 13 at 3.8m

-

Plastic Limit

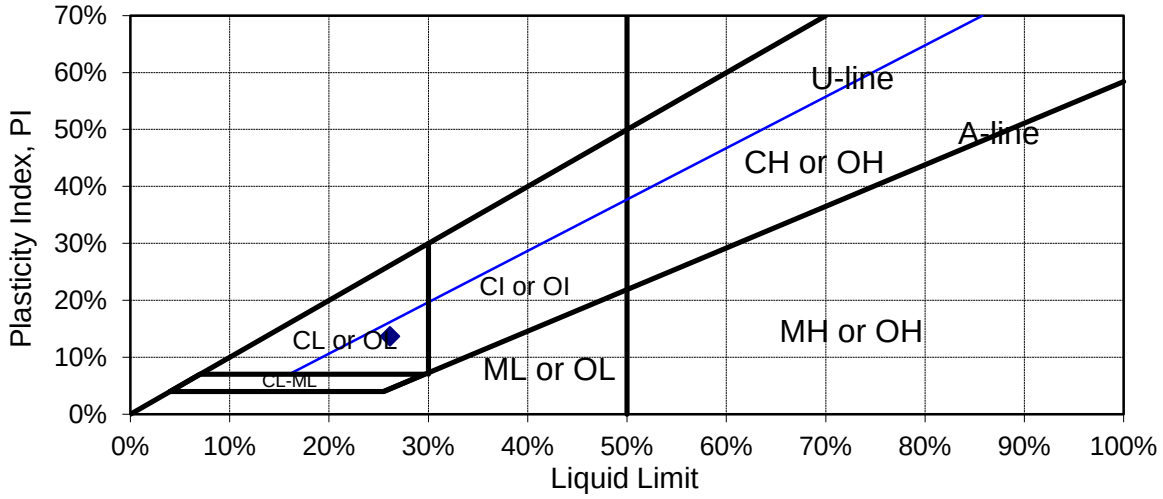
Tare #	-
Tare Wt, g	14.32
Wet + Tare, g	25.06
Dry + Tare, g	23.87
M%	12.5%

Liquid Limit (method B)

# of Blows	21	22	
Tare #	-	-	
Tare Wt, g	14.17	13.80	
Wet + tare, g	23.74	25.44	
Dry + tare, g	21.72	23.00	
Water content	26.8%	26.5%	AVERAGE
Adjusted W/C	26.2%	26.1%	26.1%

SUMMARY

Plastic Limit:	12.5%
Liquid Limit:	26.1%
Plasticity Index:	13.7%
Classification:	CL
Natural Water Content:	11.4%



Comments: -

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ATTERBERG LIMITS REPORT

(Test Reference: S.T.P. 205-41 and ASTM D 4318)

SNC·LAVALIN

Client:	Assoiciated Engineering
Project	Falcon Holdings
Project #:	626523
Technician:	RJ
Date:	3-Mar-2015

Sample: DPW-407 BH 15 at 0.3m

-

Plastic Limit

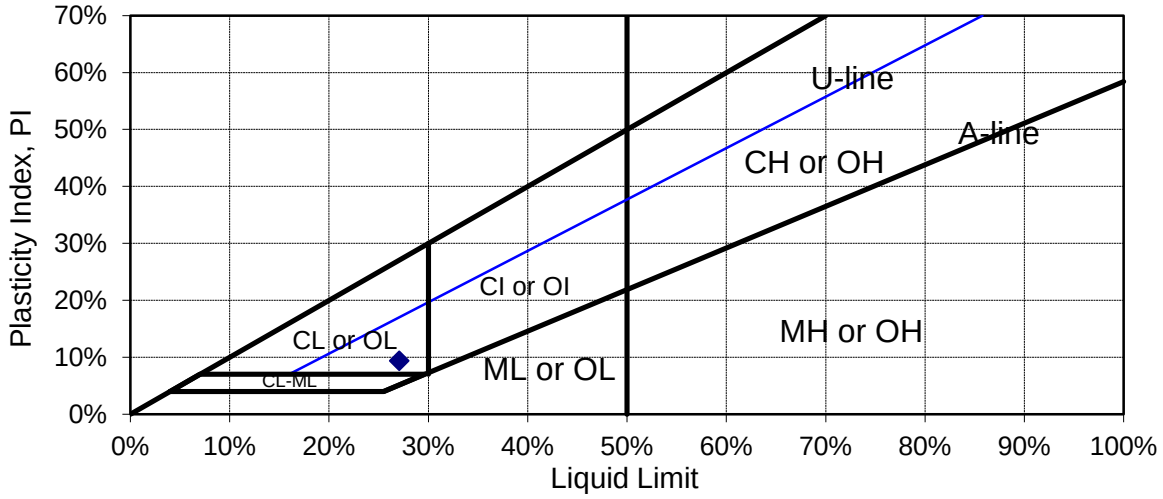
Tare #	-
Tare Wt, g	14.43
Wet + Tare, g	24.01
Dry + Tare, g	22.57
M%	17.7%

Liquid Limit (method B)

# of Blows	35	34	
Tare #	-	-	
Tare Wt, g	12.31	14.32	
Wet + tare, g	21.38	22.84	
Dry + tare, g	19.53	21.07	
Water content	25.6%	26.2%	AVERAGE
Adjusted W/C	26.8%	27.3%	27.1%

SUMMARY

Plastic Limit:	17.7%
Liquid Limit:	27.1%
Plasticity Index:	9.4%
Classification:	CL
Natural Water Content:	7.2%



Comments: -

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ATTERBERG LIMITS REPORT

(Test Reference: S.T.P. 205-41 and ASTM D 4318)

SNC·LAVALIN

Client:	Assoiciated Engineering
Project	Falcon Holdings
Project #:	626523
Technician:	RJ
Date:	3-Mar-2015

Sample: DPW-409 BH 15 at 1.5m

-

Plastic Limit

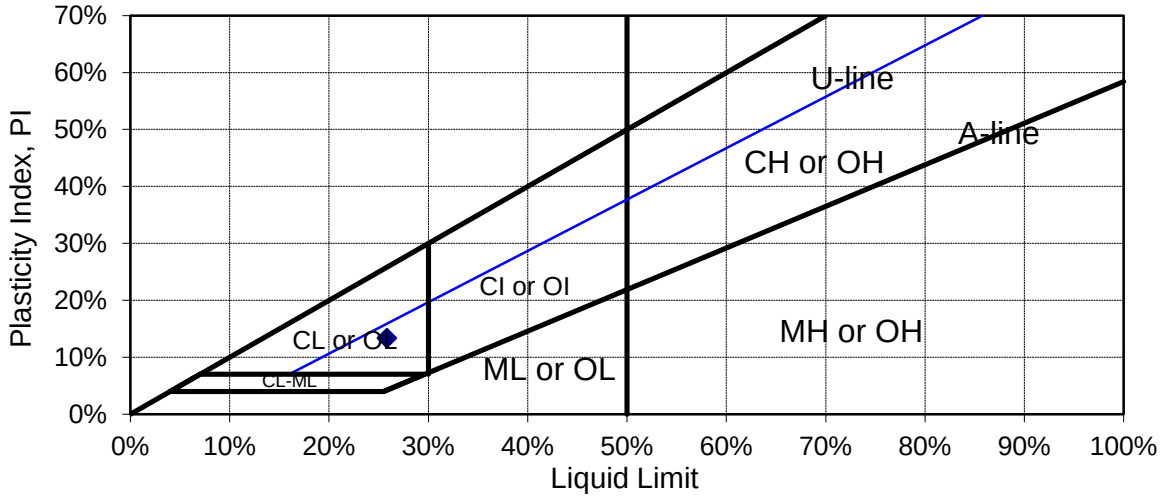
Tare #	-
Tare Wt, g	13.25
Wet + Tare, g	21.55
Dry + Tare, g	20.63
M%	12.5%

Liquid Limit (method B)

# of Blows	25	27	
Tare #	-	-	
Tare Wt, g	13.10	12.72	
Wet + tare, g	21.20	25.16	
Dry + tare, g	19.53	22.64	
Water content	26.0%	25.4%	AVERAGE
Adjusted W/C	26.0%	25.7%	25.8%

SUMMARY

Plastic Limit:	12.5%
Liquid Limit:	25.8%
Plasticity Index:	13.4%
Classification:	CL
Natural Water Content:	10.9%



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PARTICLE-SIZE ANALYSIS REPORT

(Test Reference: ASTM D 422)

Sieve Analysis	Sieve	Diameter (mm)	% Finer
	3"	76.2	100
	2"	50.8	100
	1"	25.4	100
	3/4"	19.1	100
	3/8"	9.5	96
	# 4	4.75	91
	# 10	2.00	85
	# 20	0.850	73
	# 40	0.425	60
	# 60	0.250	53
	# 100	0.150	48
	# 200	0.075	42
Hydrometer Analysis		0.0674	38.5
		0.0491	30.9
Dispersing agent:		0.0355	24.6
Sodium Hexametaphosphate		0.0254	21.6
		0.0181	19.5
Dosage of dispersing agent:		0.0133	18.2
40 g/L		0.0094	16.5
		0.0067	14.1
		0.0047	12.7
		0.0032	11.3
		0.0022	10.8
		0.0013	9.4

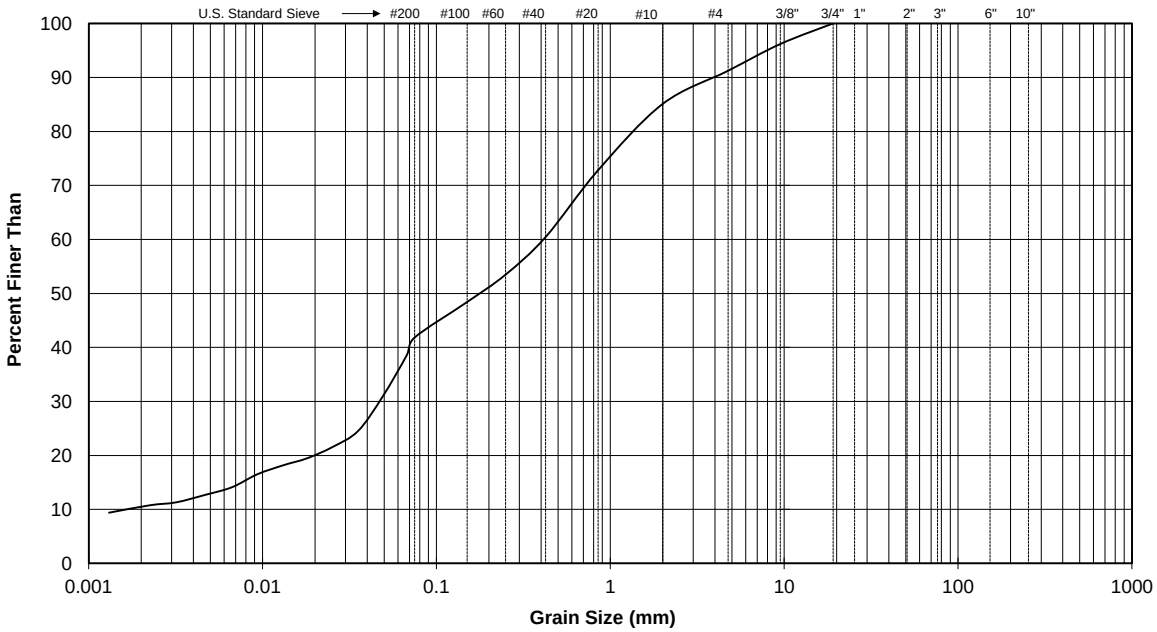
SNC·LAVALIN

Client:	Associated Engineering
Project:	Falcon Holdings
Project #:	626523
Sample:	DPW-407 at 0.3m
Date:	2-Mar-15

Particle Size Distribution Summary

% GRAVEL	9
% SAND	49
% SILT SIZE (<75μm>5μm)	29.1
% CLAY SIZE (<5μm)	12.9

Comments:



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PARTICLE-SIZE ANALYSIS REPORT

(Test Reference: ASTM D 422)

Sieve Analysis	Sieve	Diameter (mm)	% Finer
	3"	76.2	100
	2"	50.8	100
	1"	25.4	100
	3/4"	19.1	95
	3/8"	9.5	95
	# 4	4.75	93
	# 10	2.00	92
	# 20	0.850	90
	# 40	0.425	84
	# 60	0.250	75
	# 100	0.150	65
	# 200	0.075	53
Hydrometer Analysis		0.0652	48.6
		0.0470	43.1
Dispersing agent:		0.0336	40.4
Sodium Hexametaphosphate		0.0240	37.2
		0.0166	34.4
Dosage of dispersing agent:		0.0127	31.6
40 g/L		0.0090	28.4
		0.0064	26.4
		0.0046	24.2
		0.0033	20.6
		0.0023	18.9
		0.0014	16.0

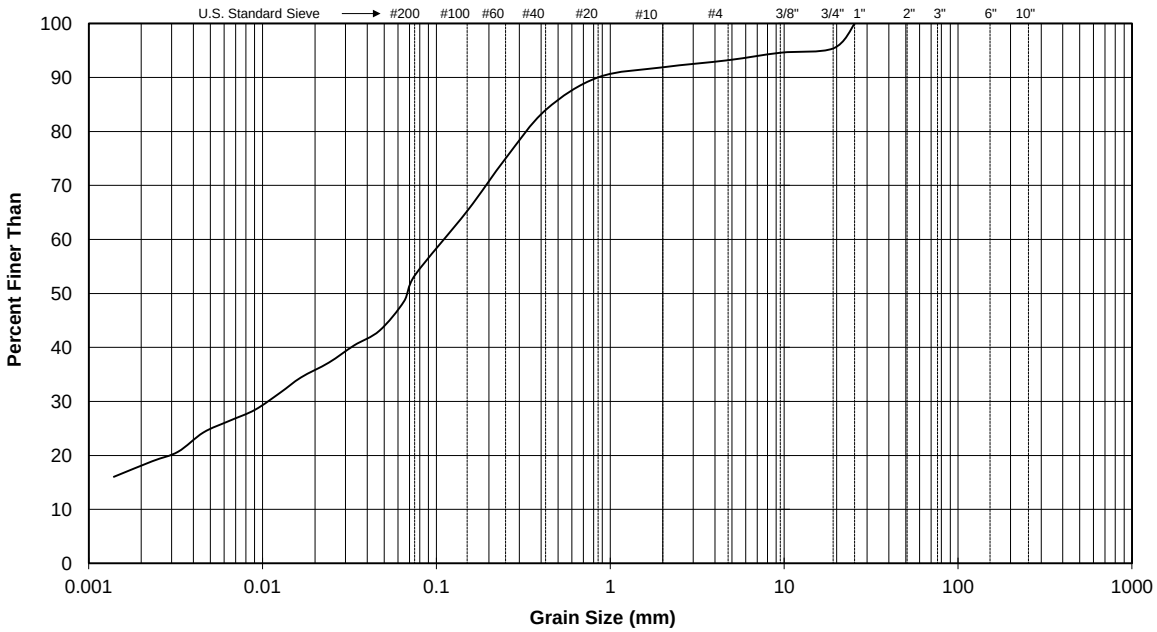
SNC·LAVALIN

Client:	Associated Engineering
Project:	Falcon Holdings
Project #:	626523
Sample:	DPW-409 at 1.5m
Date:	4-Mar-15

Particle Size Distribution Summary

% GRAVEL	7
% SAND	40
% SILT SIZE (<75μm>5μm)	28.3
% CLAY SIZE (<5μm)	24.7

Comments:



PARTICLE-SIZE ANALYSIS REPORT

(Test Reference: ASTM D 422)

Sieve Analysis	Sieve	Diameter (mm)	% Finer
	3"	76.2	100
	2"	50.8	100
	1"	25.4	100
	3/4"	19.1	100
	3/8"	9.5	99
	# 4	4.75	98
	# 10	2.00	96
	# 20	0.850	92
	# 40	0.425	86
	# 60	0.250	76
	# 100	0.150	66
	# 200	0.075	54
Hydrometer Analysis		0.0656	51.4
		0.0474	45.7
Dispersing agent:		0.0341	40.4
Sodium Hexametaphosphate		0.0242	39.0
		0.0173	35.6
Dosage of dispersing agent:		0.0124	32.7
40 g/L		0.0091	29.8
		0.0065	26.6
		0.0046	23.6
		0.0031	21.5
		0.0022	20.1
		0.0013	17.3

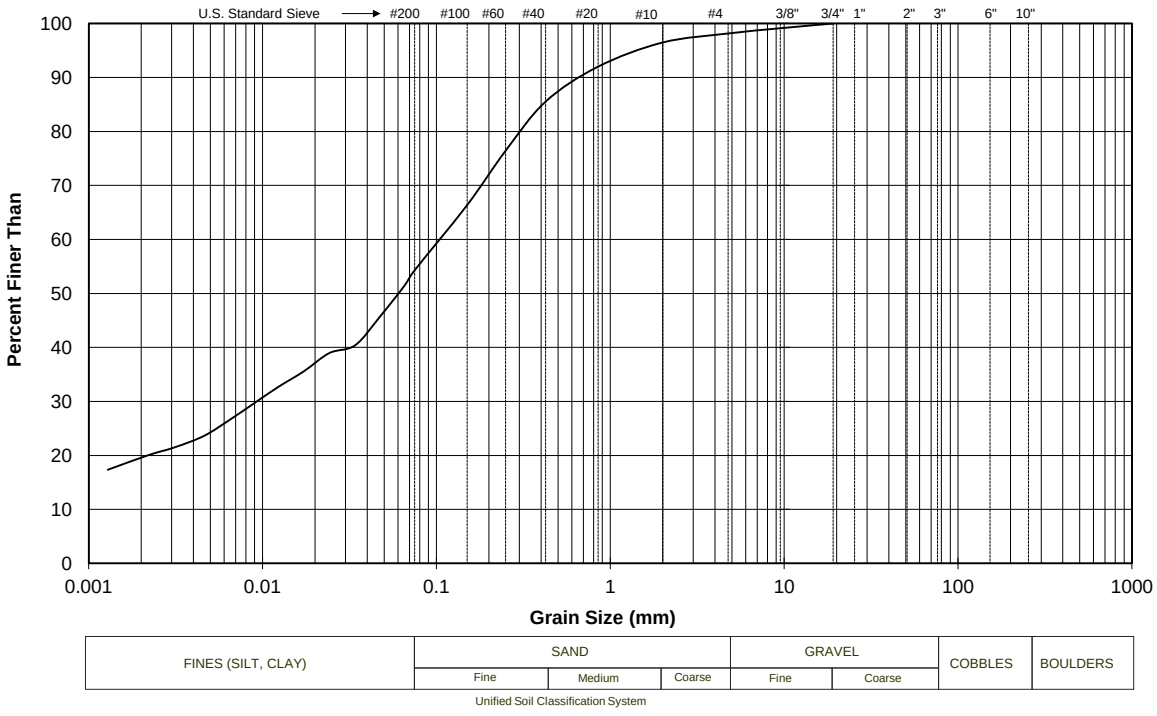
SNC·LAVALIN

Client:	Associated Engineering
Project:	Falcon Holdings
Project #:	626523
Sample:	DPW-436 at 3.8-4.3m
Date:	2-Mar-15

Particle Size Distribution Summary

% GRAVEL	2
% SAND	44
% SILT SIZE (<75μm>5μm)	29.8
% CLAY SIZE (<5μm)	24.2

Comments:



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PARTICLE-SIZE ANALYSIS REPORT

(Test Reference: ASTM D 422)

Sieve Analysis	Sieve	Diameter (mm)	% Finer
	3"	76.2	100
	2"	50.8	100
	1"	25.4	100
	3/4"	19.1	100
	3/8"	9.5	99
	# 4	4.75	97
	# 10	2.00	95
	# 20	0.850	91
	# 40	0.425	86
	# 60	0.250	77
	# 100	0.150	68
	# 200	0.075	56
Hydrometer Analysis		0.0640	54.8
		0.0466	47.3
Dispersing agent:		0.0334	43.5
Sodium Hexametaphosphate		0.0238	40.7
		0.0166	36.9
Dosage of dispersing agent:		0.0126	34.5
40 g/L		0.0090	31.2
		0.0064	28.1
		0.0045	26.4
		0.0032	23.2
		0.0023	21.5
		0.0014	16.5

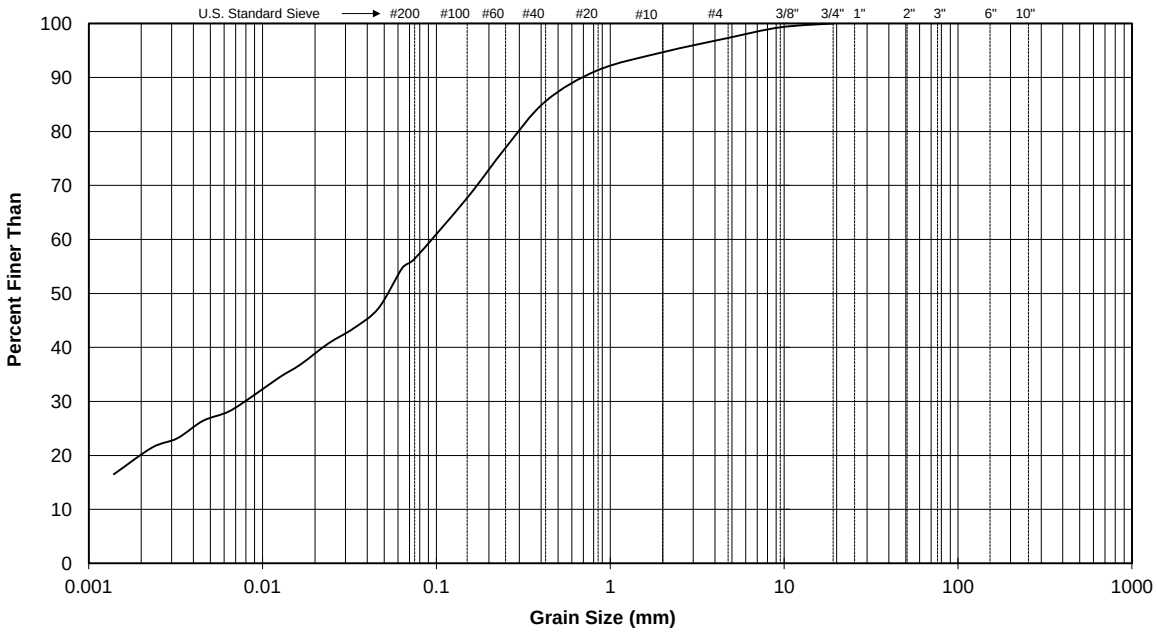
SNC·LAVALIN

Client:	Associated Engineering
Project:	Falcon Holdings
Project #:	626523
Sample:	DPW-442 at 12.9m
Date:	4-Mar-15

Particle Size Distribution Summary

% GRAVEL	3
% SAND	41
% SILT SIZE (<75μm>5μm)	29.2
% CLAY SIZE (<5μm)	26.8

Comments:



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Engineering interpretation will be provided by SNC-Lavalin upon request.

Sieve Analysis

Sieve Size			Specification		
Imperial	Metric	% Finer	Size	Min	Max
2"	50.8	100.0	50.8	0	0
1"	25.4	100.0	25.4	0	0
3/4"	19.1	100.0	19.1	0	0
3/8"	9.5	100.0	9.50	0	0
#4	4.75	99.9	4.75	0	0
#10	2.00	99.8	2.00	0	0
#20	0.85	99.5	0.850	0	0
#40	0.425	97.0	0.425	0	0
#60	0.250	56.3	0.250	0	0
#100	0.150	15.1	0.150	0	0
#200	0.075	4.6	0.075	0	0

Other Properties	Results	Specification
Moisture Content:	**18.4**	
Lightweights:	-	
Percent Fracture:	-	
Plasticity Index:	-	
Fineness Modulus:	-	
Soundness:	-	
LA Abrasion:	-	
Micro Deval:	-	
Freeze/Thaw:	-	
Clay Lumps:	-	
Flat & Elongated:	-	
Relative Density:	-	
Absorption:	-	
Unit Weight:	-	
Sand Equivalent:	-	

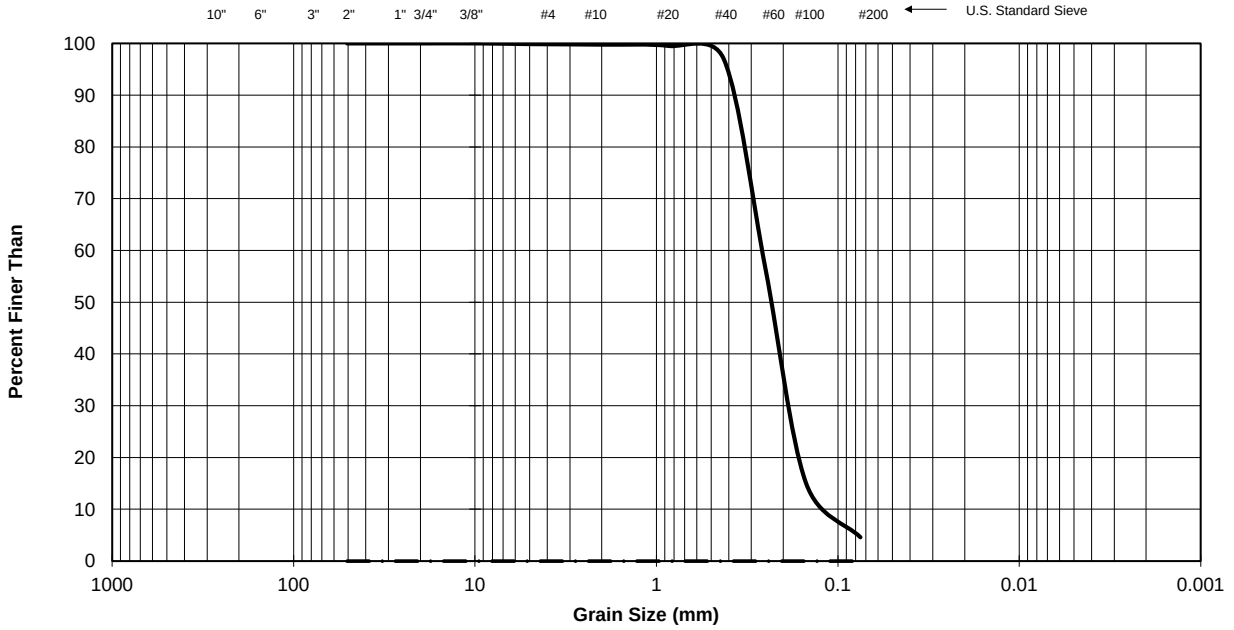
SNC·LAVALIN

Project No.:	626523
Client:	Associated Engineering
Project:	Falcon Holdings
Location:	BH 01
Sample No.:	DPW-459 at 15.9-16.4m
Date Sampled:	-
Date Received:	-
Date Tested	27-Feb-15
Sample Desc.:	-
Supplied By:	-
Sampled By:	DPW
Tested By:	JA
Sample Location:	-

Comments:

PARTICLE SIZE DISTRIBUTION SUMMARY

% COBBLES	0
% GRAVEL	0
% SAND	95
% FINES	5



BOULDERS	COBBLES	GRAVEL		SAND			FINES (SILT, CLAY)
		Coarse	Fine	Coarse	Medium	Fine	

Unified Soil Classification System

Sieve Analysis

Sieve Size			Specification		
Imperial	Metric	% Finer	Size	Min	Max
2"	50.8	100.0	50.8	0	0
1"	25.4	100.0	25.4	0	0
3/4"	19.1	100.0	19.1	0	0
3/8"	9.5	100.0	9.50	0	0
#4	4.75	99.7	4.75	0	0
#10	2.00	99.4	2.00	0	0
#20	0.85	99.0	0.850	0	0
#40	0.425	97.8	0.425	0	0
#60	0.250	91.7	0.250	0	0
#100	0.150	65.6	0.150	0	0
#200	0.075	34.1	0.075	0	0

Other Properties	Results	Specification
Moisture Content:	**15.6**	
Lightweights:	-	
Percent Fracture:	-	
Plasticity Index:	-	
Fineness Modulus:	-	
Soundness:	-	
LA Abrasion:	-	
Micro Deval:	-	
Freeze/Thaw:	-	
Clay Lumps:	-	
Flat & Elongated:	-	
Relative Density:	-	
Absorption:	-	
Unit Weight:	-	
Sand Equivalent:	-	

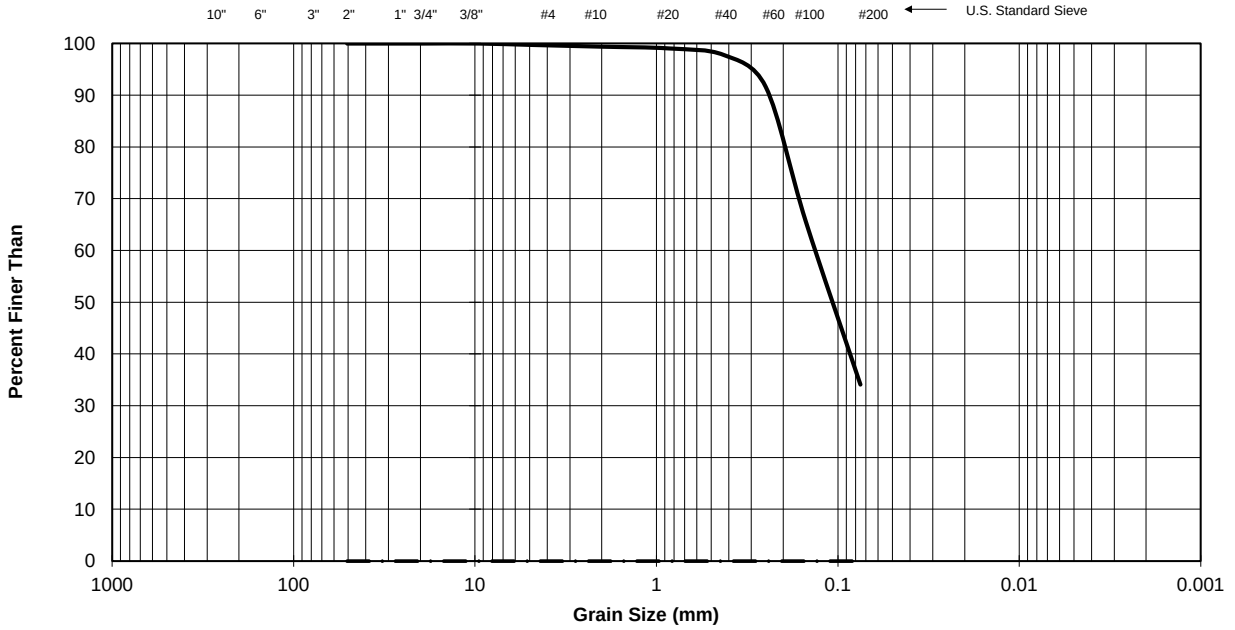
SNC·LAVALIN

Project No.:	626523
Client:	Associated Engineering
Project:	Falcon Holdings
Location:	BH 11
Sample No.:	DPW-368 at 17.4m
Date Sampled:	-
Date Received:	-
Date Tested	27-Feb-15
Sample Desc.:	-
Supplied By:	-
Sampled By:	DPW
Tested By:	JA
Sample Location:	-

Comments:

PARTICLE SIZE DISTRIBUTION SUMMARY

% COBBLES	0
% GRAVEL	0
% SAND	66
% FINES	34



BOULDERS	COBBLES	GRAVEL		SAND			FINES (SILT, CLAY)
		Coarse	Fine	Coarse	Medium	Fine	

Unified Soil Classification System

Sieve Analysis

Sieve Size			Specification		
Imperial	Metric	% Finer	Size	Min	Max
2"	50.8	100.0	50.8	0	0
1"	25.4	100.0	25.4	0	0
3/4"	19.1	100.0	19.1	0	0
3/8"	9.5	98.9	9.50	0	0
#4	4.75	94.0	4.75	0	0
#10	2.00	88.9	2.00	0	0
#20	0.85	83.1	0.850	0	0
#40	0.425	72.2	0.425	0	0
#60	0.250	59.2	0.250	0	0
#100	0.150	48.0	0.150	0	0
#200	0.075	37.8	0.075	0	0

Other Properties	Results	Specification
Moisture Content:	7.2	
Lightweights:	-	
Percent Fracture:	-	
Plasticity Index:	-	
Fineness Modulus:	-	
Soundness:	-	
LA Abrasion:	-	
Micro Deval:	-	
Freeze/Thaw:	-	
Clay Lumps:	-	
Flat & Elongated:	-	
Relative Density:	-	
Absorption:	-	
Unit Weight:	-	
Sand Equivalent:	-	

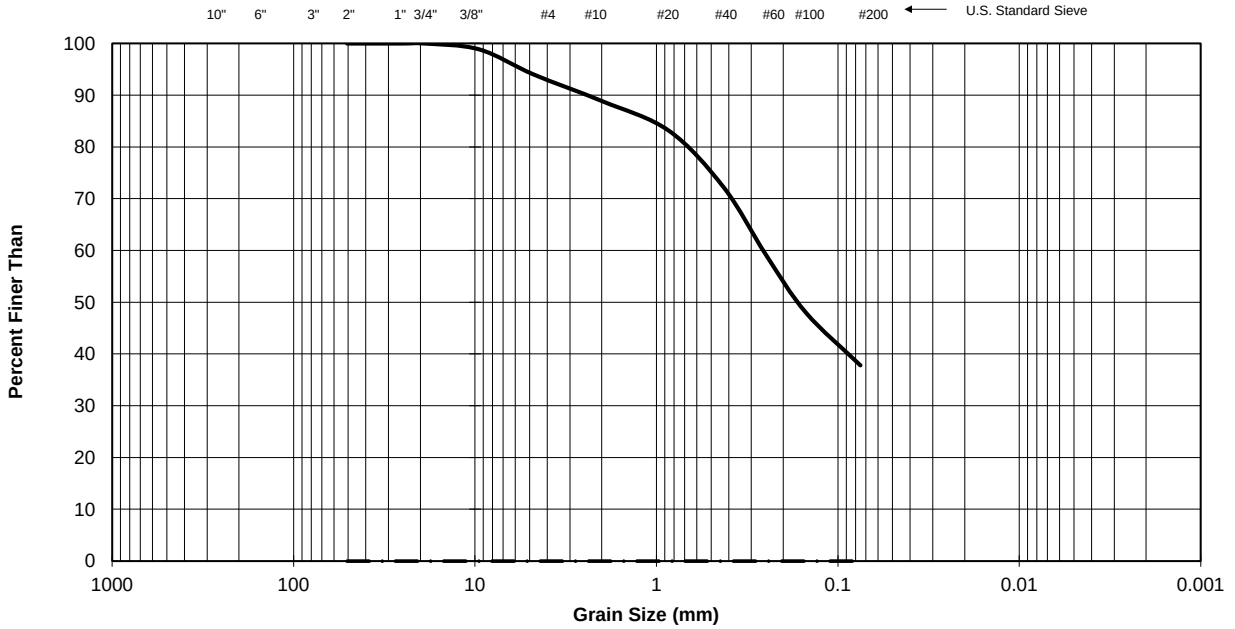
SNC·LAVALIN

Project No.:	626523
Client:	Associated Engineering
Project:	Falcon Holdings
Location:	BH 13
Sample No.:	DPW-386 at 3.8m
Date Sampled:	-
Date Received:	-
Date Tested	27-Feb-15
Sample Desc.:	-
Supplied By:	-
Sampled By:	DPW
Tested By:	MC/JA
Sample Location:	-

Comments:

PARTICLE SIZE DISTRIBUTION SUMMARY

% COBBLES	0
% GRAVEL	6
% SAND	56
% FINES	38



BOULDERS	COBBLES	GRAVEL		SAND			FINES (SILT, CLAY)
		Coarse	Fine	Coarse	Medium	Fine	

Unified Soil Classification System

Sieve Analysis

Sieve Size			Specification		
Imperial	Metric	% Finer	Size	Min	Max
2"	50.8	100.0	50.8	0	0
1"	25.4	100.0	25.4	0	0
3/4"	19.1	100.0	19.1	0	0
3/8"	9.5	99.2	9.50	0	0
#4	4.75	96.8	4.75	0	0
#10	2.00	93.6	2.00	0	0
#20	0.85	90.0	0.850	0	0
#40	0.425	84.9	0.425	0	0
#60	0.250	77.8	0.250	0	0
#100	0.150	57.9	0.150	0	0
#200	0.075	43.8	0.075	0	0

Other Properties	Results	Specification
Moisture Content:	**16.2**	
Lightweights:	-	
Percent Fracture:	-	
Plasticity Index:	-	
Fineness Modulus:	-	
Soundness:	-	
LA Abrasion:	-	
Micro Deval:	-	
Freeze/Thaw:	-	
Clay Lumps:	-	
Flat & Elongated:	-	
Relative Density:	-	
Absorption:	-	
Unit Weight:	-	
Sand Equivalent:	-	

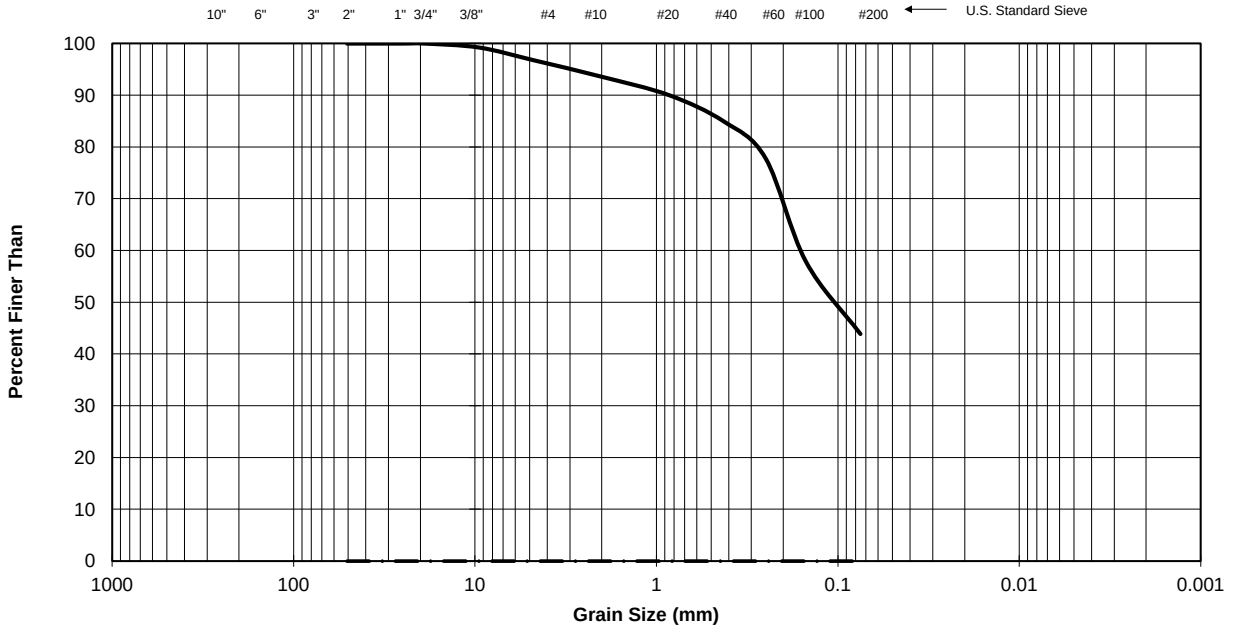
SNC·LAVALIN

Project No.:	626523
Client:	Associated Engineering
Project:	Falcon Holdings
Location:	BH 14
Sample No.:	DPW-405 at 14.4m
Date Sampled:	-
Date Received:	-
Date Tested	27-Feb-15
Sample Desc.:	-
Supplied By:	-
Sampled By:	DPW
Tested By:	MC/JA
Sample Location:	-

Comments:

PARTICLE SIZE DISTRIBUTION SUMMARY

% COBBLES	0
% GRAVEL	3
% SAND	53
% FINES	44



BOULDERS	COBBLES	GRAVEL		SAND			FINES (SILT, CLAY)
		Coarse	Fine	Coarse	Medium	Fine	

Unified Soil Classification System

Sieve Analysis

Sieve Size			Specification		
Imperial	Metric	% Finer	Size	Min	Max
2"	50.8	100.0	50.8	0	0
1"	25.4	100.0	25.4	0	0
3/4"	19.1	100.0	19.1	0	0
3/8"	9.5	100.0	9.50	0	0
#4	4.75	98.2	4.75	0	0
#10	2.00	91.1	2.00	0	0
#20	0.85	67.8	0.850	0	0
#40	0.425	33.7	0.425	0	0
#60	0.250	21.7	0.250	0	0
#100	0.150	16.4	0.150	0	0
#200	0.075	11.6	0.075	0	0

Other Properties	Results	Specification
Moisture Content:	**14.0**	
Lightweights:	-	
Percent Fracture:	-	
Plasticity Index:	-	
Fineness Modulus:	-	
Soundness:	-	
LA Abrasion:	-	
Micro Deval:	-	
Freeze/Thaw:	-	
Clay Lumps:	-	
Flat & Elongated:	-	
Relative Density:	-	
Absorption:	-	
Unit Weight:	-	
Sand Equivalent:	-	

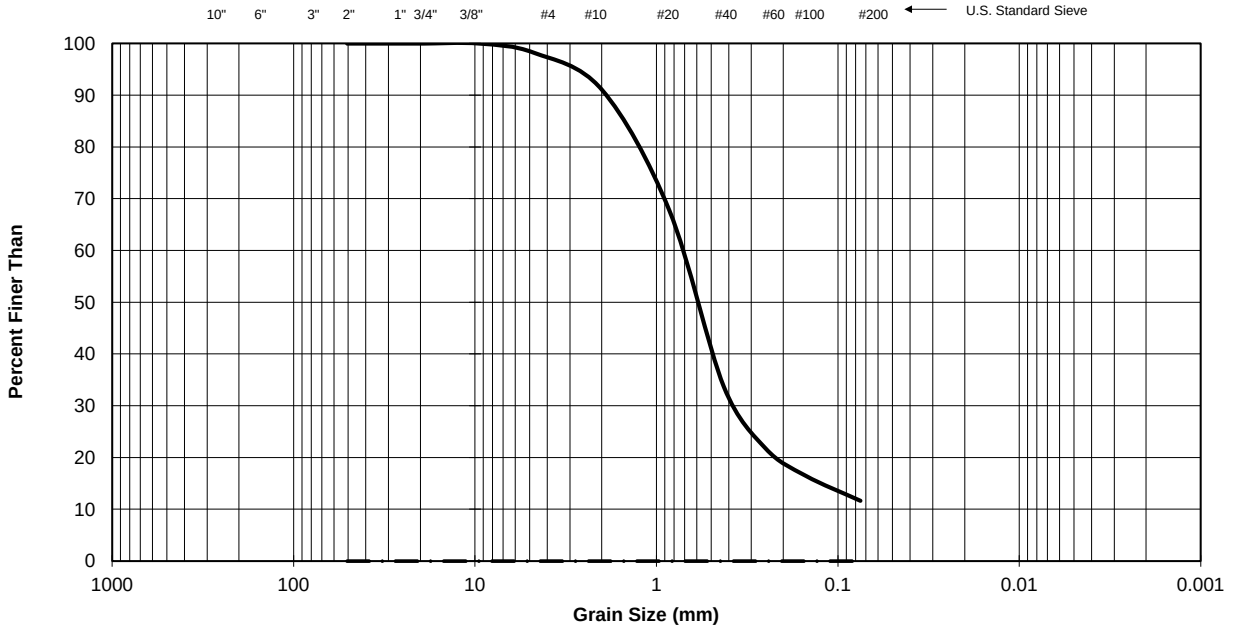
SNC·LAVALIN

Project No.:	626523
Client:	Associated Engineering
Project:	Falcon Holdings
Location:	BH 16
Sample No.:	DPW-431 at 14.4-14.9m
Date Sampled:	-
Date Received:	-
Date Tested	27-Feb-15
Sample Desc.:	-
Supplied By:	-
Sampled By:	DPW
Tested By:	MC/JA
Sample Location:	-

Comments:

PARTICLE SIZE DISTRIBUTION SUMMARY

% COBBLES	0
% GRAVEL	2
% SAND	86
% FINES	12



BOULDERS	COBBLES	GRAVEL		SAND			FINES (SILT, CLAY)
		Coarse	Fine	Coarse	Medium	Fine	

Unified Soil Classification System

Sieve Analysis

Sieve Size			Specification		
Imperial	Metric	% Finer	Size	Min	Max
2"	50.8	100.0	50.8	0	0
1"	25.4	100.0	25.4	0	0
3/4"	19.1	96.8	19.1	0	0
3/8"	9.5	95.8	9.50	0	0
#4	4.75	95.3	4.75	0	0
#10	2.00	93.7	2.00	0	0
#20	0.85	91.3	0.850	0	0
#40	0.425	81.1	0.425	0	0
#60	0.250	45.8	0.250	0	0
#100	0.150	19.6	0.150	0	0
#200	0.075	8.5	0.075	0	0

Other Properties	Results	Specification
Moisture Content:	**16.9**	
Lightweights:	-	
Percent Fracture:	-	
Plasticity Index:	-	
Fineness Modulus:	-	
Soundness:	-	
LA Abrasion:	-	
Micro Deval:	-	
Freeze/Thaw:	-	
Clay Lumps:	-	
Flat & Elongated:	-	
Relative Density:	-	
Absorption:	-	
Unit Weight:	-	
Sand Equivalent:	-	

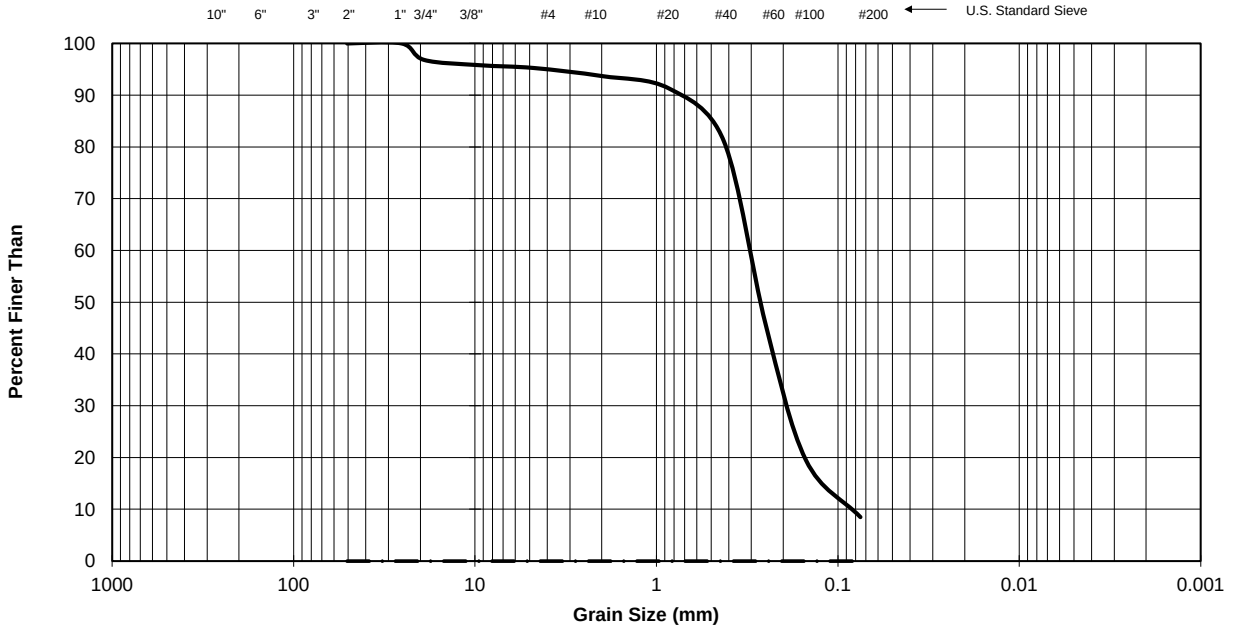
SNC·LAVALIN

Project No.:	626523
Client:	Associated Engineering
Project:	Falcon Holdings
Location:	BH 18
Sample No.:	DPW-456 at 15.9-16.4m
Date Sampled:	-
Date Received:	-
Date Tested	27-Feb-15
Sample Desc.:	-
Supplied By:	-
Sampled By:	DPW
Tested By:	JA
Sample Location:	-

Comments:

PARTICLE SIZE DISTRIBUTION SUMMARY

% COBBLES	0
% GRAVEL	5
% SAND	86
% FINES	9



BOULDERS	COBBLES	GRAVEL		SAND			FINES (SILT, CLAY)
		Coarse	Fine	Coarse	Medium	Fine	

Unified Soil Classification System

GROUP INDEX TEST REPORT

SNC·LAVALIN

Client:	Assoiciated Engineering
Project	Falcon Holdings
Project #:	626523
Technician:	RJ
Date:	3/4/2015

Sample Name	DPW-336	DPW-354			
Hole Number					
Depth					
Non-Plastic (y/n)	n	n			
Plastic Limit	12.4	14.1			
Liquid Limit	26.2	29.1			
PI	13.8	15.0			
% Passing					
#200	51.9	46.8			
T (LL)	40	40			
U (-71)	52	47			
I (PI)	14	15			
M (-71)	52	47			
Plastic Index	13.8	15			
Group Index	4.8	4.0			
Unified Class	CL	SC			
Sample Name					
Hole Number					
Depth					
Non-Plastic (y/n)					
Plastic Limit					
Liquid Limit					
PI					
% Passing					
#200					
T (LL)					
U (-71)					
I (PI)					
M (-71)					
Plastic Index					
Group Index					
Unified Class					

Comments:

BULK DENSITY TEST REPORT

SNC·LAVALIN

Client: Assoiciated Engineering
Project: Falcon Holdings
Project #: 626523
Tech: MC
Date: 24-Feb-15

Sample #	DPW-351	DPW-358	DPW-375	DPW-385	DPW-402	DPW-410
Depth	11.4-11.9	3.8-4.3	6.8-7.3	2.2-2.5	9.8-10.3	2.2-2.7
Borehole #	BH-10	BH-11	BH-12	BH-13	BH-14	BH-15
Tare #						
Tare Mass (g)	41.42	43.22	45.02	41.31	43.07	43.30
Wet sample + tare (g)	105.28	108.39	152.17	102.55	127.40	112.29
Dry sample + tare (g)	97.64	102.43	142.57	95.31	119.17	105.84
Wt. Dry sample (g)	56.22	59.21	97.55	54	76.1	62.54
Water Content (%)	13.59	10.07	9.84	13.41	10.81	10.31
Mass of sample in air (g):	169.37	168.95	157.23	85.66	155.67	110.74
Mass of sample + wax in air (g):	184.68	184.25	176.77	95.05	176.56	124.24
Mass of sample + wax in water (g):	93.08	92.58	80.45	45.28	85.42	60.77
Wet density (kg/m^3):	2277	2268	2114	2184	2300	2293
Dry density (kg/m^3):	2004	2061	1925	1926	2076	2078

Sample #	DPW-418					
Depth	14.4-14.9					
Borehole #	BH-15					
Tare #						
Tare Mass (g)	50.39					
Wet sample + tare (g)	152.16					
Dry sample + tare (g)	141.82					
Wt. Dry sample (g)	91.43					
Water Content (%)	11.31					
Mass of sample in air (g):	183.86					
Mass of sample + wax in air (g):	205.08					
Mass of sample + wax in water (g):	100.89					
Wet density (kg/m^3):	2288					
Dry density (kg/m^3):	2056					

Comments:

The testing services reported here have been performed in accordance with accepted local industry standards.

The results presented are for the sole use of the designated client only.

This report constitutes a testing service only. It does not represent any interpretation or opinion regarding specification compliance or material suitability.

Engineering interpretation will be provided by SNC Lavalin upon request.

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Saskatoon Saskatchewan Canada S7K 1K3
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Fax: 306.668.6619
www.snclavalin.com

APPENDIX C - ENVIRONMENTAL AND HERITAGE SCREENING

SUMMIT
ENVIRONMENTAL CONSULTANTS INC.
A Member of the Associated Engineering Group of Companies

REPORT

Falcon Holdings Ltd.

Environmental & Heritage Screening Study
SE 25-37-6-W3M, RM Corman Park #344, SK

CANADA'S BEST MANAGED COMPANIES

20 years Quality Service

August 2014

Table of Contents

List of Figures

1 Introduction

1.1 PROJECT BACKGROUND AND OBJECTIVE

A Natural Area and Heritage Screening Study was completed as part of the development plan submitted by Falcon Holdings Ltd. for the proposed industrial park subdivision (Korpan Industrial Park) in the Rural Municipality (RM) of Corman Park, Saskatchewan. The project area is 60 acres of land (SE 25-37-6 W3M) that is proposed to be rezoned for future industrial park development. Under Sections 6 and 9 of the Corman Park Official Community Plan (RM Corman Park #344, 2014) rural industrial parks should be located on sites that do not have unique historical or archaeological significance, do not have significant wildlife habitat, and preserve the natural character of conservation areas including significant vegetative growth and natural features.

The objective of this study is to identify environmentally sensitive areas and natural features within the project area (Appendix A – Figure A-1) and to provide recommendations for the protection and mitigation of significant natural areas, and wildlife and wildlife habitat as part of future development.

1.2 ASSESSMENT METHODS

The following methods were used to complete this project:

- Desktop study to gather available background data using readily available information about the project area (plans, maps, figures, aerial photographs, interviews) and existing databases (i.e. Saskatchewan Conservation Data Center (SKCDC) Biodiversity Website, GeoSask, Committee on the Status of Endangered Wildlife in Canada (COSEWIC) status reports, Schedule 1 of Species at Risk (SARA), Government of Saskatchewan's Saskatchewan Bird's Atlas, Water Security Agency's Water Well Information Database, Saskatchewan Soil Information Database);
- A preliminary heritage and archaeological screening assessment using the Government of Saskatchewan, Ministry of Parks, Culture and Sports, Developer's Online Screening Tool;
- A field assessment on July 17th, 2014 of the project area to confirm the ecological condition and habitat value of natural areas, identify areas of concern (e.g., species at risk, environmentally sensitive areas), obtain a general classification and quality of soil in the cultivated area;
- Assessment of potential impacts to existing aquatic and terrestrial habitats (includes a description of eco-region and vegetation, groundwater resources, wildlife and wildlife habitat, fisheries and aquatic resources, wetlands, land-use, soil capability, topography, and heritage resources) based on available preliminary development plans; and,
- Preparation of this report that summarizes the results of the study and provides recommendations to minimize project impacts.

1.3 REGULATORY OVERVIEW

The following sections outline the provincial and federal regulatory requirements considered for this project. These regulatory requirements, along with general construction best management practices, form the basis of the future mitigation recommendations presented in Section 4.

1.3.1 Provincial Regulations

Wildlife Act

Under Section 50 (1) (a) of the *Wildlife Act* it is an offense to "kill, injure, disturb, take, capture, harvest, genetically manipulate or interfere with or attempt to do any of those things to any designated species." There are fifteen "wild species at risk" identified in the Saskatchewan *Wildlife Act*. A Research Permit is required to conduct activities that may significantly affect listed species.

Environmental Management and Protection Act

The *Environmental Management and Protection Act* (EMPA) is intended to protect land, air and water resources. Any alteration of a shoreline, bed, bank or boundary or removal of riparian vegetation of any watercourse requires an Aquatic Habitat Protection Permit under Section 36 of the Act.

Wildlife Habitat and Protection Act

The *Wildlife Habitat and Protection Act* provides for the management, conservation and protection of wildlife lands and wildlife by preventing the sale and alteration of certain Crown lands. The Act prevents the government from selling designated Crown land, and lessees require permission before any clearing, breaking, or drainage occurs. The philosophy of the Act is to conserve wildlife habitat while enabling compatible traditional uses to co-exist.

1.3.2 Federal Regulations

Fisheries Act

The federal *Fisheries Act* is the main federal legislation affecting all fish, fish habitat and water quality. Section 36 (3) of the Act prohibits deposition of deleterious substances in water frequented by fish. The harmful alteration, disruption or destruction of fish habitat was prohibited under Section 35 (1); however, following recent amendments (2012) to the *Fisheries Act*, Section 35 (1) now states "No person shall carry on any work, undertaking or activity that results in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery."

Committee of the Status of Wildlife in Canada and Species at Risk Act (SARA)

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) is the independent agency that determines the status of species in Canada (Government of Saskatchewan, 2012a). The *Species at Risk Act* (SARA) is federal legislation that provides legal protection of wildlife and their habitats designated under Schedule 1 of the Act (Government of Saskatchewan, 2011). This protection applies to aquatic species, migratory birds covered by the *Migratory Birds Convention Act*, and species that occur on federal lands in Canada. Federal lands are lands owned by the federal government, such as national parks, lands

used by the Department of National Defence, reserve lands and most of the land in the three territories. The purpose of the Act is to prevent Canadian indigenous species, subspecies, and distinct populations from becoming extirpated or extinct, to provide for the recovery of endangered or threatened species, and encourage the management of other species to prevent them from becoming at risk.

It is an offence under sections 32 and 33 of the SARA to kill, harm, harass, capture or take an individual of a listed species that is extirpated, endangered or threatened; possess, collect, buy, sell or trade an individual of a listed species that is extirpated, endangered or threatened, or its part or derivative; damage or destroy the residence of one or more individuals of a listed endangered or threatened species or of a listed extirpated species if a recovery strategy has recommended its reintroduction (Government of Saskatchewan, 2011).

Migratory Bird Convention Act (Migratory Birds Regulation)

The *Migratory Bird Convention Act* is a federal act that protects migratory birds and nests from indiscriminate harvesting and destruction. Specifically, the Act stipulates that “no person shall disturb, destroy or take a nest, egg, nest shelter, or duck box of a migratory bird” (Section 6[a]); and “no person shall deposit, or permit to be deposited oil, oil wastes or any other substance harmful to migratory birds in any waters or any area frequented by migratory birds” (Section 35 [1]).

2 Environmental Overview

2.1 LAND USE AND DESIGNATED AREAS

The project area is located north of Township Road 374 (Auction Mart Road) and west of Range Road 3060 within the RM of Corman Park, SK. As depicted in Appendix A – Figure A-2, the land is currently zoned as DAG1 (D-Agricultural District; RM Corman Park #344, 2007a) and the current land use is agricultural (i.e. crop production). The northeast portion of the project area is considered under the Corman Park Future Land Use Map as a future industrial area (RM Corman Park #344, 2007b; Appendix A – Figure A-3).

DAG1 lands are intended for the continuation of traditional extensive agricultural pursuits. The permitted uses are for agricultural operations of public utility or for municipal facilities. The proposed re-zoning for a variety of industrial park uses will be considered at the discretion of the municipal Council, as this zoning allows for a combination of light industrial uses (DM1) including but not limited to manufacturing, assembly, processing, fabrication, warehousing, or storage of goods and materials (RM Corman Park #344, 2012).

The adjacent properties surrounding the project area, except directly east, are zoned as DCR1, and are currently used for agricultural purposes. The property east of the project area is zoned as DM1 (D-Light Industrial 1 District) and is used by a number of companies for industrial activities including agricultural equipment sales, trailer rentals and storage, and grain silos. A small plot of land at the southwest corner of the project area is zoned as DCR1 (D-Country Residential 1- District), where there is a domestic residence.

There are no designated areas (e.g., national or provincial park lands, historic parks, park reserves, recreation sites, wildlife habitat protection lands, game preserves, conservation easements, etc.) within five kilometres (km) of the project area (Saskatchewan Ministry of Environment, 2014). Ducks Unlimited has not identified conservation or protected areas within the project area (Ducks Unlimited, 2014).

2.2 GROUNDWATER WELLS AND GROUNDWATER

A search of the Water Security Agency's (WSA), Saskatchewan Ground Water resources GIS Web Mapping application for water well drilling records (Water Security Agency, 2014) identified no wells within the project area. Three wells are located within one km of the project area boundary (Drillers Report numbers 013160, 032020, and 220109). Well numbers 013160 and 032020, completed in 1974 and 1971 respectively, were used for domestic water withdrawals. Well number 220109 was completed in 1967 and used as a soil test hole and the water was used for research purposes. The current status of all three wells is unknown. Drilling records are provided in Appendix B.

It is important to note that the database does not contain or identify all the wells completed in the province, only those records that were submitted by drillers. Using the available Drillers' Report well logs, Summit cannot estimate the ground water table level as only well depths were provided.

2.3 ECOREGION AND VEGETATION

The project area is located within the Moist Mixed Grassland Ecoregion within the Prairie Ecozone. Trees and shrubby vegetation in this region generally occur along stream courses and permanent sloughs. The margins of the wetlands and small lakes are typically dominated by cattails, bulrushes, and sedges. The remaining land base is mostly agricultural crops and grasses with a number of flowering plants and shrubs found in the lower, moister areas (Acton, 1998). Native vegetation in this ecoregion is limited to non-arable pasture lands, where speargrasses and wheatgrasses, along with deciduous shrubs such as snowberry, rose, chokecherry, and wolf willow are among the more common species. Small aspen groves are typically found around the sloughs and are a characteristic feature of the landscape (Saskatchewan Conservation Data Centre, 2014).

Most of the property is comprised of a cultivated field, which was planted with wheat in the current year. Cattails (*Typha latifolia*), trembling aspen (*Populus tremuloides*), Caragana (*Caragana arborescens*), willow (*Salix spp*.), sow thistle (*Sonchus arvensis*), and rushes (*Juncus spp*.) were found associated with low and seasonally wet areas throughout the project area.

2.4 SOIL AND TOPOGRAPHY

The Prairie Ecozone is the ecozone that has been most modified by human activities, and is one of the most extensive agricultural regions in the world (Acton, 1998). This ecoregion is closely correlated with semi-arid moisture conditions and dark brown soils. Most landscapes are comprised of glacial till, and have short, steep slopes and numerous undrained depressions or sloughs, although several large, level glacial lake plains also occur.

Surface elevations of the project area range between 505 to 507 metres (m) above sea level. The project area is very flat with slight declines towards drainage swales on the south and east sides of the property. The surrounding land generally decreases in elevation towards the South Saskatchewan River (south and east sides of the project area).

According to Saskatchewan Soil Information (SKSI) the soil in the project area is classified as a Bradwell O.DBC soil, of the SKSI Agricultural Capability Class 3(10)M (Appendix C). Class 3 soils have moderately severe limitations that restrict the range of crops or require special conservation practices. In this case, there is a moisture limitation in the soil imparted by the semi-arid regional climate. Bradwell soils are dark brown soils that have formed by loamy lacustrine materials. The soils are well drained and stone free with textures ranging from sandy loam to loam overlying glacial till (Saskatchewan Institute of Pedology, 1992).

2.5 AQUATIC RESOURCES

During the field assessment, numerous wetland locations were identified that lacked surface water, but contained aquatic vegetation (i.e., cattails; Figure 2-1). Exposed soils suggested water was present earlier in the year. These wetlands are likely Class II wetlands (Stewart and Kantrud, 1971) due to their ephemeral nature. These are likely not significant habitats for aquatic organisms as they contain water for brief periods of time. Intensive agriculture was evident around these locations, and sometimes through them if conditions were dry; further degrading their habitat potential. However, there was evidence of amphibian use in the area. Based on visual observations, these wetlands will have a relatively low to moderate potential as significant wildlife habitat or for providing hydrological control.

Surface water was observed in a wetland on the north portion of the project area, surrounded by shrubs and bushes (Figure 2-1). This area was classified as a Class IV wetland. Class IV wetlands are considered semi-permanent water bodies that seasonally maintain surface water through the growing season (i.e., May to September). Based on visual observations, these wetlands may provide moderate habitat and aesthetic value especially if the integrity of the adjacent vegetation is preserved. However, their capacity for storm water attenuation and hydrological control is very limited due to the lack of capacity and connectivity to drainage swales.

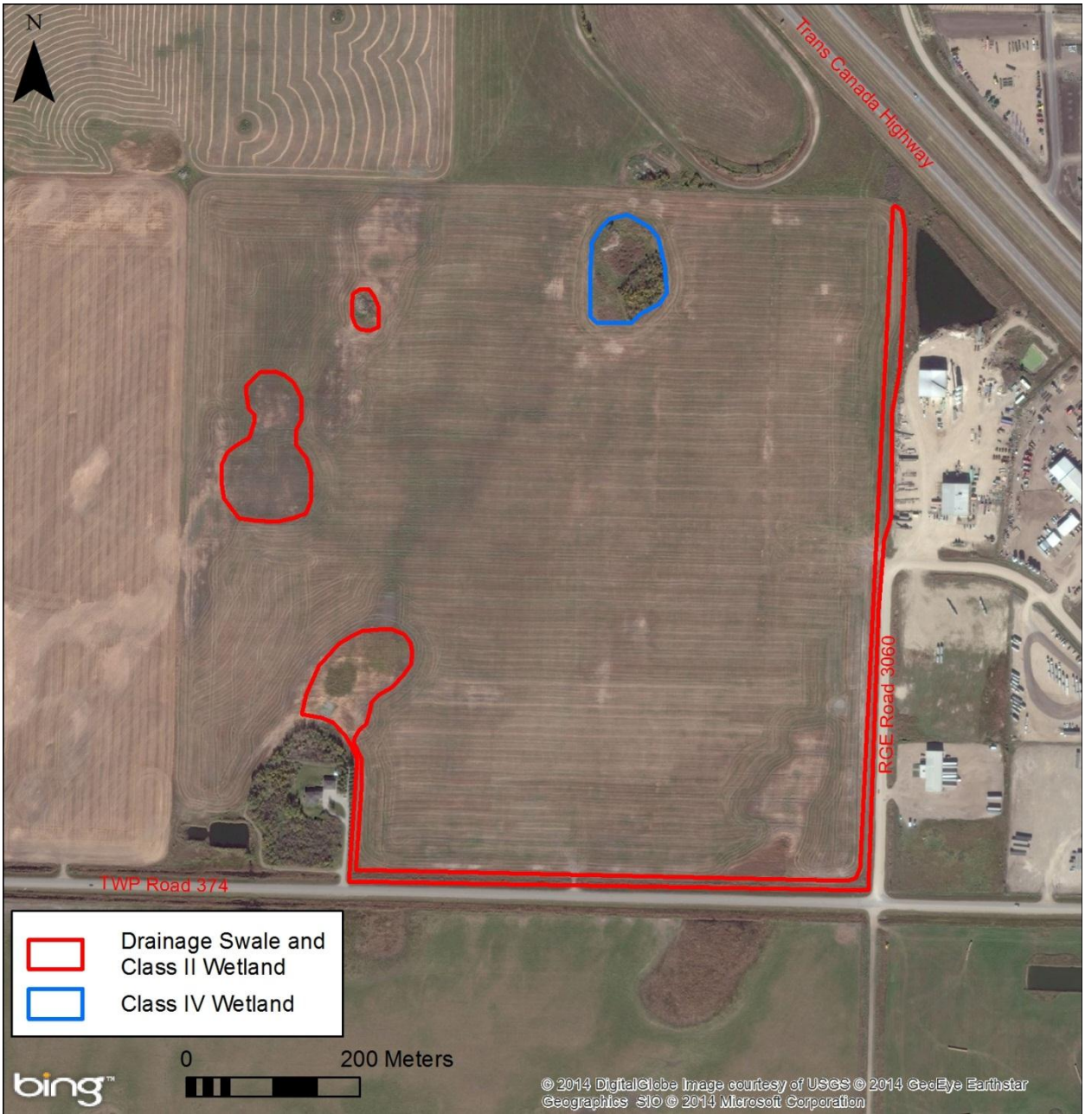

Figure 2-1
Location of Wetlands in the Project Area

2.6 WILDLIFE AND WILDLIFE HABITAT

The Class IV wetland (north wetland) and some of the Class II wetlands (drainage swales and associated wetlands) located in the project area will likely provide habitat features for a variety of waterbirds and some passerines. The western meadowlark, eastern kingbird, yellow-headed blackbird, piping plover, sharp-tailed grouse and Franklin's gull are typical birds of this ecoregion (SKCDC, 2014). Wetlands also are likely to provide habitat for amphibians including frogs (i.e. northern leopard frog) and toads. The riparian area of the north wetland also contains trees and shrubs, which provides potential foraging habitat for small mammals and nesting and foraging habitat for various bird species.

Adjacent farmland will often attract black bears and grazers such as deer. Small mammals (e.g. mice and voles) are often found along disturbed areas (i.e. highway and nearby industrial areas) and on farmland. These grazers will often attract predators such as snakes, raptors, coyotes and foxes.

Burrowing specialists such as badger, ground squirrel, and burrowing owl are known to the Prairies Ecoregion (Acton, 1998). The pronghorn antelope (*Antilocapra american*) and the plains bison (*Bison bison*) are also known to the area; however, bison have become threatened due to the past introduction of domestic cattle (Acton, 1998).

The only wildlife observed during the assessment was a red-winged black bird (*Agelaius phoeniceus*) and an unidentified frog species. The blackbirds were observed perched on cattails in a drainage swale and flying overhead.

2.7 RARE AND ENDANGERED SPECIES

No rare or endangered species were observed within the project area during the field assessment. The at-risk species, chaffweed (*Centunculus minimus*; S2 or Rare) and Englemann's spike-rush (*Eleocharis engelmannii*; S2 or Rare) have been observed at one site each within 2 km of the proposed development area. Within a 10 km radius of the project area, one migratory bird concentration site, 17 plant species and one bird species at risk were identified (SKCDC, 2014). These species (along with the other Species at Risk in Saskatchewan) and their habitat preferences are summarized in Appendix D.

Listed species having moderate to high potential to be present within the project area include:

- Bobolinks (*Doluchonyx oryzivorus;* S5B) are one of many types of "blackbirds"; found in grain fields and grasslands of SK.
- Burrowing owls (*Athene cunicularia*; S2B) are known to prefer sparsely vegetated agricultural land and may nest in the lands that are adjacent to the wetland.
- Loggerhead shrikes (*Lanius ludovicianus excubitorides*; S4B) are known to nest in grasslands, primarily native short-grass and mid-grass prairies. They have the ability to use some agricultural fields for feeding and raising young.
- Chaffweed (*Centunculus minimus*; S2) is an annual near-shore plant in wetlands that may be present in marshy zones of the project area.

- Smooth wild-rye (*Elymus glaucus*; S3S4) occurs throughout western North America.
- Red club-rush (*Scirpus rufus var. neogaeus*; SNR) is commonly found in pastures.
- Englemann's spike-rush (*Eleocharis engelmannii*; S2) occurs in sloughs and drying flooded areas of fields.

2.8 HERITAGE RESOURCES

The Province of Saskatchewan reviews project applications that are proposed for provincially-owned lands to determine whether a Heritage Resource Impact Assessment (HRIA) is required prior to initiation of a project (Government of Saskatchewan, 2012b). Using the Developer's Online Screening Tool, there were no heritage sensitivities identified within the project area. A date and time stamped report obtained July 16, 2014 is attached in Appendix E.

No further heritage resource screening by the Heritage Conservation Branch is required for this project area.

3 Potential Environmental Effects

3.1 AQUATIC RESOURCES

All of the wetlands within the proposed development area were temporary (ephemeral) or semi-permanent, and are unlikely to support fish due to shallow depths and a lack of connectivity to high value habitat.

Commercial and residential developments tend to increase impervious surfaces within a watershed, exposing surface waters to potential contamination such as increased salinity, sedimentation, hydrocarbons, metals, and nutrients (Kaushal et al., 2005 and Paul and Mayer, 2001). Although contamination within surface water bodies can occur at any time, contaminants can accumulate within snow and ice over the winter and become concentrated within surface waters as a result of impervious surfaces and spring melt water runoff, especially during periods of "first melt" and "end-melt" (Oberts et al., 2000).

Despite low fish habitat potential and a lack of connectivity to other bodies of water, increased loading of both dissolved and solid phase contaminants to surface waters within the proposed development area may cause both acute and chronic effects (e.g., mortality and impairment of biological function) to various levels of the aquatic food chain including plankton, benthic invertebrates and aquatic insects. Increased impervious surfaces will likely increase transportation of sediments and nutrients to the drainage swales, which can act as a continuous and long-term source of pollution. Accumulated contaminants in these sediments can become re-dissolved or re-suspended into the water column under certain conditions (i.e., changing redox potentials, pH, and biodegradation). Excess nutrient accumulation can result in eutrophic conditions, which can lead to decreased dissolved oxygen concentrations and result in asphyxiation of aquatic organisms (Oberts et al., 2000).

The proposed industrial activity may affect nearby domestic wells. Depending on the runoff quality, ground permeability, and soil characteristics (e.g., pH, ion exchange capacity, conductivity, organic matter content),

the accumulation of contaminants within groundwater may occur due to runoff infiltration of soils and associated leaching processes.

There is also the potential for construction and development activities to both directly and indirectly impact the drainage swales of the area. Direct effects would result in the loss of habitat, diversity, and storm water management function if the swales were altered, removed or replaced by permanent infrastructure, such as buildings or roadways. Indirect effects include the potential for increased sedimentation within the swales as a result of adjacent construction activities (e.g., grading and clearing). Excessive sedimentation can cause a degradation of water quality leading to the degradation of natural habitat (e.g., negative effects on community composition and species diversity of vegetation and wildlife).

3.2 WILDLIFE AND WILDLIFE HABITAT

Moderate to minimal loss of wildlife and wildlife habitat is expected because the majority of the land contained within the proposed development area has been previously disturbed by agricultural activities. Some riparian vegetation surrounding the north wetland and the drainage swales may be disturbed or removed as a result of land clearing; and utility, transportation, and building construction activities. The removal of trees and shrubs from the project area would also decrease the potential foraging habitat of small mammals, and resident and migratory bird species. Impacts to ground nesting birds (e.g., burrowing owl) may be significant during the clearing and construction of roadways, buildings, and other infrastructure on areas that are currently cultivated. However, any nests are likely temporary and seasonal due to frequent cultivation and customary farming practices disturbing nesting habitat.

The north wetland, drainage swales and immediately adjacent areas are likely occasionally inhabited by aquatic, terrestrial, and avian species. Development impacts on the swales would restrict their use by song birds, waterfowl, and other small animals on the project area.

3.3 HERITAGE RESOURCES REVIEW

Through the Developers' Online Screening Tool available from the Ministry of Tourism, Parks, Culture and Sport website, the Heritage Branch has confirmed that there are no concerns with the project area. Therefore, a HRIA is not required for the project area provided its delineation does not change.

4 Mitigation Recommendations

4.1 PLANNING

- Incorporate the Class II drainage swales into the project design as storm water drainage.
- Maintain adequate vegetative buffers around the drainage swales to provide multiple benefits including wildlife habitat, erosion protection, and improved water quality (filtration of sediment and

nutrients). The average width of the buffer area will depend on the adjacent land use, but at a minimum range from 2 to 30 meters.

- Inclusion of the vegetated Class IV wetland (north wetland) into development plans for use as park space; naturalized pathway areas could be considered to preserve the wetland functions to the greatest extent possible. Tree and shrub stands within the project area could provide valuable habitat and ecological value to local residents. The preservation planting of trees should be considered in future development plans, and the Regional District's engineering and grading requirements.

- A hydrological study (e.g., flows, over flows, volume, climate, etc.) and engineering design (inlet culverts, potential outlet culverts, drain tile) of the drainage swales should be conducted to confirm its suitability for storm water management based on the proposed development plan.

- A hydrogeological study (e.g., identification of the groundwater table, percolation testing, surficial and sub-surface geology) should be conducted to verify that the conditions are suitable for development (e.g., building, roads, utilities); to confirm the hydrogeology of the drainage swales (e.g., determine infiltration rates, potential use of liners, etc.) for engineering design; and, to identify potential site drainage issues.

4.2 CONSTRUCTION

- Development should avoid any land clearing, grading, or construction activities during sensitive breeding periods for amphibians (generally April to October), and breeding birds (April to July). If land clearing activities are proposed within this time period, wildlife and nesting surveys should be completed by a qualified biologist. If listed species are encountered prior to or during land clearing, grading, or construction, workers should follow the Saskatchewan Activity Restriction Guidelines for Sensitive Species in Natural Habitats – Table 1 (SMOE, 2014).

- If bird nests are identified on-site, and appropriate mitigation cannot be applied, the management buffer areas for bird nesting would apply. The recommended buffer area for high intensity activities (i.e. road and building construction) for most bird nesting areas is 500 m, all year-round (SKCDC, 2014). If burrowing owl nests are observed near the project area, a 500 m management buffer area is required and the Operation Burrowing Owl (OBO) Coordinator (obo@naturesask.ca) must be notified.

- The drainage swales should be protected during construction by use of sediment and erosion control techniques.

- Ensure all construction equipment is cleaned prior to entering the project area to prevent the spread of noxious weeds.

- Use signage or fencing to protect any valued natural features during development.

- Plan to re-vegetate disturbed areas using native ground-cover seed mixes.

5 Summary

Overall, the lands within the project area have been previously cultivated or disturbed in some way. Areas that might have had potential for being a native grass habitat have been invaded by exotic and/or non-native species, and therefore, are not comprised of native prairie vegetation types.

Impacts resulting from the proposed rezoning and intended land use are expected to be low. There were no protected, endangered, or rare plants or animals found within the proposed development area. Disruption of habitat in and around the drainage swales or north wetland during development may be minimized by incorporating these areas as parks and green space in the proposed development where possible.

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Appendix A – Project Location and Zoning

Figure A-1 Regional Map of the Project Area

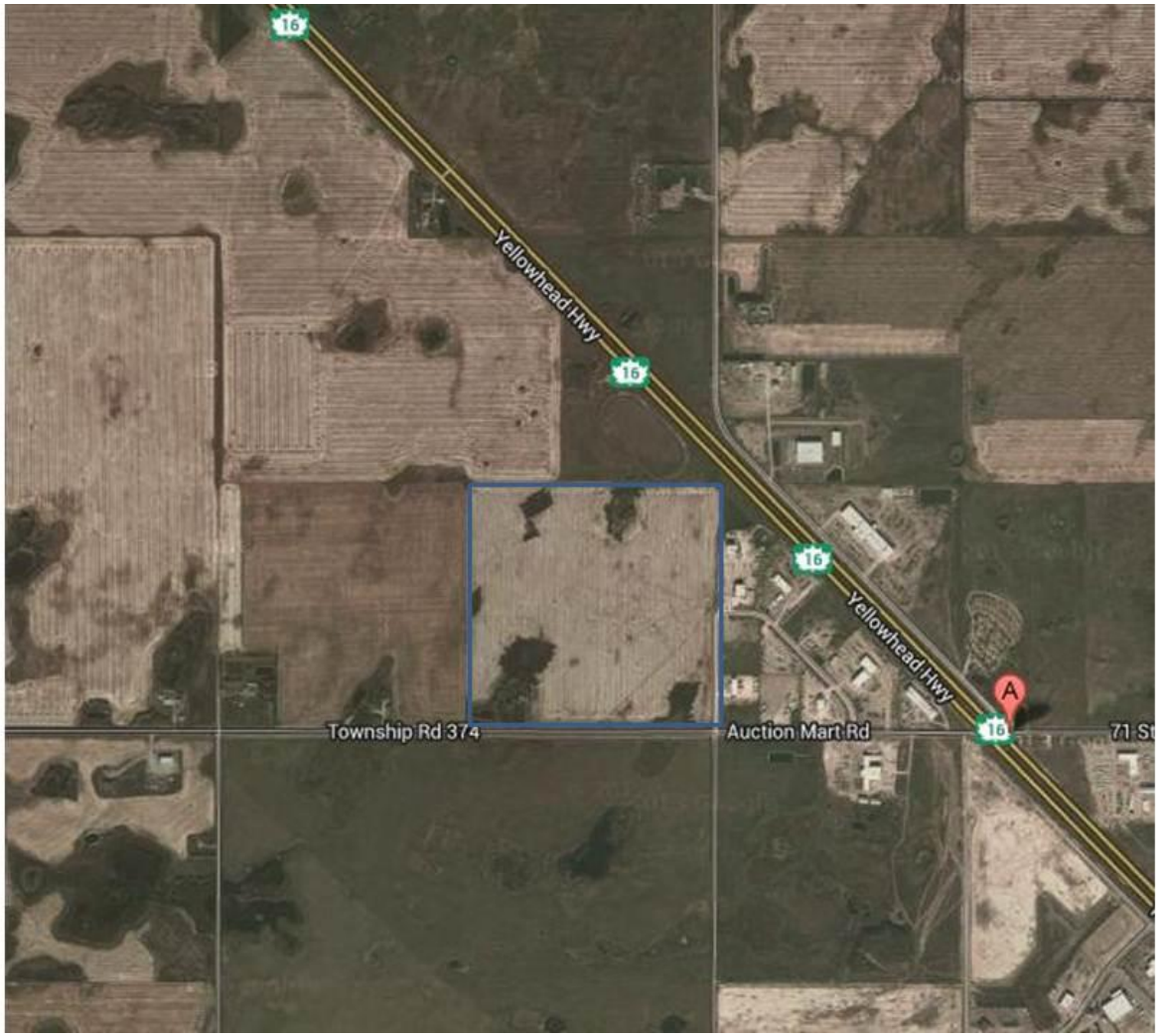


Figure A-2 Corman Park District Zoning Map

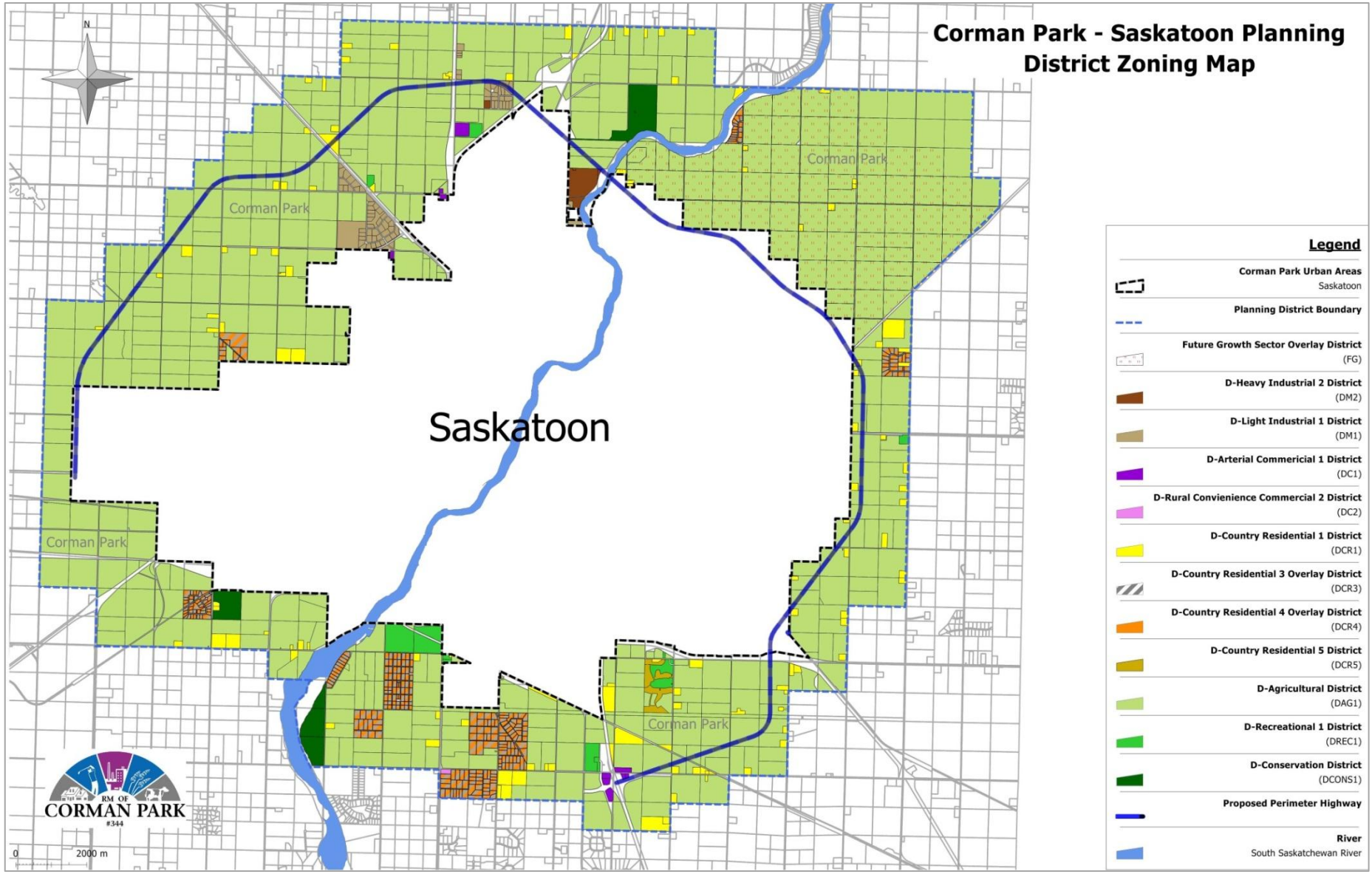
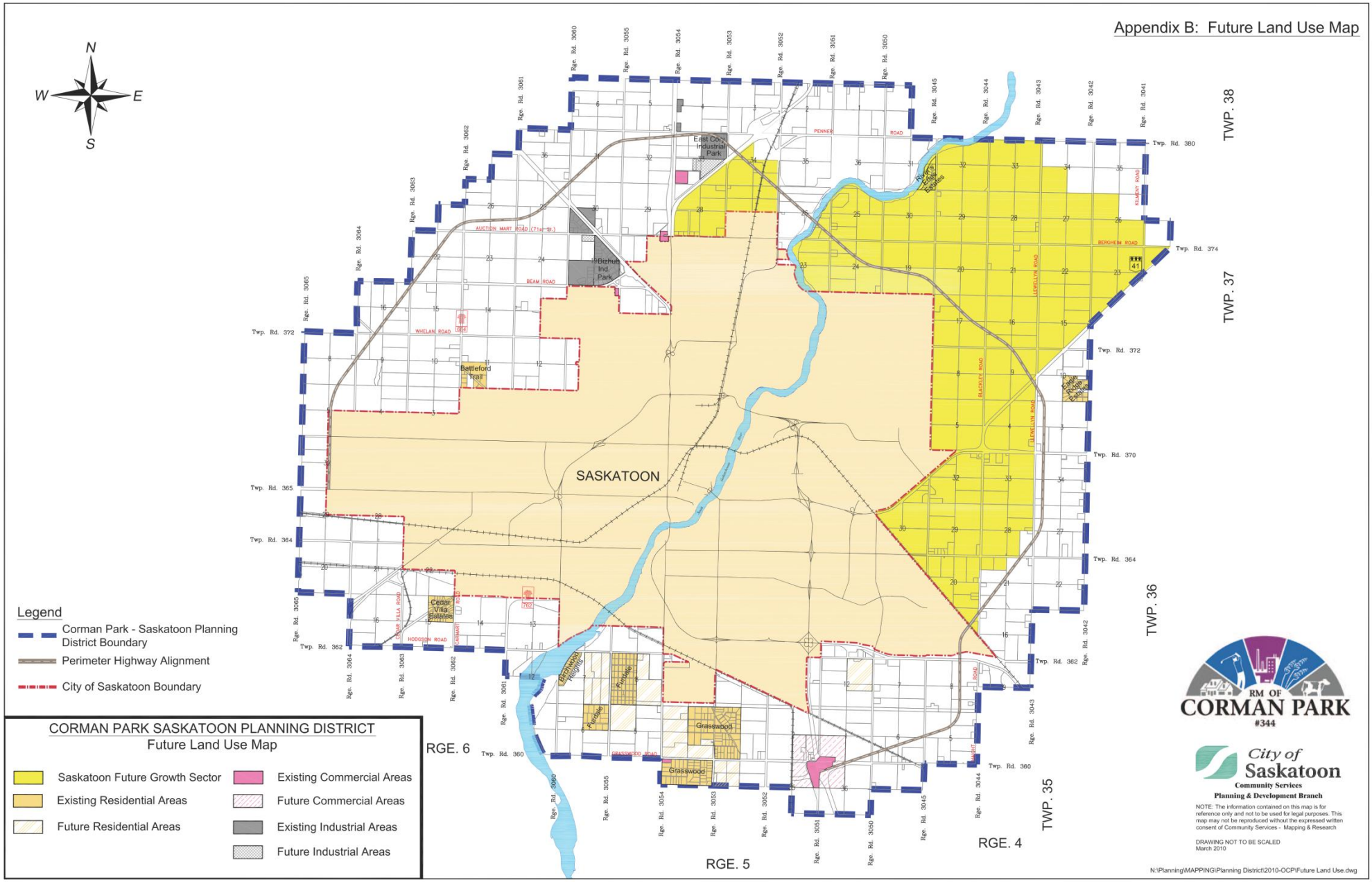


Figure A-3 Saskatoon Future Land Use



Appendix B - Saskatchewan Water Security Agency's Driller Reports

Figure B-1 Location of Well Driller's Reports

Water Well Driller's Report

7/16/2014
WSaskWWDR01

BILINSKI, R

Completion **09/30/1974**

RM
Major Basin **06**
SubBasin **30**
NTS Map **73B00**

WWDR# **013160**

Well Location

LSD	Quarter	Section	Township	Range	Meridian	Reserve	Riverlot
00	**SW**	**25**	**037**	**06**	**3**		

Zone	Easting	Northing	Source	Accuracy

Location of Well (in Quarter)
0.00 ft from N/S Boundary
0.00 ft from E/W Boundary

Well Information

Driller # **PRAIRIE WATER LTD**
Water Use **Domestic**
Hole #
Well Use **Withdrawal**
Installation Method **Bored**
Depth **53.00**
Water Level **0.00**
Bit **36.00**
Flowing Head **0.00**

Well Casings

Length (ft)	Btm (ft)	Dia (in)	Description
0.00	**0.00**	**36.00**	**Porous Concrete**
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 **1,650.00** ft
Rec. Pumping Rate **0.00**
Intake **0.00**
Aquifer
E-Log **No**
Phys **E03**

Lithology List

Depth (ft)	Material	Colour	Description
1.00	Topsoil	Unknown	Unknown
20.00	Clay	Brown	Unknown
22.00	Sandy Clay	Brown	Unknown
33.00	Clay	Brown	Unknown
53.00	Clay	Grey	Unknown

Water Well Driller's Report

SCHEDLOSKY, EUGENE

Completion **11/22/1971**

RM **344**
Major Basin **06**
SubBasin **30**
NTS Map **73B02**

WWDR# **032020**

Well Location

LSD	Quarter	Section	Township	Range	Meridian	Reserve	Riverlot
00	**NW**	**30**	**037**	**05**	**3**		

Zone	Easting	Northing	Source	Accuracy

Location of Well (in Quarter)

500.00 ft from N/S Boundary **S**

200.00 ft from E/W Boundary **W**

Well Information

Driller # **PRAIRIE WATER LTD**
Water Use **Domestic**
Hole #
Well Use **Withdrawal**
Installation Method **Bored**
Depth **49.00**
Water Level **0.00**
Bit **36.00**
Flowing Head **0.00**

Well Casings

Length (ft)	Btm (ft)	Dia (in)	Description
0.00	**49.00**	**36.00**	**Porous Concrete**
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 **1,660.00** ft
Rec. Pumping Rate **0.00**
Intake **46.00**

Aquifer
E-Log **No**
Phys **E03**

Lithology List

Depth (ft)	Material	Colour	Description
1.00	Topsoil	Unknown	Unknown
18.00	Clay	Brown	Unknown
44.00	Till	Grey	Unknown
46.00	Till	Grey	Sand Streaks
49.00	Sand	Grey	Fine

Water Well Driller's Report

SRC

Completion **10/20/1967**

RM **344**
Major Basin **06**
SubBasin **30**
NTS Map **73B02**

WWDR# **220109**

Well Location

LSD	Quarter	Section	Township	Range	Meridian	Reserve	Riverlot
00	**SW**	**30**	**037**	**05**	**3**		

Zone	Easting	Northing	Source	Accuracy

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 #
Well Use **Soil Test Hole**
Installation Method **Augered**
Depth **85.00**
Water Level **0.00**
Bit **0.00**
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 **1,646.00** ft
Rec. Pumping Rate **0.00**
Intake **0.00**

Aquifer
E-Log **No**
Phys

Lithology List

Depth (ft)	Material	Colour	Description

Appendix C - SKSI Soils Map


ASQUITH O.DBC
5(6)M 4(4)MP
BRADWELL O.DBC
3(10)M
BIGGAR O.DBC
4(10)M
TransCanada Highway
RANGE ROAD 3060
RANGE ROAD 3055
TOWN SHIP ROAD 374
RANGE ROAD 3061
RANGE ROAD 3060
TUXFORD DB.SZ
3(9)M 4(1)E
SCOTT O.DBC
3(10)M
N
W
E
S
Legend
Saskatchewan Soil Information (SKSI) polygons
SKSI Agricultural Capability Classes
1 - No Significant Limitations
2 - Moderate Limitations; moderate conservation practices required.
3 - Moderately Severe Limitations; range of crops restricted or special conservation practices required.
4 - Severe Limitations.
5 - Forage Crops - Improvement practices feasible
6 - Forage Crops - Improvement practices not feasible
7 - No Capability for arable culture or permanent pasture
0 - Organic Soils
W - Water
Meters
0 100 200 300 400 500
bing
© 2014 DigitalGlobe Image courtesy of USGS © 2014 GeoEye Earthstar Geographics SIO © 2014 Microsoft Corporation

Appendix D - Species at Risk

Table D-1 Potential At-Risk Species

Common name	Scientific name	SARA ranking[1]	COSEWIC[2]	Provincial ranking[3]	Habitat requirements[4]	Potential to occur in project area
Amphibians and Reptiles						
Great Plains Toad	Anaxyrus cognatus	Special concern	Special concern	S3	In Canada, it is likely widely distributed throughout the area bounded by the SK border to the east, the Trans-Canada Highway and AB Provincial Highway No. 3 to the south, the Taber-Vauxhall-Lake Newall area to the west, and the Red Deer River to the north. In SK, most of the few records are near the AB border. It breeds mainly in temporary wetlands that fill with water following heavy rains in late spring and early summer.	Low to Moderate
Northern Leopard Frog	Rana pipiens	Special concern	Special concern	S3	May breed in pools, ponds and lakes. In the summer, the frogs are found in a wide variety of habitats, particularly moist upland meadows and native prairie; riparian areas and ponds facilitate dispersal and provide additional corridors for movement between habitats. Current distribution information for Saskatchewan is largely lacking. However, small populations are known to exist in the region north of Lake Athabasca in northeast Alberta and northwest Saskatchewan, into adjacent southern parts of the Northwest Territories.	Low to Moderate
Eastern Yellow-bellied Racer	Coluber constrictor flaviventris	Threatened	Threatened	S3	There are only small populations in Canada, limited to south central SK. Inhabit prairie grassland, old fields, and open woods during the summer. Hibernate in holes in soft soil or in burrows dug by other animals during the winter.	Low
Greater Short-horned Lizard	Phrynosoma hernandesi	Endangered	Endangered	S2S3	In Canada, it is found in southeastern AB and southwestern SK. The Eastern subspecies is found within the dry steppe climatic region of Alberta and SK, where the climate is hot and dry, and the climax vegetation is mixed grass prairie association. In the South	Low

Table D-1 Potential At-Risk Species

					SK River area, the populations are restricted to the upper slopes of canyon or coulee, predominantly on the north (south-facing) bank. Individuals in SK have been found in the badlands among outcrops of blue shale, in relatively flat, rolling river bottoms.	
Snapping Turtle	Chelydra serpentina	Special concern	Special concern	S3	In Canada, the species is widespread from NS to southeastern SK, though it is absent from northwestern ON. Although Snapping Turtles have been observed in shallow water in almost every kind of freshwater habitat, the preferred habitat of the species is characterized by slow-moving water with a soft mud bottom and dense aquatic vegetation.	Low
Arthropods						
Dakota Skipper	Hesperia dacotae	Threatened	Threatened	S1	In Canada, they occur only in southern MB and southeastern SK. Found in native tall-grass prairies and dry, upland mixed-grass prairies. In SK, the butterfly is most often found on prairie hills above rivers, where Bluestem and Needle grasses commonly grow, as well as Purple Coneflower, an important nectar source.	Low
Checkered White Skipper	Pyrgus albescens	No status	No status	S2	Habitat includes open, sunny places with low vegetation and some bare soil including prairies, fields, roadsides, yards, gardens, and low deserts.	Low to Moderate
Dusky Dune Moth	Copablephar on longipenne	Endangered	Endangered	SNR	Since 1922, the species has been observed at 12 localities in Canada: in AB, SK and MB. Except for the population in Brandon, MB, all known populations are found in the Palliser Triangle, the driest region in the Canadian prairies. Associated with sparsely vegetated active sand dunes; only in this type of habitat.	Low
Gibson's Big Sand Tiger Beetle	Cicendela formosa gibsoni	No status	Threatened	SNR	This very restricted subspecies, with most of its populations in Canada, requires open sand dune areas. This	Low

Table D-1 Potential At-Risk Species

					habitat is declining throughout the Prairies as a result of a dune stabilization trend. There are believed to be fewer than 73 sites and a 10% possibility of extinction within 100 years based on rates of decline of open sand dunes.	
Gold-edged Gem	Schinia avemensis	Endangered	Endangered	SNR	In Canada, Golden-edged Gems are known from two disjunct populations, separated by about 750 km, in the southernmost portion of the three Prairie provinces (southwestern SK).	Low
Monarch butterfly	Danaus plexippus	Special concern	Special concern	S3B	Widely distributed from coast to coast in southern Canada. Exist primarily wherever milkweed and wildflowers exist and includes abandoned farmland, along roadsides, and other open spaces where these plants grow.	Low to Moderate
Mormon Metalmark (prairie pop'n)	Apodemia mormo	Threatened	Threatened	S1	In SK, the Mormon Metalmark is found at sites in the east and west blocks of Grasslands National Park, in the Killdeer badlands and along the Frenchman River. The Mormon Metalmark is a butterfly of arid regions, typically associated with hillsides, dunes, and embankments on barren, sandy, or gravelly soils.	Low
Pale Yellow Dune Moth	Copablephar on grande	Special concern	Special concern	SNR	In Canada, the species has been captured in 10 localities in AB, SK and MB. Since the species requires semi-stable dunes, which are declining, the moth may also be in decline. The species is most often found in semi stable dunes with sparse grass and forb cover.	Low
Verna's Flower Moth	Schinia verna	Threatened	Threatened	SH	Occurs only in Canada, in the Prairie provinces (southeastern AB, west-central SK, and southwestern MB). Inhabits sparsely vegetated prairie grasslands where colonies of pussytoes, the larval food plant, occur.	Low
Western Tiger Swallowtail	Papilio rutulus	No status	No status	SNA	Widely distributed within western North America, frequently seen in urban parks and gardens as well as in rural woodlands and riparian areas.	Low

Table D-1 Potential At-Risk Species

Birds						
Baird's Sparrow	Ammodramus bairdii	No status	Special concern	S4B	Their breeding habitat is tall grass prairie regions in southern central Canada and the northern mid-western United States. The nest is an open cup in a well-hidden grassy location on the ground.	Low
Barn Swallow	Hirundo rustica	No status	Threatened	S5B, S5M	The Barn Swallow is a bird of open country which normally uses man-made structures to breed and consequently has spread with human expansion. It builds a cup nest from mud pellets in barns or similar structures and feeds on insects caught in flight.	Low to Moderate
Bobolink	Dolichonyx oryzivorus	No status	Threatened	S5B	One of many types of “blackbirds”; found in grain fields and grasslands of SK.	Moderate
Buff-breasted Sandpiper	Tryngites subruficollis	No status	Special concern	S4M	A small shorebird that breeds in the arctic tundra of North America. It migrates mainly through central North America, and is uncommon on the coasts. Preferred habitats include grasslands and prairies, plowed fields, turf farms, wet rice fields.	Low to Moderate
Burrowing Owl	Athene cunicularia	Endangered	Endangered	S2B	Prefers flat, treeless terrain, such as pastures grazed by livestock or the edges of agricultural fields. It favours open, sparsely vegetated areas with burrows excavated by American badgers, ground squirrels and other mammals.	Moderate
Turkey Vulture	Cathartes aura	No status	No status	S2S3B	It is an uncommon nester in river valleys and coulees of the southeast.	Low
Semipalmated Plover	Charadrius semipalmatus	No status	No status	S1B	Commonly found on shores, beaches, mudflats, and around shallow pools. They breed in Alaska and Canada and winter on the west coast from San Francisco south to South America.	Low
Caspian Tern	Sterna caspia	No status	Not at risk	S2B	Their breeding habitat is large lakes and ocean coasts.	Low
Short-billed Dowitcher	Limnodromus griseus	No status	No status	S1B	During breeding season lives on tundra; found on mudflats, marshes, and edges of freshwater ponds and marshes during winter.	Low

Table D-1 Potential At-Risk Species

Sandhill Crane	Grus canadensis tabida	No status	Not at risk	S2B	Breed and forage in open prairies, grasslands, and wetlands. Outside of the breeding season, they often roost in deeper water of ponds or lakes, where they are safe from predators.	Low
Pine Grosbeak	Pinicola enucleator	No status	No status	S2B	A bird of the boreal forests, found across northern Eurasia and North America, and south into the mountains of western Canada and the United States.	Low
Northern Shrike		No status	No status	S1B	Breeds in taiga and tundra and winters in southern Canada and the northern United States. This species prefers forest edges, open willow brush, and brush-bordered swamps and bogs.	Low
Canada Warbler	Wilsonia canadensis	Threatened	Threatened	S5B	Canada Warbler breeds in a range of deciduous and coniferous, usually wet forest types, all with a well-developed, dense shrub layer. Dense shrub and understory vegetation help conceal Canada Warbler nests that are usually located on or near the ground on mossy logs or roots, along stream banks or on hummocks.	Low
Chestnut-collared Longspur	Calcarius ornatus	Threatened	Threatened	S5B	In general, they prefer native pastures, followed by other grazed grasses and hayland, and in SK, Chestnut-collared Longspurs are more often found on pastures than on hay or cropland.	Low
Chimney Swift	Chaetura pelagica	Threatened	Threatened	S3B	The Chimney Swift is an uncommon summer resident, which breeds in wooded areas near the Manitoba border and is sometimes seen in the southern half of SK.	Low
Common Nighthawk	Chordeiles minor	Threatened	Threatened	S4S5B,S4S5M	The Common Nighthawk nests in a wide range of open, vegetation-free habitats, including dunes, beaches, recently harvested forests, burnt-over areas, logged areas, rocky outcrops, rocky barrens, grasslands, pastures, peat bogs, marshes, lakeshores, and river banks. This species also inhabits mixed and coniferous forests.	Low
Eskimo Curlew	Numenius borealis	Endangered	Endangered	SHM	Eskimo Curlews formerly bred in the tundra and woodland transition zones	Low

Table D-1 Potential At-Risk Species

					of the Mackenzie District in the Northwest Territories, and possibly occurred as far west as Alaska or even Siberia. In spring, the curlews were found in tallgrass and eastern mixed-grass prairies, often in areas disturbed by recent fires, areas near water disturbed by grazing bison, and in cultivated fields. Present day habitat use is unknown.	
Ferruginous Hawk	Buteo regalis	Threatened	Threatened	S4B, S4M	Prefers prairies and open, arid habitats dominated by grasses or sagebrush. For nesting, it requires a raised area surrounded by prairies where it can chase its preferred prey, the Richardson's Ground Squirrel, which must be plentiful. It is not found where trees are abundant or where cultivation is extensive.	Low to Moderate
Greater Prairie-chicken	Tympanuchus cupido pinnatus	Extirpated	Extirpated	SX	Greater Prairie Chickens prefer undisturbed prairie and were originally found in tall grass prairies. They can tolerate agricultural land mixed with prairie, but fewer prairie chickens are found in areas that are more agricultural.	Low
Greater Sage-grouse	Centrocercus urophasianus urophasianus	Endangered	Endangered	S1B, S1N	The urophasianus subspecies of Greater Sage-Grouse is found in the mixed grassland ecoregion, a warm, dry region where the native vegetation has now been significantly reduced. The presence of Greater Sage-Grouse is associated year round with sagebrush habitat (specifically silver sagebrush in Canada).	Low
Horned Grebe	Podiceps auritus	No status	Special concern	S5B	Breeds primarily in temperate zones such as the Canadian Prairies, but can also be found in more boreal and subarctic zones. It generally nests in freshwater and occasionally in brackish water on small permanent or semi-permanent ponds which last until autumn, but it also uses marshes and shallow bays on lake borders. These water bodies are found in both open and forested areas.	Low

Table D-1 Potential At-Risk Species

Loggerhead Shrike	Lanius ludovicianus excubitorides	Threatened	Threatened	S4B	Inhabits a wide variety of open habitats, including grasslands, sagebrush stands, pastures, agricultural areas, and thinly wooded areas with small trees and shrubs.	Moderate
Long-billed Curlew	Numenius americanus	Special concern	Special concern	S3B,S4M	Nest in grasslands, primarily native short-grass and mid-grass prairies. Have the ability to use some agricultural fields for feeding and raising young. Breed in southwestern SK, north as far as Biggar. The eastern extent of their Canadian range lies between Moose Jaw and Regina.	Low to moderate
McCown's Longspur	Rhynchophanes mccownii	Special concern	Special concern	S3S4B	McCown's Longspur nests in arid grasslands with sparse, low vegetation interspersed with patches of dry, sandy, bare soil, typical of short-grass prairie or heavily grazed prairie.	Low
Mountain Plover	Charadrius montanus	Endangered	Endangered	S1B	In Canada, the bird usually nests in grazed, or recently burned, areas of native mixed grassland. As a result of various factors, both historical and more recent, Mountain Plover habitat has become both localized and restricted in size.	Low to Moderate
Olive-sided Flycatcher	Contopus cooperi	Threatened	Threatened	S4B, S4M	Most often associated with open areas containing tall live trees or snags for perching. Open areas may be forest clearings, forest edges located near natural openings (such as rivers or swamps) or human-made openings (such as logged areas), burned forest or openings within old-growth forest stands; these forests are characterized by mature trees and large numbers of dead trees.	Low
Peregrine Falcon	Falco peregrinus anatum	Special Concern	Special Concern	S1B, S4N, S2N	Found in various types of habitats, from Arctic tundra to coastal areas and from prairies to urban centres. It usually nests alone on cliff ledges or crevices, preferably 50 to 200 m in height, but sometimes on the ledges of tall buildings or bridges, always near good foraging areas. Suitable nesting sites are usually dispersed, but can be common locally in some areas.	Low

Table D-1 Potential At-Risk Species

Piping Plover	Charadrius melodus circumcinctus	Endangered	Endangered	S3B	Piping Plovers nest just above the normal high-water mark on exposed sandy or gravelly beaches. On the prairies, nesting occurs on gravel shores of shallow, saline lakes and on sandy shores of larger prairie lakes. Seeps also provide important foraging habitat on the Prairies.	Low
Red Knot	Calidris canutus rufa	Endangered	Endangered	-	Red Knots of the subspecies rufa breed in the central Canadian Arctic and winter in Tierra del Fuego at the southern tip of South America.	Low
Red-headed Woodpecker	Melanerpes erythrocephalus	Threatened	Threatened	S1B	Found in a wide variety of habitats, including open oak and beech forests, grasslands, forest edges, orchards, pastures, riparian forests, roadsides, urban parks, golf courses, cemeteries, as well as along beaver ponds and brooks. The open areas favoured by this species usually contain a high density of dead or unhealthy trees for roosting, and where holes can easily be made for nesting.	Low
Clark's Grebe	A. clarkii	No status	No status	S1B	Grebes are typically found in the larger sloughs and permanent waters of the southern half of the province; they may nest on the shore or construct colonies of floating nests of vegetation.	Low
Rusty Blackbird	Euphagus carolinus	Special Concern	Special Concern	S4B	The Rusty Blackbird nests in the boreal forest and favours the shores of wetlands such as slow-moving streams, peat bogs, marshes, swamps, beaver ponds and pasture edges. In wooded areas, the Rusty Blackbird only rarely enters the forest interior. During the winter, the Rusty Blackbird mainly frequents damp forests and, to a lesser extent, cultivated fields.	Low
Sage Thrasher	Oreoscoptes montanus	Endangered	Endangered	S1B	Almost entirely dependent on sagebrush habitat during the breeding season. Shrub size is very important for nesting, with the birds requiring sagebrush approximately one meter in height.	Low

Table D-1 Potential At-Risk Species

Snowy Egret	Egretta thula	No status	No status	S1B	They are most common along the coast, though they do breed patchily in inland wetlands. Snowy Egrets nest colonially, usually on protected islands, and often with other small herons. They concentrate on mudflats, beaches, and wetlands, but also forage in wet agricultural fields and along the edges of rivers and lakes.	Low
White-faced Ibis	Plegadis chihi	No status	No status	S2N	This species breeds colonially in marshes, usually nesting in bushes or low trees.	Low
Short-eared Owl	Asio flammeus	Special Concern	Special Concern	S3B, S2N	The Short-eared Owl makes use of a wide variety of open habitats, including arctic tundra, grasslands, peat bogs, marshes, sand-sage concentrations and old pastures. It also occasionally breeds in agricultural fields. Preferred nesting sites are dense grasslands, as well as tundra with areas of small willows.	Low to Moderate
Sprague's Pipit	Anthus spragueii	Threatened	Threatened	S3B	Found in native grasslands, but rarely found in cultivated lands or in areas where native grasses have been replaced with introduced forages.	Low
Whip-poor-will	Caprimulgus vociferus	Threatened	Threatened	S3B	It prefers to nest in semi-open forests or patchy forests with clearings, such as barrens or forests that are regenerating following major disturbances. Other necessary breeding habitat elements are thought to involve ground-level vegetation and woodland size.	Low
Whooping Crane	Grus americana	Endangered	Endangered	SXB, S1M	During the breeding season, Whooping Cranes inhabit marshes, bogs, and shallow lakes that are separated by narrow ridges. Trees on these upland ridges are mainly Black Spruce, White Spruce, Tamarack and various willow species with a ground cover that includes Dwarf Birch, Labrador Tea, and Bearberry. Bulrushes, Cattails, sedges, Musk-grass and other wetland and aquatic plants dominate the vegetation in the nesting areas.	Low

Table D-1 Potential At-Risk Species

Yellow Rail	Coturnicops noveboracensis	Special concern	Special concern	S3B, S2M	Nesting Yellow Rails are typically found in marshes dominated by sedges, true grasses, and rushes, where there is little or no standing water, and where the substrate remains saturated throughout the summer. They can be found in damp fields and meadows, on the floodplains of rivers and streams, in the herbaceous vegetation of bogs, and at the upper levels (drier margins) of estuarine and salt marshes.	Low
Mammals						
Black-footed Ferret	Mustela nigripes	Extirpated	Extirpated	SNA	The Black-footed Ferret inhabits short grass prairies, and its very localized habitat closely coincides with that of prairie dogs, its main prey. The species also uses prairie dog burrows for shelter and to escape predators and raise its young.	Low
Black-tailed Prairie Dog	Cynomys ludovicianus	Special concern	Threatened	S2	Black-tailed Prairie Dogs inhabit broad, flat river valleys and upland grasslands. The vegetation in and around the colonies is often dominated by sage (Artemesia) and wheat grass (Agropyron). In Canada, they only occur in and near the Frenchman River Valley in the very southern portion of SK.	Low
Cougar	Puma concolor couguar	No status	Data deficient	S2S3	In SK, cougars are found throughout the south with confirmed reports as far north as La Ronge and Wintego Lake. Found in mountains, forests, grasslands, swamps, and semi-deserts. Finds shelter in caves, rocks, bushes and thick undergrowth	Low
Grizzly Bear	Ursus arctos (western pop'n)	No status	Special concern	SX		Low
Plains Grizzly Bear	Ursos arctos (Prairie pop'n)	Extirpated	Non-active	SX	In Canada, they occupy habitats as diverse as temperate coastal rain forests, semi-desert arctic tundra, boreal forests, and subalpine forests. Suitable grizzly habitat must provide an adequate food supply, appropriate	Low

Table D-1 Potential At-Risk Species

					denning sites, and isolation from human disturbance.	
Little Brown Myotis	Myotis lucifugus	No status	Endangered	S5B, S5M	They tend to roost anywhere that they find appropriate - from houses to trees, to rock cavities.	Low to Moderate
Northern Myotis	Myotis Septentrionalis	No status	Endangered	S4B, SNRN	Summer roosts can include man-made structures (like attics), tree cavities, under the bark of trees, in rock crevices and caves. Winter hibernation sites (also called bat caves or hibernacula) are usually in caves or mines. Unlike the Little Brown Myotis, which often forages over water, the Northern Myotis forages more within the forest.	Low to Moderate
Olive-backed Pocket Mouse	Perognathus fasciatus	No status	No status	S3	Most often found in sandy soils on dry, open, thinly-vegetated grasslands. They also tend to avoid excessive cover, preferring to inhabit the edges of forests.	Low
Ord's Kangaroo Rat	Dipidomys ordii	Endangered	Endangered	S2	Prefers open, sparsely vegetated, sandy habitats that facilitate its hopping locomotion and extensive burrowing. Natural habitats consist of actively eroding sand dunes, sand flats, and exposed sandy slopes of valleys in sand hill areas. Kangaroo rats also use sandy areas where the soil is disturbed by human activities, such as roads.	Low
Plains Bison	Bison bison bison	No status	Threatened	S3	The Canadian range of the Plains Bison once extended across the entire Prairies and included grasslands, montane meadows, scrublands and certain wooded areas that provided the bison with shelter from the weather and predators. Plains Bison prefer open habitats provided by meadows and grasslands.	Low
Swift Fox	Vulpes velox	Threatened	Threatened	S1	Prefer open, sparsely vegetated short-grass and mixed-grass prairie, where visibility and mobility are unimpeded. Native vegetation common in such grasslands includes buffalo grass, bluestem, and wire grass.	Low to Moderate

Table D-1 Potential At-Risk Species

Wolverine	Gulo gulo	No status	Special concern	S3S4	In Saskatchewan, wolverines are moderately widespread; they are most common north of Reindeer Lake, rare south to La Ronge, and occasional records from southern Saskatchewan (i.e., rogue). The Saskatchewan ecoregions that wolverines occur include the following: Selwyn Lake Upland, Tazin Lake Upland, Athabasca Plain, Churchill River, Mid-Boreal, and Boreal.	Low
Woodland Caribou	Rangifer tarandus caribou (Boreal pop'n)	Threatened	Threatened	S3	Many subpopulations of the Woodland Caribou Boreal population show a preference for peatlands; they generally avoid clear cuts, shrub-rich habitat, and aspen-poplar dominated sites. The most common tree species in preferred habitats are Black Spruce, White Spruce, and Tamarack.	Low
Vascular plants and Moss						
Alkaline Wing-nerved Moss	Pterygoneurum kozlovii	Threatened	Threatened	S1	Commonly found in narrow strips around wetlands in flat or very slightly sloped areas. It grows only in open areas along the edges of ponds, lakes, mud flats and seepage slopes where the vegetation is short and patchy.	Low
Athabasca Thrift	Armeria maritima ssp. interior	Special concern	Special concern	S1S2	Found only in northwestern SK, in Athabasca Sand Dunes Wilderness Provincial Park. It occurs in three large dune fields along the south shore of Lake Athabasca (known as the William River, Thomson Bay, and MacFarlane River dunes).	Low
Buffalograss	Buchloe dactyloides	Threatened	Special concern	S1	Reaches the northernmost limit of its range in southeastern SK (near Estevan) and southwestern Manitoba (near Coulter), along the Souris River Valley. In Canada, Buffalograss is seemingly dependent on clay or clay-loam substrate.	Low
Chaffweed	Centunculus minimus	No status	No status	S2	This is an annual of wetland shores (marshy places in the prairie).	Moderate
Dwarf Fleabane	Erigeron radicatus	No status	No status	S2	Found on sandy dry soil or eroded, often cobbly grassland slopes and flats.	Low

Table D-1 Potential At-Risk Species

Dwarf Woolly-heads	Psilocarphus brevissimus ssp. brevissimus	Special concern	Special concern	S1S2	In Canada, Dwarf Woolly-heads is known from only the Similkameen Valley south of Princeton in south-central British Columbia and from southeastern Alberta and southwestern SK. It grows in chalky clay soils in vernal pools in large forest openings dominated by Scouler's Popcornflower and the Close-flowered Knotweed.	Low
Felt-leaf Willow	Salix silicicola	Special concern	Special concern	S2S3	The Felt-leaf Willow is found only in only two locations: the Athabasca Sand Dunes of northwestern SK and Pelly Lake in the Keewatin District in the Northwest Territories.	Low
Five-foliate Cinquefoil	Potentilla nivea var. pentaphylla	No status	No status	S2	Found on dry and hilly prairies.	Low
Floccose Tansy	Tanacetum huronense var. floccosum	Special concern	Special concern	S2S3	Floccose Tansy is found only in the Athabasca Sand Dunes of northwestern SK.	Low
Hairy Prairie-clover	Dalea villosa var. villosa	Threatened	Special concern	S1	In SK, this species is found in Dundurn, south of Saskatoon, and was historically near Mortlach and Caron, west of Regina. Occurs in the mixed-grass Prairie region. It inhabits areas of shifting or partially stabilized sand dunes and sand blowouts.	Low
Large-headed Wooly Yarrow	Achillea millefolium var. megacephalum	Special concern	Special concern	S1	The Large-headed Woolly Yarrow is found only in the Athabasca Sand Dunes of northwestern SK, and is restricted to the western part of the dune complex.	Low
Low Milk-vetch	Astragalus lotiflorus	No status	No status	S3	Associated with prairie slopes, dry calcareous gravel, and gravelly or sandy hill sides.	Low
Low Pussytoes	Antennaria dimorpha	No status	No status	S2	Found on dry sand, silt, gravel or clay in short-grass prairie.	Low to Moderate
Opposite-leaf False-bahia	Picradeniopsis oppositifolia	No status	No status	S1	Found on dry clay soils in grasslands.	Low
Beaked Annual Skeleton-weed	Shinnersoseris rostrata	Vulnerable	No status	S2	Found on dry, sandy soil in semi-active to stabilized sand dunes.	Low
MacKenzie	Deschampsi	Special	Special	S2	The species is endemic to Canada,	Low

Table D-1 Potential At-Risk Species

Hairgrass	a mackenziean a	concern	concern		with its total range restricted to the sand dunes on the south shore of Lake Athabasca in northwestern SK.	
Mud Purslane	Elatine rubella	No status	No status	S2	Found in small mats in shallow water or wet to drying mud flats, sloughs on shores, in slough bottoms, and tilled field potholes, ditches and slow moving streams.	Low to Moderate
Prairie Ragwort	Senecio plattensis	No status	No status	S3S4	Found in grassland, sloughs, shores, and woodlands.	Low
Smooth Wild-rye	Elymus glaucus	No status	No status	S2	It occurs throughout western North America from Alaska to Ontario, southward to New Mexico, northern Arizona, California, and Mexico.	Moderate
Small Dropseed	Sporobolus neglectus	No status	No status	S1	Habitats include rocky openings in upland woodlands, limestone glades, hill prairies, gravelly or sandy areas along railroads, roadsides, pastures, and barren waste areas. Dry sunny areas with a history of disturbance are preferred.	Low
Moss Gentian	Gentiana fremontii	No status	No status	S2	Found in seepy slightly saline meadows between the water's edge and fringed bluffs. Typically only found on heavily grazed locations of the meadow.	Low
Flexible Naiad	Najas flexilis	No status	No status	S2	A submersed aquatic plant typically found in shallow water of ponds, protected lake bays, and quiet streams.	Low
Hairy Germander	Teucrium canadense var. occidentale	No status	No status	S2	Found in southern SK in the Cypress Upland, Mixed Grassland, Moist Mixed Grassland, and Aspen Parkland eco-regions. Prefers prairie plains, meadows, pastures and savannas, and can grow in lake and stream shore flats, and prairie depressions.	Low to Moderate
Upright Narrow-leaved Pondweed	Potamogeton strictifolius	No status	No status	S2	A submerged aquatic plant found in shallow water.	Low to Moderate
Red Club-rush	Scirpus rufus var. neogaeus	No status	No status	SNR	Prefers prairie plains, meadows, and pastures.	Moderate
Mingan Moonwort	Botrychium minganense	No status	No status	S1	Found in mesic to wet woods, and in wet meadows from the boreal forest to	Low

Table D-1 Potential At-Risk Species

					the alpine region. (Williston 2001) (B01WIL00SKCA, 19558). As well as mesic open aspen woods and ditches.	
Porcupine Sedge	Carex hystericina	No status	No status	S2	Habitats include wet prairies, swamps, grassy fens, sedge meadows, calcareous seeps, edges of marshes (sandy & non-sandy), and ditches. This species is often found in wetlands that are calcareous.	Low to Moderate
Crowfoot	Viola pedatifida	No status	No status	S3	Habitats include mesic to slightly dry black soil prairies, savannas, and low hill prairies. Not normally encountered in disturbed or developed areas.	Low
Smooth Arid Goosefoot	Chenopodium subglabrum	Threatened	Threatened	S2	Habitat is characterized as sandy soils and sand dunes, in wind-eroded sand.	Low
Bent-flowered Milk-vetch	Astragalus vexilliflexus	No status	No status	S2	Found on eroded short-grass prairie.	Low to Moderate
Dense-flowered Knotweed	Polygonum polygaloides *ssp.* confertiflorum	No status	No status	S2	Found in moist to dried prairie depressions, slough bottom mudflats, and drying field potholes.	Low to Moderate
Few-flowered Oat-grass	Danthonia unispicata	No status	No status	S2	Found in moist draws in upland fescue and tall mixed-grass prairies.	Low
Nevada Rush	Juncus nevadensis	No status	No status	S2	Found in prairie sloughs, grassy shores, meadow slopes, and grassy aspen woods.	Low
Bur Ragweed	Ambrosia acanthicarpa	No status	No status	S2	*A. acanthicarpa* is a plant of open, sandy sites, of dry sands and river draws.	Low
Yellow Touch-me-not	Impatiens noli-tangere	No status	No status	S3S4	Found in wet, open or wooded areas, and in marsh slopes.	Low
Few-flowered Aster	Aster pauciflorus	No status	No status	S3	No habitat description.	Low
Western Spiderwort	Tradescantia occidentalis	Threatened	Threatened	S1	In Canada, the Western Spiderwort is at the northern limit of its range. It occurs at only four sites in the southern part of the Prairies: Pakowki Lake Sand Hills in southeastern Alberta, Douglas Provincial Park in SK, and Lauder and Routledge sand hills in southwestern Manitoba.	Low
White-top	Erigeron strigosus	No status	No status	S2S3	Habitats include upland areas of black soil prairies, gravel prairies, hill	Low to Moderate

Table D-1 Potential At-Risk Species

					prairies, limestone glades, dry savannas, eroding clay banks, pastures and abandoned fields, and areas along roadsides and railroads. While this plant species favours disturbed areas, it is more likely to occur in higher quality habitats.	
Bushy Cinquefoil	Potentilla paradoxa	No status	No status	S2S3	Moist or wet sandy soils of prairies, bottoms, river banks, low fields, sand bars, and lake shores.	Low to Moderate
Smooth Wild Rose	Rosa blanda	No status	No status	S1S2	Rosa blanda is a perennial rose that is fairly sturdy and can tolerate dry, nutrient poor habitats such as roadsides, and sandy soil.	Low
Blunt-leaved Yellow-cress	Rorippa curvipes var. truncata	No status	No status	S2S3	Found in streams, rivers, lakeshores, irrigation ditches, wet meadows, roadsides, and muddy shores.	Low
Rough Pennyroyal	Hedeoma hispida	No status	No status	S3	No habitat information available.	Low
Narrowleaf Goosefoot	Chenopodium leptophyllum	No status	No status	S4	Found in open, often disturbed sandy areas and fields.	Low to Moderate
Indian Milk-vetch	Astragalus aboriginum	No status	No status	S2	No habitat information available.	
Small Lupine	Lupinus pusillus ssp. pusillus	No status	No status	S3	A plant of SK's Moist Mixed Grassland and Mixed Grasssland eco-regions. Small Lupine is often found in sandy prairies, stream valleys, badlands and roadsides but the largest populations have been recorded in active or open sand dunes. This may be due to their visibility in this habitat and the fact that plants growing in the open without competition may be larger. Areas that are stabilizing near open sand dunes also support Small Lupine.	Low
Sand-dune Short-capsuled Willow	Salix brachycarpa var. psammophila	Special concern	Special concern	S2S3	The Sand-dune Short-capsuled Willow is found only in the Athabasca Sand Dunes of northwestern SK. It occurs as scattered plants throughout most of the dune fields.	Low
Sand-dune Wheatgrass	Elymus lanceolatus ssp. psammophilu	No status	No status	S2	Dry prairies, sand hills and sandy shores.	Low

Table D-1 Potential At-Risk Species

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Slender Mouse-ear-cress	Transberingia bursifolia ssp. virgata	Threatened	Threatened	S1	In Canada, it occurs at the northern limit of its range in disjunct populations restricted to a very small area in southeastern Alberta and southwestern SK. The Slender Mouse-ear-cress grows in open, short- to mid-grass prairie in sandy, alkaline soil that is dry for most of the year but may be moist in spring.	Low
Slender Spike-rush	Eleocharis elliptica	No status	No status	S2	Found in very wet, calcareous (or brackish) shores, pool margins, fens, meadows, and prairies.	Low
Small White Lady's-slipper	Cypripedium candidum	Endangered	Endangered	SH	Occurs in prairie openings, marshy or seepage areas. It is shade-intolerant; favors south facing, calcareous sandy-loam soil; favors areas affected by rotational grazing and fire.	Low
Small-flowered Sand-verbena	Tripterocalyx micranthus	Endangered	Endangered	S1	In SK, it has been found at only one site just east of the Alberta border where the South Saskatchewan River joins the Red Deer River. It grows on sand-hill areas in very dry conditions, and usually requires some drifting or unstable sand.	Low
Tiny Cryptanthe	Cryptantha minima	Endangered	Threatened	S1	In Canada, it is found along the South Saskatchewan River at three sites in Alberta and at one site in SK. Occurs on dry, open and disturbed, south-facing sandy slopes in SK.	Low
Turnor's Willow	Salix turnorii	Special concern	Special concern	S1S2	The Turnor's Willow is found only in the Athabasca Sand Dunes of northwestern SK.	Low
Bristle-leaved Sedge	Carex eburnea	No status	No status	S2	Found in open, sandy or calcareous woods or shrub lands.	Low
Idaho Fescue	Festuca idahoensis	No status	No status	S2	Found on moist prairie soils.	Low
Pale Bulrush	Scirpus pallidus	No status	No status	S2	Found in wet sandy alluvium soils.	Low
Crawe's Sedge	Carex crawei	No status	No status	S1	Found in mineral soil of moist mossy calcareous meadow-fen.	Low
Engelmann's Spike-rush	Eleocharis engelmannii	No status	No status	S2	In SK, occurs in sloughs and drying flooded areas of cultivated fields (Maher et al. 1979).	Moderate
Dwarf Bulrush	Scirpus	No status	No status	S1	Found in small depressed alkaline	Low

Table D-1 Potential At-Risk Species

	rollandii				bogs.	
Marsh Felwort	Lomatogonium rotatum	No status	No status	S2	Found in saline seeping bogs.	Low
Dry Goosefoot	Chenopodium desiccatum	No status	No status	S2	Originally found in open undisturbed soils, prairies, and sandy stabilized dunes, but it has spread to disturbed open areas within its native range and beyond.	Low to Moderate
Yellow-rattle	Rhinanthus minor	No status	No status	S2S3	Sandy beaches, trails and roadsides, and clearings usually bordering woods, and open sandy shore woods.	Low
Menzies' Catchfly	Silene menziesii	No status	No status	S3	No habitat information available.	Low
Tall Beggar's-ticks	Bidens frondosa	No status	No status	S2S3	Habitats include moist areas of black soil prairies, moist meadows near woodlands or rivers, openings in floodplain woodlands and young flatwoods, thickets, marshes, swamps, seeps, borders of ponds or lakes, poorly drained areas along railroads and roadsides, both cultivated and abandoned fields, banks of drainage canals, and miscellaneous waste areas. This plant likes disturbed areas.	Low to moderate
Neat Bug-seed	Corispermum nitidum	No status	No status	SNA	Found on sandy shores, sand dunes, sandy open prairies, disturbed roadsides and old fields.	Low
Red Elderberry	Sambucus racemosa ssp. pubens	No status	No status	S3	No habitat information available.	Low

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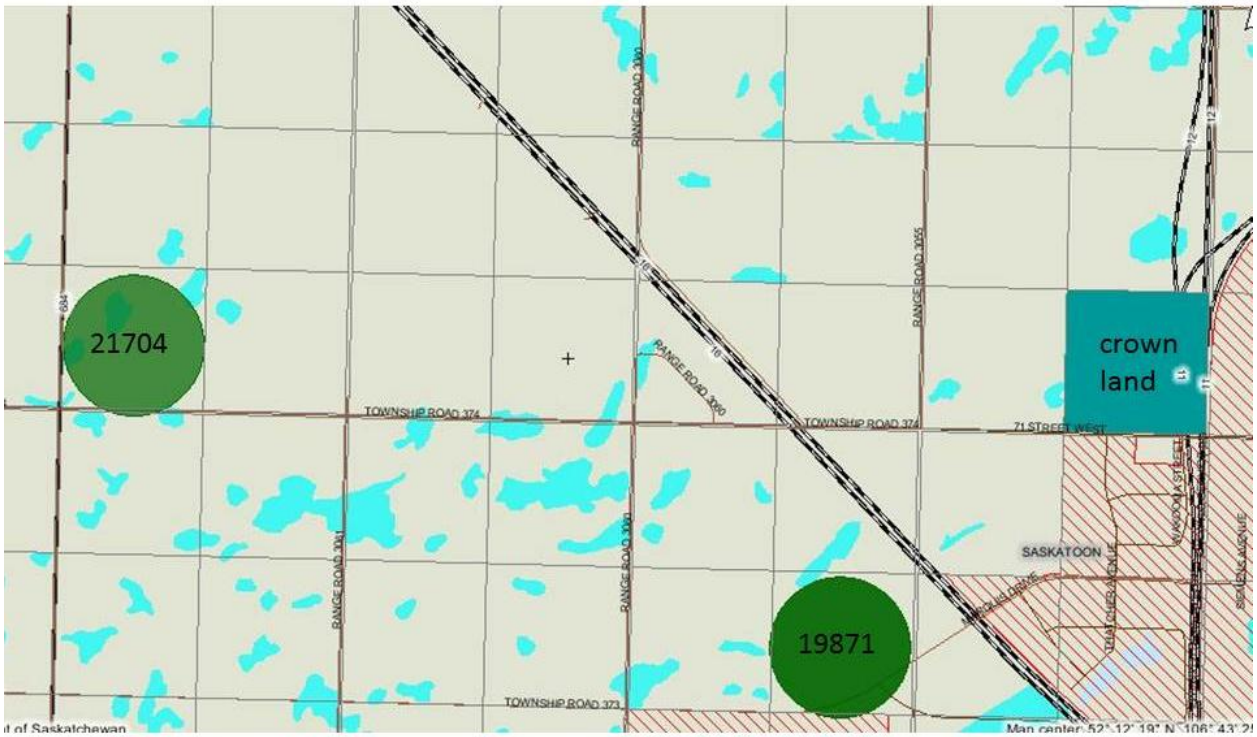
Observed within 5 km of the project area (Saskatchewan CDC, 2012)

Observed within 10 km of the project area (Saskatchewan CDC, 2012).

1 – Federally listed under the Species at Risk Act and 2 – Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 3 –Provincially listed by Saskatchewan government under the Wildlife Act. SK CDC Rankings definitions: S1 = Extremely Rare; S2 = Rare; S3 = Rare- Uncommon; S4 = Common; S5 = Very common. B = for migratory species; breeding populations within the province, M = for a migratory species, ranking applies to transient populations; H = Historical occurrence but without verification in the last 20 years; X = believed to be extinct or extirpated. 4 - Description from SARA registry website at http://www.sararegistry.gc.ca/, COSEWIC database of wildlife species available at http://www.cosewic.gc.ca/, Encyclopedia of Life website at http://www.eol.org/, and other available literature.

Figure D-1 Observations of At-Risk Species



Identify Results within 2km
Wednesday, July 16, 2014

Feature ID: 21704
Unique Occurence
Code: 3843
ELCODE: 12497
Scientific Name: Eleocharis engelmannii
Common Name: Engelmann's Spike-rush
Occurrence Type:
Occurrence Rank:
Directions: Saskatoon (52?13'N 106?45'W) 52.22 106.75 LSD 3 in Sec 26 T37 R06 W3
GeneralDescription: Dried out soil of slough bottom in field. Infrequent
Occurence Data:
First Observation: 1966-08-28
Last Observation: 1966-08-28
Habitat: In Saskatchewan, Eleocharis engelmanni (equivalent to E. ovata var. engelmanni) occurs in sloughs and drying flooded areas of cultivated fields (Maher et al. 1979).

Identification:
Management: Activity restrictions require year round low intensity activity be limited to foot traffic only adjacent to populations, medium intensity activities* should occur only at distances greater than 25 metres from the population and high intensity activities* at distances greater than 50 metres from the population.

*Examples of medium intensity activity include small vehicles <1 ton, ATVs, operating oil or gas wells, pipelines, trucks>1 ton (gravel, oil, grain), tractors (including farm tractors), pipeline construction (diameters <1 foot), operating compressor station or battery.

**Examples of high intensity activity include road construction, roads, drilling rigs, mines and quarries, construction of compressor station or battery, forest harvest, large-diameter pipeline construction, seismic exploration, blasting, rock crushing, asphalt batching, gravel pit.
Global Rank: G4G5
Convention on International Trade
in Endangered Species Rank:
International Union of
Conservation Biologists Rank:
National Rank: N2
Committee on the Status
on Endangered Wildlifein Canada Status:
U.S. Endangered Species
Act Status:
Provincial Rank: S2
Provincial Legal Status:
Occurrence Class: Plant

Feature ID: 19871
Unique Occurence
Code: 9186
ELCODE: 11903
Scientific Name: Centunculus minimus
Common Name: Chaffweed
Occurrence Type:
Occurrence Rank:

Directions: Saskatoon Just N of airport (52?07'N 106?38'W) 52.12 106.63 NE corner SE1/4 Sec 19 T37 R05 W3
GeneralDescription: Dry slough in tilled field With Beckmannia, Eleocharis engelmannii, Gratiola neglecta Occasional - hard to see
Occurence Data:
First Observation: 1965-08-21
Last Observation: 1965-08-21
Habitat: This is an annual of wetland shores (marshy places in the prairie). There are about 14 documented locations within Saskatchewan south of 53°N and west of 104°W. This is a tiny, short-lived plant not easy to see unless shores are heavily grazed. The increase in populations in 1998 are thought to be due to thunder shower activity in the area at the right time to enable germination. Because they are found near the water line, moisture supplies were adequate to ensure growth, flowering and seed production.
Identification:
Management: Activity restrictions require year round low intensity activity be limited to foot traffic only adjacent to populations, medium intensity activities* should occur only at distances greater than 25 metres from the population and high intensity activities* at distances greater than 50 metres from the population.

*Examples of medium intensity activity include small vehicles <1 ton, ATVs, operating oil or gas wells, pipelines, trucks>1 ton (gravel, oil, grain), tractors (including farm tractors), pipeline construction (diameters <1 foot), operating compressor station or battery.

**Examples of high intensity activity include road construction, roads, drilling rigs, mines and quarries, construction of compressor station or battery, forest harvest, large-diameter pipeline construction, seismic exploration, blasting, rock crushing, asphalt batching, gravel pit.
Global Rank: G5
Convention on International Trade
in Endangered Species Rank:
International Union of
Conservation Biologists Rank:
National Rank: N3N4
Committee on the Status
on Endangered Wildlifein Canada Status:
U.S. Endangered Species
Act Status:
Provincial Rank: S2
Provincial Legal Status:
Occurrence Class: Plant

Feature ID: 21702
Unique Occurence
Code: 7227
ELCODE: 12497
Scientific Name: Eleocharis engelmannii
Common Name: Engelmann's Spike-rush
Occurrence Type:
Occurrence Rank:
Directions: 5 mi N of Saskatoon (52?07'N 106?38'W) 52.12 106.63 NE corner SE1/4 Sec 19 T37 R05 W3
GeneralDescription: Mentioned as an accompanying species with collection #2258, Centunculus minimus at that place and time - JHH
Occurence Data:
First Observation: 1965-08-21
Last Observation: 1965-08-21

Habitat: In Saskatchewan, Eleocharis engelmanni (equivalent to E. ovata var. engelmanni) occurs in sloughs and drying flooded areas of cultivated fields (Maher et al. 1979).

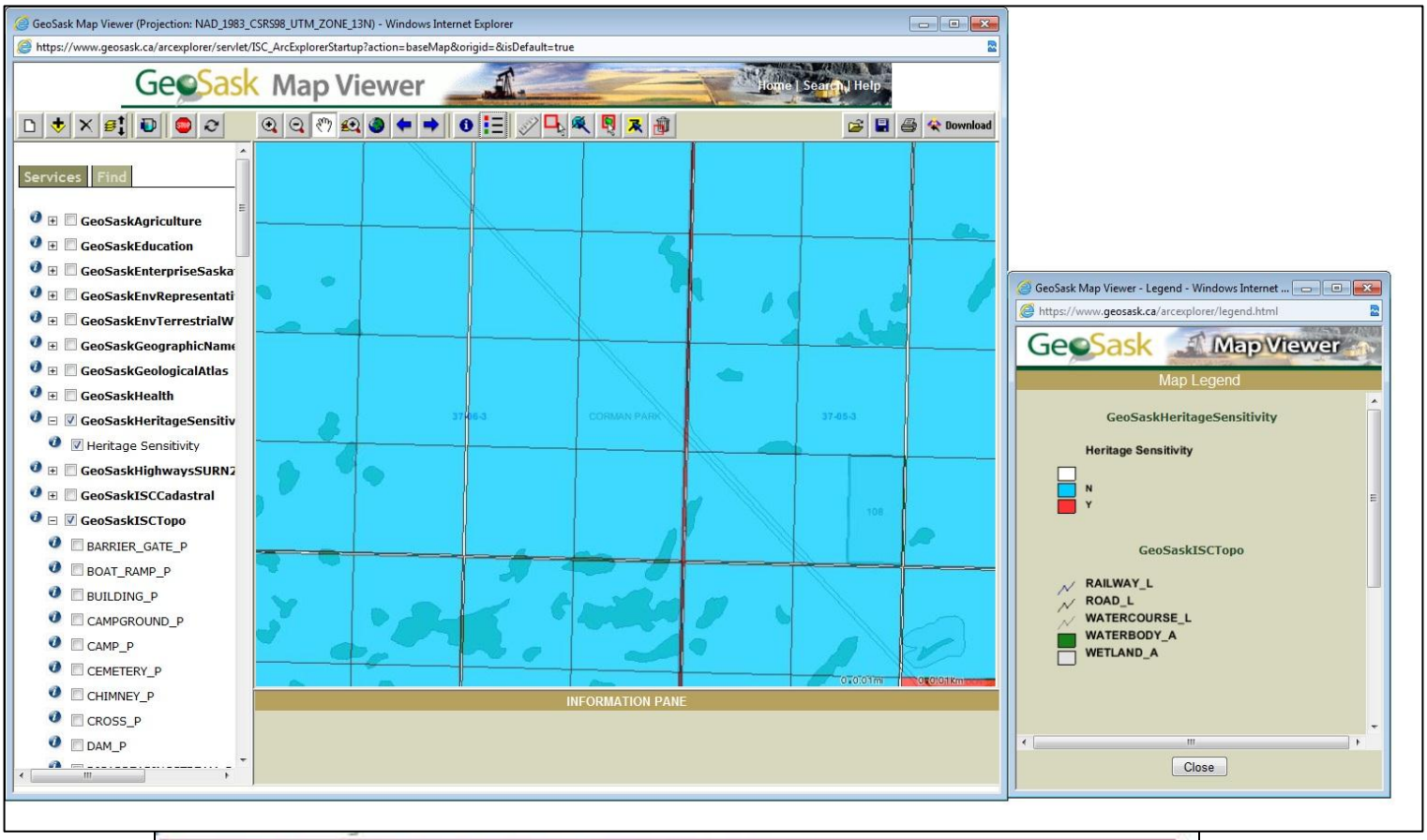
Identification:
Management: Activity restrictions require year round low intensity activity be limited to foot traffic only adjacent to populations, medium intensity activities* should occur only at distances greater than 25 metres from the population and high intensity activities* at distances greater than 50 metres from the population.

*Examples of medium intensity activity include small vehicles <1 ton, ATVs, operating oil or gas wells, pipelines, trucks>1 ton (gravel, oil, grain), tractors (including farm tractors), pipeline construction (diameters <1 foot), operating compressor station or battery.

**Examples of high intensity activity include road construction, roads, drilling rigs, mines and quarries, construction of compressor station or battery, forest harvest, large-diameter pipeline construction, seismic exploration, blasting, rock crushing, asphalt batching, gravel pit.
Global Rank: G4G5
Convention on International Trade
in Endangered Species Rank:
International Union of
Conservation Biologists Rank:
National Rank: N2
Committee on the Status
on Endangered Wildlifein Canada Status:
U.S. Endangered Species
Act Status:
Provincial Rank: S2
Provincial Legal Status:
Occurrence Class: Plant

Appendix E - Heritage Resources Review Report

Figure E-1 Heritage Screening Results



ABOUT PARKS, CULTURE AND SPORT

Inquiry was made on July 16, 2014 at 5:29 PM
You are inquiring about the heritage sensitivity of the following land location:

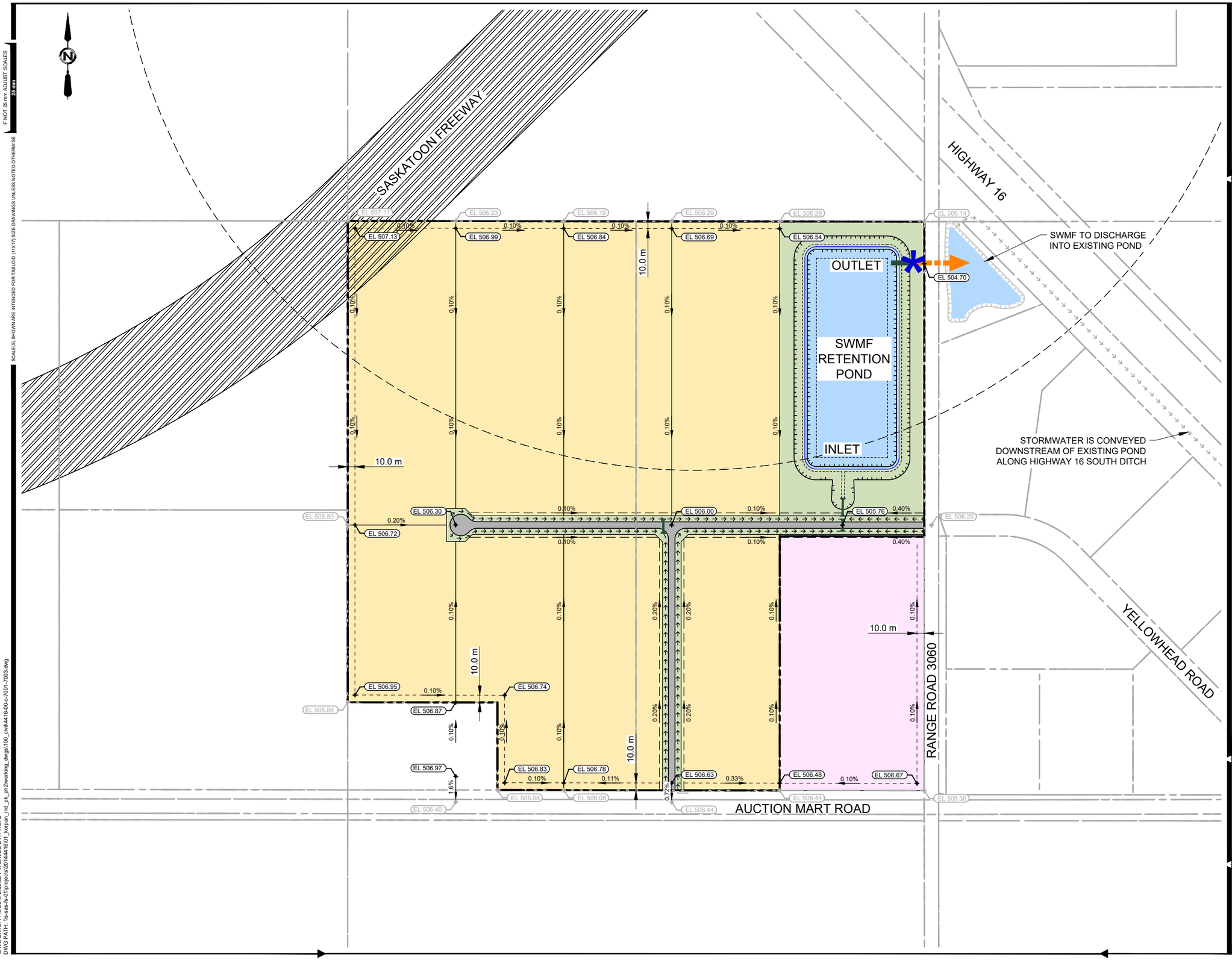
Quarter-section: SE
Section: 25
Township: 37
Range: 6
Meridian: 3

This quarter-section is NOT heritage sensitive.

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

APPENDIX D - CONCEPTUAL SERVICING PLANS

IF NOT 25 mm ADJUST SCALES
25 mm
SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE



LEGEND

- FALCON HOLDINGS LTD. PLAN AREA
- PROPOSED DITCH
- CULVERT PIPE
- SWMF DISCHARGE TO EXISTING DRAINAGE COURSE ALONG HIGHWAY 16
- STORM WATER PUMP
- EL 500.00 — EXISTING ELEVATION
- EL 500.00 — DESIGN ELEVATION
- 1.00% — DESIGN SLOPE

Associated Engineering

BEST MANAGED COMPANIES CANADA Platinum member

FIGURE 2

FALCON HOLDINGS
LAND USE CONCEPT PLAN

CIVIL
CONCEPTUAL SURFACE GRADING PLAN
INITIAL RURAL DEVELOPMENT

AE PROJECT No.	20144416-01
SCALE	1:5000
APPROVED	B. DELAINEY
DATE	2019JUL09
REV	0
DESCRIPTION	ISSUED FOR REPORT

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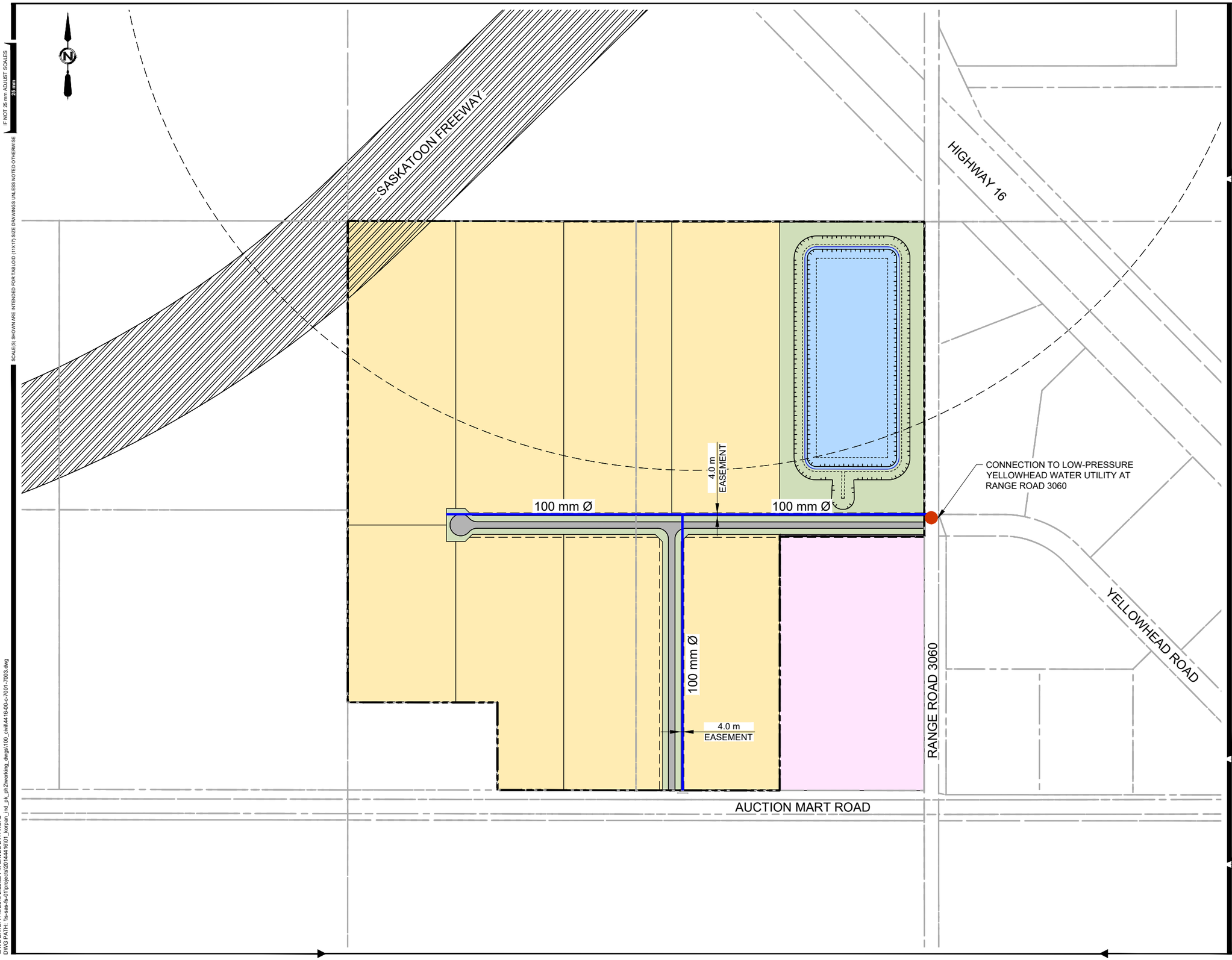

Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND

- FALCON HOLDINGS LTD. PLAN AREA
- LOW-PRESSURE RURAL WATER UTILITY LINE
- TIE-IN POINT TO THE YELLOWHEAD WATER UTILITY

NOTES:

1. PIPE SIZES SHOWN ARE CONCEPTUAL AND ARE SUBJECT TO CHANGE.

FIGURE 4

FALCON HOLDINGS
LAND USE CONCEPT PLAN

CIVIL
CONCEPTUAL WATER DISTRIBUTION PLAN
INITIAL RURAL DEVELOPMENT

AE PROJECT No.	20144416-01
SCALE	1:5000
APPROVED	J.FROH
DATE	2019JUL09
REV	0
DESCRIPTION	ISSUED FOR REPORT

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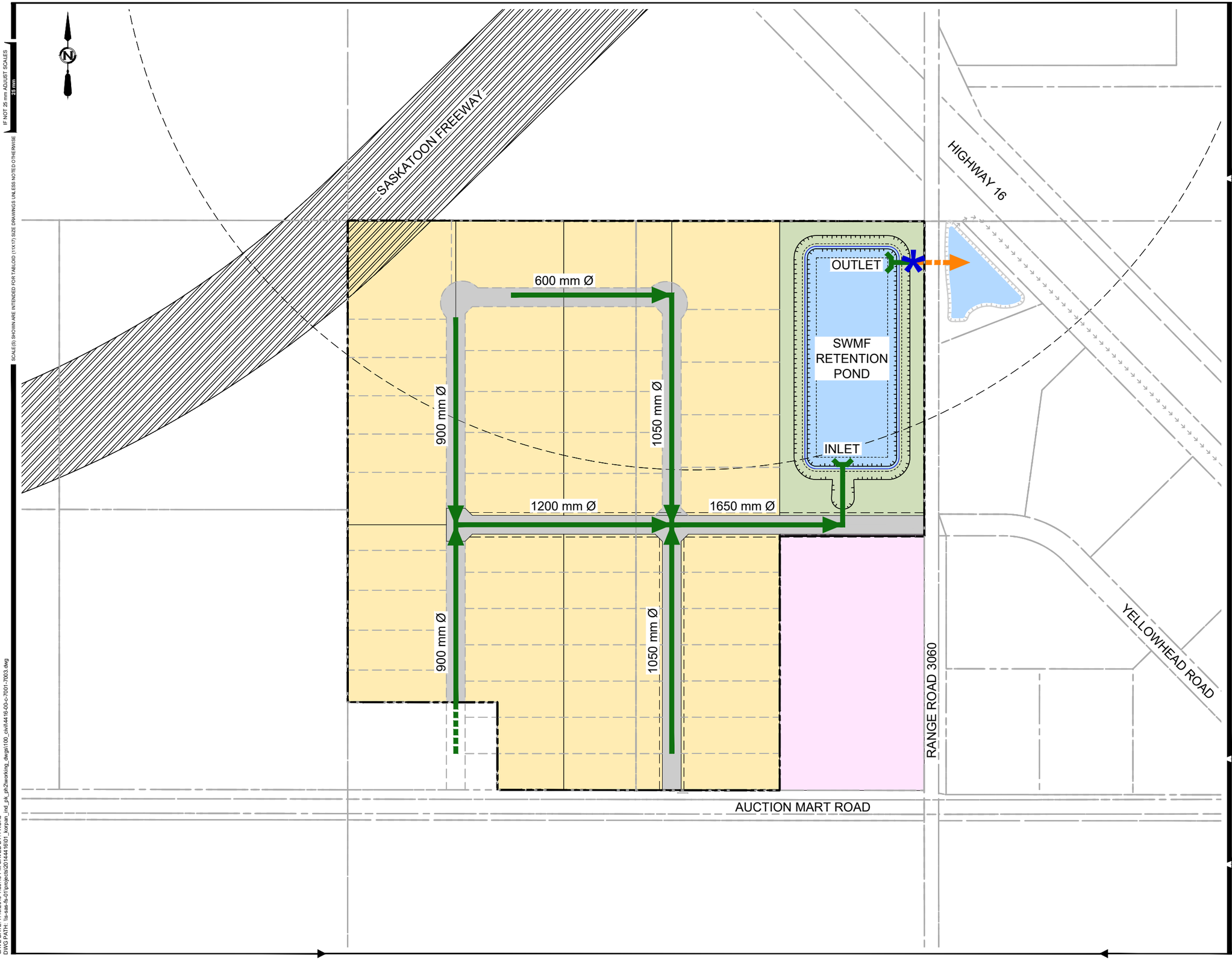

IF NOT 25 mm ADJUST SCALES
25 mm
SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

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Associated Engineering

BEST MANAGED COMPANIES CANADA
Platinum member

LEGEND

- FALCON HOLDINGS LTD. PLAN AREA
- SWMF DISCHARGE TO EXISTING DRAINAGE COURSE ALONG HIGHWAY 16
- FUTURE STORM SEWER MAIN
- STORM WATER PUMP STATION

NOTES:

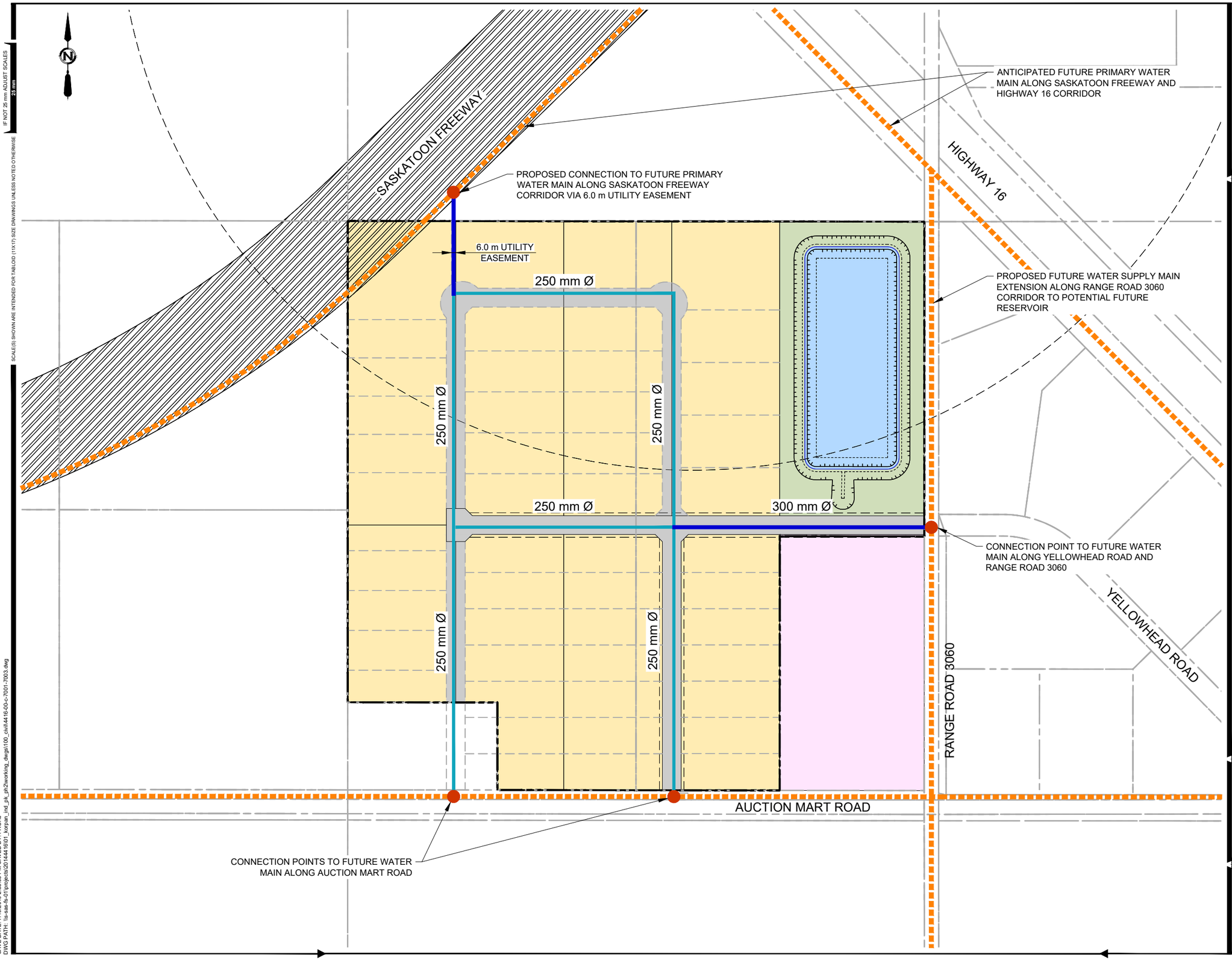
1. OIL/GRIT SEPARATORS SHALL BE INSTALLED WITHIN EACH SITE WITH 1500 m^2 OR GREATER PAVED AREA AT THE INTERFACE OF THE CONNECTION TO THE CITY OF SASKATOON'S STORM NETWORK.
2. THE CONCEPTUAL LOCATION OF THE PROPOSED PUMP STATION AND SEWER MAINS SHOWN ARE SUBJECT TO CHANGE.
3. PIPE SIZES SHOWN ARE CONCEPTUAL AND ARE SUBJECT TO CHANGE.

FIGURE 3

FALCON HOLDINGS
LAND USE CONCEPT PLAN

CIVIL
CONCEPTUAL STORM WATER MANAGEMENT PLAN
FUTURE URBAN REDEVELOPMENT

AE PROJECT No.	20144416-01
SCALE	1:5000
APPROVED	J.FROH
DATE	2019JUL09
REV	0
DESCRIPTION	ISSUED FOR REPORT



IF NOT 25 mm ADJUST SCALES
25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

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Associated Engineering

BEST MANAGED COMPANIES CANADA
Platinum member

LEGEND

- FALCON HOLDINGS LTD. PLAN AREA
- FUTURE PRIMARY WATER MAIN
- FUTURE SECONDARY WATER MAIN
- FUTURE DISTRIBUTION WATER MAIN
- TIE-IN POINT TO THE CITY'S FUTURE WATER NETWORK

NOTES:

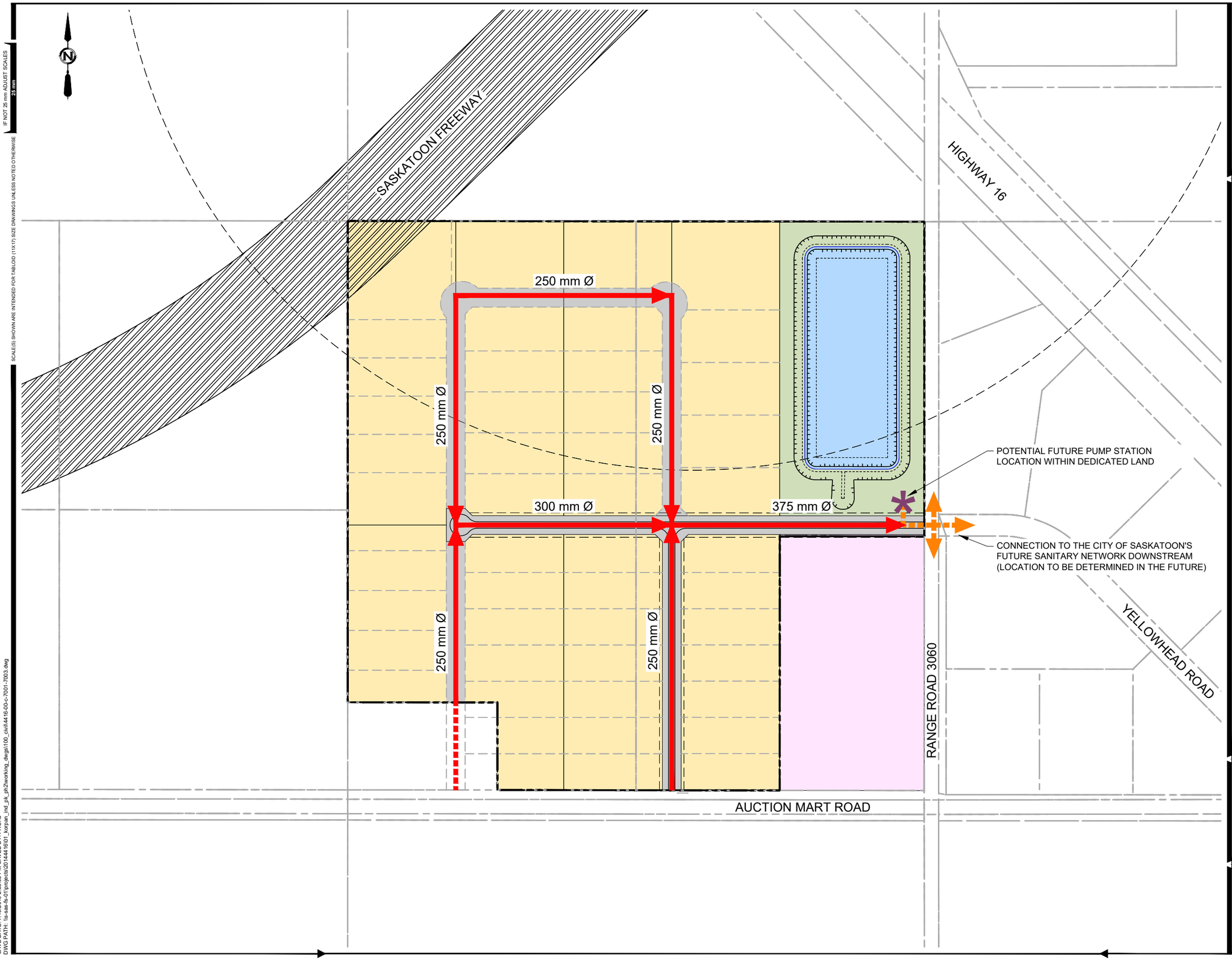
1. PIPE SIZES SHOWN ARE CONCEPTUAL AND ARE SUBJECT TO CHANGE.

FIGURE 5

FALCON HOLDINGS
LAND USE CONCEPT PLAN

CIVIL
CONCEPTUAL WATER DISTRIBUTION PLAN
FUTURE URBAN REDEVELOPMENT

AE PROJECT No.	20144416-01
SCALE	1:5000
APPROVED	J.FROH
DATE	2019JUL09
REV	0
DESCRIPTION	ISSUED FOR REPORT



IF NOT 25 mm ADJUST SCALES
25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

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Associated Engineering

BEST MANAGED COMPANIES CANADA
Platinum member

LEGEND

- FALCON HOLDINGS LTD. PLAN AREA
- FUTURE FORCEMAIN OR GRAVITY SEWER MAIN EXTENSION OFFSITE
- FUTURE SANITARY SEWER MAIN
- POTENTIAL FUTURE PUMP STATION (LOCATION TO BE CONFIRMED IN THE FUTURE)

NOTES:

1. CONCEPTUAL LOCATION OF THE PROPOSED PUMP STATION AND SEWER MAINS ARE SUBJECT TO CHANGE.
2. PIPE SIZES SHOWN ARE CONCEPTUAL AND ARE SUBJECT TO CHANGE.

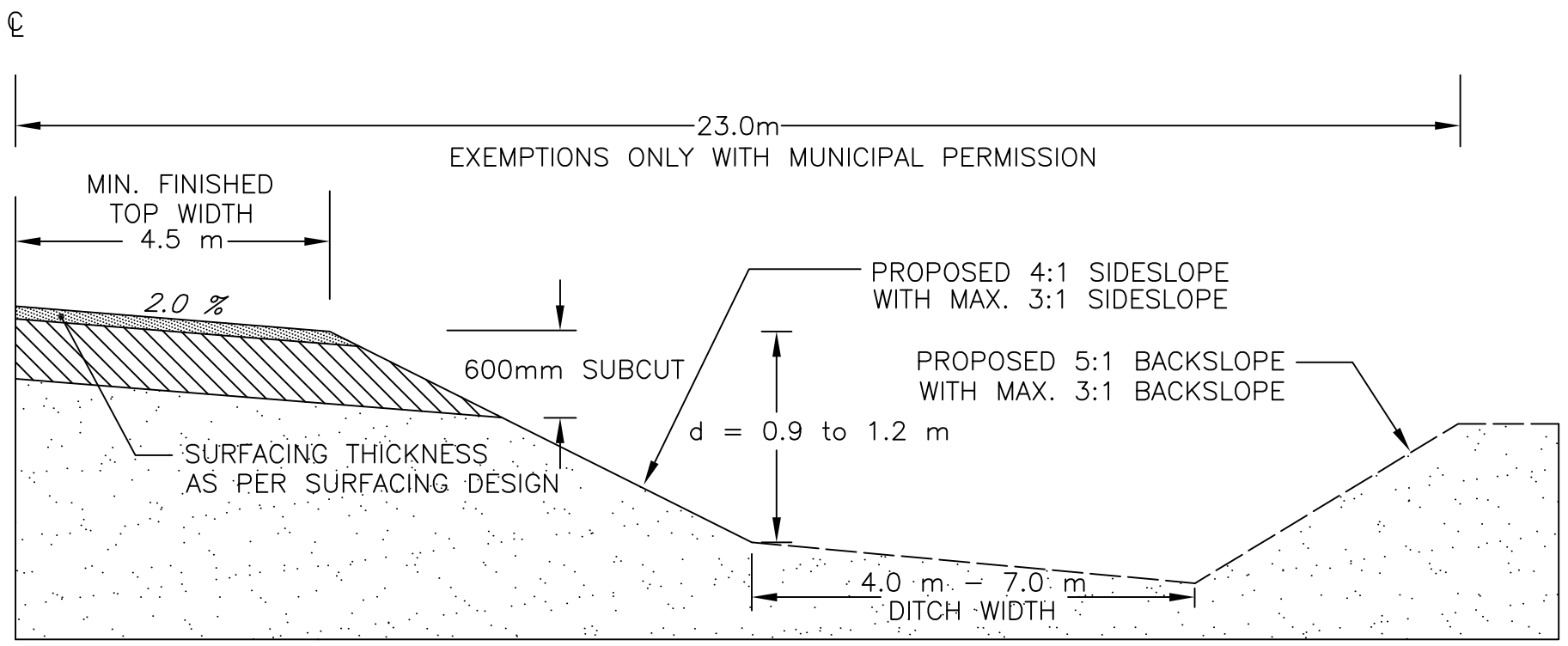
FIGURE 6

FALCON HOLDINGS
LAND USE CONCEPT PLAN

CIVIL
CONCEPTUAL WASTEWATER COLLECTION PLAN
FUTURE URBAN REDEVELOPMENT

AE PROJECT No.	20144416-01
SCALE	1:5000
APPROVED	J.FROH
DATE	2019JUL09
REV	0
DESCRIPTION	ISSUED FOR REPORT

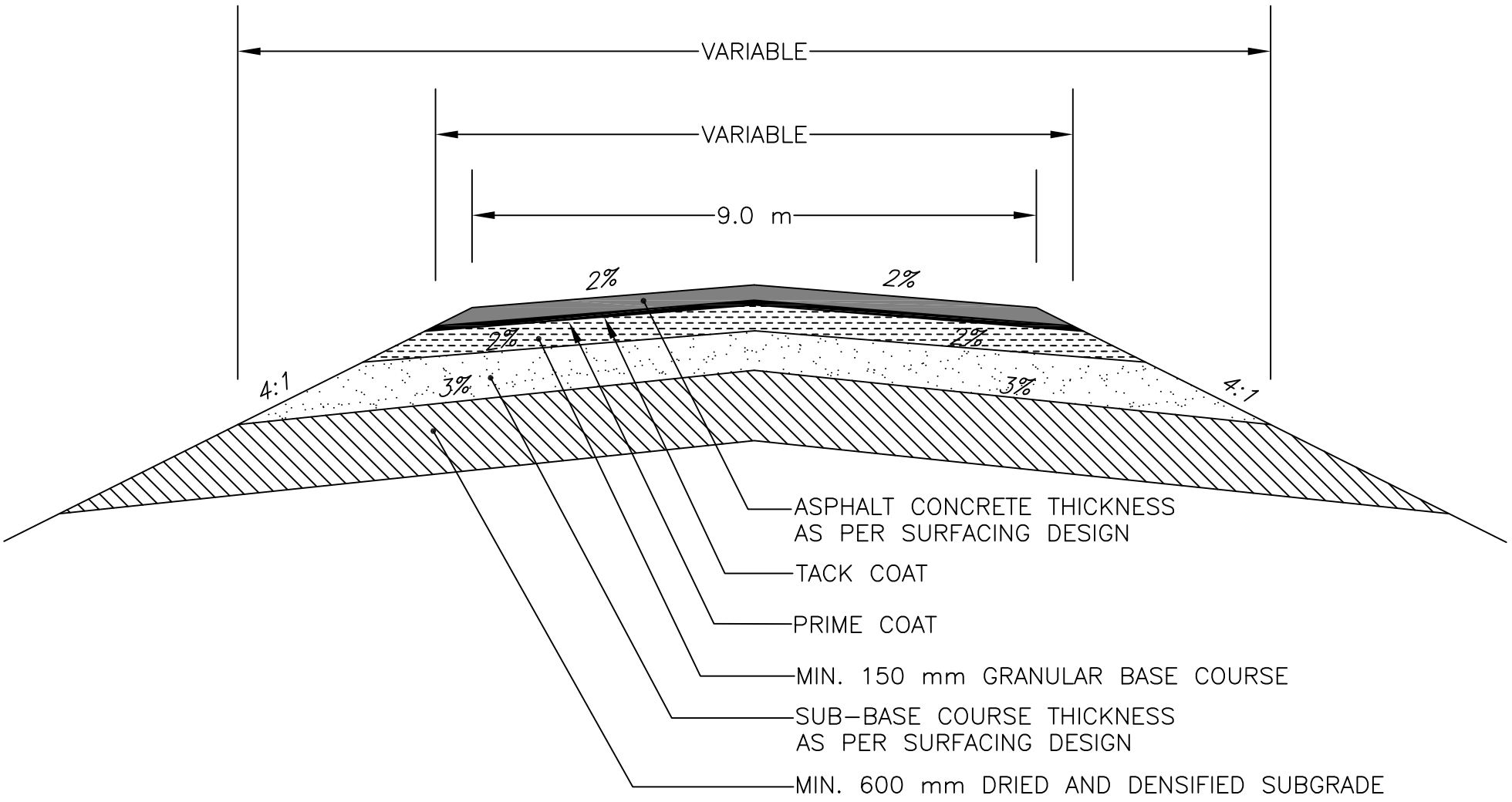
APPENDIX E - CORMAN PARK INDUSTRIAL ROAD STANDARD



Rural Municipality of Corman Park

PUBLIC WORKS
INDUSTRIAL PAVED - TYPICAL CROSS SECTION SUBGRADE

DATE: 2017	SCALE: NTS	DRAWN BY: WOOD E&I



Rural Municipality of Corman Park

PUBLIC WORKS
INDUSTRIAL PAVED - TYP. SURFACING STRUCTURE
ASPHALT CONCRETE

DATE: 2017	SCALE: NTS	DRAWN BY: WOOD E&I

1. Description

- Road design and construction standards for Industrial Paved (asphalt concrete) roads as designed within the Rural Municipality of Corman Park, No. 344 (Municipality).

2. Miscellaneous

- For the purposes of this document, the term “proponent” shall be used to address duties that shall be undertaken by the owner, developer, contractor and engineer interchangeable.
- During construction, the proponent shall be responsible for all traffic accommodation measures. This shall include but not limited to:
  - Proper signing of all access roads whereby traffic (construction or local) may access existing Municipality roads.
  - Traffic gravel shall be applied, if or as necessary for local traffic.
  - Proper measures shall be taken to ensure that local traffic can safely interact with construction equipment.
- The proponent shall ensure that all necessary Haul Road Agreements are in place including any provisions for dust control prior to the hauling of materials.
- Dust control to be applied on any approved detour routes.

3. Required Right-Of-Way Standards

- Minimum allowable Right-of-Way (ROW) purchased shall be 46.0 meters (m).
  - With special approval, the Municipality may permit that a 30.0 m ROW be purchased and utilized.
- The proponent shall be responsible for the purchase of all ROW.
- The minimum allowable ROW for cul-de-sacs and turnabouts purchased shall be 60.0 m with a minimum of 15.0 m radius for the driving surface.
- The road shall be designed and constructed in the center of the ROW unless with special permission of the Municipality.

4. Road Widths and Geometric Standards

4.1. Finished Road Width and Height

- The finished asphalt driving surface (paved width before the start of the asphalt slope) shall be as follows:
  - For fill heights of 3.0 m or less (where the road surface is from 0.0 m to 3.0 m in height), a 9.0 m finished road top width (asphalt) shall be required.
  - For fill heights greater than 3.0 m (where the road surface is from 3.1 metres in height or more), a 9.6 m finished road top width (asphalt) shall be required.

- The road cross-fall (slope) shall be constructed to 2.0% with any curves must be constructed with the proper super-elevation.
- The average shoulder elevation of the road surface should be approximately 0.9 m to 1.2 m above the adjacent ground except in cut areas.
- The subgrade surface shall not be less than 1.5 m above high water level on the ground water table. (ie: level to which free water would rise in a hole sunk in the ground).

4.2. Surfacing and Hydraulic Design

- A grading, surfacing and hydraulic design shall be completed, signed and stamped by a Professional Engineer registered with the Association Of Professional Engineers and Geoscientists of Saskatchewan (APEGS) and licensed to practice (Permission to Consult in this field of expertise) within the Province of Saskatchewan.
- The surfacing structure shall be based upon the Saskatchewan Ministry of Highways and Infrastructure's Shell Curve method and shall be based on a 15 year design life (N_{15}).
- Soils testing shall be in accordance with the Saskatchewan Ministry of Highways and Infrastructure's Standard Test Procedures manual.
- Hydraulic structures (culverts) with significant flows shall be designed (sized) in accordance with the Saskatchewan Ministry of Highways and Infrastructures Hydraulic Manual and shall be based on a Q^{25} flow (1 in 25 year (1:25)) frequency.
  - The Municipality may request that the design be based on a Q^{50} flow (1 in 50 year (1:50)) frequency based on the location (proximity) of any residences upstream of the crossing.
  - The proponent shall apply for, and shall meet all of the listed requirements, an Aquatic Habitat Protection Permit (AHPP) from SaskWatershed Authority for hydraulic passages requiring such.

4.3. Sideslopes

- Sideslopes shall range from 3:1 to 4:1 depending upon situation and with approval from the Municipality.
  - The standard required sideslope shall be 4:1.
    - For road fills ranging from 0.0 to 3.0 m in height, the sideslope shall be 4:1.
    - For road fills ranging in height from 3.0 m to 4.0 m, the toe of slope shall be 12.0 m from shoulder of the road.
    - For road fills greater than 4 m the sideslope shall be 3:1.
  - If upon review by the Municipality, a sideslope of 3:1 may be allowed only with special permission from the Municipality.

4.4. Ditch Bottom Widths

- Ditch bottom widths shall be range from 4.0 to 7.0 m depending upon grade height and backslope requirements.
  - The desirable is 7.0 m for snow storage.

4.5. Backslopes

- Sideslopes shall range from 5:1 to 3:1 depending upon the situation and with approval from the Municipality.
  - The standard required back slope shall be 5:1.
    - A backslope of ranging from a minimum of 3:1 to the standard backslope of 5:1 will be allowed in conjunction with maximizing the ditch bottom width.

4.6. Maximum Road Gradient

- The maximum road gradient allowed shall be 5.0%.
- With special approval by the Municipality, a 6.0% gradient may be allowed.

4.7. Stopping Sight and Intersection Distances

- The stopping sight distance for intersections with any road shall be a minimum of 200 m. This is based upon the SARM guidelines for a 100 km/h road design.
- The minimum length of road (constructed past an approach) shall be 100 m.
  - This is done in order to meet Stopping Sight Distances, snow and ice removal and road maintenance.
- For intersecting roads, the sight triangles shall be clear of any obstructions.
  - The sight triangle shall be a minimum of 85.0 m from the point of intersection on municipal roads and grid intersections and to a maximum of 140.0 m on primary grid roads using 80 km/h design speed; and a minimum of 140.0 m from the point of intersection on municipal roads 200 m for a highway on another heavy haul using 100 km/hr design speed.

5. Snow Clearance Standards

- When shoulder grade elevation is 0.3 m or less above natural surface at 15.0 m to 20.0 m from center line then the backslope must be flattened using a variable slope of 5:1 to a maximum of 3:1.

6. Road Construction

6.1. Clearing and Grubbing

- Timber, brush, duff (vegetation), roots, logs and stumps shall be completely cleared from the surface of the Right-of-Way.
- Debris from clearing and grubbing operations shall not be used in the construction of embankments (any portion of the road structure).
- Debris from clearing and grubbing operations shall not be buried within the Right-Of-Way.

6.2. Removal and Replacement of Topsoil

- All topsoil within the Construction Footprint shall be removed and stockpiled.
  - The Construction Footprint is defined as the area within the cut or fill stakes.
- The Contractor shall install appropriate sediment control to ensure no sedimentation from topsoil stockpiles enters into adjacent water bodies.
- Upon completion of the construction, topsoil shall be replaced to a uniform depth over the Construction Footprint excluding the road surface.
  - The maximum compacted depth of topsoil replaced will be 100 mm.
- Stones (rocks) 75 mm or more in diameter shall be removed and disposed of from the topsoil replaced.

6.3. Drainage (culvert) Installations

- If the foundation is unsuitable, the bottom of the bed shall be sub-cut to a minimum of 0.3 m below the granular backfill layer.
- A geotextile fabric shall be installed to separate the ground surface from the granular materials.
  - A minimum 8 ounce (Geotex 801 or equivalent) nonwoven geotextile shall be used.
- The bedding line shall be shaped to fit the culvert.
- Corrugated metal pipe culverts (CSP) shall be placed with the inside circumferential laps pointing downgrade and with the longitudinal laps at the sides or quarter points. The sections of the culvert shall be firmly joined with coupling bands. Joints shall be as tight as possible.
- Culverts shall be to the following minimum sizes unless larger sizes are required to meet flow requirements:
  - Approach culverts shall be a minimum of 400 mm in diameter.
  - Through grade culverts shall be a minimum of 600 mm in diameter.
- CSP culverts shall have a minimum thickness of 2.0 mm (12 gauge).
- Granular material shall be composed of sand or gravel free from undesirable quantities of soft or flaky particles, loam, and organic or other deleterious material. Granular material shall comply with the following requirements:

Sieve Designation	Percent by Weight Passing Canadian Metric Sieve Series		
	TYPE		
	115	116	10
50 mm	100	-	100
9.0 mm	-	100	-
900 µm	-	30 - 100	-
400 µm	-	15 - 75	-
160 µm	-	0 - 10	-
71 µm	0 - 15	-	0 - 20
Plasticity Index	0 - 6	0 - 6	0 - 6

- For backfilling all types of culverts and bridge abutments, Type 115 shall be used.
- For backfilling subsurface drain pipes, Type 116 shall be used as a filter Material.

- For backfilling curbs, curbs and gutters, sidewalks, driveways, storm sewers, and manholes, catch basins, and other ancillary structures, Type 10 shall be used.
- Earth backfill under the haunches of culverts, except those in approaches not to be paved shall be compacted with mechanical impact tampers.
- After the earth backfill and granular backfill has been placed and compacted around the culvert, the remainder of the embankment shall be constructed by drying the earth material to at least the optimum moisture content and compacted to an average of not less than one-hundred (100) percent of the maximum density as determined by a Saskatchewan Ministry of Highways and Infrastructure Standard Proctor test.
- The earth material above the bedding line shall be placed, simultaneously and uniformly, in lifts on each side of the culvert. In subcut sections, the lift shall extend to the limits of the sub-cut; otherwise the lifts shall extend not less than 15 m from each side of the culvert.
- No objectionable material shall be used within that portion of the embankment above or below the bedding line on culverts through the roadbed.
- The embankment, within three diameters or three span; of the culvert barrel, shall be free from rocks having a dimension of 80 mm or greater when measured in any direction.
- Random riprap shall be installed at all culvert locations where the culvert diameter is greater than 800 mm.
    - A nonwoven geotextile shall be placed prior to the placement of the riprap material.

6.4. Subgrade Embankments

- Earth embankments shall consist of acceptable earth material and rock material free from objectionable quantities of organic matter, frozen soil, stumps, trees, moss, and other unsuitable materials.
- The embankment shall be constructed by placing the material in successive layers.
- The depth of each layer shall not be more than fifteen (15) centimetres (cm) uncompacted. The full width of each segment of each layer shall be bladed with a motor grader at least twice prior to being compacted.
- The slopes and surface of the embankment shall be shaped and trimmed to a uniform smooth surface conforming to the cross-sections shown on the plans, or as staked.
- Stones having a dimension of eight (8) cm or more when measured in any direction shall be removed from the top fifteen (15) cm of the subgrade.
- The following requirements will apply for all embankments:
    - When unsuitable material is encountered below the natural ground surface in embankment areas, the material shall be excavated and removed.
    - The embankment layer (other than at culverts including the sub-cut backfill layer) from 750 mm to 600 mm below the top of the subgrade shall be dried to within 3% of the optimum moisture content.
    - Each layer of the top 600 mm of the subgrade shall be dried to at least the optimum moisture content and compacted to an average of not less than one-

hundred (100) percent of the maximum density as determined by the Saskatchewan Ministry of Highways and Infrastructure Standard Proctor test. The moisture and densities will be considered satisfactory when:

- All individual moisture test results are equal to or less than the optimum moisture content.
- Density test results average not less than one hundred (100) percent of the maximum density.
- All individual density tests are greater than ninety-eight (98) percent of the maximum density.

  - If the moisture existing in the soil is insufficient for compacting to the specified density and for finishing, the proponent may elect to add water.
  - The foregoing requirements will also apply to backfill of subcuts and the embankment required to prepare the beds and backfill drainage structures.

- Approaches to be constructed as per Municipalities Approach Construction policy.

6.5. Traffic Gravel

- Traffic gravel shall comply with Type 106.

Sieve Designation	Percent by Weight Passing Canadian Metric Sieve Series
	TYPE
	106
40.0 mm	-
31.5 mm	-
22.4 mm	100
18.0 mm	63 – 92
5.0 mm	0 – 50
2.0 mm	0 – 35
400 µm	
Fractured Faces	40% Minimum

- A tolerance of 3% in the percent by weight passing the maximum size sieve shall be permitted.

6.6. Traffic Gravel Behind Construction

- Type 106 Traffic Gravel shall be placed and spread on a newly constructed subgrade surface.
- Traffic gravel Type 106 shall not be deposited until the subgrade surface has been compacted (to the required density) and trimmed.
- Traffic gravel shall be dumped and spread uniformly on the subgrade surface as required.
- Traffic gravel shall be applied to the finished surface of all approaches.

6.7. Sub-Base Course

- Sub-base aggregate shall be composed of sound, hard, and durable particles of sand, gravel and rock free from injurious quantities of soft or flaky particles, shale, loam, clay balls and organic or other deleterious material.
- Sub-base course shall comply with the requirements listed in following table:

Sieve Designation	Percent by Weight Passing Canadian Metric Sieve Series
50 mm	100
2.0 mm	0 – 80.0
400 µm	0 – 45.0
160 µm	0 – 20.0
71 µm	0 – 8.0
Plasticity Index	0 – 6

A tolerance of 3% in the percent by weight passing the maximum size sieve shall be permitted providing 100% of the oversize passes the 63.0 mm sieve.

- The thickness of any one compacted lift of sub-base course shall not exceed 120 mm.
- Sub-base courses shall be compacted until no further settlement is apparent and the particles are well keyed into place.
- The finished surface of the sub-base course shall be true to grade and cross section and free of any surface defects, rutting or deformations the placement of the next course.

6.8. Granular Base Course

- Base aggregate shall be composed of sound, hard and durable particles of sand, gravel and rock free from injurious quantities of elongated, soft or flaky particles, shale, loam, clay balls and organic or other deleterious material.
- Base Course Mix (Type 33) shall comply with the requirements listed in following table:

Sieve Designation	Percent by Weight Passing Canadian Metric Sieve Series
18.0 mm	100
12.5 mm	75.0 – 100.0
5.0 mm	50.0 – 75.0
2.0 mm	32.0 – 52.0
900 µm	20.0 – 35.0
400 µm	15.0 – 25.0
160 µm	8.0 – 15.0
71 µm	6.0-11.0
Plasticity Index	0 - 6.0
Fractured Faces (%)	50.0% Minimum
Lightweight Pieces	5.0% Maximum

- A tolerance of 3% in the percent by weight passing the maximum size sieve shall be permitted providing 100% of the oversize passes the 22.4 mm sieve.
- Granular Base Mix shall be spread on dry and unfrozen surfaces and shall not be compacted if the atmospheric temperature is less than 2° Celsius.
- The finished surface of the Granular Base Course shall be true to grade and cross section and free of any surface defects.
- The Granular Base Course shall be considered satisfactory when:
  - It contains no surface defects.
  - The average density meets or exceeds 100% of maximum density.
  - All individual test results are greater than 98% of maximum density.
  - The moisture content is less than or equal to the optimum moisture content.
- A prime coat shall be placed on the finished final lift of Granular Base Course
  - Prime coat shall be placed within 24 hours, weather permitting.

6.9. Asphalt Prime and Tack Coat

- The proponent may elect to use MC-30, an emulsified asphalt primer, road-mixed SS-1, road-mixed SS-1H for the prime coat.
  - If using SS-1 or SS-1H, the SS-1 must be incorporated into the top 25 mm to 50 mm of the Granular Base Course.
- SS-1 or SS-1H emulsified asphalt shall be used as a tack coat.
- The tack coat shall be applied in accordance with the application rates outlined in the following table:

Surface Type	Application Rate (L/m^2)		
	Residual	Undiluted	Diluted (one part water to one part emulsified asphalt)
New Asphalt Concrete	0.14 – 0.18	0.23 – 0.32	0.45 – 0.60

- Potable water shall be used to dilute the emulsified asphalt.
- The tack coat shall be applied in a single application and uniformly across the prepared surface.
- Asphalt for prime coat and tack coat shall not be applied to a prepared surface when:
  - The surface temperature is less than 2° C.
  - The weather is misty, rainy, or if rain is impending.
- Traffic will not be permitted to travel on prime coat until 6 hours after application. After 6 hours, excess asphalt remaining on the surface shall be blotted by sand before traffic is permitted to travel on the surface.

6.10. Asphalt Concrete

- Virgin aggregate used for Asphalt Concrete shall be composed of sound, hard and durable particles of sand, gravel and rock, free from injurious quantities of elongated, soft or flaky particles, shale, clay, loam, ironstone, coal and organic or other deleterious materials.

- Type 150 – 200A asphalt shall be used as bituminous binder.
  - This material shall meet the requirements of Saskatchewan Ministry of Highways and Infrastructure's Specifications for Manufactured Materials (SMM) For Asphalt Cements.
- Hydrated-lime or liquid anti-strip shall be used as an anti-stripping agent.
  - The stripping potential shall not exceed 5% as determined by SMHI Standard Test Procedure (STP 204-15).
  - Liquid anti-stripping agent shall be added at a rate of approximately 1.0% of the weight of liquid asphalt added.
  - The amount of hydrated lime added shall be approximately 1% of the total dry aggregate by weight.
  - The Contractor shall ensure the procedures and equipment used for the addition of hydrated lime anti-stripping agent are adequate to ensure that the hydrated lime is added at a uniform consistent rate.
- Only the following Mix Design Type will be permitted:

Sieve Designation	Percent By Weight Passing Canadian Metric Sieve Series
12.5 mm	100
9.0 mm	76-89
5.0 mm	50-60
2.0 mm	30-48
900 um	19-38
400 um	10-26
160 um	3-10
71 um	2-5
Fracture Minimum %	70 (1 face)
Sand Equivalent Minimum %	45
Los Angeles Abrasion (% loss)	35 (max)
Organic Content (% passing 5 mm)	1.0
Marshal Blows	50
Marshal Stability (kN) at 60ºC min	8
Retained Stability (min %)	75
Marshal Flow Index (mm)	2-4
Air Voids in Mixture	3-5
Voids Filled With Asphalt %	70-80
Min Film Thickness	8.0

- A tack coat shall be applied and allowed to fully cure prior to the placement of the asphalt mix (paving operations).
- Asphalt concrete shall be spread on dry, clean, and unfrozen surfaces.

- Asphalt concrete shall be placed in accordance with the following temperature limitations:
  - Paving may begin, for other than the final lift, when the temperature is 0° C provided the temperature is forecast, by Environment Canada, for the closest location to the project, to reach at least 5° C that day.
  - The final lift of asphalt concrete shall not be placed if:
    - The atmospheric temperature is less than 5° C;
    - The surface temperature is less than 7° C.
- The asphalt concrete mat shall be constructed to a field density range of 97% to 98% of the Marshall Density based on readings from a correlated Nuclear Densometer gauge.
  - The proponent will develop a correlation between the results of the nuclear gauge and the results of the asphalt concrete cores obtained from the compacted lift of asphalt concrete. The density results obtained from the cores will be used to correct the Field Density results obtained from the nuclear gauge.
- The asphalt mat shall be constructed so that:
  - There are no pavement depressions.
  - Longitudinal construction joints from one lift to the next shall be separated by at least 100 mm.
- The minimum and maximum thickness of a compacted lift of asphalt concrete shall meet the following requirements:
  - Minimum asphalt mat thickness shall be 30 mm.
  - Maximum asphalt mat thickness shall be 50 mm.
- The asphalt mix temperature in the paver shall not be less than 110° C.
- Contact faces of curbs, gutters, manholes, and sidewalks shall be coated with asphalt using a hand applicator before placing the asphalt mix.
- When paving is discontinued on the roadway, the asphalt concrete shall be temporarily feathered to a slope of 10 horizontal to 1 vertical. When paving is resumed, the transverse joint shall be straight and have a vertical face when the taper is removed.
- Asphalt mix shall not be placed or allowed to fall on previously laid top lift asphalt concrete or the existing asphalt concrete.
- Transverse construction joints from one lift to the next shall be separated by at least 2.0 m.
- The proponent shall construct the asphalt mat so that there are no areas of:
  - Segregation.
  - Surface defects which may consist of:
    - Roller marks.
    - Open texture.
    - Improper matching of longitudinal and/or transverse joints.
    - Cracking or tearing.
    - Contamination by diesel, hydraulic fluids, detergent or other harmful products.
    - Foreign objects or materials that are detrimental to the asphalt concrete.
    - Clay balls or oversized materials.
  - Any repairs required shall be to the satisfaction and approval by the Municipality.

6.11. Seeding

- Prior to seeding, the area to be seeded shall be true to grade and cross section and free from irregularities.
- The proponent shall harrow the seeded areas immediately after the seeding is completed.
- The seed material shall contain the following blend of seeds:

Seed Mix Common Name	% of Mix
Sheep's Fescue	15
Canada Blue Grass	15
Blue Fescue	15
Hard Fescue	15
Chewings Fescue	15
Creeping Red Fescue	15
Perennial Rye Grass	10

- The seed application rate shall be 14 kg per hectare (31 lbs per acre).
- The Municipality may approve other grass seed mixtures having similar grass seeds or slight changes in mixture percentages.

7. Design and Construction Certification

- The Municipality reserves the right to request any and/or all test result(s) or other associated documentation at any stage of the project.
- Upon completion of the project and prior to the start of the warranty period, the proponent's Engineer and/or engineering firm shall complete and submit a signed and sealed Statutory Declaration stating that all design and construction criteria/specifications in accordance with the parameters aforementioned have been met.
    - The Engineer of Record shall be a Professional Engineer registered with the Association Of Professional Engineers and Geoscientists of Saskatchewan (APEGS) and licensed to practice (Permission to Consult) within the Province of Saskatchewan.
    - The Engineer(s) of Record shall have reviewed and/or been involved with the design and/or construction of the project and shall have firsthand knowledge of the work completed.