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LEVEL 2 HYDROGEOLOGICAL INVESTIGATION IN SUPPORT OF A CATEGORY 12 (BELOW THE WATER TABLE) QUARRY DARIEN AGGREGATES QUARRY TOWNSHIP OF LONG DISTRICT OF ALGOMA, ONTARIO

prepared for

Tulloch Engineering Inc.
1942 Regent Street, Unit L
Sudbury, Ontario
P3E 5V5

Waters Environmental Geosciences Ltd.

Project No. 214-281, August 24, 2015

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August 24, 2015 214 - 281

Tulloch Engineering Inc.
1942 Regent Street, Unit L
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Attention : Gary MacKay, P.Eng.
Project Manager

Dear Gary,

LEVEL 2 HYDROGEOLOGICAL INVESTIGATION
IN SUPPORT OF A CATEGORY 12
(BELOW THE WATER TABLE) QUARRY
DARIEN AGGREGATES QUARRY
TOWNSHIP OF LONG
DISTRICT OF ALGOMA, ONTARIO

As requested, Waters Environmental Geosciences Ltd. has prepared a Hydrogeological Level 2 Report relating to the groundwater conditions in the vicinity of a proposed quarry in Long Township, District of Algoma, near Spragge, Ontario. This Hydrogeological Level 2 assessment was conducted in accordance with guidance received from the Ministry of Natural Resources, and through reference to MNR Policy No. A.R.2.01.06 (dated March 15, 2006). Specifically, our report addresses the position of the established water table relative to the proposed excavation depth(s), the significance of any anticipated effects on the nearby groundwater and surface water regimes, and the feasibility for mitigation of the identified effects.

This report constitutes our professional opinion of the site conditions, as evidenced by our personal field observations, field monitoring activities and supplemented by available hydrogeological/geological/topographic data covering the study area. In accordance with the Professional Geoscientists Act (2000), this report has been prepared by a qualified professional (whose qualifications are appended to this document).

1.0 BACKGROUND

The proposed Darien Aggregates Quarry in Long Township (District of Algoma) is located in a remote upland area approximately 4 km north of the Highway 17 corridor, and approximately 7 km northwest of Spragge. The site is accessed from Highway 17 via Pronto Road and a bush trail located at the terminus of Pronto Road. The proposed quarry site encompasses an area of approximately 109 ha (based on information provided by Tulloch Engineering Inc.). A site location map is presented in Figure 1.

Initially, the proposed quarry operation was envisaged as being an above the water table operation, and in support of this undertaking, Waters Environmental Geosciences Ltd. was retained (in May, 2014) by Tulloch Engineering Inc. to prepare a Groundwater Summary Statement. Our report (Waters Report No. 214 - 272, dated July 26, 2014) concluded that the study site is underlain by a relatively shallow water table condition, and that the water table profile is complex (and appears to be strongly influenced by the topography and the presence of nearby surface water bodies). Water table profile mapping was provided in the report, and recommendations on possible excavation depths were made in order to maintain a minimum 2 m freeboard in bedrock, above any static water level, which is required under MNR Policy No. A.R.4.01.04 (2006). This information was subsequently passed on to the client for their consideration.

In October, 2014, Waters Environmental Geosciences Ltd. was again retained by Tulloch Engineering Inc. to undertake hydrogeological investigations in support of a decision to investigate a below the water table quarry operation at the study site. As described in our work proposal (dated September 24, 2014), the proposed quarry operation will involve excavation below the water table on Crown Land, which is a Category 12 aggregate permit. The submission of an application for a Category 12 aggregate permit must be accompanied by technical reports, which include site-specific hydrogeological investigations.

As identified in the MNR Application Standards (MNRF, 2015), the approach to the hydrogeological investigations is phased as a Hydrogeological Level 1 study, and (if warranted) a Hydrogeological Level 2 study. The Hydrogeological Level 1 study is referred to as a “preliminary” hydrogeologic evaluation, and the purpose of the Level 1 study is twofold:

- to determine the final extraction elevation relative to the established groundwater table(s) in both unconsolidated surficial materials (if present) and the consolidated bedrock strata, and

- to determine the potential for adverse effects to groundwater and surface water resources, and their uses (e.g. water wells, groundwater aquifers, surface water courses and bodies, discharge areas, etc.).

In contrast to the investigation methods followed in developing a Groundwater Summary Statement for an above the water table type of application, the below the water table application requires that the water table elevation be defined across the study area (using borehole data at strategic locations) and that the proposed site operations and depth of extraction be related to the proven water table elevation(s).

In addition, the Hydrogeological Level 1 study must assess the potential for adverse effects on the surrounding groundwater and surface water systems. Should the proposed site operations and development be shown to have minimal adverse impacts (from a hydrogeological perspective), then the site investigation would stop at the Hydrogeological Level 1 study and the supporting technical report would be issued for inclusion with the quarry Application package.

If the Hydrogeological Level 1 study identifies a potential for adverse effects of the proposed quarry operation on groundwater and surface water resources and their uses, then the Hydrogeological Level 2 study is conducted to perform an impact assessment to determine the significance of the effect(s) and to make recommendations on the feasibility of mitigation (of the identified adverse affects).

The exact scope of the Hydrogeological Level 2 study is determined by the nature of the impact(s) identified in the preliminary hydrogeologic evaluation. However, general guidance on the potential scope of work to be completed in the Hydrogeological Level 2 study is outlined in the MNRF Application Standards (2015), which indicates that the assessment should address the potential effects of the proposed quarry operation on the following features (where applicable) if they are located within the zone of influence for the extraction below the groundwater table:

- water wells
- springs
- groundwater aquifers
- surface water courses and bodies
- discharges to surface water
- proposed water diversion, storage and drainage facilities on-site
- description of the physical setting including local geology, hydrogeology and surface water systems
- water budget

As well the Hydrogeological Level 2 study will present the following:

- the study methodology
- the impact assessment
- mitigation measures including trigger mechanisms
- a contingency plan
- a monitoring plan, and
- technical support data in the form of tables, graphs and figures (usually appended to the report)

The Hydrogeological Level 2 study, therefore, seeks to quantify the significance of the identified impacts, and to determine if mitigation of the impacts is feasible. Should the outcome of the Hydrogeological Level 2 study indicate that the identified impacts can be managed, then the report would proceed to identify the mitigation measures, and provide a pro-active monitoring program (with trigger mechanisms and contingency plans).

In the present assessment, the study area abuts several surface water features and is located on the headwaters area of several small drainage sub-basins that feed nearby surface water features. The creation of a quarry at this location, therefore, has the potential to impact the nearby surface water regime.

As a result of our preliminary assessment, there was sufficient information obtained during the Hydrogeological Level 1 study program to indicate that further analysis at a Hydrogeological Level 2 study program was warranted.

These preliminary findings were reported to Tulloch Engineering Inc. in a brief report (Appendix A), dated June 22, 2015, and a recommendation was made to proceed with the on-going analysis as a Hydrogeological Level 2 study.

The present report details the findings of the Hydrogeological Level 2 study, and incorporates information gathered under the Level 1 study phase. As well, this report includes background information previously presented in the 2014 Groundwater Summary Statement (by Waters Environmental Geosciences Ltd.).

2.0 STUDY METHODOLOGY

The Hydrogeological Level 2 study involved the review of published topographical and geological reports (including past site study reports), airphoto interpretation using on-line GoogleEarth imagery, a review of nearby water well records (from the on-line Ministry of The Environment and Climate Change website), a review of climatological data (from the Environment Canada website) and the collection of field data from detailed surface water elevation and groundwater level measurements across the study area (with the assistance of Tulloch Engineering Inc. staff) in the spring of 2015.

Our approach to the impact assessment was to evaluate the role that the proposed quarry site plays in the present hydrological setting (incorporating both surface water and groundwater regimes, which are interconnected). One the relationships between surface water and groundwater systems were defined, the anticipated changes to the systems as a result of the proposed quarrying operations were assessed though a combination of water balance and seepage analyses.

Mechanisms to mitigate the anticipated changes to the surface water and groundwater systems (if required) were identified for consideration in the final planning and development of the quarry site. A monitoring program, specific to the mitigation measures, was developed, including trigger criteria and proposed contingency measures to reduce impacts.

The results of the Hydrogeological Level 2 assessment are presented in the sections which follow.

3.0 RESULTS

3.1 REGIONAL PHYSIOGRAPHY

The proposed Darien Aggregates Quarry in Long Township is located on a local height of land which rises approximately 60 m above the elevation of Lauzon Lake, a prominent surface water body on the north side of the Highway 17 corridor (Energy Mines and Resources Canada 1:50,000 NTS mapping, 41-J/2, 1995). The rise in landform on the north side of Lauzon Lake coincides with a series un-named faults that are offset and parallel to the Pronto Thrust Fault (Ontario Department of Mines, 1970), and regionally has been referred to as the Lauzon Heights (Ontario Department of Mines, 1967). The study area comprises a undulating bedrock-dominated plateau that extends from Long Lake (on the east) towards Hastie Lake (on the northwest). The underlying bedrock is identified as comprising Archean-aged (Algoman) granitic gneisses, with mafic intrusions (Ontario Department of Mines, 1970). On the plateau landform itself, local topographic relief is low, and typically is on the order of 10 m in the immediate study area.

The study area is dominated by bedrock knob topography, with subordinate ground moraine till deposits and organic deposits (NOEGTS Map 5008, 1979). The bedrock areas are characterized as having moderate local relief, and a cliffy to rugged surface condition and a dry to mixed wet and dry drainage. Overburden deposits are not mapped as being present on the highland area, although peaty organic terrain is mapped in lower elevation areas adjacent to the adjoining surface water features.

Regional drainage is directed to the south and towards Lake Huron, however the study area itself constitutes a local surficial drainage divide. Drainage in the northern and eastern portion of the study area is directed to a un-named creek and wetland area which eventually reports eastwards to Long Lake. The southern and western portion of the study area drainage is directed to a series of wetlands which eventually report to an un-named creek that drains southwards into Lake Lauzon (approximately 2 km south of the study site).

The site was visited (by Waters Environmental Geosciences Ltd.) as part of the original Groundwater Summary Statement evaluation on May 12, 2014, during which time the general site conditions were documented. The site was accessed from the Highway 17 corridor, via Pronto Road and a bush trail that lead to the northwest. Access to the interior of the property was made using an ATV (all terrain vehicle), following an existing bush trail that extended approximately 2 km to reach the southeastern part of the study area. The site reconnaissance then progressed on foot over an undulating and occasionally rock knob terrain. At the time of the field reconnaissance there was no road access to the study area.

The plateau area was observed to comprise a mixture of broad and generally flat bedrock outcrops, with occasional surface water ponds and wetlands in depressions in the bedrock surface, coupled with occasional bedrock knobs rising approximately 5 m to 10 m above the adjacent landforms. Surficial drainage in the approximate centre of the study area was observed to be directed towards both the north and to the southwest, confirming the presence of a surficial drainage divide (as inferred from the regional mapping).

Photoset 1 includes two photographs of the study area, taken from the approximate centre of the property. As depicted in these photos, the site comprises an undulating bedrock plateau, with ponded surface water in the depressed areas of the bedrock surface. No significant thickness of overburden materials was observed.

A site plan, showing the proposed site boundaries and general topographic features, is presented as Figure 2, derived from 1:20,000 Ontario Base Maps (Ministry of Natural Resources Sheets 20-17-3600-51100,51200,1999) and the site dimensions provided by Tulloch Engineering Inc.

3.2 HYDROLOGICAL SETTING

The initial Groundwater Summary Statement site work, undertaken in 2014, identified that the groundwater and surface water systems were interconnected across the study area, and that the water table profile was complex and interpreted to be strongly influenced by the topography of the bedrock dominated terrain. As part of the Hydrogeological Level 2 assessment, confirmation of the water table profile was obtained through the installation of seven monitoring wells and the detailed measurement of surface water and groundwater elevations across the study area. This work was performed by Tulloch Enginering Inc. under the general guidance of Waters Environmental Geosciences Ltd.

In addition to the field program, an assessment of the watershed characteristics was undertaken through a review of available topographic mapping and airphoto analysis. Drainage basin areas were defined, and the potential hydrologic interaction of the proposed quarry on the nearby surface water systems was evaluated through a water balance assessment, considering both existing and future anticipated water routing through the quarry site.

3.2.1 Groundwater Resources

The proposed Darien Aggregates Quarry site is located on Crown Land, approximately 4 km north of the Highway 17 corridor. The site is remote from any residential developments or municipal groundwater systems, and the nearest residential properties are near Lauzon Lake (accessed via Pronto Road and Bayview Lane) and at the Pronto Townsite properties (on the south side of Highway 17). The closest residential dwelling to the site is situated on Lauzon Lake near the terminus of Pronto Road.

A search of the on-line water well record database managed by the Ministry of the Environment and Climate Change revealed a total of 17 water well records (Appendix B) within a 6 km radius of the site. All of the water well records were associated with either residential or commercial development along the Highway 17 corridor, and the closest reported well was approximately 3 km from the study site (at the Ontario Hydro transmission site on the north side of Highway 17). In general, the recommended pumping rates from the well records indicate that the bedrock in the area has a low groundwater yield potential, indicating that the bedrock has a low hydraulic conductivity.

It should be recognized that, prior to 1984, shallow dug well constructions and owner-constructed water wells were not required to be reported to the Ministry of the Environment, and the exact number of these types of water wells in use, and their geographical distribution across the Province, is unknown and under-reported in the Ministry water well database. In addition, it is recognized that not all well constructions (bedrock or overburden) are reported to the Ministry of the Environment, despite regulatory requirements.

Therefore, the information contained in the water well database is sometimes limited, but what information is available can provide valuable insight into the subsurface hydrogeology of the area.

3.2.2 Monitoring Well Program

A monitoring well installation program was developed through consultation between Waters Environmental Geosciences Ltd., Tulloch Engineering Inc. and Rankin Construction Inc. (on behalf of Darien Aggregates). The drilling of boreholes and instrumentation with monitoring wells was undertaken directly by the client, during the winter of 2015, and Waters Environmental Geosciences Ltd.'s role in the drilling program was to provide guidance on selecting the preferred drilling locations. Accessibility to some of the borehole locations was an issue at one location, and the final field drilling program involved a total of seven boreholes (Figure 3).

The boreholes were advanced using exploration diamond drilling equipment (Chenier Drilling Services, Val Caron) running PQ-sized core and casing, and the boreholes were drilled to approximately 30 m below grade at each location. The drilling program was carried out between January 12 and 18, 2015, and drilling logs (as provided by the client) are presented in Appendix C. The materials encountered during drilling (as logged by JMK Exploration Consulting) included granitic and diabasic bedrock, with minimal overburden (less than 1 m, or absent at most locations).

Following drilling, the open rock boreholes were instrumented with 6 m (20 feet) of threaded steel casing which was grouted into the bedrock with Portland Cement. Each well received an MOE well tag number (A167665 through A167670, and A167613). The water levels in the wells were allowed to come to an equilibrium over several months, after which the wells were subjected to hydraulic testing.

The site was re-visited (by field personnel from Tulloch Engineering Inc.) in April, 2015, at which time the well constructions were examined and the top of casing (and ground surface) elevations were surveyed. The well construction details, and elevations of the critical well components based on the site survey information, are presented in Appendix D. As well, spot elevations of several nearby surface water features were obtained for integration into the hydrologic mapping for the site.

Static water levels were obtained from each monitoring well (Appendix E) using an electric water level tape, and the depth to the borehole base was recorded. Given the time of year of the measurements, the static water levels are interpreted to be representative of the highest water levels on-site.The wells were then developed using a single-use disposable bailer (Rice Engineering), and the recovering water levels were monitored over time in order to permit the calculation of the bulk hydraulic conductivity of the bedrock at each test location. The field data sheets, as provided by Tulloch Engineering Inc., are presented in Appendix F.

The hydraulic conductivity calculations are presented in Appendix G, and from this analysis the bulk hydraulic conductivity of the bedrock was observed to range from 8.1 x 10^{-8} cm/sec to 5.0 x 10^{-4} cm/sec, with a geometric mean value of 1.5 x 10^{-5} cm/sec. These values are well within the range commonly reported in the literature (Freeze and Cherry, 1979) for fractured igneous and metamorphic bedrock. For the purposes of our assessment, the bulk hydraulic conductivity of the bedrock was assumed to be equal to the geometric mean value of 1.5 x 10^{-5} cm/sec (a conservative estimate).

3.2.3 Water Table Profile

The static water level data obtained from the site monitoring wells, and the spot elevations obtained from nearby surface water features, were used to create a pre-development water table map (Figure 4) for the site. The April 2015 field data support the previous water table interpretation, as presented in the Groundwater Summary Statement (Waters Report No. 214 - 272, dated July 26, 2014), and Figure 4 is a revision of the previous water table map incorporating the new groundwater and surface water elevation data.

This groundwater contour map indicates that the site is located on a local groundwater recharge area, which is typical of most bedrock highland areas in this part of Ontario, and emphasizes the role that the surface water features play (as local groundwater discharge areas) in the groundwater flow regime. As discussed previously, the study area is situated on a surface water divide between the Long Lake and Lauzon Lake surface water systems, and similarly this divide is reflected in the pattern of groundwater contours beneath the site.

Typically, in bedrock settings, the water table appears as a subdued reflection of the local topography, and the degree to which the water table rises beneath the bedrock highlands is a function of the bedrock hydraulic conductivity and porosity. In the present assessment, the estimated bulk hydraulic conductivity value of 1.5 x 10^{-5} cm/sec (equivalent to 1.3 x 10^{-2} m/day) is not considered impermeable, but is sufficiently low to account for the observed water table profile (in that higher hydraulic conductivity formations would have a much flatter water table profile).

Based on the water table profile of Figure 4, many parts of the site will have a shallow water table depth below the existing grade (ranging from a few metres to approximately 10 m below grade), with the water table being at surface in the central wetland areas. Therefore, the development of the site will ultimately require excavation below the existing water table.

Conceptually, there are two stages being proposed to the development of the quarry site (as discussed with Tulloch Engineering Inc.). The initial stage will involve a levelling of the topography to a uniform bench elevation, and will involve the removal of the existing bedrock knobs at various locations across the site. In order to minimize potential impacts on the surrounding watersheds, and to the best extent practical, removal of the vegetative cover would be kept to a minimum as the site develops.

If the elevation of the initial bench is maintained at a level above all of the nearby surface water features, then the groundwater drainage encountered during this operation phase will constitute only interstitial water held in the fractures of the bedrock, and there will be no groundwater flow into the site derived from the nearby surface water bodies.

Although technically identified as a water table, these interstitial groundwaters are entirely due a combination of topography and rainwater infiltration, and are not capable of being replenished by any nearby surface water system because they are related to bedrock that is at a higher elevation than the adjacent surface water bodies. As a result, the drainage of groundwater from the bedrock knobs will be transient in nature, and will dissipate over time. The current water table configuration of Figure 4 will therefore flatten in response to the initial site development.

At this stage of the quarrying operation, the levelled bedrock surface would be exposed and would permit detailed surficial mapping of the bedrock structure across the site. This work would be carried out by a qualified geologist with the intent of identifying any geological conditions (such as highly fractured zones or geological contacts) that may have an impact on groundwater flow into the site. Should potentially problematic geological zones be identified, modifications to the planned site development may be required to address these concerns.

Once the quarrying proceeds to a level that is below the elevation of the nearby surface water bodies, then there will be an ongoing groundwater drainage into to the site through the bedrock from the adjacent surface water bodies. The water table configuration beneath the site will be altered to reflect this localized impact on the local hydrogeological setting, and due to active dewatering of the quarry, the groundwater contours beneath the quarried areas will drop as quarrying progresses.

When the extraction operation ceases, it is anticipated that the quarry will be allowed to flood and the open area of the quarry footprint will fill with water and eventually become a new surface water body. The water table surrounding the new pond will rebound with the rising surface water levels until hydraulic equilibrium is once again established between the groundwater flow system in the bedrock and the surrounding surface water systems.

3.2.4 Watershed Evaluation

An evaluation of the location of the proposed Darien Aggregates Quarry site in relation to the regional watershed areas was undertaken through an analysis of available topographic mapping at a 1:20,000 scale (Ministry of Natural Resources Sheets 20-17-3600-51100,51200,1999). Although the main surface water features in the study area comprise either the Long Lake system or the Lauzon Lake system, our analysis identified a total of five sub-watersheds that could potentially be impacted by site development activities. The five sub-watersheds are identified on Figure 5.

The largest sub-watershed, Watershed A, encompasses the drainage area surrounding Long Lake to the point of discharge into Spragge Creek. This sub-watershed encloses a total area of 1,159 ha, and within this area the proposed quarry site footprint occupies 29 ha of Watershed A (or a total of approximately 3 % of the watershed area).

Watershed B encompasses the drainage area surrounding the surface water ponds and wetlands that abut the northern perimeter of the proposed quarry site. This sub-watershed encloses a total area of 358 ha, and within this area the proposed quarry site footprint occupies 31 ha of Watershed B (or a total of approximately 9 % of the watershed area).

Watershed C encompasses the drainage area surrounding the un-named surface water creek system downgradient of Hastie Lake to the point of discharge to Lauzon Lake, and encroaches upon the southwest corner of proposed quarry site. This sub-watershed encloses a total area of 204 ha, and within this area the proposed quarry site footprint occupies 3 ha of Watershed C (or a total of approximately 2 % of the watershed area).

Watershed D encompasses the drainage area surrounding the surface water ponds and wetlands along the southern perimeter of the proposed quarry site, as well as the surface water ponds and wetlands contained within the proposed quarry footprint itself. Watershed D ultimately discharges into Watershed C. This sub-watershed encloses a total area of 54 ha, and within this area the proposed quarry site footprint occupies 26 ha of Watershed D (or a total of approximately 48 % of the watershed area).

Watershed E encompasses the drainage area surrounding the surface water pond and wetland that originates approximately 250 m south of the proposed quarry area, and ultimately discharges into Watershed C. This sub-watershed encloses a total area of 39 ha, and within this area the proposed quarry site footprint occupies 5 ha of Watershed C (or a total of approximately 13 % of the watershed area).

From this analysis, and based on the proposed quarry site footprint area alone, the surface water sub-watersheds that have the greatest potential for impact from the proposed quarry operation are Watershed D (48 % of which lies within the quarry footprint), Watershed E (13% of which lies within the quarry footprint) and Watershed B (9 % of which lies within the quarry footprint). The remaining sub-watersheds (Watershed A and Watershed C) have only a minimal area that is encroached upon by the proposed quarry development (less than 5 % of the total watershed areas).

This watershed area analysis was used in the impact assessment section of this report. It should be noted that the above comments on potential impact from the proposed quarrying operation focus on the hydrologic assessment only, and it is our understanding that other terrestrial effects studies are underway to assess the significance and sensitivity of the identified surface water features to the proposed quarry development.

3.2.5 Water Balance Assessment

A water balance for the proposed Darien Aggregates Quarry site was performed following the Thornthwaite Nomogram Method (Gray, 1973) and using climatological data obtained on-line from Environment Canada (2015). Since there were no climate station data available specifically for the study site (in the Spragge - Algoma Mills area), climate normal statistics specific to the proposed Darien Aggregates Quarry site were generated using climate data from the three closest weather stations, following an interpolation method described in Wang and Anderson (1982). The 20-year climate normal data from three weather stations used in this assessment were identified as Massey, Chapleau A and Sault Ste. Marie A.

The weather statistics for the proposed quarry area, which were used as input data for the Thornthwaite method, are tabled below:

	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean Temperature (°C)	- 10.5	- 9.2	- 4.2	4.3	10.7	15.7	18.5	17.8	13.5	7.1	0.7	- 6.2
Total Precipitation (mm)	60.9	44.6	59.8	62.3	73.7	74.1	73.8	84.9	94.4	100.8	90.4	76.6

Table 1 - Climate Normal Data for the Darien Aggregates site in the Township of Long

The total annual precipitation for the study area, as determined from Table 1, is 896 mm, of which (by the Thornthwaite Nomogram method) a total of 549 mm is anticipated to be lost via evapotranspiration processes, leaving an estimated net water surplus of 347 mm. This water surplus is available to either infiltrate into the groundwater system, or runoff to the surface water system.

The partitioning of the water surplus between runoff and groundwater infiltration can be evaluated by several techniques. The present analysis of groundwater infiltration/recharge potential has not relied upon a methodology based upon soil infiltration factors (Ministry of the Environment, 1995 and 2003), due to concerns raised by Richards (2007), and instead a methodology based on a watershed perspective was used. The partitioning of surface water and groundwater flow in a watershed can be described through the use of a base-flow index value, which is equal to the average rate of baseflow (i.e. groundwater discharge) to the corresponding average rate of total streamflow (Neff, et al., 2005).

In the present sub-watershed assessment, the total streamflow was assumed to be equal to the total annual water surplus value, or 347 mm annually, since all of the water surplus will eventually leave the basin at the outlet as a surface water discharge. The base flow index is a number ranging from zero to one, and as described in their publication, simulation modelling using hydrograph baseflow separation techniques was undertaken by Neff, et al. (2005) for 169 watersheds emptying into the Great Lakes Basin.

Included in their study were the watersheds for the Serpent River system and the Spanish River system (which are in a similar Canadian shield geological setting to the study area), and from our review of their tabulated study data, the anticipated long-term average base-flow index value for this region on the north shore of Lake Huron is approximately 0.70 (an average of 24 simulation runs).

Therefore, in terms of the water budget for the undeveloped site, and by applying the base-flow index method, 243 mm of the water surplus can be assigned to groundwater recharge (and subsequent discharge to the surface water system) while 104 mm of the water surplus is attributed to direct surface runoff.

It should be noted that the authors (Neff, et al., 2005) indicate that the groundwater recharge component may include water retention in wetland areas for some of the simulations. Therefore, there is a tendency for some of the simulation results to over - emphasize the recharge values. The existing water balance, for the undeveloped site and the operating quarry site, is displayed as a block diagram in Figure 6.

When the site is developed as a quarry, the vegetative cover will be removed from the active areas and the corresponding evapotranspiration effects will no longer apply to those areas. Rainwater falling on the open developed area of the site will be directed to temporary water management holding ponds, and there will be no direct surface runoff or evapotranspiration as presently occurs. A portion of the ponded water on-site will be subject to evaporation, but this effect is not a significant loss of water if the pond area is small relative to the overall quarry footprint area. Since the presence of a vegetative cover reduces the on-site water handling requirements, it is beneficial to keep the removal of the existing vegetation to a minimum as the site progresses through the various stages of development.

As well, there will eventually be groundwater drainage into the site (referred to as groundwater influx) from the surrounding bedrock formation. The amount of groundwater influx will depend upon the depth of the excavation bench in relation to the elevation of the adjacent surface water bodies. The net result will be an increase in the water surplus component for the developed area of the site, and this surplus will require management over the lifetime of the facility in order to keep the quarry site from flooding.

3.3 IMPACT ASSESSMENT

Based on discussions with Tulloch Engineering Inc., it is our understanding that the proposed Darien Aggregates Quarry will be constructed in two phases, essentially splitting the site into an eastern half (to be developed first) and a western half (to be developed at a later time). By our calculations of the site footprint provided by Tulloch Engineering Inc., the eastern half occupies an area of approximately 52 ha, the western half occupies an area of 43 ha, and the undeveloped perimeter occupies an area of 14 ha, for a total site footprint of 109 ha.

Although the final layout and operations planning are still under development, and could potentially be influenced by the results of other on-going studies, sufficient information was provided to Waters Environmental Geosciences Ltd. to allow impact assessments to be made based on the current development proposal (from a local watershed perspective).

3.3.1 Conceptual Site Development

All Category 12 quarry operations below the water table are required, under the Application Standards for Proposed Pits and Quarries, to meet a 30 m excavation set-back distance from a body of water that is not the result of excavation of the quarry itself (MNRF, 2015). This is considered to be a minimum set-back distance, and in the present analysis this requirement was applied to all mapped surface water pondings outside of the proposed site footprint area.

Internal ponds and wetland areas, for the purpose of our assessment, were not included in the setback area designation, as these areas were assumed to be consumed in the course of the quarry development (providing that they were not deemed to be sensitive areas under other studies). Where no mapped surface water features exist adjacent to the proposed site perimeter, the quarrying operation would proceed up to the identified site footprint (Figure 2), with no 30 m set-back being applied.

From discussions with the client, a maximum excavation depth of 12 m was assumed for each bench of the quarry, with the quarry face being stabilized at a 2h:1v side-slope in the bedrock. For the purpose of the present impact assessment, the quarry excavation process was conceptualized as involving an 12 m vertical drop followed by a 24 m horizontal offset before the next vertical cut (in order to achieve the overall 2h:1v side-slope). This conceptualization was done in order to aide the groundwater impact calculations, and in practice the site operations would not be restricted to this strict generalization.

As discussed with Tulloch Engineering Inc., the proposed site development will begin with an initial levelling of the existing topography to a uniform datum. This action will remove the bedrock knobs from the top of the plateau area, and assuming that a base elevation of approximately 242 m is maintained, the excavated and levelled site will lie above the elevation of any nearby surface water features.

As a result, there will be no influx of surface water into the site (via shallow groundwater flow in the bedrock), and the water surplus which does accumulate over the open area would be directed (via internal ditching) to a water management holding pond in the southeastern corner of the site (adjacent to Long Lake). The water in the holding pond would subsequently be released into the adjacent watersheds. The site operations would be encouraged to maintain the existing vegetative cover as much as practical in order to promote evapotranspiration and thereby reduce the water handing requirements as site development progresses.

As indicated previously (Section 3.2.3, Water Table Profile), the levelled bedrock surface at the elevation of 242 m would be exposed and would permit detailed surficial mapping of the bedrock structure across the site. This work would focus on identifying any geological conditions (such as highly fractured zones or geological contacts) that may have an impact on groundwater flow into the site. Should potentially problematic geological zones be identified, modifications to the planned site development may be required to address these concerns.

Working from the established bench at 242 m, quarrying would progress downwards in 12 m lifts (with a 24 m off-set, as described above) until the final excavation depth is attained. For the purposes of our impact evaluation, a final lift elevation of 182 m was assumed (or 6 benches in total). A conceptual layout of the final site configuration, showing the quarried area, the set-back areas, and the various internal bench perimeters, is presented in Figure 7 (for the eastern half of the development) and Figure 8 (for the entire site).

3.3.2 Water Management Objectives and Impact Mitigation

The primary objective of water management at the proposed Darien Aggregates Quarry is to maintain the site in as dry a condition as possible during the active quarrying phases, while preserving and maintaining surface water flows in the adjacent watersheds that are most sensitive to the site development.

The development of the quarry will result in an increase in the water surplus within the footprint of the quarry area, and this water surplus must be re-distributed to the adjacent watersheds in a manner that has the least impact (from a water balance perspective). The redistribution of the water surplus to the adjacent watersheds will be the primary mitigation mechanism used to lessen the impact of the proposed quarry operation on it's surroundings.

As previously discussed, the watersheds that are considered the most sensitive to the proposed quarry development are (from Figure 5) Watersheds B, D and E. Therefore, the proposed site water management activities will focus on the maintenance of existing flows in these watersheds through the engineered (and regulated) discharge of the available water surplus to these identified watersheds.

The remainder of the water surplus would be directed to the largest watershed (Watershed A, which includes the drainage area surrounding Long Lake), where, because of the size of the drainage basin, the water surplus residual will have the least overall impact on the existing flow within the basin.

These objectives must also be met within the constraints imposed by the climate and seasonal variations in precipitation. For the present assessment, and referring to the projected weather statistics of Table 1, an assumption was made that any on-site water management activities would cease for the winter months of December through March, where the mean temperature is projected to fall below 0 °C. Consequently, the site water management activities must include provisions for on-site storage of the water surplus accumulated during the winter months. The accumulated water surplus would then be released over the remaining 8 months (244 days) when surface water flow is occurring in the adjacent watersheds.

3.3.3 Groundwater Influx Assessment

Groundwater influx to the quarry operation will occur when the quarried elevation drops below the standing water levels in the adjacent surface water bodies. Since the goal of the water management program is to maintain the elevations of the adjacent surface water features throughout the site development, then the surface water features become (in a groundwater flow system analysis) a constant-head (or constant groundwater elevation) boundary. Pre-development elevation measurements on the adjacent surface water bodies were obtained by Tulloch Engineering Inc., and formed the basis of the present groundwater influx assessment.

The presence and maintenance of such constant-head boundaries surrounding the quarry operation will act to limit the impacts of the site operation on the adjacent groundwater flow systems and watersheds. By establishing constant-head boundaries around the quarry perimeter, the hydrogeologic impacts of the quarrying operation will be limited to the footprint of the quarry itself.

The groundwater influx assessment technique which was employed in this study was based on a steady-state analytical solution to groundwater flow, referred to as the Dupuit equation for unconfined flow (Bear, 1972, Fetter, 2001). The equation requires the elevation of groundwater (head) at an upstream location and at a downstream location in the flow system, the distance separating the two locations and the bulk hydraulic conductivity of the bedrock formation. The equation is as follows

$$Q = 0.5\ K \left(\frac{h_u^2 - h_d^2}{L} \right)$$

where Q is the discharge per unit width of flow system (m^3/day/m width), K is the bulk hydraulic conductivity of the flow system (m/day), h_u is the upstream head in the flow system, h_d is the downstream head in the flow system and L is the distance between the point where h_u and h_d are measured.

In this assessment, h_u was measured at the shoreline of any permanent water body that could potentially contribute water into the quarry via the groundwater system, while h_d was measured at the base of the excavated bench. Only surface water bodies that were aligned along the perimeter of the proposed quarry site were included in this assessment. The datum for these head measurements was taken as the elevation of the excavated bench, and following the assumptions of the Dupuit equation, horizontal flow was assumed. These were considered to be reasonable assumptions for the hydrologic setting of the site.

The bedrock which underlies the quarry site has been characterized as having a bulk hydraulic conductivity which ranges from 8.1×10^{-8} cm/sec to 5.0×10^{-4} cm/sec, with a geometric mean value of 1.5×10^{-5} cm/sec. For the purpose of our assessment, the decision was made to use the geometric mean value of 1.5×10^{-5} cm/sec, which equates to 1.3×10^{-2} m/day. This is considered to be an equivalent bulk permeability of the bedrock formation (based on the available information), and should detailed geological mapping of the exposed bedrock surface indicate un-anticipated geological conditions (such as potentially higher permeability fracture zones or geological contacts), then these calculations may require revision.

In our assessment, the initial separation distance (L) began at an initial minimum value of 30 m, equal to the mandatory set-back distance from a body of water that is not the result of excavation of the quarry itself. For each successive excavation bench into the subsurface, the set back distance was incremented by 24 m in order to maintain the 2h:1V side slope criterion. The analysis proceeded by assessing the total groundwater influx into the quarry for each bench elevation below 242 m, using the Dupuit equation.

The resultant groundwater influx to the quarry site is summarized in Table 2, based on the assumed conditions.

By our calculations, the net groundwater influx to the quarry site is relatively low, totalling (for the deepest anticipated excavation of the entire site to an elevation of 182 m) approximately 580 m^3/day (or approximately 90 Igpm). This low net influx is due to the assumed low bulk hydraulic conductivity of the surrounding bedrock.

Eastern 1/2	Groundwater Influx to the Quarry	
Excavation Bench Elevation (m)	(m^3/day)	Igpm
242	0	0
230	9.5	1.5
218	62.2	9.5
206	142.5	21.8
194	229.1	35.0
182	326.0	49.8
Western 1/2	Groundwater Influx to the Quarry	
Excavation Bench Elevation (m)	(m^3/day)	Igpm
242	0	0
230	14.7	2.3
218	63.6	9.7
206	123.4	18.9
194	190.0	29.0
182	252.8	38.6

Table 2 - Groundwater Influx Values for the Darien Aggregates site in the Township of Long

3.3.4 Water Surplus Assessment

From the water balance assessment, a water surplus from precipitation inputs will develop over the open quarry footprint, in response to the removal of the vegetative cover during quarrying and the creation of the pit area through extraction of material.

As indicated previously, the eastern half of the quarry site occupies an area of approximately 52 ha, while the western half occupies an area of 43 ha. Over these quarried areas, the annual precipitation total of 896 mm will generate a net water surplus of 4.67 x 10^5 m^3 for the eastern half, and a net water surplus of 3.81 x 10^5 m^3 for the western half.

These calculations assume that there will be no direct runoff from the quarried area, and that groundwater gradients will be into the site (and there will be no groundwater discharge component as currently exists in the undeveloped areas).

As well, a conservative assumption was made that all of the vegetative cover had been removed from the site footprint. In practice, the operator would be encouraged to retain as much vegetative cover as is possible from the undeveloped areas of the site.

The identified annual water surplus quantities will require discharge from the quarry area in order to keep the site dry (and to avoid flooding of the working areas). For the entire quarried site footprint, the total water surplus equals a discharge of 8.48×10^5 m^3 annually, or approximately 2,320 m^3/day averaged over one year.

This value is approximately 4 times the anticipated annual groundwater influx to the site, indicates that groundwater influx is not the dominant contributor of water surplus to the quarry operation. Unlike the groundwater influx component, the annual water surplus from precipitation will not change with the depth of the quarry excavation, and will require pro-active management beginning immediately at the start of the operation.

An assessment of the combined water surplus from precipitation inputs and groundwater influx was made for the eastern and western half of the proposed quarry area, using the climatological data from Table 1 and the groundwater influx data from Table 2. The assessment was carried out on a monthly basis, and assumed that the winter water volumes (four months of equivalent water depth accumulation) would be stored on-site for release during the remaining spring, summer and fall seasons (over eight months duration, or 244 days).

The results of our analysis are presented in the following sub-sections, which considered that the quarry development would proceed in two phases.

3.3.4.1 Eastern Phase Assessment

The eastern portion of the quarry operation will be developed first, beginning with a levelling of the topography to an elevation base of 242 m. Quarrying would then proceed downwards in 12 m lifts, with the side-slopes being maintained at a 2h:1v ratio (G. MacKay, pers com.). The total quarried area of this initial site operation is estimated at 52 ha.

The total accrued precipitation received over this area during the winter months of December through March is estimated (Table 1) at 241.9 mm (equivalent water depth), for a total water volume of 1.26×10^5 m^3 . This volume of water would be held in on-site ponds, to be released over the spring, summer and fall season (244 days). In addition, the groundwater influx components over the winter months would add to this storage volume and, depending on the bench elevation of the excavation, could range from 0 m^3 (at a bench elevation of 242 m) to 3.94×10^4 m^3 (at a bench elevation of 182 m).

Expressed as a constant pumping rate, and assuming the release was distributed evenly over 244 days, the maximum accrued winter water volume equals a discharge of approximately 680 m^3/day (approximately 104 lgpm). This is the daily pumping rate surcharge required to discharge the winter water storage from the site, and would be in addition to the monthly water pumping volumes over the spring, summer and fall season.

For the non-winter months, water will enter the site from both precipitation inputs and groundwater influx, and these volumes will require management and discharge to the surrounding watersheds. The groundwater influx components would be dependent upon the bench elevation of the excavation, and a series of scenarios were assessed and the anticipated total pumping requirements from the eastern portion of the quarry are presented in Table 3.

Month	Total Volume To Be Pumped per Month (m^3)			
	Bench @ 242 m	(lgpm)	Bench @ 182 m	(lgpm)
April	4.80×10^4	244	6.26×10^4	319
May	5.44×10^4	268	6.95×10^4	343
June	5.41×10^4	276	6.88×10^4	350
July	5.45×10^4	278	6.96×10^4	343
August	6.03×10^4	297	7.54×10^4	372
September	6.47×10^4	330	7.93×10^4	404
October	6.86×10^4	338	8.37×10^4	413
November	6.26×10^4	319	7.72×10^4	393

Table 3 - Total Pumping Volumes and Equivalent Pumping Rates for the Eastern Half of the Darien Aggregates site in Long Township

By our assessment, the anticipated total pumping requirements for the eastern portion of the Darien Aggregates quarry site could range from 4.80×10^4 m^3 per month (244 lgpm) to 8.37×10^4 m^3 per month (413 lgpm), depending on the final bench elevation. These rates include the pumping of the winter storage waters, as described earlier.

In order to minimize the impacts of the quarry development on the adjacent watersheds, a portion of the water pumped from the eastern half of the quarry would be directed to adjacent watersheds B, D and E. The minimum amount of water directed to each of the watersheds in order to maintain pre-development surface water flow would be equal to the

area of the watershed removed by quarrying multiplied by the water surplus for that area (347 mm annually, from the pre-development water balance).

For watershed B, the area affected by quarrying of the eastern half of the site is approximately 14 ha, which yields a total water surplus value of 4.99×10^4 m^3. For the assumed 244 day non-winter discharge period, this surplus value equates to a daily discharge of 2.05×10^2 m^3/day, or approximately 31 Igpm. This, therefore, is the minimum volume of water that would be diverted back into Watershed B in order to preserve pre-development conditions in the watershed.

For watershed D, the area affected by quarrying of the eastern half of the site is approximately 3 ha, which yields a total water surplus value of 1.16×10^4 m^3. For the assumed 244 day non-winter discharge period, this surplus value equates to a daily discharge of 4.76×10^1 m^3/day, or approximately 7 Igpm. This, therefore, is the minimum volume of water that would be diverted back into Watershed D in order to preserve pre-development conditions in the watershed.

For watershed E, the area affected by quarrying of the eastern half of the site is approximately 5 ha, which yields a total water surplus value of 1.75×10^4 m^3. For the assumed 244 day non-winter discharge period, this surplus value equates to a daily discharge of 7.15×10^1 m^3/day, or approximately 11 Igpm. This, therefore, is the minimum volume of water that would be diverted back into Watershed E in order to preserve pre-development conditions in the watershed.

The net volumes of water directed to watersheds B, D and E, equal to a constant daily discharge of 3.24×10^2 m^3/day (over the 244 day interval), would be subtracted from the total pumping volumes given in Table 3, in order to arrive at the discharge volumes that would be directed to watershed A. These calculations were performed and the results are summarized in Table 4.

From Table 4, the anticipated pumping requirements for the eastern portion of the Darien Aggregates quarry site discharge to Watershed A could range from 3.83×10^4 m^3 per month (195 Igpm) to 7.37×10^4 m^3 per month (363 Igpm), depending on the final bench elevation. In terms of the total annual surface flow in the watershed, the indicated discharges equate to an increase in flow of between 5 % and 8 % of the pre-development values (based on the initial water balance assessment). These are conservative estimates, in that no allowance has been made for any evaporative losses from the temporary water holding ponds on site.

Month	Total Volume To Be Pumped per Month (m^3) to Watershed A			
	Bench @ 242 m	(lgpm)	Bench @ 182 m	(lgpm)
April	3.83×10^4	195	5.29×10^4	269
May	4.43×10^4	218	5.95×10^4	293
June	4.44×10^4	226	5.91×10^4	301
July	4.45×10^4	219	5.96×10^4	294
August	5.06×10^4	249	6.54×10^4	322
September	5.50×10^4	280	6.96×10^4	354
October	5.86×10^4	289	7.37×10^4	363
November	5.29×10^4	269	6.75×10^4	344

Table 4 - Total Pumping Volumes and Equivalent Pumping Rates for the Eastern Half of the Darien Aggregates site in Long Township, Discharge to Watershed A

3.3.4.2 Western Phase Assessment

The western portion of the quarry operation will be developed last, beginning with a levelling of the topography to an elevation base of 242 m. As in the eastern portion of the site, quarrying would then proceed downwards in 12 m lifts, with the side-slopes being maintained at a 2h:1v ratio. The total quarried area of this final site operation is estimated at 43 ha, for a combined total of 95 ha.

The total accrued precipitation received over this area during the winter months of December through March is estimated (Table 1) at 241.9 mm (equivalent water depth), for a total water volume of 1.03×10^5 m^3 . This volume of water would be held in on-site ponds, to be released over the spring, summer and fall season (244 days). In addition, the groundwater influx components over the winter months would add to this storage volume and, depending on the bench elevation of the excavation, could range from 0 m^3 (at a bench elevation of 242 m) to 3.06×10^4 m^3 (at a bench elevation of 182 m).

Expressed as a constant pumping rate, assuming the release was distributed evenly over 244 days, the maximum accrued winter water volume equals a discharge of approximately 550 m^3/day (approximately 84 lgpm). This is the daily pumping rate surcharge required to discharge the winter water storage from the site, and would be in addition to the monthly water pumping volumes over the spring, summer and fall season.

For the non-winter months, water will enter the site from both precipitation inputs and groundwater influx, and these volumes will require management and discharge to the surrounding watersheds. The groundwater influx components would be dependent upon the bench elevation of the excavation, and a series of scenarios were assessed and the anticipated total pumping requirements from the western portion of the quarry are presented in Table 5.

Month	Total Volume To Be Pumped per Month (m^3)			
	Bench @ 242 m	(lgpm)	Bench @ 182 m	(lgpm)
April	3.91×10^4	199	5.05×10^4	257
May	4.44×10^4	219	5.61×10^4	277
June	4.41×10^4	225	5.55×10^4	283
July	4.44×10^4	219	5.61×10^4	277
August	4.92×10^4	243	6.09×10^4	300
September	5.28×10^4	269	6.41×10^4	327
October	5.59×10^4	276	6.76×10^4	333
November	5.11×10^4	260	6.24×10^4	318

Table 5 - Total Pumping Volumes and Equivalent Pumping Rates for the Western Half of the Darien Aggregates site in Long Township

By this assessment, the anticipated pumping requirements for the eastern portion of the Darien Aggregates quarry site could range from 3.91×10^4 m^3 per month (199 lgpm) to 6.76×10^4 m^3 per month (333 lgpm), depending on the final bench elevation.

In order to minimize the impacts of the quarry development on the adjacent watersheds, a portion of the water pumped from the western half of the quarry would be directed to adjacent watersheds B, D and E. The minimum amount of water directed to each of the watersheds in order to maintain pre-development surface water flow would be equal to the area of the watershed removed by quarrying multiplied by the water surplus for that area (347 mm annually, from the pre-development water balance). In terms of development of the western half of the quarry site, additional areas of the watersheds will be affected, and additional discharges to the surface water systems will be required to maintain pre-development surface water flows.

For watershed B, the area affected by quarrying of the western half of the site is approximately 17 ha, which yields a total water surplus value of 5.86×10^4 m^3. For the assumed 244 day non-winter discharge period, this surplus value equates to a daily discharge of 2.40×10^2 m^3/day , or approximately 37 Igpm.

This, therefore, is the minimum volume of water that would be diverted back into Watershed B in order to preserve pre-development conditions in the watershed, and would be added to the discharge quantities from the already developed eastern portion of the quarry. The total discharge to Watershed B would therefore equal 1.09×10^5 m^3, or approximately 68 Igm over the 244 day discharge interval.

For watershed C, the area affected by quarrying of the western half of the site is approximately 3 ha, which yields a total water surplus value of 8.95×10^3 m^3. For the assumed 244 day non-winter discharge period, this surplus value equates to a daily discharge of 3.67×10^1 m^3/day , or approximately 6 Igpm.

This is the minimum volume of water that would be diverted back into Watershed C in order to preserve pre-development conditions in the watershed. Since Watershed C is located immediately downstream of Watershed D, this relatively small discharge value would be added to the discharge to Watershed D, instead of creating an additional discharge point from the site.

For watershed D, the area affected by quarrying of the western half of the site is approximately 23 ha, which yields a total water surplus value of 7.99×10^4 m^3. For the assumed 244 day non-winter discharge period, this surplus value equates to a daily discharge of 3.28×10^2 m^3/day , or approximately 50 Igpm.

This is the minimum volume of water that would be diverted back into Watershed D in order to preserve pre-development conditions in the watershed, and would be added to the discharge quantities from the already developed eastern portion of the quarry, as well as the discharge required to meet the Watershed C objectives. The total discharge to Watershed D would therefore equal 1.01×10^5 m^3, or approximately 63 Igm over the 244 day discharge interval.

The net volumes of water directed to watersheds B, C and D, equal to a constant daily discharge of 6.05×10^2 m^3/day, would be subtracted from the total pumping volumes given in Table 5, in order to arrive at the discharge volumes to watershed A. These calculations were performed and the results are summarized in Table 6, as follows:

Month	Total Volume To Be Pumped per Month (m^3) to Watershed A			
	Bench @ 242 m	(lgpm)	Bench @ 182 m	(lgpm)
April	3.85×10^4	196	4.99×10^4	254
May	4.38×10^4	216	5.55×10^4	274
June	4.35×10^4	222	5.49×10^4	280
July	4.38×10^4	216	5.55×10^4	274
August	4.86×10^4	240	6.03×10^4	297
September	5.22×10^4	266	6.35×10^4	323
October	5.53×10^4	273	6.70×10^4	330
November	5.05×10^4	257	6.18×10^4	315

Table 6 - Total Pumping Volumes and Equivalent Pumping Rates for the Western Half of the Darien Aggregates site in Long Township, Discharge to Watershed A

From Table 6, the anticipated pumping requirements for the western portion of the Darien Aggregates quarry site discharge to Watershed A could range from 3.85×10^4 m^3 per month (196 lgpm) to 6.70×10^4 m^3 per month (330 lgpm), depending on the final bench elevation. In terms of the total annual surface flow in the watershed, the indicated discharges equate to an increase in flow of between 5 % and 8 % of the pre-development values (based on the initial water balance assessment). These are conservative estimates, in that no allowance has been made for any evaporative losses from the temporary water holding ponds on site.

In terms of the total discharge to Watershed A, the values presented in Table 4 and Table 6 are additive, since each table comments only on the discharges from the indicated phase of development. Assuming that the entire site was quarried, the total anticipated discharge to Watershed A would range from 7.68×10^4 m^3 per month (391 lgpm) to 1.41×10^5 m^3 per month (693 lgpm), depending on the final bench elevation. The indicated discharges equate to an increase in annual flow of between 10 % and 16 % of the pre-development values (based on the initial water balance assessment). Again, these are conservative estimates, in that no allowance has been made for any evaporative losses from the temporary water holding ponds on site.

3.3.4.3 Watershed Discharge Summary

For the entire site, with both eastern and western portions being excavated, the discharges to the adjacent watersheds can be summarized as follows:

- for Watershed A, the discharge will be dependent upon the month, site development phase and the bench elevations of the excavated quarry. The information contained in Table 4 and Table 6 can be used to estimate the anticipated interim and final discharge requirements as the quarrying operation proceeds. Assuming that the entire site was quarried, the total anticipated discharge to Watershed A would range from 7.68×10^4 m^3 per month (391 lgpm) to 1.41×10^5 m^3 per month (693 lgpm), depending on the final bench elevation.

- for Watershed B, over a 244 day discharge interval, the anticipated discharge requirements needed to maintain pre-development flows in the watershed are 2.05×10^2 m^3/day , or approximately 31 lgpm, for the eastern half of the site, and 2.40×10^2 m^3/day , or approximately 37 lgpm, for the western half of the site. Initially, when the eastern portion of the site is under development, the discharge to watershed B will be 2.05×10^2 m^3/day , or approximately 31 lgpm. Once the western portion of the site is under development, the total anticipated discharge requirements are 4.45×10^2 m^3/day , or approximately 68 lgpm (for the entire site).

- for Watershed C, over a 244 day discharge interval, the anticipated discharge requirements needed to maintain pre-development flows in the watershed are 3.67×10^1 m^3/day , or approximately 6 lgpm. This watershed is only affected by the western quarrying operation. Due to its location downstream of Watershed D, this discharge would be added to the discharges made at Watershed D, and no separate discharge point would be established for Watershed C.

- for Watershed D, over a 244 day discharge interval, the anticipated discharge requirements needed to maintain pre-development flows in the watershed are 4.76×10^1 m^3/day , or approximately 7 lgpm, for the eastern half of the site, and 3.28×10^2 m^3/day , or approximately 50 lgpm, for the western half of the site. Initially, when the eastern portion of the site is under development, the discharge to watershed D will be 4.76×10^1 m^3/day , or approximately 7 lgpm. Once the western portion of the site is under development, the total anticipated discharge requirements are 4.13×10^2 m^3/day , or approximately 63 lgpm (for the entire site), which includes the discharge requirements for Watershed C.

- for Watershed E, over a 244 day discharge interval, the anticipated discharge requirements needed to maintain pre-development flows in the watershed are 7.15×10^1 m^3/day , or approximately 11 lgpm. This watershed is only affected by the eastern quarrying operation, and the conditions would not change when the western quarrying operation commences.

3.3.5 Impact Mitigation Measures

The proposed water management objectives, which are intended to preserve and maintain surface water flows in the adjacent watersheds (that are most sensitive to the site development) recognize the interconnection between the groundwater flow system beneath the quarry and the surface water bodies which surround the site.

As indicated in Section 3.2.1, Groundwater Resources, the proposed Darien Aggregates Quarry site is remote from any residential developments or municipal groundwater systems, and by our assessment there are no mitigation measures required to protect the groundwater resources adjacent to the site. The reason for this is because the proposed water management process will maintain the water elevations in the adjacent surface water bodies near the site, essentially establishing constant-head boundaries on the groundwater flow system. By this method, the groundwater drawdown effects associated with quarry dewatering will be limited to the areas within the site boundaries and will not extend beyond the constant-head boundaries set by the surface water features surrounding the site.

By the present assessment, the development of the quarry will result in an increase in the water surplus within the quarry area, and this water surplus must be re-distributed to the adjacent watersheds in a manner that has the least impact (from a water balance perspective). The re-distribution of the water surplus to the adjacent watersheds will be the primary mitigation mechanism to lessen the impact of the proposed quarry operation on it's surroundings. The anticipated quantities of water to be re-distributed to the various watersheds, in order to achieve these goals, were previously detailed in Section 3.3.4, Water Surplus Assessment.

The management of internal site drainage and water routing would be based on a separation of natural site drainage from those areas where active quarrying is taking place. The areas of active quarrying would have a potential for water quality impacts due to increased turbidity and potential blasting residue. By separating the two types of water, the volumes of water that may require pre-discharge treatment and water quality polishing would be minimized.

Detailed design of internal water routing, temporary water holding ponds, sediment control and storm water management will be required in advance of any application (to the Ministry of the Environment and Climate Change) for surface water discharges to the environment. Since the final site layout is still in development, pending the completion of other environmental studies on the adjacent wetlands and surface water bodies, no further analysis of the specific surface water discharge structures had been undertaken at the time of this report.

In general, however, the discharges to the adjacent surface water systems must incorporate energy dissipation techniques (such as constructed outfalls and the provision of energy dissipating rip rap) in order to minimize scour and erosion, both within the discharge channel and at the point of emergence to the adjacent surface water systems.

No other impact mitigation measures are being proposed for this quarry development.

3.4 MONITORING

Monitoring of the effects of the proposed Darien Aggregates quarry operation on the local water resources will be undertaken through the collection of water level information, water discharge data and water chemistry analyses.

The groundwater and surface water monitoring results would be detailed in an annual report, that would contain all of the raw analytical laboratory test results and an interpretation of the data collected during the monitoring program. The report would be prepared by a qualified professional, and would compare the test results to the applicable water quality standards for groundwater and surface water, as well as any site-specific discharge criteria established by the Ministry of the Environment and Climate Change.

3.4.1 Surface Water Monitoring

Initially, baseline (i.e. pre-development) conditions on the adjacent surface water systems would be documented by assessing pre-development flows at designated surface water monitoring locations established on each watershed, and through the collection of background water quality samples during the spring, summer and fall seasons. The monitoring locations would be outfitted with a permanent monument-type marker for easy identification in the field, and would be provided with a staff gauge for flow calibration and long-term water level monitoring.

The proposed water quality analyses would include a suite of parameters that reflect general water quality indices, such as major ion chemistry, heavy metals scan, nutrient indicator parameters, nitrogen cycle, total suspended solids, total dissolved solids, total suspended solids, electrical conductivity, pH and volatile organics. In addition, field pH and conductivity measurements would be obtained at each sampling location. These parameters are considered adequate to establish baseline water chemistry conditions, and include many parameters that can be affected by quarrying activities and heavy equipment usage on-site.

Once operations begin, monitoring for the full analytical suite would be carried out three times per year (spring, summer and fall), while routine surrogate monitoring (for electrical conductivity, pH and elevation) would be taken weekly at the designated surface water monitoring points, as well as the on-site temporary holding pond. As well, the proposed monitoring suite would be amended (if required) to meet any specific discharge

requirements regulated by the Ministry of the Environment and Climate Change. Surface water flows would be obtained in spring, summer and fall, and would be correlated to the water elevations at each monitoring station (to generate and calibrate a stage discharge curve for each monitoring location).

Once two years of operating data are collected, the surface water monitoring program would be reviewed and, where conditions permit, recommendations would be made to reduce the number of samples, the analytical suite and the location of samples taken in the program.

3.4.2 Groundwater Monitoring

The monitoring wells, installed as part of the present study, would be used to monitor water level changes across the site as operations progress. As indicated previously, it is anticipated that the water levels in the bedrock beneath the site will drop in response to quarrying, and the long-term groundwater elevation trends would be used to confirm and document the changes in the bedrock flow system in response to quarrying.

Initially, baseline (i.e. pre-development) conditions on the bedrock aquifer would be documented by assessing pre-development static water levels in each monitoring well, and through the collection of background water quality samples during the spring, summer and fall seasons.

The proposed water quality analyses would include a suite of parameters that reflect general water quality indices, such as major ion chemistry, heavy metals scan, nutrient indicator parameters, nitrogen cycle, total suspended solids, total dissolved solids, total suspended solids, electrical conductivity, pH and volatile organics. In addition, field pH and conductivity measurements would be obtained at each sampling location. These parameters are considered adequate to establish baseline water chemistry conditions, and include many parameters that can be affected by quarrying activities and heavy equipment usage on-site.

Once operations begin, monitoring for the full analytical suite would be carried out three times per year (spring, summer and fall). As well, the proposed monitoring suite would be amended (if required) to meet any specific discharge requirements regulated by the Ministry of the Environment and Climate Change.

Once two years of operating data are collected, the groundwater monitoring program would be reviewed and, where conditions permit, recommendations would be made to reduce the number of samples, the analytical suite and the location of samples taken in the program.

Since the quarry operation will result in groundwater flow into the site, and not away from the site, the groundwater monitoring program would serve to assess the water quality entering the quarry from the bedrock flow system. The information gathered during the

monitoring program would assist in evaluating the background water quality from groundwater influx sources, and would be used in the overall assessment of any potential treatment requirements of the discharges from the water management system on-site.

3.5 TRIGGER CRITERIA AND CONTINGENCY PLANS

A monitoring program for the proposed Darien Aggregates quarry site was developed in order to monitor and assess any potential impacts of the quarry operation on the adjacent watersheds. Our analysis has indicated that the operation, as described in the previous sections, will have minimal impact on the hydrologic conditions in the area. However, un-anticipated conditions can arise over the lifetime operation of a facility, and in order to address these events, a set of trigger criteria have been established in order to identify the most appropriate action (contingency) with which to respond and mitigate the impacts on the environment.

Conceptually, these un-anticipated conditions can be grouped into two categories:

- chemical exceedances
- flow disruptions

Ultimately, the responses to an un-anticipated condition at the Darien Quarry operation can range from a modification to the extraction operation to the complete stoppage of quarrying activities pending a resolution of the identified impact on the surroundings. The proposed responses to each un-anticipated condition are presented in the following sub-sections.

3.5.1 Chemical Exceedances and Contingencies

Chemical exceedances of the applicable water quality standards (which are normally defined in the facility's Environmental Compliance Approval (or ECA) for the off-site discharge system) would be based on the monitored parameters that are also contained in the Provincial Water Quality Objectives (Ministry of the Environment and Energy, 1994). Exceedances could arise as a result of accidental spills on-site (for example, from temporary fuel storage, chemical storage and day-to-day equipment usage), the contamination of on-site drainage waters by explosives residues or the creation of high turbidity drainage water within the operating areas of the property.

In the case of accidental spills, the immediate contingency would be to hydraulically isolate the spill from coming into contact with un-contaminated surface water on-site, through the use of berms and/or absorbent materials, until the spill area is remediated. The appropriate response to such accidental spills would normally be identified as part of an operations manual for the facility, and would detail any spill notification requirements to the Ministry of the Environment and Climate Change.

The contamination of on-site drainage waters from explosives residues is a concern due to the high solubility of nitrate in water (from the use of ANFO) and the potential presence of associated fuel residues (which have a lower solubility in water). The drainage waters from the newly-blasted areas, and blast rock stockpiles, would be isolated and monitored as part of the on-site water management plan, and would be blended with non-contaminated drainage waters in order to achieve the regulated discharge standards set on the facility's Environmental Compliance Approval (or ECA).

Additional contingency systems (if required) could include the creation of constructed wetlands as passive de-nitrification systems, if the ECA requirements cannot be met by blending alone, or the collection and off-site disposal by a licenced waste hauler (if the water volumes requiring treatment are low).

Elevated turbidity levels from the drainage waters in the working areas of the site would normally be controlled through the use of internal settling ponds. The contingencies associated with the settling ponds would involve modifications to the pond design (for example, to increase the settling times by increasing the pond capacities) and/or the addition of chemical flocculation agents (if practical). Design modifications would be made based on demonstrated performance of the on-site water management systems, and would be site-specific (for example, depending on the watershed being considered for receiving the discharge).

3.5.2 Flow Disruption and Contingencies

The release of site drainage waters back into the adjacent surface water bodies is the primary mechanism for the mitigation of both surface water and groundwater impacts from the proposed Darien Aggregates quarry operation. An assessment of the volume of water necessary to maintain and preserve pre-development flows in the various adjacent watersheds was presented in Section 3.3.4 (Water Surplus Assessment).

Disruption of the required discharges to the various sub-basins and watersheds could result from equipment breakdown, un-planned blockages of the outlets, variations in the balancing of internal site drainage to the identified discharge points and seasonal variations in the natural discharges within the watershed. Flow disruption could result in higher than required discharges to the receiving watersheds, or (conversely) lower than required discharges to the receiving watersheds.

If flow monitoring indicates that a discharge to a particular watershed is higher than required, the contingency response would be to reduce the discharge rate to an acceptable level for that watershed through the redirection of internal site drainage to another discharge point. The determination of what constitutes an acceptable level of discharge would be based on a visual assessment of the receiving sub-basin (for evidence of excessive flooding or erosion) as well as the water balance assessments presented in this

report and any ecological and terrestrial effects study conclusions. In particular, the primary objective of any balancing of the of-site discharge waters would be to mimic (as close as possible) the natural drainage conditions that are occurring seasonally in the surrounding watersheds.

If flow monitoring indicates that a discharge to a particular watershed is lower than required, the contingency response would be to increase the discharge rate to an acceptable level for that watershed through the redirection of internal site drainage to the identified discharge point. The determination of what constitutes an acceptable level of discharge would be based on a visual assessment of the receiving sub-basin (for evidence of wetland function loss) as well as the water balance assessments presented in this report and any ecological and terrestrial effects study conclusions. Once again, the primary objective of any balancing of the of-site discharge waters would be to mimic (as close as possible) the natural drainage conditions that are occurring seasonally in the surrounding watersheds.

The contingency for un-planned blockages of the outlets (for example, due to beaver dam construction and/or excessive sedimentation) would be to visually assess the cause of the blockage and develop a contingency option to return the discharge outlet to a fully-functioning state. The action followed would, of necessity, be site-specific, and could involve either excavation of the blockage or reconstruction of the outlet configuration to prevent future blockages.

The contingency for equipment breakdown would be to have a backup pumping system (and standby power) available on-site, as part of the detailed design and operations planning.

Also, since the groundwater influx components of the water balance have relied upon hydrogeological information obtained from borehole testing at discrete locations across the site, unanticipated groundwater inflows may be encountered in areas not currently assessed by the boreholes. Detailed surficial geology mapping of the initially-levelled bedrock surface, by a qualified geologist, has been recommended with the focus of identifying any geological conditions (such as highly fractured zones or geological contacts) that may have an impact on groundwater flow into the site. Should potentially problematic geological zones be identified, contingencies would include modifications to the planned site development (for example, grouting to reduce inflow, or avoidance of problem areas).

The management of the water surplus on-site is critical to the operation of this quarry facility, and it is recommended that the operator take a pro-active approach to water management through the process of weekly site inspections of all aspects of the water management system during the active quarrying phases. When the site is in a shut-down condition (for example in the winter season), periodic site inspections are recommended so that any remedial works can be planned in advance of start-up.

4.0 CONCLUSIONS AND RECOMMENDATIONS

A Hydrogeological Level 2 Report, relating to the groundwater conditions in the vicinity of a proposed quarry in Long Township, District of Algoma, has indicated that the proposed Darien Aggregates quarry operation can be undertaken with minimal impact on the surrounding water resources.

The site is located in an upland remote area, and there are no documented or identified groundwater users within 3 km of the site. Groundwater impacts, in terms of water level lowering beneath the site from excavation and dewatering below grade, will be limited to an area within the site footprint through the preservation and maintenance of water levels in the adjacent surface water bodies.

Impacts on the local surface water system can be mitigated through the re-distribution of surface waters accrued on-site back to the adjacent watersheds. The assessment of the proportion of water to be returned to each watershed was based on a water balance assessment of the pre-development and post-development site conditions.

A monitoring program would be established to document any potential changes to the water quality and quantities in the adjacent surface water courses, and to the groundwater flow system beneath the quarry site. Trigger criteria for water quality discharges and flows, and contingency options to address un-anticipated conditions, have been developed and presented for incorporation into the site operations planning process.

In moving forward with the development of the Darien Aggregates quarry site, the present study recognizes that the water quantities involved in the dewatering of the quarry are sufficiently high to require a Permit to Take Water (from the Ministry of the Environment and Climate Change) and the off-site discharge of the site drainage waters will require an Environmental Compliance Approval under Section 53 of the Ontario Water Resources Act. Both applications were beyond the scope of the present study, and are considered to be premature pending the outcome of on-going studies and final design modifications.

The conceptual site layout and operations methods that were presented in this report were based on discussions between Waters Environmental Geosciences Ltd. and Tulloch Engineering Inc., and were considered representative of the anticipated conditions once the site is put into operation. It should be recognized that modifications to the site design may be required once all of the various site investigation reports (by others) are completed, and any figures or drawings presented in this report should be considered conceptual only, pending release of detailed design and operations drawings for the proposed facility. It is recommended that Waters Environmental Geosciences Ltd. be allowed to review any proposed changes or alterations to the proposed site operations, in order to determine if the present report's conclusions and assessments remain valid.

Please note that the above conclusions and recommendations have been based on the information provided to Waters Environmental Geosciences Ltd., and subsequent data collected by our firm, in accordance with the work program agreed to by you. No warranties, representations or liabilities of whatsoever nature are extended to other parties who may receive copies of this report (or abstracted information from it).

In no event shall Waters Environmental Geosciences Ltd. have any legal duty or responsibility to any third party reviewing this report unless it has a formal contractual relationship with such a third party. Contractors or others who are considering work activities on this site should satisfy themselves of the site conditions reported herein before submitting quotations or work proposals for this site.

Should future site development activities encounter groundwater conditions which are not anticipated by this report, it is recommended that Waters Environmental Geosciences Ltd. be contacted to determine the significance of the new information, and it's potential effect on the recommendations provided herein.

We thank you for the opportunity of working with Tulloch Engineering Inc. on this project. If you have questions regarding the information contained in this report, or require assistance in moving forwards with this project, please do not hesitate to contact the undersigned.

Yours truly,
WATERS ENVIRONMENTAL GEOSCIENCES LTD.

Peter A. Richards, M.Sc., P.Eng.
President, Senior Environmental Engineer

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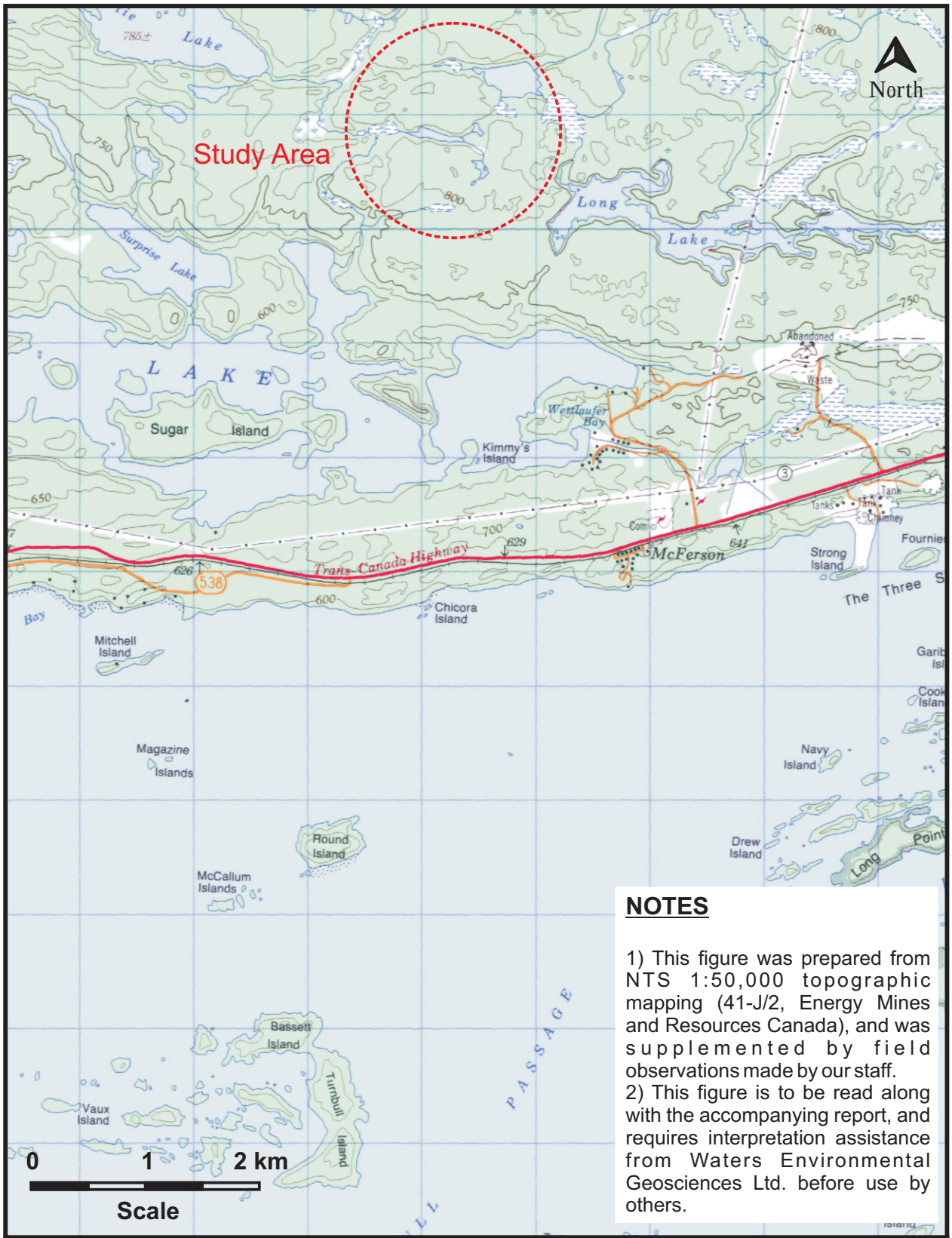
QUALIFICATIONS OF PETER A. RICHARDS, M.SC., P.ENG.

Peter A. Richards has a Masters of Science degree in Hydrogeology (1982) and an undergraduate degree in Geophysics (1978), both from Queen's University (Kingston). His strong background in Geology and Geological Sciences was further augmented in 1989, after completing an assigned examination program from the Association of Professional Engineers of Ontario, when Mr. Richards became a licensed Professional Engineer.

He has been working in the field of Hydrogeology continuously since 1983, initially in the consulting industry, then as Groundwater Evaluator in the Ministry of the Environment (covering the Northeastern Region from Sudbury) and finally back in the consulting industry, culminating in the formation of his own consulting firm, Waters Environmental Geosciences Ltd. (in 2000). Mr. Richards is President of Waters Environmental Geosciences Ltd., which operates under a Certificate of Authorization from the Professional Engineers Ontario and is in full compliance with the requirements of The Professional Geoscientists Act (2000).

Mr. Richards is a member of the International Association of Hydrogeologists, the Association of Groundwater Scientists and Engineers and the Association of Professional Engineers of Ontario. He authored an assessment of the hydrogeology of the City of Greater Sudbury (contained in The Physical Environment of the City of Sudbury, Ontario Geological Survey, Special Volume 6, 2002), and was a part-time faculty member of Laurentian University (Sudbury), where he taught 4th year Hydrogeology in the Environmental Earth Science program (from 1995 to 2007). He also taught Hydrology and Water Quality Assessment part-time at Cambrian College (Sudbury) in the Environmental Monitoring and Impact Assessment program (in 2012 and 2013). He has presented papers on hydrogeology at several conferences and is published in a peer-reviewed journal. Mr. Richards has also been retained as a hydrogeological peer reviewer of other consultants' hydrogeological work for two Conservation Authorities in Northeastern Ontario, under the Source Water Protection initiative of the Ministry of the Environment.



NOTES

1) This figure was prepared from NTS 1:50,000 topographic mapping (41-J/2, Energy Mines and Resources Canada), and was supplemented by field observations made by our staff.
2) This figure is to be read along with the accompanying report, and requires interpretation assistance from Waters Environmental Geosciences Ltd. before use by others.

Figure 1	**Site Location Map**	**Project Number 214 - 281** **Date : August, 2015**
Waters Environmental Geosciences Ltd.	**Darien Aggregates Quarry**	

North

Hastie Lake

Long Lake

Lauzon Lake

Lauzon Lake

250 m

200 m

NOTES

1) This plan was prepared from 1:20,000 topographic survey plans (Ministry of Natural Resources Sheets 20-17-3600-51100, 51200) plus information provided by Tulloch Engineering Inc., and was supplemented by field observations made by our staff. The contour interval is 10 metres.
2) The site location was provided by Tulloch Engineering Inc., and should be considered approximate. Please refer to detailed site drawings for precise dimensions and location details.
3) This figure is to be read along with the accompanying report, and requires interpretation assistance from Waters Environmental Geosciences Ltd. before use by others.

LEGEND

Topographic Contour

Surface Water

Property Boundary

0 750 m

Scale

Figure 2	**Site Plan**	**Project Number 214 - 281**
		Date : August, 2015
Waters Environmental Geosciences Ltd.	**Darien Aggregates Quarry**	

North

0 200 400 m
Scale

BH-7
BH-1
BH-8
BH-2
BH-3
BH-6
BH-4

250 m
200 m

Long Lake
Lauzon Lake

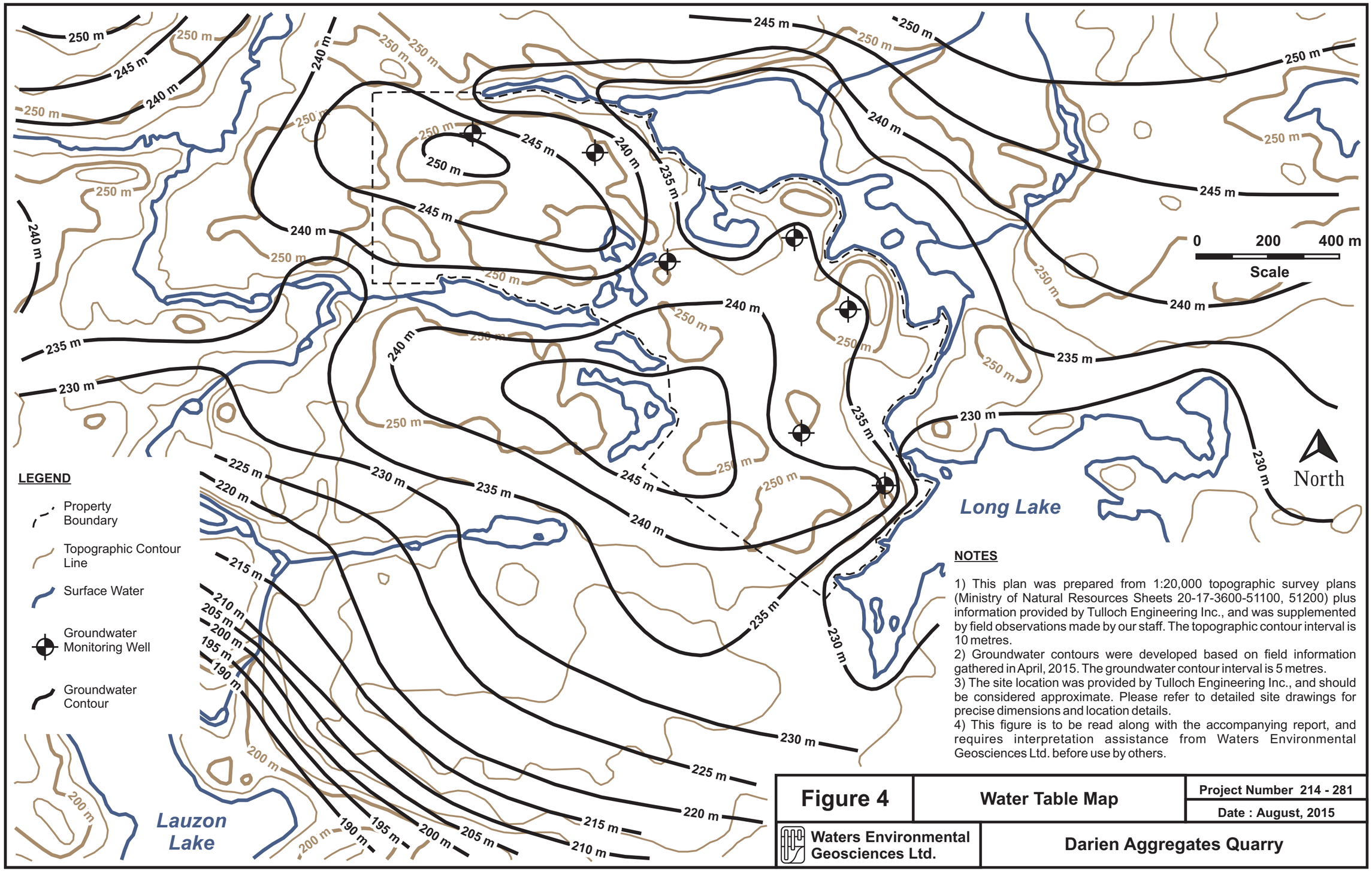
LEGEND

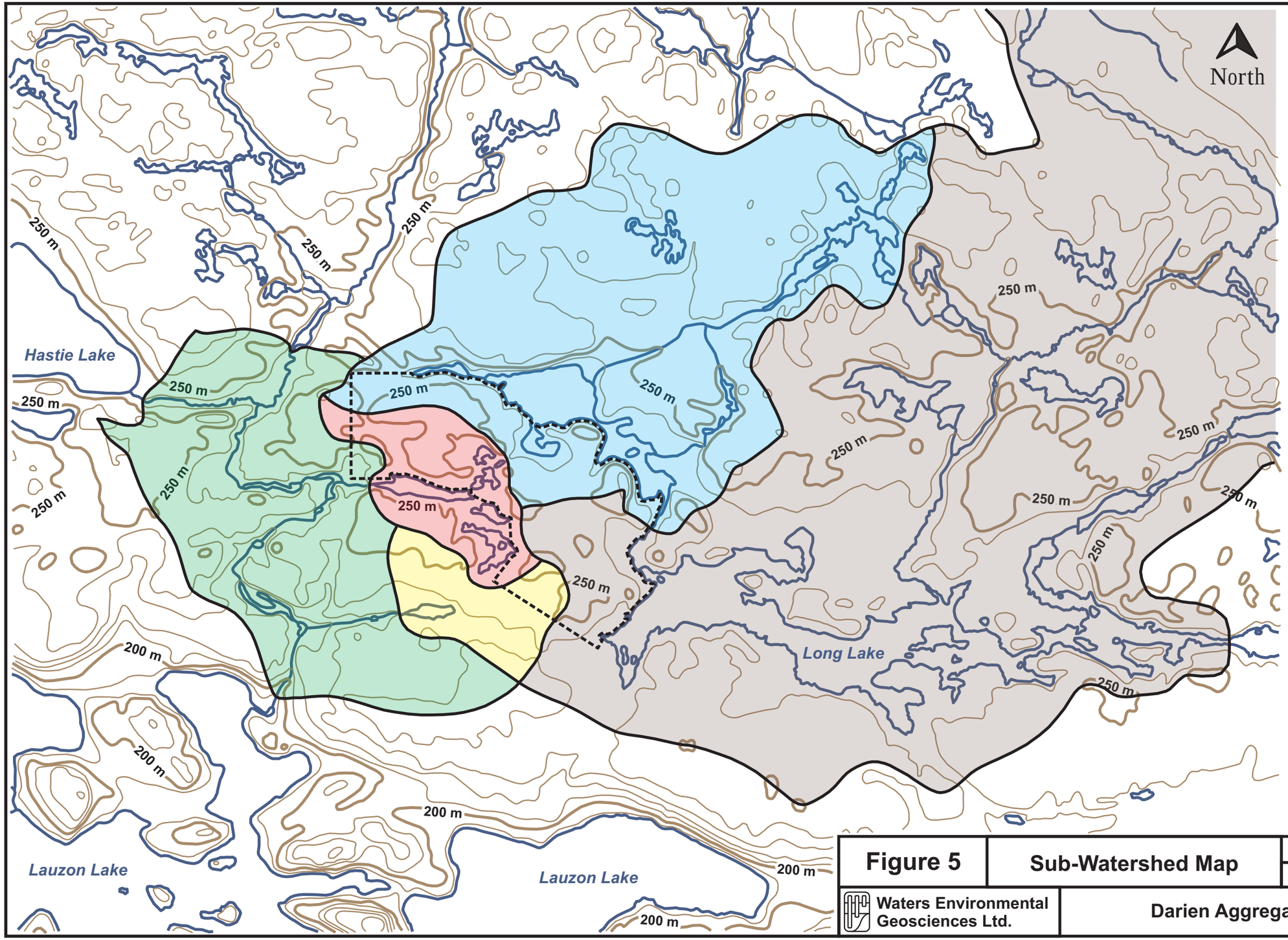
- Property Boundary
- Topographic Contour Line
- Surface Water
- Groundwater Monitoring Well

NOTES

1) This plan was prepared from 1:20,000 topographic survey plans (Ministry of Natural Resources Sheets 20-17-3600-51100, 51200) plus information provided by Tulloch Engineering Inc., and was supplemented by field observations made by our staff. The contour interval is 10 metres.
2) The site location was provided by Tulloch Engineering Inc., and should be considered approximate. Please refer to detailed site drawings for precise dimensions and location details.
3) This figure is to be read along with the accompanying report, and requires interpretation assistance from Waters Environmental Geosciences Ltd. before use by others.

Figure 3	**Monitoring Well Location Map**	**Project Number 214 - 281**
		Date : August, 2015
Waters Environmental Geosciences Ltd.	**Darien Aggregates Quarry**	


LEGEND
Property Boundary
Topographic Contour Line
Surface Water
Groundwater Monitoring Well
Groundwater Contour
0 200 400 m
Scale
North
Long Lake
Lauzon Lake
NOTES
1) This plan was prepared from 1:20,000 topographic survey plans (Ministry of Natural Resources Sheets 20-17-3600-51100, 51200) plus information provided by Tulloch Engineering Inc., and was supplemented by field observations made by our staff. The topographic contour interval is 10 metres.
2) Groundwater contours were developed based on field information gathered in April, 2015. The groundwater contour interval is 5 metres.
3) The site location was provided by Tulloch Engineering Inc., and should be considered approximate. Please refer to detailed site drawings for precise dimensions and location details.
4) This figure is to be read along with the accompanying report, and requires interpretation assistance from Waters Environmental Geosciences Ltd. before use by others.
Figure 4
Water Table Map
Project Number 214 - 281
Date : August, 2015
Waters Environmental Geosciences Ltd.
Darien Aggregates Quarry



NOTES

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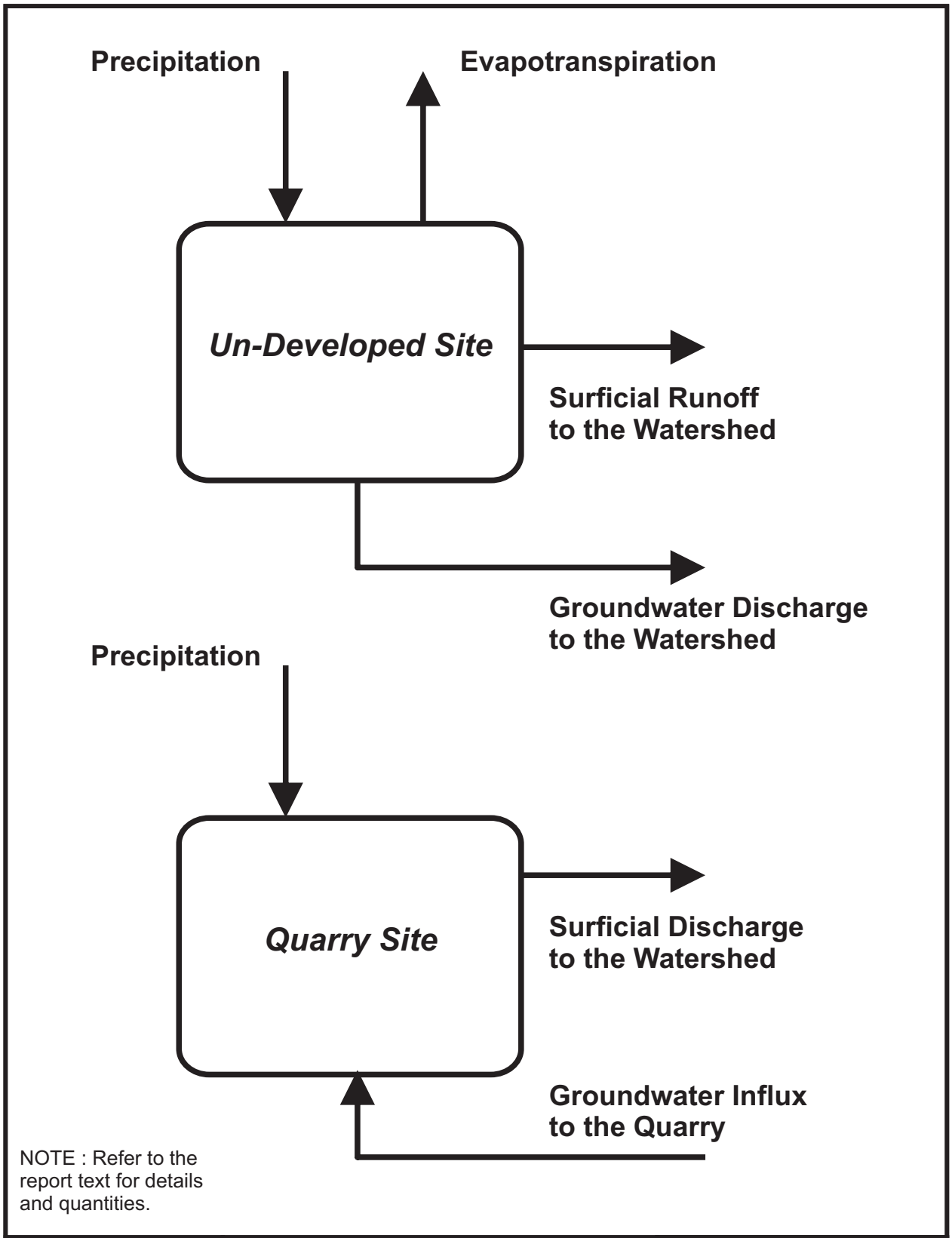
2) The site location was provided by Tulloch Engineering Inc., and should be considered approximate. Please refer to detailed site drawings for precise dimensions and location details.
3) This figure is to be read along with the accompanying report, and requires interpretation assistance from Waters Environmental Geosciences Ltd. before use by others.

LEGEND

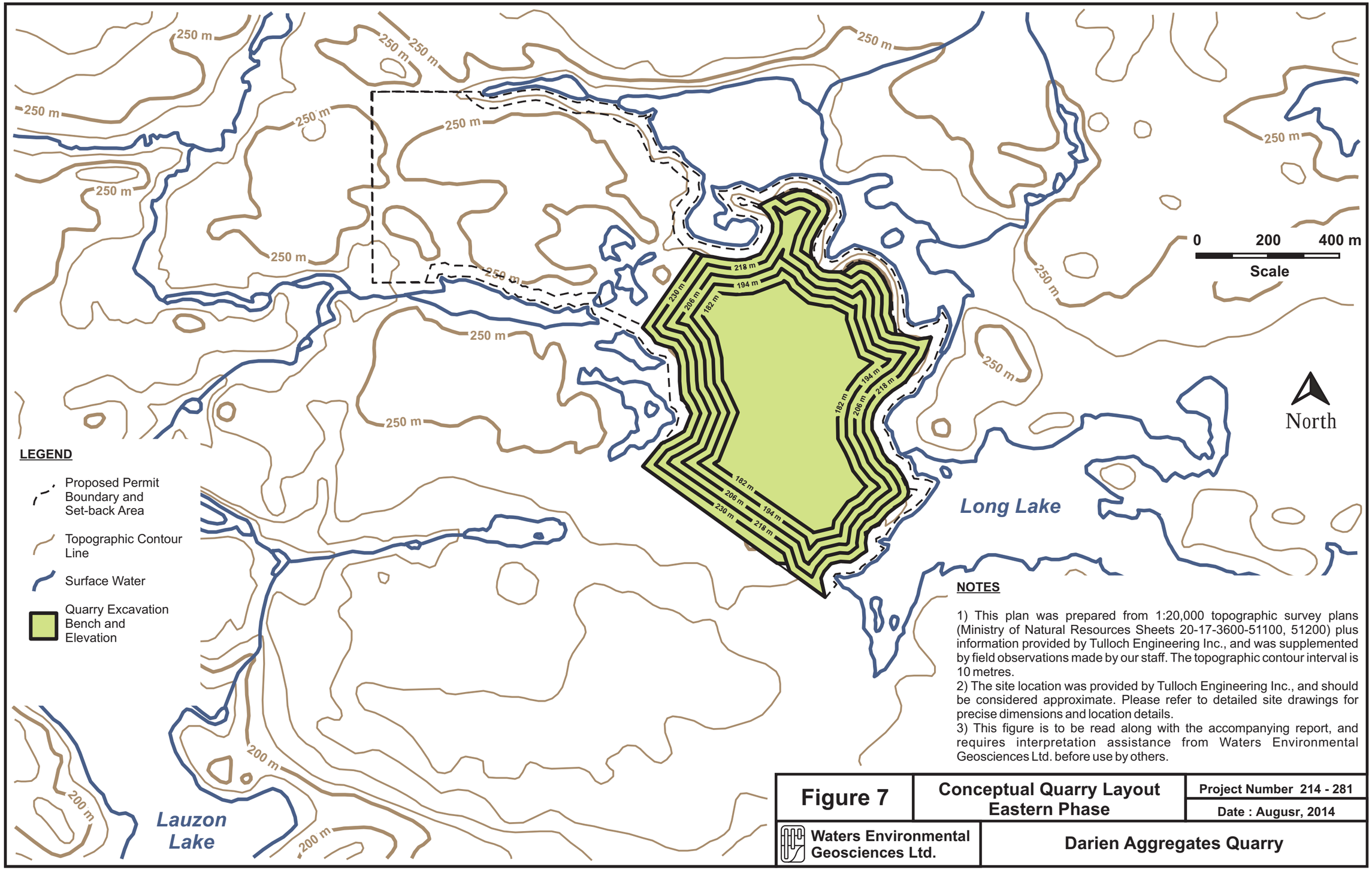
- Topographic Contour
- Surface Water
- Property Boundary
- Watershed A
- Watershed B
- Watershed C
- Watershed D
- Watershed E

Figure 5	**Sub-Watershed Map**	**Project Number 214 - 281**
		Date : August, 2015
Waters Environmental Geosciences Ltd.	**Darien Aggregates Quarry**	



NOTE : Refer to the report text for details and quantities.

Figure 6	Water Balance Block Diagram	Project Number 214 - 281
		Date : August, 2015
Waters Environmental Geosciences Ltd.	Darien Aggregates Quarry	



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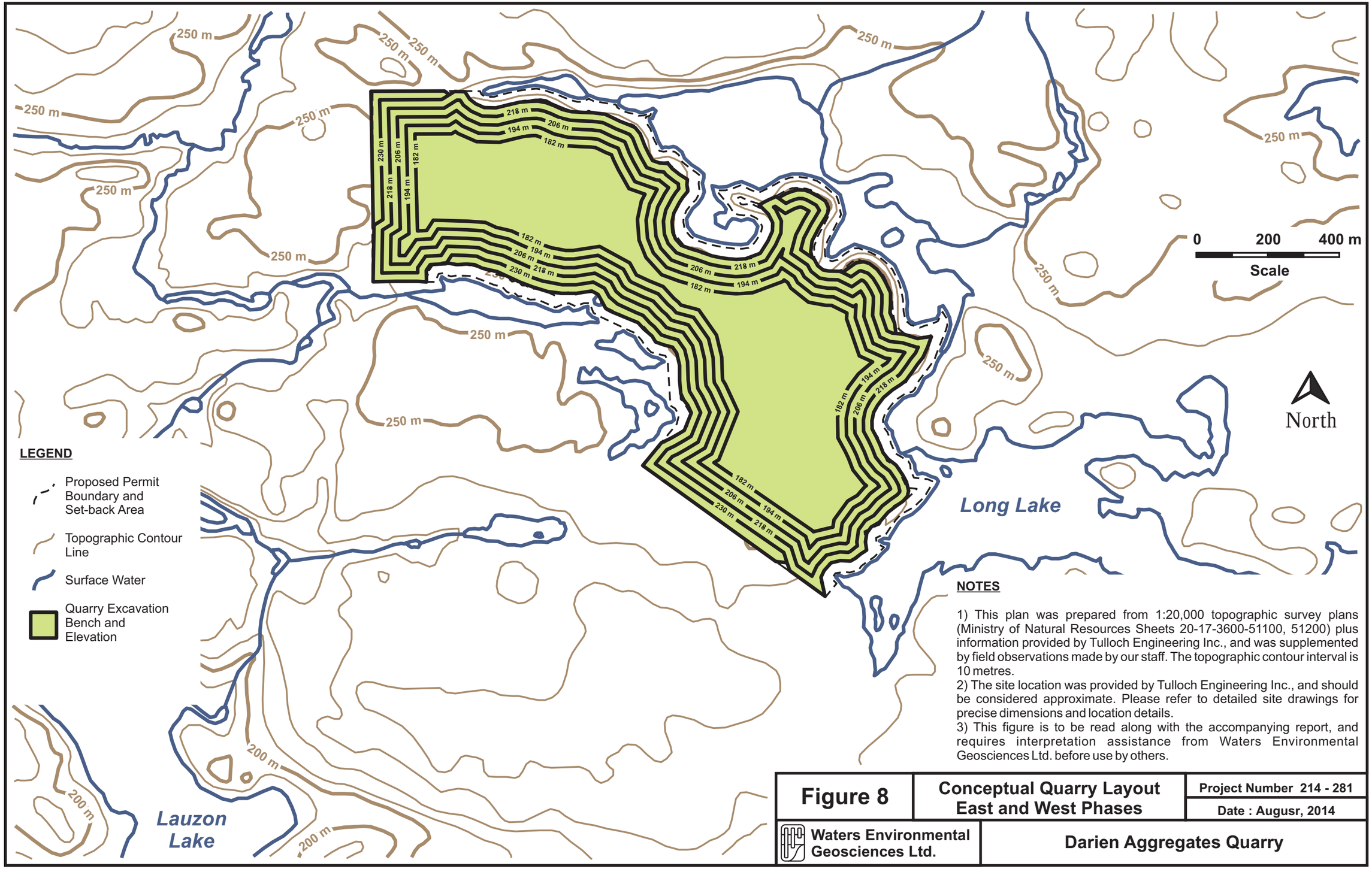
2) The site location was provided by Tulloch Engineering Inc., and should be considered approximate. Please refer to detailed site drawings for precise dimensions and location details.
3) This figure is to be read along with the accompanying report, and requires interpretation assistance from Waters Environmental Geosciences Ltd. before use by others.

Figure 7	**Conceptual Quarry Layout Eastern Phase**	**Project Number 214 - 281**
		Date : Augusr, 2014
Waters Environmental Geosciences Ltd.	**Darien Aggregates Quarry**	



NOTES

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2) The site location was provided by Tulloch Engineering Inc., and should be considered approximate. Please refer to detailed site drawings for precise dimensions and location details.
3) This figure is to be read along with the accompanying report, and requires interpretation assistance from Waters Environmental Geosciences Ltd. before use by others.

Figure 8	**Conceptual Quarry Layout East and West Phases**	**Project Number 214 - 281**
		Date : Augusr, 2014
Waters Environmental Geosciences Ltd.	**Darien Aggregates Quarry**	

Appendix A LEVEL 1 HYDROGEOLOGY LETTER REPORT Project 214-281

On June 22, 2015, Waters Environmental Geosciences Ltd. presented Tulloch Engineering Inc. with a brief letter report detailing the findings of a preliminary Level 1 Hydrogeological Study at the proposed Darien Aggregates Quarry site.

The report is presented in this Appendix.

Waters Environmental Geosciences Ltd.
P.O. Box 4341
Lively, Ontario
P3Y 1N3

Telephone **(705) 692 - 0937**
Toll Free **(888) 585 - 7805**
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June 22, 2015 214 - 281

Tulloch Engineering Inc.
1942 Regent Street, Unit L
Sudbury, Ontario
P3E 5V5

Attention : Gary MacKay, P.Eng.
Project Manager

Dear Gary,

HYDROGEOLOGICAL INVESTIGATIONS
IN SUPPORT OF A CATEGORY 12
(BELOW THE WATER TABLE) QUARRY
DARIEN AGGREGATES QUARRY
TOWNSHIP OF LONG
DISTRICT OF ALGOMA, ONTARIO

As discussed today, Waters Environmental Geosciences Ltd. is providing you with an update on our Level 1 Hydrogeological study for the Darien Aggregates site in Long Township (near Algoma Mills).

The groundwater monitoring wells, which were installed last winter, have been used to measure the static water level in the bedrock formations on-site this past spring. A comparison of the field data to our original assessment (Groundwater Summary Statement, July 2014) indicates that our original assessment of the water table profile on-site was more-or-less correct, and the water table is confirmed as being high across most of the property. Any development of the property would definitely involve excavation into and below the existing water table.

At this time, we do not foresee a groundwater aquifer issue associated with the proposed development of the property, as there is no evidence of any groundwater usage (or seasonal/permanent residential development) within one kilometre of the property. This opinion is based on our previous review of the on-line Ministry of the Environment water well database, coupled with airphoto interpretation of digital imagery obtained from the

Google Earth website. However, as the site excavation will proceed into and below the water table, a local modification to the groundwater flow system will occur, and this has a potential to impact on the nearby surface water resources (which abut the site on all sides), since the two systems are interconnected.

In the interval of time between the original Groundwater Summary Statement report, and the present study, the proposed site boundaries have changed. The general site layout, however, still occupies a local height of land, and we considered the question of potential surface water impacts by reviewing the areas of the site that contribute water to the various surface water features. This work is normally part of a more detailed Level 2 Hydrogeological assessment, but we felt that a preliminary assessment was warranted in order to provide the appropriate guidance to you. Detailed work still remains to be done, but our initial assessment has flagged a few of the surface water areas as being potentially impacted by site development and operations. Mitigation methods will be necessary.

Therefore, we are recommending that our study proceed into a Level 2 Hydrogeological program, as originally proposed, with modifications. It is our intent to proceed with the information that we have at hand, or can gather from on-line sources (i.e. weather data from Environment Canada, etc.), and we are not proposing any further field work at this time. Water level recovery data has already been collected from the on-site wells, and will be used to evaluate the anticipated water volumes that could enter the excavation over time. A water balance analysis would be undertaken in order to quantify the overall impacts on the local surface water watersheds.

We are not proposing to perform any surface water quality or groundwater quality sampling at this time, and will focus our study on assessing the water quantity issues that could arise from the proposed site development. Water quality sampling and analysis will be part of the formal application process relating to any surface water discharges from the site (under the Ontario Water Resources Act), and possible Permit To Take Water applications. At this time, it is our understanding that the site operations and development planning has not progressed to a level that would permit such a detailed assessment of water quality issues, and therefore we are recommending that water quality assessment be undertaken at a future time (and not part of the present program).

We trust that this information is of assistance, and look forward to hearing from you.

Yours truly,
WATERS ENVIRONMENTAL GEOSCIENCES LTD.

Peter A. Richards, M.Sc., P.Eng.
President, Senior Environmental Engineer

Appendix B WATER WELL RECORDS (MOECC) Project 214-281

Digital copies of water well records for wells reported within several kilometers of the Darien Aggregates Quarry site were obtained from the Ministry of the Environment and Climate Change on-line database (http://www.ontario.ca/data/water-wells).

The records are presented in this Appendix.

UTM 17 Z 316914617 E 41 5/2 E
19 R 5111717115 N
Elev. 19 R 016910
Basin 20N 11

LOT 1

ONTARIO

The Water-well Drillers Act, 1954
Department of Mines

11 No 628

GROUND WATER BRANCH
NOV 13 1958
ONTARIO WATER RESOURCES COMMISSION

Water-Well Record

County or Territorial District Algoma Township, Village, Town or City Long L.
Village, Town or City)
ddress Sprague Ont
Date completed (day) (month) (year)

Pipe and Casing Record

Casing diameter(s) 3 inch
Length(s) 49 ft and
Type of screen
Length of screen

Pumping Test

Static level 28 ft
Pumping rate Don't Know
Pumping level "
Duration of test "

Well Log

Overburden and Bedrock Record	From ft.	To ft.
gravel and boulders	0	51
" " "	0	36
This was first attempt on hole finally completed to 51 ft		
not furnished.		

Water Record

Depth(s) at which water(s) found	No. of feet water rises	Kind of water (fresh, salty, or sulphur)
51	23 ft	Don't Know
Pipe broke at 36 ft well		

For what purpose(s) is the water to be used? Industrial — Warehouse & storage buildings for oil Co. products
Is water clear or cloudy? Don't Know
Is well on upland, in valley, or on hillside? valley

Drilling firm J. C. Thurston
Address Bruce Mines

Name of Driller J. C. Thurston
Address Bruce Mines

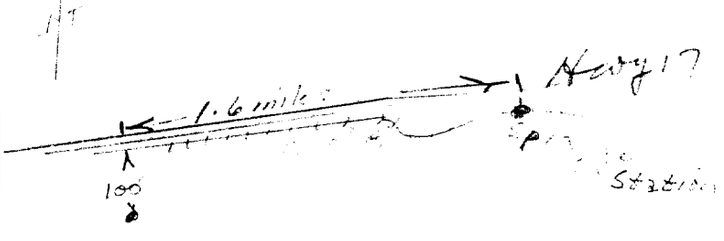
Licence Number 855

I certify that the foregoing statements of fact are true.

Date Oct 29 J. C. Thurston
Signature of Licensee

Location of Well

In diagram below show distances of well from road and lot line. Indicate north by arrow.



Form 5

CSS.S8

TM 117 | 3 7 2 1 0 0 | 41J/2E

5 R 5 1 1 8 2 8 0

ev. 5 R 2 6 0 0

in 2 2

Water management in Ontario

DIVISION OF WATER RESOURCES
MAY 13 1969
ONTARIO WATER RESOURCES COMMISSION

J.B.

1101270

3 9

The Ontario Water Resources Commission Act

WATER WELL RECORD

~~County or~~ District ALGOMA. Township, ~~Village, Town or City~~ Sprague

Sec. Lot 29 Date completed 25 (day) Feb. (month) 1969 (year)

[redacted] ress SPRAGGE ONT

Casing and Screen Record

Inside diameter of casing	2"
Total length of casing	40' Pulled
Type of screen	—
Length of screen	—
Depth to top of screen	—
Diameter of finished hole	2"

Pumping Test

Static level	
Test-pumping rate	DRY G.P.M.
Pumping level	
Duration of test pumping	Hole
Water clear or cloudy at end of test	
Recommended pumping rate	G.P.M.
with pump setting of	feet below ground surface

Well Log

Overburden and Bedrock Record	From ft.	To ft.	Water Record: Depth(s) at which water(s) found	Water Record: Kind of water (fresh, salty, sulphur)
fine Sand	0	40		
Red & Grey Granite	40	225	—	—

For what purpose(s) is the water to be used? Domestic Dry.

Is well on upland, in valley, or on hillside? FLAT.

Drilling or Boring Firm Sudbury Diamond Drilling Company

Address 197 BROOKSIDE ST Chelmsford, Ont.

Licence Number 3320

Name of Driller or Borer G. Benoit

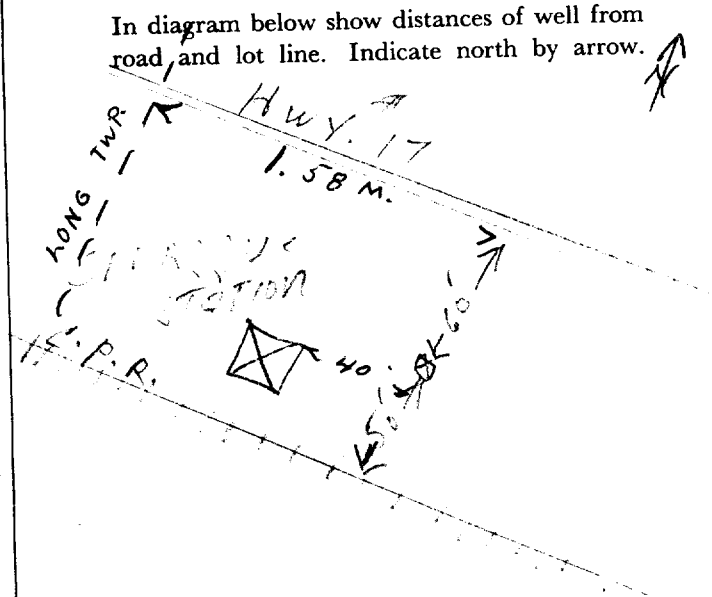
Address Same

Date APR. 23 1969.

B Vallance
(Signature of Licensed Drilling or Boring Contractor)

Location of Well

In diagram below show distances of well from road and lot line. Indicate north by arrow.



Form 7

OWRC COPY

7 CSS.S8

41J/2E

TM | | 7 | Z | 3 | 7 | 2 | 1 | 0 | 0 |

| 5 | R | 5 | 1 | 1 | 8 | 2 | 8 | 0 |

V. | 5 | R | 0 | 6 | 0 | 0 |

In | 2 | 2 | ALGOMA

Water management in Ontario

DIVISION OF WATER RESOURCES
MAY 13 1969
ONTARIO WATER RESOURCES COMMISSION

J.B.

1101271

3

The Ontario Water Resources Commission Act

WATER WELL RECORD

County or District ALGOMA Township, ~~Village, Town or City~~ Sprague

Con Sec. Lot 29 Date completed 26 (day) Feb. (month) 1969 (year)

[redacted] ress SPRAGGE ONT

Casing and Screen Record

Inside diameter of casing 2"

Total length of casing 20' D

Type of screen Drilled

Length of screen

Depth to top of screen

Diameter of finished hole 2"

Pumping Test

Static level

Test-pumping rate DRY ✓ G.P.M.

Pumping level

Duration of test pumping Bailed

Water clear or cloudy at end of test

Recommended pumping rate G.P.M.

with pump setting of feet below ground surface

Well Log

Overburden and Bedrock Record	From ft.	To ft.	Water Record: Depth(s) at which water(s) found	Water Record: Kind of water (fresh, salty, sulphur)
Fine Sand	0	19		
Red & Grey Granite	19	45	—	—

For what purpose(s) is the water to be used? Domestic Dry.

Is well on upland, in valley, or on hillside? Upland

Drilling or Boring Firm Sudbury Diamond Drilling Company

Address 177 Brocksdale S T. Chelmsford Ont.

Licence Number 3320

Name of Driller or Borer G. Benoit

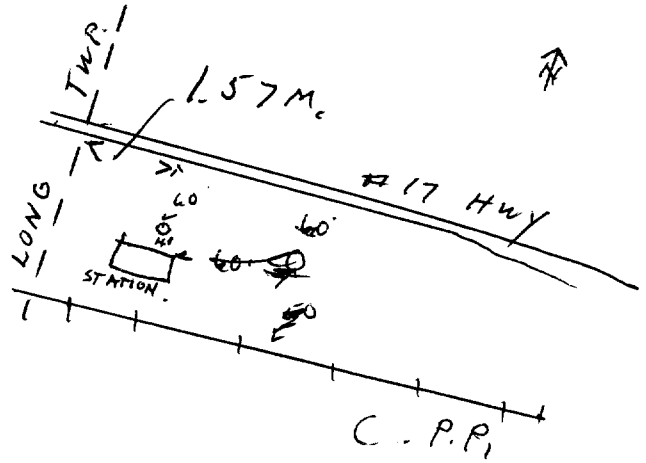
Address SAME

Date APRIL 23/69

(Signature of Licensed Drilling or Boring Contractor)

Location of Well

In diagram below show distances of well from road and lot line. Indicate north by arrow.



Form 7

OWRC COPY

6

CSS.S8

S. C.

The Ontario Water Resources Commission Act

41 J/2 E

WATER WELL RECORD

Water management in Ontario

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK ☒ CORRECT BOX WHERE APPLICABLE

1101352
11 H01352

MUNICIP. 1,1,1,1,2 CON. CON 02

COUNTY OR DISTRICT	TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE	CON., BLOCK, TRACT, SURVEY, ETC.	LOT
Algoma	LONG	II	004

OWNER (SURNAME FIRST)	ADDRESS	DATE COMPLETED
Ontario Hydro	Algoma Mills T.C.	DAY 11 MO. 05 YR. 70

21 UTM ZONE 17 EASTING 3,6,7,1,1,1 NORTHING 5,1,1,7,2,2,0 RC. 5 ELEVATION 0,6,5,0 RC. 5 BASIN CODE 2,2

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH FROM	DEPTH TO
			Sand + Gravel	0	31
			Clay	31	60
			Coarse Sand	60	64
			Gravel	64	66
			Coarse Gravel	66	70
			(1/4" - 1" dia)		
			Water obtained in bedrock.		

APL

31 0031 0911 0060 0564 1010 0070 1111

32

41 WATER RECORD

WATER FOUND AT FEET	KIND OF WATER
0070	1 ☒ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL

51 CASING & OPEN HOLE RECORD

INSIDE DIAM. INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH FROM	DEPTH TO
06 ~~6~~	1 ☒ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE	.188	0	0070 ~~70~~
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE			
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE			

SCREEN

SIZE(S) OF OPENING (SLOT NO.)	DIAMETER INCHES	LENGTH FEET

MATERIAL AND TYPE | DEPTH TO TOP OF SCREEN FEET

61 PLUGGING & SEALING RECORD

DEPTH SET AT — FEET FROM	TO	MATERIAL AND TYPE (CEMENT GROUT, LEAD PACKER, ETC.)

71 PUMPING TEST

PUMPING TEST METHOD: 1 ☒ PUMP 2 ☐ BAILER

PUMPING RATE: 0010 GPM. DURATION OF PUMPING: 08 HOURS 00 MINS.

1 ☒ PUMPING 2 ☐ RECOVERY

STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVELS DURING 15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
018 FEET	024 FEET	024 FEET	024 FEET	024 FEET	024 FEET

IF FLOWING, GIVE RATE: GPM.

PUMP INTAKE SET AT: 45 FEET

WATER AT END OF TEST: 1 ☒ CLEAR 2 ☐ CLOUDY

RECOMMENDED PUMP TYPE: ☐ SHALLOW ☒ DEEP

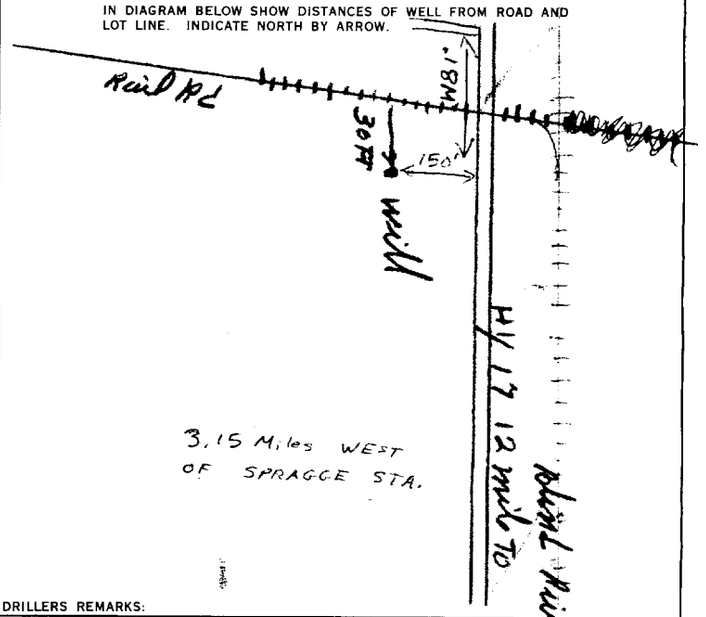
RECOMMENDED PUMP SETTING: 040 FEET

RECOMMENDED PUMPING RATE: 0006 GPM.

50-53 0017 GPM./FT. SPECIFIC CAPACITY

LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.



DRILLERS REMARKS:

FINAL STATUS OF WELL (54)
1 ☒ WATER SUPPLY 2 ☐ OBSERVATION WELL 3 ☐ TEST HOLE 4 ☐ RECHARGE WELL 5 ☐ ABANDONED, INSUFFICIENT SUPPLY 6 ☐ ABANDONED, POOR QUALITY 7 ☐ UNFINISHED

WATER USE (55-56) 04
1 ☐ DOMESTIC 2 ☐ STOCK 3 ☐ IRRIGATION 4 ☒ INDUSTRIAL ☐ OTHER 5 ☐ COMMERCIAL 6 ☐ MUNICIPAL 7 ☐ PUBLIC SUPPLY 8 ☐ COOLING OR AIR CONDITIONING 9 ☐ NOT USED

METHOD OF DRILLING (57)
1 ☒ CABLE TOOL 2 ☐ ROTARY (CONVENTIONAL) 3 ☐ ROTARY (REVERSE) 4 ☐ ROTARY (AIR) 5 ☐ AIR PERCUSSION 6 ☐ BORING 7 ☐ DIAMOND 8 ☐ JETTING 9 ☐ DRIVING

CONTRACTOR

NAME OF WELL CONTRACTOR: Yorn Zuerel + Son — LICENCE NUMBER: 4405

ADDRESS: Sturgeon Falls, Ont

NAME OF DRILLER OR BORER: Yorn Zuerel — LICENCE NUMBER: 4405

SIGNATURE OF CONTRACTOR: [signature] — SUBMISSION DATE: DAY 12 MO. 5 YR. 70

OFFICE USE ONLY

DATA SOURCE (58): 1 — CONTRACTOR (59-62): 4405 — DATE RECEIVED (63-68): 190570

DATE OF INSPECTION: 25/9/70 — INSPECTOR: IC/I

REMARKS:

CSS.S8 J.B.

OWRC COPY AT [illegible]

MINISTRY OF THE ENVIRONMENT

The Ontario Water Resources Act

WATER WELL RECORD

Ontario

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK ☒ CORRECT BOX WHERE APPLICABLE

(11) 1102454 MUNICIP. 1.1.69 CON. B30SW 41 J/2

COUNTY OR DISTRICT: Algoma

TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE: Dunlop

CON., BLOCK, TRACT, SURVEY, ETC: 30 S 4

LOT:

OWNER (SURNAME FIRST): DEAMISH CONSTN. CO. ~~Deamish Construction Co.~~

ADDRESS: Box 430 Elliot Lake

DATE COMPLETED: DAY 07 MO 04 YR. 78

(21) UTM ZONE 17 EASTING 370000 NORTHING 5117700 RC 5 ELEVATION 0650 RC 6 BASIN CODE 22

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET FROM	DEPTH - FEET TO
	Sand			0	58
	Gray Granit			58	115

(31) 0058 28 0115281

(32)

(41) WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
0107	1 ☒ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL

(51) CASING & OPEN HOLE RECORD

INSIDE DIAM INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET FROM	DEPTH - FEET TO
6 4 06	1 ☒ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE	188	0	0062
06	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☒ OPEN HOLE		62	0115
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE			

SCREEN

SIZE(S) OF OPENING (SLOT NO.)	DIAMETER INCHES	LENGTH FEET
MATERIAL AND TYPE	DEPTH TO TOP OF SCREEN FEET	

(61) PLUGGING & SEALING RECORD

DEPTH SET AT - FEET FROM	TO	MATERIAL AND TYPE (CEMENT GROUT, LEAD PACKER, ETC.)
10-13	14-17	
18-21	22-25	
26-29	30-33	

(71) PUMPING TEST

PUMPING TEST METHOD: 1 ☒ FLOW 2 ☐ BAILER

PUMPING RATE: 0010 GPM

DURATION OF PUMPING: 02 HOURS 00 MINS

STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVELS DURING: 1 ☐ PUMPING 2 ☐ RECOVERY			
		15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
013 FEET	115 ~~7 15~~ FEET	[redacted] FEET	[redacted] FEET	[redacted] FEET	[redacted] FEET

IF FLOWING, GIVE RATE: non GPM

PUMP INTAKE SET AT: 115 FEET

WATER AT END OF TEST: 1 ☒ CLEAR 2 ☐ CLOUDY

RECOMMENDED PUMP TYPE: ☒ SHALLOW ☐ DEEP

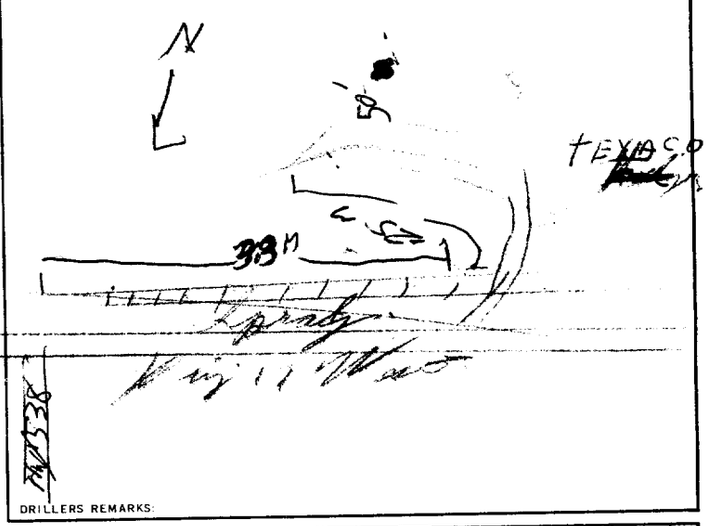
RECOMMENDED PUMP SETTING: 030 FEET

RECOMMENDED PUMPING RATE: 0002 GPM

50-53 ——— GPM./FT. SPECIFIC CAPACITY

LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.



DRILLERS REMARKS:

FINAL STATUS OF WELL (54): 1 ☐ WATER SUPPLY 2 ☒ OBSERVATION WELL 3 ☐ TEST HOLE 4 ☐ RECHARGE WELL 5 ☐ ABANDONED, INSUFFICIENT SUPPLY 6 ☐ ABANDONED, POOR QUALITY 7 ☐ UNFINISHED

WATER USE (55-56) 04: 1 ☐ DOMESTIC 2 ☐ STOCK 3 ☐ IRRIGATION 4 ☒ INDUSTRIAL ☐ OTHER 5 ☐ COMMERCIAL 6 ☐ MUNICIPAL 7 ☐ PUBLIC SUPPLY 8 ☐ COOLING OR AIR CONDITIONING 9 ☐ NOT USED

METHOD OF DRILLING (57) 4: 1 ☐ CABLE TOOL 2 ☐ ROTARY (CONVENTIONAL) 3 ☐ ROTARY (REVERSE) 4 ☒ ROTARY (AIR) 5 ☒ AIR PERCUSSION 6 ☐ BORING 7 ☐ DIAMOND 8 ☐ JETTING 9 ☐ DRIVING

CONTRACTOR

NAME OF WELL CONTRACTOR: R. Va illancourt Well Drilling — LICENCE NUMBER: 5210

ADDRESS: 125 Poulin St. Chelmsford Ont.

NAME OF DRILLER OR BORER: R. Vaillancourt — LICENCE NUMBER: 5210

SIGNATURE OF CONTRACTOR: R Vaillancourt — SUBMISSION DATE: DAY ___ MO. ___ YR. ___

OFFICE USE ONLY

DATA SOURCE (58): 1 — CONTRACTOR (59-62): 5210 — DATE RECEIVED (63-68): 221178

DATE OF INSPECTION: Jy 14/79 — INSPECTOR: DV

REMARKS: CSS.S8 — P — WI

MINISTRY OF THE ENVIRONMENT COPY

8

FORM 7 MOE 07-091

4152

Ministry of the Environment
Ontario

The Ontario Water Resources Act

WATER WELL RECORD

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK ☒ CORRECT BOX WHERE APPLICABLE

11 1103581 MUNICIP 11169 CO. 5298E

COUNTY OR DISTRICT: ALGOMA
TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE: SPRAGGE
CON. BLOCK, TRACT, SURVEY, ETC.:
LOT 25-27
DATE COMPLETED 48-53: DAY 15 MO 05 YR 84
[redacted] OLD HIGHWAY
18300 RC 5 ELEVATION 0610 RC 6 BASIN CODE 22

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET FROM	DEPTH - FEET TO
	CLAY			0	7
	GRAVEL	BOULDERS		7	10
	CLAY			10	16
	GRAVEL		FINE SILTY	16	30
	GRAVEL	BOULDERS		30	36

31 0007 05 0010 11 13 0016 05 0030 2984 0036 1113
32

41 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
10-13	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
15-18 DRY	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
20-23	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
25-28	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
30-33	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL

51 CASING & OPEN HOLE RECORD

INSIDE DIAM INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET FROM	DEPTH - FEET TO
10-11	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE			13-16
17-18	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE			20-23
24-25	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE			27-30

SCREEN

SIZE(S) OF OPENING (SLOT NO.) 31-33 | DIAMETER 34-38 INCHES | LENGTH 39-40 FEET
MATERIAL AND TYPE | DEPTH TO TOP OF SCREEN 41-44 FEET

61 PLUGGING & SEALING RECORD

DEPTH SET AT - FEET FROM	DEPTH SET AT - FEET TO	MATERIAL AND TYPE (CEMENT GROUT LEAD PACKER ETC.)
10-13	14-17	
18-21	22-25	
26-29	30-33	60

71 PUMPING TEST

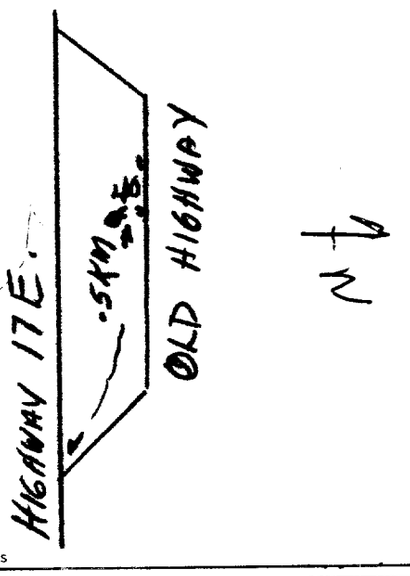
PUMPING TEST METHOD 10: 1 ☐ PUMP 2 ☐ BAILER
PUMPING RATE 11-14 GPM
DURATION OF PUMPING 15-16 HOURS 17-18 MINS

STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVELS DURING 25: 1 ☐ PUMPING 2 ☐ RECOVERY			
		15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
19-21 FEET	22-24 FEET	26-28 FEET	29-31 FEET	32-34 FEET	35-37 FEET

IF FLOWING, GIVE RATE 38-41 GPM
PUMP INTAKE SET AT FEET
WATER AT END OF TEST 42: 1 ☐ CLEAR 2 ☐ CLOUDY
RECOMMENDED PUMP TYPE: ☐ SHALLOW ☐ DEEP
RECOMMENDED PUMP SETTING 43-45 FEET
RECOMMENDED PUMPING RATE 46-49 GPM
50-53

LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.



DRILLERS REMARKS

FINAL STATUS OF WELL 54: 5
1 ☐ WATER SUPPLY 2 ☐ OBSERVATION WELL 3 ☐ TEST HOLE 4 ☐ RECHARGE WELL 5 ☒ ABANDONED, INSUFFICIENT SUPPLY 6 ☒ ABANDONED, POOR QUALITY 7 ☒ UNFINISHED

WATER USE 55-56:
1 ☐ DOMESTIC 2 ☐ STOCK 3 ☐ IRRIGATION 4 ☐ INDUSTRIAL ☐ OTHER 5 ☐ COMMERCIAL 6 ☐ MUNICIPAL 7 ☐ PUBLIC SUPPLY 8 ☐ COOLING OR AIR CONDITIONING 9 ☐ NOT USED

METHOD OF DRILLING 57: 1
1 ☒ CABLE TOOL 2 ☐ ROTARY (CONVENTIONAL) 3 ☐ ROTARY (REVERSE) 4 ☐ ROTARY (AIR) 5 ☐ AIR PERCUSSION 6 ☐ BORING 7 ☐ DIAMOND 8 ☐ JETTING 9 ☐ DRIVING

CONTRACTOR

NAME OF WELL CONTRACTOR: JIM RENNISON WELL DRILLING LTD. LICENCE NUMBER 4536
ADDRESS: 440 TOWN LINE
NAME OF DRILLER OR BORER: J. RENNISON LICENCE NUMBER 4536
SIGNATURE OF CONTRACTOR: J. Rennison
SUBMISSION DATE: DAY ____ MO. ____ YR. ____

MINISTRY OF THE ENVIRONMENT COPY

OFFICE USE ONLY

DATA SOURCE 58: 1
CONTRACTOR 59-62: 4536
DATE RECEIVED 63-68: 230784
DATE OF INSPECTION: 15/07/85
INSPECTOR: Hugo Lupi
REMARKS: - Dry

FORM NO. 0506—4—77 FORM 7

4132

Ministry of the Environment
Ontario

The Ontario Water Resources Act

WATER WELL RECORD

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK ☒ CORRECT BOX WHERE APPLICABLE

11 1103666 MUNICIP 1112 CON CON 02

COUNTY OR DISTRICT: Simcoe
TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE: Long twp
CON., BLOCK, TRACT, SURVEY, ETC.:
LOT 25-27: 002
DATE COMPLETED 48-53: DAY 31 MO 10 YR 83
[redacted] PRAGG
17400 RC 5 ELEVATION 0640 RC 6 BASIN CODE 22

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET FROM	DEPTH - FEET TO
	CLAY	STONES		0	26
	GRANIT			26	372

MACE

31 0026 0512 0372 21

32

41 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
10-13	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
15-18	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
20-23	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
25-28	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
30-33	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL

51 CASING & OPEN HOLE RECORD

INSIDE DIAM INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET FROM	DEPTH - FEET TO
06	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE	188	0	027
05				
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE			
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE			

SCREEN

SIZE(S) OF OPENING (SLOT NO.)	DIAMETER INCHES	LENGTH FEET

MATERIAL AND TYPE: DEPTH TO TOP OF SCREEN FEET

61 PLUGGING & SEALING RECORD

DEPTH SET AT - FEET FROM	DEPTH SET AT - FEET TO	MATERIAL AND TYPE (CEMENT GROUT LEAD PACKER, ETC.)
10-13	14-17	
18-21	22-25	
26-29	30-33	

71 PUMPING TEST

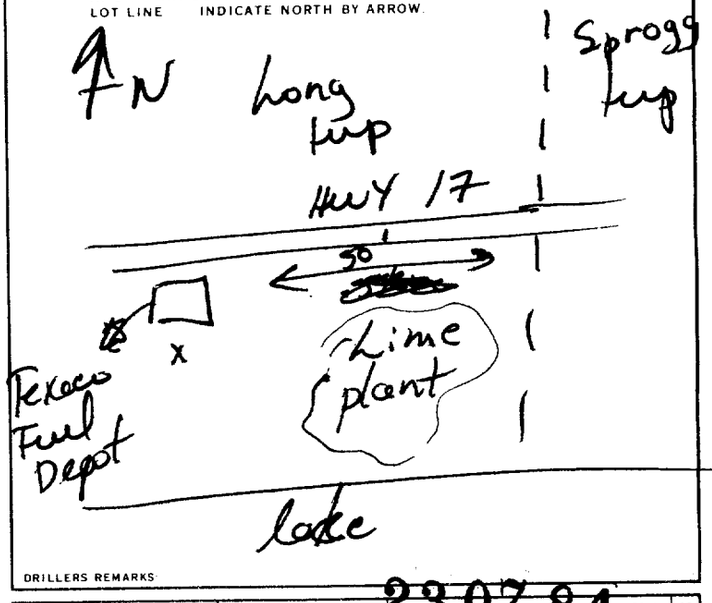
PUMPING TEST METHOD: 1 ☒ PUMP 2 ☐ BAILER — A/P
PUMPING RATE: 0001 Hz GPM
DURATION OF PUMPING: 02 HOURS 00 MINS
STATIC LEVEL: 007 FEET
WATER LEVEL END OF PUMPING: 372 FEET
WATER LEVELS DURING: 1 ☐ PUMPING 2 ☐ RECOVERY

15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
FEET	FEET	FEET	FEET

IF FLOWING, GIVE RATE: GPM
PUMP INTAKE SET AT: FEET
WATER AT END OF TEST: 1 ☐ CLEAR 2 ☐ CLOUDY
RECOMMENDED PUMP TYPE: ☐ SHALLOW ☐ DEEP
RECOMMENDED PUMP SETTING: 300 FEET
RECOMMENDED PUMPING RATE: 0001 Hz GPM

LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.



DRILLERS REMARKS:

FINAL STATUS OF WELL 54: 1 ☒ WATER SUPPLY 2 ☐ OBSERVATION WELL 3 ☐ TEST HOLE 4 ☐ RECHARGE WELL 5 ☐ ABANDONED, INSUFFICIENT SUPPLY 6 ☐ ABANDONED, POOR QUALITY 7 ☐ UNFINISHED

WATER USE 55-56: 05 — 1 ☐ DOMESTIC 2 ☐ STOCK 3 ☐ IRRIGATION 4 ☐ INDUSTRIAL ☐ OTHER 5 ☒ COMMERCIAL 6 ☐ MUNICIPAL 7 ☐ PUBLIC SUPPLY 8 ☐ COOLING OR AIR CONDITIONING 9 ☐ NOT USED

METHOD OF DRILLING 57: 4 — 1 ☐ CABLE TOOL 2 ☐ ROTARY (CONVENTIONAL) 3 ☐ ROTARY (REVERSE) 4 ☒ ROTARY (AIR) 5 ☐ AIR PERCUSSION 6 ☐ BORING 7 ☐ DIAMOND 8 ☐ JETTING 9 ☐ DRIVING

CONTRACTOR

NAME OF WELL CONTRACTOR: J WRIGHT — LICENCE NUMBER: 5516
ADDRESS:
NAME OF DRILLER OR BORER — LICENCE NUMBER:
SIGNATURE OF CONTRACTOR — SUBMISSION DATE: DAY ____ MO. ____ YR. ____

MINISTRY OF THE ENVIRONMENT COPY

OFFICE USE ONLY

DATA SOURCE 58: 1
CONTRACTOR 59-62: 5516
WELL ID 63-68: 230784
DATE OF INSPECTION: 2/07/85
INSPECTOR: Gregory Lafleur
REMARKS: Changed From 5904929 #18

FORM NO. 0506—4—77 FORM 7

Ministry of the Environment
Ontario

The Ontario Water Resources Act

WATER WELL RECORD

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK ☒ CORRECT BOX WHERE APPLICABLE

11 1103867 MUNICIP 1169 CON. 529

COUNTY OR DISTRICT	TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE	CON.	BLOCK	TRACT, SURVEY, ETC.	LOT
Algoma	North Shore Sprogs	29			

[redacted] 23 Sprague Ont. 849-2375

DATE COMPLETED: DAY 15 MO 08 YR 85

RC ELEVATION RC BASIN CODE

Comment

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET FROM	DEPTH - FEET TO
	sand & gravel			0	16
	grey granite			16	450

31

32

41 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
250	1 ☒ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
to 450	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL

51 CASING & OPEN HOLE RECORD

INSIDE DIAM INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET FROM	DEPTH - FEET TO
6¼	1 ☒ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE	.188	0	24
6	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☒ OPEN HOLE		24	450
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE			

SCREEN

SIZE(S) OF OPENING (SLOT NO.)	DIAMETER INCHES	LENGTH FEET

MATERIAL AND TYPE	DEPTH TO TOP OF SCREEN FEET

61 PLUGGING & SEALING RECORD

DEPTH SET AT - FEET FROM	DEPTH SET AT - FEET TO	MATERIAL AND TYPE (CEMENT GROUT LEAD PACKER, ETC.)

71 PUMPING TEST

PUMPING TEST METHOD	PUMPING RATE	DURATION OF PUMPING
1 ☐ PUMP 2 ☐ BAILER	7/h GPM	48 HOURS ____ MINS

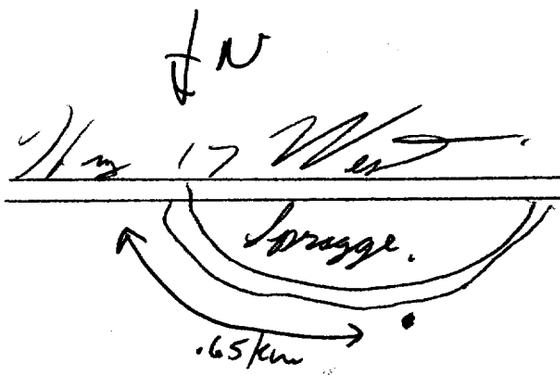
STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVELS DURING	15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
15 FEET	100 FEET	1 ☐ PUMPING 2 ☐ RECOVERY	100 FEET	100 FEET	100 FEET	100 FEET

IF FLOWING, GIVE RATE	PUMP INTAKE SET AT	WATER AT END OF TEST
GPM	100 FEET	1 ☐ CLEAR 2 ☒ CLOUDY

RECOMMENDED PUMP TYPE	RECOMMENDED PUMP SETTING	RECOMMENDED PUMPING RATE
☐ SHALLOW ☒ DEEP	400 FEET	7/h GPM

LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.



DRILLERS REMARKS

FINAL STATUS OF WELL

1 ☒ WATER SUPPLY 2 ☐ OBSERVATION WELL 3 ☐ TEST HOLE 4 ☐ RECHARGE WELL 5 ☐ ABANDONED, INSUFFICIENT SUPPLY 6 ☐ ABANDONED, POOR QUALITY 7 ☐ UNFINISHED

WATER USE

1 ☒ DOMESTIC 2 ☐ STOCK 3 ☐ IRRIGATION 4 ☐ INDUSTRIAL ☐ OTHER 5 ☐ COMMERCIAL 6 ☐ MUNICIPAL 7 ☐ PUBLIC SUPPLY 8 ☐ COOLING OR AIR CONDITIONING 9 ☐ NOT USED

METHOD OF DRILLING

1 ☐ CABLE TOOL 2 ☐ ROTARY (CONVENTIONAL) 3 ☐ ROTARY (REVERSE) 4 ☒ ROTARY (AIR) 5 ☐ AIR PERCUSSION 6 ☐ BORING 7 ☐ DIAMOND 8 ☐ JETTING 9 ☐ DRIVING

CONTRACTOR

NAME OF WELL CONTRACTOR: R. Vaillancourt & Sons Well Drilling Ltd.
LICENCE NUMBER: 5210
ADDRESS: Chelmsford Ont.
NAME OF DRILLER OR BORER: A. Vaillancourt
LICENCE NUMBER: 5216
SIGNATURE OF CONTRACTOR: R Vaillancourt
SUBMISSION DATE: DAY ____ MO. ____ YR. ____

OFFICE USE ONLY

DATA SOURCE | CONTRACTOR | DATE RECEIVED
DATE OF INSPECTION: 26/06/86
INSPECTOR
REMARKS: WDE
03 0286

MINISTRY OF THE ENVIRONMENT COPY

FORM NO. 0506—4—77 FORM 7

Ministry of the Environment
Ontario

The Ontario Water Resources Act

WATER WELL RECORD

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK ☒ CORRECT BOX WHERE APPLICABLE

11 1104637 MUNICIP 1112 CON CON 92

COUNTY OR DISTRICT: ALGOMA
TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE: NORTH SHORE Sprague
CON., BLOCK, TRACT, SURVEY, ETC: CON 2
LOT: 10
DATE COMPLETED: DAY 20 MO 04 YR 89
[redacted]
ELEVATION: ALGOMA MILL
BASIN CODE:

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET FROM	DEPTH - FEET TO
	SAND & BOULDERS			0	4
	GREY GRAN. FE			4	265

31
32

41 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
185	1 ☒ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS
×0 205	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS

51 CASING & OPEN HOLE RECORD

INSIDE DIAM INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET FROM	DEPTH - FEET TO
11 6 1/4	1 ☒ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE 5 ☐ PLASTIC	.188	0	22
6 11	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☒ OPEN HOLE 5 ☐ PLASTIC		22	265
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE 5 ☐ PLASTIC			

SCREEN

SIZE(S) OF OPENING (SLOT NO.)	DIAMETER INCHES	LENGTH FEET
MATERIAL AND TYPE	DEPTH TO TOP OF SCREEN FEET	

61 PLUGGING & SEALING RECORD

DEPTH SET AT - FEET FROM	DEPTH SET AT - FEET TO	MATERIAL AND TYPE (CEMENT GROUT LEAD PACKER ETC.)

71 PUMPING TEST

PUMPING TEST METHOD: 1 ☐ PUMP 2 ☒ BAILER
PUMPING RATE: 1/2 GPM
DURATION OF PUMPING: 1 HOURS ____ MINS

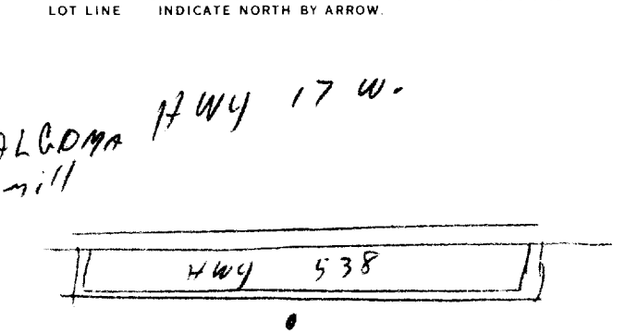
STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVELS DURING: 1 ☐ PUMPING 2 ☐ RECOVERY			
		15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
18 FEET	265 FEET	265 FEET	265 FEET	265 FEET	265 FEET

IF FLOWING, GIVE RATE	PUMP INTAKE SET AT	WATER AT END OF TEST
GPM	265 FEET	1 ☒ CLEAR 2 ☐ CLOUDY

RECOMMENDED PUMP TYPE	RECOMMENDED PUMP SETTING	RECOMMENDED PUMPING RATE
☐ SHALLOW ☒ DEEP	255 FEET	1/2 GPM

LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.



DRILLERS REMARKS: 15295

FINAL STATUS OF WELL

1 ☒ WATER SUPPLY 2 ☐ OBSERVATION WELL 3 ☐ TEST HOLE 4 ☐ RECHARGE WELL 5 ☐ ABANDONED, INSUFFICIENT SUPPLY 6 ☐ ABANDONED, POOR QUALITY 7 ☐ UNFINISHED 9 ☐ DEWATERING

WATER USE

1 ☒ DOMESTIC 2 ☐ STOCK 3 ☐ IRRIGATION 4 ☐ INDUSTRIAL ☐ OTHER 5 ☐ COMMERCIAL 6 ☐ MUNICIPAL 7 ☐ PUBLIC SUPPLY 8 ☐ COOLING OR AIR CONDITIONING 9 ☐ NOT USED

METHOD OF CONSTRUCTION

1 ☐ CABLE TOOL 2 ☐ ROTARY (CONVENTIONAL) 3 ☐ ROTARY (REVERSE) 4 ☐ ROTARY (AIR) 5 ☒ AIR PERCUSSION 6 ☐ BORING 7 ☐ DIAMOND 8 ☐ JETTING 9 ☐ DRIVING ☐ DIGGING ☐ OTHER

CONTRACTOR

NAME OF WELL CONTRACTOR: R. Vaillancourt & Sons Ltd.
WELL CONTRACTOR'S LICENCE NUMBER: 7210
ADDRESS: CHELMSFORD ONT
NAME OF WELL TECHNICIAN: R. Vaillancourt
WELL TECHNICIAN'S LICENCE NUMBER: 0087
SIGNATURE OF TECHNICIAN/CONTRACTOR: R. Vaillancourt
SUBMISSION DATE: DAY ____ MO. ____ YR. ____

OFFICE USE ONLY

DATA SOURCE
CONTRACTOR: 5210
DATE RECEIVED: MAY 16 1989
DATE OF INSPECTION: 06/90
INSPECTOR: M.F.
REMARKS: CSS.ES

MINISTRY OF THE ENVIRONMENT COPY

FORM NO. 0506 (11/86) FORM 9

MINISTRY OF THE ENVIRONMENT
The Ontario Water Resources Act

WATER WELL RECORD

Ontario

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK ☒ CORRECT BOX WHERE APPLICABLE

11 — 1105282 — MUNICIP. 11169 — CON.

COUNTY OR DISTRICT	TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE	CON., BLOCK, TRACT, SURVEY, ETC.	LOT
Algoma	SPRAGGE TWP		

DATE COMPLETED: DAY 23 MO. July YR. 88

ING | RC. | ELEVATION | RC. | BASIN CODE | II | III | IV

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET FROM	DEPTH - FEET TO
Brown	GRAVEL.	STONES	LOOSE	0	8
Grey	GRANITE		HARD	8	[redacted]
					500

31

32

41 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
250	1 ☒ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERAL
TO 378	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERAL
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERAL
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERAL
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERAL

51 CASING & OPEN HOLE RECORD

INSIDE DIAM. INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET FROM	DEPTH - FEET TO
6 1/4	1 ☒ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE	188	0	22.
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☒ OPEN HOLE		22	500
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE			

SCREEN

SIZE(S) OF OPENING (SLOT NO.)	DIAMETER INCHES	LENGTH FEET

MATERIAL AND TYPE | DEPTH TO TOP OF SCREEN FEET

61 PLUGGING & SEALING RECORD

DEPTH SET AT - FEET FROM	DEPTH SET AT - FEET TO	MATERIAL AND TYPE (CEMENT GROUT, LEAD PACKER, ETC.)

71 PUMPING TEST

PUMPING TEST METHOD: 1 ☐ PUMP 2 ☐ BAILER — Air

PUMPING RATE: 1/2 GPM. — DURATION OF PUMPING: 2 HOURS ___ MINS.

STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVELS DURING: 1 ☒ PUMPING 2 ☐ RECOVERY			
		15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
22. FEET	378 FEET	FEET	FEET	FEET	FEET

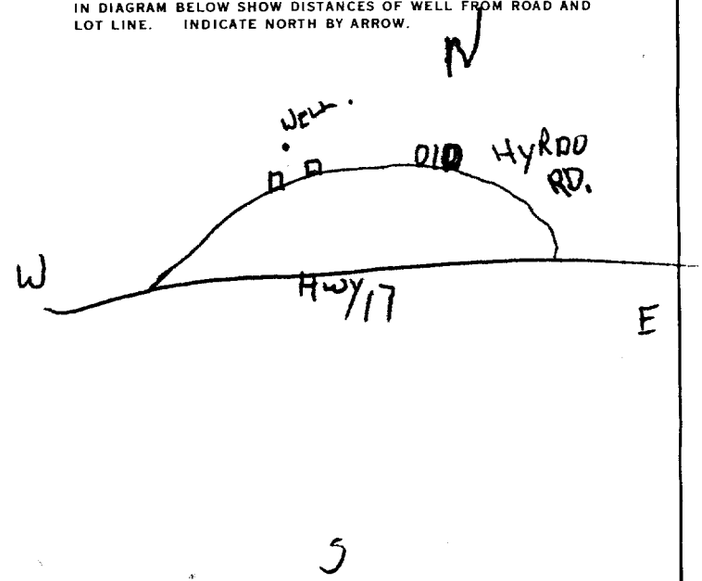
IF FLOWING, GIVE RATE	PUMP INTAKE SET AT	WATER AT END OF TEST
GPM.	FEET	1 ☐ CLEAR 2 ☒ CLOUDY

RECOMMENDED PUMP TYPE	RECOMMENDED PUMP SETTING	RECOMMENDED PUMPING RATE
☐ SHALLOW ☒ DEEP	375 FEET	1/2 GPM.

GPM./FT. SPECIFIC CAPACITY

LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.



DRILLERS REMARKS:

FINAL STATUS OF WELL
1 ☒ WATER SUPPLY 2 ☐ OBSERVATION WELL 3 ☐ TEST HOLE 4 ☐ RECHARGE WELL 5 ☐ ABANDONED, INSUFFICIENT SUPPLY 6 ☐ ABANDONED, POOR QUALITY 7 ☐ UNFINISHED

WATER USE
1 ☒ DOMESTIC 2 ☐ STOCK 3 ☐ IRRIGATION 4 ☐ INDUSTRIAL ☐ OTHER 5 ☐ COMMERCIAL 6 ☐ MUNICIPAL 7 ☐ PUBLIC SUPPLY 8 ☐ COOLING OR AIR CONDITIONING 9 ☐ NOT USED

METHOD OF DRILLING
1 ☐ CABLE TOOL 2 ☐ ROTARY (CONVENTIONAL) 3 ☐ ROTARY (REVERSE) 4 ☐ ROTARY (AIR) 5 ☒ AIR PERCUSSION 6 ☐ BORING 7 ☐ DIAMOND 8 ☐ JETTING 9 ☐ DRIVING

CONTRACTOR

NAME OF WELL CONTRACTOR: J. W. — LICENCE NUMBER: 5516

ADDRESS: Mindemoya

NAME OF DRILLER OR BORER: Edward E Wright — LICENCE NUMBER: T-0139

SIGNATURE OF CONTRACTOR: John Wright — SUBMISSION DATE: DAY ___ MO. ___ YR. ___

OFFICE USE ONLY

DATA SOURCE | CONTRACTOR 5516 | DATE RECEIVED JUL 12 1991

DATE OF INSPECTION | INSPECTOR

REMARKS: P

CSS.EWI

MINISTRY OF THE ENVIRONMENT COPY

FORM 7 MOE 07-091

Ministry of Environment and Energy
Ontario

The Ontario Water Resources Act
WATER WELL RECORD

Print only in spaces provided.
Mark correct box with a checkmark, where applicable.

11 — 1106027 — Municipality 1116 9 — Con. S29SW

County or District: [redacted]
Township/Borough/City/Town/Village: SPRAGGE
Con block tract survey, etc.: SECTION 29 SW CORNER
Lot:
Address: POBOX 108 ALGOMA MILLS ONT
Date completed: 21 day 7 month 95 year
Northing: ROR 1A0 — Elevation: RC — Basin Code: ii iii iv

21

LOG OF OVERBURDEN AND BEDROCK MATERIALS (see instructions)

General colour	Most common material	Other materials	General description	Depth – feet From	Depth – feet To
Brown	SAND	STONES, BOULDERS		0	38
	GRANITE	QUARTZITE		38	500

31

32

41 WATER RECORD

Water found at – feet	Kind of water					
170	1 ☒ Fresh	2 ☐ Salty	3 ☐ Sulphur	4 ☐ Minerals	5 ☐ Gas	6
	1 ☐ Fresh	2 ☐ Salty	3 ☐ Sulphur	4 ☐ Minerals	5 ☐ Gas	6
	1 ☐ Fresh	2 ☐ Salty	3 ☐ Sulphur	4 ☐ Minerals	5 ☐ Gas	6
	1 ☐ Fresh	2 ☐ Salty	3 ☐ Sulphur	4 ☐ Minerals	5 ☐ Gas	6
	1 ☐ Fresh	2 ☐ Salty	3 ☐ Sulphur	4 ☐ Minerals	5 ☐ Gas	6

51 CASING & OPEN HOLE RECORD

Inside diam inches	Material	Wall thickness inches	Depth – feet From	Depth – feet To
6.25	1 ☒ Steel, 2 ☐ Galvanized, 3 ☐ Concrete, 4 ☐ Open hole, 5 ☐ Plastic	.188	0	41
	1 ☐ Steel, 2 ☐ Galvanized, 3 ☐ Concrete, 4 ☒ Open hole, 5 ☐ Plastic		41	500
	1 ☐ Steel, 2 ☐ Galvanized, 3 ☐ Concrete, 4 ☐ Open hole, 5 ☐ Plastic			

SCREEN

Sizes of opening (Slot No.)	Diameter inches	Length feet

Material and type:
Depth at top of screen feet:

61 PLUGGING & SEALING RECORD

☐ Annular space ☐ Abandonment

Depth set at – feet From	Depth set at – feet To	Material and type (Cement grout, bentonite, etc.)

71 PUMPING TEST

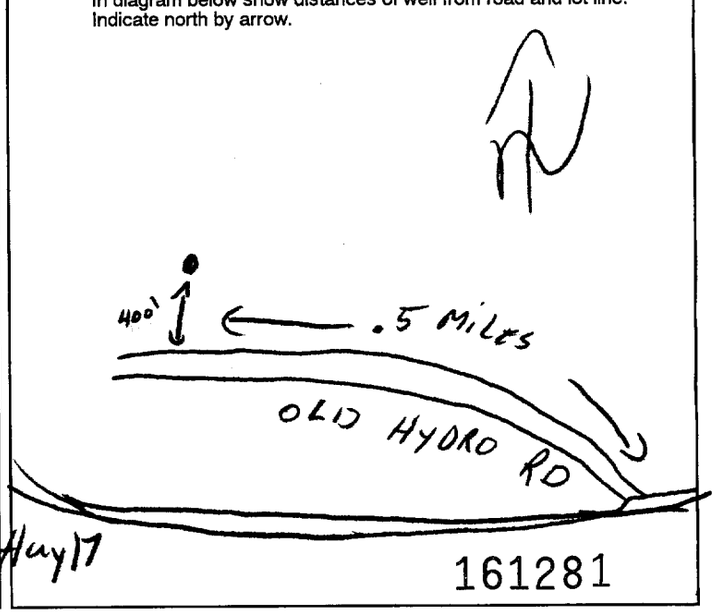
Pumping test method: ☒ Pump ☐ Bailer
Pumping rate: .5 GPM
Duration of pumping: 2 Hours ..... Mins

Static level feet	Water level end of pumping feet	Water levels during: 1 ☐ Pumping 2 ☐ Recovery	15 minutes feet	30 minutes feet	45 minutes feet	60 minutes feet

If flowing give rate: GPM
Pump intake set at: feet
Water at end of test: ☒ Clear ☐ Cloudy
Recommended pump type: ☐ Shallow ☒ Deep
Recommended pump setting: 450 feet
Recommended pump rate: .5 GPM

LOCATION OF WELL

In diagram below show distances of well from road and lot line.
Indicate north by arrow.



161281

FINAL STATUS OF WELL

1 ☒ Water supply
2 ☐ Observation well
3 ☐ Test hole
4 ☐ Recharge well
5 ☐ Abandoned, insufficient supply
6 ☐ Abandoned, poor quality
7 ☐ Abandoned (Other)
8 ☐ Dewatering
9 ☐ Unfinished
10 ☐ Replacement well

WATER USE

1 ☐ Domestic
2 ☐ Stock
3 ☐ Irrigation
4 ☐ Industrial
5 ☐ Commercial
6 ☐ Municipal
7 ☐ Public supply
8 ☐ Cooling & air conditioning
9 ☐ Not used
10 ☒ Other Hockey Rink

METHOD OF CONSTRUCTION

1 ☐ Cable tool
2 ☐ Rotary (conventional)
3 ☐ Rotary (reverse)
4 ☒ Rotary (air)
5 ☐ Air percussion
6 ☐ Boring
7 ☐ Diamond
8 ☐ Jetting
9 ☐ Driving
10 ☐ Digging
11 ☐ Other .....

Name of Well Contractor: Houle WELL DRILLING
Well Contractor's Licence No.: 2612
Address: Box 43 NOELVILLE ONT POM2NO
Name of Well Technician: Rick Houle
Well Technician's Licence No.: T-0200
Signature of Technician/Contractor: Rick Houle
Submission date: day 21 mo 7 yr 95

MINISTRY USE ONLY

Data source:
Date received: JAN 19 1996
Date of inspection:
Inspector:
Remarks:
CSS.ES

0506 (07/94) Front Form 9

2 - MINISTRY OF ENVIRONMENT & ENERGY COPY

Ministry of Environment and Energy
Ontario

The Ontario Water Resources Act
WATER WELL RECORD

Print only in spaces provided.
Mark correct box with a checkmark, where applicable.

11 — 1106329 — Municipality 1112 — Con.

County or District: ALGOMA
Township/Borough/City/Town/Village: NORTH SHORE
Con block tract survey, etc.: PLAN 1M449
Lot: 2
Address: [redacted]
Date completed: 9 Sept 98 (day month year)

21 — Northing — RC — Elevation — RC — Basin Code — ii — iii — iv

LOG OF OVERBURDEN AND BEDROCK MATERIALS (see instructions)

General colour	Most common material	Other materials	General description	Depth – feet From	Depth – feet To
SAND & GRAVEL	GREY HARD PAN	STONES		0	23
				23	25

96.35 70 1 20.5 1396.35

31
32

41 WATER RECORD

Water found at – feet	Kind of water
25'	1 ☒ Fresh 2 ☐ Salty; 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas
	1 ☐ Fresh 2 ☐ Salty; 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas
	1 ☐ Fresh 2 ☐ Salty; 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas
	1 ☐ Fresh 2 ☐ Salty; 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas
	1 ☐ Fresh 2 ☐ Salty; 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas

51 CASING & OPEN HOLE RECORD

Inside diam inches	Material	Wall thickness inches	Depth – feet From	Depth – feet To
6 1/4	1 ☒ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☐ Open hole 5 ☐ Plastic	188	0	25
	1 ☐ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☐ Open hole 5 ☐ Plastic			
	1 ☐ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☐ Open hole 5 ☐ Plastic			

SCREEN

Sizes of opening (Slot No.)	Diameter inches	Length feet
Material and type	Depth at top of screen feet	

61 PLUGGING & SEALING RECORD

☐ Annular space ☐ Abandonment

Depth set at – feet From	Depth set at – feet To	Material and type (Cement grout, bentonite, etc.)

71 PUMPING TEST

Pumping test method: 1 ☐ Pump 2 ☒ Bailer
Pumping rate: 7 GPM
Duration of pumping: ..... Hours 1/4 Mins

Static level: 8' feet
Water level end of pumping: 25 feet
Water levels during: 1 ☒ Pumping 2 ☐ Recovery

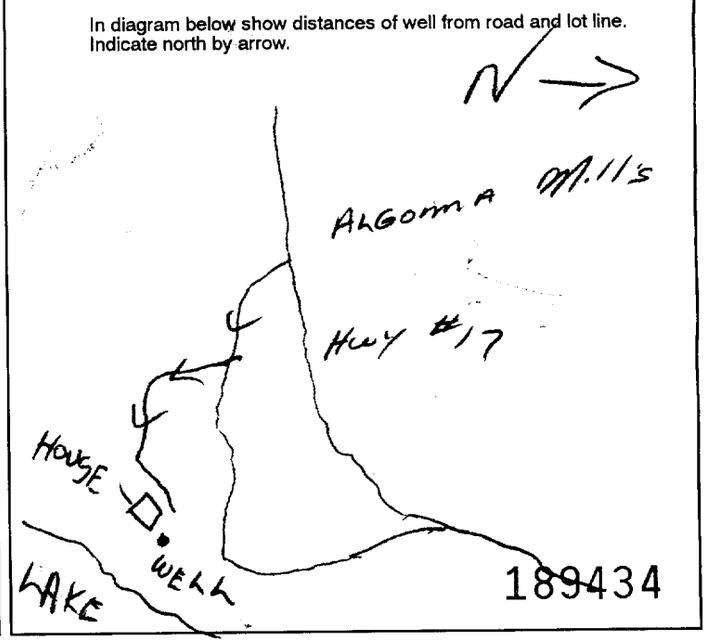
15 minutes	30 minutes	45 minutes	60 minutes
25 feet	25 feet	25 feet	25 feet

If flowing give rate: GPM
Pump intake set at: feet
Water at end of test: ☐ Clear ☒ Cloudy

Recommended pump type: ☒ Shallow ☐ Deep
Recommended pump setting: 20 feet
Recommended pump rate: 5 GPM

LOCATION OF WELL

In diagram below show distances of well from road and lot line.
Indicate north by arrow.



FINAL STATUS OF WELL

1 ☒ Water supply 2 ☐ Observation well 3 ☐ Test hole 4 ☐ Recharge well
5 ☐ Abandoned, insufficient supply 6 ☐ Abandoned, poor quality 7 ☐ Abandoned (Other) 8 ☐ Dewatering
9 ☐ Unfinished 10 ☐ Replacement well

WATER USE

1 ☒ Domestic 2 ☐ Stock 3 ☐ Irrigation 4 ☐ Industrial
5 ☐ Commercial 6 ☐ Municipal 7 ☐ Public supply 8 ☐ Cooling & air conditioning
9 ☐ Not used 10 ☐ Other .....

METHOD OF CONSTRUCTION

1 ☐ Cable tool 2 ☐ Rotary (conventional) 3 ☐ Rotary (reverse) 4 ☐ Rotary (air)
5 ☒ Air percussion 6 ☐ Boring 7 ☐ Diamond 8 ☐ Jetting
9 ☐ Driving 10 ☐ Digging 11 ☐ Other .....

Name of Well Contractor: EDWARD WRIGHT
Well Contractor's Licence No.: 70-23
Address: MINDEMOYA
Name of Well Technician: SELF
Well Technician's Licence No.: T-0139
Signature of Technician/Contractor
Submission date: day mo yr

MINISTRY USE ONLY
Data source: 7023
Date received: OCT 15 1998
Date of inspection
Inspector
Remarks: CSS. ESG

0506 (07/94) Front Form 9

2 - MINISTER OF ENVIRONMENT & ENERGY COPY

Ontario — Ministry of the Environment

Well Tag Nur A013814 (DW)

A013814

Well Record

Regulation 903 Ontario Water Resources Act

page ___ of ___

Instructions for Completing Form

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- **All metre measurements shall be reported to 1/10th of a metre.**
- Please print clearly in blue or black ink only.

Ministry Use Only

MUN [redacted] CON [redacted] LOT [redacted]

[redacted]

Address of Well Location (County/District/Municipality): BOX 44 OLD HYDRO RD

Township: NORTH [redacted] SHORE

Lot: 50

Concession: 29

RR#/Street Number/Name: 1179 OLD HYDRO RD

City/Town/Village: SPRUCE

Site/Compartment/Block/Tract etc.

GPS Reading | NAD: 83 | Zone: 17 | Easting: 372347 | Northing: 5118679

Unit Make/Model: GARMAN 12

Mode of Operation: ☐ Undifferentiated ☒ Averaged ☐ Differentiated, specify

Log of Overburden and Bedrock Materials (see instructions)

General Colour	Most common material	Other Materials	General Description	Depth From	Depth To
GREY	CLAY			0	6.09
BROWN	SAND & GRAVEL			6.09	12.80

Hole Diameter

Depth From	Depth To	Diameter Centimetres
0	12.49	15.55

Water Record

Water found at ___ Metres	Kind of Water		
12 m	☒ Fresh	☐ Sulphur	☐ Gas
	☐ Salty	☐ Minerals	☐ Other:
___ m	☐ Fresh	☐ Sulphur	☐ Gas
	☐ Salty	☐ Minerals	☐ Other:
___ m	☐ Fresh	☐ Sulphur	☐ Gas
	☐ Salty	☐ Minerals	☐ Other:

After test of well yield, water was: ☐ Clear and sediment free ☐ Other, specify

Chlorinated ☒ Yes ☐ No

Construction Record

Inside diam centimetres	Material	Wall thickness centimetres	Depth From	Depth To
Casing				
16.9	☒ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized		0	13
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			
Screen				
Outside diam	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized	Slot No.		
No Casing or Screen				
	☐ Open hole		N/A	N/A

Test of Well Yield

Pumping test method: air pump.

Pump intake set at - (metres): 12.19

Pumping rate - (litres/min): 22.75

Duration of pumping: 1 hrs + 0 min

Final water level end of pumping: 4.38 metres

Recommended pump type: ☐ Shallow ☒ Deep

Recommended pump depth: 9.14 metres

Recommended pump rate: 22.75 (litres/min)

If flowing give rate - (litres/min)

If pumping discontinued, give reason.

	Draw Down Time min	Draw Down Water Level Metres	Recovery Time min	Recovery Water Level Metres
Static Level		2.77		
1		3.62	1	3.41
2		3.96	2	2.95
3		4.17	3	2.86
4		4.29	4	2.77
5		4.35	5	
10		4.38	10	
15			15	
20			20	
25			25	
30			30	
40			40	
50			50	
60		4.38	60	2.77

Plugging and Sealing Record

☒ Annular space ☐ Abandonment

Depth set at - From	Depth set at - To	Material and type (bentonite slurry, neat cement slurry) etc.	Volume Placed (cubic metres)
0	6.10	BENTONITE SLURRY	.24

Method of Construction

☐ Cable Tool ☐ Rotary (air) ☐ Diamond ☐ Digging
☐ Rotary (conventional) ☒ Air percussion ☐ Jetting ☐ Other
☐ Rotary (reverse) ☐ Boring ☐ Driving

Water Use

☒ Domestic ☐ Industrial ☐ Public Supply ☐ Other
☐ Stock ☐ Commercial ☐ Not used
☐ Irrigation ☐ Municipal ☐ Cooling & air conditioning

Final Status of Well

☒ Water Supply ☐ Recharge well ☐ Unfinished ☐ Abandoned, (Other)
☐ Observation well ☐ Abandoned, insufficient supply ☐ Dewatering
☐ Test Hole ☐ Abandoned, poor quality ☐ Replacement well

Well Contractor/Technician Information

Name of Well Contractor: FOWLER DRILLING

Well Contractor's Licence No.: 7023

Business Address (street number, number, city etc.): BOX 14 DUNDALK

Name of Well Technician (last name, first name): SEAD

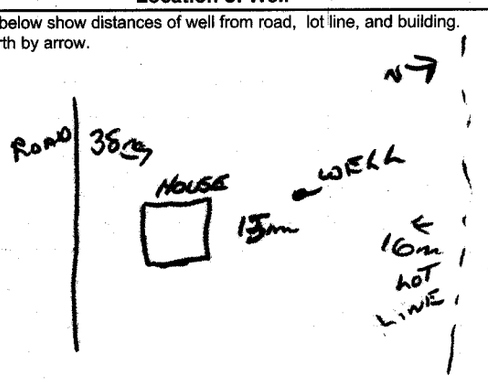
Well Technician's Licence No.: T-0139

Signature of Technician/Contractor: [signature]

Date Submitted: YYYY MM DD

Location of Well

In diagram below show distances of well from road, lot line, and building. Indicate north by arrow.



Audit No.: Z 20782

Date Well Completed: YYYY 04 MM Oct DD 27

Was the well owner's information package delivered? ☒ Yes ☐ No

Date Delivered: YYYY 04 MM Oct DD 27

Ministry Use Only

Data Source

Contractor: 7023

Date Received: YYYY MM DD NOV 25 2004

Date of Inspection: YYYY MM DD

Remarks

Well Record Number: 1107271

0506E (09/03)

Contractor's Copy ☒ Ministry's Copy ☒ Well Owner's Copy ☐

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Ontario Ministry of the Environment

Well Tag A 036502 (see below)

A036502.

Well Record

Regulation 903 Ontario Water Resources Act

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Ministry Use Only

MUN | CON | LOT

Well Owner's Information and Location of Well Information

[redacted]

Old Mill Rd.
RR#/Street Number/Name
1218

S Pragge Twp.
City/Town/Village
S Pragge

Nil Nil
Site/Compartment/Block/Tract etc.
SEC 29 SOUTH HALF

GPS Reading | NAD 83 | Zone 17 | Easting 371907 | Northing 5118184 | Unit Make/Model GARMIN 12 | Mode of Operation: ☐ Undifferentiated ☒ Averaged ☐ Differentiated, specify

Log of Overburden and Bedrock Materials (see instructions)

General Colour	Most common material	Other Materials	General Description	Depth From	Depth To
Brown	Clay & Stones Gravel.			0.	5.48
				5.48	10.66

Hole Diameter

Depth From	Depth To	Diameter Centimetres
0	10.66	15.15

Water Record

Water found at ___ Metres / Kind of Water

10.97 m ☒ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other:

___ m ☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other:

___ m ☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other:

After test of well yield, water was
☒ Clear and sediment free
☐ Other, specify

Chlorinated ☒ Yes ☐ No

Construction Record

Inside diam centimetres	Material	Wall thickness centimetres	Depth From	Depth To
Casing				
15.9	☒ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized	0.48	0.	10.97
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			
Screen				
Outside diam	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized	Slot No.		
No Casing or Screen				
	☐ Open hole		NIL	NIL

Test of Well Yield

Pumping test method: SUB PUMP

Pump intake set at - (metres) 10.66

Pumping rate - (litres/min) 22.75

Duration of pumping 1 hrs + NO min

Final water level end of pumping 9.38 metres

Recommended pump type. ☐ Shallow ☒ Deep

Recommended pump depth. 9.38 metres

Recommended pump rate. 22.75 (litres/min)

If flowing give rate - (litres/min)

If pumping discontinued, give reason.

	Draw Down Time min	Draw Down Water Level Metres	Recovery Time min	Recovery Water Level Metres
Static Level		6.55		
1	1	7.49	1	8.44
2	2	7.98	2	7.98
3	3	7.10	3	7.65
4	4	8.56	4	7.46
5	5	8.68	5	7.34
10	10	9.11	10	7.07
15	15	9.26	15	6.97
20	20	9.32	20	6.55
25	25	9.38	25	
30	30		30	
40	40		40	
50	50		50	
60	60	9.38	60	6.55

Plugging and Sealing Record

☒ Annular space ☐ Abandonment

Depth set at - Metres From	Depth set at - Metres To	Material and type (bentonite slurry, neat cement slurry) etc.	Volume Placed (cubic metres)
0	6.10	BENTONITE SLURRY	.36

Method of Construction

☐ Cable Tool ☐ Rotary (air) ☐ Diamond ☐ Digging
☐ Rotary (conventional) ☒ Air percussion ☐ Jetting ☐ Other
☐ Rotary (reverse) ☐ Boring ☐ Driving

Water Use

☒ Domestic ☐ Industrial ☐ Public Supply ☐ Other
☐ Stock ☐ Commercial ☐ Not used
☐ Irrigation ☐ Municipal ☐ Cooling & air conditioning

Final Status of Well

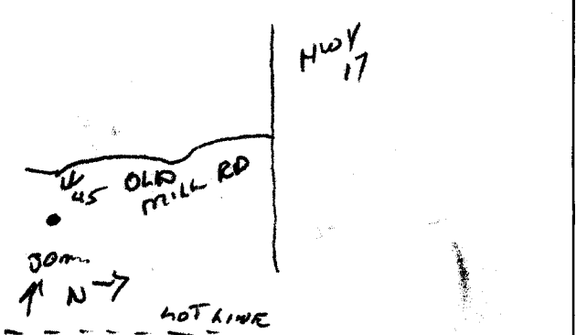
☒ Water Supply ☐ Recharge well ☐ Unfinished ☐ Abandoned, (Other)
☐ Observation well ☐ Abandoned, insufficient supply ☐ Dewatering
☐ Test Hole ☐ Abandoned, poor quality ☐ Replacement well

Well Contractor/Technician Information

Name of Well Contractor: EDWARD WRIGHT
Well Contractor's Licence No.: 7023
Business Address (street name, number, city etc.): Box 141 Minden Ont
Name of Well Technician (last name, first name): SEE
Well Technician's Licence No.: T-0139
Signature of Technician/Contractor: x Edward Wright
Date Submitted YYYY MM DD

Location of Well

In diagram below show distances of well from road, lot line, and building. Indicate north by arrow.



Audit No. Z 40407

Date Well Completed YYYY MM DD: 05 11 23

Was the well owner's information package delivered? ☒ Yes ☐ No

Date Delivered YYYY MM DD: 05 11 23

Ministry Use Only

Data Source | Contractor: 7023

Date Received YYYY MM DD: JAN 05 2006 | Date of Inspection YYYY MM DD

Remarks | Well Record Number

0506E (09/03) Contractor's Copy ☐ Ministry's Copy ☐ Well Owner's Copy ☒

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Ontario Ministry of the Environment

Well (Tag # and print number below) A 045493

A045493

Well Record

Regulation 903 Ontario Water Resources Act

page ___ of ___

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- Please print clearly in blue or black ink only.

Ministry Use Only

MUN | CON | LOT

Well Owner's Information and Location of Well Information

[redacted]

RR#/Street Number/Name: 1017 Old Mill Rd | City/Town/Village: Spragge | Site/Compartment/Block/Tract etc.: Pt 1 N.A.

GPS Reading: NAD 83 | Zone 17 | Easting 372841 | Northing 5118183 | Unit Make/Model: Garmin 12 | Mode of Operation: ☐ Undifferentiated ☒ Averaged ☐ Differentiated, specify

Log of Overburden and Bedrock Materials (see instructions)

General Colour	Most common material	Other Materials	General Description	Depth From	Depth To (Metres)
	GRAVEL			0	1.21
BLACK	GRANITE			1.21	68.88

Hole Diameter

Depth From (Metres)	Depth To (Metres)	Diameter (Centimetres)
0	6.40	15.9
6.40	68.88	15.55

Water Record

Water found at ___ Metres / Kind of Water

36 m	☒ Fresh	☐ Sulphur	☐ Gas ☐ Salty ☐ Minerals ☐ Other:
___ m	☐ Fresh	☐ Sulphur	☐ Gas ☐ Salty ☐ Minerals ☐ Other:
___ m	☐ Fresh	☐ Sulphur	☐ Gas ☐ Salty ☐ Minerals ☐ Other:

After test of well yield, water was
☐ Clear and sediment free
☒ Other, specify CLOUDY

Chlorinated ☒ Yes ☐ No

Construction Record

Inside diam centimetres	Material	Wall thickness centimetres	Depth From (Metres)	Depth To (Metres)
Casing				
15.9	☒ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized	0.48	0	6.40
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			
Screen				
Outside diam	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized	Slot No.		
No Casing or Screen				
	☒ Open hole		6.40	

Test of Well Yield

Pumping test method: sub pump

Pump intake set at - (metres): 45

Pumping rate - (litres/min): 22.75

Duration of pumping: 1 hrs + 00 min

Final water level end of pumping: 20.41 metres

Recommended pump type: ☐ Shallow ☒ Deep

Recommended pump depth: 67 metres

Recommended pump rate: 22.75 (litres/min)

If flowing give rate - (litres/min):

If pumping discontinued, give reason:

	Draw Down Time min	Draw Down Water Level Metres	Recovery Time min	Recovery Water Level Metres
Static Level		20.11		
1	20.82		1	20.11
2	20.41		2	
3			3	
4			4	
5			5	
10			10	
15			15	
20			20	
25			25	
30			30	
40			40	
50			50	
60	20.41		60	20.11

Plugging and Sealing Record

☒ Annular space ☐ Abandonment

Depth set at - Metres From	Depth set at - Metres To	Material and type (bentonite slurry, neat cement slurry) etc.	Volume Placed (cubic metres)
0	6.09	BENTONITE SLURRY	.35

Method of Construction

☐ Cable Tool ☐ Rotary (air) ☐ Diamond ☐ Digging
☐ Rotary (conventional) ☒ Air percussion ☐ Jetting ☐ Other
☐ Rotary (reverse) ☐ Boring ☐ Driving

Water Use

☒ Domestic ☐ Industrial ☐ Public Supply ☐ Other
☐ Stock ☐ Commercial ☐ Not used
☐ Irrigation ☐ Municipal ☐ Cooling & air conditioning

Final Status of Well

☒ Water Supply ☐ Recharge well ☐ Unfinished ☐ Abandoned, (Other)
☐ Observation well ☐ Abandoned, insufficient supply ☐ Dewatering
☐ Test Hole ☐ Abandoned, poor quality ☐ Replacement well

Well Contractor/Technician Information

Name of Well Contractor: EDWARD WRIGHT | Well Contractor's Licence No.: 7023

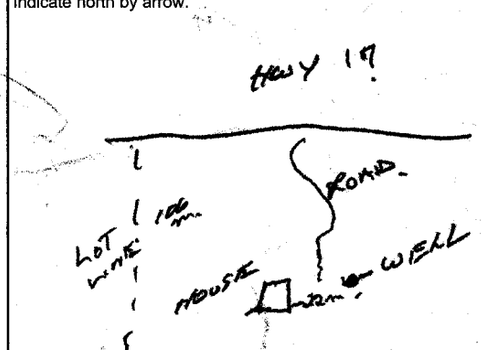
Business Address (street name, number, city etc.): BOX 141 MILDMAY

Name of Well Technician (last name, first name): SEE P | Well Technician's Licence No.: T-0139

Signature of Technician/Contractor: X Edward Wright | Date Submitted YYYY MM DD

Location of Well

In diagram below show distances of well from road, lot line, and building. Indicate north by arrow.



Audit No. Z 51004 | Date Well Completed YYYY MM DD: 2006 8 22

Was the well owner's information package delivered? ☒ Yes ☐ No | Date Delivered YYYY MM DD: 2006 8 22

Ministry Use Only

Data Source | Contractor: 7023

Date Received: AUG 31 2006 MM DD | Date of Inspection YYYY MM DD

Remarks | Well Record Number

0506E (09/03) Contractor's Copy ☐ Ministry's Copy ☒ Well Owner's Copy ☐ *Cette formule est disponible en français*

Ontario Ministry of the Environment

Well T ... umber below)
A 060208
A060 208

Well Record
Regulation 903 Ontario Water Resources Act

page ___ of ___

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- **All metre measurements shall be reported to 1/10th of a metre.**
- Please print clearly in blue or black ink only.

Ministry Use Only

[redacted]

Address of Well Location (County/District/Municipality)	Township	Lot	Concession
ALGOMA MILLS.	NORTH SHORE	PART 10	2

RR#/Street Number/Name	City/Town/Village	Site/Compartment/Block/Tract etc.
1472	ALGOMA MILLS	

GPS Reading	NAD	Zone	Easting	Northing	Unit Make/Model	Mode of Operation
	83	17	361533	5116908	GARMIN 12	☐ Undifferentiated ☒ Averaged ☐ Differentiated, specify

Log of Overburden and Bedrock Materials (see instructions)

General Colour	Most common material	Other Materials	General Description	Depth From	Depth To (Metres)
BROWN	SAND			0	3 ft
RED & GREY	GRANITE		SOFT	3 ft	375 ft

Hole Diameter

Depth From	Depth To (Metres)	Diameter (Centimetres)
0	20 ft	10"
20 ft		

Water Record

Water found at ___ Metres / Kind of Water

UNKNOWN	☒ Fresh	☐ Sulphur	
☐ Gas	☐ Salty	☐ Minerals	
☐ Other:			
___ m	☐ Fresh	☐ Sulphur	
☐ Gas	☐ Salty	☐ Minerals	
☐ Other:			
___ m	☐ Fresh	☐ Sulphur	
☐ Gas	☐ Salty	☐ Minerals	
☐ Other:			

After test of well yield, water was
☐ Clear and sediment free
☒ Other, specify CLOUDY

Chlorinated ☒ Yes ☐ No

Construction Record

Inside diam (centimetres)	Material	Wall thickness (centimetres)	Depth From	Depth To (Metres)
Casing				
6 1/4	☒ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized	1.88	0	20 ft
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			
Screen				
Outside diam	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized	Slot No.		
No Casing or Screen				
	☒ Open hole		20 ft	375 ft

Test of Well Yield

Pumping test method: SUB PUMP

Pump intake set at - (metres): 200 ft

Pumping rate (litres/min): 6 GPM

Duration of pumping: 1 hrs + 0 min

Final water level end of pumping: 237 ft (metres)

Recommended pump type: ☐ Shallow ☒ Deep

Recommended pump depth: 360 ft (metres)

Recommended pump rate: 6 GPM (litres/min)

If flowing give rate - (litres/min):

If pumping discontinued, give reason.

	Draw Down Time min	Draw Down Water Level Metres	Recovery Time min	Recovery Water Level (Metres)
Static Level	8.5			
1	13.5	1	71.4	
2	18.5	2	70.1	
3	23.1	3	68.6	
4	26.8	4	67.1	
5	30.9	5	65.6	
10	40.4	10	52.8	
15	46.3	15	53.2	
20	53.2	20	48.1	
25	58.8	25	43.0	
30	62.5	30	38.1	
40	65.5	40	28.4	
50	72.8	50	19.2	
60	75.9	60	11.0	

Plugging and Sealing Record

☒ Annular space ☐ Abandonment

Depth set at - Metres From	Depth set at - Metres To	Material and type (bentonite slurry, neat cement slurry) etc.	Volume Placed (cubic metres)
0	20 ft	BENTONITE SLURRY	.35

Method of Construction

☐ Cable Tool	☐ Rotary (air)	☐ Diamond	☐ Digging
☒ Rotary (conventional)	☒ Air percussion	☐ Jetting	☐ Other
☐ Rotary (reverse)	☐ Boring	☐ Driving	

Water Use

☒ Domestic	☐ Industrial	☐ Public Supply	☐ Other
☐ Stock	☐ Commercial	☐ Not used	
☐ Irrigation	☐ Municipal	☐ Cooling & air conditioning	

Final Status of Well

☒ Water Supply	☐ Recharge well	☐ Unfinished	☐ Abandoned, (Other)
☐ Observation well	☐ Abandoned, insufficient supply	☐ Dewatering	
☐ Test Hole	☐ Abandoned, poor quality	☐ Replacement well	

Well Contractor/Technician Information

Name of Well Contractor	Well Contractor's Licence No.
EDWARD (TED) WRIGHT	70-23

Business Address (street name, number, city etc.): BOX 141 MINDEMOYA

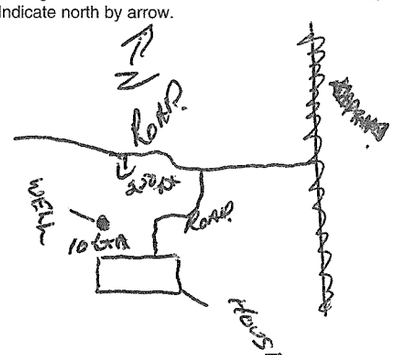
Name of Well Technician (last name, first name)	Well Technician's Licence No.
WRIGHT EDWARD	T-0139

Signature of Technician/Contractor: X Edward Wright

Date Submitted YYYY MM DD

Location of Well

In diagram below show distances of well from road, lot line, and building. Indicate north by arrow.



Audit No.	Date Well Completed YYYY MM DD
Z 57053	07 6 12
Was the well owner's information package delivered? ☐ Yes ☐ No	Date Delivered YYYY MM DD: 07 6 12

Ministry Use Only

Data Source	Contractor
	7023
Date Received YYYY MM DD: AUG 23 2007	Date of Inspection YYYY MM DD
Remarks	Well Record Number

0506E (08/2006)

Ministry's Copy

Cette formule est disponible en français

Well ID

Well ID Number: 7213200
Well Audit Number: *Z159072*
Well Tag Number: *A138801*

This table contains information from the original well record and any subsequent updates.

Well Location

Address of Well Location	1724 HWY 538
Township	LONG TOWNSHIP
Lot	
Concession	
County/District/Municipality	ALGOMA
City/Town/Village	ALGOMA MILLS
Province	ON
Postal Code	n/a
UTM Coordinates	NAD83 — Zone 17 Easting: 362787.00 Northing: 5116807.00
Municipal Plan and Sublot Number	
Other	

Overburden and Bedrock Materials Interval

General Colour	Most Common Material	Other Materials	General Description	Depth From	Depth To
BRWN	SAND	GRVL	STNS	0 ft	3 ft
GREY	GRNT	HARD		3 ft	208 ft

Annular Space/Abandonment Sealing Record

Depth From	Depth To	Type of Sealant Used (Material and Type)	Volume Placed
0 ft	20 ft	BENTONITE HOLEPLUG	

Method of Construction & Well Use

Method of Construction	Well Use
Air Percussion	Domestic

Status of Well

Water Supply

Construction Record - Casing

Inside Diameter	Open Hole or material	Depth From	Depth To
6.25 inch	STEEL	0 ft	20 ft

Construction Record - Screen

Outside Diameter	Material	Depth From	Depth To

Well Contractor and Well Technician Information

Well Contractor's Licence Number: 7023

Results of Well Yield Testing

After test of well yield, water was	CLEAR
If pumping discontinued, give reason	
Pump intake set at	200 ft
Pumping Rate	2 GPM
Duration of Pumping	1 h:0 m
Final water level	62.3 ft
If flowing give rate	
Recommended pump depth	200 ft
Recommended pump rate	2 GPM
Well Production	
Disinfected?	Y

Draw Down & Recovery

Draw Down Time(min)	Draw Down Water level	Recovery Time(min)	Recovery Water level
SWL	9.4 ft		
1	11 ft	1	59.8 ft
2	12.3 ft	2	57.3 ft
3	13.8 ft	3	54.7 ft
4	15.1 ft	4	52.3 ft
5	16.4 ft	5	50 ft
10	21.8 ft	10	39.1 ft
15	26.9 ft	15	31.6 ft
20	31.9 ft	20	25.4 ft
25	36.7 ft	25	20.1 ft
30	41.5 ft	30	16.3 ft
40	49.4 ft	40	10.7 ft
45		45	
50	56.6 ft	50	9.8 ft
60	62.3 ft	60	9.4 ft

Water Details

Water Found at Depth	Kind
20 ft	Fresh

Hole Diameter

Depth From	Depth To	Diameter
0 ft	20 ft	10 inch
20 ft	208 ft	6 inch

Audit Number: Z159072

Date Well Completed: July 16, 2013

Date Well Record Received by MOE: December 17, 2013

Updated: March 12, 2015

Appendix C DIAMOND DRILLING LOGS Project 214-281

Copies of the diamond drilling borehole logs (by JMK Exploration Consulting) were provided to Waters Environmental Geosciences Ltd. by Tulloch Engineering Inc., and are presented in this Appendix.

The diamond drill hole identification numbers, and the corresponding field borehole numbers assigned by the client, are presented in the following table:

Borehole Reference Number	Diamond Drill Hole Number
BH-1	DA15-06
BH-2	DA15-04
BH-3	DA15-03
BH-4	DA15-01
BH-6	DA15-02
BH-7	DA15-07
BH-8	DA15-05

Due to access difficulties, the location for BH-5 was dropped from the field drilling program.

Darien Aggregates Inc.

DDH: **DA15-01**

		Claims title:	3009531	Section:	
		Township:	Long	Level:	Surface
		Range:		Work place:	North Bay
Drilled by:	Chenier Drilling Services	Lot:			
Described by:	Joerg Kleinboeck	From:	12/01/2015	Description date:	09/02/2015
		To:	22/02/2015		

Collar

Azimuth:	0.00°
Dip:	-90.00°
Length:	30.00 m

UTM Coordinates

East	366,237
North	5,120,341
Elevation	252

Down hole survey

Type	Depth	Azimuth	Dip	Invalid

Type	Depth	Azimuth	Dip	Invalid

Description

Casing driven to 6.00m (PQ), left in hole, capped & locked.

Well ID #A167668

Core size: BTW Cemented: No Stored: No

		Description
0.00	0.30	OB
		Overburden
		Overburden.
0.30	4.80	FZ
		Fault Zone
		heavily fractured (RQD = <5%) dark grey fine grained massive hypersthene gabbro.
		fractures dominantly orientated at 0 deg TCA, generally infilled with chlorite.
		moderately magnetic, no visible sulphides.
4.80	21.16	NDIA_hgab; FG; MASS
		Nipissing Diabase - Hypersthene Gabbro; Fine grained; Massive
		dark grey fine grained massive hypersthene gabbro.
		local fractures infilled with 1-2mm of chlorite, generally orientated at 0 deg TCA.
		moderately magnetic, no visible sulphides.
		lower contact chilled, sharp at 25 deg TCA.
21.16	25.00	NDIA_gab; FG-MG; POR
		Nipissing Diabase - Gabbro; Fine to medium grained; Porphyritic
		dark grey fine to medium grained porphyritic gabbro with local plagioclase phenocrysts up to 3 mm in size.
		non-magnetic, no visible sulphides.
		lower contact broken.
25.00	28.90	NDIA_gab; FG; MASS
		Nipissing Diabase - Gabbro; Fine grained; Massive
		very dark grey fine grained massive gabbro/melagabbro.
		locally brecciated with occasional sections of fine to medium grained plag-phryic gabbro as from 21.16-25.00m.
		moderately to strongly magnetic, no visible sulphides.
		lower contact transitional.
28.90	30.00	NDIA_hgab; FG; MASS
		Nipissing Diabase - Hypersthene Gabbro; Fine grained; Massive
		as from 4.80-21.16m.
		moderately to strongly magnetic. no visible sulphides.
30.00		**End of DDH**
		Number of samples: 0
		Number of QAQC samples: 0
		Total sampled length: 0.00

Magnetism

From	To	Magnetism	Title	Description
4.00	5.00	33.3		
5.00	6.00	33.4		
6.00	7.00	27.7		
7.00	8.00	30.3		
8.00	9.00	25.2		
9.00	10.00	30.4		
10.00	11.00	30.8		
11.00	12.00	23.9		
12.00	13.00	31.4		
13.00	14.00	30.8		
14.00	15.00	27		
15.00	16.00	20.3		
16.00	17.00	34.3		
17.00	18.00	32.8		
18.00	19.00	33.4		
19.00	20.00	35.6		
20.00	21.00	22.5		
21.00	22.00	1.64		
22.00	23.00	0.894		
23.00	24.00	1.71		
24.00	25.00	21.2		
25.00	26.00	22.1		
26.00	27.00	1.76		
27.00	28.00	2.97		
28.00	29.00	24.2		
29.00	30.00	12.1		

Darien Aggregates Inc.

DDH: **DA15-02**

		Claims title:	3009531	Section:	
		Township:	Long	Level:	Surface
		Range:		Work place:	North Bay
Drilled by:	Chenier Drilling Services	Lot:			
Described by:	Joerg Kleinboeck	From:	13/01/2015	Description date:	09/02/2015
		To:	22/01/2015		

Collar

Azimuth:	0.00°
Dip:	-90.00°
Length:	30.00 m

UTM Coordinates

East	366,001
North	5,120,479
Elevation	259

Down hole survey

Type	Depth	Azimuth	Dip	Invalid

Type	Depth	Azimuth	Dip	Invalid

Description

Casing driven to 6.00m (PQ), left in hole, capped & locked.
Well ID #A167613

Core size: BTW Cemented: No Stored: No

		Description
0.00	7.00	NDIA_hgab; FG-MG; MASS **Nipissing Diabase - Hypersthene Gabbro; Fine to medium grained; Massive** collared in bedrock. dark grey fine to medium grained massive hypersthene gabbro. 2-4 fractures per m, generally orientated at 30, 65, and 85 deg TCA. generally non-magnetic with local sections that are weakly magnetic. no visible sulphides.
7.00	30.00	NDIA_gab; FG-MG; MASS **Nipissing Diabase - Gabbro; Fine to medium grained; Massive** dark grey fine to medium grained massive gabbro with local very coarse grained sections. weak to moderate pervasive kspar assocaited with coarser grained sections ie.) 13.00-13.10m, 19.53-20.15m weakly magnetic. no visible sulphides.
30.00		**End of DDH** **Number of samples: 0** **Number of QAQC samples: 0** **Total sampled length: 0.00**

Magnetism

From	To	Magnetism	Title	Description
0.00	1.00	2.03		
1.00	2.00	1.32		
2.00	3.00	1.5		
3.00	4.00	6.03		
4.00	5.00	1.06		
5.00	6.00	9.3		
6.00	7.00	9.08		
7.00	8.00	9.87		
8.00	9.00	8.29		
9.00	10.00	5.81		
10.00	11.00	8.3		
11.00	12.00	1.44		
12.00	13.00	3.03		
13.00	14.00	0.86		
14.00	15.00	4.5		
15.00	16.00	5.95		
16.00	17.00	5.05		
17.00	18.00	5.69		
18.00	19.00	3.45		
19.00	20.00	5.58		
20.00	21.00	2.92		
21.00	22.00	3.95		
22.00	23.00	6.75		
23.00	24.00	7.45		
24.00	25.00	6.29		
25.00	26.00	5.6		
26.00	27.00	6.05		
27.00	28.00	1.67		
28.00	29.00	1.3		
29.00	30.00	2.83		

Darien Aggregates Inc.

DDH: **DA15-03**

		Claims title:	4223995	Section:	
		Township:	Long	Level:	Surface
		Range:		Work place:	North Bay
Drilled by:	Chenier Drilling Services	Lot:			
Described by:	Joerg Kleinboeck	From:	14/01/2015	Description date:	09/02/2015
		To:	21/01/2015		

Collar

Azimuth:	0.00°
Dip:	-90.00°
Length:	30.00 m

UTM Coordinates

East	366,134
North	5,120,838
Elevation	263

Down hole survey

Type	Depth	Azimuth	Dip	Invalid

Type	Depth	Azimuth	Dip	Invalid

Description

Casing driven to 6.00m (PQ), left in hole, capped & locked.

Well ID #A167670

Core size: BTW Cemented: No Stored: No

		Description
0.00	13.20	NDIA_gab; MG; MASS **Nipissing Diabase - Gabbro; Medium Grained; Massive** grey to green medium grained massive gabbro with local leucratic sections ie.) 10.30-10.40m. non-magnetic. no visible sulphides. fractures 3-4/m @ 20-30, and 65 deg TCA. lower contact transitional.
13.20	18.50	NDIA_hgab; FG; MASS **Nipissing Diabase - Hypersthene Gabbro; Fine grained; Massive** dark grey fine grained, massive hypersthene gabbro with minor inclusions of fine grained melagabbro. inclusions are generally <15 cm in size. very weakly magnetic. no visible sulphides. fractures 3-4/m @ 20-30, and 65 deg TCA. lower contact transitional but abrupt.
18.50	28.05	NDIA_gab; MG; MASS **Nipissing Diabase - Gabbro; Medium Grained; Massive** grey to green medium grained massive gabbro as from 0.00 - 13.20m. non-magnetic. no visible sulphides. fractures 3-4/m @ 20-30, and 65 deg TCA. lower contact transitional but abrupt.
28.05	30.00	NDIA_hgab; FG; MASS **Nipissing Diabase - Hypersthene Gabbro; Fine grained; Massive** as from 13.20-18.50m. heavily fractured from 29.70-30.00m with minor pervasive chlorite+kspar about fractures. very weakly magnetic. no visible sulphides. fractures 3-4/m @ 20-30, and 65 deg TCA.
30.00		**End of DDH** **Number of samples: 0** **Number of QAQC samples: 0** **Total sampled length: 0.00**

Magnetism

From	To	Magnetism	Title	Description
0.00	1.00	1.12		
1.00	2.00	1.28		
2.00	3.00	2.14		
3.00	4.00	3.32		
4.00	5.00	2.37		
5.00	6.00	2.52		
6.00	7.00	1.28		
7.00	8.00	1.2		
8.00	9.00	0.935		
9.00	10.00	0.74		
10.00	11.00	1.41		
11.00	12.00	2.21		
12.00	13.00	1.85		
13.00	14.00	1.59		
14.00	15.00	1.67		
15.00	16.00	1.33		
16.00	17.00	0.544		
17.00	18.00	0.775		
18.00	19.00	0.66		
19.00	20.00	0.556		
20.00	21.00	0.564		
21.00	22.00	0.575		
22.00	23.00	0.51		
23.00	24.00	0.48		
24.00	25.00	0.534		
25.00	26.00	0.596		
26.00	27.00	0.734		
27.00	28.00	0.83		
28.00	29.00	1.67		
29.00	30.00	0.679		

Darien Aggregates Inc.

DDH: **DA15-04**

		Claims title:	4223995	Section:	
		Township:	Long	Level:	Surface
		Range:		Work place:	North Bay
Drilled by:	Chenier Drilling Services	Lot:			
Described by:	Joerg Kleinboeck	From:	15/01/2015	Description date:	09/02/2015
		To:	21/01/2015		

Collar

Azimuth:	0.00°
Dip:	-90.00°
Length:	30.00 m

UTM Coordinates

East	365,981
North	5,121,030
Elevation	250

Down hole survey

Type	Depth	Azimuth	Dip	Invalid

Type	Depth	Azimuth	Dip	Invalid

Description

Casing driven to 6.00m (PQ), left in hole, capped & locked.
Well ID #A167669

Core size: BTW Cemented: No Stored: No

		Description
0.00	9.95	NDIA_hgab; FG-MG; MASS **Nipissing Diabase - Hypersthene Gabbro; Fine to medium grained; Massive** dark grey, fine to medium grained massive hypersthene gabbro. non-magnetic. no visible sulphides. 5-6 fractures per m, generally at 55, 65, and 80 deg TCA. lower contact transitional but abrupt.
9.95	13.50	NDIA_lgab; CG; MASS **Nipissing Diabase - Leucogabbro; Coarse Grained; Massive** white and green coarse grained massive leucogabbro with clinopyroxene crystals up to 13mm in length. non-magnetic. no visible sulphides. lower contact transitional but abrupt.
13.50	30.00	NDIA_hgab; FG-MG; MASS **Nipissing Diabase - Hypersthene Gabbro; Fine to medium grained; Massive** dark grey, fine to medium grained, massive hypersthene gabbro. weakly magnetic, no visible sulphides. fractures 3-5/m @ 45, 65, and 80 deg TCA, generally infilled with <1mm of chlorite. 16.70-17.90m - long open fracture orientated @ 0 deg TCA. 19.00-19.50m - long open fracture orientated @ 0 deg TCA.
30.00		**End of DDH** **Number of samples: 0** **Number of QAQC samples: 0** **Total sampled length: 0.00**

Magnetism

From	To	Magnetism	Title	Description
0.00	1.00	1.92		
1.00	2.00	3.45		
2.00	3.00	4.22		
3.00	4.00	1.25		
4.00	5.00	2.15		
5.00	6.00	1.42		
6.00	7.00	1.81		
7.00	8.00	1.67		
8.00	9.00	1.3		
9.00	10.00	0.665		
10.00	11.00	0.787		
11.00	12.00	1.64		
12.00	13.00	0.306		
13.00	14.00	1.16		
14.00	15.00	2.22		
15.00	16.00	1.54		
16.00	17.00	1.05		
17.00	18.00	2.12		
18.00	19.00	1.07		
19.00	20.00	0.864		
20.00	21.00	1.85		
21.00	22.00	1.52		
22.00	23.00	0.787		
23.00	24.00	1.14		
24.00	25.00	1.88		
25.00	26.00	1.25		
26.00	27.00	1.45		
27.00	28.00	1.49		
28.00	29.00	1.26		
29.00	30.00	1.18		

Darien Aggregates Inc.

DDH: **DA15-05**

		Claims title:	4223995	Section:	
		Township:	Long	Level:	Surface
		Range:		Work place:	North Bay
Drilled by:	Chenier Drilling Services	Lot:			
Described by:	Joerg Kleinboeck	From:	15/01/2015	Description date:	09/02/2015
		To:	20/01/2015		

Collar

Azimuth:	0.00°
Dip:	-90.00°
Length:	30.00 m

UTM Coordinates

East	365,621
North	5,120,967
Elevation	252

Down hole survey

Type	Depth	Azimuth	Dip	Invalid

Type	Depth	Azimuth	Dip	Invalid

Description

Casing driven to 6.00m (PQ), left in hole, capped & locked.
Well ID #A167666

Core size: BTW Cemented: No Stored: No

		Description
0.00	30.00	GR; CG; MASS **Granite; Coarse Grained; Massive** pink coarse to very coarse grained, massive granite with local angular to partially digested mafic volcanic inclusions generally <5 cm in size. weak pervasive kspar/hematite throughout. occasional minor pegmatitic aplitic veinlets less than 5 cm in width. occasional black, very fine grained mafic dykes throughout (<5%), typically moderately magnetic and contain inclusions of the host rock (granite). trace disseminated pyrite with occasional cubes up to 1cm ie.) 16.00m.
30.00		**End of DDH** **Number of samples: 0** **Number of QAQC samples: 0** **Total sampled length: 0.00**

Magnetism

From	To	Magnetism	Title	Description
0.00	1.00	0.544		
1.00	2.00	0.771		
2.00	3.00	0.808		
3.00	4.00	0.473		
4.00	5.00	0.628		
5.00	6.00	4.01		
6.00	7.00	1.17		
7.00	8.00	0.204		
8.00	9.00	0.376		
9.00	10.00	0.314		
10.00	11.00	0.173		
11.00	12.00	0.554		
12.00	13.00	2.24		
13.00	14.00	0.355		
14.00	15.00	0.324		
15.00	16.00	6.11		
16.00	17.00	1.36		
17.00	18.00	17.5		
18.00	19.00	0.942		
19.00	20.00	2.72		
20.00	21.00	9.92		
21.00	22.00	10.7		
22.00	23.00	6.22		
23.00	24.00	6.84		
24.00	25.00	6.54		
25.00	26.00	8.82		
26.00	27.00	2.69		
27.00	28.00	2.1		
28.00	29.00	4.21		
29.00	30.00	24		

Darien Aggregates Inc.

DDH: **DA15-06**

		Claims title:	4223995	Section:	
		Township:	Long	Level:	Surface
		Range:		Work place:	North Bay
Drilled by:	Chenier Drilling Services	Lot:			
Described by:	Joerg Kleinboeck	From:	16/01/2015	Description date:	11/02/2015
		To:	19/01/2015		

Collar

Azimuth:	0.00°
Dip:	-90.00°
Length:	30.00 m

UTM Coordinates

East	365,416
North	5,121,270
Elevation	257

Down hole survey

Type	Depth	Azimuth	Dip	Invalid

Type	Depth	Azimuth	Dip	Invalid

Description

Casing driven to 6.00m (PQ), left in hole, capped and locked.
Well ID #A167665

Core size: BTW Cemented: No Stored: No

		Description
0.00	30.00	GR; CG; MASS **Granite; Coarse Grained; Massive** pink coarse grained massive granite with 2% mafic inclusions typically <5 cm in size. local minor aplitic dykes, generally <10 cm in width. weak pervasive kspar about chlorite filled fractures. non-magnetic, trace disseminated pyrite. fractures 2-3/m, orientated at 30, 65, and 80 deg TCA.
30.00		**End of DDH** **Number of samples: 0** **Number of QAQC samples: 0** **Total sampled length: 0.00**

Magnetism

From	To	Magnetism	Title	Description
0.00	1.00	6.84		
1.00	2.00	0.946		
2.00	3.00	0.311		
3.00	4.00	0.876		
4.00	5.00	1.16		
5.00	6.00	0.577		
6.00	7.00	0.393		
7.00	8.00	0.402		
8.00	9.00	3.71		
9.00	10.00	2.75		
10.00	11.00	4.12		
11.00	12.00	1.94		
12.00	13.00	1.91		
13.00	14.00	2.15		
14.00	15.00	1.77		
15.00	16.00	1.78		
16.00	17.00	3.61		
17.00	18.00	2.95		
18.00	19.00	4.7		
19.00	20.00	9.65		
20.00	21.00	11.9		
21.00	22.00	3.95		
22.00	23.00	4.66		
23.00	24.00	2.31		
24.00	25.00	5.18		
25.00	26.00	2.9		
26.00	27.00	2.53		
27.00	28.00	2.36		
28.00	29.00	2.21		
29.00	30.00	0.379		

Darien Aggregates Inc.

DDH: **DA15-07**

		Claims title:	4219196	Section:	
		Township:	Long	Level:	Surface
		Range:		Work place:	North Bay
Drilled by:	Chenier Drilling Services	Lot:			
Described by:	Joerg Kleinboeck	From:	18/01/2015	Description date:	11/02/2015
		To:	19/01/2015		

Collar

Azimuth:	0.00°
Dip:	-90.00°
Length:	30.00 m

UTM Coordinates

East	365,079
North	5,121,333
Elevation	257

Down hole survey

Type	Depth	Azimuth	Dip	Invalid

Type	Depth	Azimuth	Dip	Invalid

Description

Casing driven to 6.00m, left in hole, capped & locked.

Well ID #A167667

Approx. 50% missing core from 0.00-1.50 m (Box 1).

Core size: BTW Cemented: No Stored: No

		Description
0.00	0.20	OB
		Overburden
		Overburden.
0.20	30.00	NDIA_gab; FG-MG; MASS
		Nipissing Diabase - Gabbro; Fine to medium grained; Massive
		dark grey to green fine to medium grained generally massive gabbro with minor sections of fine grained hypersthene gabbro and coarse grained massive gabbro.
		weakly to moderately magnetic. no visible sulphides.
		fractures 4-6/m, generally orientated @ 20, 45, 55, and 75 deg TCA.
		strong kspar veining from 10.90-11.50m.
30.00		**End of DDH**
		Number of samples: 0
		Number of QAQC samples: 0
		Total sampled length: 0.00

Magnetism

From	To	Magnetism	Title	Description
0.00	1.00	11.7		
1.00	2.00	12.6		
2.00	3.00	9.88		
3.00	4.00	8.37		
4.00	5.00	5.27		
5.00	6.00	6.24		
6.00	7.00	4.4		
7.00	8.00	4.88		
8.00	9.00	6.85		
9.00	10.00	4.89		
10.00	11.00	0.369		
11.00	12.00	7.42		
12.00	13.00	5.76		
13.00	14.00	2.3		
14.00	15.00	2.81		
15.00	16.00	3.48		
16.00	17.00	3.79		
17.00	18.00	5.55		
18.00	19.00	5.31		
19.00	20.00	4.63		
20.00	21.00	0.601		
21.00	22.00	2.86		
22.00	23.00	4.32		
23.00	24.00	3.66		
24.00	25.00	2.7		
25.00	26.00	2.71		
26.00	27.00	2.11		
27.00	28.00	1.75		
28.00	29.00	2.88		
29.00	30.00	3.67		

Appendix D **WELL CONSTRUCTION DETAILS** **Project 214-281**

Monitoring Well ID	UTM Coordinates	Top of 76 mm (ID) steel casing elevation (m)	256.12
BH-1 MOE tag # A167665	365416 mE 5121270 mN	Ground surface elevation (m) and bottom of 76 mm (ID) steel casing	254.58
		Bottom of 63 mm (ID) steel casing elevation (m)	250.03
		Base of 123 mm open rock borehole elevation (m)	224.10
Monitoring Well ID	UTM Coordinates	Top of 76 mm (ID) steel casing elevation (m)	238.94
BH-2 MOE tag # A167669	365981 mE 5121030 mN	Ground surface elevation (m) and bottom of 76 mm (ID) steel casing	237.51
		Bottom of 63 mm (ID) steel casing elevation (m)	232.84
		Base of 123 mm open rock borehole elevation (m)	207.03
Monitoring Well ID	UTM Coordinates	Top of 76 mm (ID) steel casing elevation (m)	253.08
BH-3 MOE tag # A167670	366134 mE 5120838 mN	Ground surface elevation (m) and bottom of 76 mm (ID) steel casing	251.68
		Bottom of 63 mm (ID) steel casing elevation (m)	246.99
		Base of 123 mm open rock borehole elevation (m)	221.20
Monitoring Well ID	UTM Coordinates	Top of 76 mm (ID) steel casing elevation (m)	244.72
BH-4 MOE tag # A167668	366237 mE 5120341 mN	Ground surface elevation (m) and bottom of 76 mm (ID) steel casing	243.15
		Bottom of 63 mm (ID) steel casing elevation (m)	238.63
		Base of 123 mm open rock borehole elevation (m)	212.67

Monitoring Well ID	UTM Coordinates	Top of 76 mm (ID) steel casing elevation (m)	249.20
BH-6 MOE tag # A167613	366001 mE 5120479 mN	Ground surface elevation (m) and bottom of 76 mm (ID) steel casing	247.83
		Bottom of 63 mm (ID) steel casing elevation (m)	243.10
		Base of 123 mm open rock borehole elevation (m)	217.35
Monitoring Well ID	UTM Coordinates	Top of 76 mm (ID) steel casing elevation (m)	254.43
BH-7 MOE tag # A167667	365079 mE 5121333 mN	Ground surface elevation (m) and bottom of 76 mm (ID) steel casing	253.11
		Bottom of 63 mm (ID) steel casing elevation (m)	248.33
		Base of 123 mm open rock borehole elevation (m)	222.63
Monitoring Well ID	UTM Coordinates	Top of 76 mm (ID) steel casing elevation (m)	245.17
BH-8 MOE tag # A167666	365621 mE 5120967 mN	Ground surface elevation (m) and bottom of 76 mm (ID) steel casing	243.78
		Bottom of 63 mm (ID) steel casing elevation (m)	239.07
		Base of 123 mm open rock borehole elevation (m)	213.30

NOTES:

1) All elevations are reported as metres (geodetic), and were surveyed by Tulloch Engineering Inc. UTM coordinates were provided by JMK Exploration Consulting.

2) Typical monitoring well construction consisted of a 123 mm (PQ size) cored bedrock hole to a depth of 30 m, collared near surface by 6 m of 63 mm ID steel casing and extended above grade by 76 mm ID steel casing. The well casing was reportedly sealed to the rock by Portland Cement.

3) This table is to be read with the accompanying report. Interpretation assistance is required by Waters Environmental Geosciences Ltd. before use by others.

Appendix E **WATER ELEVATION DATA** **Project 214-281**

Water elevation data were collected from the 7 site monitoring wells on April 29, 2015. The results are tabled as follows:

Monitoring Well ID	Top of Casing Elevation (m)	Depth to Static Water Level (m)	Groundwater Elevation (m)
BH-1	256.12	12.50	243.62
BH-2	238.94	2.12	236.82
BH-3	253.08	16.17	236.91
BH-4	244.72	4.59	240.13
BH-6	249.20	10.80	238.40
BH-7	254.43	4.50	249.93
BH-8	245.17	6.62	238.55

NOTES:

1) All elevations are reported as metres (geodetic), and were surveyed by Tulloch Engineering Inc.

2) An originally-proposed BH-5 was not installed, however the original field numbering system was maintained during the drilling program.

3) This table is to be read with the accompanying report. Interpretation assistance is required by Waters Environmental Geosciences Ltd. before use by others.

Appendix F FIELD DATA SHEETS - RECOVERY TESTS Project 214-281

Water level recovery testing of the seven monitoring wells was carried out by Tulloch Engineering Inc. on April 28/29, 2015. Initial static water levels were measured, after which the wells were bailed down using a disposable polyethylene bailer (manufactured by Rice Engineering). The recovering water levels were measured over time.

The raw data sheets, as provided to Waters Environmental Geosciences Ltd., are presented in this Appendix.

TULLOCH ENGINEERING

Well Recovery Testing Field Sheet

Date: April 29/15 Technician Name(s): Sarah deBortoli, Phillipa Cyderman

Project Name: Darian Quarry

Project #: 122028

Weather Conditions: Sunny

Notes:

Site ID: BH1 Top of Casing Elev (m): (-0.5cm steel base for cap)

Well ID: A167665 Well Stick-Up (m): 1.478 m

Depth to Static (m): 12m 50.2cm

Depth to Well Base (m): 30m 78.5cm

Start of Bailing Time (HH:MM:SS): 9:35:30 Approx. Volume Bailed (L): 10 bailers

Recharge Measurements Following Drawdown

Reading	Time (HH:MM:SS)	Depth to Water (m)	Notes:
1	9:44:08	12m 64.5cm	
2	9:44:52	12m 62.7cm	
3	9:45:03	12m 59.8cm	
4	9:50:12	12m 55.8cm	
5			
6			
7			
8			
9			
10			
11			
12			

Photograph Reference:

Other Notes:

TULLOCH ENGINEERING

Well Recovery Testing Field Sheet

Date: April 28/15 Technician Name(s): Sarah deBortoli, Phillipa Cyderman

Project Name: Darian Quarry

Project #: 122028

Weather Conditions: Sunny, clear 16°C

Notes: water very dirty, murky

Site ID: BH2 Top of Casing Elev (m): (-0.5cm) steel base for cap.

Well ID: A167669 Well Stick-Up (m): 1.592m

Depth to Static (m): 2m 11.5cm

Depth to Well Base (m): 30.93m

Start of Bailing Time (HH:MM:SS): 15:49:07 Approx. Volume Bailed (L): 10 bailers.

Recharge Measurements Following Drawdown

Reading	~~Time (HH:MM:SS)~~ depth	~~Depth to Water (m)~~ Time	Notes:
1	4m 91.5cm	15:54:44	
2	4m 50.8cm	16:00:31	
3	4m 15.2cm	16:07:05	
4	3m 88.5cm	16:13:10	
5			
6			
7			
8			
9			
10			
11			
12			

Photograph Reference:

Other Notes:

TULLOCH ENGINEERING

Well Recovery Testing Field Sheet

Date: April 28/15 Technician Name(s): Sarah deBortoli, Phillipa Oyderman

Project Name: Danen Quarry

Project #: 122028

Weather Conditions: Sunny

Notes:

Site ID: BH3 Top of Casing Elev (m): (-0.5cm) steel base for cap.

Well ID: AL67670 Well Stick-Up (m): 1.6m

Depth to Static (m): 16m 17.2cm

Depth to Well Base (m): 31.8m

Start of Bailing Time (HH:MM:SS): 15:01:53 Approx. Volume Bailed (L): 10 bailers

Recharge Measurements Following Drawdown

Reading	Time (HH:MM:SS)	Depth to Water (m)	Notes:
1	15:15:56	19m 46.6cm	
2	15:23:40	19m 20.5cm	
3	15:30:49	19m 1.2cm	
4	16:23:40	18m 0cm	
5			
6			
7			
8			
9			
10			
11			
12			

Photograph Reference:

Other Notes:

TULLOCH ENGINEERING

Well Recovery Testing Field Sheet

Date: April 28/15 Technician Name(s): Sarah deBortoli

Project Name: Darian Quarry. Phillipa Cryderman.

Project #:

Weather Conditions:

Notes:

Site ID: BH4 Top of Casing Elev (m): (-0.5cm (steel base of cap)

Well ID: A167668 Well Stick-Up (m): 1.51m

Depth to Static (m): 4m 59cm

Depth to Well Base (m): 31m 32 1/2 cm

Start of Bailing Time (HH:MM:SS): 13:30:49 Approx. Volume Bailed (L): 10 bailers

Recharge Measurements Following Drawdown

Reading	Time (HH:MM:SS)	Depth to Water (m)	Notes:
1	13:37:08	7m 39cm	
2	13:43:00	7m 36.8cm	
3	14:34:08	7m 34.5cm	
4	16:35:38	7m 29.8cm	
5			
6			
7			
8			
9			
10			
11			
12			

Photograph Reference:

Other Notes:

TULLOCH ENGINEERING

Well Recovery Testing Field Sheet

Date: April 28/15 Technician Name(s): Sarah deBortoli, Phillipa Cryderman

Project Name: Darian

Project #: 122028

Weather Conditions: Sunny/light breeze

Notes:

Site ID: BH6 Top of Casing Elev (m): -(0.5cm) steel base for cap.

Well ID: A167613 Well Stick-Up (m): 1.54m

Depth to Static (m): 10m 79.5cm

Depth to Well Base (m): 31m 45.5cm

Start of Bailing Time (HH:MM:SS): 13:58:45 Approx. Volume Bailed (L): 10 Bailers

Recharge Measurements Following Drawdown

Reading	Time (HH:MM:SS)	Depth to Water (m)	Notes:
1	14:08:43	13m 64.5cm	
2	14:13:35	13m 29cm	
3	14:18:10	13m 1.8cm	
4	14:24:08	12m 68cm	
5			
6			
7			
8			
9			
10			
11			
12			

Photograph Reference:

Other Notes:

TULLOCH ENGINEERING

Well Recovery Testing Field Sheet

Date: April 29/15 Technician Name(s): Sarah deBortoli; Phillipa Cryderman.

Project Name: Darian Quarry.

Project #:

Weather Conditions: Overcast/Some sun.

Notes:

Site ID: BH7 Top of Casing Elev (m): (-0.5cm steel base for cap)

Well ID: A167667 Well Stick-Up (m): 1.42m

Depth to Static (m): 4m 49.5cm

Depth to Well Base (m): 29m 10cm

Start of Bailing Time (HH:MM:SS): 10:07:50 Approx. Volume Bailed (L): 10 bailers

Recharge Measurements Following Drawdown

Reading	Time (HH:MM:SS)	Depth to Water (m)	Notes:
1	10:13:22	6m 22.5cm	
2	10:14:47	5m 86cm	
3	10:17:25	5m 49.8cm	
4	10:20:58	5m 27.5cm	
5			
6			
7			
8			
9			
10			
11			
12			

Photograph Reference:

Other Notes:

TULLOCH ENGINEERING

Well Recovery Testing Field Sheet

Date: April 29/15 Technician Name(s): Sarah deBortoli, Phillipa Clydeeman.

Project Name: Darian Quarry

Project #:

Weather Conditions: Sunny, cool

Notes:

Site ID: BH8 Top of Casing Elev (m): (-1.5cm) (steel base for cap)

Well ID: A167666 Well Stick-Up (m): 1.47m

Depth to Static (m): 6m 61.5cm

Depth to Well Base (m): 31m 32cm

Start of Bailing Time (HH:MM:SS): 9:06:17 Approx. Volume Bailed (L): 10 bailers

Recharge Measurements Following Drawdown

Reading	Time (HH:MM:SS)	Depth to Water (m)	Notes:
1	9:13:30	7m 7cm	
2	9:14:27	6m 93cm	
3	9:15:30	6m 88.5cm	
4	9:17:32	6m 84.8cm	
5	9:19:48	6m 83.4cm	
6			
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8			
9			
10			
11			
12			

Photograph Reference:

Other Notes:

Appendix G HYDRAULIC RECOVERY TEST RESULTS Project 214-281

Rising head recovery testing was carried out on the monitoring wells on April 28 and 29, 2015. The wells were drawn down using a manual bailer, and the recovering water levels were monitored over time. The data were analysed by one of two methods, depending on whether the water level remained in the open borehole or if the water recovery was within the solid riser pipe of the well.

For water level recoveries within the open rock borehole, the analysis followed the borehole recovery method of Van Bavel and Kirkham (1948) which is based on the following equation

$$k = 0.617 \frac{r}{S\,d} \frac{dh}{dt}$$

where S is a shape factor coefficient, obtained from published tables (or charts). The symbol "r" refers to the radius of the borehole, "h" is the average depth of water in the borehole during recovery, "d" is the penetration of the borehole below the static water table and dh/dt is the rate of rise of the recovering water level.

For water level recoveries in the solid casing interval, the analysis followed the variable head method of Hvorslev (1951) which is based on the following equation

$$k = \frac{d^2 \ln\left(\frac{2\,m\,L}{D}\right)}{8\,L\left(t_2 - t_1\right)} \ln \frac{h_1}{h_2}$$

where "d" is the diameter of the solid riser pipe, "D" is the diameter of the "screened interval" of length "L", "h_1" is the depth to water below the static level at time "t_1", "h_2" is the depth to water below the static level at time "t_2" and m is the transformation ratio (assumed equal to unity).

The recovery analysis for the site monitoring wells is as follows:

BH-1 : Recovery was within the open borehole.

t_0 = 0 sec depth to water$_0$ = 12.645 m
t_1 = 480 sec depth to water$_1$ = 12.558 m
dh/dt = 2.39 x 10^{-4} m/sec
d = 18.283 m
h = 18.184 m h/d = 0.995
r = 0.0615 m r/d = 0.0034
S (from chart) = 0.1

Therefore $k = 0.617 \frac{(0.0615)}{0.1(18.283)}$ x 2.39 x 10^{-4} r

or k = 5.0 x 10^{-4} cm/sec

BH-2 : Recovery was within the solid standpipe.

t_1 = 0 sec h_1 = 2.800 m
t_2 = 1106 sec h_2 = 1.770 m
L = 24.93 m
D = 0.0615 m
d = 0.0315 m

Therefore $k = \frac{0.0315^2 \ln\left(\frac{49.86}{0.0615}\right)}{8(24.93)(1106)} \ln\left(\frac{2.800}{1.770}\right)$ m/sec

or k = 1.4 x 10^{-6} cm/sec

BH-3 : Recovery was within the open borehole.

t_0 = 0 sec depth to $water_0$ = 19.466 m
t_1 = 464 sec depth to $water_1$ = 18.000 m
dh/dt = 3.16 x 10^{-3} m/sec
d = 15.628 m
h = 13.067 m h/d = 0.836
r = 0.0615 m r/d = 0.0039
S (from chart) = 12

Therefore $k = 0.617 \frac{(0.0615)}{12(15.628)}$ x 3.16 x 10^{-3} m

or k = 6.4 x 10^{-5} cm/sec

BH-4 : Recovery was within the open borehole.

t_0 = 0 sec depth to $water_0$ = 7.390 m
t_1 = 10,710 sec depth to $water_1$ = 7.298 m
dh/dt = 8.59 x 10^{-6} m/sec
d = 26.735 m

h = 23.981 m h/d = 0.897
r = 0.0615 m r/d = 0.0023
S (from chart) = 15

Therefore $k = 0.617 \frac{(0.0615)}{15(26.735)}$ x 8.59 x 10^{-6} m

or k = 8.1 x 10^{-8} cm/sec

BH-6 : Recovery was within the open borehole.

t_0 = 0 sec depth to $water_0$ = 13.645 m
t_1 = 925 sec depth to $water_1$ = 12.680 m
dh/dt = 1.04 x 10^{-3} m/sec
d = 20.660 m
h = 18.293 m h/d = 0.885
r = 0.0615 m r/d = 0.0030
S (from chart) = 12

Therefore $k = 0.617 \frac{(0.0615)}{12(20.660)}$ x 1.04 x 10^{-3} m

or k = 1.6 x 10^{-5} cm/sec

BH-7 : Recovery was within the solid standpipe.

t_1 = 0 sec h_1 = 1.730 m
t_2 = 456 sec h_2 = 0.780 m
L = 23.10 m
D = 0.0615 m
d = 0.0315 m

Therefore $k = \frac{0.0315^2 \ln\left(\frac{46.20}{0.0615}\right)}{8(23.10)(456)} \ln\left(\frac{1.730}{0.780}\right)$ m/sec

or k = 6.2 x 10^{-6} cm/sec

BH-8 : Recovery was within the open borehole.

t_0 = 0 sec depth to water$_0$ = 7.700 m
t_1 = 378 sec depth to water$_1$ = 6.834 m
dh/dt = 2.29 x 10^{-3} m/sec
d = 24.705 m
h = 24.053 m h/d = 0.974
r = 0.0615 m r/d = 0.0025
S (from chart) = 0.8

Therefore $k = 0.617 \frac{(0.0615)}{0.8\,(24.705)}$ x 2.29 x 10^{-3} r

or k = 4.4 x 10^{-4} cm/sec

The hydraulic conductivity test results (recovery testing) are summarized in the following table:

Location	k (cm/sec)
BH-1	5.0 x 10^{-4}
BH-2	1.4 x 10^{-6}
BH-3	6.4 x 10^{-5}
BH-4	8.1 x 10^{-8}
BH-6	1.6 x 10^{-5}
BH-7	6.2 x 10^{-6}
BH-8	4.4 x 10^{-4}
Geometric Mean	1.5 x 10^{-5}

NOTE:

(1) These tables and calculations are to be read with the accompanying report. Interpretation assistance from Waters Environmental Geosciences Ltd. is required before use by others.

Undulating Plateau Landscape Facing Northwest

Standing Water Near The Site Centre Facing West

Photoset 1	**General Site Features**	**Project Number 214 - 281** **Date : August, 2015**
Waters Environmental Geosciences Ltd.	**Darien Aggregates Quarry**	

364000 364500 365000 365500 366000 366500 367000 367500

5122000 5121500 5121000 5120500 5120000

Darien Aggregates Inc.
Nipissing Diabase Project

N
W E
S

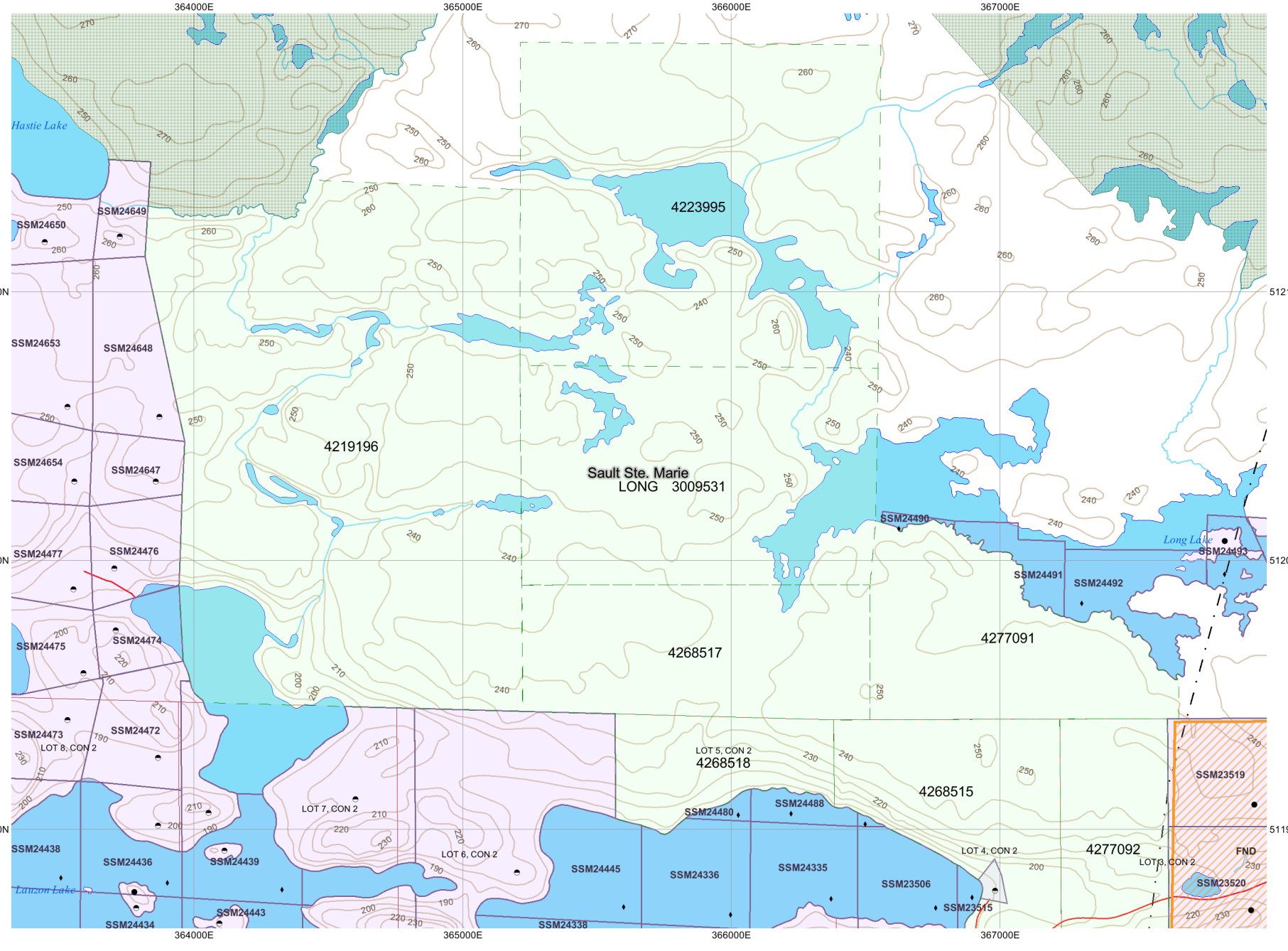
0 0.2 0.4
Kilometers

Legend

- Drill Hole (DDH/Well ID Tag)
- Trail Extension
- Existing Trail
- Roads
- Claims (Darien Aggregates Inc.)
- Township Boundary

DA15-07 / A167667
DA15-06 / A167665
DA15-04 / A167669
DA15-05 / A167666
DA15-03 / A167670
DA15-02 / A167613
DA15-01 / A167668

4223995
4219196
3009531
4268517
4277091



UTM Zone 17
1000m grid