March 13, 2020 (Revised October 13, 2021)

Our File Ref.: 170132.04

The Hindu Temple of Ottawa Carleton Inc.
4835 Bank Street
Ottawa, Ontario K1X 1G6

Attention: Mr. Harish Gupta

Subject: Terrain Analysis and Private Sewage Disposal System Impact Assessment - Proposed Assembly Hall
The Hindu Heritage Centre of Ottawa Carleton, 4835 Bank Street, Ottawa, Ontario

Dear Mr. Gupta,

LRL Associates Ltd. (LRL) has conducted a Terrain Analysis and Private Sewage Disposal System Impact Study for the proposed Hindu Heritage Centre of Ottawa Carleton Assembly Hall to be constructed on the property located at 4835 Bank Street, Ottawa, Ontario (herein referred to as the "Site"). It is understood that it is proposed that a 1,593 m² assembly hall be constructed at the eastern portion of the existing developed property which will have an available capacity of approximately 500 individuals, increasing the total occupancy of the Site to approximately 750.

The proposed assembly hall will be supplied by municipal water supply and a private septic as is the existing development on the Site.

The assessment was carried out to determine if the proposed development:

- Has soil conditions that are suitable for onsite sewage disposal; and
- Will not impair the use of groundwater resources on the Site or on adjacent lands.

The proposed sewage system for the proposed assembly hall building will be designed for approximately 4.0 m^3/day of wastewater, as outlined below. The existing building has two (2) existing sewage systems, each designed for 3,750 m^3/day, that operate independently of each other. Based on the capacity of the existing building of 250 persons and no food services/kitchen, the sewage demand of the existing building has been reassessed to 2.0 m^3/day. An application has been made to the Ottawa Septic System Office (OSSO) under separate cover to permit the change to the proposed design flow, and a response is currently pending. The response from the OSSO has been received and the approved permit is included in **Appendix H**.

The assessment involved a desktop review of available information on the geology and hydrogeology of the Site and adjacent lands in addition to an intrusive subsurface investigation (test pitting program). The Site is serviced by municipal water supply, however, neighbouring properties within 500 m of the Site were found to have records of supply wells present.

1 SITE AND AREA DESCRIPTION

The property is situated at the southern extent of the City of Ottawa at 4385 Bank Street. The property is legally described as Part Lot 22, Concession 5RF Gloucester Parts 1 & 2, 5R3156. The location of the subject site is shown in **Figure 1**. The Site's area is approximately 3.8 hectares (9.4 acres). The property is currently occupied by the Hindu Heritage Centre of Ottawa Carleton. The footprints of the existing temple building and garage are approximately 1,168 m² and 105 m^2, respectively. The existing temple is located at the western extent of the Site with the associated septic systems to the north and south of the temple. Based on the previously prepared Use Permit, dated December 5, 1985, issued by the MECP, and associated application, the existing sewage disposal system includes two (2) septic systems: one (1) to service the existing kitchen and washrooms and one (1) to service the remainder of the existing temple building. Each system was originally designed to handle the entire demand for the building, based on an assumed total occupancy of 250 individuals and the use of 15 L/day per individual. The systems are operating independently of each other, with no cross-connections. Since no food services are present in the building and none are proposed, the use of 8 L/day per individual instead of 15 L/day per individual is deemed more appropriate. This yields a total daily sewage capacity for the existing building of 2,000 L/day. An application of this change has been made to and approved by the OSSO.

The neighbouring land use is as follows:

- Bank street, followed by light industrial/commercial business to the west; and
- Vacant/treed land to the north, south and east.

The topography of the land is generally flat with an approximate elevation of 97 m above mean sea level.

These site features are shown in the **Figure 2**.

2 PROPOSED DEVELOPMENT

It is anticipated that an assembly hall will be constructed at the eastern portion of the Site with the associated septic system along the south of the proposed structure. The estimated proposed building footprint is 1,593 m^2. The proposed assembly hall is anticipated to include a dining area, a lobby and two (2) halls. No food services are proposed. The proposed development will be equipped with a full basement. Water supply will be obtained from municipal services.

It is proposed that 14 additional parking spaces be created, for a total of 181 parking spaces with a total parking and circulation area of 5,380 m^2.

In addition, it is proposed that the septic system for the existing temple building be consolidated into a single system with upgraded services.

The approximate preliminary proposed development plan is shown in **Figure 3**. Further revisions with regards to the proposed septic system footprint and components may be required at a later date.

3 FIELDWORK

On May 8th, 2017, eight (8) test pits were advanced across the Site. The test pits were placed around the general perimeter of the Site so not to disrupt existing Site activities and services. The rationale for the test pits was to determine the general upper soil and perched water conditions.

The test pits were advanced using a backhoe operated by a local contractor (Yelle Excavation, Ottawa) and under direct supervision by LRL field staff. The locations of the test pits are presented in **Figure 4** with the test pit logs included in **Appendix A**.

An open tube piezometer was installed in select test pits (TP1, TP3, TP5 and TP7) to allow for the groundwater elevation measurement and sampling of the perched water found in the overburden, herein referred to as groundwater. Groundwater samples were collected on May 8th, 2017 following purging of approximately three (3) well volumes from each piezometer. Groundwater samples were collected from each of the piezometers with the exception of TP5 which was found to have insufficient water available for sampling (i.e., dry). Samples were collected on one (1) occasion and do not represent seasonal variability. The samples collected were submitted for laboratory analyses of select nitrogen species parameters. The laboratory Certificate of Analysis is included in **Appendix B**.

Soil samples from two (2) test pits were submitted to LRL's material testing laboratory for sieve and hydrometer analyses. The sieve and hydrometer analysis certificates are included in **Appendix C**.

A ground surface elevation survey was carried out at each test pit location to obtain the elevation of the test pit ground surface and the piezometer stick-up. These elevations would aid in determining the groundwater elevations across the Site. A locally referenced benchmark was established as the top of the east arm of the hydrant located along the west of the southern entrance to the Site. The benchmark was assigned an arbitrary elevation of 100.00 m. The elevations are summarized in **Table 1A** and are presented in the test pit logs included in **Appendix A**.

4 TOPOGRAPHY, GEOLOGY AND HYDROGEOLOGY

Local topography indicates that the inferred overburden groundwater flow direction is east towards the North Castor River. The nearest open water body to the Site is an unnamed tributary that flows into the North Castor River, approximately 1.1 km east of the Site.

Surficial soil deposit mapping[1] indicates that the overburden consists of till, plain with local relief less than 5 m. Bedrock mapping[2] indicates that the underlying bedrock consists of dolomite and limestone, of the Oxford Formation.

The test pits completed across the Site were found to have a thin layer of topsoil over fill material which extended to depths between 0.7 and 1.5 m thick. The fill was underlain with silty sand in TP1. The fill layer generally extended to bedrock refusal, encountered at depths from 0.8 to 2.1 m bgs. Waste debris was observed in the fill material in TP2, TP3 and TP5, which included metal, tire debris and asphalt.

A representative till sample collected during the test pitting activities (TP3-6) was submitted for sieve analysis. The till sample was reported to be 39% silt & clay, 40% sand, and 21% gravel. This represents fine silty sand. A second representative till sample collected (TP1-3) was submitted for hydrometer analysis. The sample was reported to be 22% clay, 64% silt, 9% sand and 5% gravel. This represents a silt loam. These results are presented in the sieve and

[1] St-Onge, D.A. (compilation), 2009: Surficial geology, lower Ottawa valley, Ontario-Quebec; Geological Survey of Canada, Map 2140A, scale 1:125000

[2] Harrison, J.E., 1976. Geological Survey of Canada, Generalized Bedrock Geology, Ottawa-Hull, Ontario and Quebec, Map 1508A, scale 1:125000.

hydrometer certificates of analysis that are included in **Appendix C** and are summarized in **Table 2**. As a conservative measure, sand will be used to define the soil infiltration factor and fine sandy loam will be used for moisture surplus.

A search was conducted of the available water well records from the MECP Water Well Record Department. The search by UTM coordinates covered a 500 m radius from the site. The search returned records for twenty-three (23) wells. The well records are included in **Appendix D** and their locations are presented in **Figure 5**.

Review of the records of the wells within 500 m of the site retrieved revealed that the wells are drilled wells extending to depths between 8.2 and 67.1 m. The well records show that that the geological conditions within 500 m are relatively similar, and consist generally of mixed till materials including sand, clay, gravel and boulders from 0 to 8.0 m. Unidentified soil conditions, "soil" was described in one (1) of the well records, as noted in the table below. The described bedrock conditions varied slightly between limestone, sandstone and occasionally shale. Bedrock starting depths also vary from 0.6 to 7.9 m.

The general subsurface conditions indicated in the well records within 500 m of the site are as follows:

MOE Well Number	Distance and Direction from Site (m)	Depth (m)	Overburden Details			Bedrock Details	Groundwater Encountered (m)	Static Water Level (m)	Type of water
			Sand/ Fill (m)	Clay/ Loam (m)	Gravel/ Till (m)	Bedrock			
1502181	210 N	14.0	- -	- -	0 – 6.4	6.4- 14.0 (Limestone)	14.0	2.4	Fresh
7112950	485 N	52.7	- -	0 – 3.3	- -	3.3 – 52.7 (Limestone)	51.5	4.7	Unspecified
1533566	385 N	67.1	0 – 2.1	- -	- -	2.1 – 29.8 (Sandstone) 29.8 - 38.7 (Limestone) 38.7 - 67.1 (Sandstone)	65.8	4.8	Unspecified
1531693	385 N	67.1	- -	- -	0 – 0.9	0.9 – 67.1 (Sandstone)	62.7	9.1	Fresh
1502249	370 N	25.9	0 – 1.2	- -	- -	1.2 – 25.9 (Sandstone)	25.2	4.5	Unspecified
1502248	330 N	29.9	0 – 0.3	0.3 – 1.8	- -	1.8 – 29.9 (Sandstone)	24.3, 29.5	4.2	Fresh
1502246	335 N	24.4	- -	- -	0 – 1.5	1.5 – 24.4 (Sandstone)	9.1, 18.2, 30.1	1.5	Fresh
1517349	260 N	8.2	0 – 2.4	- -	- -	2.4 – 8.2 (Granite)	8.2	1.5	Fresh
1509925	215 N	19.2	- -	- -	0 – 3.9 "Boulders"	3.9 – 19.2 (Sandstone)	18.2	0.6	Fresh
1502175	360 NW	18.3	0 – 6.0	- -	- -	6.0 – 18.3 (Sandstone)	18.3	3.0	Fresh
1502176	250 NM	13.7	- -	0 – 5.4	- -	5.4 – 13.7 (Limestone)	13.7	1.8	Fresh
1502179	50 W	27.1	- -	- -	0 – 4.8	4.8- 7.62 (Limestone) 7.62 – 27.1 (Sandstone)	27.1	6.1	Fresh

MOE Well Number	Distance and Direction from Site (m)	Depth (m)	Overburden Details			Bedrock Details	Groundwater Encountered (m)	Static Water Level (m)	Type of water
			Sand/ Fill (m)	Clay/ Loam (m)	Gravel/ Till (m)	Bedrock			
1513436	100 SW	15.0	- -	0 – 3.6 “Soil”	3.6 – 4.8	4.8 – 15 (Limestone)	14.6	4.3	Fresh
1502180	140 S	16.8	- -	0 – 1.8 “Loam”	- -	1.8 – 16.8 (Limestone)	16.8	1.8	Fresh
1502177	195 S	18.2	0 – 2.1	- -	2.1 – 6.1	6.1 – 18.2 (Sandstone)	18.2	1.8	Fresh
1512375	230 S	22.5	0 – 2.7	- -	- -	2.7 – 22.5 (Sandstone)	22.5	3.6	Fresh
1512265	245 S	14.6	- -	0 – 0.9	- -	0.9 – 14.6 (Limestone)	2.4, 6.4, 10.3	1.2	Fresh
1514664	220 SW	15.2	- -	- -	0 – 3.9	3.9 – 9.1 (Shale) 9.1 – 38.1 (Limestone)	9.7, 16.7	6.1	Fresh
1516052	15 S	54.2	0 - 2.8	- -	2.8 – 7.9	7.9 – 13.1 (Limestone) 13.1 – 54.4 (Sandstone)	53.3	9.1	Fresh
1502178	310 SW	15.2	- -	- -	0 – 5.4	5.4 – 15.2 (Limestone)	14.6	3.9	Fresh
1510717	400 S	15.8	0 – 1.8	- -	- -	1.8 – 15.8 (Limestone)	15.2	2.1	Fresh
1514840	370 S	41.1	0 – 0.9 “Topsoil”	- -	- -	0.9 – 41.1 (Limestone)	32.0	6.0	Fresh
1502250	370 S	24.1	- -	0 – 0.6 “Loam”	- -	0.6 – 19.8 (Sandstone) 19.8 – 24.0 (Granite)	18.2, 24.0	6.0	Fresh

4.1 Groundwater from Test Pits

Groundwater samples were collected following the test pit piezometers. Prior to collection of samples each piezometer was purged of approximately three (3) well volumes. Samples were collected on one (1) occasion and do not represent seasonal variability. The Site currently has two (2) operating septic disposal systems. Therefore, the water analytical results are not considered background.

Table 3 summarizes the water quality analysis from the test pit piezometers for nitrates, nitrites, ammonia and total kjeldahl nitrogen (TKN). The Laboratory Certificate of Analysis is included in **Appendix B**.

Nitrites were not detected (<0.05 mg/L) in any of the groundwater samples collected. Nitrate levels were reported to be 0.5 mg/L in TP3 and <0.1 mg/L in both TP1 and TP7, below the ODWS of 10 mg/L. Ammonia was reported to be 0.28, 0.39 and 1.66 mg/L in TP1, TP3 and TP7, respectively. There are no set ODWS for ammonia.

TKN values were reported as 78.1, 65.3 and 131 mg/L in groundwater samples collected from TP1, TP3 and TP7, respectively. There are no set ODWS for TKN; however, based on the measured groundwater levels and corresponding elevations, the overburden groundwater flow

direction is inferred to the east. TP7 is located along the extents of one of the existing septic beds on the property, and additionally, during the advancement of TP7, organic material including a tree stump was encountered. Both of which (septic and other organic decomposition) could contribute to the elevated levels of TKN across the central portion of the Site.

4.2 Groundwater Flow

Piezometers were installed in the test pits on May 8, 2017. Groundwater levels were measured in the piezometers on the same day as construction. It is likely that the water levels in the piezometers were not given sufficient time to stabilize prior to measurement. Therefore, the groundwater elevations measured in the test pits are not considered representative.

Four (4) monitoring wells were previously installed on September 23, 2019 as part of the Phase II ESA (Phase II Environmental Site Assessment, LRL, November 22, 2019). Groundwater elevations were measured on September 30, 2019. The groundwater elevations are summarized in **Table 1B** and the groundwater elevations and interpreted flow contours are presented in **Figure 4**. Based on the groundwater elevations measured on September 30, 2019 the groundwater flow is interpreted to the east-southeast.

The shallow bedrock flow is inferred to be toward the east to northeast based on review of “Map 3-16: Potentiometric Surface and Groundwater Flow in Shallow Bedrock, Source Protection Watershed Characterization Report Maps”, by Raisin Region Conservation Authority and South Nation Conservation, dated April 30, 2008. The adjacent properties to the east and northeast are undeveloped. Therefore, based on the inferred groundwater flow direction the risk to bedrock groundwater users is considered low.

5 RECEIVING GROUNDWATER

The current and potential uses of the aquifers are identified below.

5.1 Overburden Groundwater

The overburden groundwater is unlikely to be used as a water supply based on the following:

- The Site and the adjacent properties are currently serviced by municipal water although water well records were identified in the area.
- Based on the well records reviewed and the shallow overburden conditions, no shallow wells were identified on the subject site or adjacent lands. Generally, the overburden conditions are not suitable for construction of a well.
- The buildings in this area are serviced by private septic systems; therefore, the current use of the overburden groundwater is for the attenuation of the septic system effluent.

5.2 Bedrock Aquifer

Twenty-three (23) well records were available for properties located within a 500 m radius of the Site. The records indicate that all twenty-three (23) wells tap into bedrock aquifer. Although it is our understanding that municipal water is available for the neighbouring properties, it is unknown at this time if these wells are still present or continue to be used for potable purposes.

A servicing map was provided by the City to LRL and is included in **Figure 6** (attached). As shown, the majority of properties within 500 m are serviced with municipal water. The undeveloped property immediately south of the site with no civic address is currently un-serviced. It is expected

that future development would likely occur along Bank Street on the west end of the property and would be serviced with municipal water. Various properties to the north (4805 Bank St. and 3216, 3236, 3238, 3250, 3270 Blais Road.) are un-serviced. The risk to these properties from the proposed septic system is considered low due to their distance from the Site (>200 m).

6 TERRAIN ANALYSIS AND SEPTIC DESIGN

The terrain analysis was conducted to demonstrate that the unconsolidated material on the Site is appropriate for the construction of an on-site subsurface sewage disposal system, with consideration taken regarding the existing installation.

The subsurface conditions indicated for the Site are considered suitable for a Class IV sewage disposal system with a fully raised leaching bed depending on the lot specific soil and groundwater conditions at the actual location of the proposed septic system leaching bed. The leaching bed should be constructed to conform to the specifications set out in the Ontario Building Code (OBC). As part of this assessment, an analysis was carried out to ensure that sufficient space exists at the Site for the construction of a third septic system in accordance with the OBC which will service the proposed assembly hall.

As previously mentioned, currently the existing temple building is serviced with two (2) sewage disposal systems located at the north and south sides of the buildings, respectively. Both are constructed with 9,000 L fibreglass septic tanks and 8 runs of 13.3 m length piping. One (1) of the systems was intended to service the kitchen and washrooms and the other services the remainder of the existing temple building. However, it is understood that there is no longer a kitchen in the building. Since no food services are present in the building and none are proposed, the use of 8 L/day per individual instead of 15 L/day per individual is deemed more appropriate. Therefore, it is proposed that the use of 8 L/day (no kitchen) per individual instead of 15 L/day per individual is deemed more appropriate. This yields a daily required sewage capacity of 2,000 L/day rather than the previous 3750 L/day. Due to the lower required capacity, it is proposed that the northern septic for the temple building will be decommissioned, and the southern septic system will be upgraded to become the consolidated septic for the entire temple building. This upgraded system will utilize the existing septic tank as a balancing tank, and a pressurized shallow buried trench bed with three runs of 28.34 m at 2.0 m spacing between pipes. Design drawings for the proposed system for the existing temple building upgrades by Green Valley Environmental are provided as **Appendix E**. An application has been made to the OSSO for approval of this change. The response from the OSSO is included in **Appendix H**. The proposed septic changes for the Site have been approved by the OSSO.

The daily sewage flow for the proposed assembly hall is based on the assumption that 500 individuals will occupy the building. In accordance with Schedule 8 of the OBC, it is assumed that 8 L/day will be discharged into the septic system for each individual that occupies the building. This is the set value for an assembly hall not equipped with food services. As a conservative approach to determine the expected largest septic system envelope required to service the proposed assembly hall, a septic system envelope size was calculated assuming a fully raised bed with mantle, a percolation rate of 12 min/cm for the imported sand required and a daily sewage flow of 4,000 L. The total length of pipe required for the proposed septic bed for the proposed assembly hall, assuming imported fill, was calculated as approximately 240 m using the following equation:

$$L = QT/200$$

where L = length of pipe (m);

Q = daily sewage flow for the proposed assembly hall (L/day); and

T = percolation rate of the imported sand fill material (min/cm).

Therefore, an area of approximately 360 m² is required for the septic bed assuming 16 pipes, each having a length of 15 m and a spacing of 1.6 m between the pipes. A mantle of 15 m in length would be required along the downgradient portion of the bed. Based on the total coverage of the septic bed (raised portion and mantle plus a replacement area) an area of approximately 1,215 m² would be required. This is a conservative approach based on the OBC.

However, due to the total sewage demand of the existing and proposed buildings (6,000 L/day) and available infiltration area on the site (15,888 m^2), a conventional system such as those used by the existing building and for the proposed assembly hall is not adequate and tertiary treatment is necessary. It is proposed that a tertiary system, Norweco HK 4730L-3M, be considered for both the new assembly hall and upgraded single septic system for the existing temple building.

As shown in **Appendix E**, a Norweco HK 4730L-3M tertiary treatment system is proposed for both the existing temple building and the proposed the assembly hall. The effluent from the treatment unit will be pumped from a 300 gal pump chamber with a 0.75 hp pump, timer dosed at 30 s per 30 min, to a pressurized shallow buried trench bed with three runs of 28.34 m for the existing temple building, and a pressurized shallow buried trench bed with 10 runs of 15.26 m for the proposed assembly hall.

6.1 Average Daily Water Demand Variance

It should be noted that the average daily water demand presented in the Site Servicing Report prepared by LRL, dated September 18, 2017 was calculated for the entire property using Section 7 of the OBC. The demand was calculated assuming a worst-case scenario where all fixtures at the property, both the existing and the proposed buildings, are turned on simultaneously at the applicable flowrate for each fixture as specified in the OBC. The purpose of this calculation is to size the piping required to service the site.

7 PRIVATE SEWAGE DISPOSAL SYSTEM IMPACT STUDY

The groundwater impact assessment addresses the ability of the land to attenuate the sewage effluent created by the development. Three methods for conducting the assessment are outlined in MOE's *Procedure D-5-4 Technical Guideline for Individual On-Site Sewage Systems: Water Quality Impact Risk Assessment* (1996):

- *Lot Size Consideration* for lot greater than 10 000 m^2 (1 hectare);
- *System Isolation Consideration* for areas where the septic system is hydrogeologically isolated from the potable water source; and
- *Contaminant Attenuation Consideration* for sites that do not meet the above two points.

Bedrock was encountered at depths less than 2.0 m in more than two thirds of the site, therefore the site is considered hydrogeologically sensitive with areas of thin soil over highly permeable soils (i.e., bedrock). The depth to inferred bedrock encountered during the geotechnical investigation (Geotechnical Investigation, LRL, LRL, November 2019), Phase II ESA (Phase II Environmental Site Assessment, LRL, November 22, 2019), and this terrain analysis are illustrated in **Figure 7** (attached). As shown, the depth to bedrock in the vicinity of the existing septic beds is approximately 1.4 m north of the building and 0.80 to 1.80 m south of the building. For the proposed assembly hall, at the southern locations in the general vicinity of the proposed

Norweco septic bed the inferred depth to bedrock ranged from 2.10 m (TP-1) to 6.10 m (MW19-4). Based on these elevations there is evidence to suggest that there is sufficient overburden thickness to minimize the potential for the bedrock to be a receiver of the septic effluent in the vicinity of the proposed septic bed for the future assembly hall.

The overburden material generally consisted of a fill material in the test pits with a stratum of till (TP3) or silty sand (TP1) above the bedrock in areas. As discussed in Section 4, representative samples of the till material at TP3 and TP1 were collected for sieve analysis. The results represent fine silty sand and silt loam at TP3 and TP1, respectively. The receiving groundwater for the septic system effluent is identified as the fill, silty sand and till. This groundwater is not considered an aquifer as it was encountered at depths less than 2.0 m below grade. As stated in Section 5.1, this groundwater is not a suitable supply aquifer for potable water based on its assumed poor yield, poor quality, shallow depth and likely use for the attenuation of the Site's existing, and the neighbouring properties', septic effluents. This groundwater is considered a suitable attenuation zone because alternative sources of water are available (i.e., municipal water or bedrock aquifer).

As mentioned above, the lot size is 38,000 m², with approximately 15,504 m² available for the installation of the proposed septic system. The lot size consideration for lots greater than 10,000 m^2 does not apply based on the anticipated total sewage demand of 6,000 L/day, including the existing building. Therefore, "***Contamination Attenuation***" was considered in this terrain analysis.

The Site has a total area of 38,000 m². In accordance with Section 22.5.8 of the MECP Design Guidelines for Sewage Works, the stream which is identified to bisect the Site immediately east of the proposed development must be considered in the extent of the allowable dilution area. It is understood that a 20 m setback is required from the bank of the stream and any development on the Site. The proposed septic system layouts are shown in the proposed site development plan in **Figure 3**.

7.1 Contaminant Attenuation Method (Predictive Assessment)

The Contaminant Attenuation Method (Predictive Assessment) was used to determine the impact of the proposed on-Site septic systems at the boundary of the Site. This procedure assesses the risk that the individual on-site systems will cause the concentration of the nitrate-nitrogen exceed 10 mg/L at the property boundaries. Dilution is the attenuation mechanism considered for nitrates, with precipitation being the only source of infiltration. The following parameters and assumptions were used in the nitrate attenuation calculations:

- Infiltration factors for the site;
    - Flat topography;
    - Infiltration Factors:
        i. Grain size analysis ranged from fine silty sand to silt loam. A conservative assumption of clay loam was used for this calculation;
        ii. Approximately 15,504 m² of the site is considered Cultivated Land;
    - Moisture Surplus:
        i. The remaining cultivated land is considered Shallow Rooted Crops;
        ii. Grain size analysis ranged from fine silty sand to silt loam. An assumption of Silt Loam was used for this calculation;

- Impervious areas (existing and proposed) were calculated to be of 2,866 m^2 for the buildings and 5,380 m^2 of paved driveway and parking areas; and
- Moisture surplus values from the Ottawa weather station (Environment Canada, 2011).

The moisture surplus printout is included in **Appendix F**. This location is considered representative of the site located at the south-central extent of the City of Ottawa, Ontario.

Based on the total proposed sewage volume for the entire Site of 6,000 L/day, the existing lot size, soil conditions, a nitrate concentration of the sewage of 40 g/L, the calculated levels of nitrates at the property limits is estimated as 16.14 mg/L as presented in the attached **Table 4A**. This is above the procedure's guideline limit of 10 mg/L at the property line. Based on the "*Contaminant Attenuation Method*", without tertiary treatment the current lot size and soil conditions are not suitable to attenuate the nitrate impacts generated by the septic systems of the development in accordance with D-5-4 guideline.

The above calculations are based on the current D-5-4 guideline which requires the use of 40 mg/L as the contaminant source as per Section 5.6.2 (a). Therefore, the use of an advanced tertiary treatment system such as Norweco tertiary system is necessary to reduce the levels of nitrates prior to discharge to the disposal field. This particular system is approved by the OBC and the Building Materials Evaluation Commission of the Ontario Ministry of Municipal Affairs and Housing. Furthermore, Section 5.7 of the D-5-4 guideline states that the Ministry recognises "that as research continues, information and technologies may become available which warrant minor or substantial revisions to this guideline".

The Norweco HK 4730L-3M is certified for a minimum 50% total nitrogen reduction. Therefore, a nitrate effluent concentration of 20 mg/L was used for both the proposed upgraded system for the existing temple building the proposed assembly hall in this assessment. A copy of the specifications for the Norweco tertiary system is included in **Appendix G**.

The calculated nitrate level at the property line is estimated based on the daily sewage volume for the existing building (2,000 L), which is proposed to be handled by the southern system only, treated with a Noweco tertiary system, in addition to the the daily sewage volume of the proposed system for the new building of 4,000 L, treated with a Norweco tertiary system. The detailed calculations for the proposed development are presented in the attached **Table 4B**. It is assumed that the level of nitrates in the effluent from the proposed Norweco tertiary systems are 20 mg/L. Based on these assumptions the nitrates at the property limits is estimated as 8.06 mg/L. This is below the procedure's guideline of 10.0 mg/L. Based on the "***Contaminant Attenuation Method***" the current lot size and soil conditions are suitable to attenuate the nitrate impacts generated by the septic systems on the development in accordance with current D-5-4 guidelines, provided an appropriate tertiary treatment is used for the proposed system.

8 CONCLUSIONS

Based on our review of available information and the results of the groundwater sampling and laboratory analytical programs, we conclude the following:

1. Sufficient area exists on the property for the upgrading of the existing system in the temple building with a design sewage flow of up to 2,000 L/day, and the installation of a septic system in accordance with the OBC to service the proposed Assembly Hall with a design sewage flow of up to 4,000 L/day.
2. Pre-treatment of the sewage from the proposed sewage disposal systems with Norweco tertiary systems, which have a certified nitrogen reduction of a minimum of 50%, yields a calculated nitrate concentration at the property line of 8.06 mg/L, based on the ***"Contaminant Attenuation Method"***.
3. Hydrogeologically sensitive conditions are present on the site due to thin overburden. The overburden generally consists of fill to bedrock, with till or silty sand observed at two (2) of the test pits.
4. Records of domestic wells were retrieved within 500 m of the site. The potable water source of these wells is the bedrock aquifer. A thin layer of either clay, gravel or till, with some sand in areas, being between 0.9 and 7.6 m thick over bedrock.

9 RECOMMENDATIONS

1. The septic system should be placed at least 30 m from any wells, and no future wells should be installed on the Site.
2. It is recommended that the water table be surveyed prior to installation of the sewage disposal systems.
3. It is recommended that the required 20 m setback from the normal high water mark of the identified stream east of the proposed development footprint be maintained.
4. Due to the thin soils and sensitive site conditions it is recommended that the leaching bed of the proposed system be fully raised. It is recommended that a service contract be initiated with the manufacturer. All manufacturer's recommendations regarding maintenance and monitoring of the system shall be followed.
5. It is recommended that a geodetic benchmark be used for further investigations on the site, including any additional monitoring wells and groundwater elevations.

10 LIMITATIONS

The findings contained in this report are based on data and information collected during the Terrain Analysis of the subject property conducted by LRL Associates Ltd. The conclusions and recommendations are based solely on site conditions encountered at the time of our fieldwork on May 8th, 2017, supplemented by historical information and data obtained as described in this report. The information presented in this report represents the groundwater conditions at the locations sampled. Due to natural variations in geological conditions, no inference is made to the soil or groundwater conditions between sampling points. No assurance is made regarding changes in conditions subsequent to the time of this investigation. If additional information is discovered or obtained, LRL Associates Ltd. should be requested to re-evaluate the conclusions presented in this report and to provide amendments as required.

In evaluating the subject property, LRL Associates Ltd. has relied in good faith on information provided by individuals as noted in this report. We assume that the information provided is factual and accurate. We accept no responsibility for any deficiencies, misstatements or inaccuracies contained in this report as a result of omissions, misinterpretation or fraudulent acts of the persons contacted.

Yours truly,
LRL Associates Ltd.

Jessica Arthurs
Senior Environmental Technician

Alex Wood, P. Eng.
Lead Environmental Engineer

Encl.

Figure 1 – Site Location
Figure 2 – Site Plan
Figure 3 – Proposed Site Layout
Figure 4 – Test Pit and Monitoring Well Locations, Groundwater Elevations and Groundwater Contours
Figure 5 – Well Locations, Ontario Well Records Within 500 m of the Site
Figure 6 – Servicing Map for Properties Within 500 m
Figure 7 – Depth to Bedrock in Boreholes and Test Pits

Table 1A – Summary of Groundwater Elevations in Test Pits
Table 1B – Summary of Groundwater Elevations in Monitoring Wells (September 30, 2019)
Table 2 – Summary of Sieve & Hydrometer Analyses
Table 3 – Summary of Analysis of Water Samples Collected from the Test Pits
Table 4A – Nitrate Attenuation Calculations
Table 4B – Nitrate Attenuation Calculations – Tertiary Treatment

Appendix A – Test Pit Logs
Appendix B – Laboratory Certificates of Analysis
Appendix C – Sieve & Hydrometer Analysis
Appendix D – Ontario Well Record Printouts
Appendix E – Proposed Sewage System Layout
Appendix F – Moisture Surplus Printout
Appendix G – Norweco Hydro Kinetic Specifications
Appendix H – OSSO Approval

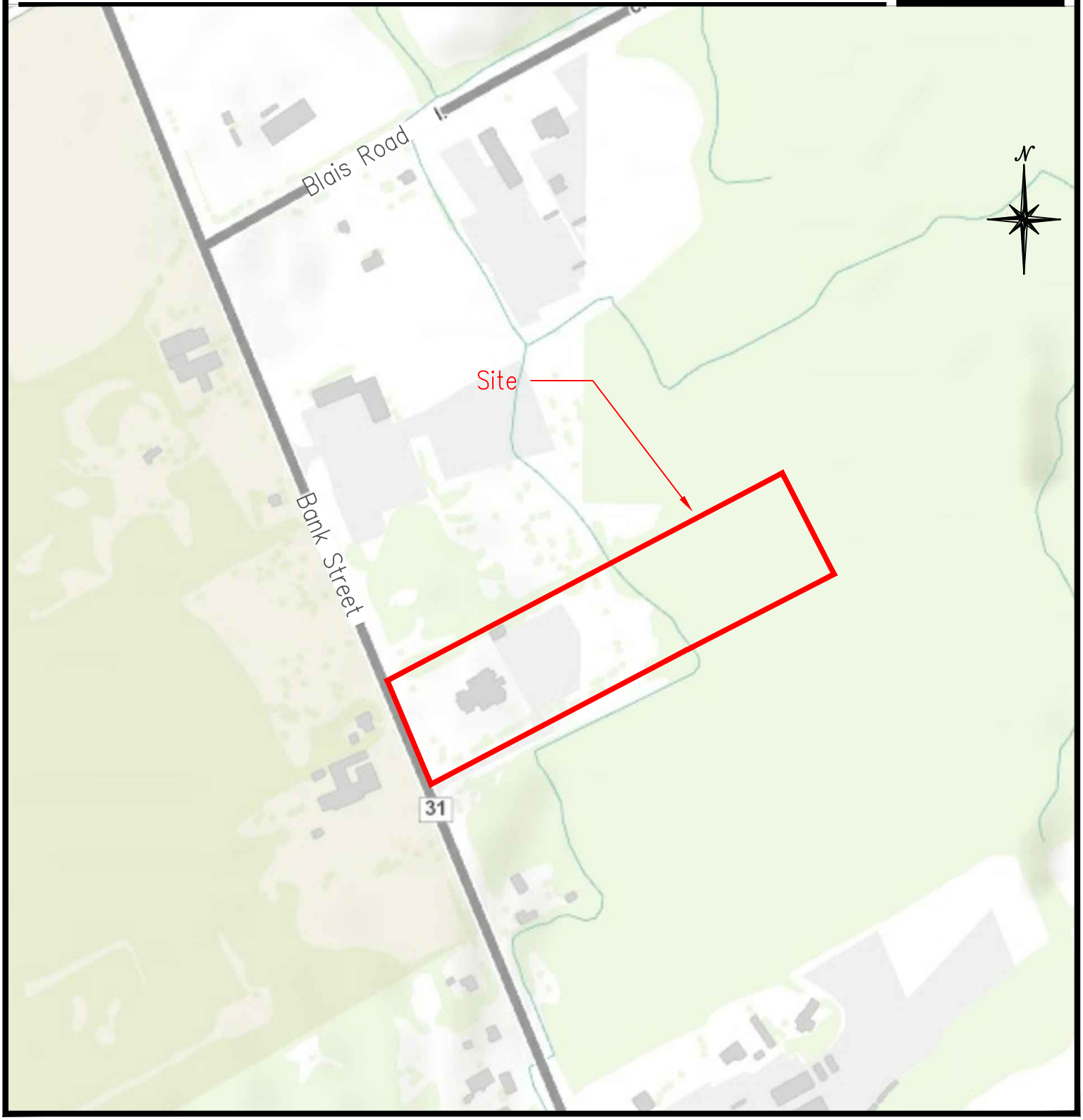
FIGURES

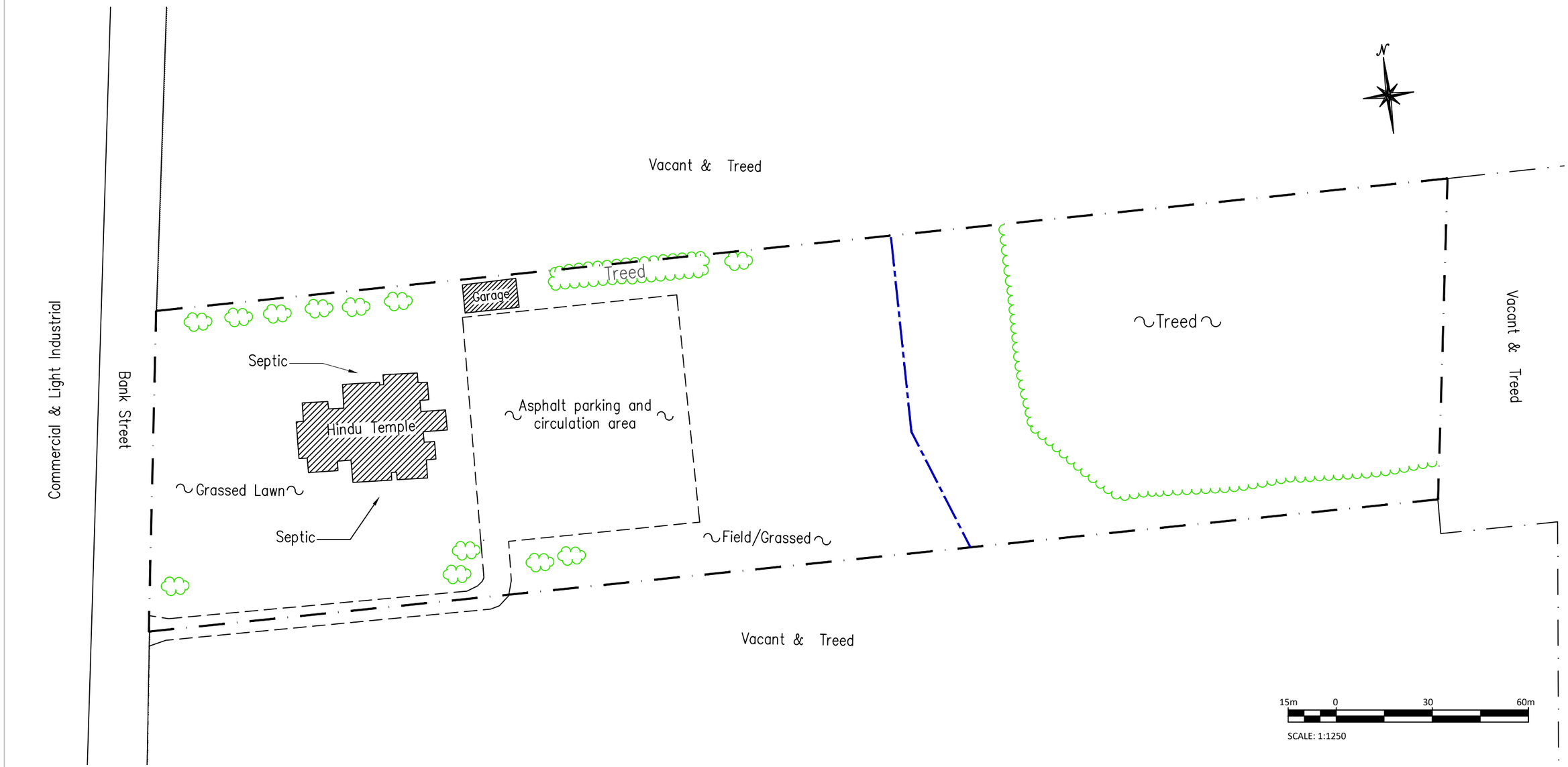
LRJ
ENGINEERING | INGÉNIERIE
5430 Canotek Road | Ottawa, ON, K1J 9G2
www.lrl.ca | (613) 842-3434

PROJECT
TERRAIN ANALYSIS AND PRIVATE SEWAGE DISPOSAL SYSTEM IMPACT STUDY
PROPOSED ASSEMBLY HALL
4835 BANK STREET, OTTAWA, ONTARIO

DRAWING TITLE
SITE LOCATION
(NOT TO SCALE)
SOURCE: GEOOTTAWA

CLIENT	DATE	PROJECT	
THE HINDU TEMPLE OF OTTAWA CARLTON	DECEMBER 2020	170132	FIGURE1





LEGEND

- Existing Building
- Division between various surface materials
- Property Line
- Tree Line
- Tree
- Inferred Stream Location

No.	REVISIONS	BY	DATE
01	ISSUED FOR REVIEW	A.S	05/18/17

LRL
ENGINEERING | INGÉNIERIE
5430 Canotek Road | Ottawa, ON, K1J 9G2
www.lrl.ca | (613) 842-3434

CLIENT
THE HINDU TEMPLE OF OTTAWA CARLTON

DESIGNED BY:	DRAWN BY:	APPROVED BY:
--	A.S	M.W

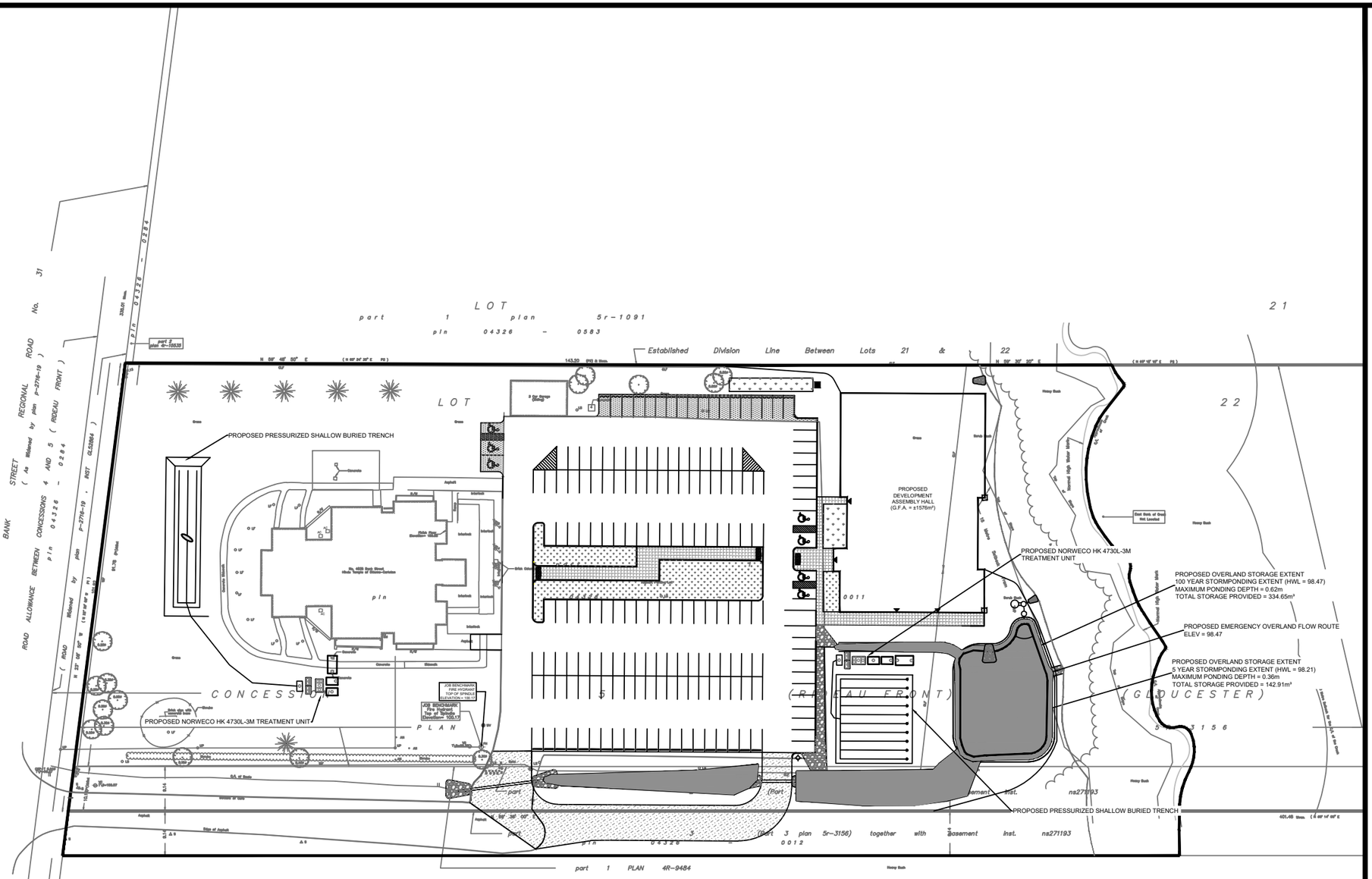
PROJECT
TERRAIN ANALYSIS AND PRIVATE SEWAGE DISPOSAL SYSTEM IMPACT STUDY - PROPOSED ASSEMBLY HALL
4835 BANK STREET, OTTAWA, ONTARIO

DRAWING TITLE
SITE PLAN

PROJECT NO.
170132

DATE
DECEMBER 2020

FIGURE2



No.	REVISIONS	BY	DATE
01	ISSUED FOR REVIEW	J.A.	01/31/18

LRL
ENGINEERING | INGÉNIERIE
5430 Canotek Road | Ottawa, ON, K1J 9G2
www.lrl.ca | (613) 842-3434

CLIENT
THE HINDU TEMPLE OF OTTAWA CARLETON

DESIGNED BY:	DRAWN BY:	APPROVED BY:
VDC	VDC	

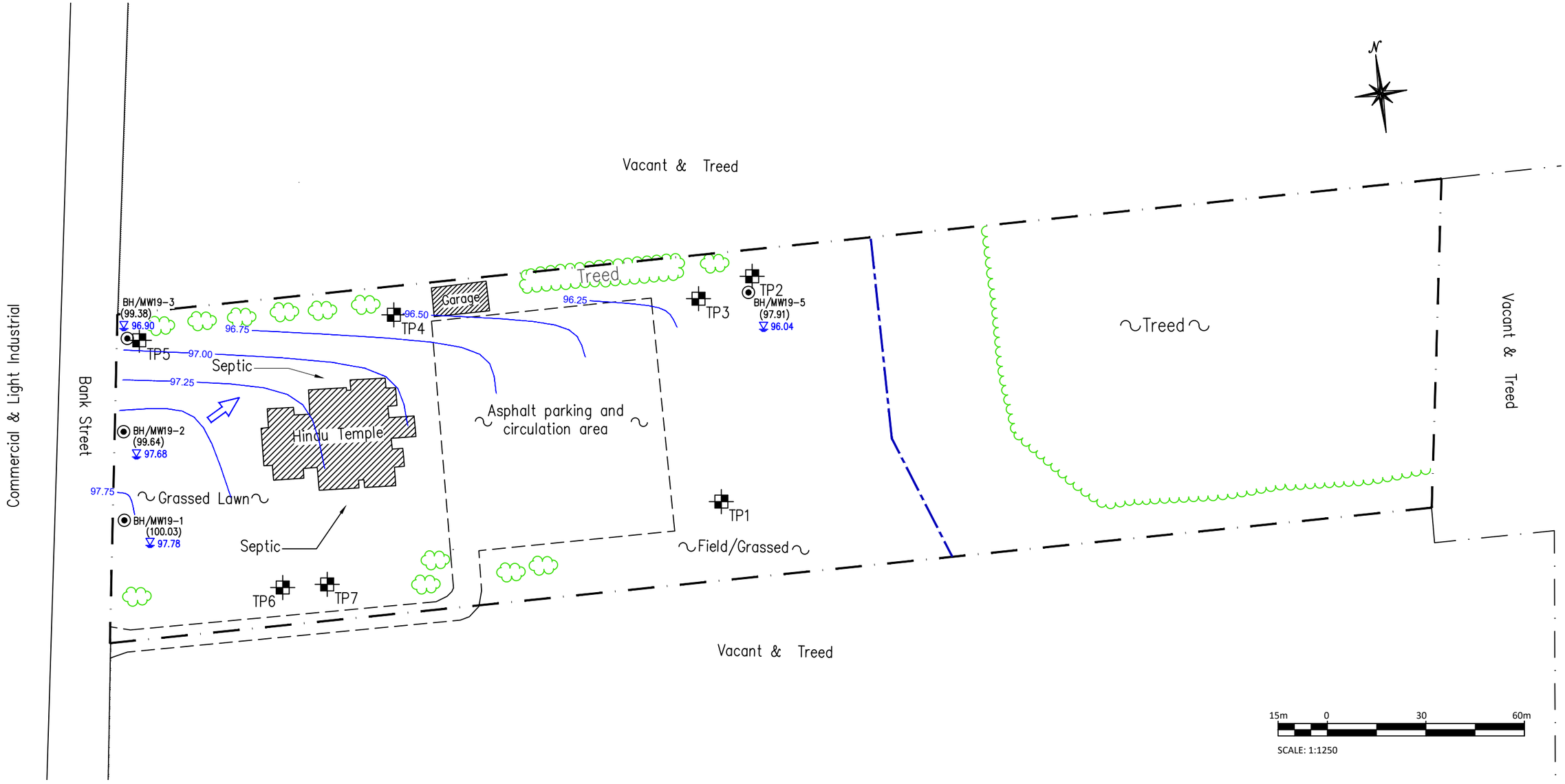
PROJECT
TERRAIN ANALYSIS AND PRIVATE SEWAGE DISPOSAL SYSTEM STUDY
- PROPOSED ASSEMBLY HALL
4835 BANK STREET, OTTAWA, ONTARIO

DRAWING TITLE
PROPOSED SITE LAYOUT

PROJECT NO.
170132

DATE
JANUARY 2021

FIGURE3



LEGEND

- Existing Building
- Division between various surface materials
- Property Line
- Tree Line
- TP99 Test Pit (May 2017)
- BH/MW1 Borehole/Monitoring Well ID and Location
- (99.99) Groundwater Elevation (May 8, 2017)
- Groundwater Contour Line
- Inferred Stream Location

No.	REVISIONS	BY	DATE
01	ISSUED FOR REVIEW	A.S	05/18/17

LRL
ENGINEERING | INGÉNIERIE
5430 Canotek Road | Ottawa, ON, K1J 9G2
www.lrl.ca | (613) 842-3434

CLIENT
THE HINDU TEMPLE OF OTTAWA CARLTON

DESIGNED BY:	DRAWN BY:	APPROVED BY:
--	A.S	M.W

PROJECT
TERRAIN ANALYSIS AND PRIVATE SEWAGE DISPOSAL SYSTEM IMPACT STUDY - PROPOSED ASSEMBLY HALL
4835 BANK STREET, OTTAWA, ONTARIO

DRAWING TITLE
TEST PIT AND MONITORING WELL LOCATIONS, GROUNDWATER ELEVATIONS AND GROUNDWATER CONTOUR LINES

PROJECT NO.
170132

DATE
DECEMBER 2020

FIGURE4

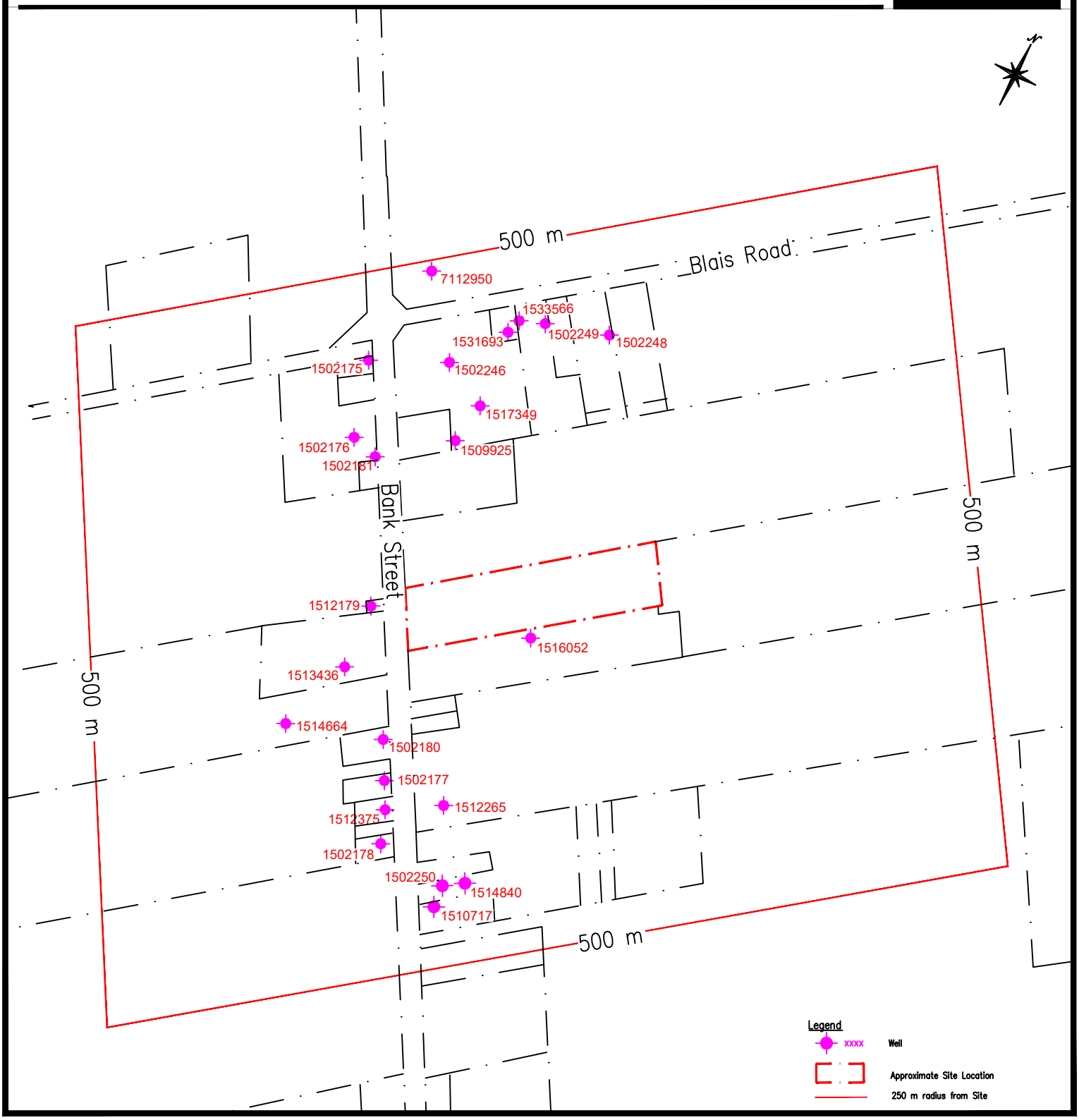
LRL
ENGINEERING | INGÉNIERIE
5430 Canotek Road | Ottawa, ON, K1J 9G2
www.lrl.ca | (613) 842-3434

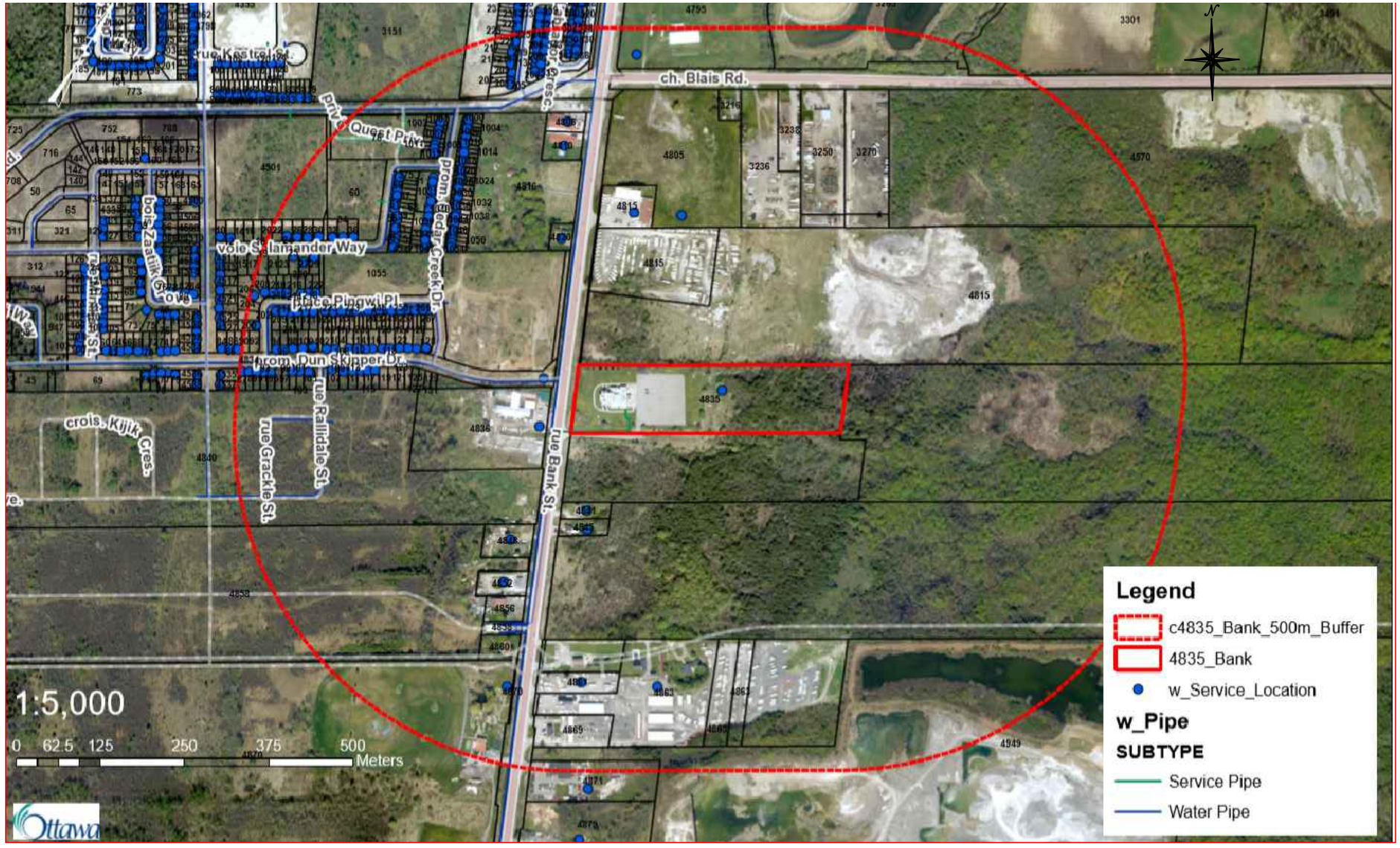
PROJECT
TERRAIN ANALYSIS AND PRIVATE SEWAGE DISPOSAL SYSTEM IMPACT STUDY
PROPOSED ASSEMBLY HALL
4835 BANK STREET, OTTAWA, ONTARIO

DRAWING TITLE
WELL LOCATIONS
ONTARIO WELL RECORDS WITHIN 500 M OF THE SITE
(NOT TO SCALE)

CLIENT	DATE	PROJECT
THE HINDU TEMPLE OF OTTAWA CARLTON	DECEMBER 2020	170132

FIGURE 5





No.	REVISIONS	BY	DATE

LRL
ENGINEERING | INGÉNIERIE
5430 Canotek Road | Ottawa, ON, K1J 9G2
www.lrl.ca | (613) 842-3434

CLIENT
HINDU TEMPLE OF
OTTAWA-CARLETON INC.

DESIGNED BY:	DRAWN BY:	APPROVED BY:
--	M.W.	M.W

PROJECT
TERRAIN ANALYSIS
4835 BANK STREET
OTTAWA, ONTARIO

DRAWING TITLE
SERVICING MAP FOR PROPERTIES
WITHIN 500 M

PROJECT NO.
170132

DATE
DECEMBER 2020

FIGURE 6

LEGEND

	Existing Building
	Division amongst surface materials
	Fenceline
	Property Line
	Tree Line
	Tree
BH/MW19-1	Borehole/Monitoring Well (Phase II ESA)
BH19-1	Borehole (Geotechnical Investigation)
TP19-1	Test Pit (Terrain Analysis)
(1.00)	Inferred Bedrock Depth below Ground Surface

No.	REVISIONS	BY	DATE
01	ISSUED FOR REVIEW	G.M.	11/10/19

LRL
ENGINEERING | INGÉNIERIE
5430 Canotek Road | Ottawa, ON, K1J 9G2
www.lrl.ca | (613) 842-3434

CLIENT
HINDU TEMPLE OF
OTTAWA-CARLETON INC.

DESIGNED BY:	DRAWN BY:	APPROVED BY:
--	G.M.	M.W

PROJECT
TERRAIN ANALYSIS
4835 BANK STREET
OTTAWA, ONTARIO

DRAWING TITLE
DEPTH TO BEDROCK IN BOREHOLES AND TEST PITS

PROJECT NO.
170132

DATE
DECEMBER 2020

FIGURE 7

TABLES

Table 1A
Summary of Groundwater Elevations in Test Pits
Terrain Analysis - Proposed Assembly Hall
4835 Bank Street, Ottawa, Ontario
LRL File: 170132

Test Pit	Ground Surface Elevation[1] (m)	Reference Elevation[2] (m)	Depth To Water Table (m)		Groundwater Elevation (m)
			Reference Point	Ground Surface	
TP1	98.21	99.15	1.35	0.41	97.80
TP2	97.09	--	--	--	--
TP3	97.75	98.98	1.94	0.71	97.04
TP4	99.54	--	--	--	--
TP5	98.78	99.02	DRY	--	--
TP6	99.38	--	--	--	--
TP7	99.60	100.79	2.52	1.33	98.27

NOTES

[1] Elevations are based off of a temporary benchmark established at the top of the east arm of the fire hydrant along the southof the Site (100.00 m).

[2] Reference elevation is top of piezometer.

Table 1B
Summary of Groundwater Elevations in Monitoring Wells (September 30, 2019)
Terrain Analysis - Proposed Assembly Hall
4835 Brank Street, Ottawa, Ontario
LRL File: 170132

Monitoring Well	Ground Surface Elevation[1] (m)	Reference Elevation[2] (m)	Depth To Water Table (m)		Groundwater Elevation (m)
			Ground Surface	Reference Point	
BH/MW19-1	100.03	100.01	2.25	2.23	97.78
BH/MW19-2	99.64	99.62	1.95	1.94	97.68
BH/MW19-3	99.38	99.32	2.48	2.42	96.90
BH/MW19-5	97.91	97.87	1.87	1.83	96.04

NOTES

[1] Elevations measured from the north rim of the hydrant valve in the central south portion of the Site (100.00 m).

[2] Reference elevation is top of PVC riser.

Table 2
Summary of Sieve & Hydrometer Analyses
Terrain Analysis - Proposed Assembly Hall
4835 Bank Street, Ottawa, Ontario
LRL File: 170132

Sample	Depth (m)	Sample Gradation[1] Percent Particles in Each Fraction						Soil Texture Classification
			Sand					
		Gravel >4.75 mm	Coarse 2.0 - 4.75 mm	Medium 425 µm - 2.0 mm	Fine 75 - 425 µm	Silt 2 - 75 µm	Clay < 2µm	
TP1-3	1.8 - 2.0	4.8	1.2	1.8	6.5	63.8	22.0	Silt Loam
TP3-6	1.4 - 1.6	21.3	7.0	12.7	20.1	39.0		Fine Silty Sand

NOTES:

[1] Unified Soil Classification System

Table 3
Summary of analysis of water samples collected from the test pits.
Terrain Analysis - Proposed Assembly Hall
4835 Bank Street, Ottawa, Ontario
LRL File: 170132

Parameter	Units	MRL	Ontario Drinking Water Standards		Sample		
			Standard	Type	TP1	TP3	TP7
Sample Date (d/m/y)					**2017-08-05**	**2017-08-05**	**2017-08-05**
Ammonia	mg/L	0.01			0.28	0.39	1.66
Total Kjeldahl Nitrogen	mg/L	0.1			78.1	65.3	131
Nitrate as N	mg/L	0.1	10	MAC	<0.1	0.5	<0.1
Nitrite as N	mg/L	0.05	1	MAC	<0.05	<0.05	<0.05

NOTES
MAC Maximum Acceptable Concentration
MRL Minimum Reportable Limit

Table 4A
Nitrate Attenuation Calculations
Terrain Analysis and Private Sewage Disposal System Impact Study - Proposed Assembly Hall
4835 Bank Street, Ottawa, Ontario
LRL File: 170132

1. Potential Infiltration

Weather Station: Ottawa

		Infiltration Factor (IF)[1]							Moisture Surplus (MS)				Potential Infiltration (PI) (IF*MS) (mm)	
No.	Section Area (m^2)	Topography	Value	Soil	Value	Cover	Value	Total	Ground Cover	Soil Type	Moisture Retention[2] (mm)	Moisture Surplus[3] (mm)	Section	Weighted
1	23,750	Flat	0.3	Clay Loam	0.2	Cultivated Land	0.1	0.6	Shallow Rooted Crops	3 Silt Loam	125	349	209.4	209.4
Total[6]	23,750												**Total**	209.4

2. Area Available for Infiltration

Approximate footprint of the exisitng assembly hall		H		1,168	m^2
Approximate footprint of the exisitng garage		H		105	m^2
Approximate footprint of the proposed assembly hall		H		1,593	m^2
Approximate area of paved parking and circulation (Existing & Proposed)		d[4]		5,380	m^2
Approximate Length of Road		L		--	m
Approximate Width of Road		w		--	m
Total Area of Property				23,750	m^2
Impervious Area				8,246	m^2
	Roads	l x w	- m^2		
	Parking and Circulation	d	5,380 m^2		
	Buidling	Sum of H's	2,866 m^2		
Area available Infiltration		A		15,504	m^2

3. Nitrate Diluation Calculations

Nitrate Concentration of Infiltration[7]	C_i	0.05	mg/L
Site Infiltration	$Q_i = A*PI$	3,247	m^3
Existing Development			
Daily Sewage Volume - Exisitng Development	Q_d	2.00	m^3
Maximum Yearly Sewage Volume - Existing Development	$Q_e=365*Q_d$	730	m^3
Nitrate Concentration in Sewage - Existing Development	C_e	40	mg/L
Proposed Development			
Daily Sewage Volume - Proposed New Development[8]	Qd	4.00	m^3
Maximum Yearly Sewage Volume (water) - Proposed New Development	Qe=365*Qd	1,460	m^3
Nitrate Concentration in Sewage - Proposed New Development	Ce	40	mg/L
Maximum Allowable Nitrate Concentration at Boundary[5]	C_m	10.0	mg/L
Increase in Nitrate Concentration at Boundaries	C = (Qe,1Ce,1+Qe,2Ce,2+QiCi)/(Qe,1+Qe,2+Qi)	**16.14**	**mg/L**

NOTES

1 Table 2: Infiltration Factors, *Hydrogical Technical Information Requirements for Land Development Applications* , Ministry of the Energy and Environment, April 1995.

2 Thornthwaite and Mather's (1957) Instructions and Tables for Computing Potential Evapotranspiration and the Water Balance.

3 Moisture surplus for data for Ottawa ON (Environment Canada Meteorological Service of Canada, 2010).

4 The vaule is a calculation of the total existing parking & circulation area foot print, and the proposed 202 Vehicle parking & circulation area presented Vector Design Architects site plan, May 2019.

5 As per *Technical Guideline for Individual On-Site Sewage Systems: Water Quality and Impact Risk Assessment* , Ministry of the Energy and Environment, August 1996.

6 The total area of the property used in this calculation is limited to the area of the Site located west of the stream.

7 The nitrate concentration of infiltration is assumed to be 0.0 mg/L.

8 Calculated using Part 8 of the Ontario Building Code, 2012: Assembly Hall - per seat, no food service, 8 L/day (500 seats)

Table 4B
Nitrate Attenuation Calculations - Tertiary Treatment
Terrain Analysis and Private Sewage Disposal System Impact Study - Proposed Assembly Hall
4835 Bank Street, Ottawa, Ontario
LRL File: 170132

1. Potential Infiltration

Weather Station: Ottawa

No.	Section Area (m^2)	Infiltration Factor (IF)[1]							Moisture Surplus (MS)				Potential Infiltration (PI) (IF*MS) (mm)	
		Topography	Value	Soil	Value	Cover	Value	Total	Ground Cover	Soil Type	Moisture Retention[2] (mm)	Moisture Surplus[3] (mm)	Section	Weighted
1	23,750	Flat	0.3	Clay Loam	0.2	Cultivated Land	0.1	0.6	Shallow Rooted Crops	3 Silt Loam	125	349	209.4	209.4
Total[6]	23,750												**Total**	209.4

2. Area Available for Infiltration

Approximate footprint of the exisitng assembly hall		H		1,168	m^2
Approximate footprint of the exisitng garage		H		105	m^2
Approximate footprint of the proposed assembly hall		H		1,593	m^2
Approximate area of paved parking and circulation (Existing & Proposed)		d[4]		5,380	m^2
Approximate Length of Road		L		--	m
Approximate Width of Road		w		--	m
Total Area of Property				23,750	m^2
Impervious Area				8,246	m^2
	Roads	l x w	-	m^2	
	Parking and Circulation	d	5,380	m^2	
	Buidling	Sum of H's	2,866	m^2	
Area available Infiltration		A		15,504	m^2

3. Nitrate Diluation Calculations

Nitrate Concentration of Infiltration[7]	C_i	0.00	mg/L
Site Infiltration	$Q_i = A*PI$	3,247	m^3
Existing Development (Norweco Hydro-Kinetic System)			
Daily Sewage Volume - Exisitng Development	Q_{d1}	2.0	m^3
Maximum Yearly Sewage Volume - Existing Development	$Q_{e1}=365*Q_{d1}$	730	m^3
Nitrate Concentration in Sewage - Existing Development	C_{e1}	20	mg/L
Proposed Development (Norweco Hydro-Kinetic System)			
Daily Sewage Volume - Proposed New Development[8]	Q_{d3}	4.00	m^3
Maximum Yearly Sewage Volume (water) - Proposed New Development	$Q_e=365*Q_d$	1,460	m^3
Nitrate Concentration in Sewage - Proposed New Development	C_e	20	mg/L
Maximum Allowable Nitrate Concentration at Boundary[5]	C_m	10.0	mg/L
Increase in Nitrate Concentration at Boundaries	$C = (Q_iC_i+Q_{e1}*C_{e1}+Q_{e2}*C_{e2}+Q_{e3}*C_{e3})/(Q_i+Q_{e1}+Q_{e2}+Q_{e3})$	**8.06**	**mg/L**

NOTES

1 Table 2: Infiltration Factors, *Hydrogical Technical Information Requirements for Land Development Applications* , Ministry of the Energy and Environment, April 1995.

2 Thornthwaite and Mather's (1957) Instructions and Tables for Computing Potential Evapotranspiration and the Water Balance.

3 Moisture surplus for data for Ottawa ON (Environment Canada Meteorological Service of Canada, 2010).

4 The vaule is a calculation of the total existing parking & circulation area foot print, and the proposed 202 Vehicle parking & circulation area presented Vector Design Architects site plan, May 2019.

5 As per *Technical Guideline for Individual On-Site Sewage Systems: Water Quality and Impact Risk Assessment* , Ministry of the Energy and Environment, August 1996.

6 The total area of the property used in this calculation is limited to the area of the Site located west of the stream.

7 The nitrate concentration of infiltration is assumed to be 0.0 mg/L.

8 Calculated using Part 8 of the Ontario Building Code, 2012: Assembly Hall - per seat, no food service, 8 L/day (500 seats)

APPENDIX A

Test Pit Logs

Test Pit Log: TP1

Project No.: 170132 **Project:** Terrain Analysis

Client: Hindu Temple of Ottawa Carleton **Location:** 4835 Bank Street, Ottawa, ON

Date: May 08, 2017 **Field Personnel:** JA

Excavation Method: Backhoe **Excavation Contractor:** Maurice Yelle Excavation ltd.

Depth (ft)	Depth (m)	Soil Description	Elev./Depth (m)	Lithology	Sample Number
0	0	Ground Surface	98.21		
		TOPSOIL Sandy, dark brown, dry.	0.00 98.01		
		FILL Sandy clay, dark brown, dry.	0.20 97.31		
	1	**Silty Sand** Trace clay, with clay seam from 1.7 to 1.8 m bgs, brown, dry. Sieve analysis completed.	0.90		1 2
	2		96.11		3
		End of Test Pit Refusal over inferred bedrock.	2.10		

Shear Strength (kPa) 50 150

Water Content (%) 25 50 75

Liquid Limit (%) 25 50 75

Water Level (Standpipe or Open Excavation)

0.4 m bgs (08/05/17)

Easting: N/M **Northing:** N/M

Site Datum: Top east arm of hydrant at south entrance (100.00 m)

Groundsurface Elevation: 98.21 **Top of Riser Elev.:** 99.15

Excavation Width: 1.2 m **Excavation Length:** 1.5 m

NOTES:

BGS- Below Ground Surface

Test Pit Log: TP2

Project No.: 170132 **Project:** Terrain Analysis

Client: Hindu Temple of Ottawa Carleton **Location:** 4835 Bank Street, Ottawa, ON

Date: May 08, 2017 **Field Personnel:** JA

Excavation Method: Backhoe **Excavation Contractor:** Maurice Yelle Excavation ltd.

SUBSURFACE PROFILE		SAMPLE DATA					
Depth (ft / m)	Soil Description	Elev./Depth (m)	Lithology	Sample Number	Shear Strength (kPa) 50 150	Water Content (%) 25 50 75 / Liquid Limit (%) 25 50 75	Water Level (Standpipe or Open Excavation)
0 ft / 0 m	Ground Surface	97.09					
	FILL Silty sand with some clay, brown, saturated with water infiltration at 0.4 m bgs. Buried metal structure/waste at approximately 0.9 m bgs.	0.00					
		96.19		4			
	End of Test Pit	0.90					
1 ft / 1 m							
2 ft / 2 m							
3 ft							
4 ft							
5 ft							
6 ft / 2 m							
7 ft							
8 ft							

Easting: N/M **Northing:** N/M

Site Datum: Top east arm of hydrant at south entrance (100.00 m)

Groundsurface Elevation: 97.09 **Top of Riser Elev.:** --

Excavation Width: 1.2 m **Excavation Length:** 1.5 m

NOTES:

Test pit terminated at 0.9 meters due to volume of water in pit.
BGS- Below Ground Surface

Test Pit Log: TP3

Project No.: 170132 **Project:** Terrain Analysis

Client: Hindu Temple of Ottawa Carleton **Location:** 4835 Bank Street, Ottawa, ON

Date: May 08, 2017 **Field Personnel:** JA

Excavation Method: Backhoe **Excavation Contractor:** Maurice Yelle Excavation ltd.

Depth (ft / m)	Soil Description	Elev./Depth (m)	Lithology	Sample Number
0 / 0	Ground Surface	97.75		
	TOPSOIL Sandy loam, dark brown, dry. Brick debris found in top 0.2 m bgs.	0.00 97.55 0.20		
1	**FILL** Sandy silt, trace boulders, brown, dry. Tire debris found at approximately 0.8 m bgs.			5
2		96.95 0.80		
3 / 1	**TILL** Silty sand, trace gravel, cobbles and boulders, brown, dry. Sieve analysis completed.			
4				
5				6
		96.05 1.70		
6 / 2	End of Test Pit Refusal at 1.7 m bgs over inferred bedrock.			
7				
8				

Shear Strength (kPa) 50 150

Water Content (%) 25 50 75

Liquid Limit (%) 25 50 75

Water Level (Standpipe or Open Excavation)

▼ 0.71 m bgs (08/05/17)

Easting: 0454091 **Northing:** 5017670

Site Datum: Top east arm of hydrant at south entrance (100.00 m)

Groundsurface Elevation: 97.75 **Top of Riser Elev.:** 98.98

Excavation Width: 1.2 m **Excavation Length:** 1.5 m

NOTES:

BGS- Below Ground Surface

Test Pit Log: TP4

Project No.: 170132 **Project:** Terrain Analysis

Client: Hindu Temple of Ottawa Carleton **Location:** 4835 Bank Street, Ottawa, ON

Date: May 08, 2017 **Field Personnel:** JA

Excavation Method: Backhoe **Excavation Contractor:** Maurice Yelle Excavation ltd.

SUBSURFACE PROFILE		SAMPLE DATA					
Depth (ft / m)	Soil Description	Elev./Depth (m)	Lithology	Sample Number	Shear Strength (kPa) 50 150	Water Content (%) 25 50 75 / Liquid Limit (%) 25 50 75	Water Level (Standpipe or Open Excavation)
0 ft / 0 m	Ground Surface	99.54					
	TOPSOIL Silty loam, trace clay,dark brown, dry.	0.00					
1		99.04					
	FILL Silty sand, trace cobbles and gravel, light brown, dry. Changing to dark brown sandy fill with trace boulders at approximately 0.8 m bgs.	0.50		7			
2				8			
3 / 1							
4		98.14					
	End of Test Pit Refusal at 1.4 m bgs over inferred bedrock or large concrete structure.	1.40					
5							
6							
7 / 2							
8							

Easting: 0454005 **Northing:** 5017628

Site Datum: Top east arm of hydrant at south entrance (100.00 m)

Groundsurface Elevation: 99.54 **Top of Riser Elev.:** --

Excavation Width: N/M **Excavation Length:** N/M

NOTES:

BGS- Below Ground Surface

Test Pit Log: TP5

Project No.: 170132 **Project:** Terrain Analysis

Client: Hindu Temple of Ottawa Carleton **Location:** 4835 Bank Street, Ottawa, ON

Date: May 08, 2017 **Field Personnel:** JA

Excavation Method: Backhoe **Excavation Contractor:** Maurice Yelle Excavation ltd.

Depth (ft / m)	Soil Description	Elev./Depth (m)	Lithology	Sample Number
0 / 0	Ground Surface	98.78		
	TOPSOIL Silty loam some sand, dark brown, dry.	0.00		
		98.63		10
	FILL Sand, some silt, trace cobbles, brown, dry. Waste debris of metal and asphalt pieces at approximately 0.9 m bgs.	0.15		
3 / 1				9
4				
5		97.28		11
	End of Test Pit Refusal at 1.5 m bgs over inferred bedrock.	1.50		
6 / 2				
7				
8				

Shear Strength (kPa) 50 150

Water Content (%) 25 50 75

Liquid Limit (%) 25 50 75

Water Level (Standpipe or Open Excavation)

Dry at 1.53 m bgs

Easting: 0453945 **Northing:** 5017595

Site Datum: Top east arm of hydrant at south entrance (100.00 m)

Groundsurface Elevation: 98.78 **Top of Riser Elev.:** 99.02

Excavation Width: N/M **Excavation Length:** N/M

NOTES:

BGS- Below Ground Surface

Test Pit Log: TP6

Project No.: 170132 | **Project:** Terrain Analysis

Client: Hindu Temple of Ottawa Carleton | **Location:** 4835 Bank Street, Ottawa, ON

Date: May 08, 2017 | **Field Personnel:** JA

Excavation Method: Backhoe | **Excavation Contractor:** Maurice Yelle Excavation ltd.

SUBSURFACE PROFILE		SAMPLE DATA					
Depth (ft / m)	Soil Description	Elev./Depth (m)	Lithology	Sample Number	Shear Strength (kPa) 50 150	Water Content (%) 25 50 75 / Liquid Limit (%) 25 50 75	Water Level (Standpipe or Open Excavation)
0 ft / 0 m	Ground Surface	99.38					
	TOPSOIL Sandy loam, dark brown, dry.	0.00					
		99.23					
	FILL Sand, some gravel, cobbles, boulders, silty seam at 0.7 m bgs, brown, dry. Refusal at 0.8 m bgs over inferred bedrock.	0.15		12			
				13			
		98.58					
3 ft / 1 m	End of Test Pit	0.80					

Easting: 0454003 | **Northing:** 5017542

Site Datum: Top east arm of hydrant at south entrance (100.00 m)

Groundsurface Elevation: 99.38 | **Top of Riser Elev.:** --

Excavation Width: N/M | **Excavation Length:** N/M

NOTES:

BGS- Below Ground Surface

Test Pit Log: TP7

Project No.: 170132 **Project:** Terrain Analysis

Client: Hindu Temple of Ottawa Carleton **Location:** 4835 Bank Street, Ottawa, ON

Date: May 08, 2017 **Field Personnel:** JA

Excavation Method: Backhoe **Excavation Contractor:** Maurice Yelle Excavation ltd.

SUBSURFACE PROFILE		SAMPLE DATA					
Depth (ft / m)	Soil Description	Elev./Depth (m)	Lithology	Sample Number	Shear Strength (kPa) 50 150	Water Content (%) 25 50 75 / Liquid Limit (%) 25 50 75	Water Level (Standpipe or Open Excavation)
0 / 0	Ground Surface	99.60					
	TOPSOIL Sandy loam, dark brown, dry.	0.00 / 99.40					
	FILL Sand, brown, trace metal debris, dry.	0.20 / 98.90					
	TILL Silty sand, trace clay, boulders, grey, organics including tree stump, roots, bl… bg… Refusal due to obstruction (tree stump).	0.70 / 97.80					
6 / 2	End of Test Pit	1.80					
8							1.33 m bgs (08/05/17)

Easting: 0454051 **Northing:** 5017564

Site Datum: Top east arm of hydrant at south entrance (100.00 m)

Groundsurface Elevation: 99.60 **Top of Riser Elev.:** 100.79

Excavation Width: N/M **Excavation Length:** N/M

NOTES:

BGS- Below Ground Surface

APPENDIX B

Laboratory Certificates of Analysis

300 - 2319 St. Laurent Blvd
Ottawa, ON, K1G 4J8
1-800-749-1947
www.paracellabs.com

Certificate of Analysis

LRL Associates Ltd.

5430 Canotek Road
Ottawa, ON K1J 9G2
Attn: Jessica Arthurs

Client PO:
Project: 170132
Custody: 32310

Report Date: 15-May-2017
Order Date: 11-May-2017

Order #: 1719377

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1719377-01	TP1
1719377-02	TP3
1719377-03	TP7

Approved By:

Dale Robertson, BSc
Laboratory Director

Certificate of Analysis
Client: LRL Associates Ltd.
Client PO:

Report Date: 15-May-2017
Order Date: 11-May-2017
Project Description: 170132

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Ammonia, as N	EPA 351.2 - Auto Colour	12-May-17	12-May-17
Anions	EPA 300.1 - IC	12-May-17	12-May-17
Total Kjeldahl Nitrogen	EPA 351.2 - Auto Colour, digestion	12-May-17	15-May-17

Order #: 1719377

Certificate of Analysis
Client: LRL Associates Ltd.
Client PO:

Report Date: 15-May-2017
Order Date: 11-May-2017
Project Description: 170132

	Client ID:	TP1	TP3	TP7	-
	Sample Date:	08-May-17	08-May-17	08-May-17	-
	Sample ID:	1719377-01	1719377-02	1719377-03	-
	MDL/Units	Water	Water	Water	-
General Inorganics					
Ammonia as N	0.01 mg/L	0.28	0.39	1.66	-
Total Kjeldahl Nitrogen	0.1 mg/L	78.1	65.3	131	-
Anions					
Nitrate as N	0.1 mg/L	<0.1	0.5	<0.1	-
Nitrite as N	0.05 mg/L	<0.05	<0.05	<0.05	-

Certificate of Analysis
Client: LRL Associates Ltd.
Client PO:

Report Date: 15-May-2017
Order Date: 11-May-2017
Project Description: 170132

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Nitrate as N	ND	0.1	mg/L						
Nitrite as N	ND	0.05	mg/L						
General Inorganics									
Ammonia as N	ND	0.01	mg/L						
Total Kjeldahl Nitrogen	ND	0.1	mg/L						

Certificate of Analysis
Client: LRL Associates Ltd.
Client PO:

Report Date: 15-May-2017
Order Date: 11-May-2017
Project Description: 170132

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Nitrate as N	ND	0.1	mg/L	ND				20	
Nitrite as N	ND	0.05	mg/L	ND				20	
General Inorganics									
Ammonia as N	0.021	0.01	mg/L	0.022			2.4	8	
Total Kjeldahl Nitrogen	1.50	0.1	mg/L	1.52			1.8	10	

Certificate of Analysis
Client: LRL Associates Ltd.
Client PO:

Report Date: 15-May-2017
Order Date: 11-May-2017
Project Description: 170132

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Nitrate as N	1.01	0.1	mg/L	ND	101	81-112			
Nitrite as N	1.02	0.05	mg/L	ND	102	76-117			
General Inorganics									
Ammonia as N	0.280	0.01	mg/L	0.022	103	81-124			
Total Kjeldahl Nitrogen	1.91	0.1	mg/L		95.7	81-126			

Certificate of Analysis
Client: LRL Associates Ltd.
Client PO:

Report Date: 15-May-2017
Order Date: 11-May-2017
Project Description: 170132

Qualifier Notes:

Login Qualifiers :

Samples received submerged in water, possibly melted ice. This condition can compromise sample integrity.
Applies to samples: TP1, TP3, TP7

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.

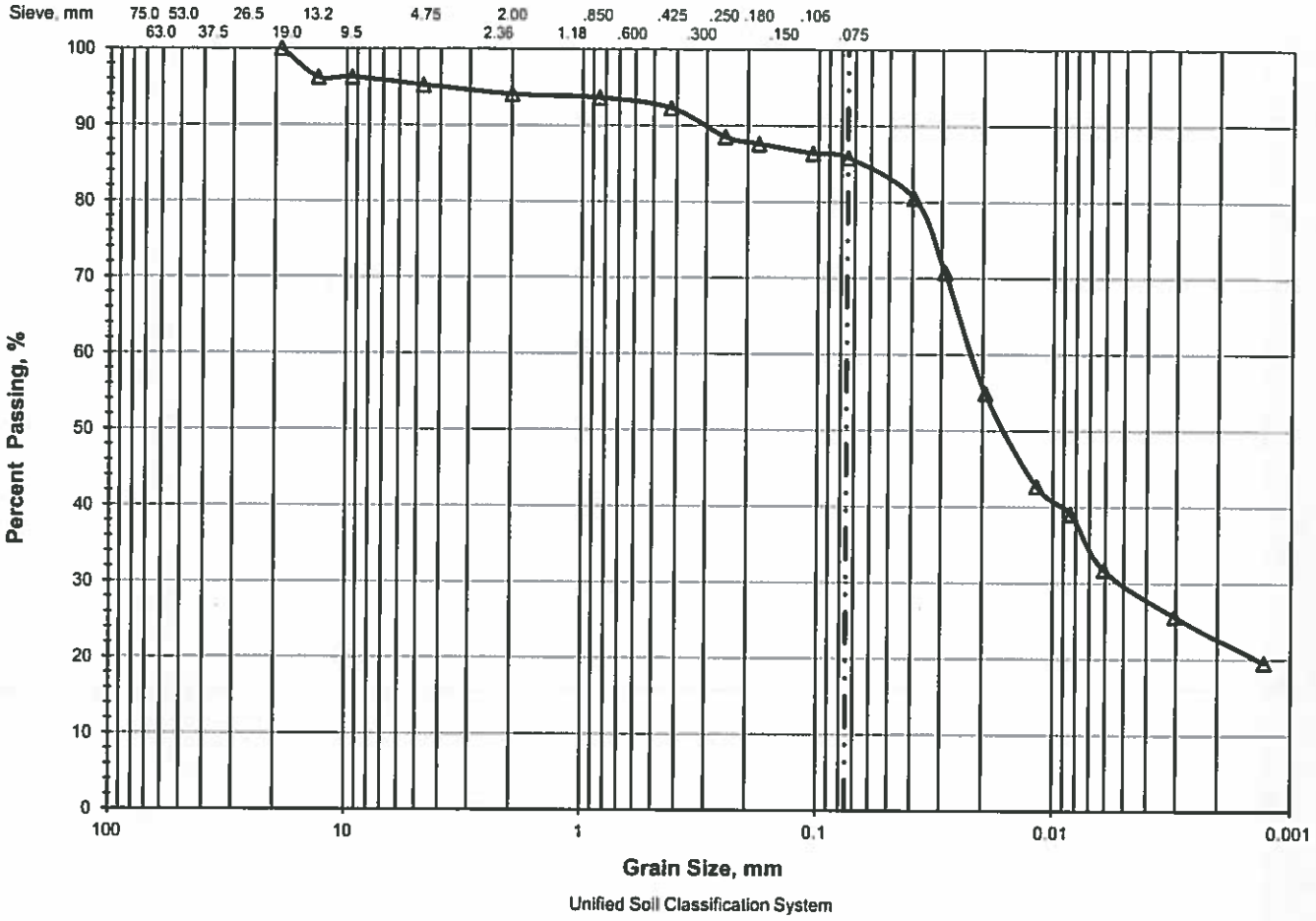
APPENDIX C

Sieve & Hydrometer Analysis

LRL Associates Ltd.

PARTICLE SIZE ANALYSIS

Client:	Lloyd Phillips & Associates Ltd.	**File No.:**	170132
Project:	Hydrogeological Assessment & Terrain Analysis	**Report No.:**	1
Location:	4835 Bank Street., Ottawa, ON.	**Date:**	May 8, 2017



	> 75 mm	% GRAVEL		% SAND			% FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
△	0.0	0.0	4.8	1.2	1.8	6.5	63.8	22.0

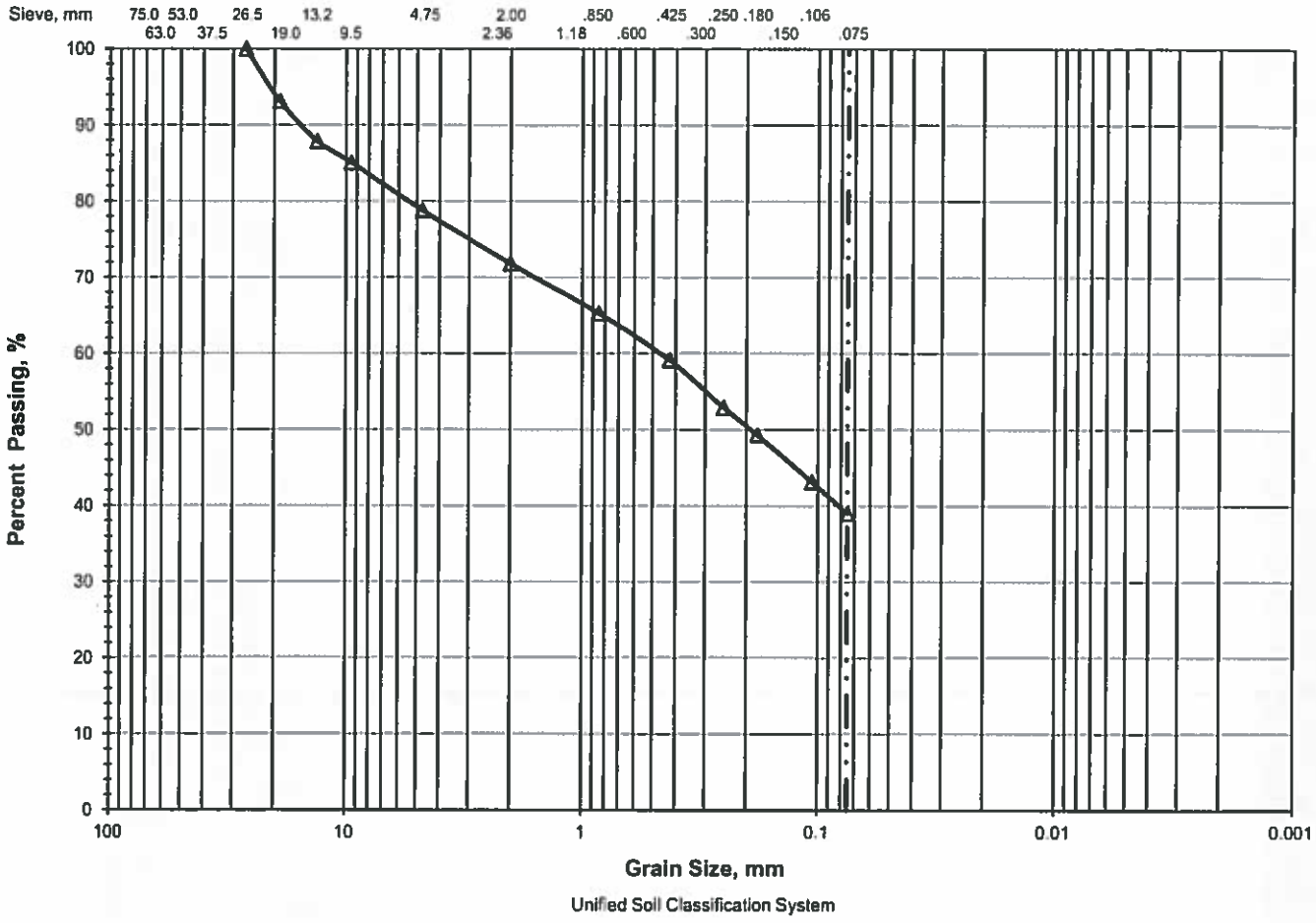
	Location	Sample	Depth, m	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
△	TP-1	3	1.80 - 2.00	0.0226	0.0164	0.0052				

LRL Associates Ltd.

PARTICLE SIZE ANALYSIS

ASTM D 422 / LS-702

Client:	Lloyd Phillips & Associates Ltd.	**File No.:**	170132
Project:	Hydrogeological Assessment & Terrain Analysis	**Report No.:**	2
Location:	4835 Bank Street., Ottawa, ON.	**Date:**	May 8, 2017



Unified Soil Classification System

	> 75 mm	% GRAVEL		% SAND			% FINES
		Coarse	Fine	Coarse	Medium	Fine	Silt & Clay
△	0.0	6.0	15.3	7.0	12.7	20.1	39.0

	Location	Sample	Depth, m	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
△	TP3	6	1.4 - 1.6	0.4855	0.1932					

APPENDIX D

Ontario Well Record Printouts

Well ID Number: 1512375
Well Audit Number:
Well Tag Number:

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

Well Location

Address of Well Location	
Township	GLOUCESTER TOWNSHIP
Lot	022
Concession	RF 04
County/District/Municipality	OTTAWA-CARLETON
City/Town/Village	
Province	ON
Postal Code	n/a
UTM Coordinates	NAD83 — Zone 18 Easting: 454020.70 Northing: 5017262.00
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	OBDN	SAND		0 ft	9 ft
WHIT	SNDS			9 ft	74 ft

Annular Space/Abandonment Sealing Record

Depth From	Depth To	Type of Sealant Used (Material and Type)	Volume Placed

Method of Construction & Well Use

Method of Construction	Well Use
Diamond	
	Domestic

Status of Well

Water Supply

Construction Record - Casing

Inside Diameter	Open Hole or material	Depth From	Depth To
2 inch	GALVANIZED		20 ft
	OPEN HOLE		74 ft

Construction Record - Screen

Outside Diameter	Material	Depth From	Depth To

Well Contractor and Well Technician Information

Well Contractor's Licence Number: 1703

Results of Well Yield Testing

After test of well yield, water was	CLEAR
If pumping discontinued, give reason	
Pump intake set at	
Pumping Rate	8 GPM
Duration of Pumping	2 h:0 m
Final water level	12 ft
If flowing give rate	
Recommended pump depth	35 ft
Recommended pump rate	8 GPM
Well Production	PUMP
Disinfected?	

Draw Down & Recovery

Draw Down Time(min)	Draw Down Water level	Recovery Time(min)	Recovery Water level
SWL	6 ft		
1		1	
2		2	
3		3	
4		4	
5		5	
10		10	
15	12 ft	15	
20		20	
25		25	
30	12 ft	30	
40		40	
45	12 ft	45	
50		50	
60	12 ft	60	

Water Details

Water Found at Depth	Kind
74 ft	Fresh

Hole Diameter

Depth From	Depth To	Diameter

Audit Number:

Date Well Completed: November 27, 1972

Date Well Record Received by MOE: March 07, 1973

Updated: February 2, 2018
Rate Rate
Share facebook twitter Print
Tags

- Environment and energy,

APPENDIX E

Proposed Sewage System Layout

APPENDIX F

Moisture Surplus Printout

Ottawa Airport, ON WATER BUDGET MEANS FOR THE PERIOD 1950-2010 DC20492

LAT.... 45.32 WATER HOLDING CAPACITY... 50 MM HEAT INDEX... 36.41
LONG... 75.67 LOWER ZONE..... 30 MM A..... 1.075

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	-10.6	64	13	15	0	0	0	27	83	50	299
28- 2	-8.8	57	12	18	1	1	0	29	110	50	356
31- 3	-2.7	66	32	80	5	5	0	107	64	50	422
30- 4	5.9	72	67	69	32	32	0	104	0	50	494
31- 5	13.0	74	74	0	80	79	-1	13	0	32	568
30- 6	18.3	82	82	0	116	97	-19	4	0	14	651
31- 7	20.8	89	89	0	135	94	-41	3	0	5	740
31- 8	19.5	87	87	0	117	83	-34	1	0	9	827
30- 9	14.6	84	84	0	75	66	-9	7	0	20	912
31-10	8.1	77	76	0	36	35	-1	24	0	37	77
30-11	1.3	80	63	8	10	10	0	50	9	49	157
31-12	-7.0	78	26	15	1	1	0	38	47	50	236
AVE	5.9 TTL	911	705	205	608	503	-105	407			

Ottawa Airport, ON STANDARD DEVIATIONS FOR THE PERIOD 1950-2010 DC20492

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	3.0	26	16	18	1	1	0	31	43	0	55
28- 2	2.6	29	15	27	1	1	0	37	59	0	59
31- 3	2.3	28	22	47	4	4	0	53	83	0	65
30- 4	1.7	31	31	84	8	8	0	84	0	2	74
31- 5	1.9	32	32	0	12	11	5	21	0	19	85
30- 6	1.2	38	38	0	9	26	26	17	0	19	93
31- 7	1.2	42	42	0	8	30	31	12	0	14	93
31- 8	1.3	39	39	0	8	30	32	5	0	16	107
30- 9	1.5	38	38	0	8	14	13	20	0	21	110
31-10	1.4	37	37	2	7	7	3	27	0	19	37
30-11	1.7	27	28	9	4	4	0	30	13	6	45
31-12	3.0	30	22	14	1	1	0	29	34	0	56

Ottawa Airport, ON WATER BUDGET MEANS FOR THE PERIOD 1950-2010 DC20492

LAT.... 45.32 WATER HOLDING CAPACITY... 75 MM HEAT INDEX... 36.41
LONG... 75.67 LOWER ZONE..... 45 MM A..... 1.075

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	-10.6	64	13	15	0	0	0	27	83	75	299
28- 2	-8.8	57	12	18	1	1	0	29	110	75	356
31- 3	-2.7	66	32	80	5	5	0	107	64	75	422
30- 4	5.9	72	67	69	32	32	0	104	0	75	494
31- 5	13.0	74	74	0	80	80	0	13	0	56	568
30- 6	18.3	82	82	0	116	107	-10	4	0	28	651
31- 7	20.8	89	89	0	135	104	-32	2	0	10	740
31- 8	19.5	87	87	0	117	85	-32	1	0	12	827
30- 9	14.6	84	84	0	75	66	-9	4	0	26	912
31-10	8.1	77	76	0	36	35	-1	15	0	52	77
30-11	1.3	80	63	8	10	10	0	42	9	71	157
31-12	-7.0	78	26	15	1	1	0	36	47	75	236
AVE	5.9 TTL	911	705	205	608	526	-84	384			

Ottawa Airport, ON STANDARD DEVIATIONS FOR THE PERIOD 1950-2010 DC20492

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	3.0	26	16	18	1	1	0	30	43	0	55
28- 2	2.6	29	15	27	1	1	0	37	59	0	59
31- 3	2.3	28	22	47	4	4	0	53	83	0	65
30- 4	1.7	31	31	84	8	8	0	84	0	2	74
31- 5	1.9	32	32	0	12	12	0	21	0	22	85
30- 6	1.2	38	38	0	9	19	19	17	0	28	93
31- 7	1.2	42	42	0	8	28	30	11	0	22	93
31- 8	1.3	39	39	0	8	29	31	5	0	23	107
30- 9	1.5	38	38	0	8	14	14	17	0	29	110
31-10	1.4	37	37	2	7	7	2	23	0	28	37
30-11	1.7	27	28	9	4	4	0	33	13	11	45
31-12	3.0	30	22	14	1	1	0	30	34	3	56

Ottawa Airport, ON WATER BUDGET MEANS FOR THE PERIOD 1950-2010 DC20492

LAT.... 45.32 WATER HOLDING CAPACITY...100 MM HEAT INDEX... 36.41
LONG... 75.67 LOWER ZONE..... 60 MM A..... 1.075

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	-10.6	64	13	15	0	0	0	25	83	99	299
28- 2	-8.8	57	12	18	1	1	0	28	110	99	356
31- 3	-2.7	66	32	80	5	5	0	106	64	100	422
30- 4	5.9	72	67	69	32	32	0	104	0	100	494
31- 5	13.0	74	74	0	80	80	0	13	0	81	568
30- 6	18.3	82	82	0	116	112	-4	4	0	47	651
31- 7	20.8	89	89	0	135	115	-21	2	0	19	740
31- 8	19.5	87	87	0	117	88	-29	1	0	18	827
30- 9	14.6	84	84	0	75	66	-8	3	0	32	912
31-10	8.1	77	76	0	36	35	-1	10	0	63	77
30-11	1.3	80	63	8	10	10	0	34	9	91	157
31-12	-7.0	78	26	15	1	1	0	33	47	97	236
AVE	5.9 TTL	911	705	205	608	545	-63	363			

Ottawa Airport, ON STANDARD DEVIATIONS FOR THE PERIOD 1950-2010 DC20492

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	3.0	26	16	18	1	1	0	30	43	5	55
28- 2	2.6	29	15	27	1	1	0	37	59	3	59
31- 3	2.3	28	22	47	4	4	0	53	83	0	65
30- 4	1.7	31	31	84	8	8	0	84	0	2	74
31- 5	1.9	32	32	0	12	12	0	21	0	22	85
30- 6	1.2	38	38	0	9	12	11	17	0	34	93
31- 7	1.2	42	42	0	8	25	26	11	0	30	93
31- 8	1.3	39	39	0	8	29	30	5	0	30	107
30- 9	1.5	38	38	0	8	14	13	15	0	35	110
31-10	1.4	37	37	2	7	6	2	21	0	36	37
30-11	1.7	27	28	9	4	4	0	34	13	19	45
31-12	3.0	30	22	14	1	1	0	30	34	8	56

Ottawa Airport, ON WATER BUDGET MEANS FOR THE PERIOD 1950-2010 DC20492

LAT.... 45.32 WATER HOLDING CAPACITY...125 MM HEAT INDEX... 36.41
LONG... 75.67 LOWER ZONE..... 75 MM A..... 1.075

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	-10.6	64	13	15	0	0	0	24	83	122	299
28- 2	-8.8	57	12	18	1	1	0	28	110	123	356
31- 3	-2.7	66	32	80	5	5	0	105	64	125	422
30- 4	5.9	72	67	69	32	32	0	104	0	125	494
31- 5	13.0	74	74	0	80	80	0	13	0	106	568
30- 6	18.3	82	82	0	116	115	-1	4	0	69	651
31- 7	20.8	89	89	0	135	122	-13	2	0	33	740
31- 8	19.5	87	87	0	117	92	-25	1	0	28	827
30- 9	14.6	84	84	0	75	67	-7	3	0	41	912
31-10	8.1	77	76	0	36	35	-1	9	0	74	77
30-11	1.3	80	63	8	10	10	0	27	9	108	157
31-12	-7.0	78	26	15	1	1	0	29	47	119	236
AVE	5.9 TTL	911	705	205	608	560	-47	349			

Ottawa Airport, ON STANDARD DEVIATIONS FOR THE PERIOD 1950-2010 DC20492

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	3.0	26	16	18	1	1	0	31	43	10	55
28- 2	2.6	29	15	27	1	1	0	37	59	8	59
31- 3	2.3	28	22	47	4	4	0	54	83	0	65
30- 4	1.7	31	31	84	8	8	0	84	0	2	74
31- 5	1.9	32	32	0	12	12	0	21	0	22	85
30- 6	1.2	38	38	0	9	9	4	17	0	39	93
31- 7	1.2	42	42	0	8	21	23	11	0	37	93
31- 8	1.3	39	39	0	8	26	28	5	0	38	107
30- 9	1.5	38	38	0	8	13	11	14	0	42	110
31-10	1.4	37	37	2	7	6	2	20	0	42	37
30-11	1.7	27	28	9	4	4	0	32	13	25	45
31-12	3.0	30	22	14	1	1	0	30	34	14	56

Ottawa Airport, ON WATER BUDGET MEANS FOR THE PERIOD 1950-2010 DC20492

LAT.... 45.32 WATER HOLDING CAPACITY...150 MM HEAT INDEX... 36.41
LONG... 75.67 LOWER ZONE..... 90 MM A..... 1.075

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	-10.6	64	13	15	0	0	0	23	83	144	299
28- 2	-8.8	57	12	18	1	1	0	26	110	146	356
31- 3	-2.7	66	32	80	5	5	0	103	64	150	422
30- 4	5.9	72	67	69	32	32	0	104	0	150	494
31- 5	13.0	74	74	0	80	80	0	13	0	131	568
30- 6	18.3	82	82	0	116	116	0	4	0	93	651
31- 7	20.8	89	89	0	135	127	-8	2	0	52	740
31- 8	19.5	87	87	0	117	97	-19	1	0	41	827
30- 9	14.6	84	84	0	75	68	-6	3	0	54	912
31-10	8.1	77	76	0	36	36	-1	8	0	88	77
30-11	1.3	80	63	8	10	10	0	23	9	126	157
31-12	-7.0	78	26	15	1	1	0	26	47	140	236
AVE	5.9 TTL	911	705	205	608	573	-34	336			

Ottawa Airport, ON STANDARD DEVIATIONS FOR THE PERIOD 1950-2010 DC20492

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	3.0	26	16	18	1	1	0	31	43	15	55
28- 2	2.6	29	15	27	1	1	0	37	59	12	59
31- 3	2.3	28	22	47	4	4	0	54	83	0	65
30- 4	1.7	31	31	84	8	8	0	84	0	2	74
31- 5	1.9	32	32	0	12	12	0	21	0	22	85
30- 6	1.2	38	38	0	9	8	1	17	0	41	93
31- 7	1.2	42	42	0	8	18	18	11	0	42	93
31- 8	1.3	39	39	0	8	22	23	5	0	44	107
30- 9	1.5	38	38	0	8	12	10	14	0	49	110
31-10	1.4	37	37	2	7	6	2	19	0	47	37
30-11	1.7	27	28	9	4	4	0	30	13	31	45
31-12	3.0	30	22	14	1	1	0	29	34	20	56

Ottawa Airport, ON WATER BUDGET MEANS FOR THE PERIOD 1950-2010 DC20492

LAT.... 45.32 WATER HOLDING CAPACITY...200 MM HEAT INDEX... 36.41
LONG... 75.67 LOWER ZONE.....120 MM A..... 1.075

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	-10.6	64	13	15	0	0	0	21	83	187	299
28- 2	-8.8	57	12	18	1	1	0	24	110	191	356
31- 3	-2.7	66	32	80	5	5	0	99	64	199	422
30- 4	5.9	72	67	69	32	32	0	103	0	200	494
31- 5	13.0	74	74	0	80	80	0	13	0	181	568
30- 6	18.3	82	82	0	116	116	0	4	0	143	651
31- 7	20.8	89	89	0	135	132	-3	2	0	97	740
31- 8	19.5	87	87	0	117	106	-11	1	0	78	827
30- 9	14.6	84	84	0	75	70	-4	3	0	89	912
31-10	8.1	77	76	0	36	36	0	7	0	123	77
30-11	1.3	80	63	8	10	10	0	19	9	164	157
31-12	-7.0	78	26	15	1	1	0	22	47	182	236
AVE	5.9 TTL	911	705	205	608	589	-18	318			

Ottawa Airport, ON STANDARD DEVIATIONS FOR THE PERIOD 1950-2010 DC20492

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	3.0	26	16	18	1	1	0	30	43	24	55
28- 2	2.6	29	15	27	1	1	0	36	59	20	59
31- 3	2.3	28	22	47	4	4	0	55	83	4	65
30- 4	1.7	31	31	84	8	8	0	83	0	2	74
31- 5	1.9	32	32	0	12	12	0	21	0	22	85
30- 6	1.2	38	38	0	9	9	0	17	0	41	93
31- 7	1.2	42	42	0	8	11	10	11	0	48	93
31- 8	1.3	39	39	0	8	16	16	5	0	54	107
30- 9	1.5	38	38	0	8	10	8	14	0	59	110
31-10	1.4	37	37	2	7	6	1	19	0	55	37
30-11	1.7	27	28	9	4	4	0	29	13	41	45
31-12	3.0	30	22	14	1	1	0	28	34	29	56

Ottawa Airport, ON WATER BUDGET MEANS FOR THE PERIOD 1950-2010 DC20492

LAT.... 45.32 WATER HOLDING CAPACITY...225 MM HEAT INDEX... 36.41
LONG... 75.67 LOWER ZONE.....135 MM A..... 1.075

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	-10.6	64	13	15	0	0	0	21	83	209	299
28- 2	-8.8	57	12	18	1	1	0	24	110	214	356
31- 3	-2.7	66	32	80	5	5	0	97	64	224	422
30- 4	5.9	72	67	69	32	32	0	103	0	225	494
31- 5	13.0	74	74	0	80	80	0	13	0	206	568
30- 6	18.3	82	82	0	116	116	0	4	0	168	651
31- 7	20.8	89	89	0	135	133	-2	2	0	121	740
31- 8	19.5	87	87	0	117	109	-8	1	0	99	827
30- 9	14.6	84	84	0	75	71	-4	3	0	109	912
31-10	8.1	77	76	0	36	36	0	7	0	143	77
30-11	1.3	80	63	8	10	10	0	18	9	185	157
31-12	-7.0	78	26	15	1	1	0	21	47	204	236
AVE	5.9 TTL	911	705	205	608	594	-14	314			

Ottawa Airport, ON STANDARD DEVIATIONS FOR THE PERIOD 1950-2010 DC20492

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	3.0	26	16	18	1	1	0	30	43	28	55
28- 2	2.6	29	15	27	1	1	0	36	59	24	59
31- 3	2.3	28	22	47	4	4	0	56	83	7	65
30- 4	1.7	31	31	84	8	8	0	82	0	2	74
31- 5	1.9	32	32	0	12	12	0	21	0	22	85
30- 6	1.2	38	38	0	9	9	0	17	0	41	93
31- 7	1.2	42	42	0	8	10	7	11	0	49	93
31- 8	1.3	39	39	0	8	14	13	5	0	58	107
30- 9	1.5	38	38	0	8	10	7	14	0	63	110
31-10	1.4	37	37	2	7	6	1	19	0	58	37
30-11	1.7	27	28	9	4	4	0	29	13	44	45
31-12	3.0	30	22	14	1	1	0	28	34	33	56

Ottawa Airport, ON WATER BUDGET MEANS FOR THE PERIOD 1950-2010 DC20492

LAT.... 45.32 WATER HOLDING CAPACITY...250 MM HEAT INDEX... 36.41
LONG... 75.67 LOWER ZONE.....150 MM A..... 1.075

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	-10.6	64	13	15	0	0	0	20	83	232	299
28- 2	-8.8	57	12	18	1	1	0	23	110	238	356
31- 3	-2.7	66	32	80	5	5	0	96	64	248	422
30- 4	5.9	72	67	69	32	32	0	102	0	250	494
31- 5	13.0	74	74	0	80	80	0	13	0	231	568
30- 6	18.3	82	82	0	116	116	0	4	0	193	651
31- 7	20.8	89	89	0	135	134	-1	2	0	145	740
31- 8	19.5	87	87	0	117	111	-6	1	0	121	827
30- 9	14.6	84	84	0	75	72	-3	3	0	130	912
31-10	8.1	77	76	0	36	36	0	7	0	164	77
30-11	1.3	80	63	8	10	10	0	18	9	207	157
31-12	-7.0	78	26	15	1	1	0	20	47	226	236
AVE	5.9 TTL	911	705	205	608	598	-10	309			

Ottawa Airport, ON STANDARD DEVIATIONS FOR THE PERIOD 1950-2010 DC20492

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	3.0	26	16	18	1	1	0	29	43	32	55
28- 2	2.6	29	15	27	1	1	0	36	59	27	59
31- 3	2.3	28	22	47	4	4	0	56	83	9	65
30- 4	1.7	31	31	84	8	8	0	82	0	2	74
31- 5	1.9	32	32	0	12	12	0	21	0	22	85
30- 6	1.2	38	38	0	9	9	0	17	0	41	93
31- 7	1.2	42	42	0	8	9	5	11	0	50	93
31- 8	1.3	39	39	0	8	12	11	5	0	61	107
30- 9	1.5	38	38	0	8	9	6	14	0	66	110
31-10	1.4	37	37	2	7	7	1	19	0	61	37
30-11	1.7	27	28	9	4	4	0	29	13	47	45
31-12	3.0	30	22	14	1	1	0	28	34	36	56

Ottawa Airport, ON WATER BUDGET MEANS FOR THE PERIOD 1950-2010 DC20492

LAT.... 45.32 WATER HOLDING CAPACITY...265 MM HEAT INDEX... 36.41
LONG... 75.67 LOWER ZONE.....159 MM A..... 1.075

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	-10.6	64	13	15	0	0	0	20	83	246	299
28- 2	-8.8	57	12	18	1	1	0	23	110	252	356
31- 3	-2.7	66	32	80	5	5	0	96	64	263	422
30- 4	5.9	72	67	69	32	32	0	102	0	265	494
31- 5	13.0	74	74	0	80	80	0	13	0	246	568
30- 6	18.3	82	82	0	116	116	0	4	0	208	651
31- 7	20.8	89	89	0	135	134	-1	2	0	160	740
31- 8	19.5	87	87	0	117	112	-5	1	0	135	827
30- 9	14.6	84	84	0	75	72	-3	3	0	144	912
31-10	8.1	77	76	0	36	36	0	7	0	177	77
30-11	1.3	80	63	8	10	10	0	18	9	221	157
31-12	-7.0	78	26	15	1	1	0	20	47	240	236
AVE	5.9 TTL	911	705	205	608	599	-9	309			

Ottawa Airport, ON STANDARD DEVIATIONS FOR THE PERIOD 1950-2010 DC20492

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	3.0	26	16	18	1	1	0	29	43	34	55
28- 2	2.6	29	15	27	1	1	0	36	59	29	59
31- 3	2.3	28	22	47	4	4	0	56	83	10	65
30- 4	1.7	31	31	84	8	8	0	82	0	2	74
31- 5	1.9	32	32	0	12	12	0	21	0	22	85
30- 6	1.2	38	38	0	9	9	0	17	0	41	93
31- 7	1.2	42	42	0	8	8	4	11	0	51	93
31- 8	1.3	39	39	0	8	11	10	5	0	62	107
30- 9	1.5	38	38	0	8	9	5	14	0	68	110
31-10	1.4	37	37	2	7	7	1	19	0	62	37
30-11	1.7	27	28	9	4	4	0	29	13	49	45
31-12	3.0	30	22	14	1	1	0	28	34	38	56

Ottawa Airport, ON WATER BUDGET MEANS FOR THE PERIOD 1950-2010 DC20492

LAT.... 45.32 WATER HOLDING CAPACITY...275 MM HEAT INDEX... 36.41
LONG... 75.67 LOWER ZONE.....165 MM A..... 1.075

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	-10.6	64	13	15	0	0	0	19	83	255	299
28- 2	-8.8	57	12	18	1	1	0	23	110	261	356
31- 3	-2.7	66	32	80	5	5	0	96	64	272	422
30- 4	5.9	72	67	69	32	32	0	101	0	275	494
31- 5	13.0	74	74	0	80	80	0	13	0	256	568
30- 6	18.3	82	82	0	116	116	0	4	0	218	651
31- 7	20.8	89	89	0	135	135	-1	2	0	170	740
31- 8	19.5	87	87	0	117	113	-4	1	0	144	827
30- 9	14.6	84	84	0	75	72	-2	3	0	153	912
31-10	8.1	77	76	0	36	36	0	7	0	186	77
30-11	1.3	80	63	8	10	10	0	18	9	230	157
31-12	-7.0	78	26	15	1	1	0	20	47	249	236
AVE	5.9 TTL	911	705	205	608	601	-7	307			

Ottawa Airport, ON STANDARD DEVIATIONS FOR THE PERIOD 1950-2010 DC20492

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	3.0	26	16	18	1	1	0	29	43	35	55
28- 2	2.6	29	15	27	1	1	0	36	59	30	59
31- 3	2.3	28	22	47	4	4	0	56	83	11	65
30- 4	1.7	31	31	84	8	8	0	81	0	2	74
31- 5	1.9	32	32	0	12	12	0	21	0	22	85
30- 6	1.2	38	38	0	9	9	0	17	0	41	93
31- 7	1.2	42	42	0	8	8	3	11	0	51	93
31- 8	1.3	39	39	0	8	11	9	5	0	63	107
30- 9	1.5	38	38	0	8	9	5	14	0	69	110
31-10	1.4	37	37	2	7	7	1	19	0	63	37
30-11	1.7	27	28	9	4	4	0	29	13	50	45
31-12	3.0	30	22	14	1	1	0	28	34	39	56

Ottawa Airport, ON WATER BUDGET MEANS FOR THE PERIOD 1950-2010 DC20492

LAT.... 45.32 WATER HOLDING CAPACITY...280 MM HEAT INDEX... 36.41
LONG... 75.67 LOWER ZONE.....168 MM A..... 1.075

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	-10.6	64	13	15	0	0	0	19	83	260	299
28- 2	-8.8	57	12	18	1	1	0	23	110	266	356
31- 3	-2.7	66	32	80	5	5	0	95	64	277	422
30- 4	5.9	72	67	69	32	32	0	101	0	280	494
31- 5	13.0	74	74	0	80	80	0	13	0	261	568
30- 6	18.3	82	82	0	116	116	0	4	0	223	651
31- 7	20.8	89	89	0	135	135	-1	2	0	175	740
31- 8	19.5	87	87	0	117	113	-4	1	0	148	827
30- 9	14.6	84	84	0	75	72	-2	3	0	157	912
31-10	8.1	77	76	0	36	36	0	7	0	191	77
30-11	1.3	80	63	8	10	10	0	18	9	234	157
31-12	-7.0	78	26	15	1	1	0	20	47	254	236
AVE	5.9 TTL	911	705	205	608	601	-7	306			

Ottawa Airport, ON STANDARD DEVIATIONS FOR THE PERIOD 1950-2010 DC20492

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	3.0	26	16	18	1	1	0	29	43	35	55
28- 2	2.6	29	15	27	1	1	0	36	59	31	59
31- 3	2.3	28	22	47	4	4	0	56	83	12	65
30- 4	1.7	31	31	84	8	8	0	81	0	2	74
31- 5	1.9	32	32	0	12	12	0	21	0	22	85
30- 6	1.2	38	38	0	9	9	0	17	0	41	93
31- 7	1.2	42	42	0	8	8	3	11	0	52	93
31- 8	1.3	39	39	0	8	10	9	5	0	64	107
30- 9	1.5	38	38	0	8	9	5	14	0	69	110
31-10	1.4	37	37	2	7	7	1	19	0	64	37
30-11	1.7	27	28	9	4	4	0	29	13	50	45
31-12	3.0	30	22	14	1	1	0	28	34	39	56

Ottawa Airport, ON WATER BUDGET MEANS FOR THE PERIOD 1950-2010 DC20492

LAT.... 45.32 WATER HOLDING CAPACITY...300 MM HEAT INDEX... 36.41
LONG... 75.67 LOWER ZONE.....180 MM A..... 1.075

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	-10.6	64	13	15	0	0	0	19	83	279	299
28- 2	-8.8	57	12	18	1	1	0	23	110	285	356
31- 3	-2.7	66	32	80	5	5	0	95	64	297	422
30- 4	5.9	72	67	69	32	32	0	101	0	300	494
31- 5	13.0	74	74	0	80	80	0	13	0	281	568
30- 6	18.3	82	82	0	116	116	0	4	0	243	651
31- 7	20.8	89	89	0	135	135	0	2	0	194	740
31- 8	19.5	87	87	0	117	114	-3	1	0	167	827
30- 9	14.6	84	84	0	75	73	-2	3	0	176	912
31-10	8.1	77	76	0	36	36	0	7	0	209	77
30-11	1.3	80	63	8	10	10	0	18	9	252	157
31-12	-7.0	78	26	15	1	1	0	20	47	272	236
AVE	5.9 TTL	911	705	205	608	603	-5	306			

Ottawa Airport, ON STANDARD DEVIATIONS FOR THE PERIOD 1950-2010 DC20492

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	3.0	26	16	18	1	1	0	29	43	37	55
28- 2	2.6	29	15	27	1	1	0	36	59	33	59
31- 3	2.3	28	22	47	4	4	0	57	83	13	65
30- 4	1.7	31	31	84	8	8	0	81	0	2	74
31- 5	1.9	32	32	0	12	12	0	21	0	22	85
30- 6	1.2	38	38	0	9	9	0	17	0	41	93
31- 7	1.2	42	42	0	8	8	2	11	0	52	93
31- 8	1.3	39	39	0	8	10	8	5	0	65	107
30- 9	1.5	38	38	0	8	9	5	14	0	71	110
31-10	1.4	37	37	2	7	7	1	19	0	65	37
30-11	1.7	27	28	9	4	4	0	29	13	52	45
31-12	3.0	30	22	14	1	1	0	28	34	41	56

Ottawa Airport, ON WATER BUDGET MEANS FOR THE PERIOD 1950-2010 DC20492

LAT.... 45.32 WATER HOLDING CAPACITY...400 MM HEAT INDEX... 36.41
LONG... 75.67 LOWER ZONE.....240 MM A..... 1.075

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	-10.6	64	13	15	0	0	0	19	83	375	299
28- 2	-8.8	57	12	18	1	1	0	22	110	382	356
31- 3	-2.7	66	32	80	5	5	0	94	64	395	422
30- 4	5.9	72	67	69	32	32	0	99	0	400	494
31- 5	13.0	74	74	0	80	80	0	13	0	381	568
30- 6	18.3	82	82	0	116	116	0	4	0	343	651
31- 7	20.8	89	89	0	135	135	0	2	0	294	740
31- 8	19.5	87	87	0	117	116	-1	1	0	265	827
30- 9	14.6	84	84	0	75	74	-1	3	0	272	912
31-10	8.1	77	76	0	36	36	0	7	0	305	77
30-11	1.3	80	63	8	10	10	0	18	9	349	157
31-12	-7.0	78	26	15	1	1	0	19	47	369	236
AVE	5.9 TTL	911	705	205	608	606	-2	301			

Ottawa Airport, ON STANDARD DEVIATIONS FOR THE PERIOD 1950-2010 DC20492

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	3.0	26	16	18	1	1	0	29	43	44	55
28- 2	2.6	29	15	27	1	1	0	36	59	39	59
31- 3	2.3	28	22	47	4	4	0	57	83	20	65
30- 4	1.7	31	31	84	8	8	0	80	0	2	74
31- 5	1.9	32	32	0	12	12	0	21	0	22	85
30- 6	1.2	38	38	0	9	9	0	17	0	41	93
31- 7	1.2	42	42	0	8	8	0	11	0	53	93
31- 8	1.3	39	39	0	8	8	4	5	0	69	107
30- 9	1.5	38	38	0	8	8	2	14	0	76	110
31-10	1.4	37	37	2	7	7	0	19	0	69	37
30-11	1.7	27	28	9	4	4	0	29	13	57	45
31-12	3.0	30	22	14	1	1	0	28	34	46	56

APPENDIX G

Norweco Hydro Kinetic Specifications

norweco®

HYDRO-KINETIC® GREEN WASTEWATER TREATMENT SYSTEM

WITH SERVICE PRO® CONTROL CENTER

SPECIFICATIONS

SPECIFICATIONS

GENERAL SPECIFICATIONS

The contractor shall furnish and install one complete Hydro-Kinetic Green wastewater treatment system with all necessary parts and equipment as described in the following specifications. Treatment of the domestic wastewater shall be accomplished by the extended aeration process with non-mechanical flow equalization, pretreatment of the influent and filtration of the final effluent. The treatment system shall provide primary, secondary and tertiary treatment of the wastewater flow, denitrification, and if required, chlorination/dechlorination or ultraviolet disinfection of the effluent prior to discharge. All treatment processes shall be contained within tankage which shall be manufactured using high density polyethylene resin. The wastewater treatment system shall be a Hydro-Kinetic Green as manufactured by Norweco, Inc., Norwalk, Ohio, USA.

The wastewater treatment system shall include high density polyethylene tankage providing separate pretreatment, anoxic, aeration, clarification and final filtration chambers. The tankage shall be furnished with a Schedule 40 PVC inlet hub, submerged transfer ports, access risers with removable covers, molded plastic vent assembly, molded receiving flange and Schedule 40 PVC outlet hub. Principal items of electro-mechanical equipment supplied with the Hydro-Kinetic Green system shall be an air pump, recirculation pump, UL Listed Service Pro Model 801P electrical control center with MCD technology, flow equalization device and Hydro-Kinetic Bio-Film Reactor for final filtration of system effluent.

OPERATING CONDITIONS

Total holding capacity of the system shall provide a minimum of 85 hour retention of the daily flow. The pretreatment chamber shall provide at least 18 hour retention, the anoxic chamber shall provide at least 24 hour retention, the extended aeration chamber shall provide at least 24 hour retention, the clarification chamber shall provide at least 7 hour retention and the Hydro-Kinetic Bio-Film Reactor shall provide at least 12 hour retention of the daily flow. The non-mechanical flow equalization device shall increase individual chamber and total system retention time in direct proportion to loading. Design of the system shall include a compartmented tank and non-mechanical flow equalization device to insure successful treatment performance without upset even when the significant runoff period is six hours. Hydraulic design considerations of the system and flow equalization device shall be such that intermittent peak flow factors as high as four shall not upset hydraulic reliability within the system. Capability of the system to perform as outlined, when built by an approved manufacturer, shall be certified by an independent testing laboratory and approved for use by the local governing regulatory agency.

PRETREATMENT CHAMBER

The pretreatment chamber shall be an integral part of the wastewater treatment system. All domestic wastewater shall be preconditioned and flow equalized while passing through the pretreatment chamber prior to being introduced to the anoxic chamber. The outlet of the pretreatment chamber shall be equipped with a discharge tee that extends vertically into the liquid so that only the preconditioned flow from the center area of the chamber is displaced to the anoxic chamber. The discharge tee and transfer port shall be of adequate size to handle a peak flow factor of four without restricting the outlet and disturbing hydraulic displacement to the anoxic chamber. A removable inspection cover shall be incorporated into the top of the pretreatment chamber to allow tank and transfer tee inspection.

ANOXIC CHAMBER

The anoxic chamber shall provide in excess of 24 hour retention of the equalized daily flow. In the anoxic chamber, low oxygen levels shall compel facultative heterotrophic bacteria to use nitrate-bound oxygen in their respiratory process. Nitrified liquid from the clarifier shall enter the chamber in measured doses and nitrogen compounds shall be converted to harmless nitrogen gas which shall escape into the atmosphere. Overall design of the chamber shall insure that effective mixing and suspension of the biomass is maintained in an anoxic condition to insure consistent biological denitrification. Systems that have not been performance certified to reduce Total Nitrogen (TN) more than 50% shall not be considered for this application.

AERATION CHAMBER

The extended aeration chamber shall provide in excess of 24 hour retention of the equalized daily flow. The chamber shall be of sufficient size to provide a minimum of 80 cubic feet of tank capacity per pound of applied BOD. The aeration chamber shall be an integral part of the system flow path and configured to insure effective mixing of microorganisms, wastewater and fresh air. No area of the chamber shall be isolated from process mixing, thereby eliminating dead or quiescent areas of the treatment chamber which are detrimental to the treatment process. Influent into the aeration chamber shall be preconditioned, equalized flow from the anoxic chamber.

FINAL CLARIFICATION CHAMBER

The final clarification chamber shall consist of 5 functionally independent zones operating together to provide satisfactory settling and clarification of the equalized flow. An inlet zone shall be provided and shall dissipate transfer turbulence at the flow inlet of the clarification chamber. Liquid is then displaced into the hopper zone of the clarifier. In this zone, settling by gravity takes place. Three of the four sidewalls are slanted to form a hopper which directs all settled material back to the settled sludge zone. A recirculation pump in the settled sludge zone shall transfer a portion of the wastewater back to the anoxic chamber. Clarified liquid from the hopper zone shall be displaced into the final settling zone to provide additional clarification of the liquid. The liquid is finally displaced to the outlet zone where the treated effluent shall pass through the flow equalization device and be discharged from the final clarification chamber.

FLOW EQUALIZATION DEVICE

The system shall include a non-mechanical, demand use, flow equalization device. The device shall be installed with the design flow equalization port located below the normal liquid level of the clarifier. If intermittent flow rates exceed the capacity of the design flow port, flow shall be held upstream until the intermittent flow dissipates. If the intermittent flow continues to increase, the liquid level may reach a sustained flow equalization port. With both ports in use, flow through the system increases while continuing to provide flow equalization to upstream and downstream processes. A peak flow equalization port is supplied but should not be required in a properly sized system. The device shall control normal residential flow rates and reduce typical residential flow surges. The flow equalization rate shall be dependent upon the specific loading pattern and the duration of flow surges. At the 600 GPD (gallons per day) NSF Standard 40/245 design loading schedule, minimum performance of the device shall equalize daily flow an average of 50%.

HYDRO-KINETIC BIO-FILM REACTOR

Significant reduction of organic matter shall occur in the treatment system prior to the Hydro-Kinetic Bio-Film Reactor. The Bio-Film Reactor shall provide final treatment of the effluent to a near pristine state. Flow equalized liquid from the clarifier shall enter the influent chamber, travel down and be evenly distributed beneath the Reactor Elements. The effects of gravity shall cause solids to settle to the bottom of the tank. As liquid travels up through the proprietary attached growth media, further reduction of organic matter shall take place. Additional settling and consolidation of solids shall take place downstream of the filter media. After passing through the filtration media for final polishing, the highly treated liquid shall flow into the final effluent zone before exiting the Bio-Film Reactor through the outlet tee.

SERVICE PRO® MODEL 801P ELECTRICAL CONTROL CENTER

The Model 801P control center with MCD technology shall provide Monitoring, Compliance and Diagnostic functions for the treatment system. The pre-wired controls shall be mounted in a lockable NEMA rated enclosure designed specifically for outdoor use. The control center shall be a UL Listed assembly and shall include a time clock, alarm light, reset button, power switch, power light, phone/network light, recirculation pump light, air pump light, high water light and auxiliary alarm light. A pre-programmed time clock shall control the recirculation pump to insure that approximately 400% of the average daily flow is returned to the anoxic chamber. The control center shall monitor recirculation pump current, air pump operation, high water and auxiliary alarm circuitry. In the event of an alarm from the air pump or auxiliary input, the audible and visual alarms shall activate and the optional telemetry system shall report the condition. If abnormal operation of the recirculation pump is detected, a diagnostic sequence shall begin and the visual alarm shall activate. After a factory programmed recovery interval, an automatic restart attempt shall be initiated. If normal pump operation does not resume during 24 programmed recovery and restart cycles, the audible alarm shall activate and the optional telemetry system shall report the condition to the Service Pro monitoring center.

SERVICE PRO‖ MONITORING CENTER

The Service Pro monitoring center shall include a 256 bit encrypted password protected website for interface with the monitoring center database. Access to the secure website shall be obtained through a unique user name and password that provides tiered access to data from monitored treatment systems. Access level tiers shall include dealers, service providers, regulatory agencies and individual system owners. Dealers and service providers shall be able to create accounts, enter serial numbers for system equipment, maintain service records and grant regulatory agencies access to the information. The monitoring center shall have the capability to schedule future service inspections and provide notification. Individual system owners shall be able to view information regarding their own systems, as well as download instructional information. Integrity of stored data shall be maintained through the use of multiple servers operating in geographically isolated locations.

MODEL AT 1500 ULTRAVIOLET DISINFECTION SYSTEM (Optional)

The Hydro-Kinetic Green system shall be furnished complete with a Model AT 1500 ultraviolet disinfection system. The AT 1500 system shall incorporate a turbulence inducer and dual-pass design to insure bacteria receive maximum exposure to the ultraviolet light source. The ultraviolet disinfection system shall be UL Listed under Standard 979 as a residential treatment device and shall include a disinfection chamber, turbulence inducer, extension riser, quartz tube with Teflon cover, ultraviolet bulb and controls. An interlock switch shall be furnished to automatically disable the ultraviolet light source when the disinfection chamber is accessed. Ultraviolet disinfection systems without a residential UL Listing have not demonstrated compliance with international electrical standards for safety and reliability and shall not be considered for this application.

SPECIFICATIONS

CERTIFIED PERFORMANCE

The wastewater treatment system shall be certified to operate for 12 consecutive months at the rated daily capacity without routine service. This performance shall be demonstrated by a continuous 12 month evaluation performed by an independent ANSI accredited, third-party testing facility. The evaluation shall consist of 2 consecutive ANSI/NSF Standard 40 and 245 evaluations, including the stress sequences, with no maintenance allowed in between. The system shall also be certified by a SCC accredited, third-party testing facility to BNQ Standards CAN/BNQ 3680-600 and NQ 3680-910. For the entire certification protocol, the system shall achieve a total test average of less than 5 mg/L Biochemical Oxygen Demand (CBOD), less than 5 mg/L Total Suspended Solids (TSS), and greater than 50% reduction of Total Nitrogen (TN) in the effluent. Systems unable to meet these effluent quality parameters for at least 12 months of continuous testing by independent ANSI and SCC accredited, third-party testing facilities without service do not provide the desired level of effluent quality or service frequency, and shall not be considered for this application.

AIR PUMP

The air pump shall be configured to allow remote mounting or installation within the mounting riser above the aeration chamber. When installed in the access riser, fresh air shall be supplied through a vented, injection molded, heavy duty, glass-filled polypropylene access cover above the air pump. Fresh air shall enter the air pump through a filter located under the housing cover and be introduced below the liquid surface through a prefabricated diffuser assembly. Only the plastic diffuser assembly and the air piping shall be installed in contact with the liquid. The air pump shall be wired for 115 volt, single phase, 60 cycle operation. The air pump shall include impact-resistant rubber diaphragms and valves which prolong operational life. The unique design and construction shall provide easy maintenance, excellent cooling and quiet operation. The air pump shall continue aerating and mixing the aeration chamber even during high water conditions. Treatment systems that interrupt air delivery during high water conditions disrupt biological activity and shall not be considered for this application.

RECIRCULATION PUMP

The submersible recirculation pump shall be wired for 115 volt, single phase, 60 cycle operation and shall be installed in the clarification chamber. Operation of the submersible recirculation pump shall be controlled by the Service Pro control center. The pump shall periodically recirculate nitrified liquid from the clarification chamber to the anoxic chamber. The pump shall be designed to be non-overloading throughout the entire pump curve and shall draw less than 8 full load amps. The pump motor shall contain moisture resistant windings and shall be securely mounted inside an oil-filled, watertight housing for maximum pump life. The stator housing and casing shall be of high grade cast iron, stainless steel or thermoplastic construction.

BLUE CRYSTAL® CHLORINATION SYSTEM (Optional)

The Hydro-Kinetic Green system shall be furnished complete with a tablet feeder and a six month supply of Blue Crystal disinfecting tablets. Blue Crystal tablets shall be specifically formulated for consistent chlorine dosage and effluent disinfection to the sustained, variable and intermittent flows that are typical of domestic wastewater treatment systems. The tablets shall be manufactured from pure calcium hypochlorite and contain a minimum of 70% available chlorine. Each tablet shall be 2⅝" diameter, compressed to a 1" thickness, weigh approximately 5 ounces and be white in color with blue crystals for easy identification. The tablets shall dissolve in direct proportion to the flow rate, releasing controlled amounts of chlorine.

BIO-MAX® DECHLORINATION SYSTEM (Optional)

The Hydro-Kinetic Green system shall be furnished complete with a tablet feeder and a six month supply of Bio-Max dechlorination tablets. The dechlorination tablets shall contain 92% sodium sulfite as the active ingredient and shall be specially formulated to chemically neutralize both free and combined chlorine. Each tablet shall be 2⅝" diameter, compressed to a 13⁄16" thickness, weigh approximately 5 ounces and be green in color for easy identification. The tablets shall dissolve slowly, releasing controlled amounts of chemical

PROGRESS THROUGH SERVICE SINCE 1906

DISTRIBUTED LOCALLY BY:

220 REPUBLIC STREET
NORWALK, OHIO, U.S.A. 44857-1156
TELEPHONE (419) 668-4471
FAX (419) 663-5440
www.norweco.com

APPENDIX H

OSSO Approval