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# Scoped Hydrogeological Evaluation and Terrain Analysis Playvalue Toys, 130 David Manchester Road

Ottawa, Ontario

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Submitted to:

Playvalue Toys
130 David Manchester Road
Ottawa, Ontario
K0A 1L0

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Ottawa, Ontario

December 7, 2020 – Rev 1
Project: 61118.03

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# 1.0 INTRODUCTION

GEMTEC Consulting Engineers and Scientists Limited (GEMTEC) was retained by Playvalue Toys to carry out a scoped hydrogeological evaluation, terrain analysis and provide a site-specific water balance in response to comments made by the City of Ottawa Hydrogeology group and the Mississippi Valley Conservation Authority (MVCA) during the pre-application consultation meeting for the proposed Playvalue Toys Phase 2 Expansion at 130 David Manchester Road, Ottawa held on June 16, 2020. The site location is provided on Figure 1, which is located following the text of this report.

Based on available information and items noted by the hydrogeology group and MVCA, the purpose of the Hydrogeological Investigation and Terrain Analysis is as follows:

- Confirm that the condition of the well is in accordance with the Ministry of Environment, Conservation and Parks (MECP) requirements;
- Confirm that the quality of the well water meets the Ontario Drinking Water Standards and maximum treatable limits prescribed in MECP Procedure D-5-5;
- Confirm that the quantity of water following the construction of the proposed addition will meet the MECP requirements;
- Confirm that the septic impact assessment meets the MECP requirements; and,
- Complete a groundwater water balance to confirm that the proposed addition will not adversely affect the moderate to high recharge area and that storm water management measures will be implemented in order to meet infiltration targets set in the Carp Subwatershed Study if required.

# 2.0 SITE BACKGROUND

## 2.1 Project Description

Based on the overview of the proposed Phase 2 expansion, the proposed addition consists of the construction of a 1-storey warehouse of approximately 1,782 $m^2$, which will slightly more than double the current building surface area. No staff changes are anticipated therefore no additional water or septic demand is anticipated. The existing water demand, well and septic system are therefore expected to remain unchanged.

The site is currently developed with the existing Playvalue Toys building (1,283 $m^2$) and asphalt access road and parking lots around the building. The property also features an existing water supply well and septic system. The total site area is 16,470 $m^2$.

## 2.2 Site Geology

Surficial geology maps (Ontario Geological Survey, 2010) indicate that the site is underlain by coarse-textured glaciomarine deposits consisting of sand, gravel, minor silt and clay overlying

relatively shallow bedrock in the western portion of the site and Paleozoic bedrock outcrops in the eastern portion of the site. The Ontario Geological Survey map of the Paleozoic Geology of Southern Ontario (2007) indicates that bedrock consists of limestone of the Bobcaygeon formation at depths ranging from ground surface to less than 3 m below ground surface. Available karst mapping (Brunton and Dodge, 2008) indicates the presence of inferred or potential karstic features at the site and surrounding area.

### 2.3 Background Studies

A number of available background reports were reviewed as part of this investigation, including:

- "Hydrogeological Assessment Report, 130 David Manchester Road, Carp, Ontario" prepared by McIntosh Perry Consulting Engineers Ltd. and dated March 2011 (ref: CP-10-124). This report is referred to herein as the "Hydrogeological Assessment Report".
- "Pre-Application Consultation Meeting Notes, Property Address: 130 David Manchester Road" dated Tuesday, June 16, 2020 (ref: PC2020-0133). This document will herein be referred to as the "Pre-Application Consultation Meeting Notes".

Based on the background reports, the site is located within an area of moderate to high recharge that is considered hydrogeologically sensitive and falls within the Carp subwatershed. Given the significance of recharge in this area, infiltrations targets from the Carp Subwatershed Study must be met or a local scale water budget setting site-specific infiltration targets must be prepared.

### 2.4 Additional Study Completed by Houle Chevrier and GEMTEC

The studies completed by Houle Chevrier and GEMTEC for the subject site include:

- "Geotechnical Investigation, Proposed Commercial Building, 130 David Manchester Road, Ottawa, Ontario" prepared by Houle Chevrier Engineering Ltd. and dated April 18, 2012 (ref: 12-066). This report will herein be referred to as the "Geotechnical Investigation Report"
- "Addendum - Geotechnical Investigation, Proposed Commercial Building, 130 David Manchester Road, Ottawa, Ontario" prepared by Houle Chevrier Engineering Ltd. and dated September 12, 2012 (ref: 12-066). This report will herein be referred to as the "Addendum Report"
- "Geotechnical Comments, Proposed Addition, 130 David Manchester Road, Ottawa, Ontario" prepared by GEMTEC and dated September 4, 2020 (ref: 61118.03). This report will herein be referred to as the "Geotechnical Comments letter".

The relevant subsurface information from the geotechnical investigation is discussed in the terrain analysis section below. The Geotechnical Comments letter confirmed that findings of the Geotechnical Investigation report and Addendum report are applicable to the proposed expansion

given that the future expansion was identified and covered in the scope of work at the time of the investigations in 2012.

## 3.0 TERRAIN ANALYSIS

### 3.1 Subsurface Conditions

The subsurface conditions at the subject site are described in the geotechnical investigations completed by Houle Chevrier. The field work for the geotechnical investigation was carried out on March 30, 2012 and August 30, 2012. Six test pits numbered 12-1 to 12-6 were advanced across the subject site in March and thirteen test pits numbered 12-1A to 12-13A were completed in August 2012. Practical test pit refusal was encountered at depths between about 0.2 and 1.8 metres below ground surface level. The results of the boreholes and test pits are provided on the Record of Borehole and Test Pit sheets in Appendix B. The test pit logs indicate the subsurface conditions at the specific test locations only. Boundaries between zones on the logs are often not distinct, but rather are transitional and have been interpreted. Subsurface conditions at other than the test pit locations may vary from the conditions encountered in the test pits. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site.

The locations of the test holes are shown on the Site Plan, Figure 1. The overburden thickness map is shown on Figure 2. Areas where bedrock was encountered at or near surface are shown on Figure 3.

A summary of the soil conditions, based on the geotechnical investigation, are summarized below.

**Topsoil**

Topsoil was encountered from ground surface in all of the test pits. The topsoil has a thickness of ranging from approximately 10 to 36 centimetres. Topsoil was encountered at all test pit locations except test pit 12-10A where sand was present at surface.

**Fine to Medium Sand/Silty Sand**

A deposit of fine to medium grained sand with silt to silty sand was encountered below the topsoil in all test pits except 12-2, 12-4A, 12-5 and 12-6A where no sand was present and in 12-10A where fine to medium grained sand was observed at surface. The fine to medium grained sand with silt to silty sand is brown to dark brown in colour and contains some roots as well as trace gravel. The thickness of the fine to medium grained sand with silt to silty sand deposit is about 0.1 to 0.6 metres across the site.

**Fine to Coarse Sand**

A deposit of fine to coarse sand with gravel and cobbles was encountered in beneath the fine to medium grained sand with silt to silty sand unit, except in test pits 12-8A and 12-12A. The fine to

coarse sand deposit has a thickness ranging from approximately 0.2 and 1.1 metres and extends to the bedrock surface. The sand and gravel is brown in colour and contains some cobbles and trace silt.

**Bedrock**

Practical excavator refusal occurred in all of the test pits between 0.2 and 1.8 metres below ground surface (elevation 135.3 to 136.5 metres).

It should be noted that practical auger refusal can sometimes occur within cobbles and boulders and may not necessarily be representative of the upper surface of the bedrock.

### 3.2 Groundwater Levels

Based on subsurface conditions described in the Geotechnical Investigation report and Addendum report, all of the test pits were dry upon completion of excavating, with the exception of two test pits where groundwater was observed at a depth of approximately 1.0 m below ground surface on March 30, 2012, translating to groundwater elevations of 136.3 and 136.1 m.

## 4.0 GROUNDWATER SUPPLY ASSESSMENT REVIEW

### 4.1 Background Water Well Records

As part of Mcintosh Perry's hydrogeological assessment for the construction of the existing on-site water supply well, a search of the Ministry of Environment, Conservation and Parks (MECP) water well records (https://www.ontario.ca/environment-and-energy/map-well-records) was conducted and returned 4 water well records within 500 metres of the subject site. Details pertaining to these records are provided in MacIntosh Perry's Hydrogeological Assessment Report. The well depths range from 36.6 to 44.2 metres below ground surface, with an average well depth of 40.2 metres. The recommended pumping rates provided by the well drillers ranged from 22.7 to 66.6 litres per minute, with an average of 48.4 litres per minute.

Of the 41 well records located within 500 metres of the site, 13 are located in the adjacent West Lake Estates residential subdivision. A review of the well construction details indicates that the majority of wells within the subdivision are completed in the limestone bedrock.

### 4.2 On-Site Test Well Construction

A water supply well (Well Tag No. A099470) was constructed at 130 David Manchester Road on January 28, 2011, by a licensed MECP well contractor (Wilf Hall and Sons Water Well Drilling; Licence No. 2558). The approximate location of the water well is provided on the Site Plan, Figure 1. A copy of the MECP Water Well Record is provided in Appendix C.

The construction details from the MECP Water Well Record are summarized in Table 1:

**Table 1: On-Site Water Well Construction Details**

| Well Construction Details – Well ID A099470 | |
|---|---|
| Depth to Bedrock | 1.5 metres |
| Length of Well Casing | NA(1) |
| Length of Well Casing Above Ground Surface | NA(1) |
| Length of Well Casing Below Ground Surface | 13.4 metres |
| Length of Well Casing Set Into Bedrock | 11.9 metres |
| Depth Water Found | NA(1) |
| Total Well Depth | 91.4 metres |
| Overburden Description | Sand/gravel |
| Bedrock Description | Black/grey limestone |

Note: 1. Measurement not provided on the Water Well Record

Probably due to the shallow bedrock conditions encountered on-site, ranging from surface to 1.8 metres below ground surface, the well casing was extended from the minimum MECP requirements of 6 metres to 13.4 metres below ground surface. The extended well casing recommendation is typically provided to reduce potential impacts from surface. From a well construction point of view, the construction of the existing water supply well appears suitable for the hydrogeological setting at the site.

### 4.3 Groundwater Quantity

A pumping test was carried out on the water well by McIntosh Perry on February 3, 2011. The well was pumped at a rate of 14 to 18.5 litres per minute (average of 15 litres per minute) for a period of seven hours. The water discharge was directed away from the pumping well and was allowed to flow overland across the subject property. At the time of the pumping test, the ground was snow covered and the weather was cold (-20°C to -6°C).

Water level and flow rate measurements were taken at regular intervals throughout the pumping test. Water levels were also taken during the recovery phase of the pumping test (after the pump was turned off). The pumping test drawdown and recovery graph from the Hydrogeological Assessment report are provided in Appendix D.

During the pumping test the water level decreased approximately 18.1 metres from a static water level of 2.40 metres below ground surface and stabilized, following approximately 180 minutes of pumping. During the completion of the test, approximately 6,000 litres of water were pumped from the well. Greater than 95% recovery in water level was achieved in approximately 513 minutes following stoppage of the pump. Full recovery was achieved in approximately 1300 minutes.

The transmissivity of the water supply aquifer was estimated by McIntosh Perry from the pumping test drawdown data using Aquifer WIN32 software. The pumping test data was analyzed using the Theis (1935) solution (confined aquifer) and Hantush (1964) solution (leaky aquifer in confined conditions). The results of the Aquifer WIN32 analyses carried by McIntosh Perry are provided in Appendix D.

The Theis and Hantush analyses indicate that the transmissivity of the water supply aquifer is calculated to be $6.0 \times 10^{-6}$ $m^2/s$ and $4.0 \times 10^{-6}$ $m^2/s$, respectively. The maximum drawdown in the water level of the well was approximately 18.1 metres following 7 hours of pumping at an average flow rate of 15 litres per minute. Based on a static water level of 2.4 metres below ground surface, the total well depth of 91.4 metres, a recommended pump depth of 61 metres and the water level after 7 hours of pumping, the remaining available drawdown in the well is approximately 42.9 metres.

As mentioned in the Pre-Application Consultation Meeting Notes, no changes in water demand are anticipated as a result of the proposed development. It is therefore anticipated that the maximum water demand will not exceed 4,000 litres per day. As indicated above, approximately 6,000 litres of water were pumped during the pumping test, which significantly exceeds the maximum daily demand of 4,000 litres while maintaining approximately 43 metres of available drawdown and fully recovering in less than 24 hours. It is therefore GEMTEC's opinion that the current water supply well is adequate to meet the water demand, even after the construction of the proposed expansion.

### 4.4 Groundwater Quality

Due to the configuration of the water system at the site including the water supply well and a large cistern initially filled with City water, the collection of a raw groundwater sample at this time was not practical. The assessment of groundwater quality was therefore performed using water quality data obtained my McIntosh Perry during the completion of their pumping test.

Water samples were collected by McIntosh Perry in the middle and at the end of the seven hours of pumping and were submitted for analysis of parameters listed in a subdivision package. The results of the laboratory analysis on the water samples are presented in detail in the Hydrogeological Assessment Report. The following comments are provided regarding the drinking water quality and exceedances of the Ontario Drinking Water Quality Standards (ODWQS):

**Bacteriological Results**

Total chlorine measurements at the time of bacteriological sampling confirmed that total chlorine concentrations in the groundwater were non-detectable.

The results of the bacteriological analysis of the February 3rd, 2011 water samples indicate that the water samples met all the standards of the ODWQS for bacteriological parameters. In addition, the concentration of other bacteria indicator species such as fecal coliform, were determined to be non-detectable in all of the water samples.

Based on the bacteriological testing, the water is suitable for consumption.

**Maximum Acceptable Concentrations Exceedances**

The results of the chemical testing on the water samples indicate that Maximum Acceptable Concentrations (MAC) were exceeded for fluoride (TW1-1) and turbidity (TW1-1 and TW1-2) and the sodium (TW1-1) concentrations exceeded the ODWQS warning level of 20 mg/L for persons on sodium restricted diets but were below the MAC of 200 mg/L.

The fluoride exceedance was marginal at 1.89 mg/L over its MAC of 1.5 mg/L and fluoride was interpreted to be of natural origin and may have been the result of elevated total suspended solids in the initial sample as the fluoride concentration decreased below the MAC to 0.91 mg/L in the 7-hour sample.

Turbidity was initially found in exceedance of the MAC of 1.0 NTU at 75.2 NTU (TW1-1), and reduced to 2.4 NTU in the 7-hour sample, which exceeds the MAC but is within treatability limits. It was noted that the well was tested shortly after construction and that turbidity would decrease with long term use and it should not be a problem for water treatment, should it be needed. Turbidity is therefore not considered a problem for the development.

The sodium concentration in TW1-1 initially exceeded the warning level of 20 mg/L for persons with sodium-restricted diets at 127 mg/L, but it remained below the MAC of 200 mg/L. Sodium concentrations decreased to 17 mg/L as the pumping test progressed and it was therefore not considered a problem for the water supply.

**Operational Guidelines and Aesthetic Objectives Exceedances**

Groundwater sampling completed as part of the pumping test indicated exceedances of operational guidelines (OG) and aesthetic objectives (AO) for multiple parameters including colour (AO), hydrogen sulphide (AO), total dissolved solids (AO), hardness (OG) and iron (AO). Although these parameters exceed their respective AO or OG, they were found at treatable concentrations. Detailed results for those parameters are available in the Hydrogeological Assessment report.

### Water Treatment

Based on analytical results obtained during the pumping test conducted by McIntosh Perry, GEMTEC concurs with McIntosh Perry's recommendation for disinfection and aesthetic water softening treatment. Given the high hardness and current sodium concentrations, GEMTEC also recommends the use of potassium salt in order to prevent generating excessive sodium concentrations in drinking water.

## 5.0 IMPACT ASSESSMENT

The impact on groundwater and surface water resources due to wastewater treatment and disposal by the onsite sewage disposal system on the subject site was assessed in the Hydrogeological Assessment Report. The water demand and septic flows are not expected to change with the addition of the new building given that no significant staffing changes are expected. Based on the surface area of the property exceeding 1.6 hectare, the lot size was deemed sufficient to accommodate the original development septic system without adversely impact the aquifer groundwater quality with nitrate outside of the property limits.

### 5.1 Groundwater Impacts

The original development comprised the construction of impervious structures and surfaces such as the existing building, parking lots and loading bays, which resulted in the addition of an impervious surface over a total surface area of 4,793 $m^2$. The proposed development including the addition of the warehouse and the extension of the loading area and widening of the site entrance will result in an increase of the impervious surface area by 1,958 $m^2$ for a total of 6,741 $m^2$. Given that the surface area of the entire property is 16,470 $m^2$, the remaining total surface area available for infiltration after the completion of the additional development will be 9,719 $m^2$, which is almost 1 hectare and above 0.8 hectare. Given that the water demand and septic flows at the property are not expected to change, this area should still be sufficient to attenuate nitrate concentrations resulting from the presence of the septic system. Furthermore, as discussed in section 5.2 below, the site falls within a moderate to high recharge area and measures are taken to manage storm water and promote infiltration in order to maintain the water balance at the site. These measures will increase the effective area for infiltration and, as a result, will increase infiltration volumes and promote dilution of nitrates on the property, increasing the conservativeness of the septic impacts assessment above.

### 5.2 Hydrogeological Sensitivity

Areas of thin soils cover, fractured bedrock exposed at ground surface and karst environments contribute to hydrogeological sensitivity of the site, which may not allow for sufficient attenuative processes for on-site septic systems and negatively impact the receiving aquifer. Areas of thin soil cover, generally taken to be less than two metres, were encountered at the subject site and the overburden thickness is expected to range from 0 to 1.8 metres across the site (Figure 2). Karst mapping (Brunton and Dodge, 2008) indicates the presence of inferred or potential karstic

features, however no karstic features were observed on-site on limited bedrock exposures during the geotechnical investigation. As highlighted by the Mississippi Valley Conservation Authority and documented in the Pre-Application Consultation Meeting Notes provided in Appendix F, the site falls within a moderate to high infiltration area identified as part of the Carp River Watershed Study. Based on the thin drift thickness, the potential presence of karstic features and the site location within a moderate to high recharge area, the site is considered hydrogeologically sensitive.

Based on the MECP water well records in the vicinity of the subject site and the overburden thickness observed during the geotechnical investigations, the receiving aquifer for the septic effluent is the limestone bedrock aquifer. The groundwater samples TW1-1 and TW1-2 reported low background nitrate concentrations of <0.1 mg/L. Protective measures such as a clay liner beneath the septic system, increased well casing and increased separation distance between well and septic were recommended in the Hydrogeological Assessment Report to reduce potential impacts from septic effluent. Those recommendations appear to have been implemented based on the well construction featuring an extended well casing to a depth in excess of 13 metres below ground surface and the location of the septic system far on the southeastern portion of the property.

## 6.0 WATER BALANCE

The subject site is located within an area of moderate to high groundwater recharge area based on available Carp River Watershed Study. Pre, current and future development water budgets were calculated for the subject site in order to assess the additional groundwater impact of the proposed warehouse development.

### 6.1 Water Balance Method

The water balance of the site was assessed, based on the following equation:

**Mean Annual Precipitation – Change in Groundwater Storage – Evapotranspiration = Runoff + Infiltration**

where:

- Mean annual precipitation is based on data provided by Environment Canada, from the Ottawa Int A weather station for the period of 1939-2013 and Carlton Place – Appleton weather stations for the period of 1984-2006. The Ottawa Intl A and Carleton-Place – Appleton weather station are located approximately 25 and 14 kilometres from the subject site, respectively.

- Long term changes to groundwater storage are assumed to be negligible. Short term or seasonal changes are anticipated to balance out (e.g. increased groundwater recharge following spring freshet, followed by dry conditions in the summer months).

- Evapotranspiration is calculated based on the Thornthwaite and Mather (1955) model, run by Environment Canada. The technical documentation provided by Environment Canada is titled “Water Balance Tabulations for Canadian Climate Stations”, written by K.Johnstone and P.Y.T. Louie, Hydrometeorology Division, Canadian Climate Centre, Atmospheric Environmental Services (undated).

The hydrologic factors used to estimate infiltration, such as topography, soil, cover and water holding capacities are based on the Ministry of Environment (MOE) Stormwater Management Planning and Design Manual Section 3.0 (MOE, 2003) and the Ministry of the Environment and Energy (MOEE) Hydrogeological Technical Information Requirements for Land Development Applications (MOEE, 1995).

### 6.2 Pre-Development

The subject site covers an area of 16,392 $m^2$ and is currently developed, featuring the Playvalue Toys building and associated paved parking lot and loading areas. However, in order to quantify impacts to groundwater of the existing and future development, infiltration during pre-development conditions was also estimated. For the pre-development scenario, soil conditions consist of fine to coarse sand / silty sand to sand and gravel. The site is vegetated with grasses and shrubs, along with trees lining the northern and southern portion of the site. The subject site is generally flat, with a gentle slope to the south. Based on the site characteristics, the infiltration factor is estimated to be 0.70, based on the following:

- Topography factor of 0.2 – rolling land with an average slope between 2.8 m to 3.8m /km;
    - The site is generally flat, with steep gentle slope to the south.
- Soil factor of 0.4 – open sandy loam; and,
    - On-site soils characterized as fine to medium sand / silty sand to sand and gravel (high permeability).
- Cover factor of 0.1 – Cultivated land.
    - The site surface consists of topsoil, bedrock and short grasses.

An estimated water holding capacity of 100 mm was selected from Table 3.1 of the MOE Stormwater Management Planning and Design Manual (MOE, 2003). The site vegetation is classified as pasture and shrubs underlain by fine sandy loam. For areas where bedrock was at surface or covered with less than 0.3 m of topsoil or sand, the water holding capacity of bedrock was estimated at 50 mm.

### 6.3 Current Development

The subject site currently occupied by the main Playvalue Toys building and associated paved parking lot and loading areas. The building and paved areas constitute impervious surfaces preventing infiltration over surface areas of 1,283 $m^2$ and 3,310$m^{2,}$ respectively, for a total of 4,793 $m^2$ (Figure 1). Based on the current site development site characteristics, there are no changes to the estimated infiltration factor for vegetated areas, which remains to be 0.70. The proposed building and paved parking and loading areas (29% coverage) are considered to be impervious and the infiltration factor for those surfaces is 0. Based on the landscaping of the existing soils and presence of sand cover and bedrock at/near surface (Figure 3), a weight averaged water holding capacity was estimated at 96 mm for the site (based on 15,231 $m^2$ of sandy soils and 1,239 $m^2$ of bedrock at/near surface). The post-development site vegetation is classified as urban lawn underlain by fine sand.

### 6.4 Future Development

The post-development conditions at the subject site will consist of 3,064 $m^2$ of buildings including the existing building and the proposed warehouse, and an extended parking area of 3,686 $m^2$. The remaining vegetated areas are anticipated to be landscaped similarly to current development conditions (Figure 1). Based on the anticipated post-development site characteristics, there are no changes to the estimated infiltration factor for vegetated areas, which remains to be 0.70. The proposed expanded building and paved parking and loading areas (41% coverage) are considered to be impervious and the infiltration factor for those surfaces is 0. Based on the landscaping of the existing soils and presence of sand cover and bedrock at/near surface (Figure 3), a weight averaged water holding capacity was estimated at 96 mm for the site (based on 15,231 $m^2$ of sandy soils and 1,239 $m^2$ of bedrock at/near surface). The post-development site vegetation is classified as urban lawn underlain by fine sand.

### 6.5 Water Balance Summary

Based on the water balance calculations and not considering stormwater management measures enhancing infiltration, the annual infiltration volumes would decrease from 4,219 $m^3$ to 2,991 $m^3$ to 2,490 $m^3$ following the two stages of development. As a result, runoff would increase from 1,808 $m^3$ to 4,775 $m^3$ to 5,988 $m^3$ post-development. The hydrologic factors and the water balance calculations are provided in Appendix G. The pre, current and post-development infiltration and runoff factors are summarized in Table 2.

According to the Carp River Watershed Study, infiltration targets of 262 mm/year and 104 mm/year must be maintained for sand and gravel and for Paleozoic bedrock, respectively. The water budget for the pre-development conditions indicates infiltration of 254 mm/year for fine to coarse-grained sand and up to 281 mm/year for the Paleozoic bedrock. A weighted average infiltration target of 256 mm was calculated for the site where the sand deposits cover

approximately 92% of the surface area of property and limestone/thin soils over limestone covers the remaining 8%.

**Table 2: Water Balance Summary**

| Summary | Infiltration (mm/year) | Runoff (mm/year) | Infiltration ($m^3$/year) | Runoff ($m^3$/year) |
|---|---|---|---|---|
| Pre-Development | 256 | 110 | 4219 | 1808 |
| Current Development | 182 | 290 | 2991 | 4775 |
| Future Development | 151 | 364 | 2490 | 5988 |
| Change Current Development[1] | -75 | 180 | -1227 | 2967 |
| Change Future Development[1] | -105 | 254 | -1729 | 4180 |

Notes: 1. Weighted averages based on area (refer to Appendix F).

## 7.0 CONCLUSIONS AND RECOMMENDATIONS

### 7.1 Conclusions

Based on the results of this investigation, the following conclusions are provided:

- The surficial soils encountered at the subject site consist of fine to medium grained sand / silty sand and sand and gravel material, ranging in thickness from 0.2 to 1.8 metres below ground surface. The site is considered to be hydrogeologically sensitive and protective measures are recommended to minimize potential impacts to the water supply aquifer.

- The existing water supply well is capable of providing at least 6,000 litres per day, which is greater than the anticipated maximum water demand of 4,000 litres per day as per the Hydrogeological Assessment Report. The maximum drawdown in the water level of the well was approximately 18.1 metres following 7 hours of pumping at an average flow rate of 15 litres per minute.  the total well depth of 91.4 metres, a recommended pump depth of 61 metres and the water level after 7 hours of pumping, the remaining available drawdown in the well is approximately 42.9 metres. The water demand will not be affected by the proposed expansion therefore the findings of the Hydrogeological Assessment Report pertaining to water supply remain applicable.

- The groundwater quality exceeds the ODWQS for the maximum acceptable concentrations for tudbidity and fluoride (first sample only), the operational guideline for hardness, the aesthetic objectives for total dissolved solids, colour, hydrogen sulphide and

iron, and the warning levels for sodium. However, all concentrations are within treatable limits.

- The subject site is considered to be hydrogeologically sensitive due to thin soils encountered on-site. The on-site water supply well casing extends to a total depth of 13.4 metres below ground surface, of which 11.9 metres are installed into bedrock as a protective measure. Background nitrates in the water supply aquifer was measured to be less than 0.1 mg/L.

- The impact on groundwater and surface water resources due to wastewater treatment and disposal by the onsite sewage disposal system on the subject site was assessed in the Hydrogeological Assessment Report. The water demand and septic flows are not expected to change with the addition of the new building. The main changes to groundwater impacts would be related to a decrease of infiltration due to the addition of impervious surfaces. However, the surface area available for infiltration in the post-development setting remains above one hectare, which should be sufficient to prevent unacceptable nitrate impacts to the aquifer. Furthermore, measures taken to manage storm water and promote infiltration in order to maintain the water balance at the site will also contribute to the attenuation of nitrates.

- Based on the water balance calculations and not considering stormwater management measures enhancing infiltration, the annual infiltration volumes would decrease from 4,219 $m^3$ to 2,991 $m^3$ to 2,490 $m^3$ following the two stages of development. As a result, runoff would increase from 1,808 $m^3$ to 4,775 $m^3$ to 5,988 $m^3$ post-development. The subject site is located within an area of low to moderate groundwater recharge area based on available Carp River Watershed Study and pre-development infiltration should be maintained in order to maintain recharge to the bedrock aquifer.

    - Low impact development (LID) and stormwater management measures are present at the site in order to maintain pre-development infiltration rates. GEMTEC reviewed the Servicing and Stormwater Management Report written by Capital Engineering Group Ltd. (November 30, 2020) and their Erosion & Sediment Control Plan G2 and it is GEMTEC's opinion that the existing retention areas and grass swales are adequate to maintain infiltration and meet infiltration targets at the site.

### 7.2 Recommendations

Based on the results of this investigation, the following water supply, septic system and groundwater impact mitigation measures recommendations are provided:

**Water Supply Recommendations**

- Given that the water demand is not anticipated to change and that it was not practical to conduct additional raw groundwater sampling at the site due to the configuration of the water distribution system at the site, GEMTEC recommends following water treatment recommendations presented in McIntosh Perry's Hydrogeological Assessment Report.
- If the water demand will be increased above current water takings in the future, a new hydrogeological assessment must be conducted to reassess the capacity of the well to meet the increased demand and the water quality at higher pumping rates.

**Septic System Recommendations**

- Given that the water demand and septic flows are not anticipated to change and that the surface area available for infiltration in the post-development setting remains above one hectare, no actions pertaining to the septic system are required at this time.
- If the water demand and septic flows are increased in the future, a new hydrogeological assessment must be conducted to reassess the impacts of the septic system to the aquifer and the potential need for a new septic system.

**Groundwater Impact Mitigation Recommendations**

- Low Impact Development (LID) and stormwater management measures present at the site to maintain pre-development infiltration rates of 256 mm/year. The post-development infiltration rates without those measures are calculated to be 157 mm/year, therefore the existing retention areas and grass swales should be maintained.

- The post-development water balance indicates significant increase in runoff, which is diverted to grass swales and stormwater retention areas. The stormwater grass swales and retention areas should remove 80% TSS. Based on their Servicing and Stormwater Management Report and Erosion & Sediment Control Plan G2, Capital Engineering Group Ltd. proposes adding check dams as per OPSD 219.211 in the grass swales, which should improve TSS removal to 80%. Potential impacts from contaminant sources include winter maintenance (road salting) and fuel spills from the repair shop. It is recommended that BMP for road salting and fuel storage/spills be followed.

    - It is recommended that the best management practices for the application of road salts should follow the City of Ottawa's "Material Application Policy, Revision 3.2, October 31, 2011" Salt Management Plan.
    - It is recommended that the best management practices for fuel storage follow the Liquid Fuels Handling Code and the Ontario Water Resources Act.
    - It is recommended that best management practices be implemented for waste treatment.

- It is recommended that a spills prevention and management plan be prepared to protect the vulnerable aquifer which is used as a drinking water source for adjacent developments.

## 8.0 LIMITATIONS OF REPORT

This report was prepared for Playvalue Toys and is intended for the exclusive use of Playvalue Toys. This report may not be relied upon by any other person or entity without the express written consent of GEMTEC and Playvalue Toys. Nothing in this report is intended to provide a legal opinion.

The investigation undertaken by GEMTEC with respect to this report and any conclusions or recommendations made in this report reflect the best judgments of GEMTEC based on the site conditions observed during the investigations undertaken at the date(s) identified in the report and on the information available at the time the report was prepared. This report has been prepared for the application noted and it is based, in part, on visual observations made at the site, subsurface investigations at discrete locations and depths and laboratory analyses of specific chemical parameters and material during a specific time interval, all as described in the report. Unless otherwise stated, the findings contained in this report cannot be extrapolated or extended to previous or future site conditions, portions of the site that were unavailable for direct investigation, subsurface locations on the site that were not investigated directly, or chemical parameters, materials or analysis which were not addressed.

Should new information become available during future work, including excavations, borings or other studies, GEMTEC should be requested to review the information and, if necessary, re-assess the conclusions presented herein.

We trust that this report is sufficient for your purposes. If you have any questions or require additional information, please contact the undersigned.

Jean-Philippe Gobeil, M.Sc., P.Geo.
Senior Hydrogeologist

PROFESSIONAL GEOSCIENTIST
JEAN-PHILIPPE GOBEIL
PRACTISING MEMBER
3194
03 Dec 2020
ONTARIO

Shaun Pelkey, M.Sc.E., P.Eng.
Principal, Environmental Engineer

## 9.0 REFERENCES


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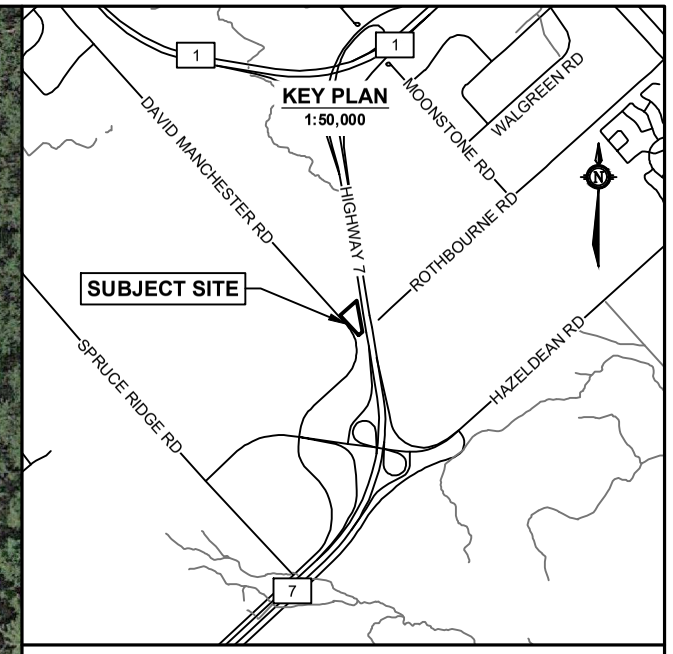



**LEGEND**

- TEST PIT LOCATION IN PLAN (current investigation by GEMTEC)
- BH/TP # — BH/TP ID
- XX.XX — GROUND SURFACE ELEVATION, IN METRES GEODETIC DATUM
- PROPERTY LINE

Scale 1:1250

0 25 50 75m

GEMTEC
CONSULTING ENGINEERS AND SCIENTISTS
32 Steacie Drive
Ottawa, ON K2K 2A9
Tel: (613) 836-1422
www.gemtec.ca
ottawa@gemtec.ca

Drawing: SITE PLAN

Client: PLAYVALUE TOYS

Project: 61118.03

HYDROGEOLOGICAL ASSESSMENT AND TERRAIN ANALYSIS
PHASE 2 EXPANSION
130 DAVID MANCHESTER DRIVE
OTTAWA, ONTARIO

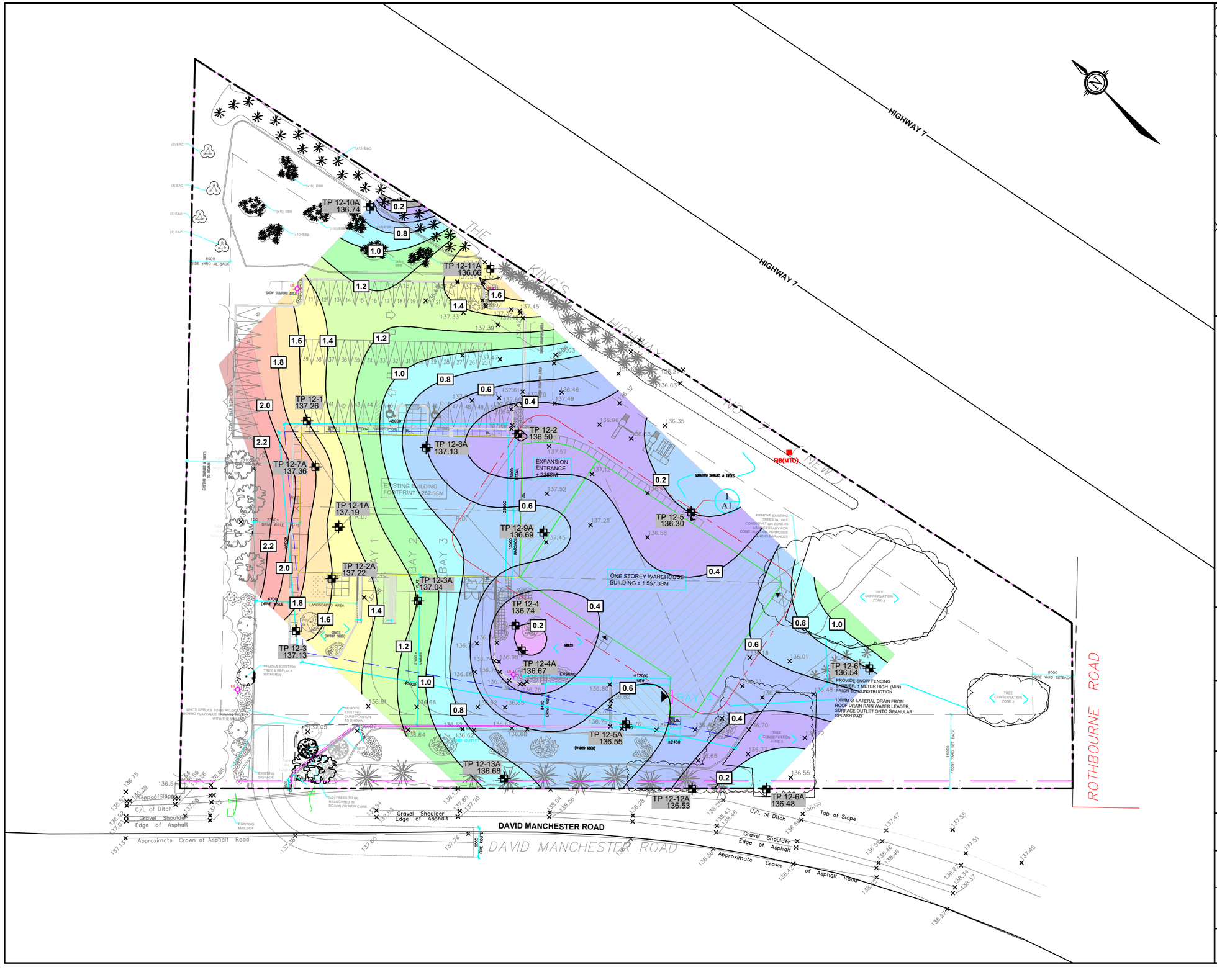
Drwn by: S.L.

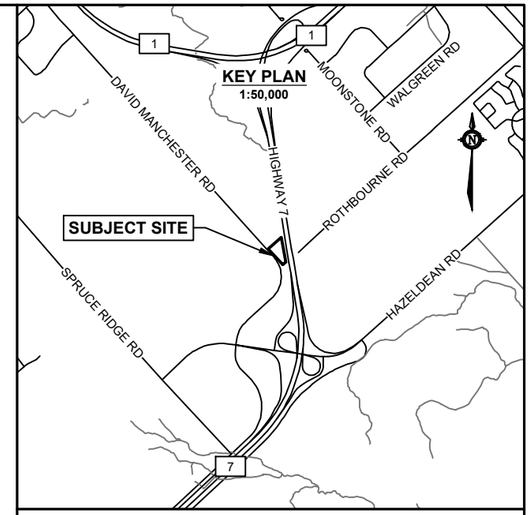
Chkd by: J.P.

Date: NOVEMBER, 2020

Rev.: 0

**FIGURE 1**




**LEGEND**

- TEST PIT LOCATION IN PLAN (current investigation by GEMTEC)
- BH/TP # — BH/TP ID
- XX.XX — GROUND SURFACE ELEVATION, IN METRES GEODETIC DATUM
- PROPERTY LINE
- 1.0 — DRIFT THICKNESS CONTOUR, IN METRES

Scale 1:1250

0 25 50 75m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CONSULTING ENGINEERS AND SCIENTISTS
32 Steacie Drive
Ottawa, ON K2K 2A9
Tel: (613) 836-1422
www.gemtec.ca
ottawa@gemtec.ca


Drawing: DRIFT THICKNESS

Client: PLAYVALUE TOYS

Project: 61118.03

HYDROGEOLOGICAL ASSESSMENT AND TERRAIN ANALYSIS
PHASE 2 EXPANSION
130 DAVID MANCHESTER DRIVE
OTTAWA, ONTARIO

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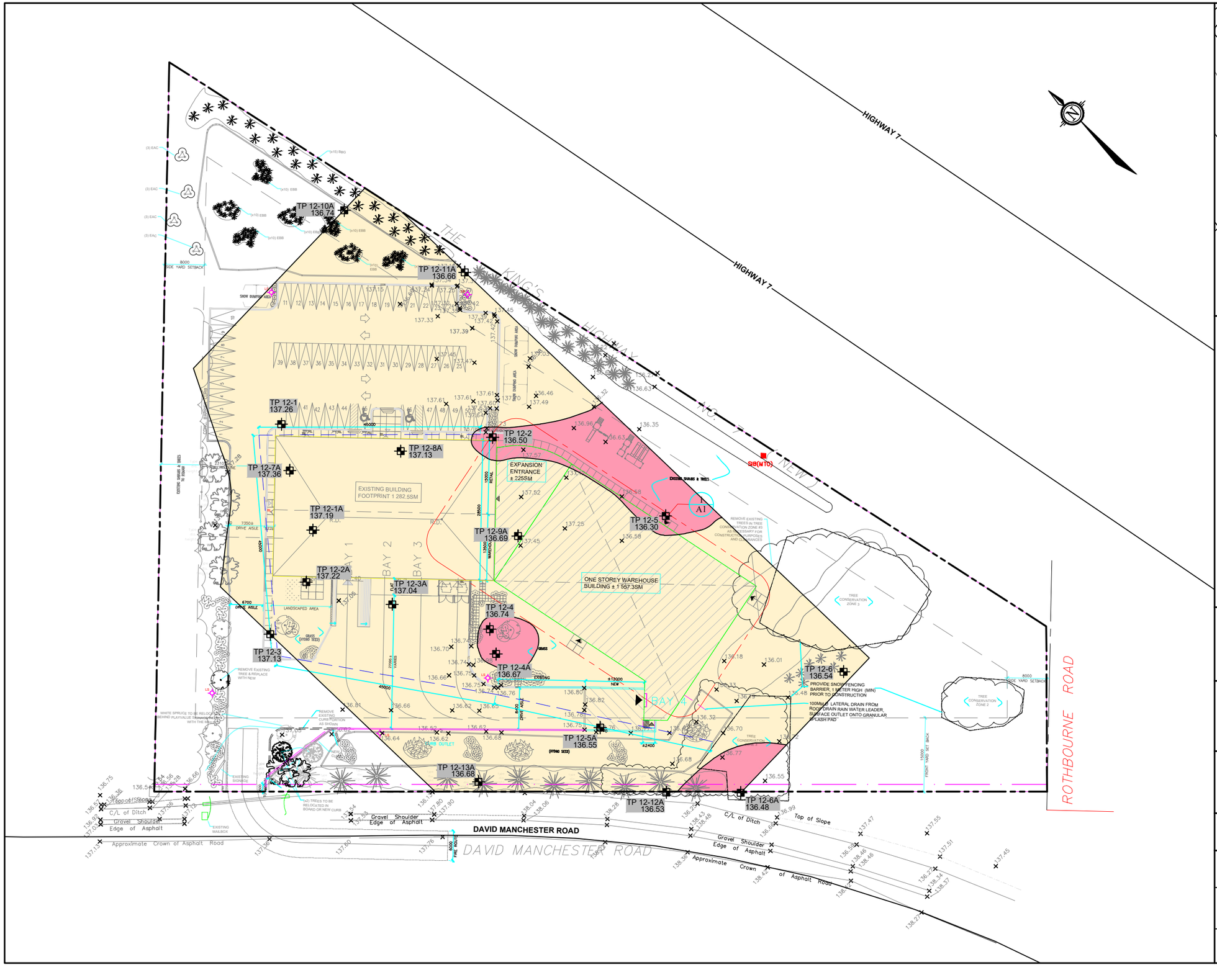
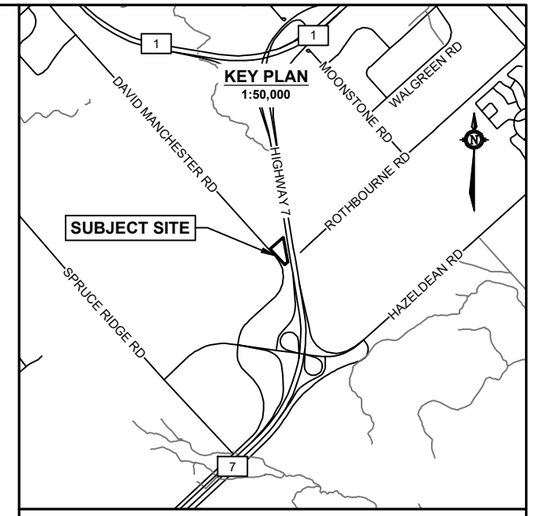
Rev.: 0

**FIGURE 2**




**LEGEND**

**TEST PIT LOCATION IN PLAN**
(current investigation by GEMTEC)

BH/TP # — BH/TP ID

XX.XX — GROUND SURFACE ELEVATION, IN METRES GEODETIC DATUM

PROPERTY LINE

BEDROCK

SAND

Scale 1:750

0 15 30 45m


GEMTEC
CONSULTING ENGINEERS AND SCIENTISTS
32 Steacie Drive
Ottawa, ON K2K 2A9
Tel: (613) 836-1422
www.gemtec.ca
ottawa@gemtec.ca


Drawing: SURFICIAL GEOLOGY

Client: PLAYVALUE TOYS

Project: 61118.03

HYDROGEOLOGICAL ASSESSMENT AND TERRAIN ANALYSIS
PHASE 2 EXPANSION
130 DAVID MANCHESTER DRIVE
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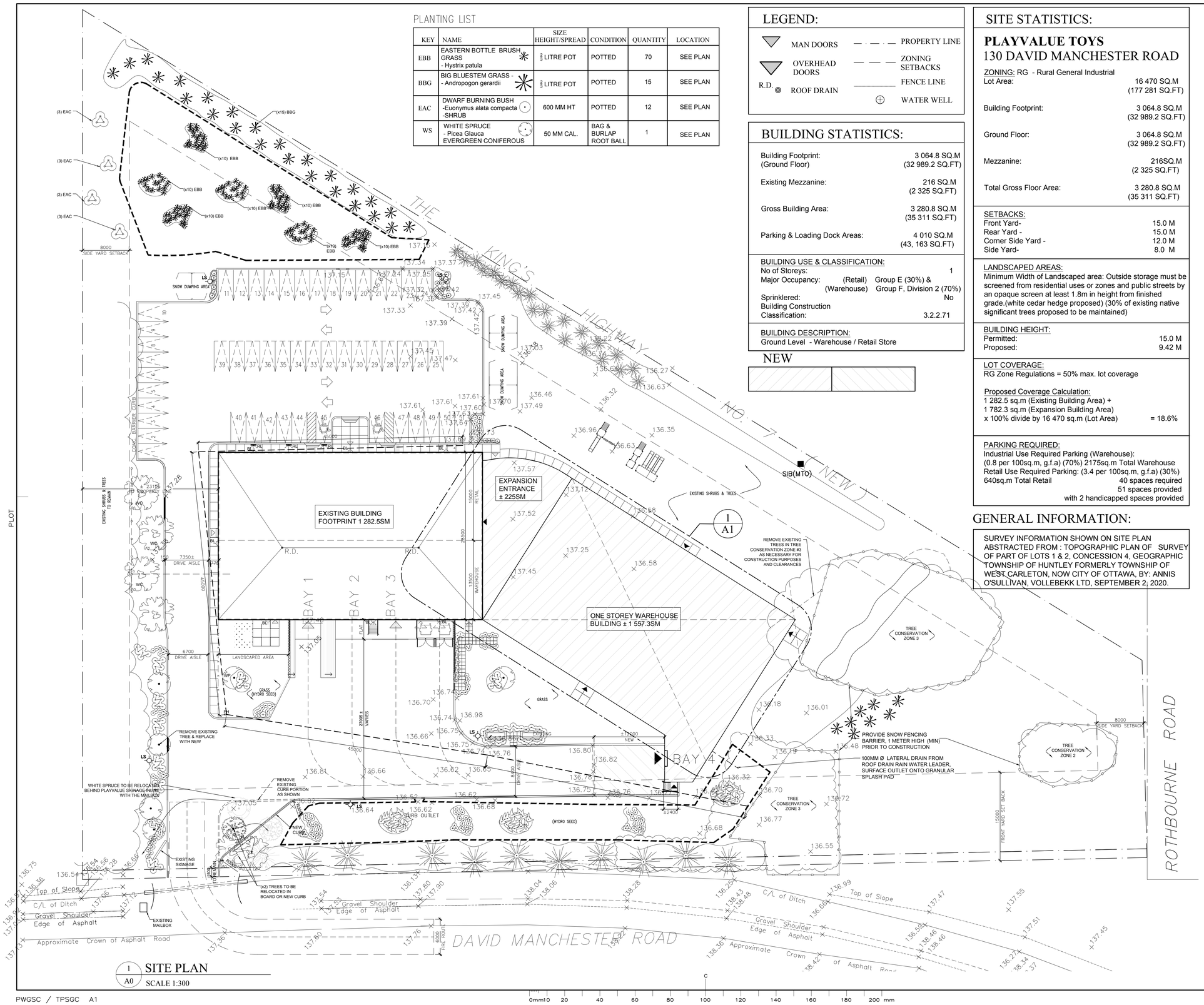
**FIGURE 3**

# APPENDIX A

Development Plan

## PLANTING LIST

| KEY | NAME | SIZE HEIGHT/SPREAD | CONDITION | QUANTITY | LOCATION |
|---|---|---|---|---|---|
| EBB | EASTERN BOTTLE BRUSH GRASS - Hystrix patula | #3 LITRE POT | POTTED | 70 | SEE PLAN |
| BBG | BIG BLUESTEM GRASS - - Andropogon gerardii | #3 LITRE POT | POTTED | 15 | SEE PLAN |
| EAC | DWARF BURNING BUSH -Euonymus alata compacta -SHRUB | 600 MM HT | POTTED | 12 | SEE PLAN |
| WS | WHITE SPRUCE - Picea Glauca EVERGREEN CONIFEROUS | 50 MM CAL. | BAG & BURLAP ROOT BALL | 1 | SEE PLAN |




1 / A0 SITE PLAN
SCALE 1:300

PWGSC / TPSGC A1

0mm 10 20 40 60 80 100 120 140 160 180 200 mm

## LEGEND:

- MAN DOORS
- OVERHEAD DOORS
- R.D. ROOF DRAIN
- PROPERTY LINE
- ZONING SETBACKS
- FENCE LINE
- WATER WELL

## BUILDING STATISTICS:

| | |
|---|---|
| Building Footprint: (Ground Floor) | 3 064.8 SQ.M (32 989.2 SQ.FT) |
| Existing Mezzanine: | 216 SQ.M (2 325 SQ.FT) |
| Gross Building Area: | 3 280.8 SQ.M (35 311 SQ.FT) |
| Parking & Loading Dock Areas: | 4 010 SQ.M (43, 163 SQ.FT) |

BUILDING USE & CLASSIFICATION:

| | |
|---|---|
| No of Storeys: | 1 |
| Major Occupancy: (Retail) (Warehouse) | Group E (30%) & Group F, Division 2 (70%) |
| Sprinklered: | No |
| Building Construction Classification: | 3.2.2.71 |

BUILDING DESCRIPTION:
Ground Level - Warehouse / Retail Store

NEW

## SITE STATISTICS:

**PLAYVALUE TOYS**
130 DAVID MANCHESTER ROAD

ZONING: RG - Rural General Industrial

| | |
|---|---|
| Lot Area: | 16 470 SQ.M (177 281 SQ.FT) |
| Building Footprint: | 3 064.8 SQ.M (32 989.2 SQ.FT) |
| Ground Floor: | 3 064.8 SQ.M (32 989.2 SQ.FT) |
| Mezzanine: | 216SQ.M (2 325 SQ.FT) |
| Total Gross Floor Area: | 3 280.8 SQ.M (35 311 SQ.FT) |

SETBACKS:

| | |
|---|---|
| Front Yard- | 15.0 M |
| Rear Yard - | 15.0 M |
| Corner Side Yard - | 12.0 M |
| Side Yard- | 8.0 M |

LANDSCAPED AREAS:
Minimum Width of Landscaped area: Outside storage must be screened from residential uses or zones and public streets by an opaque screen at least 1.8m in height from finished grade.(white cedar hedge proposed) (30% of existing native significant trees proposed to be maintained)

BUILDING HEIGHT:

| | |
|---|---|
| Permitted: | 15.0 M |
| Proposed: | 9.42 M |

LOT COVERAGE:
RG Zone Regulations = 50% max. lot coverage

Proposed Coverage Calculation:
1 282.5 sq.m (Existing Building Area) +
1 782.3 sq.m (Expansion Building Area)
x 100% divide by 16 470 sq.m (Lot Area) = 18.6%

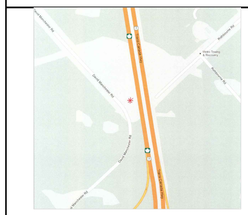
PARKING REQUIRED:
Industrial Use Required Parking (Warehouse):
(0.8 per 100sq.m, g.f.a) (70%) 2175sq.m Total Warehouse
Retail Use Required Parking: (3.4 per 100sq.m, g.f.a) (30%)
640sq.m Total Retail 40 spaces required
51 spaces provided
with 2 handicapped spaces provided

## GENERAL INFORMATION:

SURVEY INFORMATION SHOWN ON SITE PLAN ABSTRACTED FROM : TOPOGRAPHIC PLAN OF SURVEY OF PART OF LOTS 1 & 2, CONCESSION 4, GEOGRAPHIC TOWNSHIP OF HUNTLEY FORMERLY TOWNSHIP OF WEST CARLETON, NOW CITY OF OTTAWA, BY: ANNIS O'SULLIVAN, VOLLEBEKK LTD, SEPTEMBER 2, 2020.


playvalue TOYS .com

RICKSON OUTHET ARCHITECT
319 Daly Avenue
Ottawa - Ontario - K1N 6G6
613.728-1637 - FAX 613.728-8501

APPROXIMATE LOCATION

TRUE NORTH PROJECT NORTH

| revision | | date |
|---|---|---|
| 3 | REVIEW | OCT 10 20 |
| 2 | REVIEW | SEP 2 20 |
| 1 | REVIEW / PRINT | AUG 24 20 |

A detail no. no. du d?tail
B location drawing no. no. de localisation
C drawing no. no. du dessin

project / projet
PLAYVALUE TOYS
130 DAVID MANCHESTER ROAD

drawing / dessin
SITE PLAN

designed / con?u: J.G. APRIL 27 2020
drawn / dessin?: J.G. APRIL 20 20
revised / revis?: R.O APRIL 22 2020
approved / approuv?: R.O APRIL 27 20
tender / soumission: R.O TBD
project no. / no. du projet: 2020–06
drawing no. / no. du dessin: A–0

# APPENDIX B

Records of Test Pits

# LIST OF ABBREVIATIONS AND TERMINOLOGY

## SAMPLE TYPES

AS auger sample
CS chunk sample
DO drive open
MS manual sample
RC rock core
ST slotted tube
TO thin-walled open Shelby tube
TP thin-walled piston Shelby tube
WS wash sample

## PENETRATION RESISTANCE

Standard Penetration Resistance, N

The number of blows by a 63.5 kg hammer dropped 760 millimetres required to drive a 50 mm drive open sampler for a distance of 300 mm. For split spoon samples where less than 300 mm of penetration was achieved, the number of blows is reported over the sampler penetration in mm.

Dynamic Penetration Resistance

The number of blows by a 63.5 kg hammer dropped 760 mm to drive a 50 mm diameter, 60° cone attached to 'A' size drill rods for a distance of 300 mm.

WH

Sampler advanced by static weight of hammer and drill rods.

WR

Sampler advanced by static weight of drill rods.

PH

Sampler advanced by hydraulic pressure from drill rig.

PM

Sampler advanced by manual pressure.

## SOIL TESTS

C consolidation test
H hydrometer analysis
M sieve analysis
MH sieve and hydrometer analysis
U unconfined compression test
Q undrained triaxial test
V field vane, undisturbed and remoulded shear strength
AL Atterberg limits test

## SOIL DESCRIPTIONS

| Relative Density | 'N' Value |
|---|---|
| Very Loose | 0 to 4 |
| Loose | 4 to 10 |
| Compact | 10 to 30 |
| Dense | 30 to 50 |
| Very Dense | over 50 |

| Consistency | Undrained Shear Strength (kPa) |
|---|---|
| Very soft | 0 to 12 |
| Soft | 12 to 25 |
| Firm | 25 to 50 |
| Stiff | 50 to 100 |
| Very Stiff | over 100 |

## LIST OF COMMON SYMBOLS

$c_u$ undrained shear strength
e void ratio
$C_c$ compression index
$c_v$ coefficient of consolidation
k coefficient of permeability
$I_p$ plasticity index
n porosity
u pore pressure
w moisture content
$w_L$ liquid limit
$w_P$ plastic limit
$\phi^1$ effective angle of friction
$\gamma$ unit weight of soil
$\gamma^1$ unit weight of submerged soil
$\sigma$ normal stress

PROJECT: 12-066

# RECORD OF TEST PIT 12-1

SHEET 1 OF 1

LOCATION: See Test Pit Location Plan, Figure 2

DATUM: Geodetic

DATE OF EXCAVATION: March 30, 2012

TYPE OF EXCAVATOR:

| DEPTH SCALE METRES | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLE NUMBER | SHEAR STRENGTH, Cu (kPa) — Natural. V - ⊕ / Remoulded. V - + (20 40 60 80) | WATER CONTENT (PERCENT) — Wp ⊢ W ⊣ Wl (20 40 60 80) | ADDITIONAL LAB. TESTING | WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|
| 0 | Ground Surface | | 137.26 | | | | | Native Backfill |
| | Dark brown sandy silt, some organic material (TOPSOIL) | | 137.08 / 0.18 | | | | | |
| | Brown SAND, some silt | | 136.62 / 0.64 | | | | | |
| 1 | Brown SAND AND GRAVEL, some cobbles, trace silt | | 135.74 / 1.52 | | | | | ▽ Ground water inflow observed at about 1.0 metre below ground surface (elevation 136.3 metres geodetic datum) on March 30, 2012. |
| | Shovel refusal on probable bedrock<br>End of test pit | | | | | | | |
| 2 | | | | | | | | |

DEPTH SCALE

1 to 10

**Houle Chevrier Engineering Ltd.**

LOGGED: A.N.

CHECKED:

TESTPIT RECORD 2012 WITH LAB WC TP LOGS.GPJ 4/18/12

PROJECT: 12-066

# RECORD OF TEST PIT 12-2

SHEET 1 OF 1

LOCATION: See Test Pit Location Plan, Figure 2

DATUM: Geodetic

DATE OF EXCAVATION: March 30, 2012

TYPE OF EXCAVATOR:

| DEPTH SCALE METRES | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. DEPTH (m) | SAMPLE NUMBER | SHEAR STRENGTH, Cu (kPa) — Natural. V - ⊕ Remoulded. V - + (20 40 60 80) | WATER CONTENT (PERCENT) — Wp W Wl (20 40 60 80) | ADDITIONAL LAB. TESTING | WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|
| 0 | Ground Surface | | 136.50 | | | | | |
| | Dark brown sandy silt, some organic material (TOPSOIL) | | | | | | | Native Backfill |
| | | | 136.25 | | | | | |
| | Shovel refusal on probable bedrock<br>End of test pit | | 0.25 | | | | | No groundwater inflow observed on completion of excavating. |
| 1 | | | | | | | | |
| 2 | | | | | | | | |

DEPTH SCALE

1 to 10

**Houle Chevrier Engineering Ltd.**

LOGGED: A.N.

CHECKED:

TESTPIT RECORD 2012 WITH LAB WC TP LOGS.GPJ 4/18/12

PROJECT: 12-066

# RECORD OF TEST PIT 12-3

SHEET 1 OF 1

LOCATION: See Test Pit Location Plan, Figure 2

DATUM: Geodetic

DATE OF EXCAVATION: March 30, 2012

TYPE OF EXCAVATOR:

| DEPTH SCALE METRES | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLE NUMBER | SHEAR STRENGTH, Cu (kPa) (Natural. V - +, Remoulded. V - ⊕; 20 40 60 80) | WATER CONTENT (PERCENT) (Wp W Wl; 20 40 60 80) | ADDITIONAL LAB. TESTING | WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|
| 0 | Ground Surface | | 137.13 | | | | | Native Backfill |
| | Dark brown sandy silt, some organic material (TOPSOIL) | | 136.93 | 1 | | | | |
| | | | 0.20 | | | | | |
| | Brown SAND, some silt, trace gravel | | | 2 | | | | |
| | | | 136.62 | | | | | |
| | | | 0.51 | | | | | |
| 1 | Brown SAND AND GRAVEL, some cobbles, trace silt | | | 3 | | | | ▽ |
| | | | 135.48 | | | | | Ground water inflow observed at about 1.0 metre below ground surface (elevation 136.1 metres geodetic datum) on March 30, 2012. |
| | | | 1.65 | | | | | |
| | Shovel refusal on probable bedrock<br>End of test pit | | | | | | | |
| 2 | | | | | | | | |

DEPTH SCALE

1 to 10

**Houle Chevrier Engineering Ltd.**

LOGGED: A.N.

CHECKED:

TESTPIT RECORD 2012 WITH LAB WC TP LOGS.GPJ 4/18/12

PROJECT: 12-066

# RECORD OF TEST PIT 12-4

SHEET 1 OF 1

LOCATION: See Test Pit Location Plan, Figure 2

DATUM: Geodetic

DATE OF EXCAVATION: March 30, 2012

TYPE OF EXCAVATOR:

| DEPTH SCALE METRES | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLE NUMBER | SHEAR STRENGTH, Cu (kPa) — Natural. V - +, Remoulded. V - ⊕ (20 40 60 80) | WATER CONTENT (PERCENT) — Wp W Wl (20 40 60 80) | ADDITIONAL LAB. TESTING | WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|
| 0 | Ground Surface | | 136.74 | | | | | Native Backfill |
| | Dark brown sandy silt, some organic material (TOPSOIL) | | 136.64 / 0.10 | | | | | |
| | Brown SILTY SAND, trace roots | | | 1 | | | | |
| | Shovel refusal on probable bedrock<br>End of test pit | | 136.49 / 0.25 | | | | | No groundwater inflow observed on completion of excavating. |
| 1 | | | | | | | | |
| 2 | | | | | | | | |

DEPTH SCALE

1 to 10

**Houle Chevrier Engineering Ltd.**

LOGGED: A.N.

CHECKED:

TESTPIT RECORD 2012 WITH LAB WC TP LOGS.GPJ 4/18/12

PROJECT: 12-066

# RECORD OF TEST PIT 12-5

SHEET 1 OF 1

LOCATION: See Test Pit Location Plan, Figure 2

DATUM: Geodetic

DATE OF EXCAVATION: March 30, 2012

TYPE OF EXCAVATOR:

| DEPTH SCALE METRES | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. DEPTH (m) | SAMPLE NUMBER | SHEAR STRENGTH, Cu (kPa) — Natural. V - ⊕ Remoulded. V - + (20 40 60 80) | WATER CONTENT (PERCENT) — Wp W Wl (20 40 60 80) | ADDITIONAL LAB. TESTING | WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|
| 0 | Ground Surface | | 136.30 | | | | | |
| | Dark brown sandy silt, some organic material (TOPSOIL) | | | | | | | Native Backfill |
| | | | 136.07 | | | | | |
| | Shovel refusal on probable bedrock<br>End of test pit | | 0.23 | | | | | No groundwater inflow observed on completion of excavating. |
| 1 | | | | | | | | |
| 2 | | | | | | | | |

DEPTH SCALE

1 to 10

**Houle Chevrier Engineering Ltd.**

LOGGED: A.N.

CHECKED:

TESTPIT RECORD 2012 WITH LAB WC TP LOGS.GPJ 4/18/12

PROJECT: 12-066

# RECORD OF TEST PIT 12-6

SHEET 1 OF 1

LOCATION: See Test Pit Location Plan, Figure 2

DATUM: Geodetic

DATE OF EXCAVATION: March 30, 2012

TYPE OF EXCAVATOR:

| DEPTH SCALE METRES | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLE NUMBER | SHEAR STRENGTH, Cu (kPa) — Natural. V - ⊕ / Remoulded. V - + (20 40 60 80) | WATER CONTENT (PERCENT) — Wp ⊢ W ⊣ Wl (20 40 60 80) | ADDITIONAL LAB. TESTING | WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|
| 0 | Ground Surface | | 136.54 | | | | | Native Backfill |
| | Dark brown silty sand, some organic material (TOPSOIL) | | | 1 | | | | |
| | | | 136.29 / 0.25 | | | | | |
| | Brown SILTY SAND, some roots, trace gravel with depth | | | 2 | | | Sieve (See Figure 3) | |
| | | | | 3 | | | | |
| | | | | 4 | | | | |
| | | | 135.68 / 0.86 | | | | | No groundwater inflow observed on completion of excavating. |
| | Shovel refusal on probable bedrock<br>End of test pit | | | | | | | |
| 1 | | | | | | | | |
| 2 | | | | | | | | |

DEPTH SCALE

1 to 10

**Houle Chevrier Engineering Ltd.**

LOGGED: A.N.

CHECKED:

TESTPIT RECORD 2012 WITH LAB WC TP LOGS.GPJ 4/18/12

PROJECT: 12-066

# RECORD OF TEST PIT 12-1A

SHEET 1 OF 1

LOCATION: See Test Pit Location Plan, Figure 1

DATUM: Geodetic

DATE OF EXCAVATION: August 30, 2012

TYPE OF EXCAVATOR:

| DEPTH SCALE METRES | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLE NUMBER | SHEAR STRENGTH, Cu (kPa) — Natural. V - ; Remoulded. V - ⊕ — 20 40 60 80 | WATER CONTENT (PERCENT) — Wp W Wl — 20 40 60 80 | ADDITIONAL LAB. TESTING | WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|
| 0 | Ground Surface | | 137.19 | | | | | Native Backfill |
| | Dark brown, fine to medium grained sand, trace silt, some organic material (TOPSOIL) | | 137.04 / 0.15 | | | | | |
| | Brown, fine grained SAND, trace silt, trace gravel | | 136.55 / 0.64 | | | | | |
| 1 | Grey brown, fine to coarse grained SAND, trace silt, some gravel, cobbles | | 135.74 / 1.45 | | | | | |
| | End of Test Pit<br>Shovel refusal on inferred bedrock | | | | | | | |
| | Notes:<br>- No groundwater observed upon completion of test pit | | | | | | | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |

DEPTH SCALE

1 to 20

**Houle Chevrier Engineering Ltd.**

LOGGED: A.N.

CHECKED:

TESTPIT RECORD 2012 TP LOGS.GPJ HCE DATA TEMPLATE.GDT 9/12/12

PROJECT: 12-066

# RECORD OF TEST PIT 12-2A

SHEET 1 OF 1

LOCATION: See Test Pit Location Plan, Figure 1

DATUM: Geodetic

DATE OF EXCAVATION: August 30, 2012

TYPE OF EXCAVATOR:

| DEPTH SCALE METRES | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLE NUMBER | SHEAR STRENGTH, Cu (kPa) — Natural. V - ; Remoulded. V - ⊕ (20 40 60 80) | WATER CONTENT (PERCENT) — Wp W Wl (20 40 60 80) | ADDITIONAL LAB. TESTING | WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|
| 0 | Ground Surface | | 137.22 | | | | | Native Backfill |
| | Dark brown, fine to medium grained sand, trace silt, some organic material (TOPSOIL) | | 137.02 | 1 | | | | |
| | Brown, fine grained SAND, trace silt, trace gravel | | 0.20<br>136.71 | 2 | | | | |
| 1 | Grey brown, fine to coarse grained SAND, trace silt, some gravel, cobbles | | 0.51<br>135.67 | 3 | | | | |
| | End of Test Pit<br>Shovel refusal on inferred bedrock | | 1.55 | | | | | |
| 2 | Notes:<br>- No groundwater observed upon completion of test pit. | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |

DEPTH SCALE

1 to 20

**Houle Chevrier Engineering Ltd.**

LOGGED: A.N.

CHECKED:

TESTPIT RECORD 2012 TP LOGS.GPJ HCE DATA TEMPLATE.GDT 9/12/12

PROJECT: 12-066

# RECORD OF TEST PIT 12-3A

SHEET 1 OF 1

LOCATION: See Test Pit Location Plan, Figure 1

DATUM: Geodetic

DATE OF EXCAVATION: August 30, 2012

TYPE OF EXCAVATOR:

| DEPTH SCALE METRES | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLE NUMBER | SHEAR STRENGTH, Cu (kPa) — Natural. V - ; Remoulded. V - ⊕ — 20 40 60 80 | WATER CONTENT (PERCENT) — Wp W Wl — 20 40 60 80 | ADDITIONAL LAB. TESTING | WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|
| 0 | Ground Surface | | 137.04 | | | | | Native Backfill |
| | Dark brown, fine to medium grained sand, trace silt, some organic material (TOPSOIL) | | 136.84 | 1 | | | | |
| | | | 0.20 | | | | | |
| | Brown, fine to medium grained SAND, trace silt, trace roots | | 136.63 | 2 | | | | |
| | | | 0.41 | | | | | |
| 1 | Grey brown, fine to coarse grained SAND, trace silt, some gravel, cobbles | | | 3 | | | | |
| | | | 135.85 | | | | | |
| | End of Test Pit<br>Shovel refusal on inferred bedrock | | 1.19 | | | | | |
| | Notes:<br>- No groundwater observed upon completion of test pit. | | | | | | | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |

DEPTH SCALE

1 to 20

**Houle Chevrier Engineering Ltd.**

LOGGED: A.N.

CHECKED:

TESTPIT RECORD 2012 TP LOGS.GPJ HCE DATA TEMPLATE.GDT 9/12/12

PROJECT: 12-066

# RECORD OF TEST PIT 12-4A

SHEET 1 OF 1

LOCATION: See Test Pit Location Plan, Figure 1

DATUM: Geodetic

DATE OF EXCAVATION: August 30, 2012

TYPE OF EXCAVATOR:

| DEPTH SCALE METRES | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLE NUMBER | SHEAR STRENGTH, Cu (kPa) — Natural. V - +, Remoulded. V - ⊕ (20 40 60 80) | WATER CONTENT (PERCENT) — Wp W Wl (20 40 60 80) | ADDITIONAL LAB. TESTING | WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|
| 0 | Ground Surface | | 136.67 | | | | | Native Backfill |
| | Dark brown, fine to medium grained sand, trace silt, some organic material (TOPSOIL) | | 136.52 / 0.15 | | | | | |
| | End of Test Pit<br>Shovel refusal on inferred bedrock<br><br>Notes:<br><br>- No groundwater observed upon completion of test pit. | | | | | | | |
| 1 | | | | | | | | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |

DEPTH SCALE

1 to 20

**Houle Chevrier Engineering Ltd.**

LOGGED: A.N.

CHECKED:

TESTPIT RECORD 2012 TP LOGS.GPJ HCE DATA TEMPLATE.GDT 9/12/12

PROJECT: 12-066

# RECORD OF TEST PIT 12-5A

SHEET 1 OF 1

LOCATION: See Test Pit Location Plan, Figure 1

DATUM: Geodetic

DATE OF EXCAVATION: August 30, 2012

TYPE OF EXCAVATOR:

| DEPTH SCALE METRES | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLE NUMBER | SHEAR STRENGTH, Cu (kPa) — Natural. V - ; Remoulded. V - ⊕ — 20 40 60 80 | WATER CONTENT (PERCENT) — Wp W Wl — 20 40 60 80 | ADDITIONAL LAB. TESTING | WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|
| 0 | Ground Surface | | 136.55 | | | | | Native Backfill |
| | Dark brown, fine grained sand, trace silt, some organic material (TOPSOIL) | | 136.42 / 0.13 | 1 | | | | |
| | Brown, fine grained SAND, trace silt, trace gravel | | 136.12 / 0.43 | 2 | | | | |
| | Grey brown, fine to medium grained SAND, trace silt, some gravel, cobbles | | 135.81 / 0.74 | 3 | | | | |
| 1 | End of Test Pit<br>Shovel refusal on inferred bedrock | | | | | | | |
| | Notes:<br>- No groundwater observed upon completion of test pit. | | | | | | | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |

DEPTH SCALE

1 to 20

**Houle Chevrier Engineering Ltd.**

LOGGED: A.N.

CHECKED:

TESTPIT RECORD 2012 TP LOGS.GPJ HCE DATA TEMPLATE.GDT 9/12/12

PROJECT: 12-066

# RECORD OF TEST PIT 12-6A

SHEET 1 OF 1

LOCATION: See Test Pit Location Plan, Figure 1

DATUM: Geodetic

DATE OF EXCAVATION: August 30, 2012

TYPE OF EXCAVATOR:

| DEPTH SCALE METRES | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLE NUMBER | SHEAR STRENGTH, Cu (kPa) — Natural. V - ; Remoulded. V - ⊕ (20 40 60 80) | WATER CONTENT (PERCENT) — Wp W Wl (20 40 60 80) | ADDITIONAL LAB. TESTING | WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|
| 0 | Ground Surface | | 136.48 | | | | | Native Backfill |
| | Dark brown, fine to medium grained sand, trace silt, some organic material (TOPSOIL) | | 136.38 / 0.10 | | | | | |
| | End of Test Pit<br>Shovel refusal on inferred bedrock | | | | | | | |
| | Notes:<br>- No groundwater observed upon completion of test pit. | | | | | | | |
| 1 | | | | | | | | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |

DEPTH SCALE

1 to 20

**Houle Chevrier Engineering Ltd.**

LOGGED: A.N.

CHECKED:

TESTPIT RECORD 2012 TP LOGS.GPJ HCE DATA TEMPLATE.GDT 9/12/12

PROJECT: 12-066

# RECORD OF TEST PIT 12-7A

SHEET 1 OF 1

LOCATION: See Test Pit Location Plan, Figure 1

DATUM: Geodetic

DATE OF EXCAVATION: August 30, 2012

TYPE OF EXCAVATOR:

| DEPTH SCALE METRES | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLE NUMBER | SHEAR STRENGTH, Cu (kPa) — Natural. V - ; Remoulded. V - ⊕ (20 40 60 80) | WATER CONTENT (PERCENT) — Wp W Wl (20 40 60 80) | ADDITIONAL LAB. TESTING | WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|
| 0 | Ground Surface | | 137.36 | | | | | Native Backfill |
| | Dark brown, fine to medium grained sand, trace silt, some organic material (TOPSOIL) | | 137.08 / 0.28 | 1 | | | | |
| | Brown, fine to medium grained SAND, trace silt, trace roots | | 136.57 / 0.79 | 2 | | | | |
| 1 | Grey brown, fine to coarse grained SAND, trace silt, some gravel, cobbles | | 135.61 / 1.75 | 3 | | | | |
| | End of Test Pit<br>Shovel refusal on inferred bedrock | | | | | | | |
| | Notes:<br>- No groundwater observed upon completion of test pit. | | | | | | | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |

DEPTH SCALE

1 to 20

**Houle Chevrier Engineering Ltd.**

LOGGED: A.N.

CHECKED:

TESTPIT RECORD 2012 TP LOGS.GPJ HCE DATA TEMPLATE.GDT 9/12/12

PROJECT: 12-066

# RECORD OF TEST PIT 12-8A

SHEET 1 OF 1

LOCATION: See Test Pit Location Plan, Figure 1

DATUM: Geodetic

DATE OF EXCAVATION: August 30, 2012

TYPE OF EXCAVATOR:

| DEPTH SCALE METRES | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLE NUMBER | SHEAR STRENGTH, Cu (kPa) — Natural. V - +, Remoulded. V - ⊕ (20 40 60 80) | WATER CONTENT (PERCENT) — Wp W Wl (20 40 60 80) | ADDITIONAL LAB. TESTING | WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|
| 0 | Ground Surface | | 137.13 | | | | | Native Backfill |
| | Dark brown, fine to medium grained sand, trace silt, some organic material (TOPSOIL) | | 136.98 / 0.15 | | | | | |
| | Brown, fine to medium grained SAND, trace silt, trace roots | | 136.52 / 0.61 | | | | | |
| | End of Test Pit<br>Shovel refusal on inferred bedrock<br><br>Notes:<br><br>- No groundwater observed upon completion of test pit. | | | | | | | |
| 1 | | | | | | | | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |

DEPTH SCALE

1 to 20

**Houle Chevrier Engineering Ltd.**

LOGGED: A.N.

CHECKED:

TESTPIT RECORD 2012 TP LOGS.GPJ HCE DATA TEMPLATE.GDT 9/12/12

PROJECT: 12-066

# RECORD OF TEST PIT 12-9A

SHEET 1 OF 1

LOCATION: See Test Pit Location Plan, Figure 1

DATUM: Geodetic

DATE OF EXCAVATION: August 30, 2012

TYPE OF EXCAVATOR:

| DEPTH SCALE METRES | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLE NUMBER | SHEAR STRENGTH, Cu (kPa) — Natural. V - ; Remoulded. V - ⊕ — 20 40 60 80 | WATER CONTENT (PERCENT) — Wp W Wl — 20 40 60 80 | ADDITIONAL LAB. TESTING | WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|
| 0 | Ground Surface | | 136.69 | | | | | Native Backfill |
| | Dark brown, fine to medium grained sand, trace silt, some organic material (TOPSOIL) | | 136.51 / 0.18 | | | | | |
| | Brown, fine to medium grained SAND, trace silt, trace gravel | | 136.28 / 0.41 | | | | | |
| | Grey brown, fine to coarse grained SAND, trace silt, some gravel, cobbles | | 136.03 / 0.66 | | | | | |
| | End of Test Pit<br>Shovel refusal on inferred bedrock<br><br>Notes:<br><br>- No groundwater observed upon completion of test pit. | | | | | | | |
| 1 | | | | | | | | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |

DEPTH SCALE

1 to 20

**Houle Chevrier Engineering Ltd.**

LOGGED: A.N.

CHECKED:

TESTPIT RECORD 2012 TP LOGS.GPJ HCE DATA TEMPLATE.GDT 9/12/12

PROJECT: 12-066

# RECORD OF TEST PIT 12-10A

SHEET 1 OF 1

LOCATION: See Test Pit Location Plan, Figure 1

DATUM: Geodetic

DATE OF EXCAVATION: August 30, 2012

TYPE OF EXCAVATOR:

| DEPTH SCALE METRES | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLE NUMBER | SHEAR STRENGTH, Cu (kPa) — Natural. V - ; Remoulded. V - ⊕ — 20 40 60 80 | WATER CONTENT (PERCENT) — Wp W Wl — 20 40 60 80 | ADDITIONAL LAB. TESTING | WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|
| 0 | Ground Surface | | 136.74 | | | | | Native Backfill |
| | Brown, fine to medium grained SAND, trace silt, some gravel, cobbles | | 136.36 / 0.38 | | | | | |
| | Grey brown, fine to coarse grained SAND, trace silt, some gravel, cobbles | | 136.03 / 0.71 | | | | | |
| 1 | End of Test Pit<br>Shovel refusal on inferred bedrock<br><br>Notes:<br><br>- No groundwater observed upon completion of test pit. | | | | | | | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |

DEPTH SCALE

1 to 20

**Houle Chevrier Engineering Ltd.**

LOGGED: A.N.

CHECKED:

TESTPIT RECORD 2012 TP LOGS.GPJ HCE DATA TEMPLATE.GDT 9/12/12

PROJECT: 12-066

# RECORD OF TEST PIT 12-11A

SHEET 1 OF 1

LOCATION: See Test Pit Location Plan, Figure 1

DATUM: Geodetic

DATE OF EXCAVATION: August 30, 2012

TYPE OF EXCAVATOR:

| DEPTH SCALE METRES | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLE NUMBER | SHEAR STRENGTH, Cu (kPa) — Natural. V - + Remoulded. V - ⊕ (20 40 60 80) | WATER CONTENT (PERCENT) — Wp W Wl (20 40 60 80) | ADDITIONAL LAB. TESTING | WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|
| 0 | Ground Surface | | 136.66 | | | | | Native Backfill |
| | Dark brown, fine grained sand, trace silt, some gravel, some organic material (TOPSOIL) | | 136.30 / 0.36 | 1 | | | | |
| | Brown, fine to medium grained SAND, trace to some silt, some gravel | | 136.00 / 0.66 | 2 | | | | |
| 1 | Grey brown, medium to coarse grained SAND, trace silt, some gravel, cobbles | | 135.29 / 1.37 | 3 | | | | |
| | End of Test Pit<br>Shovel refusal on inferred bedrock<br><br>Notes:<br><br>- No groundwater observed upon completion of test pit. | | | | | | | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |

DEPTH SCALE

1 to 20

**Houle Chevrier Engineering Ltd.**

LOGGED: A.N.

CHECKED:

TESTPIT RECORD 2012 TP LOGS.GPJ HCE DATA TEMPLATE.GDT 9/12/12

PROJECT: 12-066

# RECORD OF TEST PIT 12-12A

SHEET 1 OF 1

LOCATION: See Test Pit Location Plan, Figure 1

DATUM: Geodetic

DATE OF EXCAVATION: August 30, 2012

TYPE OF EXCAVATOR:

| DEPTH SCALE METRES | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLE NUMBER | SHEAR STRENGTH, Cu (kPa) — Natural. V - ; Remoulded. V - ⊕ — 20 40 60 80 | WATER CONTENT (PERCENT) — Wp W Wl — 20 40 60 80 | ADDITIONAL LAB. TESTING | WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|
| 0 | Ground Surface | | 136.53 | | | | | Native Backfill |
| | Dark brown silty sand, some organic material (TOPSOIL) | | 136.33 / 0.20 | | | | | |
| | Brown, fine grained SAND, trace to some silt, some gravel | | 136.25 / 0.28 | | | | | |
| | End of Test Pit<br>Shovel refusal on inferred bedrock | | | | | | | |
| | Notes:<br>- No groundwater observed upon completion of test pit. | | | | | | | |
| 1 | | | | | | | | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |

DEPTH SCALE

1 to 20

**Houle Chevrier Engineering Ltd.**

LOGGED: A.N.

CHECKED:

TESTPIT RECORD 2012 TP LOGS.GPJ HCE DATA TEMPLATE.GDT 9/12/12

PROJECT: 12-066

# RECORD OF TEST PIT 12-13A

SHEET 1 OF 1

LOCATION: See Test Pit Location Plan, Figure 1

DATUM: Geodetic

DATE OF EXCAVATION: August 30, 2012

TYPE OF EXCAVATOR:

| DEPTH SCALE METRES | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLE NUMBER | SHEAR STRENGTH, Cu (kPa) — Natural. V - ; Remoulded. V - ⊕ (20 40 60 80) | WATER CONTENT (PERCENT) — Wp W Wl (20 40 60 80) | ADDITIONAL LAB. TESTING | WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|
| 0 | Ground Surface | | 136.68 | | | | | Native Backfill |
| | Dark brown, fine grained sand, some silt, some organic material (TOPSOIL) | | 136.40 | 1 | | | | |
| | Brown, fine to medium grained sand, trace silt (POSSIBLE FILL) | | 0.28 136.25 | 2 | | | | |
| | Dark brown silty sand (POSSIBLE FORMER TOPSOIL) | | 0.43 136.12 | 3 | | | | |
| | Grey brown, fine to coarse grained SAND, some gravel, cobbles | | 0.56 135.77 | 4 | | | | |
| 1 | End of Test Pit<br>Shovel refusal on inferred bedrock | | 0.91 | | | | | |
| | Notes:<br>- No groundwater observed upon completion of test pit. | | | | | | | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |

DEPTH SCALE

1 to 20

**Houle Chevrier Engineering Ltd.**

LOGGED: A.N.

CHECKED:

TESTPIT RECORD 2012 TP LOGS.GPJ HCE DATA TEMPLATE.GDT 9/12/12

# APPENDIX C

Water Well Record - Well ID A099470

Ontario — Ministry of the Environment

Measurements recorded in: ☐ Metric ☑ Imperial

Well Tag No. (Place Sticker and Print Below) A099470 **A 099470**

# Well Record

Regulation 903 Ontario Water Resources Act

Page 1 of 1

[redacted]

| Address of Well Location (Street Number/Name) | Township | Lot | Concession |
|---|---|---|---|
| 130 David Manchester Rd. | Huntley | 1 | 4 |

| County/District/Municipality | City/Town/Village | Province | Postal Code |
|---|---|---|---|
| Ottawa | Carp | Ontario | K0A1L0 |

| UTM Coordinates | Zone | Easting | Northing | Municipal Plan and Sublot Number | Other |
|---|---|---|---|---|---|
| NAD 83 | 18 | 423652 | 5012001 | — | — |

## Overburden and Bedrock Materials/Abandonment Sealing Record *(see instructions on the back of this form)*

| General Colour | Most Common Material | Other Materials | General Description | Depth (m/ft) From | Depth (m/ft) To |
|---|---|---|---|---|---|
| | Sand/gravel | | | 0 | 5' |
| black/grey | limestone | | | 5' | 300' |

## Annular Space

| Depth Set at (m/ft) From | To | Type of Sealant Used (Material and Type) | Volume Placed (m³/ft³) |
|---|---|---|---|
| 0 | 44' | 2 Bags cement | 0.044 |
| | | 4 Bags quick grout | 0.088 |
| | | 1/2 Bag 3/4" Hole Plug | 0.022 |

## Method of Construction

☐ Cable Tool ☐ Diamond ☐ Rotary (Conventional) ☐ Jetting ☐ Rotary (Reverse) ☐ Driving ☐ Boring ☐ Digging ☑ Air percussion ☐ Other, specify

## Well Use

☐ Public ☐ Commercial ☐ Not used ☑ Domestic ☐ Municipal ☐ Dewatering ☐ Livestock ☐ Test Hole ☐ Monitoring ☐ Irrigation ☐ Cooling & Air Conditioning ☐ Industrial ☐ Other, specify

## Construction Record - Casing

| Inside Diameter (cm/in) | Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel) | Wall Thickness (cm/in) | Depth (m/ft) From | Depth (m/ft) To |
|---|---|---|---|---|
| 6" | Steel | .48cm | 0' | 44' |

## Construction Record - Screen

| Outside Diameter (cm/in) | Material (Plastic, Galvanized, Steel) | Slot No. | Depth (m/ft) From | Depth (m/ft) To |
|---|---|---|---|---|
| | | | | |

## Status of Well

☑ Water Supply ☐ Replacement Well ☐ Test Hole ☐ Recharge Well ☐ Dewatering Well ☐ Observation and/or Monitoring Hole ☐ Alteration (Construction) ☐ Abandoned, Insufficient Supply ☐ Abandoned, Poor Water Quality ☐ Abandoned, other, specify ☐ Other, specify

## Water Details

| Water found at Depth (m/ft) | Kind of Water | Hole Diameter Depth From | Depth To | Diameter (cm/in) |
|---|---|---|---|---|
| ? (m/ft) ☐ Gas | ☐ Fresh ☑ Untested ☐ Other, specify | 0' | 44' | 25.4cm |
| (m/ft) ☐ Gas | Kind of Water: ☐ Fresh ☐ Untested ☐ Other, specify | | | |
| (m/ft) ☐ Gas | Kind of Water: ☐ Fresh ☐ Untested ☐ Other, specify | | | |

## Results of Well Yield Testing

After test of well yield, water was: ☐ Clear and sand free ☑ Other, specify Cloudy

If pumping discontinued, give reason: —

Pump intake set at (m/ft): 200

Pumping rate (l/min / GPM): 4gpm.

Duration of pumping: 1 hrs + ____ min

Final water level end of pumping (m/ft): 17.5'

If flowing give rate (l/min / GPM): Ø

Recommended pump depth (m/ft): 250'

Recommended pump rate (l/min / GPM): 3gpm.

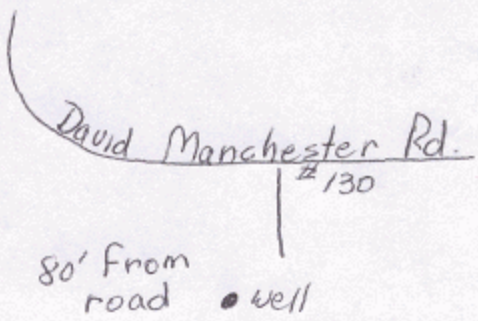
Well production (l/min / GPM): 2 1/2 gpm.

Disinfected? ☑ Yes ☐ No

| Draw Down Time (min) | Draw Down Water Level (m/ft) | Recovery Time (min) | Recovery Water Level (m/ft) |
|---|---|---|---|
| Static Level | | | |
| 1 | 17.75' | 1 | 86.4' |
| 2 | 18.0' | 2 | 83.5' |
| 3 | 20.7' | 3 | 80.7' |
| 4 | 23.2' | 4 | 78.1' |
| 5 | 25.5' | 5 | 75.4' |
| 10 | 35.2' | 10 | 63.1' |
| 15 | 43.4' | 15 | 52.4' |
| 20 | 51.3' | 20 | 43.6' |
| 25 | 57.6' | 25 | 37.2' |
| 30 | 62.9' | 30 | 32.2' |
| 40 | 72.3' | 40 | 25.5' |
| 50 | 80.7' | 50 | 21.8' |
| 60 | 88.9' | 60 | 19.8' |

## Map of Well Location

Please provide a map below following instructions on the back.




Comments:

## Well Contractor and Well Technician Information

| Business Name of Well Contractor | Well Contractor's Licence No. |
|---|---|
| Wilf Hall + Sons Well Drilling | 2515 |

| Business Address (Street Number/Name) | Municipality |
|---|---|
| RR1 256 Hall Shore Rd. | McDonald's Corners |

| Province | Postal Code | Business E-mail Address |
|---|---|---|
| Ont | K0G1M0 | wilfhallltd@bellnet.ca |

| Bus. Telephone No. (inc. area code) | Name of Well Technician (Last Name, First Name) |
|---|---|
| 6132782933 | Hall Mark |

| Well Technician's Licence No. | Signature of Technician and/or Contractor | Date Submitted |
|---|---|---|
| 12128 | Mark Hall | 2011/01/27 |

| Well owner's information package delivered | Date Package Delivered | Date Work Completed |
|---|---|---|
| ☑ Yes ☐ No | 2011/01/28 | 2011/01/28 |

**Ministry Use Only**

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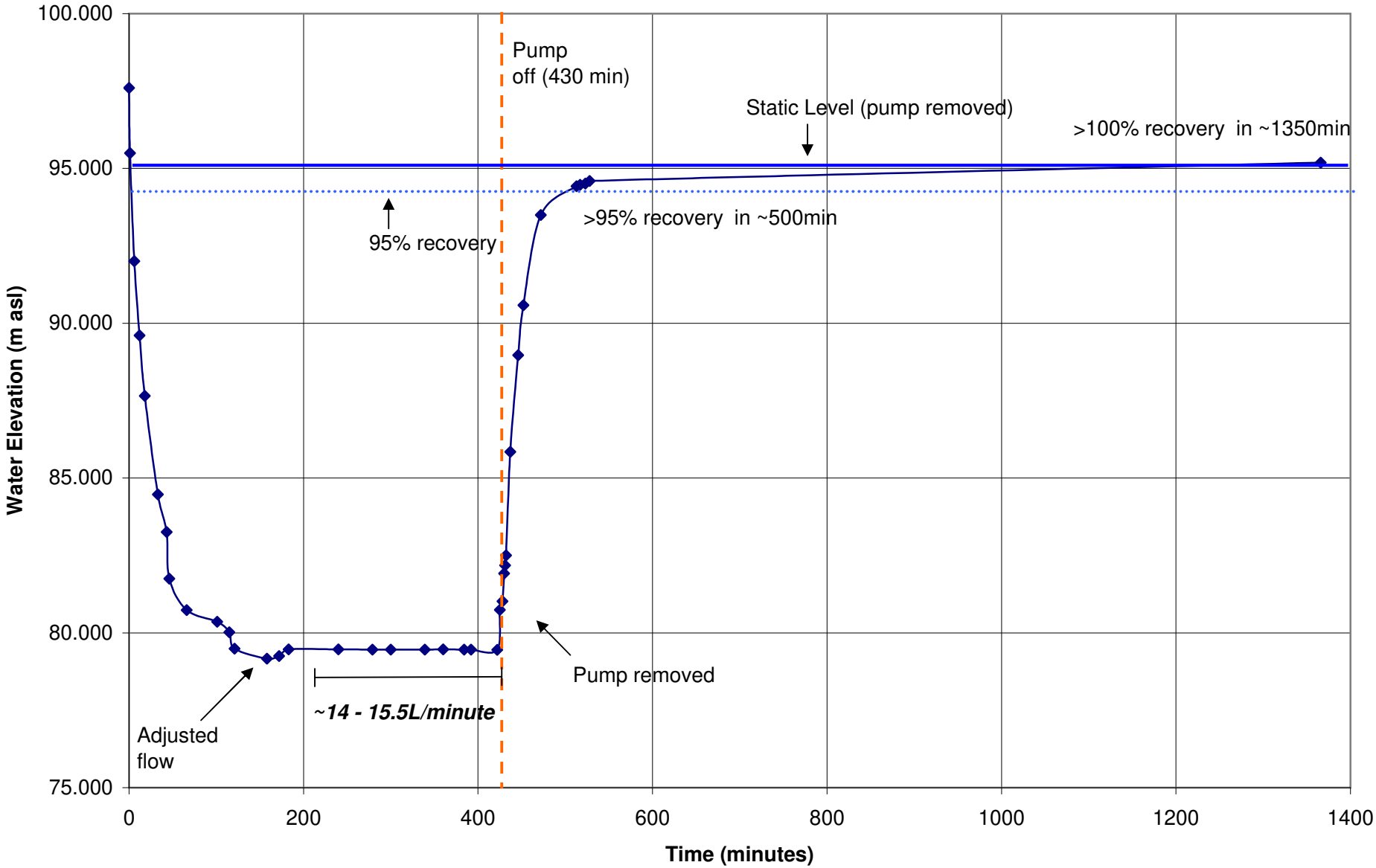
# APPENDIX D

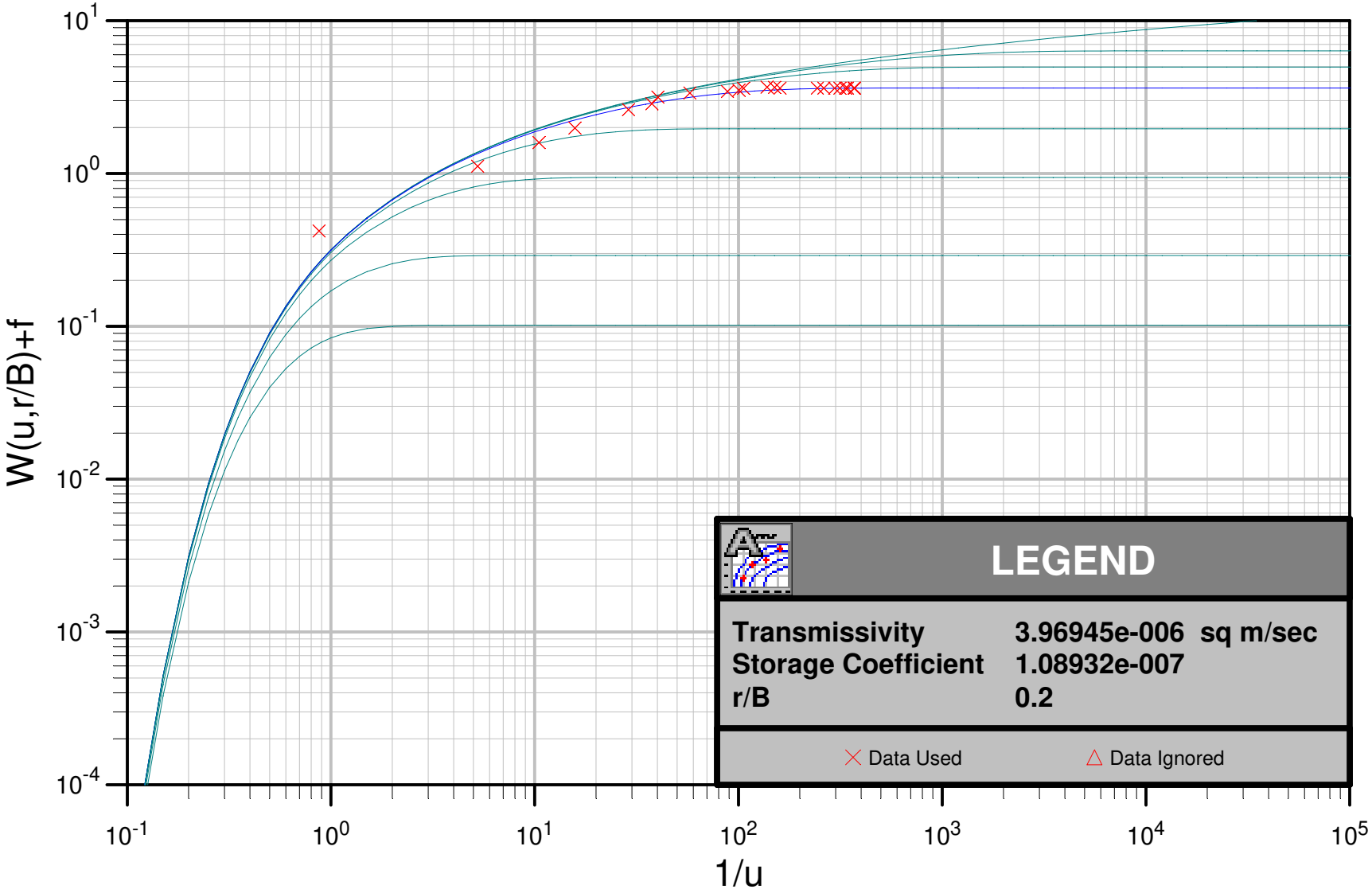
Pumping Test Data (Mcintosh Perry)

**Water Level - Test Well TW1**
**Proposed Lockwood Subdivision - Glen Tay, ON**



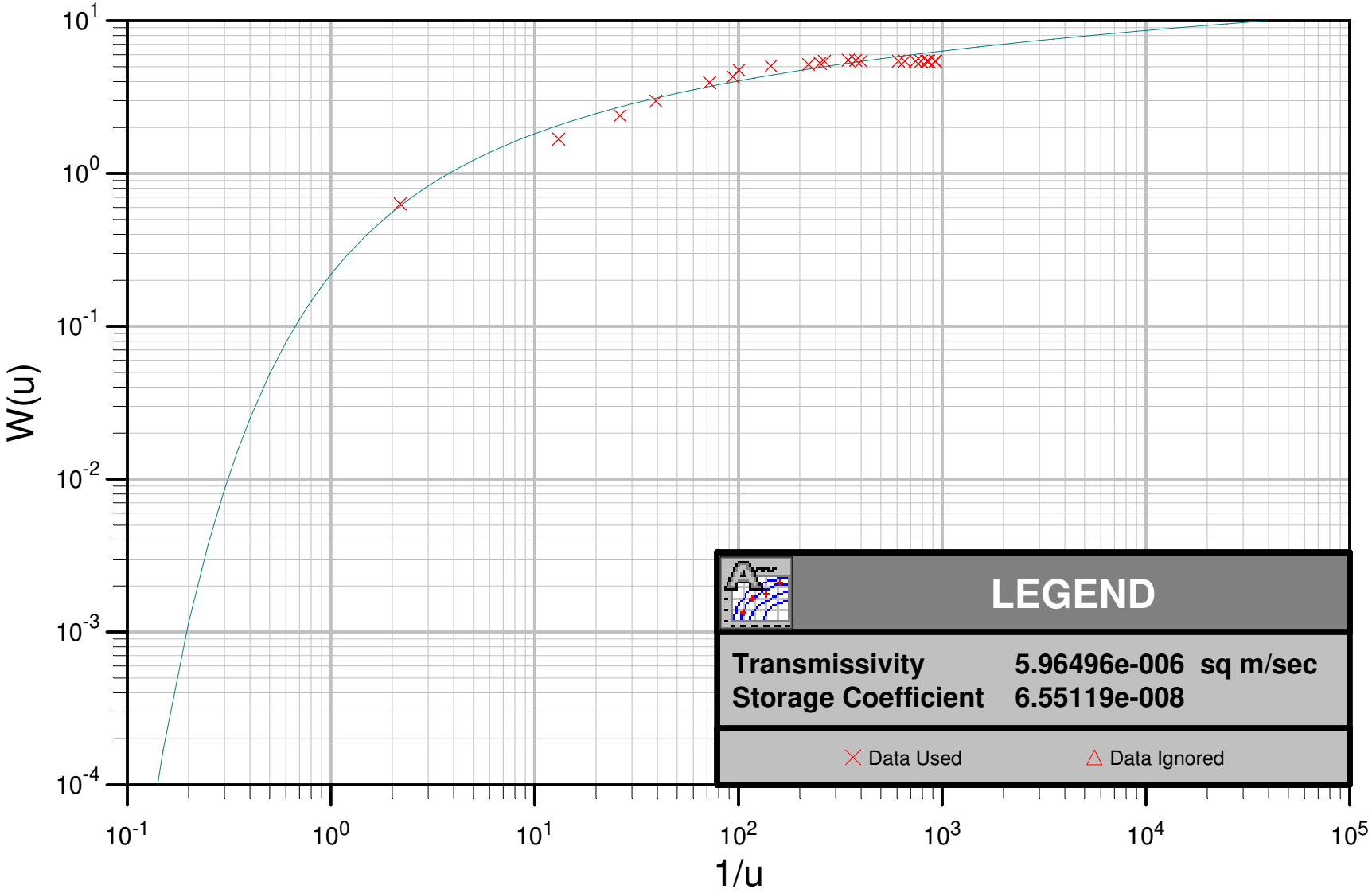
TW-1 (0CP-10124)

# Hantush



TW-1 (0CP-10124)

# Theis



# APPENDIX E

Laboratory Certificates of Analysis & Summary Tables
(Mcintosh Perry)

Table 3-5
Summary of Water Quality Results (Lab Data)

130 David Manchester Rd. Carp, ON

**Project:** CP-10-124
**Matrix:** water

| | | | | | GUIDELINE | | |
|---|---|---|---|---|---|---|---|
| | **Sample Date:** | | 2011-02-03 | 2011-02-03 | | | |
| | **Sample ID:** | | TW1-1 | TW1-2 | ODWSOG | | |
| **PARAMETER** | **UNITS** | **MRL** | Test Well TW1 | | **TYPE** | **LIMIT** | **UNITS** |
| Alkalinity as CaCO3 | mg/L | 5 | 259 | 261 | OG | 500 | mg/L |
| Chloride | mg/L | 1 | 17 | 4 | AO | 250 | mg/L |
| Colour | TCU | 2 | 3 | 7 | AO | 5 | TCU |
| Conductivity | uS/cm | 5 | 965 | 520 | | | |
| Dissolved Organic Carbon | mg/L | 0.5 | 1.8 | 3.0 | AO | 5 | mg/L |
| Fluoride | mg/L | 0.10 | ***1.89*** | 0.91 | MAC | 1.5 | mg/L |
| Hydrogen Sulphide | mg/L | 0.01 | <1.0* | 0.38 | AO | 0.05 | mg/L |
| N-NH3 (Ammonia) | mg/L | 0.02 | 0.13 | 0.16 | | | |
| N-NO2 (Nitrite) | mg/L | 0.10 | <0.10 | <0.10 | MAC | 1.0 | mg/L |
| N-NO3 (Nitrate) | mg/L | 0.10 | <0.10 | <0.10 | MAC | 10.0 | mg/L |
| pH | | | 8.05 | 7.91 | | 6.5-8.5 | |
| Phenols | mg/L | 0.001 | <0.001 | <0.001 | | | |
| Sulphate | mg/L | 1 | 212 | 22 | AO | 500 | mg/L |
| Tannin & Lignin | mg/L | 0.1 | <0.1 | <0.1 | | | |
| TDS (COND - CALC) | mg/L | 5 | 627 | 338 | AO | 500 | mg/L |
| Total Kjeldahl Nitrogen | mg/L | 0.10 | 0.16 | 0.17 | | | |
| Turbidity | NTU | 0.1 | ***75.2*** | ***2.4*** | MAC | 1.0 | NTU |
| Hardness as CaCO3 | mg/L | 1 | 210 | 226 | OG | 100 | mg/L |
| Ion Balance | | 0.01 | 0.98 | 0.93 | | | |
| Calcium | mg/L | 1 | 48 | 56 | | | |
| Magnesium | mg/L | 1 | 22 | 21 | | | |
| Potassium | mg/L | 1 | 7 | 6 | | | |
| Sodium | mg/L | 2 | ***127*** | 17 | MAC | 20 | mg/L |
| Iron | mg/L | 0.03 | 4.26 | 0.06 | AO | 0.3 | mg/L |
| Manganese | mg/L | 0.01 | 0.04 | 0.01 | AO | 0.05 | mg/L |
| UV Transmittance @ 254 nm | % | 0.1 | | 88.5 | | | |
| | | | | | | | |
| Total Coliforms | ct/100mL | | 0 | 0 | MAC | 0 | ct/100mL |
| Escherichia Coli | ct/100mL | | 0 | 0 | MAC | 0 | ct/100mL |
| Heterotrophic Plate Count | ct/1mL | | 189 | 81 | | | |
| Faecal Coliforms | ct/100mL | | 0 | 0 | | | |
| Faecal Streptococcus | ct/100mL | | 0 | 0 | | | |

MRL = Method Reporting Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline
MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration
* - H2S MRL raised due to sample turbidity
Comment:

| | |
|---|---|
| Concentration exceeds AO or OG | 232 |
| Concentration exceeds MAC | ***5.3*** |

H2S MRL raised due to sample turbidity

# REPORT OF ANALYSIS

**Client:** **McIntosh Perry Consulting Engineers Ltd.**
115 Walgreen Rd., R.R. #3
Carp, ON
K0A 1L0
**Attention:** **Ms. Meghan Cameron**

**Report Number:** 1102291
**Date:** 2011-02-11
**Date Submitted:** 2011-02-04

**Project:** OCP-10124

**P.O. Number:**
**Matrix:** Water

**Chain of Custody Number:** **108641**

| | | | **LAB ID:** | 861015 | 861016 | | | | **GUIDELINE** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Sample Date:** | 2011-02-03 | 2011-02-03 | | | | | | |
| | | | **Sample ID:** | TW1-1 | TW1-2 | | | | ODWSOG | | |
| **PARAMETER** | **UNITS** | **MRL** | | | | | | | **TYPE** | **LIMIT** | **UNITS** |
| Alkalinity as CaCO3 | mg/L | 5 | | 259 | 261 | | | | OG | 500 | mg/L |
| Chloride | mg/L | 1 | | 17 | 4 | | | | AO | 250 | mg/L |
| Colour | TCU | 2 | | 3 | 7 | | | | AO | 5 | TCU |
| Conductivity | uS/cm | 5 | | 965 | 520 | | | | | | |
| Dissolved Organic Carbon | mg/L | 0.5 | | 1.8 | 3.0 | | | | AO | 5 | mg/L |
| Fluoride | mg/L | 0.1 | | 1.89 | 0.91 | | | | MAC | 1.5 | mg/L |
| Hydrogen Sulphide | mg/L | 0.01 | | <1.0 | 0.38 | | | | AO | 0.05 | mg/L |
| N-NH3 (Ammonia) | mg/L | 0.02 | | 0.13 | 0.16 | | | | | | |
| N-NO2 (Nitrite) | mg/L | 0.1 | | <0.10 | <0.10 | | | | MAC | 1.0 | mg/L |
| N-NO3 (Nitrate) | mg/L | 0.1 | | <0.10 | <0.10 | | | | MAC | 10.0 | mg/L |
| pH | | | | 8.05 | 7.91 | | | | | 6.5-8.5 | |
| Phenols | mg/L | 0.001 | | <0.001 | <0.001 | | | | | | |
| Sulphate | mg/L | 1 | | 212 | 22 | | | | AO | 500 | mg/L |
| Tannin & Lignin | mg/L | 0.1 | | <0.1 | <0.1 | | | | | | |
| Total Dissolved Solids (COND - CALC) | mg/L | 5 | | 627 | 338 | | | | AO | 500 | mg/L |
| Total Kjeldahl Nitrogen | mg/L | 0.1 | | 0.16 | 0.17 | | | | | | |
| Turbidity | NTU | 0.1 | | 75.2 | 2.4 | | | | MAC | 1.0 | NTU |
| Hardness as CaCO3 | mg/L | 1 | | 210 | 226 | | | | OG | 100 | mg/L |
| Ion Balance | | 0.01 | | 0.98 | 0.93 | | | | | | |
| Calcium | mg/L | 1 | | 48 | 56 | | | | | | |
| Magnesium | mg/L | 1 | | 22 | 21 | | | | | | |
| Potassium | mg/L | 1 | | 7 | 6 | | | | | | |
| Sodium | mg/L | 2 | | 127 | 17 | | | | AO | 200 | mg/L |
| Iron | mg/L | 0.03 | | 4.26 | 0.06 | | | | AO | 0.3 | mg/L |
| Manganese | mg/L | 0.01 | | 0.04 | 0.01 | | | | AO | 0.05 | mg/L |
| UV Transmittance @ 254 nm | % | 0.1 | | | 88.5 | | | | | | |

MRL = Method Reporting Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration

Comment:
861015: H2S MRL raised due to sample turbidity

APPROVAL: _____
Ewan McRobbie
Inorganic Lab Supervisor

Methods references and/or additional QA/QC information available on request.

# APPENDIX F

Pre-Application Consultation Meeting Notes

**Pre-Application Consultation Meeting Notes**

**Property Address:** 130 David Manchester Road
PC2020-0133
Tuesday, June 16, 2020; Online Zoom meeting

**Attendees:**
Sarah McCormick, City of Ottawa, Planner II
Sarah.McCormick@ottawa.ca
Kevin Hall, City of Ottawa, Senior Project Manager
Kevin.Hall@ottawa.ca
Sami Rehman, City of Ottawa, Environmental Planner II
Sami.Rehman@ottawa.ca
Erica Ogden, Mississippi Valley Conservation Authority, Environmental Planner
eogden@mvc.on.ca
Stephen Kapusta, MTO
stephen.kapusta@ontario.ca
Rickson Outhet, Rickson Outhet Architect, applicant
roarch@rogers.com
Josiane, Rickson Outhet Architect, applicant
Doug Jones, Playvalue Toys Inc., owner
doug@playvaluetoys.com
Andy Naoum, CEGL, civil engineer
cegl@rogers.com

**Regrets:**
Mike Giampa, City of Ottawa, Transportation Engineer
Mike.Giampa@ottawa.ca

**Subject: 130 David Manchester Road**

**Meeting notes:**

Overview of Proposal

- Original build was mixed use; retail (45%) and warehouse (50%); approximately 1,280m$^2$.
- Worked with MTO for signage
- Existing building is a cross laminated timber; proposed additional will be of the same material.
- The proposal is for a 1-storey warehouse addition of approximately 1,280m$^2$ to the existing Playvalue building. This will double the footprint of the existing building, with all warehouse, in order to accommodate more demand in online sales.
- One additional loading bay will form part of the proposed addition.
- No anticipated staffing changes; perhaps a couple of extra staff, but don't anticipate additional demand for water or septic.
- The original civic drawings did account for a future phase, including the vehicular entrance.
- Requested slightly larger entrance width to accommodate the turning radius.

Preliminary comments and questions from staff and agencies, including follow-up actions:

- Planning
  - Official Plan: Rural Natural Features (policies of the General Rural Area also apply)
    - The property is designated Rural Natural Features in Schedule A of the Official Plan.
    - As per policy 3.2.4(7); development and site alteration will not be permitted for development in or within 120 metres of the boundary of a natural heritage feature, unless an Environmental Impact Statement demonstrates that there will be no negative impacts on the natural features within the area.
    - Policies of the General Rural Area designation also apply to properties designated Rural Natural Features

  - Current Zoning: Rural General Industrial Zone (RG)
    - Warehouse is a permitted use within the RG zone.
    - Please ensure the minimum parking and loading requirements of the Zoning By-law are met.

  - Discussion
    - The application will need to demonstrate there is sufficient parking provided for both the existing and the proposed uses. From the details provided on the concept plan, based on a total building area of 2,795 sq metres, and a 55%/45% split between warehouse and retail space, a minimum of 55 parking spaces are required. Only 51 spaces are shown on the site plan.
    - The Site Plan will require a full zoning table illustrating how the proposal meets the zoning provisions of the RG zone.
    - Given Highway 416 is identified as a Scenic Entry Route in Schedule I of the Official Plan, staff will be paying particular attention to the design of the building.
    - The façade of the building which faces the Highway should have more architectural detail, particularly of a rural nature. A mix of materials, including brick, finishes and colours are encouraged to break up the white massing of the building.
    - The MTO will be circulated on the application. Approval from the MTO is required in relation to various reports/plans (please see below).
    - Additional landscaping will be required.
    - The landscape plan will need to identify the existing landscaping as well as the proposed. Please ensure the existing versus new landscaping can be differentiated from each other.
    - The landscape plan will need to demonstrate that all landscaping from the previously approved site plan application has been introduced on the property. Where that landscaping has not been introduced, those plantings will need to be implemented through this development. Missing landscaping should be identified on the plan as new.
    - The proposed development will trigger a Standard Rural Site Plan.

- Engineering
  - Staff confirm that the Subject Property is not located within the Feedmill Creek Study area, therefore the restrictive stormwater requirements are not application for the site.

- The requirements of the Carp River Subwatershed Study will be required.
- A Hydrogeological Report update will be required. Staff can also consider an engineering memo to confirm the well can service the addition.
- Similarly, staff will also required confirmation from an engineer that the septic system has sufficient capacity for the proposed development.
- Site lighting control (full cut-off) is required.
- A Geotech Report will be required.
- An ECA application from the MECP will be required.

- Hydrogeology
  - The Subject Property is identified as thin soils and potential/inferred karst.
  - The supporting documents will need to confirm the soil thickness and soil type onsite to determine if the area is hydrogeologically sensitive.
  - A servicing report that identifies the water and septic demand compared to the existing demand and existing capacity. The suitability of well water quantity and quality is also required and can be a scoped analysis if demand is not changing.
  - If an increase in demand or a change to the well or septic system (i.e. if a new well or septic system is installed) is required, then a complete hydrogeological report and terrain analysis will be required.
  - It should be noted that the area is identified as thin soils and potential karst, so if there are any changes to the well or septic, then hydrogeological sensitivity will need to be confirmed onsite and additional mitigative measures will be required if the site (i.e. extended well casing, increased separation distance between well and septic, siting well and septic based on overburden thickness distribution and groundwater flow direction, etc.).
  - The fact that the area is in a moderate to high recharge area is directly related to it being hydrogeologically sensitive.
  - To account for the high recharge area, within the hydrogeological report (or stormwater management report), measures must be identified to ensure clean infiltration onsite.
  - Infiltration targets from the Carp Subwatershed Study must be met. As per the Subwatershed Study, the applicant can alternatively prepare a local-scale water budget to determine site-specific infiltration targets.

- Transportation
  - A Transportation Impact Assessment will not be required for the proposed addition.
  - A Noise Study will not be required.
  - While the access is existing, there is a vertical curve on David Manchester Road approximately 130 metres to the south. The applicant must demonstrate adequate southerly sightlines on David Manchester to accommodate additional WB-20 truck traffic. Vehicles travelling northbound around the curve must be able to see an entering/existing WB-20 and be able to come to a stop, if necessary. If this can't be achieved, mitigation is required (flashing beacon, signage, tree branch removal, etc.).

- Environmental
  - The property is located within the Rural Natural Feature designation and is adjacent to significant woodlands.
  - There is also potential for habitat for Species at Risk.

- It appears there are trees over 10cm in diameter, therefore a Tree Conservation Report will be required.
- There are no watercourses present on or near the site.
- An Environmental Impact Statement will be required. The EIS will need to address potential species at risk. The season for this study is right now.
- There is identified habitat for species at risk further down avid Manchester Road; the EIS will need to consider any potential impacts the proposed addition will have on that habitat.
- The additional projects into the existing trees; the applicant is encouraged to preserve as much of the existing vegetation as possible. Staff will be looking for enhancements where possible, including trees, shrubs and perennials.
- Staff acknowledge that there was a report prepared for the Site Plan associated with the existing building. Policies and regulations have changed since the preparation and approval of that report with the field work being conducted approximately 10 years ago. The previous report can be used in part, however a new site visit(s) will be required and the report will need to be updated and brought to standards.

- Mississippi Valley Conservation Authority
  - MVCA staff have confirm that this property does not fall within the area that requires compensation related to Poole Creek.
  - MVCA's information sources do not identify any potential hazard features within the scope of their review as being associated with the subject lands.
  - The subject property is not regulated under Ontario Regulation 153/06.
  - With regards to stomwater management:
    - The subject property is located within the Carp River Watershed Study, and has been identified as a mix of:
      - Sand and gravel which has High Recharge and an infiltration target of 262 mm/yr;
      - Paleozoic Bedrock which has a Moderate Recharge and an infiltration target of 104mm/yr;
      - For sites located with a mix of soils types a weighted average based on site conditions should be applied.
    - An enhanced level of protection, 80% TSS removal, is required.
  - The initial stormwater management design for the site completed in 2012 included only normal levels of protection with 70% TSS removal and did not include specific information regarding achieving infiltration targets.

- MTO
  - An updated photometric plan must be completed demonstrating there is no light spillover onto the highway right-of-way.
  - The MTO standards for stormwater management has not changed. New reports will need to meet these standards.
  - A building and land use permit will be required from the MTO.
  - Any additional signs will require a permit from the MTO (on top of any permit or permission required from the City).

**Submission requirements and fees**

- The proposal triggers a Rural Standard Site Plan application. The application form with associated fees can be found here.
- Additional information regarding fees related to planning applications can be found here.
- Please refer to the accompanying required plans and studies list for all documents required to form a complete Site Plan application.
- Please refer to the Guide(s) to Preparing Plans and Studies, found here.

**Next steps**

- The applicant is encouraged to discuss the proposal with Councillor, community groups and neighbours.

# APPENDIX G

Water Balance Calculations

# Water Budget - Playvalue Toys

## Pre-Development Conditions

| Geology | Land Use[1] | Water Holding Capacity (mm)[1] | Area (m2) | Surplus[2] (mm/yr) | Topography Factor | Soil Factor | Vegetation Factor | Infiltration Coefficient | Runoff Coefficient | Infiltration (mm/yr) | Runoff (mm/yr) | Infiltration Volume (m3/yr) | Runoff Volume (m3/yr) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fine to coarse-grained sand | Urban Lawns | 100 | 15231 | 363 | 0.2 | 0.4 | 0.1 | 0.7 | 0.3 | 254 | 109 | 3870 | 1659 |
| Limestone | Urban Lawns | 50 | 1239 | 402 | 0.2 | 0.4 | 0.1 | 0.7 | 0.3 | 281 | 121 | 349 | 149 |
| Total Site Area | | 96 | 16470 | 366 | 0.2 | 0.4 | 0.1 | 0.7 | 0.3 | 256 | 110 | 4219 | 1808 |

1. Table 3.1 MOE SWMP Planning and Design Manual (2003)
2. Surplus data taken to be average of Environment Canada Water Budget Means for Ottawa Intl A 1939-2013 and Carleton-Appleton 1984-2006.

## Current Development Conditions

| Geology | Land Use[1] | Water Holding Capacity (mm)[1] | Area (m2) | Surplus[2] (mm/yr) | Topography Factor | Soil Factor | Vegetation Factor | Infiltration Coefficient | Runoff Coefficient | Infiltration (mm/yr) | Runoff (mm/yr) | Infiltration Volume (m3/yr) | Runoff Volume (m3/yr) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fine to coarse-grained sand and limestone | Urban Lawn | 96 | 11678 | 366 | 0.2 | 0.4 | 0.1 | 0.7 | 0.3 | 256 | 110 | 2991 | 1282 |
| Hard Surface (building and parking) | Impermeable[3] | 0 | 4792 | 729 | - | - | - | 0 | 1 | 0 | 729 | 0 | 3493 |
| Total | | | 16470 | | | | | | | | | 2991 | 4775 |
| | | | | | | | | Weighted Average [4] | | 182 | 290 | | |

1. Table 3.1 MOE SWMP Planning and Design Manual (2003)
2. Surplus data taken to be average of Environment Canada Water Budget Means for Ottawa Intl A 1939-2013 and Carleton-Appleton 1984-2006.
3. Hard Surface surplus calculated to be average precipitation - 20% evaporation (conservative estimate as per Cuddy et al., 2013)
4. Weight average

## Future Development Conditions

| Geology | Land Use[1] | Water Holding Capacity (mm)[1] | Area (m2) | Surplus[2] (mm/yr) | Topography Factor | Soil Factor | Vegetation Factor | Infiltration Coefficient | Runoff Coefficient | Infiltration (mm/yr) | Runoff (mm/yr) | Infiltration Volume (m3/yr) | Runoff Volume (m3/yr) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fine to coarse-grained sand and limestone | Urban Lawn | 96 | 9719 | 366 | 0.2 | 0.4 | 0.1 | 0.7 | 0.3 | 256 | 110 | 2490 | 1067 |
| Hard Surface (building and parking) | Impermeable[3] | 0 | 6751 | 729 | - | - | - | 0 | 1 | 0 | 729 | 0 | 4921 |
| Total | | | 16470 | | | | | | | | | 2490 | 5988 |
| | | | | | | | | Weighted Average [4] | | 151 | 364 | | |

1. Table 3.1 MOE SWMP Planning and Design Manual (2003)
2. Surplus data taken to be average of Environment Canada Water Budget Means for Ottawa Intl A 1939-2013 and Carleton-Appleton 1984-2006.
3. Hard Surface surplus calculated to be average precipitation - 20% evaporation (conservative estimate as per Cuddy et al., 2013)
4. Weight average

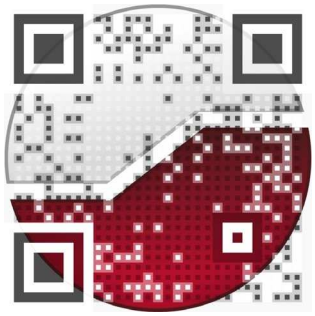
## Water Budget Summary

| Summary | Infil mm/yr | Runoff mm/yr | Infiltration $m^3/yr$ | Runoff $m^3/yr$ |
|---|---|---|---|---|
| Pre-Development | 256 | 110 | 4219 | 1808 |
| Current Development | 182 | 290 | 2991 | 4775 |
| Future Development | 151 | 364 | 2490 | 5988 |
| **Change Current Development** | **-75** | **180** | **-1227** | **2967** |
| **% Change Current Development** | | | **-29** | **164** |
| **Change Future Development** | **-105** | **254** | **-1729** | **4180** |
| **% Change Future Development** | | | **-41** | **231** |

GEMTEC
Consulting Engineers and Scientists

Project: 61118.03
Date: December 2020

experience • knowledge • integrity



| | |
|---|---|
| civil | civil |
| geotechnical | géotechnique |
| environmental | environnementale |
| field services | surveillance de chantier |
| materials testing | service de laboratoire des matériaux |

expérience • connaissance • intégrité