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November 17, 2016

Glenn Harrington
Harrington McAvan Ltd.
6882 14th Avenue,
Markham, Ontario
L6B 1A8

Dear Mr. Harrington:

RE: Hydrogeologic Assessment Compliance With The County of Wellington OPA 81.

As requested, we have reviewed the relevant sections of County of Wellington Official Plan Amendment 81 (OPA 81) as they relate to the Tri City Lands Ltd. Spencer Pit proposal. We can confirm that our February 20145 report, titled: *Hydrogeologic Assessment, Tri City Lands Ltd. Proposed Spencer Pit, Part Lots 14, 15, 16, and, Lots 17 & 18, Concession B, Township of Guelph/Eramosa, County of Wellington*, and subsequent technical recommendations developed to date as part of the peer review process, and as listed on the current proposed Site Plan, conforms with the technical requirements of OPA 81 related to hydrogeology and groundwater, and specifically to Source Water Protection.

We note that according to OPA 81, and information available regarding the Grand River Watershed within the Lake Erie Source Protection Region (available at: https://www.sourcewater.ca/en/source-protection-areas/Grand-River-Source-Protection-Plan.aspx), the site is not within any identified Well Head Protection area.

If you have any questions, or require further information, please do not hesitate to contact us.

Sincerely,

Andrew Pentney, P.Geo.
Hydrogeologist

PROFESSIONAL GEOSCIENTIST
ANDREW H. PENTNEY
PRACTISING MEMBER
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Hydrogeologic Assessment, Tri City Lands Ltd. Proposed Spencer Pit Part Lots 14, 15, 16, and, Lots 17 & 18, Concession B, Township of Guelph/Eramosa County of Wellington

Prepared For:

Harrington McAvan Ltd.
6882 14th Avenue
Markham, Ontario
L6B 1A8

Prepared By:

Andrew Pentney, P.Geo.
Groundwater Science Corp.

February 2014

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1.0 INTRODUCTION

This report presents the results of a hydrogeologic assessment completed at the Tri City Lands Ltd. proposed Spencer Pit. The study site is located within Part Lots 14, 15 and 16, and Lots 17 and 18, Concession B, Township of Guelph/Eramosa, County of Wellington, Ontario. This study was completed as part of a Category 3 Licence application under the Aggregate Resources Act (ARA) to extract aggregate from above the water table.

1.1 BACKGROUND

The proposed Spencer Pit is located on the south side of Wellington Road 124, northeast of the unopened road allowance dividing the City of Cambridge and the Township of Guelph-Eramosa, and, northwest of the unopened road allowance between the Township of Puslinch and the Township of Guelph-Eramosa.

The site is approximately 2 kilometers (km) north of the City of Cambridge (Hespler), as shown in **Figure 1**. The site is currently in agricultural use. The property immediately south of the site (south of the railway) is an existing Licenced quarry that has undergone below water extraction. Other surrounding land use in the general area is primarily agricultural with some rural residential properties.

1.2 SCOPE

The study scope is intended to address the current groundwater related ARA Provincial Standards for the proposed pit in addition to general Environmental Impact Study (EIS) type requirements.

1.2.1 Aggregate Resource Act Requirements

The ARA provincial Standards for a Category 3 Application (Class A Pit Above Water) indicates that the pit operation is restricted to extracting aggregate material no closer than 1.5 metres (m) above the established water table. Accordingly, the Site Plan must show the following information:

1.1.19 the elevation of the established groundwater table or provide information that the final depth of extraction is at least 1.5 metres above the water table;

Additionally, the Summary Statement accompanying the application must provide information on the following:

2.1.7 determine the elevation of the established groundwater table within the site or demonstrate that the final depth of extraction is at least 1.5 metres above the water table;

With regard to ARA requirements, this report has been prepared to determine the elevation of the established (ground) water table within the site. This information is to be included in the Summary Report and on the Site Plan.

1.2.2 Impact Assessment Approach

As part of the licencing process for the site some municipal planning applications are expected occur. An Environmental Impact Study (EIS) can be required as part of that process. This report follows a typical EIS approach, which is identified as follows:

- an outline of the study methodology
- a description of the topographic setting, local surface water drainage and natural environment features (including springs, wetlands, etc.);
- a description of reported local water well locations;
- a description of the geologic and hydrogeologic setting (including aquifers, groundwater/surface water interaction, water budget, well head protection areas, etc.);
- a description of the proposed extraction;
- an examination of the potential impact of the proposed extraction (impact assessment); and,
- conclusions and recommendations.

This report follows the general EIS approach to characterize the local setting and as a basis for the impact assessment.

2.0 METHODOLOGY

This assessment included a background information review to characterize the site setting, detailed site-specific fieldwork to characterize local conditions and the use of specific analysis methods for the water budget and impact assessment.

Standard hydrogeologic field and analysis methods are used for this study. The specific methodologies used for each step of the characterization and analysis are outlined in the respective Sections of this report.

2.1 INFORMATION REVIEW

As part of this study the following information sources were used:

1) Harrington McAvan Ltd., February 2014; *Spencer Pit Site Plan*.
2) Stantec Consulting Ltd., February 2014: *Spencer Pit Natural Environment Level 1 & 2 Technical Report*.
3) Harrington McAvan Ltd.; December 18, 2012: *Feasibility Study, Spencer Property, Highway 24 at Kossuth Road, Guelph Township, Wellington County*.
4) Lake Erie Region Source Protection Committee; April 16, 202: *Grand River Source Protection Area Approved Assessment Report*.
5) Aqua Resources Inc.: June 2009: *Integrated Water Budget Report, Grand River Watershed*.
6) Grand River Conservation Authority online interactive mapping website: GRIN (http:// http://www.grandriver.ca).
7) Ministry of the Environment (MOE) water well records.
8) Ontario Base Map (OBM) 1:10,000 series topographic mapping.
9) Ontario Geological Survey; 1989: *Limestone Industries of Ontario* (and preceding editions dated 1960, 1964 and 1971).

Additional general references used are noted in the text of this report.

The description of the regional setting is compiled from the above referenced sources, including the Source Protection Report and supporting documents. Site-specific geologic and hydrogeologic information was obtained from aggregate resource assessments and additional work completed at the Spencer Property for this study.

3.0 BACKGROUND REVIEW

The local site setting and proposed Licence boundary is shown on **Figure 2**. The west edge of the site corresponds to an unopened road allowance. The north edge is bounded by Hespler Road / Wellington Road 124. The east edge corresponds to a farm field edge, just west of an unnamed tributary of the Speed River. The southeast edge is bounded by a CNR railway line. The south edge is bounded by the former quarry property. The Speed River and associated valley is located generally east of the site.

3.1 TOPOGRAPHY AND DRAINAGE

Please refer to the Site Plan for specific topographic information at the property. Local topography, drainage and ponds are also shown on **Figure 2**.

The ground surface in the vicinity of the site slopes generally northwest to southeast, generally toward the Speed River valley. Within the Spencer property the ground surface slopes generally from Hespler Road / County Road 124 to either the existing quarry south of the site (west portion of the site), or, to the Speed River Valley (east portion of the site). On-site maximum ground surface elevations, of approximately 321 mAMSL, occur at the western corner of the site near the Kossuth Road intersection. The lowest ground surface elevation, of approximately 306 mAMSL, occurs along the east boundary of the site (at the railway line). On-site drainage follows topography, generally west-northwest from Hesper Road / County Road 124 to south-southeast toward the existing quarry and Speed River valley.

Overland flow within the southwestern half of the site moves along a topographic depression system toward the adjacent quarry. The single on-site defined drainage channel occurs within this topographic depression. The channel begins west of the site and directs intermittent flow eastward, crossing Hespler Road (elevation approximately 314.5 mAMSL) onto the site and then to the south-central portion of the property, where the channel ends (elevation approximately 310 mAMSL). The area between the channel terminus and the south site edge (at quarry) is cropped (i.e. no defined channel occurs).

Overland flow within the northeastern half of the property is directed toward a topographic depression system that appears to begin northwest of County Road 124 and is oriented west-east across the site. An off-site drainage channel is mapped northeast of County Road 124, but the channel ends within a closed depression (elevation 312.8 mAMSL) and does not extend on-site. Therefore no overland flow is expected to enter the northeast portion of the property across County Road 124. On-site overland flow within this topographic depression system moves as sheet flow (i.e. no defined channel occurs) west to east, crosses the railway line, and continues toward the river valley.

Off-site drainage features include the Speed River southeast of the Spencer property, and unnamed tributary along the northeast property boundary. The Speed River channel is located approximately 395 m southeast of the site and flows northeast to southwest. According to the *GRCA River Data* web page (*GRCA monitoring network - Speed River*) the normal summer low flow (assumed to correspond to baseflow) at the Beaverdale Road (Cambridge, Preston) monitoring gauge is 3.5 m^3/s (3,500 L/s). The railway line and existing quarry occur between the Spencer site and the river. Topographic mapping indicates the river elevation varies between approximately 290 and 295 mAMSL in the

area of the site. The river valley is naturally steep-walled (up to 10 m vertical relief within 40 m horizontal distance) in the area. The valley floor occurs generally between 295 and 297 mAMSL near the site.

The unnamed tributary begins within wetland areas over 3 km north of the site, flows generally south to the site then southeastward to the confluence with river (460 m southeast of the site). The tributary channel occurs within 30 m of the northeast property boundary. The tributary has intermittent flow near the site. The tributary channel is relatively deeply incised (up to 6 m below surrounding topography). Site inspections confirm that bedrock outcrops along the channel near the site. The tributary elevation ranges from approximately 301 to 304 mAMSL adjacent to the site.

No other drainage channels or streams are mapped on-site or within 120 m of the site.

3.2 EXISTING QUARRY

The Carmeuse Lime (Canada) quarry, Licence No. 5482 is located immediately south of the Spencer site. The CNR railway divides the quarry into two sections, referenced as east and west of the rail line respectively.

Quarrying and lime production began at this site in the early 20th Century. The quarry is variously described as the (former) Glen Christie or Glenchristie Quarry. Some information regarding the quarry is provided in the *Limestone Industries of Ontario* report series. In 1960 it was reported that the quarry face height east of the railway is reported to be a maximum of 23.8 m (78 feet). In 1964 it was reported that the quarry west of the railway was opened (in September 1961) and that the quarry face was 14.3 m (47 feet). The quarry is reported to still be in operation in 1971. However by 1989 the quarry was reported to be "*inactive for several years*".

OBM mapping (published 2002, based on 1983 air photo) indicates that the elevation of the top of the east quarry face is approximately 305 metres above mean sea level (mAMSL). The OBM mapping shows a small pond within the central portion of the quarry floor, and the surrounding floor elevation is shown at approximately 280 mAMSL (i.e. 25 m quarry face height). The top of the west quarry face is shown at approximately 310 mAMSL, and a pond covers the entire quarry floor. The west quarry pond elevation is shown at approximately 295 mAMSL (i.e. at least 15 m face height). Therefore expected maximum historical quarrying depths correspond to elevations between 280 and 295 mAMSL.

More recent air photos available through the GRCA mapping website (e.g. 2000 to 2010) indicate a larger pond area now occurs east of the railway. Based on GRCA reported elevation contours (1 m interval), the east pond is shown at an elevation of approximately 292 mAMSL. West of the railway the pond is shown as occupying the entire excavation area, corresponding to an elevation of approximately 299 mAMSL. The more recent pond elevation data indicates some dewatering likely occurred during active quarrying. Subsequent quarry pond level recovery to current (assumed equilibrated) conditions has occurred since dewatering ceased.

The elevation data shown on the Spencer Pit Site Plan indicates the east and west pond elevations were approximately 292 mAMSL and 301 mAMSL respectively at the time of the topographic survey (May 2013).

3.3 NATURAL ENVIRONMENT FEATURES

The Natural Environment Assessment (Stantec) provides detailed natural feature description and delineation at and near the site, please refer to that report for actual wetland or drainage channel boundaries and classification. General locations for these features are also shown on **Figure 2** and **Figure 3** of this report.

There are no wetlands, ponds or fish habitat reported within the site boundaries. Off-site features include the Speed River and tributary; ponds; and, wetlands.

The study area is located within the Speed River Watershed, as identified by the GRCA. The Grand River Source Protection and Water Budget studies indicate that the Speed River near the site receives significant groundwater discharge, likely from regional to local scale flow systems (extending 4 to 5 km north and south of the river). These flow systems include both overburden and (primarily) deep bedrock flow paths.

The Speed River wetland complex is associated with, and occurs along, the Speed River east and southeast of the site. Near the Spencer property the wetland complex is generally confined to the river valley, and occurs at an elevation below 296 mAMSL. Site inspections indicate that the water table is likely at or near surface over much of the wetland within the river valley. A small isolated (dug) pond is located just south of the railway line where it enters into the existing quarry lands. The small pond occurs at an elevation of approximately 294 mAMSL.

Further from the site, the Glenchristie Wetland Complex occurs west of Hespler Road, and the Ellis Creek Wetland complex occurs north and northeast of the site.

3.4 QUATERNARY GEOLOGY

Physiographic mapping indicates the site is located within a glacial spillway associated with the Speed River, within the southern portion of the Guelph Drumlin field, between the Paris/Galt Moraine (to the southeast) and the Waterloo Moraine (to the west).

Quaternary mapping is included in **Appendix A**. According to mapping available for the area, including summaries provided in the Source Protection Study, the site is located within a glaciofluvial outwash gravel deposit which brackets the river. Bedrock outcrops are mapped near the site along the Speed River valley edge (within the existing quarry and where the unnamed tributary flows over the valley edge). Sand and more recent fluvial deposits are mapped within the river valley.

The Port Stanley Till (silt to sandy silt till) is mapped at surface north of the outwash deposit. South of the outwash deposit (river) the Wentworth Till (stony, sandy silt till) is mapped at surface. Both represent regional till units.

3.5 BEDROCK GEOLOGY

The underlying bedrock at the site is the middle Silurian brown to tan dolostone of the Guelph Formation. Regional mapping indicates the bedrock surface elevation is reported to be approximately 300 mAMSL at the site, with an overall slope to the southwest. The Amabel Formation dolostone occurs below the Guelph Formation.

3.6 WELL HEAD PROTECTION AREAS

Well Head Protection (WHPA) mapping is included in **Appendix A**. The site is not located within or adjacent to any identified WHPA, as identified by the GRCA interactive mapping website and the Source Protection reports. The WHPA associated with the City of Guelph water supply wells is located generally northeast of the site, and, the WHPA associated with one City of Cambridge water supply well is located southwest of the site.

3.7 PRIVATE WATER WELLS

Private water well location mapping, and a summary of information for wells reported within 500 m of the site, is included in **Appendix A**. The mapping and summaries are based on information obtained through the MOE interactive water well mapping website.

One well record (No. 6701012) is reported on-site, however appears to be plotted incorrectly. A matching well was located during site inspection at the former barn (foundation) within the southwest portion of the site. This well is in use as part of the monitoring program for this study. Details are provided in **Section 4.1** of this report.

A total of 27 wells are reported within (or just beyond) 500 m of the site. Of these wells 24 are completed in bedrock, 1 is completed in overburden (adjacent to the Speed River) and 2 have no detailed geologic information associated with the record. Bedrock well depths vary from 10.6 to 61.6 m. The overburden well depth is 13.1 m. The primary water use is reported to be for domestic purposes, 2 wells are listed as including livestock supply and 1 well is listed as an industrial supply (likely within the existing quarry lands). Based on this information the bedrock system forms the primary water supply aquifer in the area. The bedrock aquifer is considered unconfined where the static water level is within rock or in sand/gravel that overlies rock, and confined where the static level is within an overlying fine grained (e.g. clay) deposit.

3.8 AGGREGATE RESOURCE ASSESSMENT

The aggregate resource assessment included 53 test pits, up to 12 m in depth, distributed across the site. The test pit locations are shown on the Site Plan. A summary of test pit results are included in **Appendix A**.

Sand and gravel was encountered at 42 test pit locations, extending up to 8 m below ground surface. All of the test pits were “dry” (i.e. the water table was not encountered). At 17 of those locations a till (or silt) unit was encountered below the sand and gravel. The sand and gravel was found to extend to bedrock at 4 locations. At 11 locations fine grained (e.g. Wentworth Till) occurred at surface and extended to depth (or bedrock). Bedrock was encountered at a total of 8 locations, estimated bedrock elevations are shown in **Appendix A**.

4.0 FIELD WORK

The on-site fieldwork completed for this assessment included site inspections, drilling and water table monitor installation. In addition, water level measurements are ongoing.

4.1 BOREHOLE DRILLING AND MONITOR INSTALLATION

Three (3) on-site boreholes (BH1, BH2 and BH3) were drilled and groundwater monitoring wells installed at the site. Drilling was completed by Knoll Drilling Ltd. (Maryhill, Ontario) from August 27, 2013 to September 6, 2013. The monitoring well locations are shown in **Figure 3** and the borehole logs are included in **Appendix B**.

At all three new well locations water was encountered in the bedrock. Each of the new wells were drilled to depth in bedrock and equipped for groundwater level monitoring. The well at BH1 consists of 2-inch diameter PVC pipe and 10 foot slotted screen positioned at the bottom of the hole. At BH1 a silica sand-pack was placed over the screened interval and the remainder of the annual space was sealed with bentonite. Both BH2 and BH3 consist of 2-inch diameter PVC pipe grout sealed (with bentonite) into the upper bedrock, with the remaining bedrock interval left as an open hole (in rock).

In addition, an existing water well was found near the (former) barn foundation in the southwest portion of the site, referenced as the Barn Well for this study. Based on the well construction it appears to correspond to MOE well record number 6701012. The Barn Well is completed at depth in bedrock and is utilized as part of the water level monitoring program for the site.

Elevation data for the water level monitors shown below was determined by a level survey completed by Groundwater Science Corp. relative to an assumed ground surface elevation of 318.0 mAMSL at BH1 (based on Site Plan elevation contours). Construction details and elevations are included in **Table 1**.

Monitor	Elevations (mAMSL)				
	Top of Casing	Ground Surface	Bedrock	Top of Well Interval	Bottom of Well
BH1	318.87	318.00	312.1	300.3	297.3
BH2	314.12	313.21	302.8	302.8	227.6
BH3	308.01	307.08	303.1	303.1	232.4
Barn Well	316.20	315.26	306.1	288.8	288.8

Table 1: Construction Details

The drilling results are discussed further in **Section 5.0**.

4.2 WATER LEVEL MONITORING

Water level measurements were obtained through October and November 2013. Water level monitoring continues on a monthly basis. The measurements were obtained as depth to water below top of well casing using a Heron Instruments® electronic water level tape and recorded in the field.

The measured water table elevations are summarized in **Table 2**.

Date	Water Level Elevations (mAMSL)			
	BH1	BH2	BH3	Barn Well
1-Oct-13	309.06	298.60	296.68	n/a
18-Oct-13	309.07	298.56	296.72	301.61
24-Oct-13	309.02	298.51	296.67	301.56
14-Nov-13	309.23	298.52	296.80	301.68
13-Dec-13	309.28	298.36	296.72	301.65
9-Jan-14	309.23	298.30	296.68	301.61

Table 2: Water Level Elevations

As illustrated by the measurements, the water table at the site is located within the bedrock aquifer. The October and November measurements represent “fall” conditions and therefore should reflect seasonal (relative high) water table elevations. However, additional monitoring through the spring of 2014 will also be completed. Interpreted water table contours at the site are shown on **Figure 4**.

Additional interpretation of the observed water level data is provided in **Section 5**.

5.0 HYDROGEOLOGIC SETTING

The hydrogeologic setting is discussed in context of the reported regional and local geologic conditions, occurrence and location of surface water features in the area, and, the results of the site-specific investigation completed for this study.

Test pit and drilling results indicate that the sand and gravel occurs over much of the site and either overlies bedrock or a discontinuous till unit. An interpreted bedrock surface contour map, based on bedrock elevations as encountered at test pits and boreholes on-site and reported at well record locations along the boundary of the site, is shown in **Figure 5**. The bedrock surface elevation is variable, however slopes generally west to east within the Spencer property. Locally the upper bedrock at the site consists of the Guelph Formation, which is underlain by the Amebel Formation. The Guelph and Amabel Formations are considered a regional bedrock aquifer system with relatively high water supply capacity.

At the proposed Spencer Pit site the water table occurs within the bedrock (unconfined) aquifer, and slopes relatively steeply west to east. The water table along the southeast and east edges of the site is controlled by surface water features (and assumed discharge to these features) adjacent to the site. The surface water features include the Speed River and associated valley wetlands, and, ponds within the adjacent quarry. The water table is approximately 3 to 4 m below the bedrock surface near County Road 124 and 4 to 6 m below the bedrock surface along the southeast and east edges of the site.

Conditions on-site are illustrated on a cross-section developed through the site, as shown in **Figure 6**. The cross-section location is shown on **Figure 3**. The section is based on available topographic mapping, MOE water well records, on-site drilling results and water level monitoring results. The section illustrates: the overall topographic variation and existing quarry depth; on-site occurrence of sand and gravel and till units; the underlying bedrock formations; and, water table slope.

The site is a recharge area, which contributes to a large regional scale groundwater flow system moving eastward toward the existing quarry and river (see **Appendix A**). Based on the Integrated Water Budget report, recharge rates of approximately 0.355 m/yr and runoff rates of 0.008 m/yr (GAWSER derived average recharge rate 1980 to 1999 for sand and gravel with medium vegetation not within an area of hummocky topography) are expected at the site. Given a total proposed Licenced area of 51.16 ha, the site annual groundwater recharge volume contribution to the regional flow system is calculated to be 5.8 L/s on average (or about 0.2% of the Speed River normal summer low flow). As expected given the scale of the regional flow system moving toward the Speed River, on-site recharge comprises only a small component of the overall water volume reaching the river and wetland system. Similarly, the calculated annual average site runoff of 0.1 L/s (only half of which would flow directly toward the valley) is also considered minor with respect to both the river and associated wetland system adjacent to the site.

The bedrock aquifer forms the primary source of water for local water supply wells. All of the local water supply wells are located upgradient (east and northeast) or cross-gradient (north or south) of the site. There are no reported domestic wells located downgradient of the site, between the site and either the existing quarry or river.

6.0 PROPOSED EXTRACTION

For details regarding existing site conditions or the extraction plan (including the proposed sequence of extraction) please refer to the Site Plan.

For the purposes of the Site Plan, the established groundwater table at this time is shown in **Figure 4**, and represents the fall high water levels measured on October 18, 2013. The established water table varies across the site from approximately 309 mAMSL at BH1 to 295 mAMSL at the mid-point of the east site boundary, near the adjacent east quarry pond. As illustrated, the water table is steeply sloped west to east across the site, likely influenced by the Speed River valley and existing quarry. Comparing the water table elevation (**Figure 4**) to bedrock surface elevation (**Figure 5**) indicates that the water table at the site is currently 3 m or more below the bedrock surface.

The proposed extraction would remove gravel to a maximum depth corresponding to the bedrock surface (or till unit where encountered) and remain (no closer than) 1.5 m above the established groundwater table. Rehabilitation will include replacing topsoil once extraction is complete. The overall plan is to return the site to agricultural use post-extraction.

The proposed aggregate processing includes washing activities, which is expected to require a separate application for a Permit To Take Water from the Ministry of the Environment (MOE). The application would include an MOE review of potential impacts to both local water supply wells and natural environment features. The specific water taking volume or other operational requirements of aggregate washing are not available at this time, and would rely on the success of the ARA application.

Although this report does not specifically analyze the impact of washing activities, the following discussion provides general background information. Aggregate washing within this setting would include a recirculation system with water movement from a source (clear) pond into a silt (settling) pond and back to the source pond, with little consumptive use of water. Because the water table is within the bedrock the ponds would need to be lined (e.g. with wash fines) and a make-up groundwater supply well needed. Any infiltration losses from the ponds would recharge the local bedrock aquifer and would not represent a loss to the aquifer. Groundwater supply options would include utilizing the existing Barn Well or drilling a new well. Given the capacity of the bedrock aquifer; separation distance between the processing area and local wells or natural environment features; size of the pit operation; and, the fact that overall losses are small relative to actual pumping rates, washing activities in this setting are not expected to significantly impact the local groundwater system. Permit To Take Water application analysis, and permit conditions, would ensure potential impacts are minimal.

Fuel storage and equipment maintenance will occur on-site. Any fuel storage, handing and use on-site would conform to all applicable regulations and standards, which reduces the potential for impact on the environment. There are no proposed water diversion, storage or drainage facilities on-site.

7.0 POTENTIAL IMPACTS

The proposed extraction will remain above the water table; therefore no direct water level effects on the local groundwater system are expected. There are no water supply wells downgradient of the site; therefore any potential water quality changes associated with the proposal would not affect groundwater use in the area. The intermittent tributary northeast of the site, which may have seasonal groundwater discharge, is cross-gradient of the site and therefore will also not be affected by the proposed extraction.

Potential indirect effects of the extraction and rehabilitation plan relate primarily to changes in on-site water balance (runoff and infiltration) associated with the proposed change in topography. The rehabilitation plan will create a large enclosed drainage area. This will result in a conversion of existing runoff (estimated to be approximately 0.1 L/s on average) to future groundwater recharge. Assuming all of the existing (estimated) runoff is converted to groundwater recharge, future recharge at the site would be on the order of 5.9 L/s on average. This represents a 2.2% increase in recharge. The overall impact of the water balance change is therefore expected to be small in scale. We note that a number of indicators at the site, including the drainage channel infiltration and active cropping through potential runoff areas, also suggest significant runoff volumes do not currently leave the site and that most surface water infiltrations within the property. Therefore overall water balance changes may be less than 2.2%. In addition, any on-site recharge will enter the groundwater system and move toward the Speed River valley. Therefore any change from runoff to recharge does not represent a loss in water contribution to the local natural environment system. We also note that groundwater flow from most of the site moves towards the existing quarry and does not interact directly with the Speed River or associated wetland system.

7.1 MONITORING PLAN

No significant change in groundwater conditions is expected at local natural environment features or water supply wells due to the proposed extraction. Therefore the proposed monitoring plan is limited to monthly water level monitoring for one year to confirm the seasonal high water table elevation, in addition to quarterly water level measurements during the first three years of extraction to confirm groundwater conditions.

The following monitoring plan is recommended to be shown on the Site Plan:

1. *Water level measurements shall be obtained at the existing on-site monitoring well locations (as accessible) BH1, BH2, BH3 and Barn Well on a monthly basis for one year.*
2. *Subsequent water level measurements shall be obtained on a quarterly basis at the existing on-site monitoring well locations (as accessible) BH1, BH2, BH3 and Barn Well during the first three years of extraction operations*
3. *The Barn Well is within a proposed extraction area and should be abandoned in accordance with applicable regulations if the well is not utilized as a monitor or water supply well.*
4. *At the end of three years of monitoring the data shall be summarized in a report provided to the Ministry of Natural Resources. The monitoring program shall be discontinued if no groundwater impacts are observed after 3 years.*

8.0 CONCLUSIONS

For the purposes of the Site Plan the Established Water Table for the site, representative of the high water table elevation measured to date, is shown on **Figure 4** and described in **Section 6.0** of this report.

Based on the results of this assessment, there are no potential for adverse effects to groundwater and surface water resources and their uses; and, no potential significant impact to local natural environment features or water wells associated with the Spencer Pit extraction as proposed.

All of which is respectfully submitted,

Andrew Pentney, P.Geo.
Senior Hydrogeologist
Groundwater Science Corp.

Figures

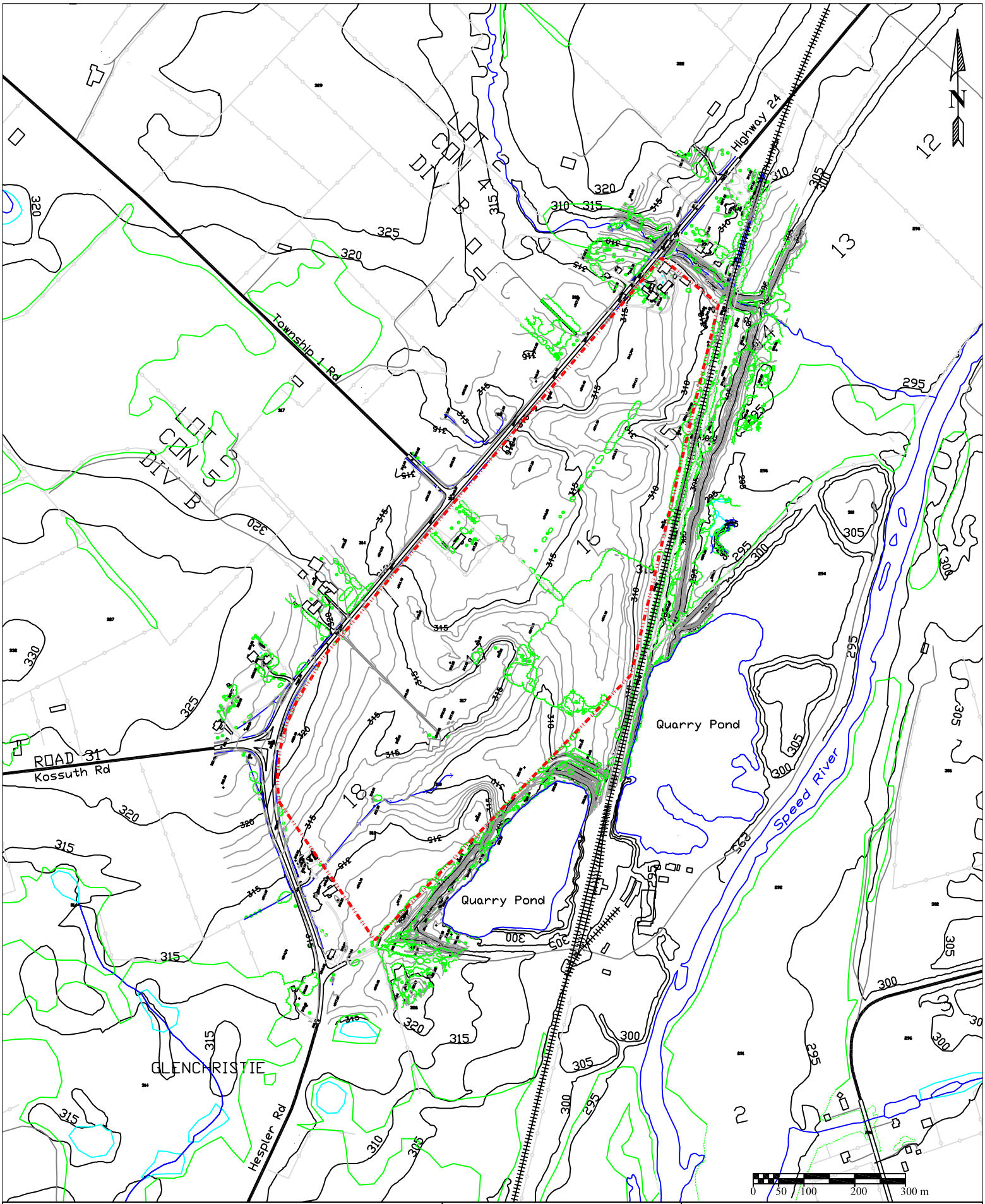
Site (approximate)

Date: February 2014
scale: as shown (approximate)

Groundwater Science Corp.

Figure 1: Site Location

Tri City Lands Ltd. Proposed Spencer Pit
Hydrogrologic Assessment



surface water feature, pond or stream

wetland / marsh (OBM Mapping)

contour interval as shown

proposed licence boundary

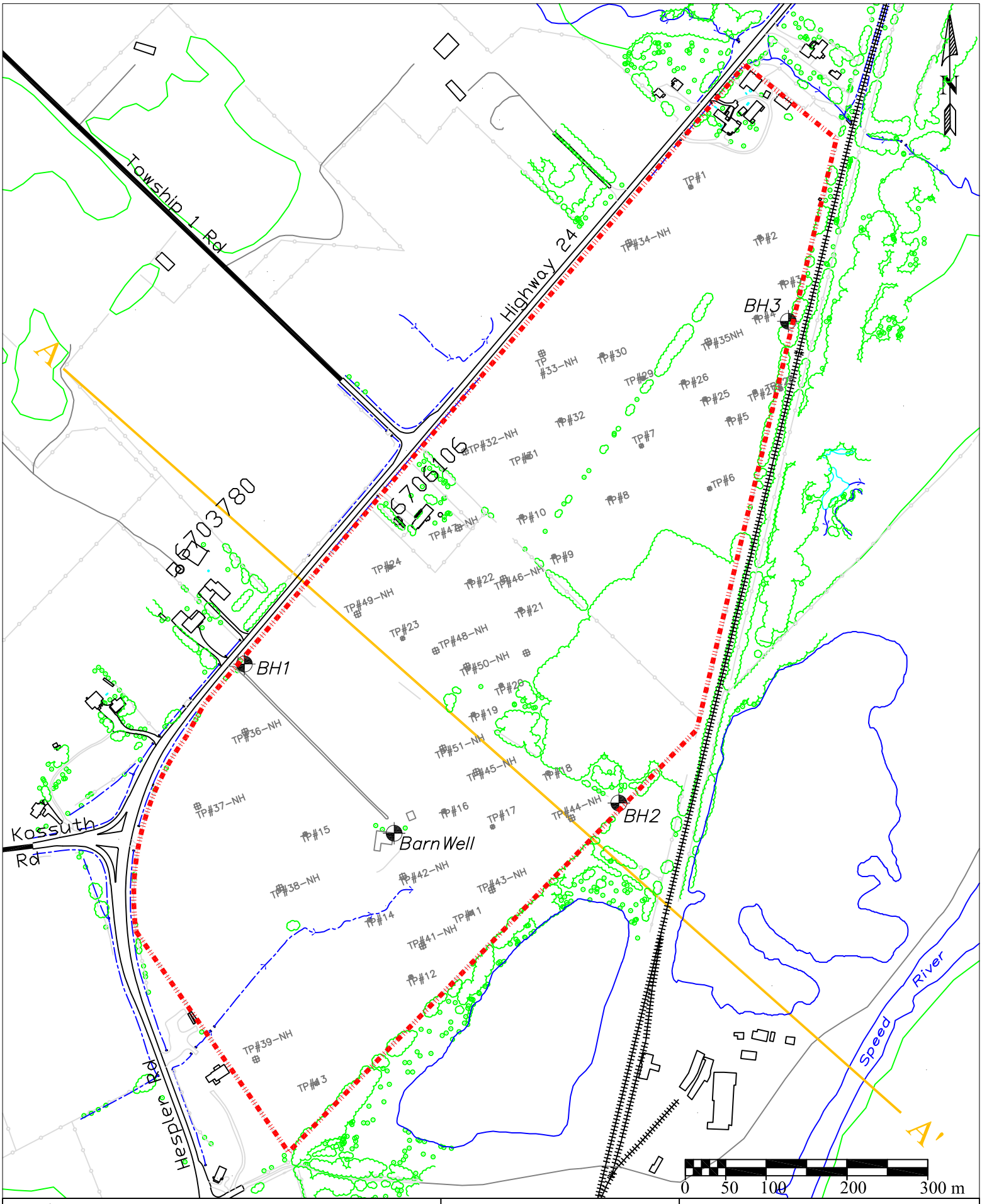
modified from: OBM mapping

Figure 2: Site Setting

February 2014
Scale: as shown

Groundwater Science Corp.

Tri City Lands Ltd.
Proposed Spencer Pit



borehole location and reference

test pit location and reference

selected water well record location

schematic cross-section location

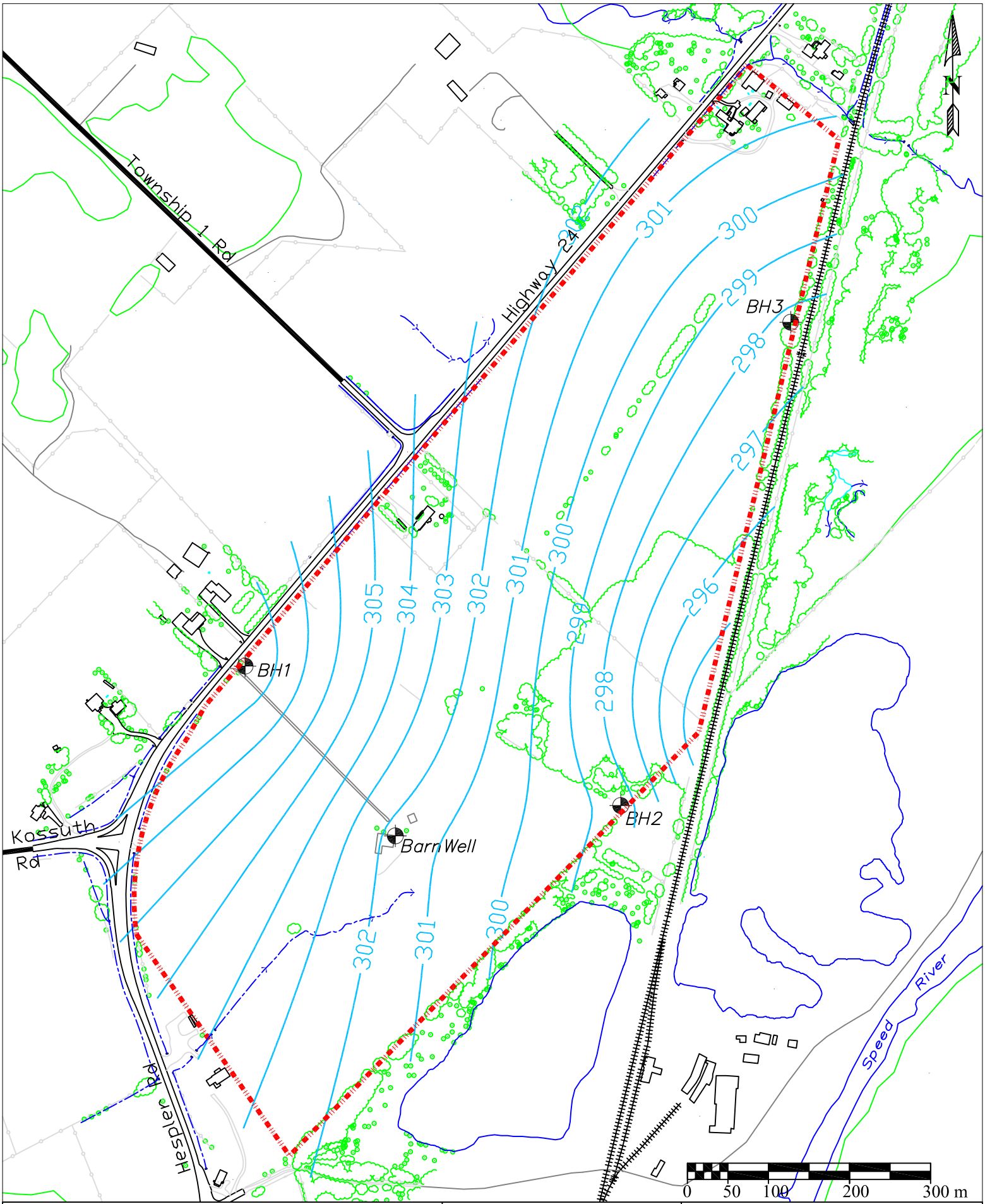
modified from: OBM mapping
UNDER LICENSE, WITHOUT PREJUDICE OR ENDORSEMENT, FROM THE QUEEN'S PRINTER OF ONTARIO

February 2014
Scale: as shown

Groundwater Science Corp.

Figure 3: Borehole Locations

Tri City Lands Ltd.
Proposed Spencer Pit



projected water table contour (mAMSL)

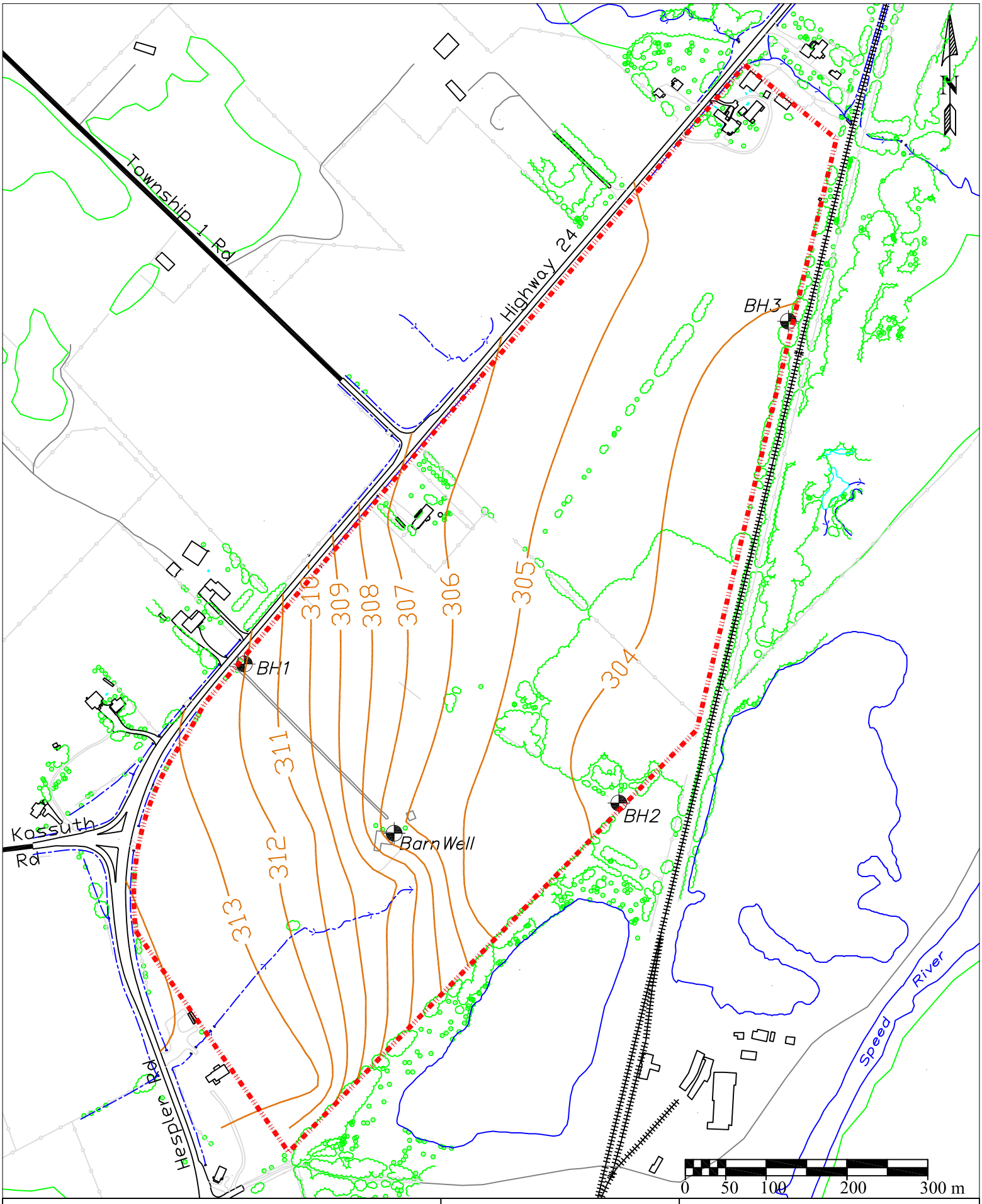
modified from: OBM mapping
UNDER LICENSE, WITHOUT PREJUDICE OR ENDORSEMENT, FROM THE QUEEN'S PRINTER OF ONTARIO

Figure 4: Water Table Contours

February 2014
Scale: as shown

Groundwater Science Corp.

Tri City Lands Ltd.
Proposed Spencer Pit



projected bedrock surface contour (mAMSL)

modified from: OBM mapping
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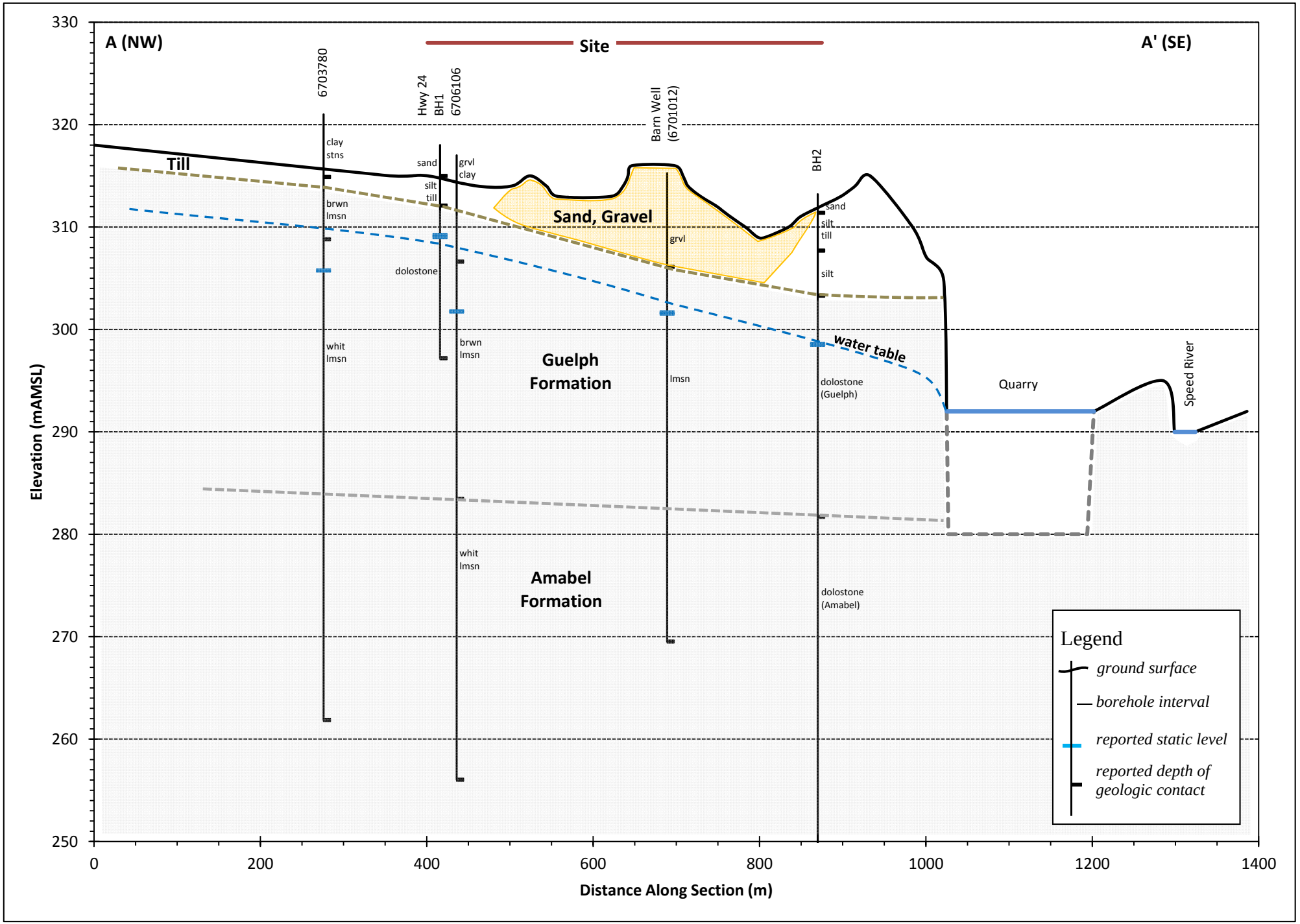
Figure 5: Bedrock Surface

February 2014
Scale: as shown

Groundwater Science Corp.

Tri City Lands Ltd.
Proposed Spencer Pit

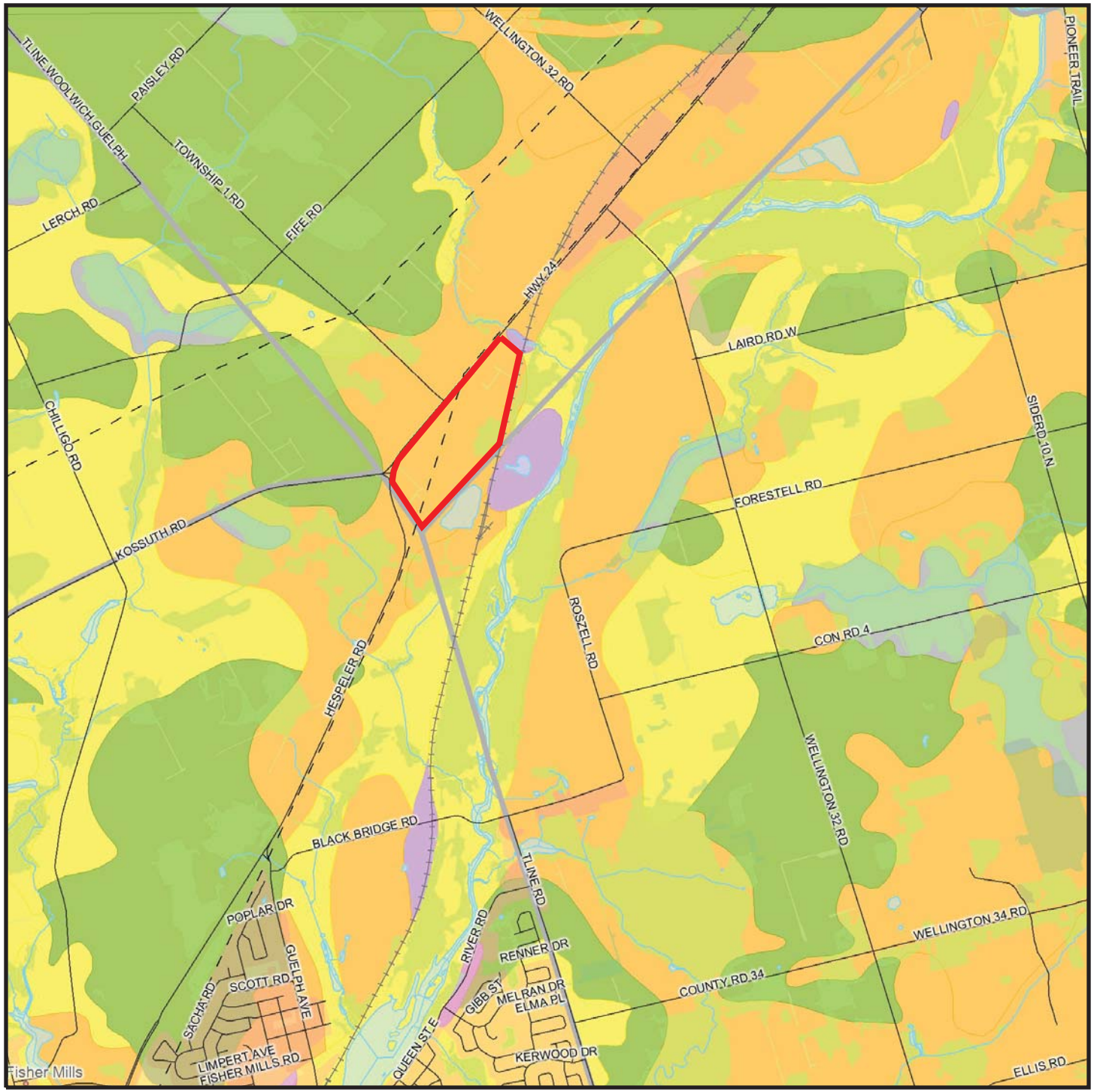


Tri-City Lands Ltd.
Proposed Spencer Pit

Figure 6: Schematic Section A-A'

Groundwater Science Corp.
Hydrogeologic Assessment

Appendix A
Background Information



Grand River Conservation Authority

Map created: January 18, 2012

LEGEND

- WATERSHED MASK
- WATERSHED BOUNDARY (GRCA)
- UTILITY LINE (NRVIS)
- ROADS-ADDRESSED (MNR)
- RAILWAY (NRVIS)
- MUNICIPAL BOUNDARY (GRCA)
- DRAINAGE-NETWORK (GRCA)
- SURFACE WATER IPZ (MUN)
  - IPZ 1
  - IPZ 2
  - IPZ 3
- PARKS (GRCA)
- DRAINAGE-POLY (NRVIS)
- WOODED AREA (MNR)
  - HEDGEROW
  - PLANTATION
  - TREED
- BUILT-UP (MNR)
  - BUILT-UP PERVIOUS
  - BUILT-UP IMPERVIOUS
- SURFICIAL GEOLOGY (MNDM)
  - null
  - clay
  - diamicton
  - fill
  - gravel
  - organic deposits
  - Paleozoic Bedrock
  - sand
  - silt

Quaternary Geology

Site (approx)

GRCA Disclaimer

This map is for illustrative purposes only. Information contained hereon is not a substitute for professional review or a site survey and is subject to change without notice. The Grand River Conservation Authority takes no responsibility for, nor guarantees, the accuracy of the information contained on this map. Any interpretations or conclusions drawn from this map are the sole responsibility of the user.

The source for each data layer is shown in parentheses in the map legend. For a complete listing of sources and citations go to:

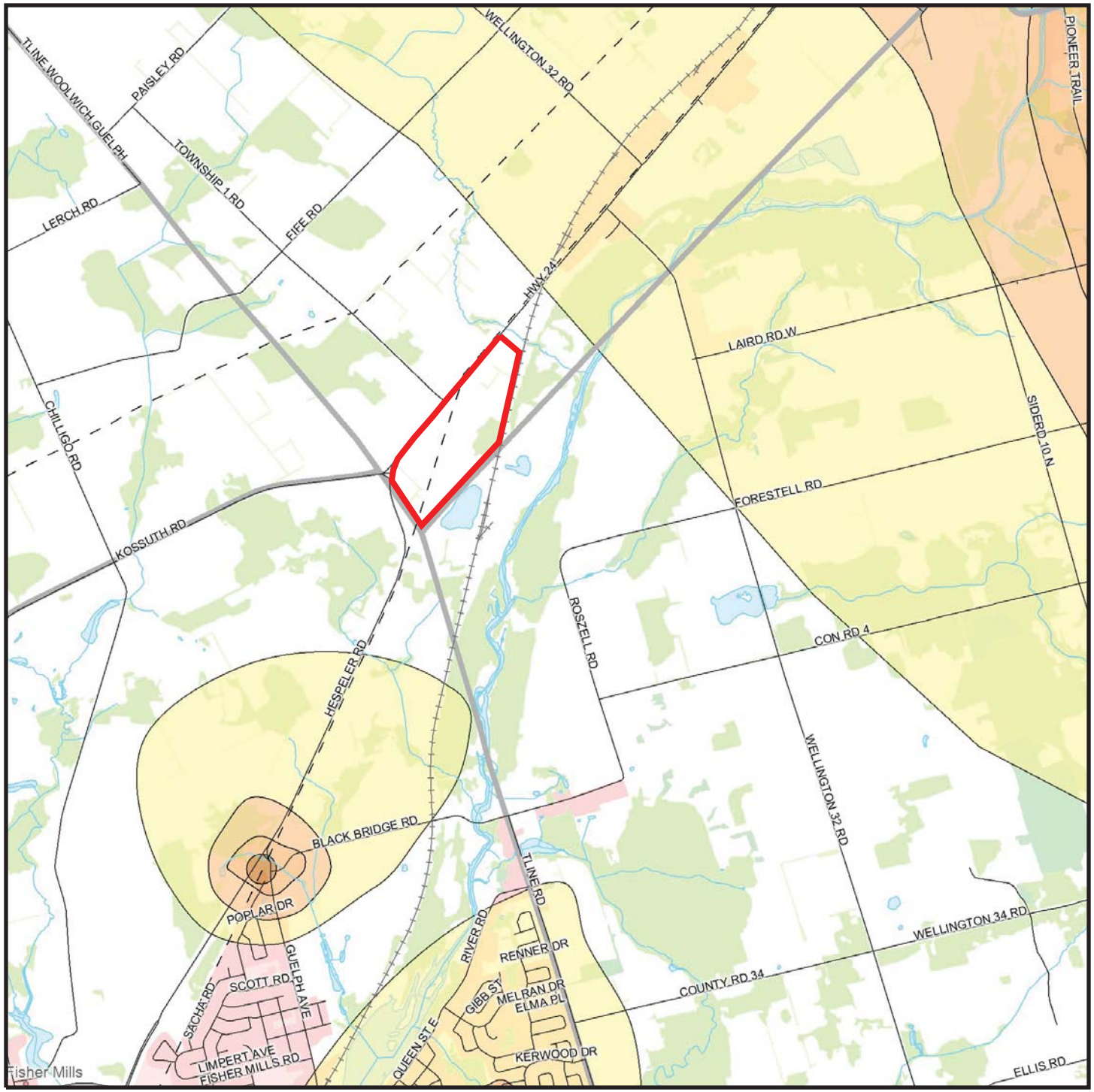
http://grims.grandriver.ca/docs/SourcesCitations2.htm

0 450 900 1350 1800 m.

NAD 1983, UTM Zone 17 Scale 1:38,139

N

THIS MAP IS NOT TO BE USED FOR NAVIGATION



Grand River Conservation Authority

Map created: January 18, 2012

LEGEND

- WATERSHED MASK
- WATERSHED BOUNDARY (GRCA)
- UTILITY LINE (NRVIS)
- ROADS-ADDRESSED (MNR)
- RAILWAY (NRVIS)
- MUNICIPAL BOUNDARY (GRCA)
- DRAINAGE-NETWORK (GRCA)
- WELLHEAD PROTECTION (MUN)
  - WHPA-A
  - WHPA-B
  - WHPA-C
  - WHPA-C1
  - WHPA-D
- PARKS (GRCA)
- DRAINAGE-POLY (NRVIS)
- WOODED AREA (MNR)
  - HEDGEROW
  - PLANTATION
  - TREED
- BUILT-UP (MNR)
  - BUILT-UP PERVIOUS
  - BUILT-UP IMPERVIOUS

Well Head Protection Areas

Site (approx)

GRCA Disclaimer

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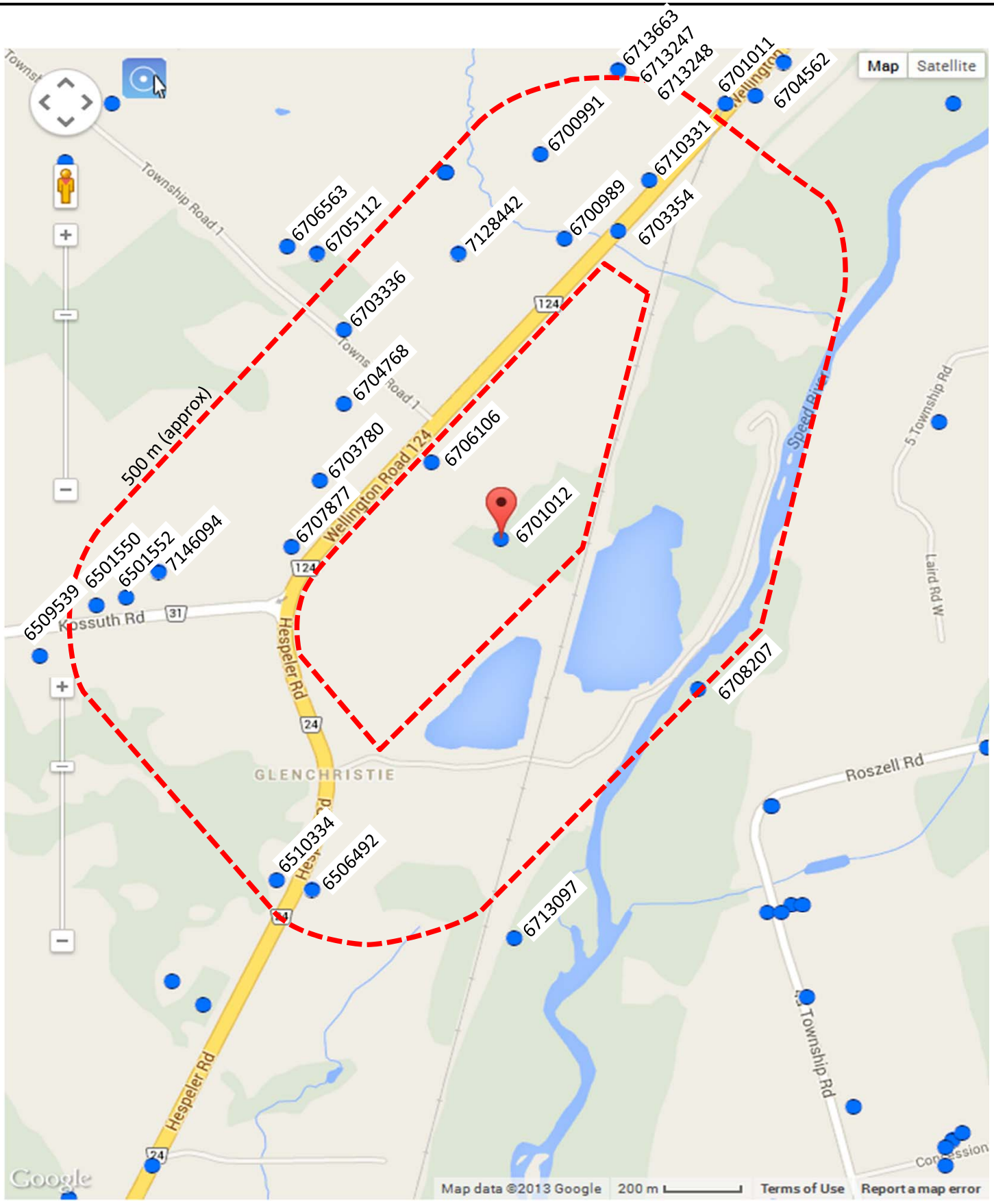
0 450 900 1350 1800 m.

NAD 1983, UTM Zone 17 Scale 1:38,139

N

THIS MAP IS NOT TO BE USED FOR NAVIGATION



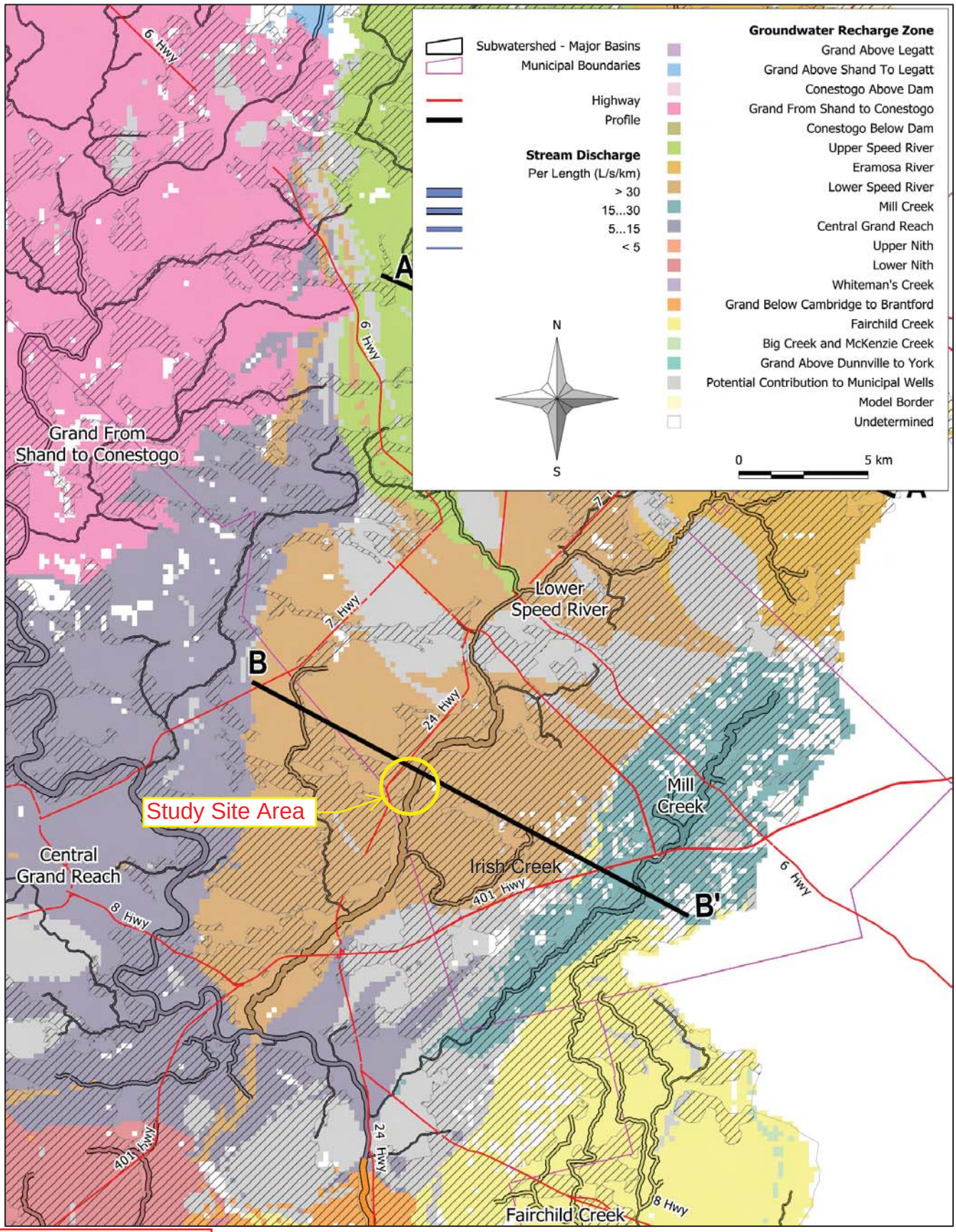
modified from:

http://www.ene.gov.on.ca/environment/en/mapping/wells/index.htm

Site (approximate)	Date: December 2013 scale: not to scale	**Reported Water Well Locations**
	Groundwater Science Corp.	Tri City Lands Ltd. Proposed Spencer Pit Hydrogrologic Assessment

Record No.	Total Depth (m)	Type		Use	Static Level (m)	Bedrock Depth (m)	Source Classification
		constr.	unit				
6501550	17.4	drilled	bedrock	domestic	6.1	3.0	unconfined bedrock aquifer
6501552	21.6	drilled	bedrock	domestic	9.1	5.2	unconfined bedrock aquifer
6506492	18.6	drilled	bedrock	domestic	8.5	14.3	confined bedrock aquifer
6509539	10.6	drilled	bedrock	domestic	1.5	7.6	confined bedrock aquifer
6510334	30.5	drilled	bedrock	domestic	10.7	11.6	confined bedrock aquifer
6700989	40.2	drilled	bedrock	domestic	11.3	9.1	unconfined bedrock aquifer
6700990	48.8	drilled	bedrock	domestic	17.7	4.6	unconfined bedrock aquifer
6700991	35.1	drilled	bedrock	livestock, domestic	7.6	29.0	confined bedrock aquifer
6701012	45.7	drilled	bedrock	livestock, domestic	15.2	9.1	unconfined bedrock aquifer
6701077	33.5	drilled	bedrock	domestic	10.1	4.3	unconfined bedrock aquifer
6703336	31.1	drilled	bedrock	domestic	5.5	10.4	confined bedrock aquifer
6703354	48.2	drilled	bedrock	domestic	7.6	3.0	unconfined bedrock aquifer
6703780	59.1	drilled	bedrock	livestock, domestic	17.1	6.1	unconfined bedrock aquifer
6704562	35.4	drilled	bedrock	domestic	10.7	4.3	unconfined bedrock aquifer
6704768	45.7	drilled	bedrock	domestic	3.0	9.8	unconfined bedrock aquifer
6705112	26.8	drilled	bedrock	domestic	1.8	8.5	unconfined bedrock aquifer
6706106	61.0	drilled	bedrock	domestic	15.2	10.4	unconfined bedrock aquifer
6706563	61.0	drilled	bedrock	domestic	6.7	13.7	confined bedrock aquifer
6707877	61.6	drilled	bedrock	domestic	10.7	10.1	unconfined bedrock aquifer
6708207	25.6	drilled	bedrock	industrial	1.5	4.0	unconfined bedrock aquifer
6710331	39.3	drilled	bedrock	domestic	8.5	3.0	unconfined bedrock aquifer
6713097	13.1	drilled	overburden	domestic	9.8	-	unconfined sand/gravel aquifer
6713247	37.5	drilled	bedrock	domestic	14.6	7.0	unconfined bedrock aquifer
6713248	no information			domestic	no information		
6713663	36.6	drilled	bedrock	domestic	11.6	12.8	unconfined bedrock aquifer
7128442	appears to be record of well abandonment, no installation or geologic information						
7146094	36.6	drilled	bedrock	domestic	9.8	11.6	confined bedrock aquifer

Location	Ground Elevation (mAMSL)	Depth Encountered To (m)				Test Pit Total Depth (m)	Bedrock Elevation (mAMSL)
		Topsoil, Overburden , Till	Sand or Gravel	Till Below Sand/Gravel	Bedrock		
TP1	315	1.5	2.5	4.6	-	4.6	-
TP2	312	4.3	-	-	-	4.3	-
TP3	310	0.2	4.6	-	4.6	4.6	305.4
TP4	310	0.2	4.9	4.9	-	4.9	-
TP5	311	0.6	4.4	4.4	-	4.4	-
TP6	311	4.0	-	-	-	4.0	-
TP7	313	0.3	3.0	-	-	3.0	-
TP8	316	0.2	4.0	-	-	4.0	-
TP9	316	0.5	4.0	-	-	4.0	-
TP10	317	0.3	4.6	-	-	4.6	-
TP11	317	0.2	5.0	-	-	4.0	-
TP12	316	0.2	1.4	1.4	-	1.4	-
TP13	317	0.3	3.7	-	3.7	3.7	313.4
TP14	310.5	1.0	-	-	1.0	1.0	309.5
TP15	315	0.3	4.0	-	4.0	4.0	311.0
TP16	315	0.3	0.6	1.5	-	1.5	-
TP17	310	1.0	2.0	3.0	-	3.0	-
TP18	310	0.3	1.6	3.0	-	3.0	-
TP19	317	0.2	4.0	-	-	4.0	-
TP20	317	0.0	4.0	-	-	4.0	-
TP21	315	0.2	4.5	4.5	-	4.5	-
TP22	316	0.2	4.0	-	-	4.0	-
TP23	315	0.3	4.0	-	-	4.0	-
TP24	315	0.3	3.0	-	-	3.0	-
TP25	313	0.3	4.6	4.6	-	4.6	-
TP26	313	3.5	-	-	-	3.5	-
TP27	311	0.5	2.0	2.0	-	2.0	-
TP28	308	3.0	-	-	-	3.0	-
TP29	314	0.2	2.2	-	-	2.2	-
TP30	313	0.3	5.0	-	-	5.0	-
TP31	317	0.3	3.7	-	-	3.7	-
TP32	317	0.3	4.0	-	-	4.0	-
TP32 NH	316.5	0.6	6.0	-	-	6.0	-
TP33 NH	315	1.4	8.0	-	-	8.0	-
TP34 NH	316	0.5	5.5	6.0	-	6.0	-
TP35 NH	309.5	0.6	5.0	6.0	-	6.0	-
TP36 NH	318	6.1	-	-	-	6.1	-
TP37 NH	319	6.1	-	-	-	6.1	-
TP38 NH	313.5	1.5	-	-	1.5	1.5	312.0
TP39 NH	316	0.3	1.5	5.0	-	5.0	-
TP40 NH	n/a	0.3	0.9	8.0	-	8.0	-
TP41 NH	313.5	0.3	8.0	-	-	8.0	-
TP42 NH	309	0.3	1.0	-	2.0	2.0	307.0
TP43 NH	309.5	6.0	-	-	6.5	6.5	303.0
TP44 NH	310.5	6.0	-	-	6.0	6.0	304.5
TP45 NH	315	0.3	4.0	12.0	-	12.0	-
TP46 NH	316	0.3	5.0	6.0	-	8.0	-
TP47 NH	317	0.3	8.0	-	-	8.0	-
TP48 NH	313.5	0.3	6.0	-	-	6.0	-
TP49 NH	314	8.0	-	-	-	8.0	-
TP50 NH	312.5	0.3	8.0	-	-	8.0	-
TP51 NH	316.5	0.3	8.0	-	-	8.0	-
TP52 NH	312	0.3	8.0	-	-	8.0	-



Modified from:
Integrated Water Budget Report
Grand River Watershed
Final Report, June 2009

Figure 77
Speed and Mill – Recharge and Discharge

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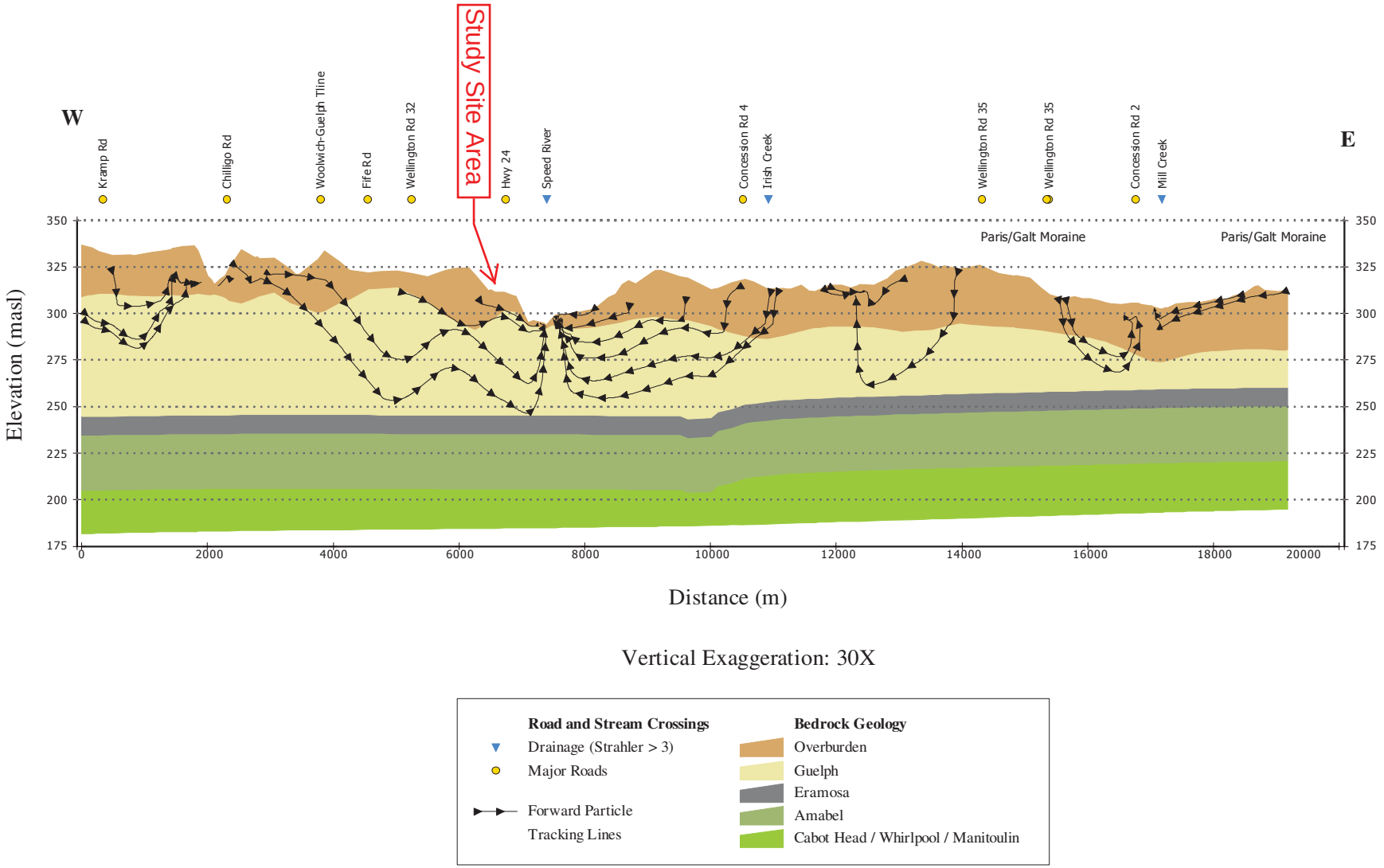

Sanford, B.V. 1969 Geology of the Toronto–Windsor Area, Ontario; Geological Survey of Canada, Map 1263A.
Various Authors, 1975-1980, Paleozoic Geology, Southern Ontario, Ontario Division of Mines. Refer to GRCA metadata.

Figure 78 – Groundwater Pathlines (Profile B-B')

Printed 29/05/2009 3:21 PM

Appendix B
Borehole Logs

BOREHOLE LOG

Borehole: BH1

Project: Proposed Spencer Pit
Location: north property edge at entry lane
Method: Hollow Stem Auger to bedrock, then HQ core
Samples: continuous, 1.5 m (5 ft) sample barrel

Date: Aug 27 to 28, 2013
Supervisor: AP., DN.
Elevations TOC: 318.87 mAMSL
GS: 380.0 mAMSL

Depth Ft.	Depth m.	Sample No.	Sample Interval (metres)	Sample Rec.	Description	Monitor Installation
0	0				**Sand**	protective casing,
			auger		- red/brown fine sand, trace gravel,	cement and bentonite
5			cuttings		dry	(holeplug) seal at surface
10					**Silt Till at 3.0 m**	
15	5				- brown silt till, trace fine gravel, dry	bentonite grout
20					**(Guelph Fm.) Dolostone at 5.9 m**	
		1	5.9 to 7.2	1.30	- grey/brown, weathered, broken, vuggy, porous	
25		2	7.2 to 8.8	1.52	- grey to grey brown soft sugary dolostone, beds 40-60cm, some vertical fracturing	
30		3	8.8 to 10.3	1.52	- grey brown to buff sugary, porous, vuggy, mud infilling in fractures	water level 8.9 mBGS October 1, 2013
	10	4	10.3 to 11.8	1.52	- as above	
35						
40		5	11.8 to 13.3	1.52	- iron staining in fractures, increase in fossil content	nominal 5.1 cm diameter PVC riser and slotted screen
45		6	13.3 to 14.8	1.45	- thicker bedding (60-80 cm), increase in fossil content, larger vugs	
50	15	7	14.8 to 16.3	1.52	- thicker bedding (>1m), calcite infilling fractures	bentonite (holeplug)
55		8	16.3 to 17.8	1.50	- as above	
60		9	17.8 to 19.3	1.52	- coral fossils visible, broken core, evidence of groundwater flow	screen length 3.0 m
65	20	10	19.3 to 20.8	1.37	- as above	silica sand pack
70					**End of Hole at 20.8 m**	
75						
80	25					
85						
90						
95						
100	30					

Groundwater Science Corp.

BOREHOLE LOG

Borehole: BH2

Project: Proposed Spencer Pit
Location: southeast property edge, near gate
Method: Hollow Stem Auger to bedrock, then HQ core
Samples: continuous, 1.5 m (5 ft) sample barrel

Date: Aug 28 to Sept 5, 2013
Supervisor: DN.
Elevations TOC: 314.12 mAMSL
GS: 313.21 mAMSL

Depth Ft.	Depth m.	Sample No.	Sample Interval (metres)	Sample Rec.	Description	Monitor Installation
0	0				**Sand**	protective casing, cement and bentonite (holeplug) seal at surface
			auger cuttings		- brown silty sand, some gravel, dry	
5						
10					**Silt Till at 1.8 m** - brown silt till, trace fine gravel, damp	
15	5					
20					**Silt at 5.5 m** - dense, compacted silt, some clay	bentonite (holeplug)
25						
30						nominal 5.1 cm diameter PVC riser
	10				**(Guelph Fm.) Dolostone at 9.9 m**	
35		1	9.9 to 11.7	1.52	- brown sugary, weathered dolostone, thick bedding, homogeneous	shale traps
40		2	11.7 to 13.1	1.45	- as above	
45		3	13.1 to 14.7	1.55	- as above	
50	15	4	14.7 to 16.2	1.52	- as above	water level 14.9 mBGS October 1, 2013
55		5	16.2 to 17.8	1.52	- as above	
60		6	17.8 to 19.3	1.52	- as above	
65	20	7	19.3 to 20.8	1.50	- as above	open hole in rock
70		8	20.8 to 22.1	1.37	- as above	
75		9	22.1 to 23.8	1.65	- at 22.1 m 0.3 thick layer blue-grey mottled dolostone, fossils present, vuggy	
80	25	10	23.8 to 25.4	1.52	- as above - fracture at 25.7 m, circulation lost	
85		11	25.4 to 26.9	1.32	- as above	
90		12	26.9 to 28.4	1.50	- at 28.6 m change to blue-grey mottled dolostone, vuggy, fossiliferous, intact corals	
95		13	28.4 to 29.8	1.47	- as above	
100	30					

BOREHOLE LOG	**Borehole: BH2**

Project: Proposed Spencer Pit
Location: southeast property edge, near gate
Method: Hollow Stem Auger to bedrock, then HQ core
Samples: continuous, 1.5 m (5 ft) sample barrel

Date: Aug 28 to Sept 5, 2013
Supervisor: DN.
Elevations TOC: 314.12 mAMSL
GS: 313.21 mAMSL

Depth Ft.	Depth m.	Sample No.	Sample Interval (metres)	Sample Rec.	Description	Monitor Installation (continued)
100		14	29.8 to 31.3	1.50	- as above	
					(Amabel Fm.) Dolostone at 31.5 m	open hole in rock
105		15	31.3 to 32.9	1.52	- formation change, dark bedding feature, broken fossil 'hash' below, blue-grey mottled	
110		16	32.9 to 34.4	1.52	dolostone, porous, vuggy, crinoid fossils present	
115	35	17	34.4 to 35.9	1.47	- as above	
120		18	35.9 to 37.4	1.50	- beds 15-20 cm spacing, bioturbated, coral fossils present	
125		19	37.4 to 38.8	1.42	- as above	
130	40	20	38.8 to 40.4	1.42	- competent rock, minimal fracturing	
135		21	40.4 to 41.9	1.45	- as above	
140		22	41.9 to 43.3	1.40	- as above	
145		23	43.3 to 44.8	1.52	- as above	
150	45	24	44.8 to 46.4	1.45	- as above	
155		25	46.4 to 47.7	1.47	- as above	
160		26	47.7 to 49.3	1.55	- as above	
165	50	27	49.3 to 51.0	1.52	- increase in fracturing, less competent, iron staining at fractures (water producing zones)	
170		28	51.0 to 52.3	1.40	- as above	
175		29	52.3 to 53.9	1.57	- very competent, few fractures, bedding thickness 10-20 cm	
180	55	30	53.9 to 55.4	1.47	- as above	
185		31	55.4 to 56.9	1.50	- as above	
190		32	56.9 to 58.4	1.47	- as above	
195	60	33	58.4 to 59.0	0.53	- as above	
200		34	59.0 to 60.5	1.55	- as above	

BOREHOLE LOG | **Borehole: BH2**

Project: Proposed Spencer Pit | Date: Aug 28 to Sept 5, 2013
Location: southeast property edge, near gate | Supervisor: DN.
Method: Hollow Stem Auger to bedrock, then HQ core | Elevations TOC: 314.12 mAMSL
Samples: continuous, 1.5 m (5 ft) sample barrel | GS: 313.21 mAMSL

Depth Ft.	Depth m.	Sample No.	Sample Interval (metres)	Sample Rec.	Description	Monitor Installation (continued)
200		35	60.5 to 61.1	0.53	- as above	
		36	61.1 to 62.6	1.55	- as above	open hole in rock
205		37	62.6 to 63.7	1.14	- as above	
210		38	63.7 to 65.2	1.47	- as above	
	65					
215		39	65.2 to 66.0	0.76	- as above	
		40	66.0 to 67.5	1.47	- as above	
220						
		41	67.5 to 69.0	1.52	- as above	
225						
		42	69.0 to 70.6	1.50	- as above	
230	70					
		43	70.6 to 72.1	1.42	- as above	
235						
120		44	72.1 to 73.6	1.52	- as above	
		45	73.6 to 74.9	1.32	- as above	
245	75					
		46	74.9 to 76.5	1.52	- as above	
250						
		47	76.5 to 78.0	1.52	- as above	
255						
		48	78.0 to 79.5	1.50	- as above	
260						
	80	49	79.5 to 81.0	1.50	- as above	
265						
		50	81.0 to 82.5	1.55	**(Rochester Fm?) Shale/Dolostone at 81.8 m**	
270					- formation change, dark grey thinly bedded	
		51	82.5 to 84.0	1.52	shale, interlayered with blue-grey dolostone	
275						
	85	52	84.0 to 85.5	1.52	- as above	
280						
					End of Hole at 85.5 m	
285						
290						
295	90					
300						

BOREHOLE LOG

Borehole: BH3

Project: Proposed Spencer Pit
Location: east property edge, south of laneway
Method: Hollow Stem Auger to bedrock, then HQ core
Samples: continuous, 1.5 m (5 ft) sample barrel

Date: Sept 6 to 12, 2013
Supervisor: DN.
Elevations TOC: 308.01 mAMSL
GS: 307.08 mAMSL

Depth Ft.	Depth m.	Sample No.	Sample Interval (metres)	Sample Rec.	Description	Monitor Installation
0	0				**Sand**	protective casing, cement and bentonite (holeplug) seal at surface
			auger cuttings		- fine brown sand, some silt, trace gravel, dry	
5					- fine brown sand, some gravel, dry	
10						bentonite (holeplug)
15	5	1	4.0 to 4.1	0.05	**(Guelph Fm.) Dolostone at 4.0 m**	
		2	4.1 to 5.6	1.45	- tan/white mottled white/grey, dolostone sugary, porous, vuggy, no distinct bedding	shale traps
20		3	5.6 to 7.2	1.52	- as above	nominal 5.1 cm diameter PVC riser
25		4	7.2 to 8.7	1.52	- mottled grey-white to blue grey, coral fossils - fracture at 9.1 m, infilled with mud	
30	10	5	8.7 to 10.2	1.50	- as above	
35		6	10.2 to 11.7	1.47	- water producing zones at 11.1 m, 11.6 m	
40		7	11.7 to 13.3	1.60	- as above	▽ water level 12.8 mBGS October 1, 2013
45		8	13.3 to 14.8	1.50	- as above	
50	15	9	14.8 to 16.3	1.45	- as above	
55		10	16.3 to 17.8	1.52	- grey to blue grey dolostone, fossiliferous, vuggy, soft (6-9 fractures per metre)	
60		11	17.8 to 19.3	1.50	- as above	
65	20	12	19.3 to 20.8	1.55	- as above	open hole in rock
70		13	20.8 to 22.3	1.37	- as above	
75		14	22.3 to 23.9	1.52	- as above	
80	25	15	23.9 to 25.4	1.52	- as above	
85		16	25.4 to 26.9	1.50	- as above	
90		17	26.9 to 28.4	1.52	- as above	
95		18	28.4 to 29.9	1.22	- large fracture/void space 29.1 to 29.6 m	
100	30				- 29.6 to 31.7 some dark brown layered zones,	

BOREHOLE LOG	**Borehole: BH3**

Project: Proposed Spencer Pit
Location: east property edge, south of laneway
Method: Hollow Stem Auger to bedrock, then HQ core
Samples: continuous, 1.5 m (5 ft) sample barrel

Date: Sept 6 to 12, 2013
Supervisor: DN.
Elevations TOC: 308.01 mAMSL
GS: 307.08 mAMSL

Depth Ft.	Depth m.	Sample No.	Sample Interval (metres)	Sample Rec.	Description	Monitor Installation (continued)
100		19	29.9 to 31.3	1.40	thinly bedded and, fossiliferous, bioturbated	
					(Amabel Fm?) Dolostone at 31.7 m	open hole in rock
105		20	31.3 to 32.7	1.47	- possible formation change, blue-grey dolostone, massive, low porosity,	
110		21	32.7 to 34.4	1.65	large fracture (total circulation loss) at 32.7 m	
115	35	22	34.4 to 35.9	1.55	- as above	
120		23	35.9 to 37.5	1.55	- as above	
125		24	37.5 to 39.0	1.50	- as above	
130	40	25	39.0 to 40.5	1.52	- as above	
135		26	40.5 to 42.0	1.45	- as above	
140		27	42.0 to 43.2	1.27	- as above	
		28	43.2 to 44.8	1.52	- 0.2 m void space at 43.9 m	
145	45	29	44.8 to 46.3	1.55	- as above	
150		30	46.3 to 47.9	1.55	- as above	
155		31	47.9 to 49.4	1.52	- soft white dolostone, fossil 'hash' with abundant crinoid fossils	
160	50	32	49.4 to 50.8	1.45	- massive blue grey dolostone at 50.3 m	
165		33	50.8 to 52.3	1.52	- as above	
170		34	52.3 to 53.9	1.52	- as above	
175		35	53.9 to 55.4	1.55	- as above	
180	55	36	55.4 to 56.9	1.52	- as above	
185		37	56.9 to 58.5	1.52	- as above	
190		38	58.5 to 60.0	1.52	- as above	
195	60	39	60.0 to 61.5	1.52	- as above	
200						

BOREHOLE LOG | **Borehole: BH3**

Project: Proposed Spencer Pit
Location: east property edge, south of laneway
Method: Hollow Stem Auger to bedrock, then HQ core
Samples: continuous, 1.5 m (5 ft) sample barrel

Date: Sept 6 to 12, 2013
Supervisor: DN.
Elevations TOC: 308.01 mAMSL
GS: 307.08 mAMSL

Depth Ft.	Depth m.	Sample No.	Sample Interval (metres)	Sample Rec.	Description	Monitor Installation (continued)
200						
		40	61.5 to 63.0	1.50	- as above	open hole in rock
205						
		41	63.0 to 64.5	1.52	- as above	
210						
	65	42	64.5 to 66.1	1.55	- as above	
215						
		43	66.1 to 67.6	1.52	- as above	
220						
		44	67.6 to 69.1	1.52	- as above	
225						
		45	69.1 to 70.6	1.45	- as above	
230	70					
		46	70.6 to 72.1	1.52	- as above	
235						
120		47	72.1 to 73.6	1.50	- as above	
		48	73.6 to 75.1	1.52	- as above	
245	75					
		49	75.1 to 76.6	1.47	- as above	
250						
		50	76.6 to 78.2	1.57	- as above	
255						
		51	78.2 to 79.7	1.40	- major void encountered end of run	
260						
	80	52	79.7 to 81.2	0.15	- fracture / void space, little return	
265						
					End of Hole at 81.2 m	
270						
275						
	85					
280						
285						
290						
295	90					
300						

Appendix C
Qualifications

Groundwater Science Corp.

328 Daleview Place,
Waterloo, ON N2L 5M5
Phone: (519) 746-6916
groundwaterscience.ca

QUALIFICATIONS

February 2014

Andrew Pentney, B.Sc., P.Geo.

Current Position

Principal, Hydrogeologist Groundwater Science Corp., Waterloo, ON

Providing hydrogeological consulting expertise to regulatory agencies, environmental consultants and industry. Services ranging from individual consulting and assessments to project support for larger study teams, including testimony at OMB hearings.

Over 25 years of hydrogeologic consulting experience.

Education

B.Sc. (1987) : University of Waterloo, Waterloo, ON

General Science, including Geology (stratigraphy, quaternary geology and hydrogeology courses).

Professional memberships

Registered Professional Geoscientist in Ontario

Licenced MOE Well Technician and Contractor

Range of Experience

- Technical consultation for 8 Subwatershed Scale characterization studies (for GRCA, CVC). Focus on assessing groundwater – surface water interaction (at rivers, streams, wetlands, ponds).
- Planning approval and environmental peer review, watershed planning support to Credit Valley Conservation on an as-needed basis from 2001 to 2013.
- Community Scale Septic System Impact studies for Alton, Cheltenham and Erin as part of Village Planning Assessments.
- Water supply development, testing and impact assessment, Permit To Take Water consulting, Source Water Protection characterization and water balance studies for municipal water supplies, golf courses, industrial supply (over 20 assessments).
- Aggregate Resource Act Level 1 and Level 2 Assessments, and associated Zoning and Official Plan amendment impact assessments, at over 25 above water and 26 below water extraction sites. Extensive assessment and analysis of groundwater-surface water interactions (at rivers, streams, wetlands, ponds).
- Aggregate Resource Act compliance monitoring at over 26 above water and/or below water extraction sites. Includes measurement of water level, water quality, thermal impact and groundwater-surface interaction.