HYDROGEOLOGICAL ASSESSMENT REPORT FOR
ABOVE-WATER EXTRACTION
PROPOSED HOGS BACK PIT
PART LOT 31, CONCESSION 3 (PROTON)
TOWNSHIP OF SOUTHGATE, GREY COUNTY

Prepared for:

H. Bye Construction Ltd.
395 Church Street
Mount Forest, ON N0G 2L2

Prepared by:

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Project No. 19-047

December 2021

GSS ENGINEERING CONSULTANTS LTD

19-047

December 9, 2021

H. Bye Construction Ltd.
395 Church Street
Mount Forest, Ontario
N0G 2L2

Attention: Mr. Randy Bye, President

RE: Hydrogeological Assessment Report for Above-Water Extraction
Proposed Hogs Back Pit
Part Lot 31, Concession 3 (Proton)
Township of Southgate, Grey County

Dear Sir,

This report provides the results of a hydrogeological assessment carried out in support of an application under the Aggregate Resources Act for a pit above the groundwater table to be developed in Part of Lot 31, Concession 3 in the geographic Township of Proton, now in the Township of Southgate.

We trust that this report meets your present requirements. If we can be of additional service, please contact this office.

GSS Engineering Consultants Ltd.

W. Brad Benson, P.Eng.
Senior Hydrogeologist

WBB/bb

cc Genevieve Scott, Cuesta Planning Consultants Inc.

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Appendices

1.0 INTRODUCTION

1.1 General

This report provides the results of a hydrogeological assessment carried out by GSS Engineering Consultants Ltd. (GSS) for H. Bye Construction Ltd. (the Applicant) in support of an application under the Aggregate Resources Act for an above the groundwater table pit, identified as the Hogs Back Pit, to be located in part of Lot 31, Concession 3 in the geographic Township of Proton, now in the Township of Southgate (the Site). The property on which the pit would be located (the Property) consists of Lot 31, Concession 3 and is owned by the Applicant. Information on Grey County Maps indicated that the area of the Property was 41.17 hectares (101.74 acres), and the municipal address was identified as 046365 Southgate Road 04. The proposed licensed area, referred to in this report as the Site, is irregular in shape and has an area of 13.71 ha (33.9 acres).

The Property is located in the southeast corner of Grey County, approximately 2 kilometres north of Highway 89 and 2.5 km west of Grey Road 8. The hamlet of Keldon is located 4 km southeast of the Site. The location and limits of the Property and the Site are shown on **Figure 1**.

1.2 Background

The proposed extraction would occur within an esker that crosses the Site from north to south. The esker is part of the Keldon Esker, which has been identified by the Ministry of Natural Resources and Forestry (MNRF) as a provincially significant earth science Area of Natural and Scientific Interest (ES-ANSI). The mapped limits of the ES-ANSI on the Property are shown on Figure 1.

GSS contacted representatives of the MNRF in September 2019 to initiate a pre-consultation process on the feasibility of, and most suitable approach for, obtaining approval for extraction of sand and gravel from within the identified ES-ANSI on the Site. GSS was advised to submit preliminary information on the proposed gravel pit at the Site and the associated ES-ANSI to the MNRF for the Ministry to consider and then provide comments.

GSS prepared a technical memorandum dated February 27, 2020 that described the local physiography, aggregate resources, available information on the designation of the ES-ANSI, and preliminary plans for the proposed pit at the Site. A copy of this memo and the February 27, 2020 covering letter to the MNRF requesting comments is included in **Appendix A** of this report. A summary of the information that was considered to be relevant with respect to potentially obtaining approval for extraction of sand and gravel from within the identified ES-ANSI on the Site is provided below.

- The Keldon Esker was one of seven relatively long eskers on the Dundalk Till Plain that were identified from a review of physiographic and geological mapping. GSS could find no record of detailed information on the characteristics of the Keldon Esker that supported designation of portions of the esker as a provincially significant ES-ANSI.

- The Ontario Geological Survey (OGS) Aggregate Resources Inventory for the geographic Township of Proton (ARIP 51, 1981) noted that the eskers currently identified as the Keldon Esker and Egerton Esker, which has also been designated as a provincially significant ES-ANSI, constituted the only source of crushable aggregate in the township and were an important component of the local resource base. The report concluded that these deposits should be protected as much as possible to preserve the remaining material for future extraction.
- The Keldon Esker on the Site was identified as a primary sand and gravel resource in the Southgate Township and Grey County Official Plans.
- Only limited information on the Keldon Esker ES-ANSI was obtained. GSS was uncertain if an ANSI report as described most recently in the 2011 MNRF Identification and Confirmation Procedure exists. No formal documentation of the reasoning and process for the ES-ANSI designation was identified.
- Information obtained from the MNRF noted that the area having the best potential to represent the Keldon Esker ES-ANSI was where the ridge straddled the boundary separating Concessions 1 and 2 in the former Proton Township. The proposed licensed area on the Site is located in Concession 3 of the former Proton Township, approximately 1.8 km northwest of the location where the Keldon Esker straddles the boundary between Concessions 1 and 2.
- A 1990 study of the depositional and deformational structures of the Keldon Esker, together with the Egerton and Mountview Eskers, noted that fresh exposures in active pits provided the most detailed information for assessment of the eskers.
- A portion of the Keldon Esker on the Site was previously extracted from a wayside pit that was located on the Site prior to 1981.
- A portion of the Keldon Esker ES-ANSI located in an area of provincially significant wetlands southeast of the Site, on the south side of Southgate Road 04, was previously approved by the MNRF for a below-water pit. The site plans obtained indicated that approval was provided in 1993.
- In addition to stating that development and site alteration shall not be permitted in significant ANSIs where there will be significant impacts to the natural features, the Provincial Policy Statement (2014) also stated that aggregate resources shall be protected for long-term use and as much of the resources as is realistically possible shall be made available as close to markets as possible.

At the time of preparing this report, GSS had received no comments from the MNRF on the submission provided in February 2020. Follow-up inquiries regarding the status of the submission were made to the MNRF on May 21 and September 8, 2020. On May 22, 2020, GSS was notified that the submission had been forwarded on that date to the MNRF Integrated Aggregate Operations Section (IAOS). In a response to the September 8 inquiry, the MNRF IAOS provided no indication of when preliminary comments would be forthcoming. After discussion with the Applicant, GSS proceeded with a subsurface investigation at the Site in November 2020 so that

monitoring wells would be in place to measure groundwater levels during the spring freshet in 2021.

1.3 Purpose and Scope of Work

The purpose of the hydrogeological assessment was to identify the elevation of the water table on the Site and to assess the potential for impacts from the proposed pit on local water resources and surface water features. The study included the following:

- a reconnaissance visit to observe conditions on the Site and surrounding Property, to identify suitable locations for installation of monitoring wells, and to install staff gauges in surface water features on the Site and Property;
- borehole drilling and installation of four monitoring wells for monitoring groundwater levels;
- water level monitoring over the period from October 2020 to November 2021;
- a Site survey to establish the location and elevation of monitoring wells, staff gauges, surface water features, and other relevant features; and
- preparation of a report including a description of the local geology and hydrogeology, water level monitoring data, inferred water table contours indicating the high water table at the Site, and comments on the potential for impacts to local water resources from the proposed above-water pit.

The proposed work plan for the hydrogeological assessment was provided in a September 24, 2019 letter to Cuesta Planning Consultants Inc. Authorization to proceed with the work was provided by the Applicant on October 4, 2019.

2.0 SITE CONDITIONS

2.1 Site Description

The Site is 13.71 ha in area and is located in the northern and central portion of the Property. The most prominent physical feature on the Site was the esker that crossed the Site generally from north to south, undulating slightly. Based on a topographic survey of the Site, the top of the esker varied in elevation from approximately 496 metres at the north end of the Site to 503 m through the central portion of the Site. The width of the esker, based on topography, varied from approximately 65 m at the north end of the Site to 100 m through the central portion of the Site. South of the Site, in the southeastern corner of the Property, the esker width increased to approximately 120 m. South of Southgate Road 04, the esker turned to the east. The esker on the Site typically had a relatively flat crest and steep side slopes. Based on the survey data, in some locations the existing slopes were steeper than 2 horizontal to 1 vertical, but typically the side slopes were between 2H:1V and 4H:1V.

Beyond the esker, the ground surface on the Property was relatively flat. The highest ground was located in the southwest portion of the Property, at approximate elevation 495 m and sloping toward the northwest. East and west of the esker, the ground surface in the central portion of the Property was at approximate elevation 491 m on the west side and 490 m on the east side, and was occupied by wetlands, as discussed subsequently in Section 2.2.

Current municipal zoning for the Property is a mix of agricultural, wetland protection, and environmental protection. The current land use consisted of a cultivated field in the south and southwest portion of the Property, with the remainder a combination of vacant open space, woodland, and/or wetland. Aerial imagery for the vicinity of the Property from 1954 showed what appeared to be a cultivated field in the northwest portion of the Property, with additional cultivated fields on the adjacent property to the west. In 2021, that area was overgrown with tall grasses and other vegetation. The wetlands located east and west of the esker on the Property were wooded. A description of the vegetation was provided in the Natural Environment Technical Report (NETR) for the Site (SAAR, 2021). Much of the esker was also previously wooded, although large sections had been cleared by a previous owner before the Property was acquired by the Applicant in 2019. Many of the cut trees were placed on the east and west margins of the esker, adjacent to the wetlands.

A former wayside pit was located on the esker in the east-central portion of the Property, near the south end of the Site. Available information on the former wayside pit was summarized in the memorandum in Appendix A. A gravel access road extended north from Southgate Road 04 to the location of the former wayside pit, and a less-developed access lane extended further north along the west side of the esker. Aerial imagery from 2010 indicated what appeared to be a small house and the foundation for a small barn in the southeast portion of the Property, south of the Site. There are currently no buildings on the Property, with the exception of a small shed placed at a location on the west side of the access road, west of the former wayside pit.

To the east, west and south, the Property was bordered by undeveloped wooded properties. To the north, the Property was bordered by an 82-hectare agricultural property with some wooded

areas and no buildings. A pasture was located on that property in the area north and west of the northwest corner of the Property. The remainder of the area immediately north of the Property was wooded. An existing licensed gravel pit was located on Lot 32, Concession 2, diagonally opposite the southeast corner of the Property. Available site plans indicated that property was licensed for below-water extraction (MNRF ID 4875) by Gordon Townsend in 1993 and was subsequently transferred to the Township of East Luther Grand Valley (now the Town of Grand Valley). Available aerial imagery dating back to 2000 indicated the presence of a gravel pit pond on that property, which was extended to the west and northwest over the years. North of the current pond, the esker on that property had been removed to the approximate elevation of the adjacent road.

2.2 Surface Water Features

The Property is crossed by a divide between the Saugeen Valley watershed to the north and west and the Grand River watershed to the south and east. The location of the watershed boundary, based on SVCA and GRCA mapping, is shown on Figure 1.

Surface water drainage features in the vicinity of the Site are shown on **Figure 2**. Topographic mapping produced by the MNRF (Ontario Base Map (OBM), 2002, 1:10,000) and Grey County (Grey County Maps, GIS platform) indicated the presence of wetlands on the Property both east and west of the esker and extending off-Property to the east and west. A separate wetland was indicated in the northwest corner of the Property and extending off-Property to the north and west. GSS identified a small dugout pond located on the Site in the southeast corner of that wetland. Review of aerial imagery indicated that the dugout pond was created between 2010 and 2015.

MNRF and Grey County topographic mapping indicated the presence of a watercourse flowing easterly into the wetland located partially in the northwest corner of the Property and a watercourse flowing out of that wetland in a northerly direction.

No watercourses were mapped within the wetlands located on the Property east and west of the esker. A narrow surface water channel with multiple short tributaries was visible on 2010 and 2015 aerial imagery on Grey County Maps in the northern part of the wetland located west of the esker in the central portion of the Property. This channel extended off-Property in a westerly direction and appeared to turn south, but there was no discernible south-flowing channel in the wetland located west of the Property. A subwatershed area generated using the MNRF Ontario Flow Assessment Tool (OFAT) and shown on Figure 2 indicated that the north portion of the wetland located west of the esker, and all of the Site, drained in a northerly direction into a watercourse flowing northwesterly on the properties located north of the Site. Almost all of the wetland located east of the esker, north of Southgate Road 04, was also shown to drain in a northerly direction toward the same watercourse. This was not consistent with the watershed boundary identified by SVCA and GRCA mapping. Subwatershed mapping generated with the OFAT indicated that the remaining portion of the wetland located west of the Site drained in a southerly direction. A visible drainage channel extending north and south of Southgate Road 04 at a location approximately 950 m west of the Site entrance suggested a hydraulic connection between the wetlands north and south of the road at that location, although GSS did not observe a culvert at that location in October 2020.

Subcatchment boundaries shown on the GRCA Web-Map (GIS platform) indicated that the wetland located on the Property east of the esker generally drained toward the east and the wetland located in the central portion of the Property west of the esker generally drained toward the southwest. Contour mapping at 0.5 m intervals on the GRCA Web-Map indicated that the ground surface in the wetland east of the esker was relatively flat at an elevation between 490 and 489.5 m and the ground surface elevation in the wetland west of the esker was generally between 491 and 490.5 m. In general, the east wetland was physically defined by the 490 m contour and the west wetland was physically defined by the 491 m contour.

Mapping shown on the MNRF Make a Map: Natural Heritage Areas (GIS platform) identified much of the wetland located on the Property east of the esker and the wetland extending onto the northwest corner of the Property as provincially significant, as indicated on Figure 1. In addition, a portion of the wetland located west of the esker in the central portion of the Property was also identified as provincially significant. Based on the mapping reviewed for this assessment, the identified limits of the wetlands in the vicinity of the Site were noted to vary somewhat between reference sources, and in some locations the mapped limits of the wetlands were considered to be inconsistent with the topographic information, in particular where the provincially significant wetland was shown to extend onto the esker ridge. Site-specific ground truthing of the provincially significant wetland limits in the vicinity of the Site was provided in the NETR (SAAR, 2021).

As noted in Section 2.1, a gravel pit pond was located on the south side of Southgate Road 04, approximately 200 m southeast of the Site. The 1993 site plans for that gravel pit indicated that the pond water level would be approximately 491.5 m. Current 0.5 m topographic mapping shown on the GRCA Web-Map indicated that the gravel pit pond water level was at approximate elevation 490.5 m.

3.0 HYDROGEOLOGICAL SETTING

3.1 Physiography and Geology

The Site is located in the physiographic region of Ontario identified by Chapman and Putnam (1984) as the Dundalk Till Plain. The till plain was formed by retreating glaciers and is a gently rolling, partially drumlinized and fluted surface at an elevation ranging between 523 and 485 m (Gwyn, 1975). A description of the glaciation processes that created the Keldon Esker that crosses the Site, and other similar eskers in the region, was provided in the memorandum in Appendix A.

Quaternary geology in the vicinity of the Site was shown on OGS Preliminary Map P.727 (Gwyn, 1972), and is reproduced on **Figure 3**. The mapping indicated the presence of the relatively narrow esker crossing the Site in a predominantly north-south direction. The soils associated with the esker were mapped as ice-contact stratified drift: sand and gravel (mainly gravel). The esker was shown to extend approximately half-way across the property located north of the Site. The soils associated with the wetlands located on the Property east and west of the esker were mapped as bog deposits: peat, muck and marl. Soils in the northwest portion of the Site, north of the west wetland, were mapped as glacial-outwash sand. The soils associated with the higher ground in the southwest portion of the Property, in the area of the current cultivated field, were mapped as till: mainly sandy silty till with some pebbly silty sandy till.

Mapping shown on the Quaternary Geology of Ontario, Southern Sheet, (Barnett et al, 1991, 1:1,000,000) indicated that the till in the vicinity of the southern portion of the Property and the area south of the Property was Tavistock Till: sandy silt to silt matrix, silty clay matrix in the south and in the north. In the area north of the Property, the till was identified as Elma Till: sandy silt to silt matrix, clayey silt along the southern margin, moderately stony.

The sand and gravel resources at the Site were described in the February 27, 2020 GSS memo in Appendix A. The OGS Aggregate Resources Inventory of Proton Township (ARIP 51, 1981) indicated that the esker crossing the Site contained high-quality, crushable aggregate and was an important component of the local resource base. The esker on the Site was included in the identified Sand and Gravel Resource Areas of Primary Significance.

Review of available bedrock geology mapping and reports (AquaResource, 2008; Saugeen Valley Source Protection Area, 2015) indicated that the upper bedrock beneath the Site consists of Middle Silurian-aged, Guelph Formation dolostone. Drift thickness mapping for the vicinity of the Property (Gwyn and Frazer, 1975) indicated that the depth to bedrock was between 15 and 23 m (50 and 75 feet). There was a paucity of water well records in the vicinity of the Property on which to base that mapping. Additional comments on the depth to bedrock are provided in the review of water well records in Section 3.2.

3.2 Groundwater Use

Water well records for the vicinity of the Site were obtained from the Ministry of the Environment, Conservation and Parks (MECP) water well record (WWR) database. In particular, the WWR

database was searched for wells located within approximately 500 m of the perimeter of the Property.

No water well records were identified for the area located within 500 m of the Property. The closest well record for a property on Southgate Road 04 was located in Lot 35, Concession 3, approximately 1.3 km east of the Property. That well (ID 2508540) was completed in the bedrock, which was encountered at a depth of 17.4 m (57 feet). North of the Property, there was a well record for Lot 29, Concession 4, at a location approximately 1.0 km north-northwest of the Property. That well (ID 2507932) was completed in the bedrock, which was encountered at a depth of 24.1 m (79 feet).

Based on review of 2019 aerial imagery, the closest buildings to the Site were a house and barn located in Lot 33, Concession 3, approximately 700 m east of the Site. There was no mapped well record for that property.

4.0 PROCEDURES FOR FIELD INVESTIGATION

4.1 Subsurface Investigation

Four boreholes (designated BH1 to BH4) were advanced at the Site on November 16 and 17, 2020. Monitoring wells were installed in each borehole and were designated as MW1 to MW4, corresponding to the borehole numbers. The locations of the monitoring wells are shown on **Figure 4**. Two monitoring wells were located on each side of the esker that crosses the Site, at locations on level ground near the outer margins of the esker, just beyond the anticipated area of extraction so that the wells could be maintained for future monitoring, if necessary.

The boreholes were advanced with a track-mounted, power auger drill rig supplied and operated by Orbit Garant Drilling of Newmarket, Ontario. The drill rig was equipped with 110-mm ID hollow stem augers and the drilling was monitored on a full-time basis by GSS staff. Standard penetration testing and soil sampling were carried out in the boreholes at regular intervals of depth using 50-mm diameter split-spoon sampling equipment. The samples were logged in the field for soil type and moisture conditions and returned to the GSS office for additional examination. The subsurface conditions encountered in the boreholes are described on the borehole logs in **Appendix B**.

The monitoring wells were constructed with 50-mm diameter PVC well screen and pipe, which were pre-packaged by the manufacturer and transported to the Site by the drilling contractor. The well screens were 3.0 m in length. The borehole annulus was backfilled with commercial filter sand to approximately 0.6 m above the well screen. The remainder of the annulus was backfilled with granular bentonite. The monitoring wells were covered at surface with lockable, aboveground, steel protective covers. Details of the monitoring well installations are shown on the borehole logs and relevant information is summarized in **Table 4-1**, below.

Table 4-1: Information on Groundwater Monitoring Wells

MW ID	Ground Surface Elevation (m)	Borehole Bottom		Well Screen Interval Depth (mbgs)		Well Screen Interval Elevation (m)	
		Depth (mbgs)	Elevation (m)	From	To	From	To
MW1	492.34	5.0	487.3	1.5	4.5	490.8	487.8
MW2	491.48	5.0	486.5	1.4	4.4	490.1	487.1
MW3	492.24	4.6	487.6	1.5	4.5	490.7	487.7
MW4	492.46	4.6	487.9	1.5	4.5	491.0	488.0

Notes: 1. Elevations in metres relative to geodetic datum
2. mbgs = metres below ground surface

4.2 Water Level Monitoring

Groundwater

Following installation and monitoring of the monitoring wells in November 2020, manual groundwater level monitoring at the Site was carried out in March, May, July, and November 2021. Recorded groundwater level data are shown in Table C-1 in **Appendix C**.

In addition to the manual measurements, water levels were also monitored continuously at 1-hour intervals at selected wells using a pressure transducer data logger. Continuous groundwater level monitoring was carried out in MW3 from November 17, 2020 to November 8, 2021, in MW1 from November 17, 2020 to July 5, 2021, and in MW2 from July 5 to November 8, 2021. The water level data were corrected for variations in barometric pressure using hourly barometric pressure measurements recorded by a data logger placed at the Site. The recorded water level data are shown graphically on Figure C-1, together with the manual groundwater level measurements.

Observations of standing water in four partially open test pits identified at locations near the margins of the esker at the north end of the Site were noted during the initial site visit on October 16, 2020, and in subsequent site visits. Those test pits were excavated by the Applicant in 2019 to assess the quality of the aggregate at the Site. The water levels were considered to be indicative of the depth of the water table at the test pit locations. The locations of the test pits are shown on Figure 4.

On November 8, 2021, GSS manually installed a temporary shallow piezometer (designated P1) in a partially open test pit near the toe of the esker slope at a location approximately 115 m north of MW1, as shown on Figure 4. The exposed soil in the test pit consisted predominantly of fine- to medium-grained sand. The piezometer was constructed with a stainless steel, screened, drive-point 0.41 m long, coupled to lengths of 19-mm diameter steel piping. The piezometer was driven to a depth of approximately 2.4 m below the ground surface in the test pit, which was approximately 0.6 m lower than the existing ground surface elevation on the west side of the test pit. The elevation of P1 was surveyed by GSS relative to the elevation of MW1 and the location of P1 was determined with a hand-held GPS device. The groundwater level in P1 was monitored at approximately 0.5-hour intervals on November 8 until the level had stabilized. The stabilized water level is recorded in Table C-1.

Surface Water

Three temporary staff gauges (SG1 to SG3) were established at selected locations at or in the vicinity of the Site for the purpose of monitoring surface water levels. Staff gauges consisted of a steel t-post manually driven to a depth of approximately 1.2 m into the shallow soils.

SG1 and SG2 were installed on October 16, 2020 at locations on the west side of the esker that crossed the Site. SG1 was installed in a water-filled swale located in the west wetland and SG2 was installed in the dugout pond in the northwest portion of the Site. SG3 was installed in a relatively small area of standing water in the east wetland on November 17, at the time of the Site survey. The locations of the staff gauges are shown on Figure 4.

Water levels were measured at the staff gauges in conjunction with groundwater level monitoring events and the data are recorded in Table C-1. Elevations of standing water at selected locations on the Property were also determined in conjunction with the November 17 site survey.

4.3 Surveying

The locations and elevations of the monitoring wells, staff gauges, and other selected features on the Site and Property were determined on November 17, 2020 by a specialist survey firm (SMC Geomatics Inc.) retained by GSS and using GPS-based survey equipment. The elevations were determined relative to geodetic datum using the Leica Geosystems reference network. At the same time, SMC Geomatics carried out a topographic survey of the Site for preparation of the site plans.

Property bars at the southeast and southwest corners of the Property were established from a legal survey in November 2020 by Wilson-Ford Surveying & Engineering, retained by the Applicant. Locations for those bars were provided to GSS by Wilson-Ford and were incorporated into the survey data for the Site.

5.0 SUBSURFACE SOIL CONDITIONS

The subsurface soil conditions encountered in the boreholes advanced at the Site are shown on the borehole logs in Appendix B. The soil conditions in each borehole were inferred from non-continuous samples and observations of drilling resistance. Soil layers depicted on the borehole logs typically represent a transition from one soil type to another and should not be interpreted to represent exact planes of geological change.

Soil conditions between boreholes were inferred based on the conditions encountered at the boreholes as well as observations of exposed soils on the esker crossing the Site, including at the former wayside pit in the southern portion of the Site, and in open test pits from a 2019 investigation by the Applicant. It should be noted that soil conditions between and beyond the boreholes may vary from the conditions depicted at the borehole locations.

All of the boreholes encountered surficial topsoil or silt with organic material, underlain by variable strata of granular soils. BH1 encountered silty sand with some gravel to a depth of approximately 1.3 m, underlain by silt to a depth of 2.2 m. BH2 encountered silty sand underlain by sand and gravel to a depth of approximately 2.2 m. BH3 encountered predominantly sand and gravel to a depth of approximately 2.3 m. BH4 encountered sequential strata of silty sand, sandy silt, and silt to a depth of approximately 1.8 m.

The granular soils at the borehole locations were underlain by a deposit of what was generally described as clayey silt till. The till was encountered at depths ranging from approximately 1.8 m at BH4 to 2.3 m at BH3, and at elevations ranging from 490.6 m at BH4 to 489.3 m at BH2.

6.0 GROUNDWATER CONDITIONS AT THE SITE

6.1 Water Level Monitoring Data

Water level monitoring data for the period of this assessment from October 2020 to November 2021 are summarized in Table C-1 in Appendix C. To facilitate interpretation, the water level data are also shown graphically on Figure C-1. Also shown on Figure C-1 are daily rainfall data recorded at the Fergus Shand Dam station.

The continuous water level data for MW1 and MW3 indicated that the groundwater level at the Site generally increased slightly in the period from mid-November to early January, and then declined until the end of February. An increase in groundwater levels of approximately 0.6 m was recorded on March 10 and 11. This increase did not coincide with a recorded rainfall event; however, temperature data recorded at the Mount Forest (Aut) station showed recorded highs on those days of 11.4 and 15.4 ºC, after an extended period of sub-zero temperatures. GSS inferred that much of the snow cover at the Site melted at that time. The highest groundwater levels at the Site were recorded by the data loggers at the end of March, following recorded rainfall events on March 25, 26 and 27. After the end of March, the recorded groundwater levels generally declined, with relatively short-term increases following rainfall events. The highest manually measured water levels at the Site were recorded by GSS during a site visit on March 23.

The continuously recorded water level data for MW2 and MW3 indicated that the seasonal low groundwater levels at the Site occurred in late August or early September, after which the recorded groundwater levels generally increased. Responses to recorded rainfall events were more pronounced at MW2 than MW3, which was considered to be a result of the relatively shallow water table at MW2 relative to the surrounding ground surface. The measured groundwater levels at the monitoring locations in November 2021 were similar to the levels recorded in November 2020.

Measured surface water levels in the wetlands located west and east of the Site (SG1 and SG3, respectively) showed less variability than the measured groundwater levels. The measured surface water level at SG1 on March 23, 2021 was 0.11 m higher than the measured level on October 16, 2020 and the measured surface water level at SG3 on March 23 was only 0.03 m higher than the measured level on November 17, 2020. For each monitoring event, the measured surface water elevation at SG1 in the west wetland was approximately 1.2 m higher than the measured surface water elevation at SG3 in the east wetland (approximately 490.9 m versus 489.7 m). In comparison to the closest groundwater monitor, the recorded surface water elevation at SG1 was within 0.1 m of the recorded groundwater elevation at MW2 for each event, while the recorded surface water elevation at SG3 varied from approximately 0.7 to 1.1 m lower than the recorded groundwater elevation at MW3. On July 5, 2021, no surface water was present in the wetlands at SG1 and SG3.

The recorded water level data were used to identify seasonal high water table elevations at the locations of the monitoring wells and at SG2 in the dugout pond. These elevations are shown in **Table 6-1** on the following page. The high water table elevations at MW1 and MW3 were based on the hourly water level data recorded by the data loggers placed in those wells. The high water

table elevations at MW2, MW4 and SG2 were based on the measured water levels on March 23 and adjusted higher based on comparison to the continuous water level data for MW1 and MW3 and the surveyed ground surface elevations in the vicinity of the monitors.

Table 6-1: Identified High Water Table Elevations at the Monitoring Locations

Monitor	Ground Surface Elevation (m)	Identified High Water Table Elev. (m)	Basis	Water Table Depth (mbgs)
MW1	492.34	492.2	Recorded on March 11, 26, and 28	0.14
MW2	491.48	491.2	Estimated from March 23 water level data	0.28
MW3	492.24	491.1	Recorded on March 28 to 30	1.14
MW4	492.46	492.2	Estimated from March 23 water level data	0.26
SG2	489.52	490.1	Estimated from March 23 water level data	-0.58

Notes: 1. Elevations in metres relative to geodetic datum.
2. mbgs = metres below ground surface.

The higher water table elevations at MW1 and MW4 were consistent with the higher ground surface elevations and the thinner surficial sand and gravel strata at those locations. At MW1, lower-permeability silt was encountered beneath the surficial silty sand with some gravel at a depth of approximately 1.3 m and at MW4 silt was encountered beneath the upper silty sand and sandy silt at a depth of 1.4 m.

6.2 Comparison to Regional Precipitation and Groundwater Level Data

Available precipitation data for the vicinity of the Site were reviewed to assess the conditions when the water level data were collected relative to the precipitation in a typical year. The closest Environment Canada meteorological station to the Site for which 30-year (1981-2010) climate normal data were available was Proton Station, located 14.5 km north of the Site at elevation 480 m. The 30-year normal annual precipitation for that station was 1106.3 mm. However, daily and monthly precipitation data were not available for the period after 2002. Four other stations with 1981-2010 normal data were identified at locations between 31.6 and 36.1 km from the Site (Orangeville MOE, Ruskview, Durham, Fergus Shand Dam); however, only one of those stations (Fergus Shand Dam, 36.1 km) had available daily or monthly precipitation data for 2020 and 2021. The monthly 30-year normal precipitation data for Proton Station and Fergus Shand Dam are shown in **Table 6-2**, on the following page.

The closest station to the Site with relatively recent precipitation data was the Mount Forest (Aut) automatic station (26.1 km); although the daily precipitation data available for that station did not differentiate between snow and rain and data were missing for a substantial period (12 days) in October 2020. The closest station to the Site with both reasonably complete daily precipitation data for 2020 and 2021 and 30-year normal data was Fergus Shand Dam (36.1 km). The monthly precipitation data for Mount Forest (Aut) and Fergus Shand Dam for the period of study and the antecedent period (July 2020 to July 2021) are summarized in Table 6-2.

Table 6-2: Summary of Precipitation Data for Current Year

Month and Year	Total Precipitation Mount Forest (Aut) (mm)	Total Precipitation Fergus Shand Dam (mm)	1981-2010 Normal Precipitation (mm)	
			Proton Station (Elev. 480 m)	Fergus Shand Dam (Elev. 418 m)
Annual Average	--	945.7	1106.3	945.7
July 2020	128.9 (<5 d)[1]	43.7 (<2 d)	77.9	89.2
Aug 2020	131.2 (<1 d)	103.2 (<1 d)	91.9	96.6
Sep 2020	72.1 (<1 d)	90.6	104.4	93.1
Oct 2020	41.9 (<12 d)	78.3	92.3	77.2
Nov 2020	69.5	83.0	110.9	93.0
Dec 2020	97.3	93.2	102.1	68.6
Jan 2021	21.6 (<1 d)	35.6	107.8	67.9
Feb 2021	46.6	62.8	84.3	55.9
Mar 2021	54.6 (<1 d)	36.6	79.2	59.6
Apr 2021	50.9	54.5	72.1	74.1
May 2021	39.5	25.2	89.8	86.9
Jun 2021	77.9 (<2 d)	105.4	93.5	83.8
July 2021	137.2 (<2 d)	92.7	77.9	89.2
12 Month Total (Jul – Jun)	832.0	812.1	--	--

Note: 1. (<5 d) indicates five days of missing data for that month.

The data indicated that monthly precipitation in the vicinity of the Site was generally near normal in the period from July to December 2020. Recorded monthly precipitation in the period from January to May 2021 was less than normal, with January and May being particularly dry relative to the 30-year norms. This was followed by near-normal precipitation in June and July. For the 12-month period from July 2020 to June 2021, the total recorded precipitation at the Fergus Shand Dam station was approximately 14% less than the 30-year norm. For some months, the data indicated considerable variation between the two nearby stations with records of daily precipitation.

To evaluate the potential significance of below-average precipitation in the early part of 2021 on the representativeness of the recorded water level data at the Site, a comparison was made to available data for monitoring wells installed in similar conditions. The Provincial Groundwater Monitoring Network (PGMN) is a partnership program between the MECP and the conservation authorities to collect and manage ambient (baseline) groundwater level and quality information for key aquifers located across Ontario. GSS examined the available well information for PGMN monitors located in the vicinity of the Site to identify a representative well that was constructed in conditions similar to those at the Site, i.e., a shallow well completed in a surficial (unconfined) sand and gravel aquifer. The closest well with those characteristics was identified at a location

24 km southwest of the Site, near Riverstown (south-southeast of Mount Forest) in the watershed managed by the Maitland Valley Conservation Authority. That well (identified as W0000276-2) was reportedly screened in sand and gravel at a depth of 4.0 to 5.2 m, with a ground surface elevation of 439.6 m. The coordinates of the well indicated that it was located at the County of Wellington Riverstown landfill site. Based on available geological mapping, the landfill was located at a former gravel pit site owned by the Town of Arthur and located within the Riverstown esker. Immediately west of the former gravel pit, the Riverstown Twin Eskers were identified as an ES-ANSI. Based on its location, depth and geological setting, PGMN W0000276-2 (referred to as Well 276-2) was considered to be a suitable reference well for comparing seasonal variations in the water table level to the conditions at the Site.

Hourly water level data for Well 276-2 available for download from the PGMN datasets website was current to March 1, 2018. To evaluate the 2021 conditions at the Site, GSS requested more recent data for Well 276-2 from the MECP and subsequently received hourly water level data that was current to July 6, 2021. A graph of water level data for Well 276-2 for the period from March 2003 to July 2021 is shown on Figure C-2 in Appendix C. Review of the data suggested that there may have been a change in conditions at the monitored location after 2011 as the seasonal high water levels recorded after 2011 were generally lower than the seasonal highs recorded in prior years. Further, much of the data for 2013 was missing. For the purpose of evaluating the conditions at the Site, GSS focused on the recorded seasonal high water table elevations at Well 276-2 in the 8-year period from 2014 to 2021. During that period, brief spikes in the water level elevations were recorded on June 23, 2017, February 21, 2018, March 15, 2019, and January 12, 2020. Based on precipitation data for the Mount Forest (Aut) station (or the Wroxeter station for January 12, 2020), the June 23, 2017 peak coincided with 159.6 mm of recorded rainfall on June 22 and 23, the February 21, 2018 peak coincided with 40.2 mm of recorded rainfall on February 19 and 20, the March 15, 2019 peak coincided with 17.2 mm of recorded rainfall on March 14 and 15, and the January 12, 2020 peak coincided with 81.6 mm of recorded rainfall on January 10 and 11. Excluding the March 15, 2020 peak, the other recorded water level spikes were considered to be a result of relatively extreme rainfall events and were not considered to be indicative of the typical seasonal high water table.

The recorded annual seasonal high water levels recorded at Well 276-2 for the period from 2014 to 2021, excluding the short-duration spikes on June 13, 2017, February 21, 2018, and January 12, 2020, are summarized in **Table 6-3**, below.

Table 6-3: Seasonal High Water Levels Recorded at PGMN Well 276-2 (2014 to 2021)

Date	Recorded Groundwater Elevation (m)	Date	Recorded Groundwater Elevation (m)
Apr 10, 2014	436.21	Apr 22, 2018	436.11
Mar 16, 2015	436.15	Mar 15, 2019	436.51
Mar 28, 2016	436.09	Mar 20, 2020	436.13
May 7, 2017	436.10	Mar 11, 2021	436.19

Notes: 1. Elevations in metres relative to geodetic datum.

The seasonal high water level of 436.19 m recorded at Well 276-2 on March 11, 2021 was higher than the recorded seasonal high water levels in 2015, 2016, 2017, 2018, and 2020, slightly lower than the seasonal high water level of 436.21 m recorded in 2014, and 0.32 m lower than the seasonal high water level recorded in 2019. GSS interpreted this data to indicate that the seasonal high water levels measured at the Site in 2021 were likely to be reasonably representative of the typical high water table elevation at the Site.

6.3 Groundwater Flow Conditions

Inferred water table contours at the Site based on the identified high water table elevations are shown on Figure 4. The highest water table elevations were indicated in the vicinity of MW1 and MW4.

Within the esker, the sand and gravel was inferred to extend more than a metre, and likely as much as several metres, below the ground surface elevation at the margins of the esker. Exposed soils in test pits at the north end of the Site from a 2019 investigation by the Applicant indicated the presence of sand and gravel to a depth of at least 1 metre. Also, as previously noted, sand and gravel was being extracted from below the water table at a licensed gravel pit in the same esker on the south side of Southgate Road 04, southeast of the Site, and that pit was approved for extraction of material to a depth of approximately 6.5 m below the water table.

The hydraulic conductivity of the sand and gravel associated with the esker was expected to be considerably higher than the hydraulic conductivity of the surrounding soils, and the corresponding hydraulic gradient within the sand and gravel was expected to be relatively low. For three recent groundwater investigations at sites in the southern portion of Grey County with similar soil conditions, GSS identified horizontal hydraulic gradients ranging from 0.001 to 0.006, with an average gradient of approximately 0.003 (equivalent to an increase in the water table elevation of 0.3 m over a horizontal distance of 100 m).

Excluding MW1, the water level data were considered to be indicative of a south to north groundwater flow direction within the sand and gravel associated with the esker. For monitoring events on March 23, May 13, and July 5, the recorded groundwater elevation at MW4 near the south end of the Site ranged from 2.1 to 1.5 m higher than the recorded water elevation at SG2 in the dugout pond at the north end of the Site. The dugout pond was located within a mapped deposit of glacial-outwash sand and the surface water level at that location was considered to be indicative of the local water table elevation. The recorded water table elevations at MW4 and SG2 indicated a hydraulic gradient ranging from approximately 0.004 to 0.003 along the length of the esker, which was considered typical for a continuous sand and gravel deposit.

Extending the hydraulic gradient of 0.004 southward from MW2 indicated a high water table at approximate elevation 493 m within the esker at the south end of the Site. GSS inferred that there was a groundwater divide within the esker just beyond the south end of the Site, which would be consistent with the local topography and the MNRF OFAT subwatershed drainage area shown on Figure 2, and also with the indicated water level elevation of approximately 490.5 m in the gravel pit pond located south of Southgate Road 04. The northwesterly-flowing watercourse shown on topographic mapping to be located approximately 500 m north of the Site was

considered to be the likely outlet for shallow groundwater flowing northerly within the sand and gravel esker.

The recorded water level data for MW1 were considered to be somewhat inconsistent with the other water level data and indicated the presence of a localized high in the water table at that location. For each monitoring event, the inferred water table elevation at MW1 was approximately 0.7 to 0.9 m higher than the water table elevation in the wetland located approximately 60 m to the southwest and 1.3 to 1.9 m higher than the water level in the dugout pond located approximately 170 m to the north. For monitoring events in November, March, and May, the water table elevation at MW1 was also higher than the surveyed ground surface elevation near the west boundary of the Site approximately 60 m west of MW1. GSS considered it unlikely that the recorded groundwater elevations at MW1 were indicative of the water table elevation within the sand and gravel of the esker in that area. On November 17, 2020, the surveyed water level of 489.79 m in an open test pit on the east margin of the esker approximately 110 m northeast of MW1 was 1.98 m lower than the measured groundwater level at MW1.

MW1 was located within a mapped deposit of glacial-outwash sand that was shown to extend westerly for approximately 400 m from the west side of the esker, southerly to the wetland in the west-central portion of the Property, and northerly to a low-lying wet area with a northwesterly flowing watercourse on the adjacent property north of the Site. The soil conditions encountered at MW1 consisted of approximately 0.2 m of topsoil underlain by silty sand with some gravel to a depth of approximately 1.3 m. The silty sand was underlain by silt with clayey silt layers to the top of the till at a depth of approximately 2.2 m.

The continuously recorded water level data for MW1 showed relatively strong reactions in response to recorded rainfall events in the vicinity of the Site, with short-term increases of the order of 0.4 m. These were substantially larger than the responses recorded at MW3. GSS inferred that the higher water table elevation recorded in the vicinity of MW1 was likely to be related to enhanced infiltration of precipitation on the relatively flat ground within the localized sand deposit in that area. It was also noted that ground surface contours derived from the topographic survey at the Site indicated the presence of a swale on the west side of the esker adjacent to MW1 that would tend to capture and hold runoff, resulting in enhanced infiltration in the area immediately east of MW1.

The high water table elevation identified in the vicinity of MW1 was used in establishing the bottom elevations for the proposed gravel pit, but was considered to be indicative of a relatively localized condition. To validate that interpretation, piezometer P1 was installed at a location approximately 115 m north of MW1 on November 8, 2021, as described in Section 4.2. The measured groundwater elevation of 490.06 m at P1 on November 8 was 1.59 m lower than the groundwater elevation at MW1, and was considered to be consistent with a groundwater flow direction of south to north within the esker and the inferred groundwater contours shown on Figure 4.

6.4 Hydrogeological Setting and Water Budget

Grey County and GRCA mapping indicated that the Site is located on a divide at the top of the watersheds for two major river systems, the Saugeen Valley watershed to the north and west and

the Grand River watershed to the south and east. Watershed scale water budget assessments were previously carried out as part of the provincial source water protection program. Results for the Grand River watershed were presented in the Integrated Water Budget Report for the Grand River Watershed (AquaResource, 2009). The results of the surface water assessment for the Saugeen Valley watershed were presented in the Saugeen Valley, Grey Sauble, and Northern Bruce Peninsula Tier 1 Surface Water Budget and Stress Assessment Report (AquaResource, 2008), and were subsequently incorporated into Chapter 3 of the Approved Assessment Report for the Saugeen Valley Source Protection Area (2015). In the Grand River watershed report, the southern portion of the Site was located within a subwatershed identified as "Grand Above Legatt" and in the Saugeen Valley watershed report, the northern portion of the Site was located within a subwatershed identified as "South Saugeen/Mount Forest". The average annual water budget components from the model results for both subwatersheds are shown below.

Subwatershed	Area (km^2)	Precipitation (mm)	Evapotranspiration (ET) (mm)	Runoff (mm)	Recharge (mm)
S. Saugeen/Mount Forest	547	1007	627	173	207
Grand Above Legatt	365	988	469	345	174

The annual precipitation values used in the models were similar; however, there was a substantial difference in the evapotranspiration rates. The estimated evapotranspiration of 627 mm for the subwatershed located within the Saugeen River drainage area would leave 380 mm of precipitation as potential recharge, without the effects of runoff. The estimated evapotranspiration of 469 mm for the subwatershed located within the Grand River drainage area would leave 519 mm of precipitation as potential recharge, without the effects of runoff. Within each subwatershed, there would be variations in the estimated evapotranspiration, runoff, and recharge values based on differences in surface topography, surface cover, and soil conditions. However, the average evapotranspiration rate on the Site would be approximately the same for both watersheds. Based on the availability of shallow groundwater, the evapotranspiration rate from the wetland portions of the Site would be expected to be higher than the evapotranspiration rate from the esker portion.

The Grand River watershed report noted that provincial estimates of mean annual evapotranspiration were documented in the Water Quantity Resources of Ontario (MNR, 1984), and were calculated by subtracting mean annual streamflow from mean annual precipitation. For the Grand River watershed, average annual evapotranspiration was estimated to be 400-500 mm in the north, 600 mm in the extreme south, and generally 500-600 mm over the majority of the watershed (AquaResource, 2009). The Saugeen Valley watershed report noted that the potential evaporation rates used in the SVCA model were successfully used in the adjacent GRCA model and only slight reductions were required for use within the SVCA model.

Watershed characterization information obtained from the MNRF OFAT for the generated subwatershed shown on Figure 2 indicated that the mean annual precipitation was 991 mm, consistent with the above-noted water budget reports. The mean annual streamflow for the 229.2 ha subwatershed was indicated to be 2,592 m^3/day, which would be equivalent to 413 mm of

annual precipitation. That would imply an average annual evapotranspiration rate of approximately 578 mm.

The major land surface/soil components that characterized the Property were the wetlands and the sand and gravel esker. In addition, there was a relatively small area mapped as sandy silt till in the southwest portion of the Site and a smaller area mapped as glacial-outwash sands located on the west side of the esker, between the north and south wetlands. All of the proposed extraction would occur within the sand and gravel esker on the Site. Table 4.6 in the water budget report for the Grand River watershed indicated the range of simulated runoff and recharge rates shown below for relevant hydrologic response units located across the study area, based on the GAWSER surface water modelling.

Hydrologic Response Unit	Runoff (mm/yr)			Recharge (mm/yr)		
	Min	Max	Avg	Min	Max	Avg
Sand, Gravel (medium vegetation, non-hummocky)	4	8	8	351	402	355
Wetland	457	573	499	111	113	112

Similar information was not presented in the same way in the Saugeen Valley watershed report; however, maps of modelled mean annual runoff and mean annual infiltration per response unit indicated runoff of less than 50 mm for the sand and gravel deposit on the Site and recharge of 200 to 300 mm.

Based on the presence of relatively low-permeability till beneath the sand and gravel esker at the Site, much of the infiltration from precipitation in the sand and gravel unit would be expected to move laterally. As discussed in Section 6.2, the inferred direction of shallow groundwater flow in the sand and gravel esker on the Site was primarily towards the north. In addition to flow within the sand and gravel deposit, the identified hydraulic gradient also indicated the potential for movement of shallow groundwater from the esker to the adjacent wetland to the east, although flow in that direction would be limited by the presence of the near-surface, low permeability till and the organic soils associated with the wetland. Groundwater level monitoring indicated that on July 5, 2021, the groundwater level at MW3 was less than 0.2 m above the top of the till. The inferred hydraulic gradient between the esker and the adjacent wetlands to the west and northwest was smaller than the easterly gradient and suggested the potential for only very minor, seasonal groundwater flow from the esker to those wetlands. It was considered that there was also a potential for minor seasonal flow of shallow groundwater from those wetlands into the sand and gravel of the esker.

Based on the size of the proposed area of extraction relative to the area of the wetlands and associated drainage area, any groundwater flow from the proposed area of extraction would be expected to be a very minor contributor to the water supply of the wetlands. The area of the generated subwatershed shown on Figure 2 that contained the Site and much of the wetlands located east, west and northwest of the Site was approximately 229 ha, of which 133 ha was mapped as wetlands. The proposed area of extraction at the Site is 5.77 ha, which would represent approximately 2.5% of the inferred drainage area.

Mapping provided for the Saugeen Valley Source Protection Area and interactive GIS mapping for the Grand River watershed indicated that the Site was not located in an area subject to source water protection policies.

7.0 PROPOSED AGGREGATE EXTRACTION

The identified high water table elevation at the Site and inferred water table contours were used to identify the bottom elevations for the proposed gravel pit, based on a minimum separation distance of 1.5 m between the pit bottom and the high water table. The proposed gravel pit bottom is shown on the cross-sections on **Figure 5**. Spot elevations for the proposed gravel pit bottom are shown at selected locations on Figure 4. The bottom elevations varied from 495.0 m near the south limit of the former wayside pit, to 493.7 m at the south end of the intact esker, to 491.5 m at the north end of the Site.

The proposed pit bottom elevations were used to identify the limits of extraction, as all of the excavation would occur within the raised esker at an elevation higher than the surrounding ground east and west of the esker. The proposed area of extraction is 5.77 ha in area and is shown on Figure 4. At the location of the former wayside pit at the south end of the Site, the identified bottom elevation was approximately 0.4 to 1.6 m below the bottom of the former wayside pit (i.e. the current ground surface in that area). There is a potential for extraction of up to approximately 6 m of material in that area in the portion of the esker that remains intact. North of the former wayside pit, the depth of extraction from the top of the esker would vary from approximately 6 to 11 m.

The volume of aggregate that would potentially be available for removal from the Site was estimated by comparing the existing ground surface defined by the contours shown on Figure 4 to the proposed pit bottom elevations, as indicated on Figures 4 and 5. Assuming an average topsoil thickness of 0.3 m, the estimated in situ volume of aggregate was estimated to be of the order of 160,000 cubic metres (m^3). Based on an assumed in situ density of 2.1 tonnes/m^3 for sand and gravel, the estimated volume would equate to approximately 336,000 tonnes of aggregate.

Extraction of sand and gravel would generally proceed from south to north, with a haul road extended along the floor of the pit. Post-extraction, it is understood that the Site will be rehabilitated for passive recreational use, including a potential campground, as well as a re-forested area in the northern portion of the Site to create a wildlife corridor.

No aggregate washing is proposed for the Site. Fuel storage and equipment maintenance will occur at a designated location near the south end of the Site. Any fuel storage, handling, and on-Site use must adhere to all applicable regulations and standards, which reduces the potential for related impacts to the environment. There are no proposed water diversion, storage or drainage facilities for the Site.

8.0 ASSESSMENT OF POTENTIAL IMPACTS FROM PROPOSED GRAVEL PIT

The proposed extraction of sand and gravel at the Site will occur at an elevation 1.5 m or more above the typical high water table. Therefore, no direct effects on local groundwater levels are anticipated.

No water supply wells were identified within 500 m of the Site. Therefore, no potential for impacts on groundwater use were identified as a result of potential inadvertent changes to groundwater quality from the proposed extraction. Further, the information reviewed indicated that the closest water supply wells to the Site obtained groundwater from a confined bedrock aquifer.

The potential for indirect effects of aggregate extraction and subsequent rehabilitation at the Site was evaluated with respect to changes in the Site water balance. During extraction, the existing vegetation cover and topsoil would be removed to expose the underlying aggregate. The temporary absence of vegetation and topsoil would be expected to result in a slight reduction in losses from evapotranspiration, which would result in a slight increase in runoff and/or infiltration. After rehabilitation, the evapotranspiration losses at the Site would be expected to be similar to pre-extraction conditions.

During extraction, runoff from areas of exposed soils should be contained so that solids-laden water does not flow into the adjacent wetlands. Appropriate measures would be employed to restrict runoff from stripped areas from flowing down the slopes outside the area of extraction and to promote infiltration of runoff on the pit floor. This is anticipated to result in a reduction in runoff from the Site, which would be offset by a corresponding increase in infiltration. As the Site will be progressively rehabilitated, with runoff restored in rehabilitated areas, the area with temporary reduced runoff is anticipated to be less than half of the proposed extraction area.

After the Site is rehabilitated, it is considered that there would be a potential for reduced runoff from the Site relative to the pre-existing conditions as a result of reduced slopes on the esker. This would be offset by a corresponding increase in infiltration. No net reduction in water input to the adjacent wetlands from the Site was indicated.

Guidance for water balance infiltration factors provided in the MECP Stormwater Management Planning and Design Manual (2003) indicated that the proposed change in topography at the Site could potentially result in a reduction in runoff in the extracted area of the order of 50%, with a corresponding increase in infiltration of the order of 12.5%. Based on an average annual precipitation rate of 991 mm and an average annual evapotranspiration rate of 578 mm (derived from the MNRF OFAT subwatershed mapping described in Section 6.3 and generally consistent with the regional water budget modelling results), the potential recharge rate for the Site was estimated to be approximately 413 mm. Most of this water would be considered to represent a potential input to adjacent wetlands via runoff or infiltration and lateral movement, although the timing of those inputs would be different. Under existing conditions, the runoff component from the esker was estimated to be approximately 83 mm, leaving approximately 330 mm for infiltration. A 50% reduction in the estimated runoff would be approximately 41 mm, and there would be a corresponding increase in infiltration to approximately 372 mm. For the proposed area of extraction of 5.77 ha, a reduction in runoff of 41 mm would equate to approximately 2,370 m^3 annually.

In areas beyond the sand and gravel esker, expected runoff from the lower-permeability soils in the vicinity of the Site would be considerably higher, closer to approximately 190 mm per year based on the water budget modelling results for the Saugeen Valley watershed described in Section 6.3. As described in Section 6.3 and shown on Figure 2, the inferred drainage area containing the Site was approximately 229 ha in area, of which approximately 133 ha was mapped as wetlands. Based on an estimated runoff component of 190 mm from the lands located outside the mapped wetlands, the estimated annual runoff to the wetlands would be approximately 182,000 m^3. The estimated annual input of water to the wetlands from direct precipitation would be approximately 1,318,000 m^3. A reduction in the annual runoff from the Site of approximately 2,370 m^3 post-extraction would represent approximately 1.3% of the estimated total runoff input to the wetlands, and approximately 0.25% of the estimated total water input. Further, the estimated reduction in the runoff input to the wetlands would be accompanied by a corresponding increase in the input from shallow groundwater flow.

In summary, no reduction in the net water input to the adjacent wetlands as a result of the proposed above the water table pit at the Site was indicated. The estimated potential reduction in the seasonal runoff input to the wetlands as a result of the proposed extraction represented a small fraction of the estimated water inputs to the wetlands and it was considered that it would have a negligible effect on the hydroperiod of the adjacent wetlands. No potential for the proposed gravel pit to negatively affect water levels in the adjacent wetlands was identified.

9.0 MONITORING PLAN

No effects on local groundwater and surface water resources from the proposed extraction at the Site are anticipated. Therefore, the monitoring program is limited to water level monitoring for one year following issuance of this report to confirm that the seasonal high water table identified in this report is generally representative of typical conditions at the Site. This would be followed by water level measurements three times per year in the first three years of extraction to document groundwater conditions.

The following monitoring program is recommended to be shown on the site plans.

- Water level measurements at the existing on-Site monitoring wells (MW1, MW2, MW3, MW4), staff gauges (SG1, SG2, SG3), and piezometer (P1) shall be carried out for one year following issuance of the hydrogeological report, with a minimum of three events in the spring (March, April, May) and one event each in the summer and fall.
- Following approval of aggregate extraction at the Site, water level measurements at the existing monitoring wells, staff gauges, and piezometer shall be carried out at a minimum frequency of three times per year in the spring, summer, and fall for the first three years of extraction operations.
- At the end of three years, the monitoring data shall be summarized in a report prepared by a qualified professional and submitted to the MNRF, with a recommendation to either discontinue the monitoring program or to continue the monitoring program for a specified minimum number of additional years.
- If it is recommended that monitoring be discontinued, and the MNRF concurs with the findings of the report, then the monitoring wells shall be properly abandoned in accordance with the requirements of O.Reg. 903 and amending regulations.

10.0 SUMMARY AND CONCLUSIONS

Based on the results of this hydrogeological assessment, the following summary of findings is provided.

- Four monitoring wells were installed at the Site in November 2020. Groundwater levels in two wells were monitored continuously (1-hour intervals) from November 2020 to November 2021. Groundwater levels in all of the monitoring wells were measured at approximately monthly intervals from March to July 2021. Surface water levels were measured in adjacent wetlands located east and west of the Site and in a dugout pond located in the northwest portion of the Site.
- The seasonal high water table elevation at the monitoring locations occurred in late March 2021, with identified elevations ranging from 492.2 to 490.1 m. Contours considered to be representative of the high water table at the Site are shown on Figure 4 of this report.
- To maintain a minimum separation of 1.5 m above the identified high water table, pit floor elevations ranging from 495.0 m at the south end of the Site to 491.5 m at the north end were identified.
- The proposed pit floor elevations were used to identify the limits of extraction on the Site, as all of the extraction would occur within the existing raised esker at an elevation higher than the surrounding ground surface beyond the esker. The proposed area of extraction is 5.77 ha and is shown on Figure 4 of this report.
- Based on the results of this assessment, no potential impacts to local groundwater and surface water resources from the proposed above the water table pit were identified.

Respectfully submitted,

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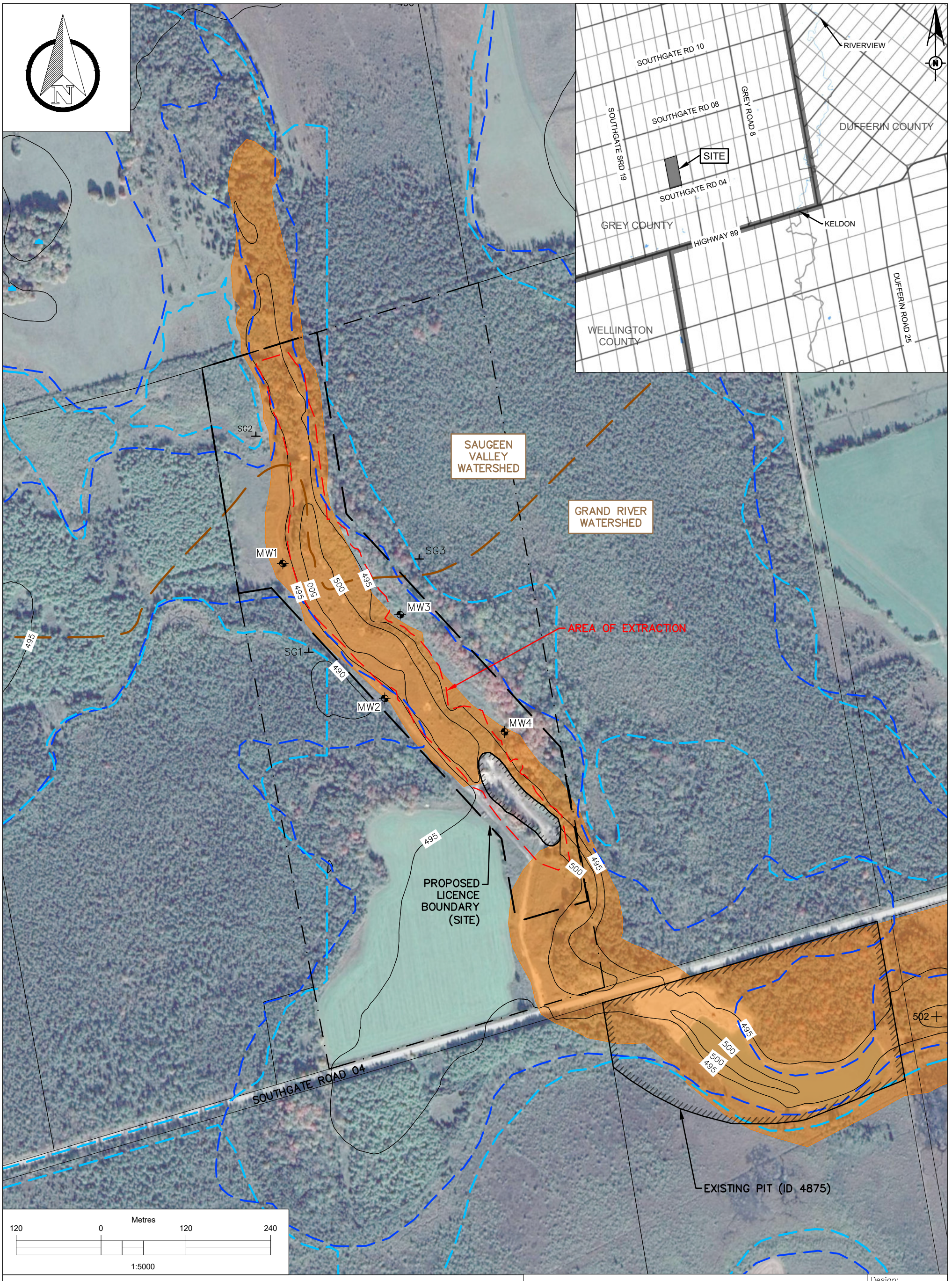
FIGURES



LEGEND

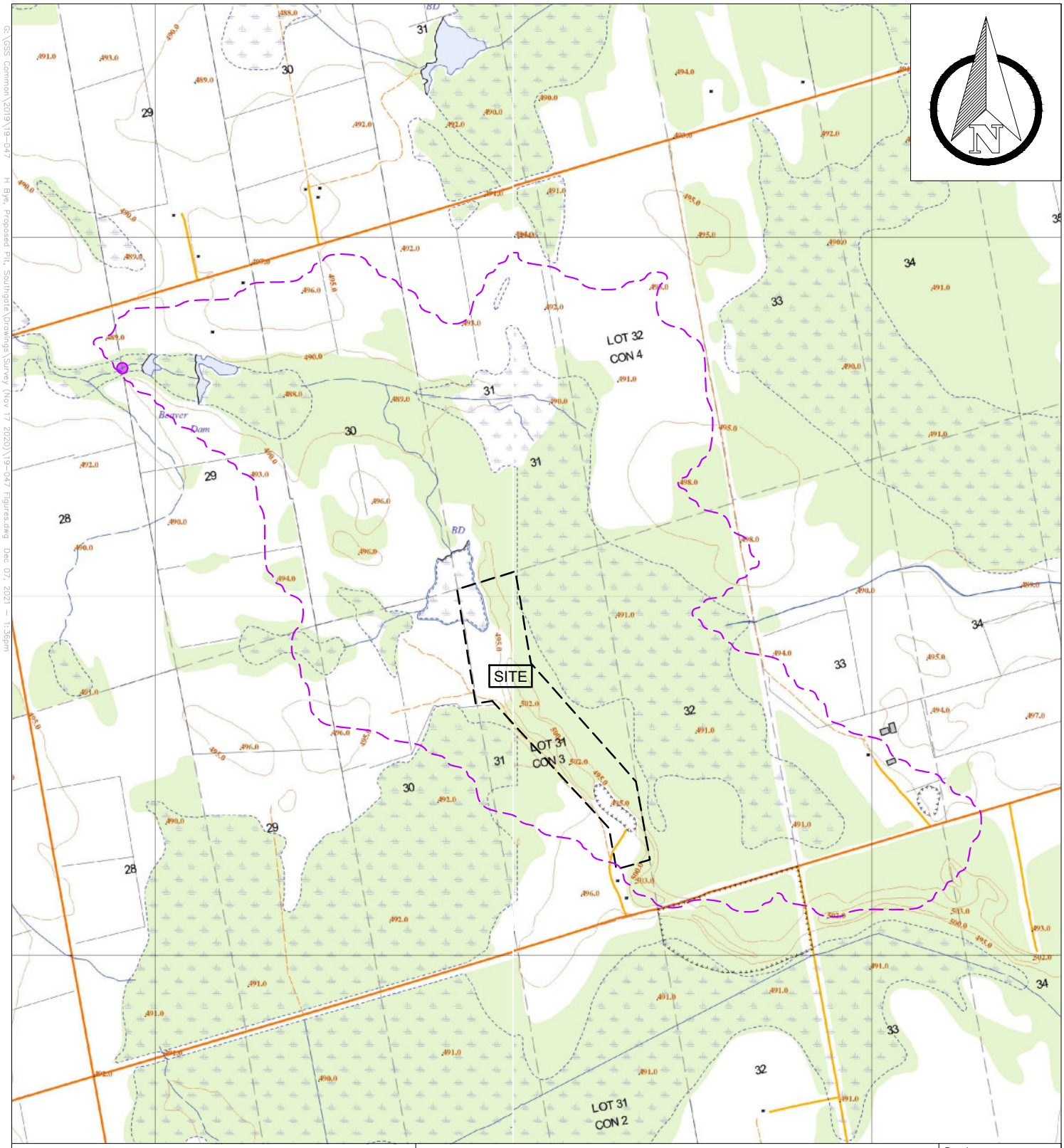
- PROPERTY OWNED BY APPLICANT
- FORMER WAYSIDE PIT (MNRF 1:10,000 ONTARIO BASE MAP, 2002)
- EARTH SCIENCE ANSI (MNRF NATURAL HERITAGE MAPPING)
- WETLAND (MNRF 1:10,000 ONTARIO BASE MAP, 2002)
- PROVINCIALLY SIGNIFICANT WETLAND (MNRF NATURAL HERITAGE MAPPING)
- 500 — 5m CONTOURS
- MONITORING WELL
- SURFACE WATER STAFF GAUGE
- WATERSHED BOUNDARY (GREY COUNTY MAPS)

REFERENCES
1. GREY COUNTY PARCEL MAPPING AND CONTOURS
2. GOOGLE EARTH IMAGE (OCT. 7, 2019)

Site Plan
H. Bye Construction Proposed Hogs Back Pit
Lot 31, Concession 3 (Proton)
Township of Southgate, Grey County

GSS ENGINEERING CONSULTANTS LTD

Design:	WBB
Drawn:	TDL
APPROVED:	MRS
Date:	DEC. 2021
Scale:	1:5000
FILE No.	19-047
FIG. No.	1



Area of Vegetation.

Area of Marsh.

Access Road.

Pit.

Beaver Dam.

Map Point for Subwatershed Boundary

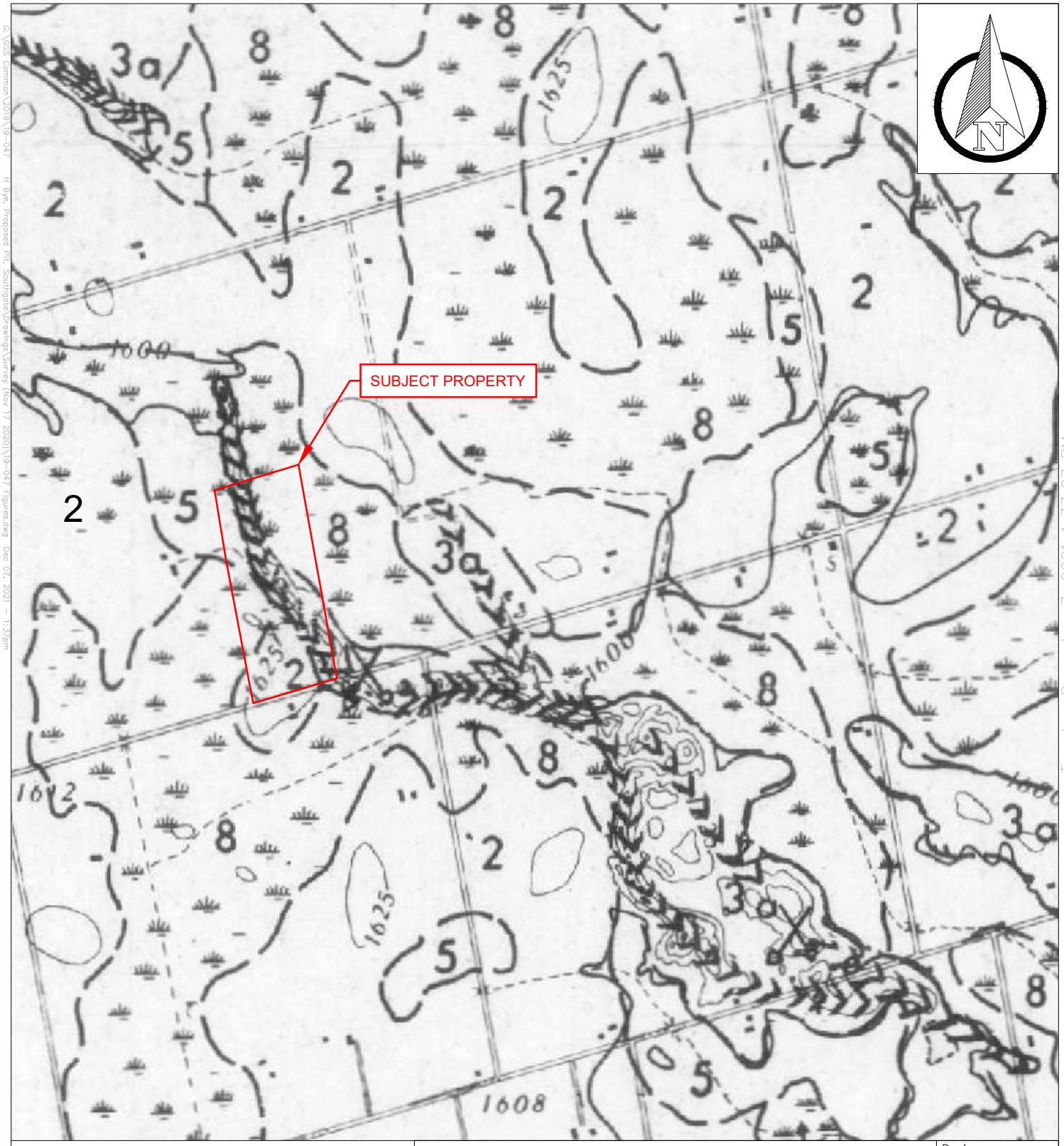
Subwatershed Boundary from MNRF OFAT

Reference: MNRF Ontario Base Map
(Air Photography 1982, Published 2002, 1:10,000)

Surface Drainage Plan
H. Bye Construction Proposed Hogs Back Pit
Lot 31, Concession 3 (Proton)
Township of Southgate, Grey County

GSS ENGINEERING CONSULTANTS LTD

Design:	WBB
Drawn:	TDL
APPROVED:	MRS
Date:	DEC. 2021
Scale:	1:15,000
FILE No.	19-047
FIG. No.	2



Reference: Gwyn, Q.H.J., 1972. Quaternary Geology of the Dundalk Area, Ontario Department of Mines and Northern Affairs, Map P.727 Scale 1:50,000.

8	Bog deposits. Peat, muck, and marl.
5	Glacial-outwash sand.
3	Ice-contact stratified drift. Sand and gravel, includes some till and silt. a) Mainly gravel. b) Mainly sand.
2	Till. Mainly sandy silty till with some pebbly silty sandy till.
	Sand or gravel pit.
	Esker (arrowheads show current direction).

Quaternary Geology Mapping
H. Bye Construction Proposed Hogs Back Pit
Lot 31, Concession 3 (Proton)
Township of Southgate, Grey County

GSS ENGINEERING CONSULTANTS LTD

Design:	WBB
Drawn:	TDL
APPROVED:	MRS
Date:	DEC. 2021
Scale:	1:25,000
FILE No.	19-047
FIG. No.	3

Metres
50 0 50 100
1:3000

N

LICENCE BOUNDARY
PROPERTY OWNED BY APPLICANT
PROPERTY LINE
LOT/CONCESSION LINE
495 EXISTING CONTOURS
× 495.0 SPOT ELEVATION
EXISTING FENCE (P&W)
EXISTING TREE LINE
TREE
ACCESS ROAD
WET AREA (FROM AVAILABLE MAPPING)
WETLAND LIMITS (FROM NETR, SAAR 2021)
POND FEATURE
WATERCOURSE
A CROSS-SECTION LOCATION

SOUTHGATE ROAD 04

LEGEND

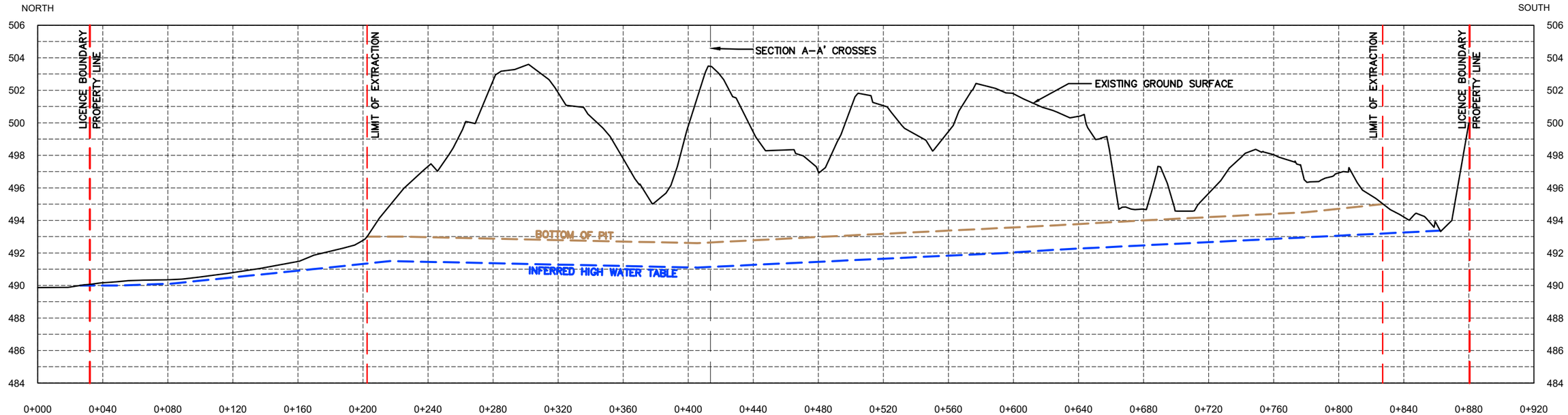
- MONITORING WELL
- SURFACE WATER STAFF GAUGE
- PREVIOUS TEST PIT (2019)
- SHALLOW PIEZOMETER
- LIMIT OF EXTRACTION
- 491.04 WATER ELEVATION (m) (MARCH 23, 2021)
- (491.2) INFERRED HIGH WATER TABLE ELEVATION (m)
- INFERRED HIGH WATER TABLE CONTOURS (m)
- 494.5 PROPOSED PIT BOTTOM ELEVATION (m)

Groundwater Monitoring Locations
H. Bye Construction Proposed Hogs Back Pit
Lot 31, Concession 3 (Proton)
Township of Southgate, Grey County

GSS ENGINEERING CONSULTANTS LTD

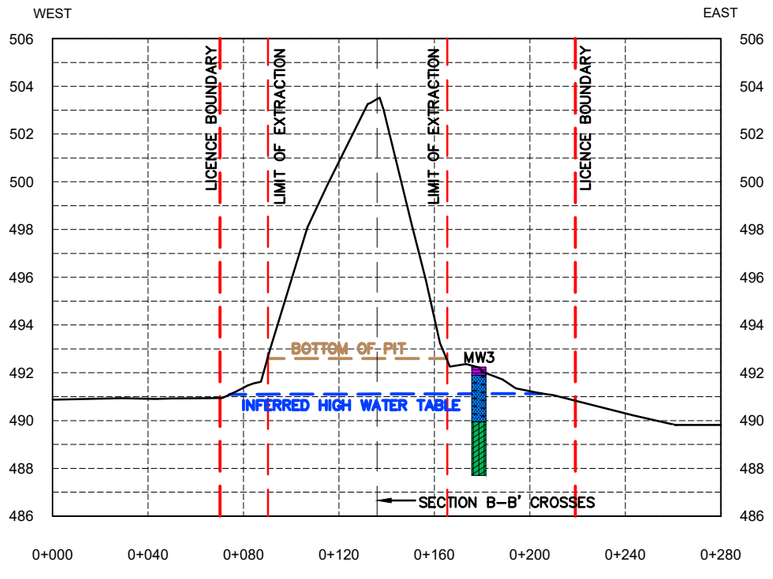
Design:	WBB
Drawn:	TDL
APPROVED:	MRS
Date:	DEC. 2021
Scale:	1:3000
FILE No.	19-047
FIG. No.	4

SECTION B-B'



HORIZONTAL SCALE 1:2500
VERTICAL SCALE 1:250

SECTION A-A'



HORIZONTAL SCALE 1:2500
VERTICAL SCALE 1:250

STRATIGRAPHY LEGEND

- TOPSOIL
- SAND & GRAVEL
- CLAYEY SILT TILL

Inferred Cross-Sections
H. Bye Construction Proposed Hogs Back Pit
Lot 31, Concession 3 (Proton)
Township of Southgate, Grey County

GSS ENGINEERING CONSULTANTS LTD

Design:	WBB
Drawn:	TDL
APPROVED:	MRS
Date:	DEC. 2021
Scale:	AS SHOWN
FILE No.	19-047
FIG. No.	5

APPENDIX A

Copy of February 27, 2020 GSS Technical Memo to MNRF

and Cover Letter

GSS ENGINEERING CONSULTANTS LTD

19-047

February 27, 2020

Ministry of Natural Resources and Forestry
Owen Sound Office
1450 7th Avenue East
Owen Sound, Ontario
N4K 2Z1

Attention: Mr. Jason McLay
Aggregate Technical Specialist

Re: **Preliminary Information for a Proposed ARA Licence Application**
H. Bye Construction Limited
Lot 31, Concession 3, Former Proton Township
Township of Southgate, Grey County

Dear Sir,

Further to our recent discussions, enclosed is a technical memorandum prepared by GSS Engineering on behalf of H. Bye Construction Limited to provide background information on a proposed above-water pit that would be located in Lot 31, Concession 3 (Proton) in the Township of Southgate (the Site). As we discussed, the Site is crossed by an esker that has been designated as a provincially significant earth science ANSI. The gravel resource is located within the esker, a portion of which was previously removed from a wayside pit formerly located on the Site. The memo was prepared to provide relevant information for the Ministry to consider in order to provide preliminary comments on the potential for obtaining MNRF approval for an above-water pit at this Site, and also to provide comments on appropriate steps to follow for addressing the related impacts to the ES-ANSI in the application process.

We would welcome an opportunity to meet with MNRF representatives at the Site so that the site conditions can be observed firsthand. Mr. Bye has indicated that he would be pleased to reimburse the Ministry for any expenses that would be incurred for a site visit.

We appreciate the opportunity to provide this information and we look forward to your comments.

Yours truly,

GSS Engineering Consultants Ltd.

W. Brad Benson, P.Eng.
Senior Hydrogeologist

WBB/bb

Enclosure: Technical Memorandum dated February 27, 2020

cc Randy Bye, H. Bye Construction Limited
Genevieve Scott, Cuesta Planning Consultants Inc.

GSS ENGINEERING CONSULTANTS LTD

TECHNICAL MEMORANDUM

To:	**Jason McLay, Aggregate Technical Specialist** **Ministry of Natural Resources and Forestry**	Date:	Feb. 27, 2020
From:	**Brad Benson, Ross Slaughter**	Pages:	10 plus 5 figures
Cc:	**Randy Bye, H. Bye Construction Limited** **Genevieve Scott, Cuesta Planning**	Project:	19-047
Subject:	**Preliminary Information on Proposed ARA Licence Application** **Lot 31, Concession 3 (Formerly Proton), Township of Southgate, Grey County**		

LOCAL HISTORY (Preamble by Randy Bye)

As with all local townships, pioneers built the original roads in Proton Township. Stumps, mud, swamps and bogs created many challenges; removing the trees was the easy part. Each deed granted by the Crown to the early pioneers came with an attached work order to help build the roads. When gravel was found during construction it didn't take long for the would-be roadbuilders to use it, and to use it wisely.

As the decades evolved, mechanical equipment replaced horses and scrapers replaced men with shovels. Small gravel pits in the 1920s and 30s were spotted wherever the resource was accessible. Many pits remained active until licensing became a necessity in the 1970s. In some cases, a decade passed before anyone complained about unlicensed pits being utilized. Provincial and municipal laws at one time permitted wayside permits for road construction and other municipal or provincial uses. Today, the remains of wayside and other unlicensed pits are abundant throughout Ontario. In Proton, with a short drive around, you can spot them very quickly as the resource was (and is) scarce at the least.

The current proposed pit is a former wayside pit. Photos suggest that approximately 50,000 tons or more has already been drawn from this unlicensed site, not including what was taken from the road allowance. The proximity to servicing the southeast corner of the township as well as Grand Valley make this commodity highly sought after (see attached letter from the Town of Grand Valley).

Throughout the years, previous landowners have cleared the "hog's back" on this property, perhaps with the thought of future extraction of this precious commodity, and perhaps without realizing all of the necessary steps that are required in order to make this process legal.

BACKGROUND

This memo provides preliminary information on a proposed licence application under the Aggregate Resources Act (ARA) by H. Bye Construction Limited for an above-water pit at Lot 31, Concession 3 in the geographic Township of Proton, now in the Township of Southgate in Grey County (the Site). The location of the Site in the Township of Southgate is shown on **Figure 1**. The proposed extraction would occur within an esker that crosses the Site from north to south. The esker on the Site is part of an area that has been identified by the Ministry of Natural Resources and Forestry (MNRF) as a provincially significant earth science Area of Natural and Scientific Interest (ES-ANSI). This memo is provided with the aim of obtaining preliminary comments from the MNRF on the feasibility of, and most suitable approach for, obtaining approval for extraction of sand and gravel from within the identified ES-ANSI on the Site.

PHYSIOGRAPHY

The Site is located within the Dundalk Till Plain (Chapman and Putnam, 1984). The till plain was formed by retreating glaciers and is a gently rolling, partially drumlinized and fluted surface at an elevation ranging between 523 and 485 m (Gwyn, 1975).

Ontario Geological Survey (OGS) Map P.2715 (Physiography of Southern Ontario, Chapman and Putnam, 1984) indicated the presence of four relatively long eskers crossing the Dundalk Till Plain, generally trending from northwest to southeast, as shown on **Figure 2**. Portions of what are currently referred to as the Egerton Esker and the Keldon Esker within Grey County have been designated as provincially significant ES-ANSIs. The Mountview Esker to the south, which was mapped primarily in Wellington County, and the Riverview Esker to the east, which was mapped primarily in Dufferin County, were not shown on MNRF natural heritage mapping to be designated ES-ANSIs. Gwyn (1975) and MacNaughton Hermsen, et al (2014) identified an additional feature northeast of the Riverview Esker in Dufferin County as the Shrigley Esker. On OGS Map P.2715, this feature was mapped as a kame moraine. The Shrigley Esker was not shown to be an ES-ANSI. Cowan (1979) identified two additional elongated eskers trending to the southeast at locations southwest of the Mountview Esker (see **Figure 3**). The more southerly of these, the Riverbank Esker, was also indicated on OGS Map P.2715. Cowan (1979) showed the Riverstown Esker between the Mountview and Riverbank Eskers. MNRF natural heritage mapping indicated that a portion of the Riverstown Esker was designated as an ES-ANSI. In general, available mapping indicated all of the eskers to be significant sand and gravel resources.

A summary of glaciation events in the former Proton Township was provided in the OGS Aggregate Resources Inventory of Proton Township (ARIP 51, 1981). The report indicated that at the time of maximum glacial extent, the township was covered by a submass of the main ice sheet which advanced to the southeast. The ice deposited a layer of glacial till at its base as it advanced. The Tavistock Till was reported to occur throughout the southern and central portion of the township and to form part of the extensive physiographic region identified as the Dundalk Till Plain. ARIP 51 (1981) reported that during a subsequent warming period the margin of the ice lobe melted back a short distance to the northwest but then readvanced, depositing the Elma Till. It was reported that

the Elma Till covers most of the central and northern parts of the former Proton Township and forms a rolling till plain with numerous drumlin hills. ARIP 51 (1981) indicated that the ice that deposited the Elma Till melted in place at the end of the glacial stage, with large amounts of meltwater flowing in crevasses and at the base of the ice forming several large southeast trending esker deposits. It was reported that these deposits formed two well-developed, single-segmented ridges in the southwestern and central portions of the former township. These ridges are reportedly composed of poorly to well sorted and stratified coarse gravel and sand and have been traditional sites for extraction.

AGGREGATE RESOURCES

ARIP 51 (1981) identified three primary sand and gravel resource areas in the former Proton Township. These consisted of both of the large eskers as well as the extensive deposit of ice-contact stratified drift located between the eskers at Kingscote. It was reported that the coarse aggregate in the drift deposit was variable in distribution and may be unsuitable for crushing.

What is currently known as the Keldon Esker was identified as Selected Sand and Gravel Resource Area 1. It was reported that the esker consisted of a single, sharply-defined ridge with local relief of 8 to 18 m. The segment at the southern boundary was reported to consist of several branching segments and was associated with ice-contact stratified drift (i.e., kame deposits). The esker ridge was reported to be "beaded" for most of its length, consisting of numerous ridge segments separated by short intervals of subdued or absent ridge and finer-textured material. Oversize material was noted to be present throughout the deposit. In the southern end of Resource Area 1, the distribution of coarse material within the deposit was reported to be more variable, particularly within the kame deposits.

ARIP 51 (1981) indicated that there were three sources licensed for extraction in Resource Area 1. The mapped locations of those licensed pits coincided with current MNRF IDs 4899 (Terry Mather), 4898 (Township of Southgate), and 4841 (Mike Croft Contracting Inc.). An additional ten (10) sources in Resource Area 1 were identified as unlicensed sand or gravel pits (abandoned pit or wayside pit operating on demand under authority of a permit). ARIP 51 (1981) noted that since Proton Township was designated in 1975 under the Pits and Quarries Control Act of 1971, many sand and gravel pits became inactive. One of the inactive pits was identified on the Site. The accompanying information in Table 2 in ARIP 51 (1981) identified this pit as MTC No. D4-61, indicating that it was likely to have been a wayside pit under the Ministry of Transportation and Communications. The presence of this pit was indicated on 2002 MNRF 1:10,000 Ontario Base Map (OBM) topographic mapping (air photography 1982) for the vicinity of the Site and is shown on the attached Site Plan, **Figure 4**. Table 2 in ARIP 51 (1981) indicated that the face height of the pit was 3 to 5 m, with 40 to 50% gravel.

ARIP 51 (1981) noted that the two large eskers contained virtually all of the former Proton Township's possible resources of crushable aggregate and were an important component of the local resource base. The two eskers were selected as Sand and Gravel Resource Areas of Primary Significance. The report concluded that these deposits contained large amounts of high-

quality material and should be protected as much as possible to preserve the remaining material for future extraction.

In addition to the three licensed pits identified in ARIP 51 (1981), current MNRF pits and quarries mapping indicated that there are currently four additional licensed pits in Resource Area 1 – IDs 4877 (Township of Southgate), 5112 (Jerry Jack), 4953 (1765508 Ontario Inc.), and 4875 (Town of Grand Valley). Three of those pits appeared to coincide with locations shown as unlicensed pits in ARIP 51 (1981). Licensed pit 4875 is located on the south side of Southgate Road 04, as indicated on Figure 4. Based on information obtained from the MNRF, the current site plans for that pit were prepared in 1992 and approved by the MNRF in 1993. The approved licence boundary is located within the ES-ANSI. The Existing Features plan showed a small above-water pit located near the road in 1992. ARIP 51 (1981) showed an unlicensed pit at that location. That site was approved for below-water extraction to elevation 485 m.

The three primary sand and gravel resources areas identified in ARIP 51 (1981) are currently shown as primary aggregate resource areas in the Township of Southgate Official Plan (Schedule C Environmental Constraints, consolidated January 2009). In the Grey County Official Plan (June 2019), only a relatively small area in the southeast corner of the Site was mapped as High Potential Mineral Aggregate Resources (Map 2, Schedule B). It appeared from the Grey County Aggregate Resource Inventory Master Plan (2004) that much of the primary sand and gravel resource area on the Site was not included because of the proximity of provincially significant and other wetlands. It did not appear that the primary sand and gravel resource was excluded because of the presence of the ES-ANSI because other portions of the Keldon Esker and most of the Keldon Esker – Northern Extension were mapped as High Potential Mineral Aggregate Resources. The presence of wetlands on the Site will be assessed in conjunction with the proposed licence application.

EARTH SCIENCE ANSI DESIGNATION

The identified sand and gravel resources on the Site are mapped as part of a provincially significant ES-ANSI identified as the Keldon Esker. The mapped extent of the Keldon Esker ES-ANSI is shown on **Figure 5**. The Keldon Esker ES-ANSI is relatively narrow across the Site and extends approximately 300 m north of the Site into Lot 31, Concession 4. The portion of the Site that was occupied by the former wayside pit was excluded from the ES-ANSI. South of the Site, the Keldon Esker ES-ANSI is wider and extends south to the south boundary of Grey County at Highway 89. That portion of the ANSI includes the mapped twin eskers and the associated ice-contact stratified drift (Gwyn, 1975). The mapped portion of the esker located north of Southgate Road 04 and east of the Site (Gwyn, 1975) was shown at a lower elevation and was not included in the ES-ANSI.

Four portions of the Keldon Esker located further north of the Site between Southgate Road 10 and Grey Road 9 were mapped as a separate ES-ANSI, currently identified as the Keldon Esker – Northern Extension.

Relatively little information has been obtained to date on the rationale for designating the Keldon Esker as a provincially significant ES-ANSI. The MNRF document Ontario's Natural Heritage Areas

(2009) noted that ES-ANSIs are geological in nature and consist of some of the most significant representative examples of the bedrock, fossil and landforms in Ontario and include examples of ongoing geological processes. The document described five selection criteria used to evaluate candidate sites: representation, condition, diversity, other ecological considerations, and special features. Using those criteria, ANSIs are assessed and graded as provincially, regionally, or locally significant. Provincially significant ES-ANSIs are to contain the best examples of earth science features and processes for an environmental theme.

The identification and confirmation procedure for ANSIs was described in the 2011 MNRF document "Identification and Confirmation Procedure for Areas of Natural and Scientific Interest", which replaced a 2000 document with the same title. The Procedure described a seven-step evaluation, notification, and communication process, as follows:

1. Identify Priorities and Complete Work Planning
2. Plan for ANSI Fieldwork
3. Landowner/Municipality/District Notice
4. Fieldwork and Data Analysis
5. Report Writing
6. Report Review by ANSI Review Committee
7. ANSI Report Approvals

To date, through requests to the Natural Heritage Information Centre and the MNRF District Office, only limited information on the Keldon Esker ANSI has been obtained. We are uncertain if an ANSI report as described in the 2011 Procedure exists.

A copy of the documentation obtained from the MNRF District Office for the Keldon Esker and the Keldon Esker – Northern Extension ES-ANSIs is attached. For the Keldon Esker, the documentation consisted of 1.5 pages of text, with no date or author indicated, and a portion of a 1970 topographic plan marked with the esker location and the limits of the ANSI. The first page of text largely described the glacial origin of the Keldon Esker and the basis for separating the Keldon Esker and Keldon Esker – Northern Extension based on the age of the associated tills. The geological references that were cited included the following:

- Chapman and Putnam, 1984;
- Sharpe and Broster, 1977;
- Barnett et al, 1991.

The reference to Barnett, et al, 1991 (inferred to be Quaternary Geology of Ontario, Southern Sheet, OGS Map 2556) indicated that the documentation provided was produced after 1991.

The last paragraph of the document noted that the area having the best potential to represent the Tavistock Till segment of the Keldon Esker (i.e., the Keldon Esker ANSI) was where the ridge straddled the boundary separating Concessions 1 and 2 in Proton Township. The Site is located in Concession 3 of the former of Proton Township and therefore north of the area identified as having the best potential to represent the Keldon Esker ES-ANSI.

For the Keldon Esker – Northern Extension, the documentation obtained consisted of 1.5 pages of text, with no date or author indicated, a mosaic plan with portions of a topographic plan and an aerial image showing the limits of the four segments that comprised the ANSI, and a 2-page computer printout for the Keldon Esker Extension.

The computer printout for the Keldon Esker Extension noted that the status was a nominated ANSI. The year that the document was prepared could not be discerned. Most of the document consisted of a detailed description of the ANSI boundaries. Under the heading of Comments, the following information was included:

- ANSI consists of 4 separate areas;
- selected areas free from disturbance;
- esker is under pressure from extraction;
- boundaries reflect meandering nature of esker and effects of extraction on the continuity of the esker (i.e., needed 4 boundaries).

Most of the text portion of the documentation obtained for the Keldon Esker – Northern Extension was similar to the text obtained for the Keldon Esker ANSI.

PREVIOUS STUDIES

An assessment of the depositional and deformational structures of the Keldon Esker, together with the Egerton and Mountview Eskers, was presented in a 1990 thesis submitted to Wilfrid Laurier University by John D. Parish. Mr. Parish went on to found Parish Geomorphic Ltd. in 1997 and was a prominent fluvial geomorphologist in Ontario. In this 1990 thesis, the Keldon Esker was referred to as the Hopeville Esker. The principal objective of the thesis was to perform a detailed sedimentological analysis of the eskers in an effort to deduce the processes responsible for their formation. Mr. Parish observed, documented, and sampled primary sedimentary structures at eight (8) exposures along the Keldon Esker. One of those exposures may have been the previous wayside pit at the Site, although this could not be confirmed from the mapping provided. Mr. Parish indicated that the most detailed information for assessment of the esker was obtained from four active pits which provided fresh exposures. This indicated the importance of active pits for facilitating study of the esker.

PROPOSED PIT

The current proposal is to make an application under the Aggregate Resources Act for an above-water pit at the Site. A groundwater assessment will be carried out to establish the water table elevation at the Site and to provide comments on the potential for hydrogeological-related impacts to nearby wetlands and surface water features from the proposed above-water extraction. A natural environment assessment will be carried out and will include identification of the limits of the nearby wetlands on the Site and appropriate setbacks for the area of extraction. As the proposal is for an above-water pit at the Site, it is currently considered unlikely that the extraction would impact nearby wetlands. It is anticipated that the subsurface investigation to identify the water table

elevation would provide information on the elevation and nature of the till adjacent to the esker on the Site.

A preliminary proposed licence boundary is shown on Figure 4 and is provided for initial MNRF comments. Based on this proposed boundary, the existing esker feature on the Site south of the former wayside pit would remain in its current form. In addition, approximately 150 m of the existing esker feature at the north end of the Site, in closest proximity to the mapped provincially significant wetlands, would remain in its current form.

PROVINCIAL POLICY

Policy direction on matters of provincial interest related to land use planning and development are outlined in the Provincial Policy Statement (PPS). Section 2.1.5 of the PPS (2014), under the heading of 2.1 Natural Heritage, states that "Development and site alteration shall not be permitted in: … e) significant areas of natural and scientific interest … unless it has been demonstrated that there will be no negative impacts on the natural features or their ecological functions.

Section 2.5.1 of the PPS, under the heading of 2.5 Mineral Aggregate Resources, states that "Mineral aggregate resources shall be protected for long-term use and, where provincial information is available, deposits of mineral aggregates shall be identified." Section 2.5.2.1 of the PPS, under the heading of 2.5.2 Protection of Long-Term Resource Supply, states that "As much of the mineral aggregate resources as is realistically possible shall be made available as close to markets as possible. Demonstration of need for mineral aggregate resources, including any type of supply/demand analysis, shall not be required, notwithstanding the availability, designation or licensing for extraction of mineral aggregate resources locally or elsewhere." Section 2.5.2.2 states that "Extraction shall be undertaken in a manner which minimizes social, economic and environmental impacts."

It is our understanding that Sections 2.1 Natural Heritage and 2.5 Mineral Aggregate Resources of the PPS have equal standing. For the proposed pit at the Site the two measures are in conflict as utilization of the aggregate resource will necessarily result in removal of the landform designated as an ES-ANSI.

SUMMARY

Based on our review, the following information was considered to be relevant with respect to potentially obtaining approval for extraction of sand and gravel from within the identified ES-ANSI on the Site.

- The Keldon Esker was one of seven relatively long eskers on the Dundalk Till Plain that were identified from a review of physiographic and geological mapping. To date, detailed information on the characteristics of the Keldon Esker that supported designation of portions of the esker as a provincially significant ES-ANSI has not been obtained.

- The OGS Aggregate Resources Inventory for the geographic Township of Proton (ARIP 51, 1981) noted that the eskers currently identified as the Keldon Esker and Egerton Esker, which has also been designated as a provincially significant ES-ANSI, constituted the only source of crushable aggregate in the township and were an important component of the local resource base. The report concluded that these deposits should be protected as much as possible to preserve the remaining material for future extraction.
- The Keldon Esker on the Site has been identified as a primary sand and gravel resource in the Southgate Township and Grey County Official Plans.
- To date, only limited information on the Keldon Esker ES-ANSI has been obtained. We are uncertain if an ANSI report as described most recently in the 2011 MNRF Identification and Confirmation Procedure exists. The reasoning and process for the ES-ANSI designation is not clear to us.
- Documentation obtained from the MNRF noted that the area having the best potential to represent the Keldon Esker ES-ANSI was where the ridge straddled the boundary separating Concessions 1 and 2 in the former Proton Township. The proposed licensed area on the Site is located in Concession 3 of the former Proton Township, approximately 1.8 km northwest of the location where the Keldon Esker straddles the boundary between Concessions 1 and 2.
- A 1990 study of the depositional and deformational structures of the Keldon Esker, together with the Egerton and Mountview Eskers, noted that fresh exposures in active pits provided the most detailed information for assessment of the eskers.
- A portion of the Keldon Esker on the Site was previously extracted from a wayside pit that was located on the Site prior to 1981.
- A portion of the Keldon Esker ES-ANSI located south of the Site was previously approved by the MNRF for a below-water pit. The plans obtained indicated that approval was provided in 1993.
- In addition to stating that development and site alteration shall not be permitted in significant ANSIs where there will be significant impacts to the natural features, the Provincial Policy Statement (2014) also states that aggregate resources shall be protected for long-term use and as much of the resources as is realistically possible shall be made available as close to markets as possible.

We trust that this provides sufficient information for the MNRF to provide preliminary comments on the proposed licence application.

GSS Engineering Consultants Ltd.

W. Brad Benson, P.Eng.
Senior Hydrogeologist

Ross Slaughter, P.Eng.
Water Resources Engineer

Attachments: Figures 1 to 5

Documentation from MNRF on the Keldon Esker and Keldon Esker – Northern Extension ES-ANSIs

Copy of December 10, 2019 letter from Town of Grand Valley to H. Bye Construction Limited

REFERENCES

Barnett, P.J., Cowan, W.R., and Henry, A.P. (1991). *Quaternary Geology of Ontario, Southern Sheet*, Ontario Geological Survey, Map 2556, Scale 1:1,000,000.

Chapman, L.J., and Putnam, D.F. (1984). *Physiography of Southern Ontario*, Ontario Geological Survey, Map P.2715, Scale 1:600,000.

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Cowan, W.R. (1979). *Quaternary Geology of the Palmerston Area, Southern Ontario*, Ontario Geological Survey Report 187, 64 p., Accompanied by Maps 2383, 2384, Scale 1:50,000.

Gwyn, Q.H.J. (1975). *Quaternary Geology of the Dundalk Area, Southern Ontario*, Ontario Division of Mines Open File Report 5132, 138 p., Accompanied by Maps P.727, P.1023, Scale 1:50,000.

Jagger Hims Limited, Skelton Brumwell & Associates Inc., ESG International, C.N. Watson Limited (2004). *Aggregate Resources Inventory Master Plan, Grey County*, October 2004.

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Ontario Geological Survey (1984). *Aggregate Resources Inventory of Egrement Township, Grey County,* Ontario Geological Survey Aggregate Resources Inventory Paper 85, 39 p.

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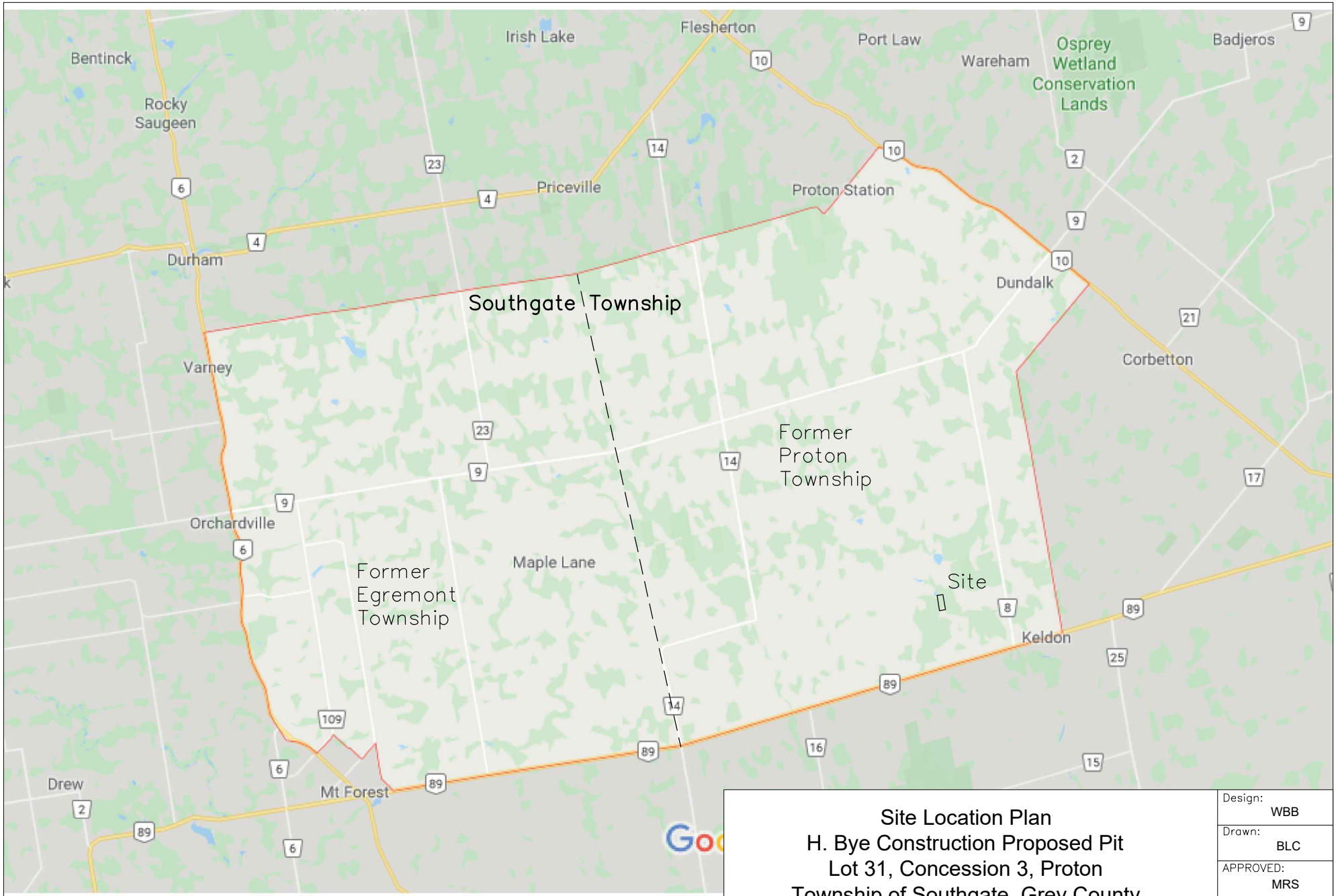
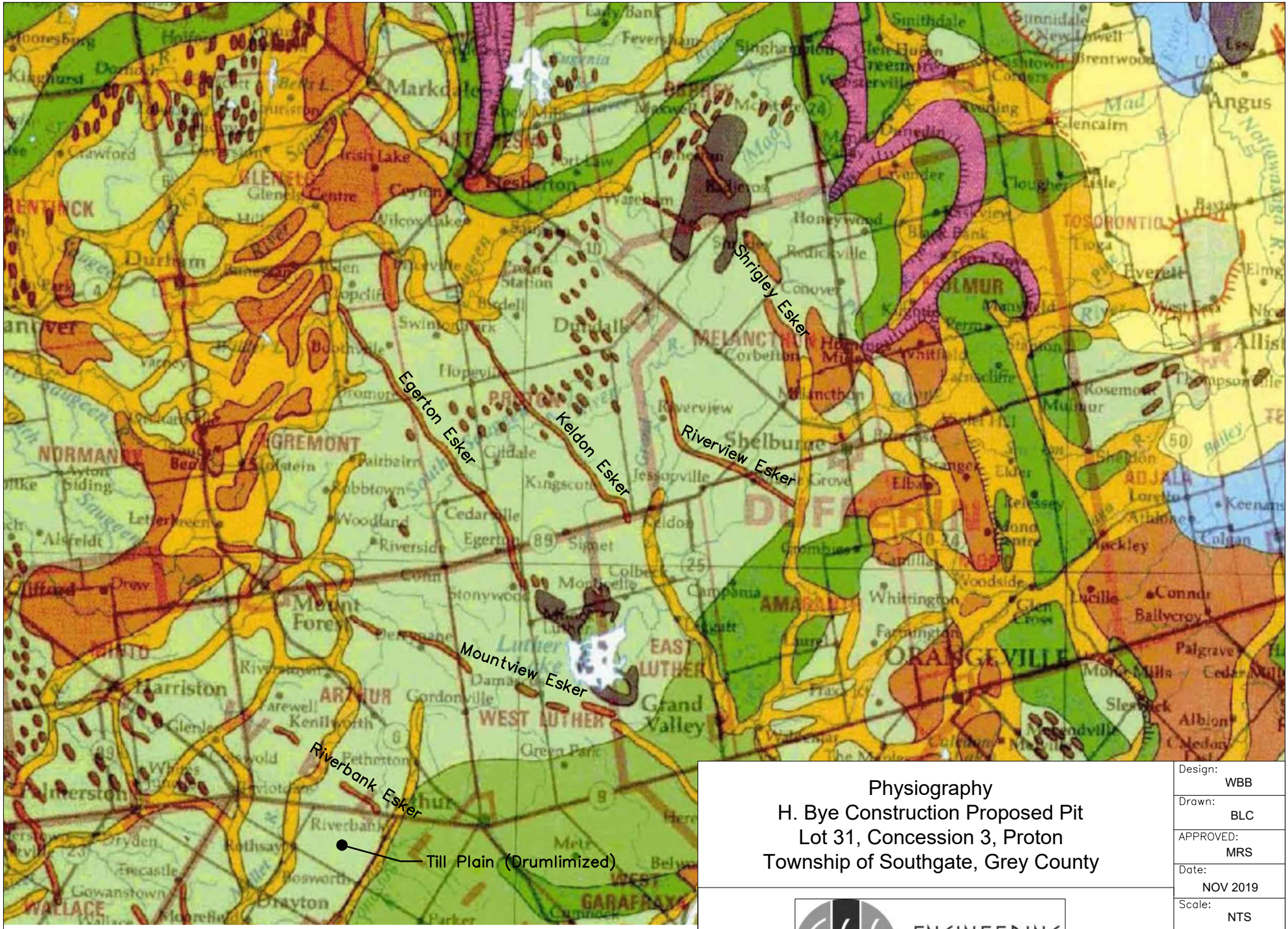


Site Location Plan
H. Bye Construction Proposed Pit
Lot 31, Concession 3, Proton
Township of Southgate, Grey County

GSS ENGINEERING CONSULTANTS LTD

Design:	WBB
Drawn:	BLC
APPROVED:	MRS
Date:	NOV 2019
Scale:	NTS
FILE No.	19-047
FIG. No.	1

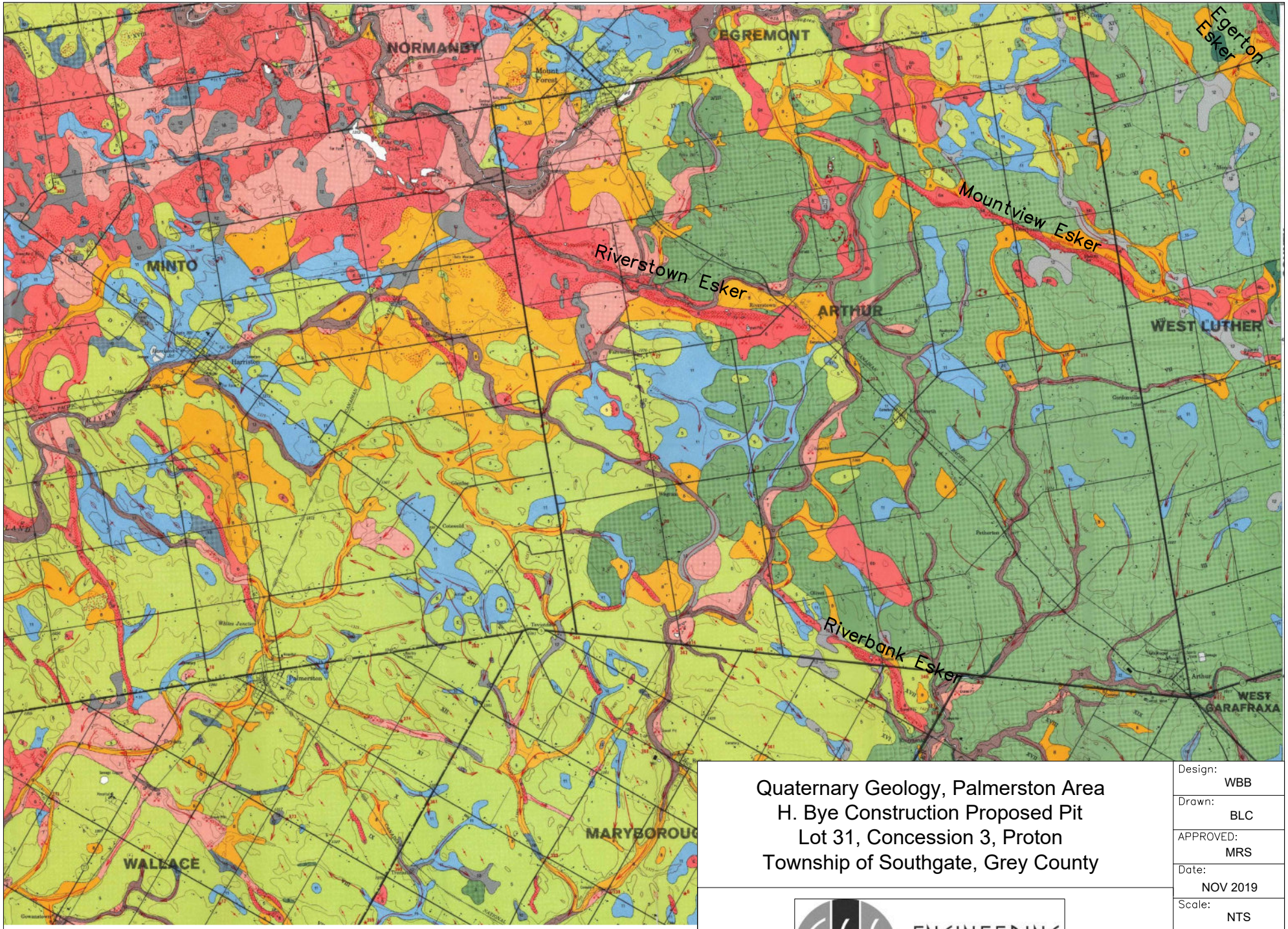


Reference: Chapman and Putnam 1984. Physiography of Southern Ontario, OGS Map P.2715, Scale 1:600,000.

Physiography
H. Bye Construction Proposed Pit
Lot 31, Concession 3, Proton
Township of Southgate, Grey County

GSS ENGINEERING CONSULTANTS LTD

Design:	WBB
Drawn:	BLC
APPROVED:	MRS
Date:	NOV 2019
Scale:	NTS
FILE No.	19-047
FIG. No.	2



Reference: Cowan, W.R. (1979). Quaternary Geology of the Palmerston Area, OGS Map 2383, Scale 1:50,000.

Quaternary Geology, Palmerston Area
H. Bye Construction Proposed Pit
Lot 31, Concession 3, Proton
Township of Southgate, Grey County

GSS ENGINEERING CONSULTANTS LTD

Design:	WBB
Drawn:	BLC
APPROVED:	MRS
Date:	NOV 2019
Scale:	NTS
FILE No.	19-047
FIG. No.	3

Metres
120 0 120 240
1:5000

PROPOSED LICENCE BOUNDARY

EXISTING PIT (ID 4875)

SOUTHGATE ROAD 04

LEGEND

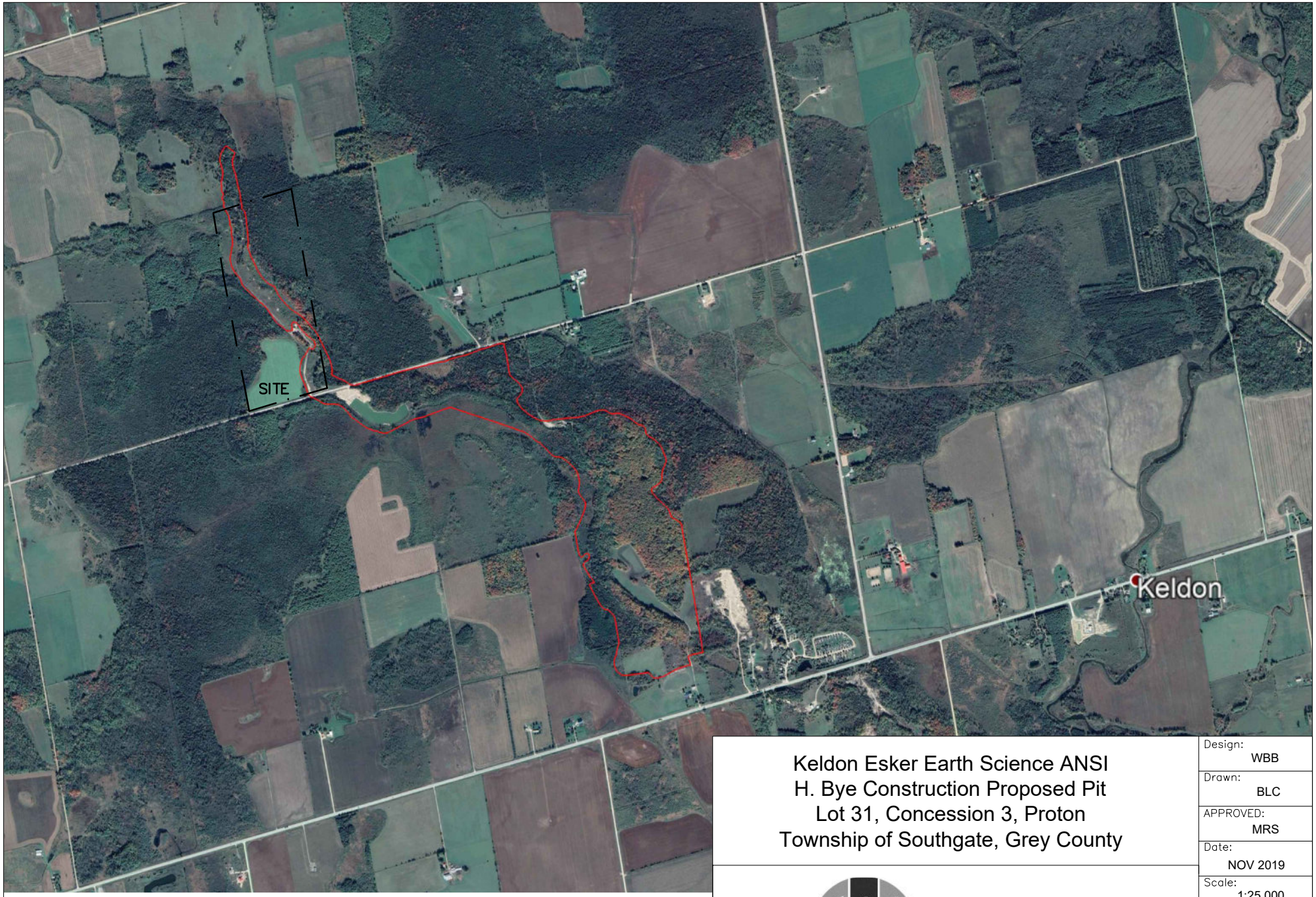
- SITE BOUNDARY
- EXISTING PIT (MNRF 1:10,000 OBM MAPPING, 2002)
- EARTH SCIENCE ANSI (MNRF NATURAL HERITAGE MAPPING)
- WETLAND (MNRF 1:10,000 OBM MAPPING, 2002)
- PROVINCIALLY SIGNIFICANT WETLAND (MNRF NATURAL HERITAGE MAPPING)
- 500 — 5m CONTOURS
- 495 SPOT ELEVATION (MNRF 1:10,000 OBM MAPPING, 2002)

REFERENCES
1. GREY COUNTY PARCEL MAPPING AND CONTOURS
2. GOOGLE EARTH IMAGE (OCT. 7, 2019)

Site Plan
H.Bye Construction Proposed Pit
Lot 31, Concession 3, Proton
Township of Southgate, Grey County

GSS ENGINEERING CONSULTANTS LTD

Design:	WBB
Drawn:	TDL
APPROVED:	MRS
Date:	NOV. 2019
Scale:	1:5000
FILE No.	19-047
FIG. No.	4



Reference: Google Earth Image (Oct. 7, 2019).

0 600 1200
Meters

Keldon Esker Earth Science ANSI
H. Bye Construction Proposed Pit
Lot 31, Concession 3, Proton
Township of Southgate, Grey County

GSS ENGINEERING CONSULTANTS LTD

Design:	WBB
Drawn:	BLC
APPROVED:	MRS
Date:	NOV 2019
Scale:	1:25,000
FILE No.	19-047
FIG. No.	5

Keldon Esker

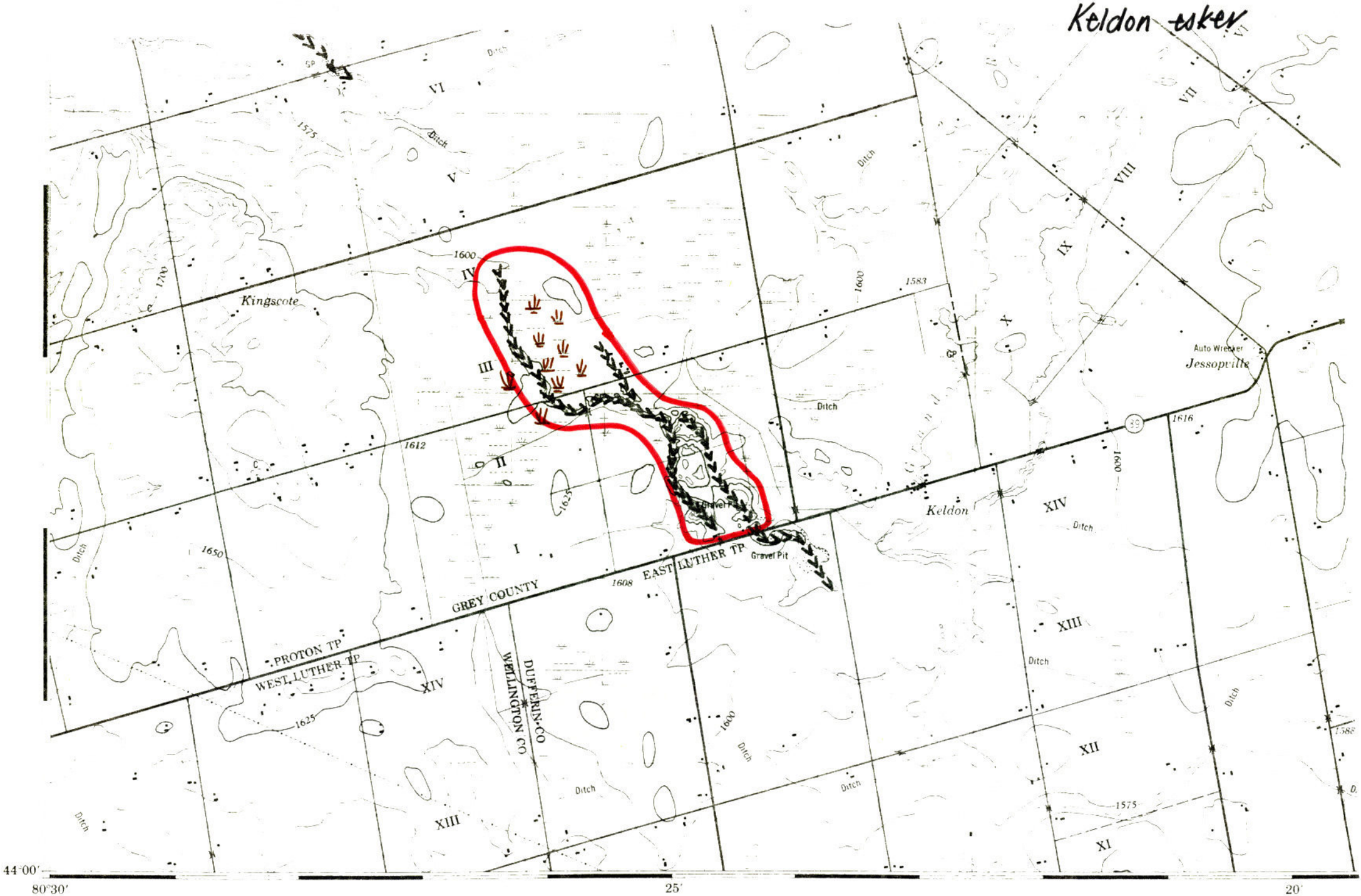
The Keldon Esker is a long, slightly discontinuous, primarily single ridge feature that is depicted on most maps (e.g., Chapman and Putnam, 1984) as traceable from Keldon on Highway 89 at the south end of Proton Township northwest to the Saugeen River near the township's northern boundary. Sharpe and Broster (1977) show it continuing beyond the Saugeen River to Turner Lake in Artemesia Township. Barnett et al. (1991) also show it terminating near Turner Lake and extend it further southeast from Keldon towards Laurel in Amaranth Township. They also show it passing through a gap in the Maple Lane Moraine northeast of Hopeville. The Maple Lane Moraine is typically described as a recessional moraine that formed during a temporary halt in the, glacier's retreat. According to the current research literature the Keldon Esker was formed during the Port Bruce Stade, which, in this area, involved a number of advances associated with the combined Huron-Georgian Bay Lobe. The oldest and most important of these advances laid down the Tavistock Till. Following a number of minor advances, the combined lobes are described as acting independently towards the end of the Stade in that the Georgian Bay lobe advanced and deposited the Elma Till and the Huron lobe the Rannoch Till inland from the Lake Huron shoreline. The distinct time difference between the Elma and Tavistock Tills presents a problem for most renditions of the Keldon Esker in that the two tills and the time difference infer distinct advances. Recent mapping in this area (Sharpe & Broster, 1976; Barnett et al., 1991) shows the Elma Till extending southeasterly to roughly the boundary separating Wellington and Grey Counties. If this is the case, it is difficult to envision the Keldon Esker as one contiguous ridge system straddling two till types that were deposited at two different times (i.e., the older Tavistock Till at the beginning of the Port Bruce Stade and the Elma Till near the end). What are the chances of the lower and upper halves of each esker system in this belt being aligned in the manner that they appear to be? If, on the on hand, the Elma Till is only an up-ice phase of the Tavistock Till, it would not be contemporaneous with the Rannoch Till. In the two advances scenario the southern end would have been deposited in association with retreating Tavistock ice and the northern end in association with retreating Elma ice. It can be assumed, in these circumstances, that there would be some evidence along the ridge system marking where the advancing Elma ice halted.

This conundrum has some bearing on choosing a site in that the Ministry has divided the ridge system into two separate entities. This checksheet relates to the south section, which the Ministry refers to as Keldon Esker. The northern section (covered by a separate checksheet) is referred to as Keldon Esker-Northern Extension. If they are not two separate ridge systems formed by different advances there is not much need to distinguish between the two ends. If the ridge system was formed by two advances it would be appropriate to determine where along the lineal system that the physical separation occurred. In this area (i.e. between Egerton and Dundalk), the height of land separating the Saugeen and Grand River systems appears to roughly approximate the Elma and Tavistock Tills and, accordingly, the terminal halt of the advance that deposited the Elma Till. I believe this watershed divide between Riverview in the east and Kingscote in the west marks the halt position for this

advance and essentially separates the so-called Keldon Esker into two distinct physical entities that were formed at two different times. Based on the watershed distinction and aerial photos the advance is assumed to have truncated the southern section (i.e., the ridge that formed in association with retreating Tavistock ice) along the Proton Township road separating Concessions 4 and 5 (a hill just northwest of Kingscote appears to have eroded ice-contact slopes on its back side).

In light of the above discussion, the area having the best potential to represent the Tavistock Till segment of the Keldon Esker is where the ridge straddles the boundary separating Concessions 1 and 2 in Proton Township. There are three bulbous expansions on the east side of the sinuous ridge in this area at the 505 metre (1657 feet) contour that could have formed in meltwater ponds ;either on or within the ice or a pro-glacial lake at the level at which this delta or deltas formed or perhaps a Huron-Erie Port Bruce-related basinal lake that reached this far north on the Ontario Island and is now severely tilted due to isostatic uplift. I favour the latter scenario as there appears to be shoreline features at the same contour along this isobar to the northeast in the Kingscote area. They probably formed as one integral ice-contact "perched" or "hanging" delta, (but have the appearance of three separate entities due to the fact that the feature is partitioned by (kettle holes and troughs. The two southerly sections appear flat-top while the northern one is ridged. This uppermost part also provides direct evidence that the ice made a brief halt at this site. What initially appears to be shallow pro-glacial meltwater ponding on both the east and west sides of the esker, but more so on the west side, at roughly the 491 metre level may represent a lower level in the postulated Port Bruce lake set described above. Extensive swamps now mantle the bottoms of what I believe was a former lake bed. The significance of this general area (i.e., the (esker ridge and swamps) can be seen in the fact that it has been designated a regionally significant Life Science ANSI (Lindsay, 1980; Keldon Esker and Swamp), an International Biological Program site (IBP), a Ministry of Natural Resources Sensitive Area and an Environmentally Sensitive Area in South Grey.

Chapman&Putnam,84 Cordiner,88;IBP,72;Lindsay,80;Sharpe&Broster,77



Produced 1970 by the SURVEYS AND MAPPING BRANCH,
DEPARTMENT OF ENERGY, MINES AND RESOURCES.
Updated from aerial photographs taken in 1959. Culture check
1970. Printed 1972

Keldon Esker N Extension

The Keldon Esker is a long, slightly discontinuous, primarily single ridge feature that is depicted on most maps (e.g., Chapman and Putnam, 1984) as traceable from Keldon on Highway 89 at the south end of Proton Township northwest to the Saugeen River near the township's northern boundary. Sharpe and Broster (1977) show it continuing beyond the Saugeen River to Turner Lake in Artemesia Township. Barnett et al. (1991) also show it terminating near Turner Lake and extend it further southeast from Keldon towards Laurel in Amaranth Township. They also show it passing through a gap in the Maple Lane Moraine northeast of Hopeville. The Maple Lane Moraine is typically described as a recessional moraine that formed during a temporary halt in the glacier's retreat. According to the research literature, the Keldon Esker formed during the Port Bruce Stade, which, in this area, involved a number of advances associated with the combined Huron-Georgian Bay Lobe. The oldest of these advances laid down the Tavistock Till. After retreating, the combined lobes are described as acting independently towards the end of the Stade in that the Georgian Bay lobe advanced and deposited the Elma Till and the Huron lobe be Rannoch Till inland from the Lake Huron shoreline (I am not convinced the latter two events are related in that I believe the Rannoch Till is associated with an advance that ploughed its way from Walkerton to Wilder Lake and, in doing so, deposited the first tranche of Dunkeld Till). The distinct time difference between the Elma and Tavistock Tills presents a problem for most renditions of the Keldon Esker in that the two tills and the time difference infer distinct advances. Recent mapping in this area (Sharpe & Broster, 1976; Barnett et al., (1991) shows the Elma Till as extending southeasterly to roughly the boundary separating Wellington and Grey Counties. If this is the case, it is difficult to envision the Keldon Esker as one contiguous ridge system straddling two till types that were deposited at two different times (i.e., the older Tavistock Till at the beginning of the Port Bruce Stade and the Elma Till near the end). What are the chances of the lower and upper halves of each esker system in this belt being aligned in the manner that they appear to be? If, on the one hand, the Elma Till is only an up-ice phase of the Tavistock Till, it would not be contemporaneous with the Rannoch Till. In the two advances scenario the southern end would have been deposited in association with retreating Tavistock ice and the northern end in association with retreating Elma ice. It can be assumed, in these circumstances, that there would be some evidence along the ridge system marking where the advancing Elma ice halted.

This conundrum has some bearing on choosing a site in that the Ministry has divided the ridge system into two separate entities. The south section is referred to as Keldon Esker and the northern section, to which this checksheet pertains, as Keldon Esker-Northern Extension. If they are not two separate ridge systems formed by different advances there is no need to distinguish (between the two ends. If the ridge system was formed by two advances it would be appropriate to determine where the physical separation occurs. To align the checksheet description with the literature, I have used the height of land separating the Saugeen and Grand River systems in this area (i.e., between Kingscote and Riverview) to mark where the advance that laid down the Elma

Till halted. This depiction separates the so-called Keldon Esker into two distinct physical entities that were formed at two different times. Based on the watershed distinction and aerial photos the Elma advance is assumed to have truncated the southern ridge section (i.e., the ridge that formed in association with retreating Tavistock ice) at roughly the Proton Township road separating (Concessions 4 and 5. From this point northwards the retreating Elma ice formed the Northern Extension of the Keldon Esker. This brings up the question as to how to name this ridge system. For example, should the southern section be referred to as "Keldon Esker" and the northern section differently to reflect the fact that they belong to different advances but just coincidently line up.

In light of the above discussion, the area with the best potential, in my view, to represent what the MNR refers to as the Keldon Esker-Northern Extension is a well-defined esker ridge at UTM 5392E 48845N (41A102) with a lineal outwash or deltaic apron on its west side. This apron may also have raised strand features reflecting meltwater drainage, proglacial ponding or even a Huron-Erie basinal lake that occupied this part of the Ontario Island. Regardless of whether the southern and northern sections are one and the same or two different events I believe the south end (i.e., Keldon Esker) was associated with a lake that was at 505 metres and this section (i.e., Keldon Esker-Northern Extension) was associated with a lake that was at 495 metres. I also believe there may be a lower level located along the ridge's basal slope. From here north the esker ridge is coincident with a much younger meltwater channel that funneled water south from the above-mentioned advance before being captured in this area by the South Saugeen River, which, in turn, took the water southwest where it cut a gap in the Egerton Esker near Gildale to ultimately enter a lake that formed downstream in front of what I refer to as the Saugeen Moraine (see Wilder Lake Terraces checksheet).

REFERENCES

Barnett et al,91;Chapman&Putnam,94;Cordiner,88;Sharpe&Broster,77

NAME: Keldon Esker Extension

NTS/UTM: 41A/01 410830

STATUS: Nominated ANSI
AUTHORITY: DLUG
CLASSIFICATION: Geological
INTEREST: Provincial
OWNERSHIP: Private
LAND USES:

OBM: 10 17 5400 48800
COUNTY: Grey
TOWNSHIP: Proton
CON/LOT:
MNR: SW-Owen Sound
CA: Saugeen
SIZE:

KEYWORDS: Lake Huron Basin
: Late Wisconsinan
: En-Proglacial/Bruce
: Grv; Snd
:
: Keldon esker; braided esker pattern; Georgian Bay ice lobe

DESCRIPTION: Keldon Esker Extension ANSI

REFERENCES: Davidson, 1974

ADDITIONAL OBM: 10 17 5350 48800*
10 17 5350 48850*

AIR PHOTO MOSAICS: 441B03-NE

AIR PHOTO COVERAGE: N

DOCKET:

YEAR: 1978

ROLL:	135	134	262	263	263
LINE:	4406	4407	4408	4409	4410
NUMBER:	14-18	241-244	56-61	100-103	211-215

COMMENTS: - ANSI consists of 4 separate areas
- selected areas free from disturbance
- esker is under pressure from extraction
- boundaries reflect meandering nature of esker and the effects of extraction on the continuity of the esker (ie: needed 4 boundaries)

Attachment:

ANSI BOUNDARIES (refer to OBM & MOSAIC for roads and locations)

Sections are described from South to North; 4 ANSI Boundary Descriptions

SECTION 1: (OBM 10 17 5400 48800)

START - jct. of stream and concession road (N side) at UTM 431805;
40m NE of "T" junction; NW along stream (downstream) for 240m
- SW; tree line; 140m
- NW; line 100m SW of and parallel to esker crest; 500m
- NW; line 50m SW of and parallel to esker crest; 500m

Attachment :

- NW(340); line across stream to point 50m SW of esker crest; 60m
- NW; line 50m SW of and parallel to esker crest; 550m
- NW; trail; 90m
- NE,SE,SW; stream (upstream); 900m
- S; across beaver dam; 40m
- SE; shore of pond; 130m
- SE; stream (upstream); 800m

STOP - jct. of stream and concession road (N side) at UTM 431805; 40m NE of "T" junction; NW along stream (downstream) for 240m

SECTION 2: (OBM 10 17 5400 48800)

START - jct. of stream and concession road at UTM 419822; downstream for 1000m
- SW; fence line; 160m
- NW; line 60m SW of and parallel to esker crest; 120m
- NW; tree line; 120m
- NW; trail; 250m

Attachment :

- NE; trail; 50m
- SE,NE; tree line; 180m
- SE; stream (upstream); 350m

STOP - jct. of stream and concession road at UTM 419822; downstream for 1000m

SECTION 3: (OBM 10 17 5400 48800 & Air Photo Mosaic 441803-NE)

START - crossroads jct. at UTM 404839; SW along S side of concession road for 450m to jct. of concession road and driveway
- E; tree line; 100m
- SE(100); line form tree line to tree line; 60m
- SE; tree line; 120m
- SW; line along face of gravel pit; 100m
- W(250); line form pit face to topo (480m) contour; 60m
- NW; topo (480m) contour; 320m

STOP - crossroads jct. at UTM 404839; SW along S side of concession road for 450m to jct. of concession road and driveway

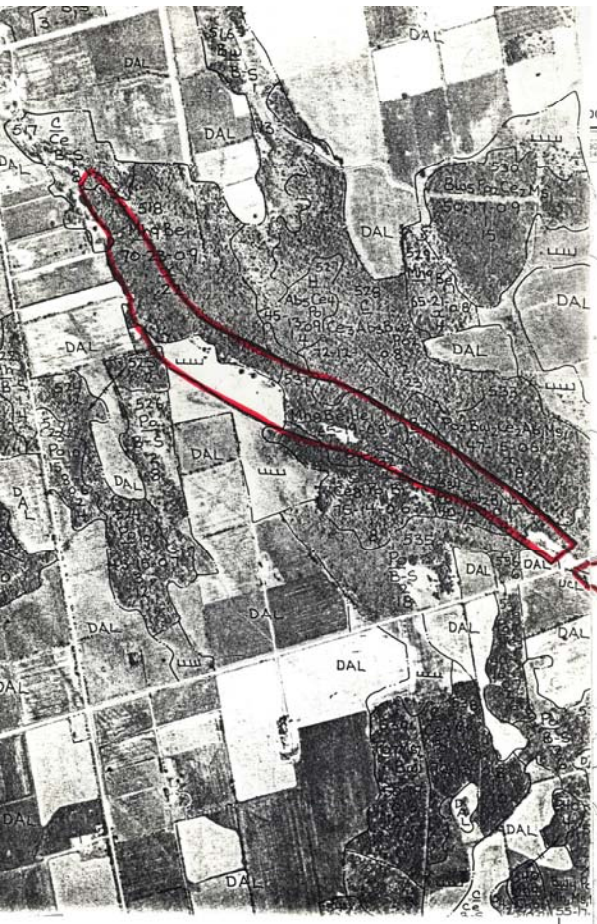
Attachment :

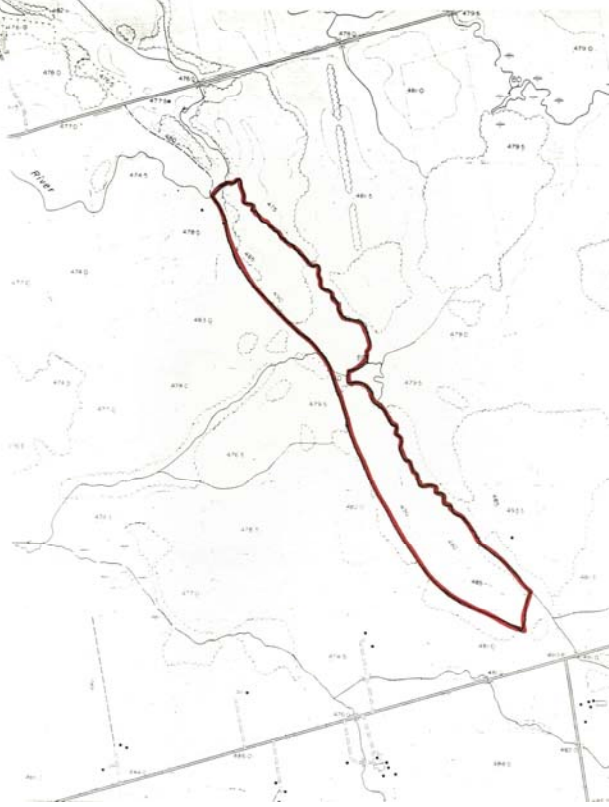
SECTION 4: (Air Photo Mosaic 441803-NE)

START - crossroads jct. at UTM 404839; SW along N side of concession road for 500m; N along line for 30m
- NW; line 60m SW of and parallel to esker crest; 800m
- NW; line 120m SW of and parallel to esker crest; 500m
- NW; tree line; 550m
- NE; along face of gravel extraction; 70m
- SE; line 60m NE of and parallel to esker crest; 950m
- SE; line 120m NE of and parallel to main esker crest; 500m
- SE; line 60m NE of and parallel to esker crest; 450m
- SW; line along gravel pit face; 120m

STOP - crossroads jct. at UTM 404839; SW along N side of concession road for 500m; N along line for 30m

Attachment :





Keldon Esker Extension

Scale 1:10 000

500 0 500

Metres

GRAND VALLEY

The Corporation of the Town of Grand Valley
5 Main Street North
Grand Valley, ON L9W 5S6
Tel: (519) 928-5652
Fax: (519) 928-2275

www.townofgrandvalley.ca

December 10, 2019

H. Bye Construction Limited
395 Church St. N. P.O. Box 189
Mount Forest, ON
N0G 2L0

Dear Randy:

This letter will confirm that the Town of Grand Valley is not in competition with Bye Construction. Our pit is for our own purposes only.

Town of Grand Valley supports H. Bye Construction licensing the newly acquired land on Southgate Road 4.

In future if the need arises, we would be interested in purchasing gravel aggregates from this location, as the location is in close proximity to the north end of our Township.

Regards

Jane M. Wilson
CAO/Clerk Treasurer
jwilson@townofgrandvalley.ca

ds/

APPENDIX B

Records of Boreholes

RECORD OF BOREHOLE: BH1

SHEET: 1 of 1

PROJECT NO: 19-047
LOCATION: Proposed Hogs Back Pit, Southgate Township
CLIENT: H. Bye Construction Ltd.

DATE: November 16, 2020
DRILLER: Orbit Garant
METHOD: 110mm ID Hollow Stem Auger

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	ELEV. DEPTH (m)	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES N-VALUE	MONITOR INSTALLATION MW1
0	Ground Surface	492.34					
	Brown silty TOPSOIL, some roots	492.14					
	Compact, brown SILTY SAND, some gravel, inferred cobbles	0.20		1	50 SS	5	Granular Bentonite
							Nov. 17, 2020
1				2	50 SS	>30	Nov. 16, 2020 (Enc.)
		491.04					
	Compact, brown SILT, trace sand, trace to some clay, with clayey silt layers	1.30		3	50 SS	38	
2		490.13					
	Hard, grey CLAYEY SILT, trace to some sand (TILL)	2.21		4	50 SS	50	
3							Filter Sand
				5	50 SS	53	
							Groundwater encountered during drilling at 0.8m depth.
4				6	50 SS	47	Groundwater measured at 0.57m depth (El. 491.77m) on Nov. 17/20.
				7	50 SS	63	
5		487.31					
	END OF BOREHOLE	5.03					
6							
7							
8							
9							

DEPTH SCALE - 1:50

GSS ENGINEERING CONSULTANTS LTD

LOGGED: WBB
CHECKED: RS

RECORD OF BOREHOLE: BH2

SHEET: 1 of 1

PROJECT NO: 19-047
LOCATION: Proposed Hogs Back Pit, Southgate Township
CLIENT: H. Bye Construction Ltd.

DATE: November 16, 2020
DRILLER: Orbit Garant
METHOD: 110mm ID Hollow Stem Auger

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	ELEV. / DEPTH (m)	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES N-VALUE	MONITOR INSTALLATION MW2
0	Ground Surface	491.48					
	Very loose, brown SANDY SILT, trace gravel, roots and organic material in upper 0.2m	490.79		1	50 SS	3	Granular Bentonite
1	Loose, brown SILTY SAND	0.69 / 489.86		2	50 SS	22	Nov. 17, 2020 ▽ / Nov. 16, 2020 (Enc.) ▼
2	Loose, grey SAND and GRAVEL, some silt	1.62 / 489.27		3	50 SS	25	
3	Hard, grey CLAYEY SILT, trace sand, trace to some gravel (TILL), inferred boulder at 3.8m depth	2.21		4	50 SS	44	
				5	50 SS	51	Filter Sand
4							Groundwater encountered during drilling at 0.8m depth.
5		486.45		6	50 SS	88	Groundwater measured at 0.59m depth (El. 490.89m) on Nov. 17/20.
	END OF BOREHOLE	5.03					
6							
7							
8							
9							

DEPTH SCALE - 1:50

GSS ENGINEERING CONSULTANTS LTD

LOGGED: WBB
CHECKED: RS

RECORD OF BOREHOLE: BH3

SHEET: 1 of 1

PROJECT NO: 19-047
DATE: November 17, 2020
LOCATION: Proposed Hogs Back Pit, Southgate Township
DRILLER: Orbit Garant
CLIENT: H. Bye Construction Ltd.
METHOD: 110mm ID Hollow Stem Auger

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	ELEV. / DEPTH (m)	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES N-VALUE	MONITOR INSTALLATION MW3
0	Ground Surface	492.24					
	Brown silty TOPSOIL, some roots, trace to some gravel	491.63		1	50 SS	--	Granular Bentonite
1	Loose, brown SAND and GRAVEL, trace to some silt, fine sand layer at 1.5m depth, inferred cobbles	0.61					
				2	50 SS	27	Nov. 17, 2020 (Enc.)
2		489.95					Nov. 17, 2020
	Hard, brown changing to grey CLAYEY SILT, trace sand, trace to some gravel (TILL), siltier in upper 0.2m, inferred cobbles and/or boulders	2.29		3	50 SS	48	
3							
				4	50 SS	79	Filter Sand
4							
		487.67		5	50 SS	67	Groundwater encountered during drilling at 1.5m depth.
	END OF BOREHOLE	4.57					Groundwater measured at 1.81m depth (El. 490.43m) on Nov. 17/20.
5							
6							
7							
8							
9							

DEPTH SCALE - 1:50

GSS ENGINEERING CONSULTANTS LTD

LOGGED: WBB
CHECKED: RS

RECORD OF BOREHOLE: BH4

SHEET: 1 of 1

PROJECT NO: 19-047
LOCATION: Proposed Hogs Back Pit, Southgate Township
CLIENT: H. Bye Construction Ltd.

DATE: November 17, 2020
DRILLER: Orbit Garant
METHOD: 110mm ID Hollow Stem Auger

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	ELEV. / DEPTH (m)	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES N-VALUE	MONITOR INSTALLATION MW4
0	Ground Surface	492.46					
	Black silty TOPSOIL	492.26					
	Compact, brown SILTY SAND, trace gravel, trace organics	0.20 491.55		1	50 SS	--	Mar. 23, 2021 Granular Bentonite
1	Compact, brown SANDY SILT, trace to some gravel	0.91 491.01		2	50 SS	40	Nov. 17, 2020 (Enc.)
	Loose, brown SILT, trace clay	1.45 490.63		3	50 SS	25	
2	Hard, brown changing to grey CLAYEY SILT, trace to some gravel (TILL)	1.83		4	50 SS	62	
3				5	50 SS	125	Filter Sand
4				6	50 SS	76	Groundwater encountered during drilling at 1.5m depth. Groundwater measured at 0.33m depth (El. 492.13m) on Mar. 23/21.
	END OF BOREHOLE	487.89 4.57					
5							
6							
7							
8							
9							

DEPTH SCALE - 1:50

GSS ENGINEERING CONSULTANTS LTD

LOGGED: WBB
CHECKED: RS

APPENDIX C

Water Level Monitoring Data

Table C-1: Water Level Monitoring Data
Proposed Hogs Back Pit, H. Bye Construction Ltd., Township of Southgate

Well or Monitor	MW1		MW2		MW3		MW4		SG1		SG2		SG3		P1	
Depth of Well (mbgs)	4.6		4.6		4.4		4.6		-		-		-		2.4	
Ground Elevation (m)	492.34		491.48		492.24		492.46		490.58		489.52		489.60		491.84	
Top of Casing Elevation (m)	493.26		492.43		493.19		493.34		491.44		490.30		490.50		492.88	
Water Level	Depth (mbgs)	Elevation (m)	Depth (mbgs)	Elevation (m)	Depth (mbgs)	Elevation (m)	Depth (mbgs)	Elevation (m)	Depth (mbmp)	Elevation (m)	Depth (mbmp)	Elevation (m)	Depth (mbmp)	Elevation (m)	Depth (mbgs)	Elevation (m)
Measurement Date																
October 16, 2020	-	-	-	-	-	-	-	-	0.61	490.83	0.57	489.73	-	-	-	-
November 17, 2020	0.57	491.77	0.59	490.89	1.81	490.43	3.81 [3]	488.65 [3]	0.55	490.89	-	489.92	0.77	489.73	-	-
March 23, 2021	0.47	491.87	0.44	491.04	1.39	490.85	0.33	492.13	0.50	490.94	0.26	490.04	0.745	489.76	-	-
May 13, 2021	0.73	491.61	0.62	490.86	1.55	490.69	0.78	491.68	0.565	490.88	0.30	490.00	0.79	489.71	-	-
July 5, 2021	1.39	490.95	0.92	490.56	2.63	490.14	1.39	491.07	Dry to 0.70	<490.74	0.68	489.62	Dry to 0.90	<489.60	-	-
November 8, 2021	0.69	491.65	0.61	490.88	2.32	490.53	0.79	491.67	0.54	490.90	0.32	489.98	0.77	489.73	1.78	490.06

NOTES:
1. "-" indicates no measurement on that date.
2. mbmp - metres below measuring point; mbgs - metres below ground surface.
3. The Nov. 17, 2020 measurement in MW4 was carried out 2.5 hours after well completion and was not considered to be indicative of static conditions.
4. Table to be read in conjunction with accompanying report.

Figure C-1: Site Water Level Data
Proposed Hogs Back Pit, H. Bye Construction Ltd., Township of Southgate

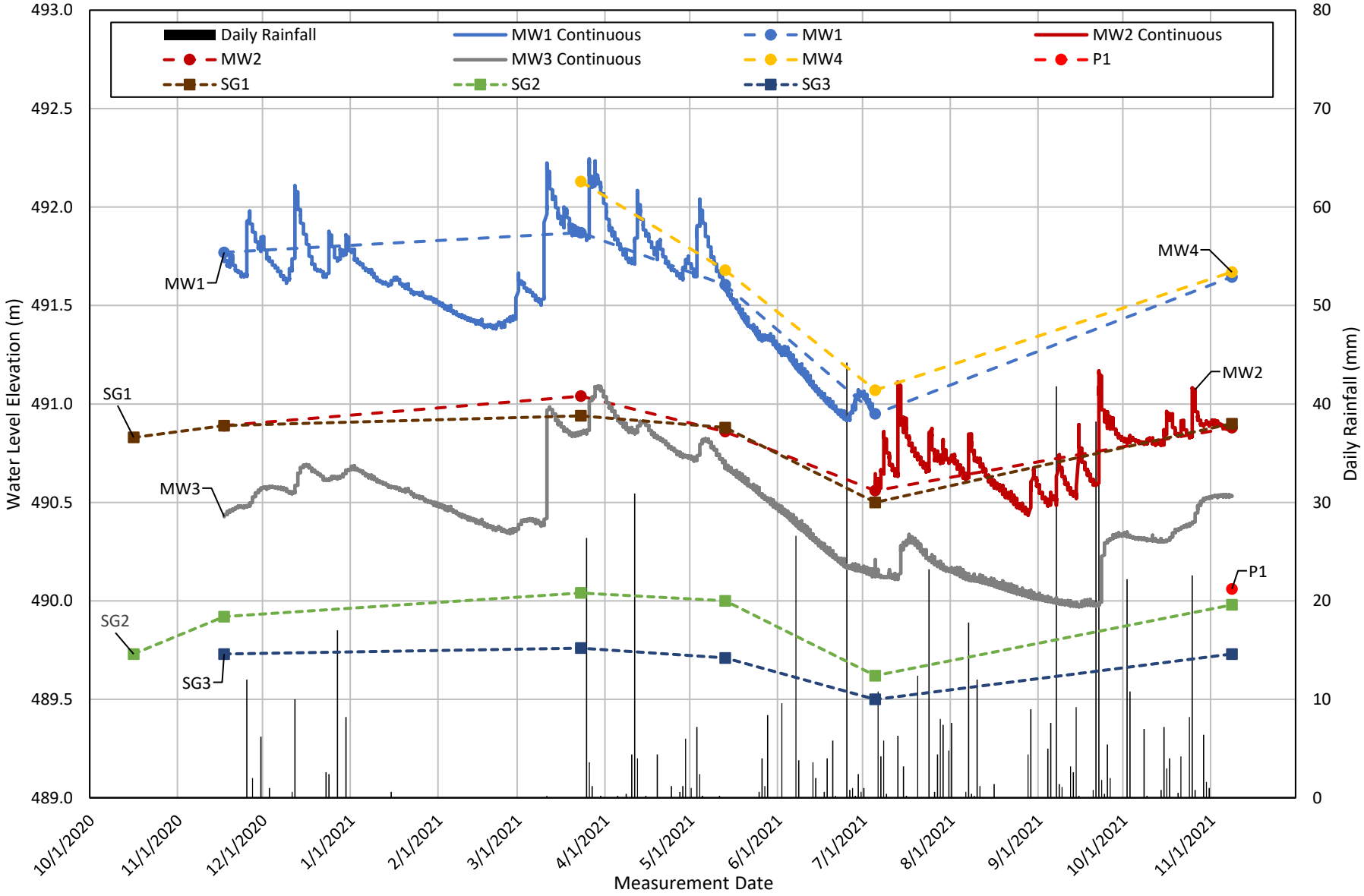


Figure C-2: PGMN Well 276-2 Water Level Data
Proposed Hogs Back Pit, H. Bye Construction Ltd., Township of Southgate