FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT

White Cedar Estates - Residential Development
Landsdown Drive
City of Guelph
December 2013

KAM ENGINEERING LTD.

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KAM-13-084

18 December 2013

Dunsire Developments
465 Phillip Street, Suite 203A
Waterloo, ON N2L 6C7

Attn: Mr. Yousif Kazandji, Development Manager

Re: Functional Servicing and Stormwater Management Report
White Cedar Estates - Residential Development
Landsdown Drive
City of Guelph

1. INTRODUCTION

KAM Engineering Ltd. has prepared this report to address the functional servicing and stormwater management (SWM) requirements in support of the Draft Plan of Condominium on Part of Lots 6, 9, 10 and 13, Registered Plan 488, City of Guelph, hereafter referred to as the White Cedar Estates Development. The 1.87 hectare site is bound by single family residential lots and Landsdown Drive to the south, existing residential lands to the east & west, and an existing Grand River Conservation Authority (GRCA) wetland to the north. The site is currently comprised mainly of the rear portion of existing residential lots, a small Scott's Pine plantation, and a single family residential lot with associated one storey brick dwelling, two accessory buildings, an asphalt driveway, concrete walkways, and landscaped areas. Refer to the Topographic Sketch by J.D. Barnes Limited for existing site conditions and the key plan on drawing C1 for the relative location of the proposed development, both in Appendix A.

It is the intent of the owner, at this time, to develop 1.62 ha of the site with 26 single-family condominium dwellings, associated asphalt roads and driveways, and site accessed from Landsdown Drive and the neighbouring Valley Road Estates development. Of the remaining site area, 0.17ha is wetland buffer proposed to be conveyed to the City of Guelph and 0.08 ha of the site will be single family residential freehold lot fronting on, and serviced from, Landsdown Drive. Refer to the Draft Plan of Condominium in Appendix A for the proposed site layout.

2. EXISTING CONDITIONS

2.1. Land Use

Under existing conditions, the majority of the site is the rear portion of existing residential lots including a small Scott's Pine plantation. There is an existing single family residential lot with associated one storey brick dwelling, two accessory buildings, an asphalt driveway, concrete walkways, and landscaped areas at the south portion of the site adjacent to Landsdown Drive.

The site is bordered by a GRCA wetland to the north, hereafter referred to as the wetland. Portions of 15m and 30m wetland buffer are located at the northwest corner of the site.

2.2. Topography

The entire site slopes from the south property limit north towards the wetland. The existing ground elevations range from 344.00 to 332.75 and have an average gradient across the site of 6%.

2.3. Soils

The predominant soil type throughout the site is clayey silt to silty sand with trace gravel and becomes sandy silt with some clay as the depth increases, as per the geotechnical report by Inspec-Sol Inc. attached in Appendix B.

Inspec-Sol Inc. completed five (5) boreholes throughout the site on August 6, 2013. Borehole Reports and location plan are included in the geotechnical report provided in Appendix B.

The soil samples are classified as SM according to the Unified Soil Classification System.

2.4. Groundwater

The measurements of groundwater elevations are shown in the borehole reports included in the geotechnical report provided in Appendix B.

3. PROPOSED DEVELOPMENT

The proposed Draft Plan of Condominium by Astrid J. Clos Planning Consultants, in Appendix A, illustrates the proposed site layout including condo units, roadways, stormwater management area, and existing wetland and buffers. Road accesses to the development are from Landsdown Drive to the South and the Valley Road Estates development to the East. Road access to future development to the West is also provided. A future walkway/trail is provided for along the north side of the site within the 15m wetland buffer.

3.1. Site Grading

The site grading for the proposed residential units, internal roads, and stormwater management area is shown on the Preliminary Site Grading Plan C1 provided in Appendix A.

The proposed site grading will match the existing ground elevations along the perimeter of the site and slope to match existing elevations along the northwest corner of the site within the wetland buffers.

In an effort to maintain reasonable grades on the roadway and yards and work towards a balanced cut/fill balance on site, proposed residential units have been graded from back to front or as split drainage lots with rear look-outs or walk-outs.

3.2. Internal Roads and Private Driveways

The internal roads throughout the site are designed with a minimum gradient of 1.0% and a maximum gradient of 6.0% and private driveways are designed with a minimum gradient of 2.0% and a maximum gradient of 8.0%, all as per municipal standards.

The typical internal roads cross-sections are shown on drawing C3 in Appendix A. The proposed 7m wide private drive extends from Landsdown Drive to a 'T' intersection with another private drive that extends from the west limit of the development (available for future development) to the Valley Road Estates development at the east limit of the site. A drive width of 6.55m and asphalt width of 6m will be maintained on all private drives.

3.3. Water Supply

Domestic and fire-fighting water supply for the proposed development will be provided by a 150mm diameter watermain. Connections will be made to the existing municipal watermain on Landsdown Drive and private watermain within the Valley Road Estates development.

The design of the water distribution system within the proposed development will be completed during the detailed design stage and will create a looped system.

3.4. Sanitary Service

A 200mm diameter sanitary sewer will provide sanitary service to the condo units within the proposed development.

Due to the difference in elevation between the proposed development and the existing sanitary sewer on Landsdown Drive, a gravity connection to for the development to the Landsdown sewer is not feasible. Therefore, the sanitary sewer within the proposed development will discharge via gravity to the existing sanitary pumping station located in the adjacent Valley Road Estates development. This pumping station pumps the sanitary discharge via a forcemain to the existing municipal gravity sanitary sewer system on Landsdown Drive.

As per the Valley Road Estates Sewage Pumping Station Final Design Brief dated September 2008 by Gamsby and Mannerow Limited, the sewage pumping station is designed for a total of 53 single family dwellings. Since the Valley Road Estates development has 21 units and this development has 26 proposed units (for a total of 47 units), the existing sewage pumping station should have capacity for this development, however, this will be further reviewed and confirmed during the detailed design stage along with the on-site gravity sanitary sewer system.

3.5. Storm Sewers

Storm water drainage for the proposed development will be provided by a gravity storm sewer system. The preliminary design of the storm sewer system is shown on drawing C2 in Appendix A.

The storm sewer system provides drainage for the rear yard swales and internal road and outlets to an oil/grit separator where runoff is controlled for quality before draining to the stormwater management area. There, runoff is controlled for quantity before it outlets to the wetland. The SWM system is described in Section 4 of this report.

4. STORMWATER MANAGEMENT

4.1. Reference Documents

The following reference documents were used to develop an appropriate SWM scheme for this development:

4.1.1. Ontario Ministry of the Environment Guidelines

4.1.1.1. Stormwater Management Planning and Design Manual, 2003
This manual "provides technical and procedural guidance for the planning, design, and review of SWM practices."

4.1.2. Ontario Ministry of Transportation Guidelines

4.1.2.1. Drainage Management Technical Guidelines, 1991

4.1.3. Region of Waterloo Guidelines

4.1.3.1. Design Guidelines and Supplemental Specification for Municipal Services (DGSSMS), 2013
This document provides "design guidelines and contract specifications to facilitate the design and construction of municipal services."

4.1.4. Instructions and Tables for Computing Potential Evapotranspiration and the Water Balance (Thornthwaite & Mather, 1957)
This document provides design methodology for the water budget analysis

4.1.5. Environment Canada Climate Normals 1971-2000 - Guelph Arboretum
This reference provides average monthly precipitation values used in the water budget analysis

4.1.6. Site Specific Documents

4.1.6.1. Draft Plan of Condominium – Astrid J. Clos Planning Consultants – September, 2013

4.1.6.2. Topographic Sketch – J.D. Barnes Limited.– July 15, 2013

4.1.6.3. Geotechnical Report – Inspec-Sol Inc. – *October 7, 2013*

4.1.6.4. City of Guelph As-Recorded Plan & Profile Drawings of Landsdown Road

4.2. Design Criteria

The following SWM management criteria were established for this site:

4.2.1. Quantity Controls

4.2.1.1. The post-development flows generated from the site during the 5-year and 100-year design storms are to be attenuated to the 5-year pre-development levels respectively.

4.2.1.2. The major flows, exceeding the 100-year design storm, are to be routed overland northerly to the existing GRCA wetland.

4.2.2. Quality Controls

4.2.2.1. An enhanced level of stormwater quality control (80% total suspended solids removal) is required prior to discharging from the site.

4.2.2.2. Maintain as much as feasible, the recharge and runoff patterns of the pre-development site.

4.2.2.3. Roof water leaders are to discharge to grade to promote pre-treatment and groundwater recharge.

4.2.3. Rainfall Parameters

The City of Guelph rainfall parameters were used to generate the mass rainfall data required to model the 5-year and 100-year design storms. The Chicago storm parameters for the above noted storms are as follows:

Return Period (Years)	Parameters			Duration (Hours)
	a	b	c	
5	1593	11	0.8789	3
100	4688	17	0.9624	3

4.2.4. Hydrologic Modelling

As the proposed development is relatively small (less than 2ha), the Rational Method was used for hydrologic modelling to calculate runoff volumes and route flows through the storm sewers and storage pond.

4.3. Wetland Outlet

One of the goals of this development is to preserve the flow volumes to the existing wetland that is partially supplied by this site. The wetland has been labelled as shown on the Draft Plan of Condominium included in Appendix A.

4.4. Pre-Development Conditions

The existing 1.62 ha condo site area is currently comprised mainly of grassed rear-yard areas, a small Scott's Pine plantation, and a portion of an existing single family residential lot.

The Topographic Sketch by J.D. Barnes Limited shows that runoff from the site sheetflows overland from the high elevations along the south property Line (adjacent to the Landsdown Drive R.O.W.) to the existing GRCA wetland located to the north of the property at an average surface slope of about 6.0%. Refer to the Pre-Development Catchment Area Plan on drawing C2 provided in Appendix A for pre-development catchment areas and contours.

A runoff coefficient of 0.15, as selected from the DGSSMS, was used for the pre-development catchment area 'A0'. The low extreme for grassed areas was conservatively selected to produce a lower allowable release rate (restricted flow rate) which is the 5-year pre-development flow rate at the 10 minute time of concentration. The 5-year pre-development flow rate was determined to be 75.54 L/s as shown in the SWM Calculations provided in Appendix C.

4.5. Post-Development Conditions

The 1.62 ha condo site is comprised of the proposed single-family residential condominium development under post-development conditions. Refer to the Draft Plan of Condominium in Appendix A for the proposed site layout. The 0.17ha wetland buffer and 0.08 ha single family residential lot fronting on, and serviced from, Landsdown Drive are external to the condominium site and are therefore excluded from the SWM analysis.

4.5.1. Stormwater Management Overview

The intent of the stormwater management scheme is to match, as much as possible, the pre-development conditions of the site by maintaining similar drainage patterns to the existing wetland.

The stormwater management system is a "treatment train" approach with lot level, conveyance, and end-of-pipe controls to provide the required water quality and quantity controls for the development.

4.5.2. Lot Level Controls

Lot level controls for all single family detached dwellings include sump pumps to direct foundation drainage from all units to grassed yard areas and/or swales and conveyed to the storm sewer system or SWM pond.

Where practical, the lengths of the rear yard swales have been maximized to extend the contact time with the grassed surfaces.

To promote infiltration on the lots and in the swales and be consistent with the Geotechnical report, it is recommended that the average depth of the graded topsoil be maximized (100 mm min.).

4.5.3. Conveyance Controls

The storm conveyance system for the development consists of grassed swales, storm sewers, and an oil/grit separator. Conveyance controls will be achieved through regular maintenance of the system, including regular cleanout of the catchbasins, manholes, and the oil/grit separator as part of site's annual maintenance program including the cleanout of manholes, catchbasins, and the oil/grit separator to remove debris, sediment, and oil collected during rainfall events.

4.5.4. End-of-pipe Controls

One (1) oil/grit separator will pre-treat the stormwater runoff for quality prior to discharging to the stormwater management ponding area for quantity control. The proposed locations of these features are shown on drawings C1 and C2 in Appendix A.

4.5.5. Post-Development Catchments

The post-development catchment areas are shown on drawing C3 provided in Appendix A.

The 1.62 ha site area is divided into five (5) catchment areas (A1-A5). Areas A1-A3 (containing the internal roads) outlet to the oil/grit separator where runoff is quality controlled before discharging to the SWM quantity pond. Areas A4 and A5 are conveyed over grassed areas for some level of pre-treatment before discharging directly to the SWM quantity pond as the runoff from these areas is from rooftops and grassed yards only and is considered to be "clean". The SWM ponding area controls the runoff for quantity prior to discharging into the existing GRCA wetland to the north.

A runoff coefficient (C) of 0.45, as selected from the DGSSMS, was used for the post-development controlled catchment areas. The high extreme for single family residential lands was conservatively selected to produce a higher runoff volumes and storage requirements.

4.5.6. Quality Controls

The minor flows from catchment areas A1-A3 are conveyed to the proposed Stormceptor model STC 750 oil/grit separator prior to discharging to the proposed SWM quantity pond. These areas have an estimated imperviousness of 40%, which corresponds to the runoff coefficient (C) of 0.45 selected for hydrologic modelling. The Stormceptor Design Summary provided in Appendix D shows that this model provides an enhanced level stormwater quality control at 80% total suspended solids removal.

Areas A4 and A5 are conveyed over grassed areas for some level of pre-treatment before discharging directly to the SWM quantity pond as the runoff from these areas is from rooftops and grassed yards only and is considered to be "clean".

4.5.7. Quantity Controls

The 100-year post-development flows from the catchment areas are attenuated to the 5-year pre-development flow rate of 75.54 L/s at the outlet structure of the SWM quantity pond. The outlet structure is comprised of a 182mm diameter orifice on the outlet pipe, restricting the outlet flow to 75.54 L/s and creating the ponding in the SWM detention area.

This restriction creates a maximum required storage volume of 285.6 m^3 during the 100-year design storm event. The proposed SWM quantity pond with a maximum 100-year ponding elevation of 334.70 masl and ponding depth of 0.79 m provides a storage volume of 353.8 m^3, exceeded the required storage volume. The 100-year hydrologic modelling using the Rational Method and the orifice restriction calculations are shown in the calculations provided in Appendix C.

Runoff from storms exceeding the 100-year design storm event will be conveyed as overland sheetflow to the GRCA wetland via a 5 m overflow weir located on the north side of the pond at the 100-year ponding elevation of 334.70 masl.

4.6. Water Budget

The pre-development and post-development monthly water budget calculations provided in Appendix E utilize the Thornthwaite & Mather (1957) method for computing monthly potential Evapotranspiration and the Water Balance.

The average annual precipitation for the area in which this site is located is about 923 mm. This amount, the average monthly precipitation, and average monthly temperatures were obtained from data recorded at the Guelph Arboretum meteorological station for the period from 1971 to 2000. The soil type was obtained from the site's geotechnical report by Inspec-Sol Inc. The runoff factor for this soil type and vegetation was obtained from the MOE SWM Planning & Design Manual (2003).

Under existing conditions, the entire 1.62 ha site is comprised of pervious surfaces. Approximately 40% of the post-development site area is comprised of impervious surface, which corresponds to the runoff coefficient (C) of 0.45 selected for hydrologic modelling. This impervious area is estimated to contribute 10% of the precipitation it receives to evapotranspiration, 90% to runoff, and 0% to recharge/infiltration. As such, development (increased impervious cover) results in additional precipitation being available for runoff and recharge due to the decrease in evapotranspiration. A table summarizing the effect the proposed development has on monthly and total yearly values of these parameters for the site is provided below.

Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total Yearly
Pre-Development Evapotranspiration Volume (m^3)	0.0	0.0	0.0	49.0	122.5	164.8	175.9	164.3	116.3	60.0	15.7	0.0	**868.4**
Post-Development Evapotranspiration Volume (m^3)	0.0	0.0	0.0	31.4	78.4	105.5	112.6	105.1	74.4	38.4	10.1	0.0	**555.8**
Percent Change	0.0%	0.0%	0.0%	-36.0%	-36.0%	-36.0%	-36.0%	-36.0%	-36.0%	-36.0%	-36.0%	0.0%	**-36.0%**
Pre-Development Runoff & Rechage* Volume (m^3)	15.7	7.9	3.9	82.5	212.0	106.4	53.4	26.8	13.4	7.7	65.9	31.4	**627.1**
Post-Development Runoff & Rechage* Volume (m^3)	20.8	10.4	5.2	92.0	238.8	149.4	106.6	83.0	62.4	43.0	86.4	41.7	**939.8**
Percent Change	32.6%	32.6%	32.6%	11.5%	12.6%	40.5%	99.6%	209.7%	364.6%	458.5%	31.1%	32.6%	**49.9%**
Pre-Development Runoff Volume (m^3)	6.3	3.1	1.6	33.0	84.8	42.6	21.4	10.7	5.4	3.1	26.4	12.6	**250.8**
Post-Development Runoff Volume (m^3)	12.5	6.3	3.1	55.2	143.3	89.7	63.9	49.8	37.5	25.8	51.8	25.0	**563.9**
Percent Change	98.9%	98.9%	98.9%	67.2%	68.9%	110.7%	199.4%	364.5%	596.9%	737.7%	96.6%	98.9%	**124.8%**
Pre-Development Recharge* Volume (m^3)	9.4	4.7	2.4	49.5	127.2	63.8	32.0	16.1	8.1	4.6	39.5	18.9	**376.3**
Post-Development Recharge* Volume (m^3)	8.3	4.2	2.1	36.8	95.5	59.8	42.6	33.2	25.0	17.2	34.6	16.7	**375.9**
Percent Change	-11.6%	-11.6%	-11.6%	-25.7%	-24.9%	-6.4%	33.1%	106.4%	209.7%	272.3%	-12.6%	-11.6%	**-0.1%**

*Note: Recharge is synominous with infiltration in the MOE SWM Planning and Design Manual, some of which discharges back the the wetland as base flow.

The above table shows that the post development evapotranspiration is reduced by 36% which results in about 50% increase in runoff and recharge, no appreciable change in recharge/infiltration, and about 125% increase in runoff. It is noted that, although runoff volumes from this site to the wetland increase under post-development conditions, this site represents a very small portion of the total are contributing to the GRCA wetland and these runoff volumes are controlled for quality (80% removal of total suspended solids) and quantity (flows from the 100-year storm event and less are attenuated to the pre-development 5-year storm levels) by the site SWM system prior to discharging to the GRCA wetland.

5. SEDIMENT AND EROSION CONTROL PLAN

Primary sediment control will be achieved with the installation of a heavy duty silt fence to OPSD 219.130 within the 30 m wetland buffer and light duty silt fence to OPSD 219.110 along the north and west property lines outside of the 30 m wetland buffer. Refer to drawing C1 in Appendix A for locations.

Erosion control is provided by the site's SWM quantity controls, limiting the post-development 100-year flows to the 5-year pre-development levels. Additionally, 450 mm thick 150-300 mm diameter rip-rap protection is proposed at the pipe inlets to the pond, and the pond's pipe (minor flows) and overflow weir (major flows) outlets to the GRCA wetland.

The following sediment and erosion control will be incorporated on the detailed design drawings:

1. Protect all exposed surfaces and control all runoff during construction.
2. All erosion control measures to be in place before starting construction and remain in place until restoration is completed.
3. Maintain erosion control measures during construction.
4. All collected sediment to be disposed of at an approved location.
5. Minimize area disturbed during construction.
6. All dewatering to be disposed of in an approved sedimentation basin.
7. Protect all catchbasins, manholes, and pipe ends from sediment intrusion with geotextile (Terrafix 270 R or approved equal).
8. Keep all sumps clean during construction.
9. Prevent wind-blown dust.
10. Straw bales to be used in localized areas as directed by the engineer during construction for works which are in or adjacent to flood lines, fill lines and hazardous slopes.
11. Straw bales to be terminated by rounding bales to contain and filter runoff.

12. Obtain approval from the City of Guelph and the Grand River Conservation Authority (GRCA) prior to construction for works which are in, or adjacent to wetlands, flood lines, fill lines, and hazardous slopes.
13. All silt fencing and details are at the minimum to be constructed in accordance with the Ministry of Natural Resources Guidelines on Erosion and Sediment Control for Urban Construction Sites.

All of the above notes and any sediment and erosion control measures are at the minimum to be in accordance with the Ministry of Natural Resources Guidelines on Erosion and Sediment Control for Urban Construction Sites. We recommend that the contractor incorporate additional, site-specific sediment control measures to their construction management plan. Additional sediment and erosion control measures may be required as site-determined by the City of Guelph or Engineer.

6. CONCLUSIONS

The following is as summary of the preceding preliminary site servicing and SWM design:

- Sanitary and water services can be provided to the proposed development and will be designed during the detailed design phase of the project.

- The 5 and 100-year post-development stormwater runoff flows are attenuated to the 5-year pre-development levels of 75.54 L/s through the use of a 182 mm on-line orifice plate, restricting flows from catchment areas A1-A5.

- The 182 mm on-line orifice plate creates a maximum ponding depth in the SWM detention pond of 0.79 m during the 100-year design storm and a total storage required volume of 285.6 m^3.

- The major stormwater flows from storms exceeding the 100-year design storm are conveyed overland, northerly to the existing GRCA wetland through the SWM quantity pond's 5 m wide overflow weir (elevation 334.70 m).

- The proposed Stormceptor STC 750 oil/grit separator provides an enhanced level of stormwater quality control (80% removal of total suspended solids).

- The existing GRCA wetland will be partially maintained by the flows from the site's SWM system.

- The site's SWM system meets the current Provincial, Conservation Authority, and Municipal guidelines for stormwater quantity and quality controls.

- The site's SWM system, in conjunction with other sediment and erosion control measures, will be used to retain sediment on-site and reduce the potential for erosion of downstream features.

8. LIMITATIONS

This report was prepared by KAM Engineering Ltd. for the City of Guelph and Dunsire Developments. Any use which a third party makes of this report or any reliance on or decisions to be made based on it, are the

responsibility of such third parties. KAM Engineering Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

The review was limited to the reference documents listed in this report. KAM Engineering Ltd. accepts no responsibility for the accuracy of the information provided by others. All opinions presented in this report are based on the information available at the time of the review.

9. CLOSURE

We trust this review meets your satisfaction. Should you have any questions or require further information, please do not hesitate to contact us.

Respectfully Submitted,
KAM ENGINEERING LTD.

Kevin Moniz, P.Eng.
Project Engineer

APPENDIX A

Topographic Sketch
Draft Plan of Condominium
Preliminary Site Engineering Drawings

TOPOGRAPHIC SKETCH OF

PART OF LOTS 6, 7 AND 13
AND
PART OF BLOCK A
AND
ALL OF LOTS 8, 9, 10 AND 12 REGISTERED PLAN 488

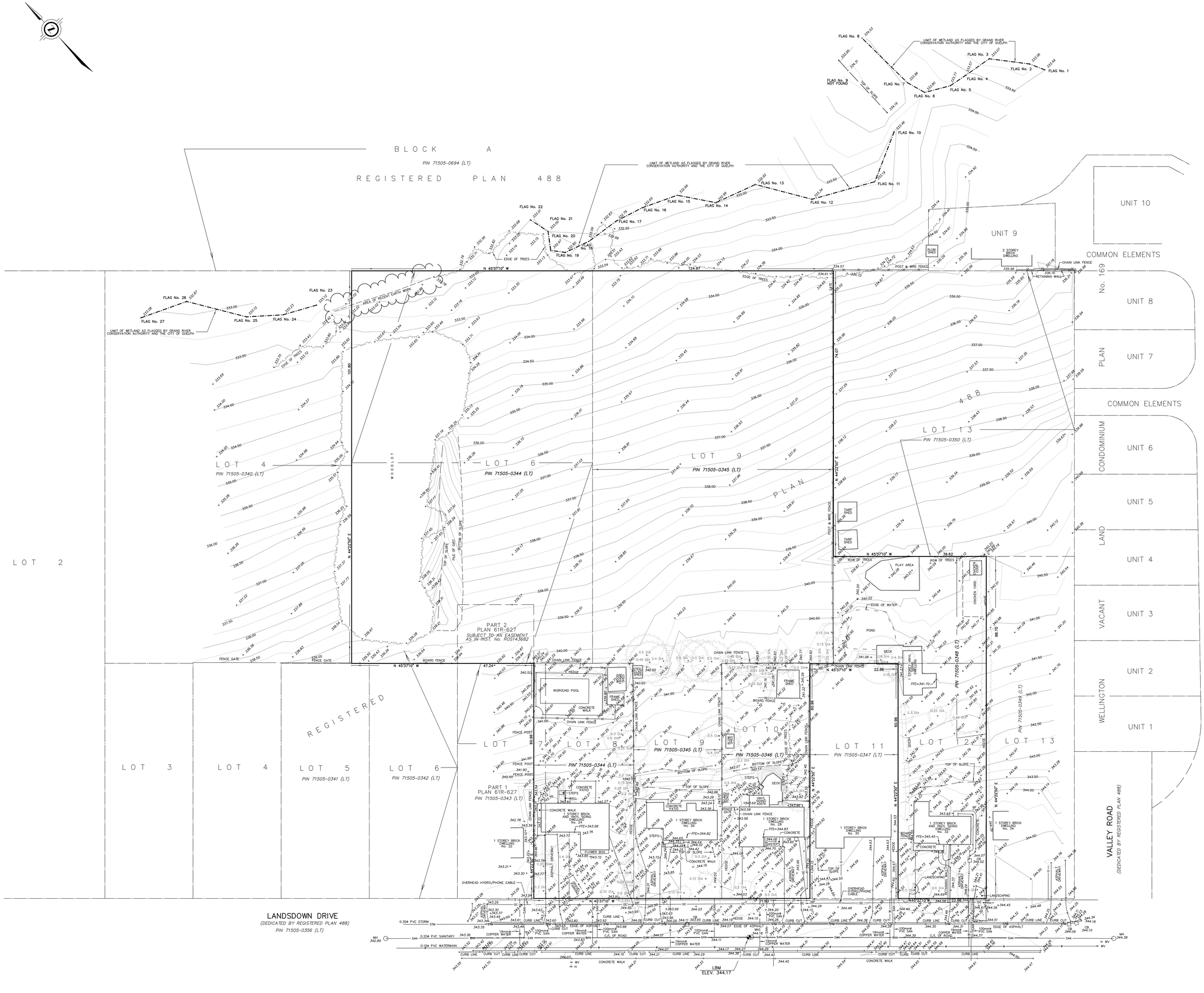
CITY OF GUELPH

SCALE 1 : 300

5 0 5 10 20 metres

J.D. BARNES LIMITED

METRIC DISTANCES AND/OR COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.



LEGEND

CB	DENOTES SINGLE CATCHBASIN
MH	DENOTES MANHOLE
HP	DENOTES HYDRO POLE
H	DENOTES FIRE HYDRANT
WV	DENOTES WATER VALVE
MW	DENOTES MONITORING WELL
FFE	DENOTES FINISHED FLOOR ELEVATION
PVC	DENOTES POLYVINYL CHLORIDE
W	DENOTES WATER MAIN
OHP	DENOTES OVERHEAD HYDRO/PHONE CABLES
SAN	DENOTES SANITARY LINE
GAS	DENOTES GAS SERVICE LINE
STM	DENOTES STORM LINE
BM	DENOTES LOCAL BENCHMARK
DIA	DENOTES DIAMETER OF TRUNK IN METRES
	DENOTES DECIDUOUS TREE
	DENOTES CONIFEROUS TREE

NOTES

BEARINGS ARE UTM GRID, DERIVED FROM GPS OBSERVATIONS USING REAL TIME NETWORK (RTN) OBSERVATIONS, UTM ZONE 17, NAD83 (CSRS) (1997.0).

DISTANCES ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.999599.

BOUNDARY INFORMATION HAS BEEN COMPILED FROM AVAILABLE PAPER RECORDS ONLY AND ROTATED TO MATCH GRID BEARINGS AND HAS NOT BEEN VERIFIED BY FIELD MEASUREMENTS.

UNDERGROUND SERVICES HAVE BEEN DIGITIZED FROM THE CITY OF GUELPH'S ENGINEERING DEPARTMENT, DRAWING FOR LANDSDOWN DRIVE, CITY REFERENCE No. I-320.

BENCHMARK

ELEVATIONS HEREIN ARE GEODETIC AND ARE REFERRED TO MINISTRY OF TRANSPORTATION BENCHMARK 00B1969BB10 HAVING AN ELEVATION OF 333.831m.

LOCAL BENCHMARK

LBM - A CONCRETE NAIL NORTH OF A MANHOLE LOCATED ALONG THE CENTRELINE OF LANDSDOWN DRIVE DIRECTLY OPPOSITE A 1 STORY BRICK DWELLING, No. 28, HAVING AN ELEVATION OF 344.17 METRES.

IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THAT THE LOCAL BENCHMARKS HAVE NOT BEEN ALTERED OR DISTURBED AND THAT THE ELEVATIONS, DATUMS AND DESCRIPTIONS AGREE WITH THE INFORMATION SHOWN ON THIS PLAN.

BEFORE DIGGING, UNDERGROUND SERVICES SHOULD BE LOCATED ON SITE BY THE RESPECTIVE AGENCIES.

ALL CURB ELEVATIONS ARE FROM THE TOP OF CURB.

INDEX CONTOURS ARE AT 0.50m INTERVALS.
INTERMEDIATE CONTOURS ARE AT 0.25m INTERVALS.

THE FIELDWORK WAS COMPLETED ON JUNE 24th, 2013.

J.D.BARNES LIMITED SURVEYING MAPPING GIS
LAND INFORMATION SPECIALISTS
401 WHEELABRATOR WAY, SUITE A, MILTON, ON L9T 3C1
T: (905) 875-9955 F: (905) 875-9956 www.jdbarnes.com

DRAWN BY:	CHECKED BY:	REFERENCE NO.:
RSQ		13-30-500-00-A
FILE: © \13-30-500\2013\13-30-500-00-A.dgn	DATED: JULY 15th, 2013	
	PLOTTED: 7/15/2013	

ASTRID J. CLOS
PLANNING CONSULTANTS

Phone: (519) 836-7526 (836-PLAN)
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423 WOOLWICH STREET, SUITE 201
GUELPH , ONTARIO N1H 3X3

DRAFT PLAN OF CONDOMINIUM
LANDSDOWN DRIVE

DATE: SEPTEMBER 16, 2013	SCALE 1:400
PROJECT No. 1323	DRAWN BY: G.K.S.

WETLAND FLAGGED BY DOUGAN & ASSOCIATES MAY 13, 2013
CONFIRMED BY GRCA ON MAY 28, 2013
SURVEYED BY J.D. BARNES ON JUNE 24, 2013

BLOCK A
REGISTERED PLAN 488

COMMON ELEMENT
STORMWATER MANAGEMENT AREA
0.128 ha

TREED AREA

REGISTERED PLAN 488

LOT 4 | LOT 3 | LOT 5 | LOT 6 | LOT 7 | LOT 8 | LOT 9 | LOT 10 | LOT 11 | LOT 12 | LOT 13

PART 1
PLAN 61R-627

PROPOSED LOT
822m²

COMMON ELEMENT

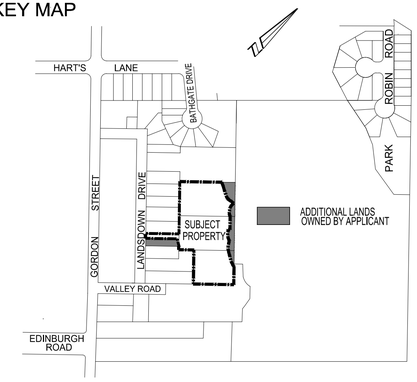
LANDSDOWN DRIVE
(DEDICATED BY REGISTERED PLAN 488)

VALLEY ROAD
(DEDICATED BY REGISTERED PLAN 488)

PUMPING STATION

UNIT 10
UNIT 9
UNIT 8
UNIT 7
COMMON ELEMENTS
WELLINGTON VACANT LAND CONDOMINIUM PLAN No. 169
UNIT 6
UNIT 5
UNIT 4
UNIT 3
UNIT 2
UNIT 1

KEY MAP



LEGAL DESCRIPTION

PART OF LOTS 6, 7 AND 13
AND
PART OF BLOCK A
AND
ALL OF LOTS 8, 9, 10 AND 12
REGISTERED PLAN 488
CITY OF GUELPH

LAND USE SCHEDULE

DESCRIPTION	UNITS	DWELLINGS	AREA (hectares)
SINGLE DETACHED UNITS	1-26	26	1.267
COMMON ELEMENT STORM WATER MANAGMENT	-	-	0.128
COMMON ELEMENT ROAD	-	-	0.228
TOTAL	26	26	1.623

NOTES

1. ORIGINAL SURVEY AND TOPOGRAPHICAL INFORMATION BY J.D. BARNES LTD.

ADDITIONAL INFORMATION

(UNDER SECTION 51(17) OF THE PLANNING ACT)

INFORMATION REQUIRED BY CLAUSES a,b,c,d,e,f,g,j and I ARE AS SHOWN ON DRAFT PLAN.

(h) MUNICIPAL WATER
(k) MUNICIPAL SEWER

OWNER'S CERTIFICATE

I AUTHORIZE ASTRID J. CLOS, PLANNING CONSULTANTS TO PREPARE AND SUBMIT THIS DRAFT PLAN OF CONDOMINIUM TO THE CITY OF GUELPH

SHAWN KEEPER
DUNSIRE (LANDSDOWN) INC.

DATE

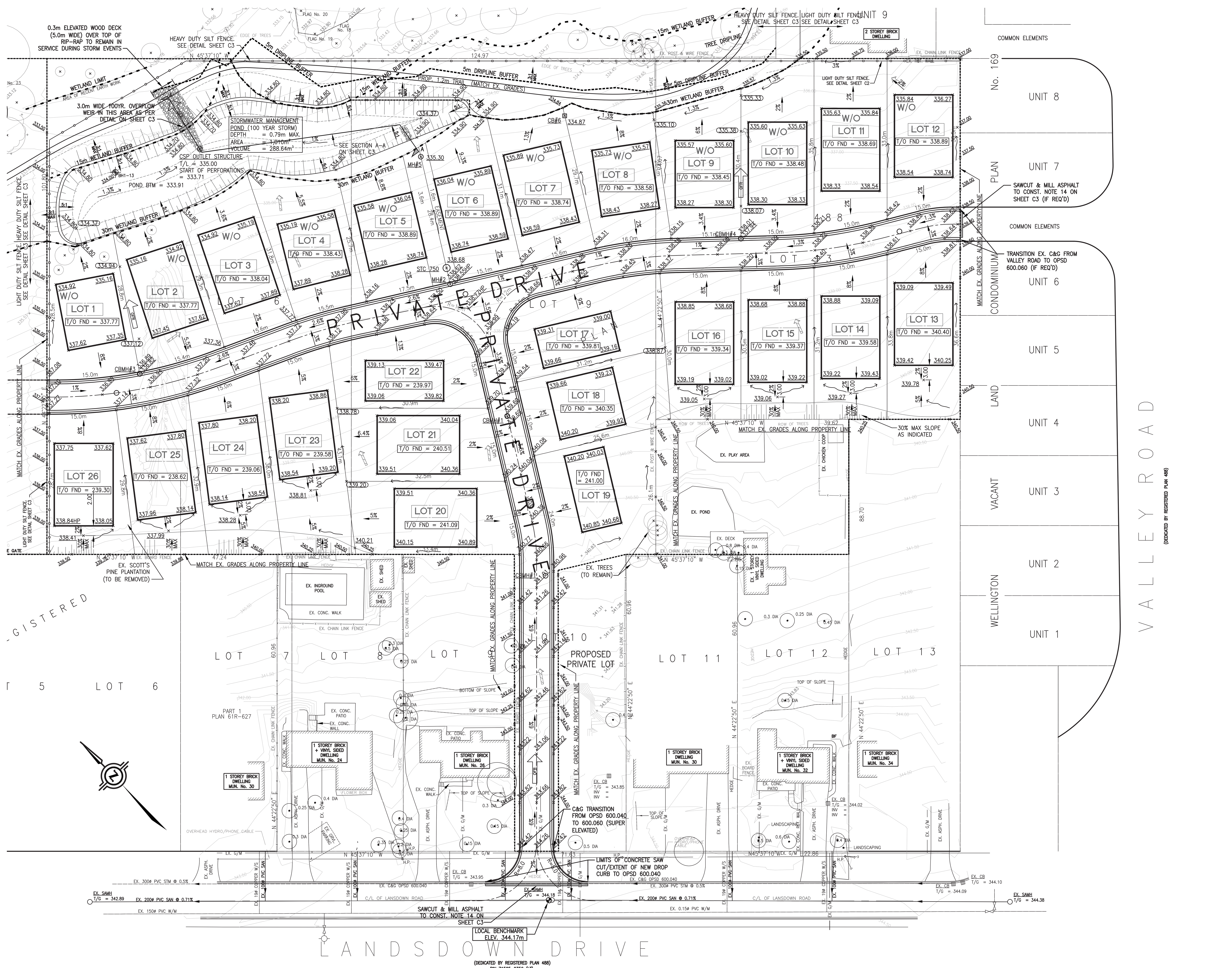
SURVEYOR'S CERTIFICATE

I CERTIFY THAT THE BOUNDARIES OF THE LAND TO BE SUBDIVIDED AND THEIR RELATIONSHIP TO THE ADJACENT LANDS ARE CORRECTLY SHOWN.

GRANT STIDWELL, O.L.S.
J.D. BARNES LTD.

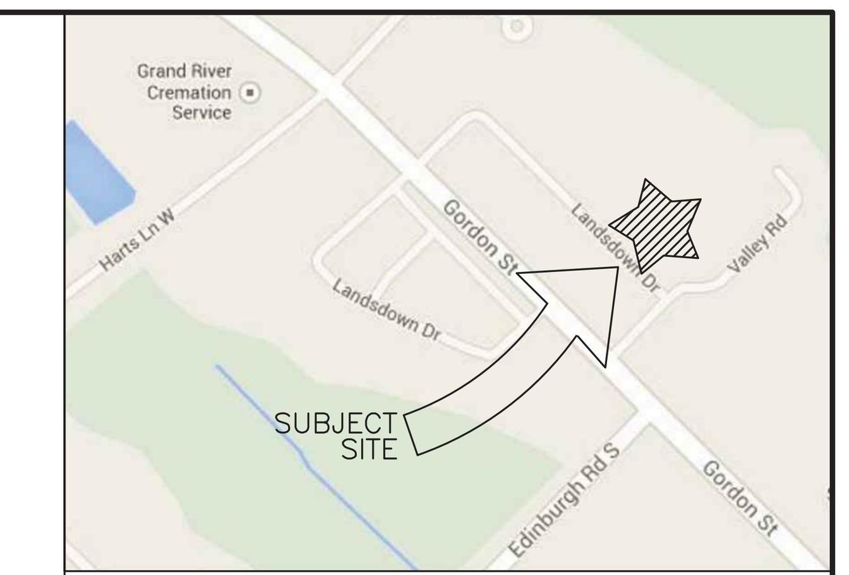
DATE

Dec 05,2013-2:17pm (21577-13)
C:\Users\George.Shirton\appdata\local\temp\AcPublish_4480\Condo Draft Plan Landsdown Dr



LEGAL INFORMATION

PART OF
LOTS 6 + 7
AND ALL OF
LOTS 8 + 9 RP 488
IN THE
CITY OF GUELPH
COUNTY OF WELLINGTON



KEY PLAN

N.T.S.

BENCHMARK:

ELEVATIONS HERON ARE GEODETIC AND ARE REFERRED TO MINISTRY OF TRANSPORTATION BENCHMARK 00819698810 HAVING AN ELEVATION OF 333.831m.

LOCAL BENCHMARK:

LOCATION: A CONCRETE NAIL NORTH OF A MANHOLE LOCATED ALONG THE CENTRELINE OF LANDSDOWN DRIVE DIRECTLY OPPOSITE A 1 STOREY BRICK DWELLING, No. 28

GEODETIC ELEVATION = 344.17m

REFERENCE DOCUMENTS

1. LEGAL & TOPOGRAPHICAL INFORMATION OBTAINED FROM PLAN PROVIDED BY J.D. BARNES LTD. REFERENCE No. 13-30-500-01-B DATED SEPTEMBER 27, 2013.
2. EXISTING MUNICIPAL SERVICING AS-BUILTS PROVIDED BY THE CITY OF GUELPH.
3. SITE PLAN PROVIDED BY ASTRID CLOS PROJECT No. 2013-178 DATED NOVEMBER 5, 2013.
4. GEOTECHNICAL INFORMATION OBTAINED FROM REPORT No. T040938a1, DATED OCTOBER 7, 2013 BY INSPECSOL ENGINEERING SOLUTIONS

GENERAL NOTES:

1. THE OWNER'S PROFESSIONAL ENGINEER IS REQUIRED TO INSPECT THE INSTALLATION OF SERVICES AND GRADING INCLUDED IN THIS PROJECT IN ACCORDANCE WITH THE GENERAL REVIEW COMMITMENT CERTIFICATION PROCESS. THE CONTRACTOR IS TO PROVIDE AT LEAST 48 HOURS PRIOR TO COMMENCING CONSTRUCTION OF THE SITE SERVICES.
2. KAM ENGINEERING LTD. IN NO WAY ACCEPTS RESPONSIBILITY FOR ANY INACCURACIES FOUND ON THIS PLAN RELATIVE TO EXISTING CONDITIONS FOR THE SITE.

GRADING NOTES:

1. EXISTING DRAINAGE OF ABUTTING LANDS IS NOT TO BE DISTURBED.
2. BASEMENT OPENINGS TO BE MINIMUM 300mm ABOVE THE CENTRELINE OF ROAD UNLESS OTHERWISE APPROVED BY THE CITY ENGINEER.
3. GROUND ELEVATIONS AT HOUSES ABUTTING OVERLAND FLOW ROUTES ARE TO BE 225mm ABOVE OVERLAND FLOW ROUTE ELEVATIONS.
4. RETAINING WALLS 1.0m HIGH OR GREATER, AND GUARD RAILS (IF REQUIRED) ARE TO BE DESIGNED BY AND CONSTRUCTED TO THE SPECIFICATIONS OF A REGISTERED PROFESSIONAL ENGINEER IN ACCORDANCE WITH THE ONTARIO BUILDING CODE.
5. GRADE IS TO SLOPE 2% MIN AWAY FROM THE PROPOSED UNITS FOR 1.5m MIN.

LEGEND

271.00	EXISTING SPOT ELEVATION TO REMAIN (ASSUMED BASED ON EX. CONTOURS)
271.00	EXISTING CONTOUR
x 271.00	PROPOSED SPOT ELEVATION
x (271.00)	PROPOSED SWALE ELEVATION
	EXISTING CATCHBASIN
	PROPOSED CATCHBASIN
	EXISTING MANHOLE
	PROPOSED MANHOLE
	PROPOSED SWALE
2.0%	PROPOSED SLOPE
	PROPOSED DRAINAGE DIRECTION
	EXISTING OVERLAND FLOW ROUTE
OFR	PROPOSED OVERLAND FLOW ROUTE
	PROPOSED SILT FENCE
	EXISTING FIRE HYDRANT
	EXISTING WATER VALVE
Ⓜ Ⓖ	EXISTING WATER OR GAS METER
W/O	PROPOSED WALK-OUT
L/O	PROPOSED LOOK-OUT

AS CONSTRUCTED SERVICES	COMPLETION			No.	REVISIONS	D/M/Y	BY
		DESIGN	KEK	1	FOR ENVIRONMENTAL IMPACT STUDY	18/12/13	KAM
		DRAWN	KEK				
		CHECKED	KAM				
		APPROVED	KAM				
		DATE	05-11-13				
		CAD	13-084				

CONSULTANT

KAM
KAM ENGINEERING LTD.
1828 BLUE HERON DR., UNIT 21
LONDON, ONTARIO, N6H 0B7
P: 519 474 0410 F: 519 471 0034
E: kam@kameng.ca

ENGINEER'S STAMP
LICENSED PROFESSIONAL ENGINEER
K. A. MONIZ
100124664
DEC. 18/13
PROVINCE OF ONTARIO

ENGINEER'S STAMP

CLIENT
DUNSIRE DEVELOPMENTS
465 PHILLIP STREET, SUITE 203A
WATERLOO, ON N2L 6C7
P:1.888.519.2346
E: INFO@DUNSIRE.COM

SCALE
SCALE - 1 : 400
4.0 0 8.0m

TITLE
SITE GRADING PLAN
--
WHITE CEDAR ESTATES
LANDSDOWN DRIVE
GUELPH, ONTARIO

PROJECT No. KAM-13-084
SHEET No. C1
PLAN FILE No. -

K:\2013 Projects\KAM-13-084 Dunsire-White Cedar Estates\KAM CAD\KAM-13-084 Dunsire - Landsdown - 13-12-18.dwg

PROJECT: White Cedar Estates																	
			STORM SEWER DESIGN SHEET										DESIGN PARAMETERS				
													RATIONAL FORMULA		Q = 2.78*A*I*R l/s		
													RETURN PERIOD		100 YEAR		
Date: 18/12/2013			PROJECT NUMBER: KAM - 13-084										I = a / ((tc + b) ^ c)		Manning's n= 0.013		
Designed by: K.Kane													a= 1593				
Checked by: K. Moniz													b= 11				
													c= 0.8789				
			DRAINAGE AREA							PIPE SELECTION							
STREET	FROM M.H.	TO M.H.	AREA (ha)	R	A x R (ha)	ACCUM A X R (ha)	T of C (min.)	I (mm/hr)	Q (L/s)	LENGTH OF PIPE	PIPE SIZE (mm)	SLOPE %	CAPACITY (Full) (L/s)	VELOCITY (Full) (m/s)	VELOCITY (Act) (m/s)	TIME OF FLOW	REMARKS
Private Drive																	
	CBMH#1	MH#2	0.106	0.45	0.048	0.000	10.00	196.54	26.162	29.5	200	4.00	65.597	2.088	2.048	0.24	
	CBMH#3	MH#2	0.458	0.45	0.206	0.000	10.00	196.54	112.575	66.3	375	0.50	123.977	1.123	1.256	0.98	
	CBMH#4	MH#2	0.483	0.45	0.217	0.000	10.00	196.54	118.801	60.4	300	2.00	136.756	1.935	2.161	0.52	
	MH#2	STC 750	0.000	0.45	0.000	1.047	10.00	196.54	257.538	3.4	375	2.20	260.057	2.355	2.614	0.02	
	STC 750	MH#5	0.000	0.45	0.000	1.047	10.00	196.54	257.538	23.5	450	1.80	382.510	2.405	2.601	0.16	
	CB#6	MH#5	0.233	0.45	0.105	0.000	10.00	196.54	57.396	30.7	300	0.36	58.020	0.821	0.912	0.62	
	MH#5	SWM POND	0.000	0.45	0.000	1.281	10.00	196.54	314.935	7.9	600	0.30	336.308	1.189	1.330	0.11	

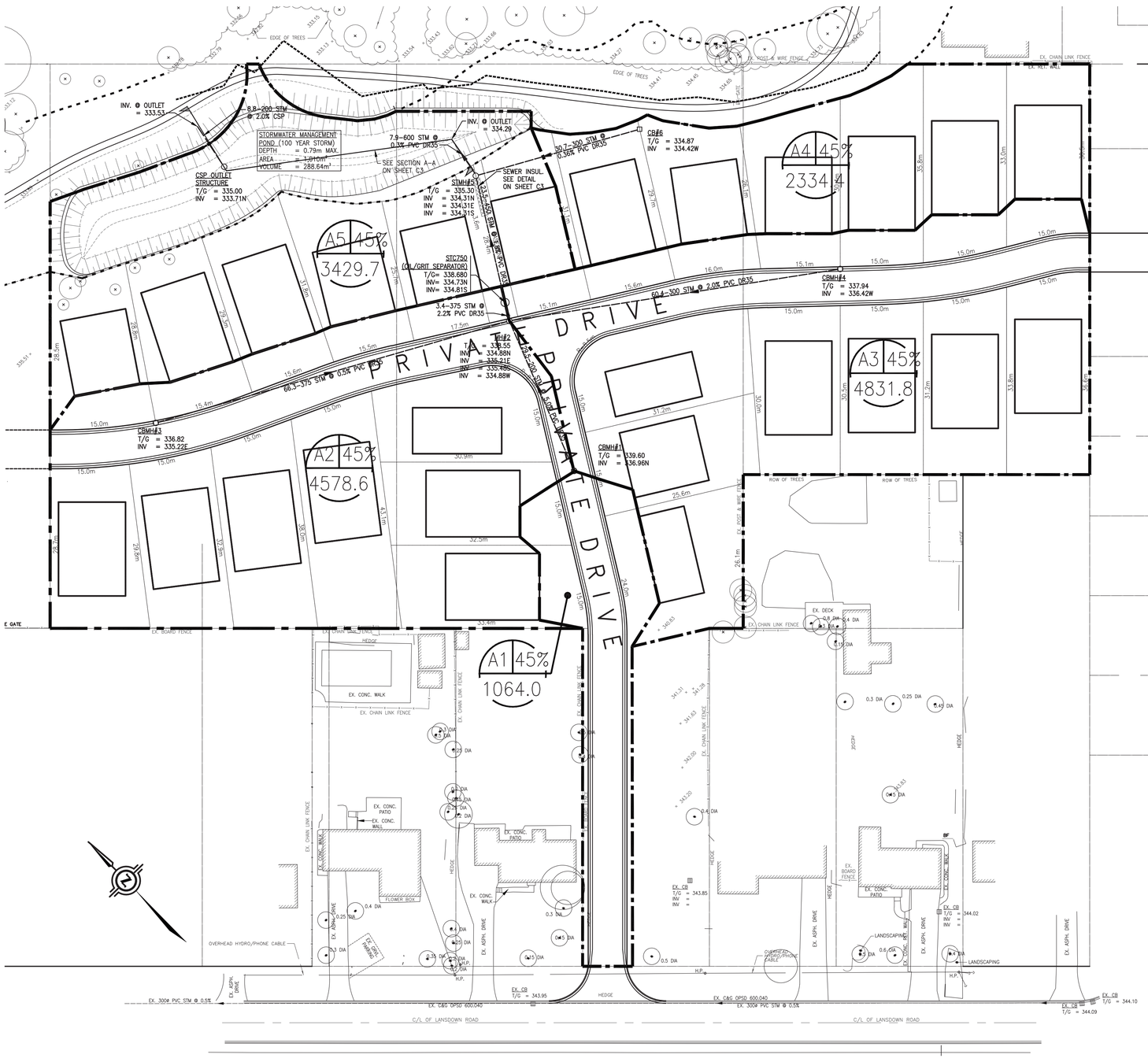
LEGEND

- EXISTING CATCHBASIN
- PROPOSED CATCHBASIN
- EXISTING MANHOLE
- PROPOSED MANHOLE
- 20.0–300 ST–1.0% EXISTING STORM SEWER
- 20.0–300 ST–1.0% PROPOSED STORM SEWER
- PROPOSED CATCHMENT LINE

DRAINAGE PARCEL NUMBER — AX | XXX — IMPERVIOUSNESS (%)

XXXXX — TOTAL DRAINAGE PARCEL AREA (m^2)

CATCHMENT AREA MARKER



PRE-DEVELOPMENT SWM CATCHMENT AREA

SCALE = 1:800

AS CONSTRUCTED SERVICES	COMPLETION		No.	REVISIONS	D/M/Y	BY
		DESIGN KEK	1	FOR ENVIRONMENTAL IMPACT STUDY	18/12/13	KAM
		DRAWN KEK				
		CHECKED KAM				
		APPROVED KAM				
		DATE 05–11–13				
		CAD 13–084				

CONSULTANT

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ENGINEER'S STAMP — LICENSED PROFESSIONAL ENGINEER — K. A. MONIZ — 100124864 — DEC. 18/13 — PROVINCE OF ONTARIO

ENGINEER'S STAMP

CLIENT

DUNSIRE DEVELOPMENTS
465 PHILLIP STREET, SUITE 203A
WATERLOO, ON N2L 6C7
P:1.888.519.2346
E: INFO@DUNSIRE.COM

SCALE

SCALE – 1 : 400
4.0 0 8.0m

TITLE: STORM SEWER CATCHMENT AREAS & DEISGN SHEET

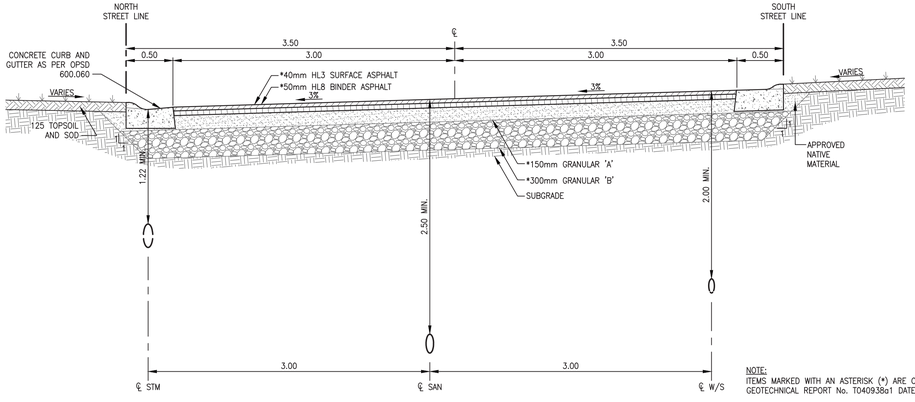
WHITE CEDAR ESTATES
LANDSDOWN DRIVE
GUELPH, ONTARIO

PROJECT No. KAM–13–084

SHEET No. C2

PLAN FILE No. –

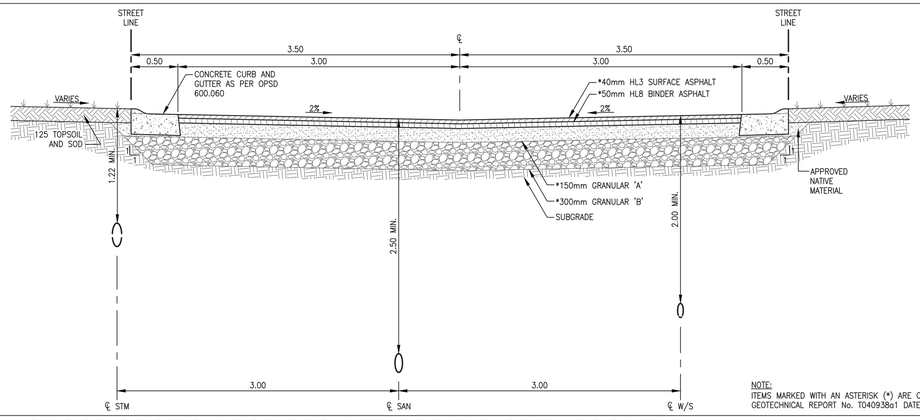
K:\2013 Projects\KAM-13-084 Dunsley,White Cedar Estates\KAM CAD\KAM-13-084 Dunsire - Landsdown - 13-12-18.dwg



NOTE:
ITEMS MARKED WITH AN ASTERISK (*) ARE OBTAINED FROM GEOTECHNICAL REPORT No. T0409381 DATED OCTOBER 7, 2013

TYPICAL CROSS SECTION FOR PRIVATE DRIVE (EAST / WEST)

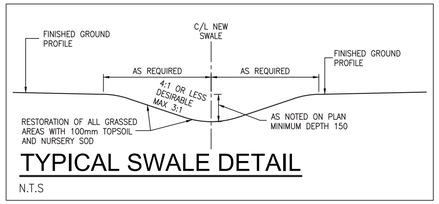
SCALE = 1:30



NOTE:
ITEMS MARKED WITH AN ASTERISK (*) ARE OBTAINED FROM GEOTECHNICAL REPORT No. T0409381 DATED OCTOBER 7, 2013

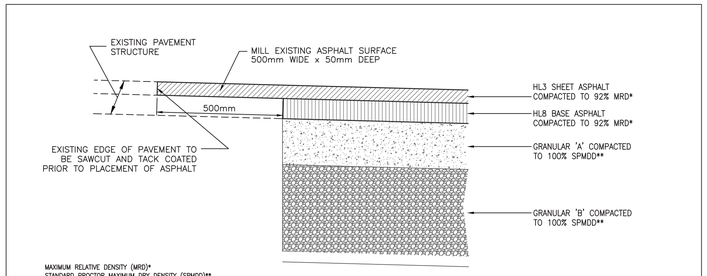
TYPICAL CROSS SECTION FOR PRIVATE DRIVE (NORTH / SOUTH)

SCALE = 1:30



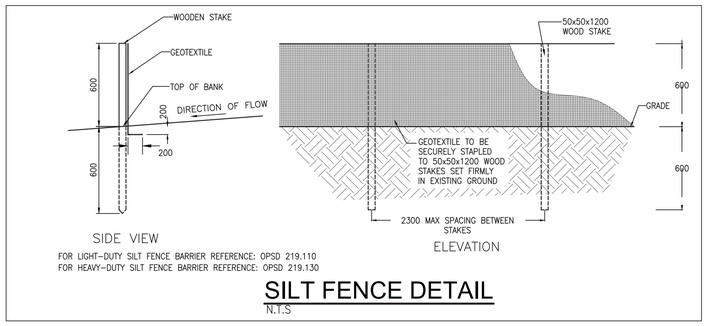
TYPICAL SWALE DETAIL

N.T.S



PAVEMENT MILLING DETAIL

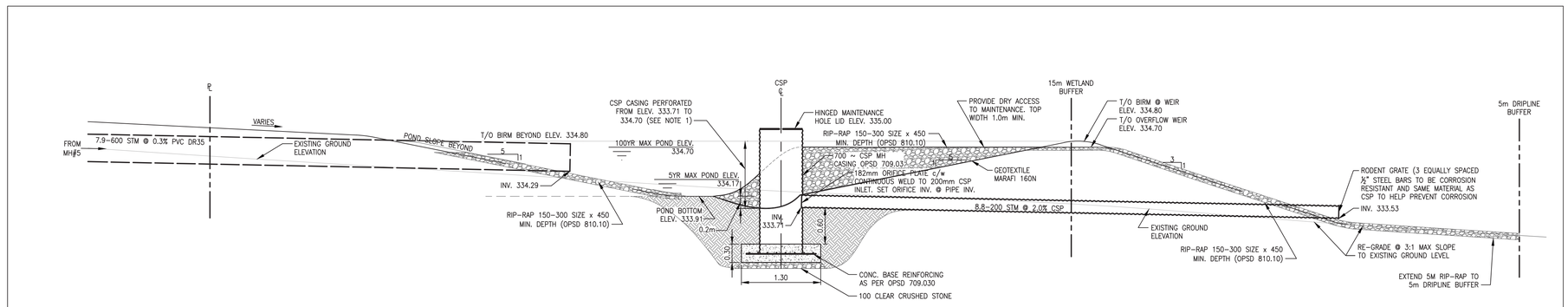
N.T.S



FOR LIGHT-DUTY SILT FENCE BARRIER REFERENCE: OPSD 219.110
FOR HEAVY-DUTY SILT FENCE BARRIER REFERENCE: OPSD 219.130

SILT FENCE DETAIL

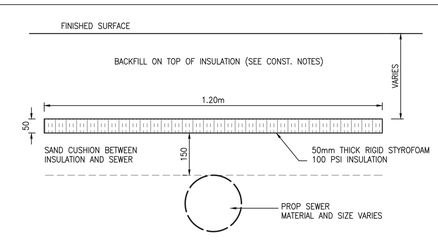
N.T.S



NOTES:
1. 700mm~ CSP MH CASING - TYPE 2 ALUMINIZED STEEL.
2. 50mm~ PERFORATIONS @ 147mm O.C. HORIZONTAL SPACING (15 PER ROW) AND 136MM O.C. VERTICAL SPACING (EVERY SECOND RIBBING)

SECTION A-A - STORMWATER MANAGEMENT POND THROUGH WEIR

SCALE = 1:40



SEWER INSULATION DETAIL

N.T.S

SEDIMENT CONTROL MEASURES

1. PROTECT ALL EXPOSED SURFACES AND CONTROL ALL RUNOFF DURING CONSTRUCTION.
2. ALL EROSION CONTROL MEASURES TO BE IN PLACE BEFORE STARTING CONSTRUCTION AND REMAIN IN PLACE UNTIL RESTORATION IS COMPLETED.
3. MAINTAIN EROSION CONTROL MEASURES DURING CONSTRUCTION.
4. ALL COLLECTED SEDIMENT TO BE DISPOSED OF AT AN APPROVED LOCATION.
5. MINIMIZE AREA DISTURBED DURING CONSTRUCTION.
6. ALL DEWATERING TO BE DISPOSED OF IN AN APPROVED SEDIMENTATION BASIN.
7. PROTECT ALL CATCH BASINS, MANHOLES AND PIPE ENDS FROM SEDIMENT INTRUSION WITH A SILT SACK OR A GEOTEXTILE FABRIC (TERRAFIX 270 R) OR APPROVED SILT SACS.
8. KEEP ALL SUMPS CLEAN DURING CONSTRUCTION.
9. PREVENT WIND-BLOWN DUST.
10. STRAW BALES TO BE USED IN LOCALIZED AREAS AS DIRECTED BY THE ENGINEER DURING CONSTRUCTION FOR WORKS WHICH ARE IN OR ADJACENT TO FLOOD LINES, FILL LINES AND HAZARDOUS SLOPES.
11. STRAW BALES TO BE TERMINATED BY ROUNDING BALES TO CONTAIN AND FILTER RUNOFF.
12. OBTAIN APPROVAL FROM GRCA PRIOR TO CONSTRUCTION FOR WORKS WHICH ARE IN, OR ADJACENT TO FLOOD LINES, FILL LINES AND HAZARDOUS SLOPES.
13. ALL SILT FENCING AND DETAILS ARE AT THE MINIMUM TO BE CONSTRUCTED IN ACCORDANCE WITH THE MINISTRY OF NATURAL RESOURCES GUIDELINES ON EROSION AND SEDIMENT CONTROL FOR URBAN CONSTRUCTION SITES.
14. ALL OF THE ABOVE NOTES AND ANY SEDIMENT & EROSION CONTROL MEASURES ARE AT THE MINIMUM TO BE IN ACCORDANCE WITH THE MINISTRY OF NATURAL RESOURCES GUIDELINES ON EROSION AND SEDIMENT CONTROL FOR URBAN CONSTRUCTION SITES.

CONSTRUCTION NOTES:

1. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONARY MEASURES UNDER THE OCCUPATIONAL HEALTH AND SAFETY ACT AS REQUIRED BY THE MINISTRY OF LABOUR.
2. ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE MINIMUM STANDARDS AND SPECIFICATIONS OF THE MUNICIPALITY'S ENGINEERING DEPARTMENT.
3. ALL WORK IN THE MUNICIPAL ROAD ALLOWANCE SHALL MEET THE MINIMUM STANDARDS AND SPECIFICATIONS OF THE MUNICIPALITY'S ENGINEERING DEPARTMENT. THE STANDARD CONTRACT DOCUMENTS FOR MUNICIPAL CONSTRUCTION PROJECTS AS ADOPTED AND AS AMENDED FROM TIME TO TIME ARE TO BE APPLIED TO WORKS WITHIN THE MUNICIPAL ROAD ALLOWANCE UNLESS OTHERWISE APPROVED BY THE MUNICIPAL ENGINEER. THE CONTRACTOR IS REQUIRED TO OBTAIN & PAY FOR PERMIT TO WORK IN MUNICIPAL R.O.W.
4. ALL EXCAVATIONS FOR PROPOSED SERVICES SHALL BE SUPPORTED ON GRANULAR FILL. ALL TOPSOIL, SOFT AND OTHERWISE UNSUITABLE MATERIAL SHALL BE REMOVED AND THE SUBGRADE SHOULD BE PROOF-ROLLED AND INSPECTED BY THE GEOTECHNICAL ENGINEER. ANY LOOSE OR SOFT ZONES NOTED IN THE INSPECTION SHOULD BE EXCAVATED AND REPLACED WITH APPROVED INORGANIC ON-SITE OR IMPORTED FILL. ALL FILL MATERIAL SHOULD BE INSPECTED AND APPROVED BY THE GEOTECHNICAL ENGINEER AND SHOULD BE PLACED IN LIFTS NOT EXCEEDING 300mm THAT ARE COMPACTED TO 100% SPMDD. THE FILL MATERIAL SHOULD COMPRISE OF CLEAN COMPACTIBLE FILL WITHIN 3% OF THE OPTIMUM MOISTURE CONTENT.
5. PRIOR TO COMMENCING ANY WORK ON THE INSTALLATION OF SERVICES & GRADING, AN APPROVED SET OF PLANS AND SPECIFICATIONS MUST BE AVAILABLE ON THE JOB AND SHALL REMAIN THERE WHILE WORK IS BEING DONE.
6. THE OWNERS OF THE UTILITIES MUST BE INFORMED AT LEAST TWO WEEKS PRIOR TO CONSTRUCTION ON ANY EXISTING MUNICIPAL ROAD ALLOWANCE. ALL EXISTING UNDERGROUND UTILITIES WITHIN THE LIMITS OF THE CONSTRUCTION SITE SHALL BE LOCATED AND MARKED. ANY UTILITIES, DAMAGED OR DISTURBED DURING CONSTRUCTION, SHALL BE REPAIRED OR REPLACED TO THE SATISFACTION OF THE GOVERNING BODY AT THE CONTRACTOR'S EXPENSE.
7. PRIOR TO COMMENCING ANY CONSTRUCTION, ALL SEWER OUTLET INFORMATION, BENCHMARKS, ELEVATIONS, DIMENSIONS AND GRADES MUST BE CHECKED BY THE CONTRACTOR AND VERIFIED AND ANY DISCREPANCIES REPORTED TO THE ENGINEER.
8. THE CONTRACTOR SHALL CONSTRUCT TEMPORARY MEASURES TO CONTROL SILT ENTERING THE STORM DRAINAGE SYSTEM TO THE SPECIFICATIONS OUTLINED IN THE GUIDELINES ON EROSION AND SEDIMENT CONTROL FOR URBAN CONSTRUCTION SITES PREPARED BY THE MINISTRY OF NATURAL RESOURCES. THESE MEASURES ARE TO BE INSTALLED PRIOR TO COMMENCING ANY CONSTRUCTION FOR THIS PROJECT AND ARE TO REMAIN IN PLACE UNTIL CONSTRUCTION HAS BEEN COMPLETED TO THE SPECIFICATIONS OF THE MUNICIPALITY'S ENGINEERING DEPARTMENT.
9. ALL EXISTING UNDERGROUND UTILITY (TELEPHONE DUCT, GAS MAINS, SEWER, WATERMAINS) THAT WILL BE CROSSED UNDER DURING THE INSTALLATION OF SERVICES FOR THIS DEVELOPMENT SHALL BE SUPPORTED BY A SUPPORT BEAM OR BY OTHER METHODS AS MAY BE REQUIRED BY THE OWNERS OF THE UTILITY BEING CROSSED UNDER.
10. THE CONTRACTOR SHALL INFORM THE MUNICIPAL PUBLIC TRANSIT COMMISSION AT LEAST FOUR DAYS PRIOR TO COMMENCING CONSTRUCTION ON ANY STREET THAT IS AN MUNICIPAL PUBLIC TRANSIT ROUTE THAT WILL BE AFFECTED BY CONSTRUCTION.
11. THE OWNER/CONSTRUCTION ENGINEER SHALL HAVE ITS PROFESSIONAL ENGINEER PROVIDE FULL-TIME INSPECTION DURING CONSTRUCTION ON AN EXISTING MUNICIPAL STREET OR EASEMENT AND PROVIDE A CERTIFICATE OF COMPLETION OF WORKS UPON COMPLETION OF ALL WORKS TO BE CONSTRUCTED.
12. THE CONTRACTOR IS RESPONSIBLE FOR:
    -CONNECTING ANY EXISTING SEWER OR DRAIN ENCOUNTERED DURING CONSTRUCTION TO A NEW SEWER OF SIMILAR SIZE AND MATERIAL OR INTO ANOTHER EXISTING SEWER.
    -ENSURING THAT THERE IS NO INTERRUPTION OF ANY SURFACE OR SUBSURFACE DRAINAGE FLOW THAT WOULD ADVERSELY AFFECT NEIGHBOURING PROPERTIES.
13. STRIP FULL DEPTH OF TOPSOIL IN AREAS TO BE DISTURBED AND STOCK PILE FOR RE-USE IN GRASSED/LANDSCAPED AREAS.
14. ALL SURFACES WHICH ARE DISTURBED DURING CONSTRUCTION SHALL BE RESTORED TO A CONDITION AT LEAST AS GOOD AS ORIGINAL, OR AS PER BELOW (WHICHEVER IS GREATER) OR IF WITHIN THE MUNICIPAL RIGHT OF WAY TO THE SATISFACTION OF THE MUNICIPAL ENGINEER, ALL AT NO COST TO THE MUNICIPALITY.
    - 14.1. GRASSED AREAS TO BE RESTORED w/ 100mm TOPSOIL + SOD
    - 14.2. CONCRETE SIDEWALK TO OPSD 310.010.
    - 14.3. CONCRETE CURB AND GUTTER AS SPECIFIED.
    - 14.4. ANY ASPHALT AREA DISTURBED DURING CONSTRUCTION SHALL BE RESTORED AS FOLLOWS:
        - 14.4.1. PROOF ROLL SUBGRADE (TO THE SATISFACTION OF THE GEOTECHNICAL ENGINEER) PRIOR TO PLACEMENT OF GRANULARS (98% SPMDD MIN.).
        - 14.4.2. MILL ADJACENT ASPHALT TO BE TIED INTO 50mm DEEP x 500mm WIDE PRIOR TO RESTORATION (SEE DETAIL ON SHEET C3.
        - 14.4.3. MIN. RECOMMENDED LIGHT DUTY PAVEMENT STRUCTURE (TO BE REVIEWED & APPROVED BY THE GEOTECHNICAL ENGINEER)
            - 40mm HL3 SURFACE ASPHALT COMPACTED TO 92% MAXIMUM RELATIVE DENSITY
            - 50mm HL8 BINDER ASPHALT COMPACTED TO 92% MAXIMUM RELATIVE DENSITY
                - ASPHALT TO BE SUPPLIED AND PLACED IN ACCORDANCE WITH OPSS 310
            - 150mm OF GRANULAR 'A' COMPACTED TO 98% SPMDD
            - 300mm OF GRANULAR 'B' COMPACTED TO 98% SPMDD
15. ALL PROPOSED STORM AND SANITARY SEWER PIPE TO BE PVC DR 35 OR MUNICIPALITY APPROVED PIPE WITH TYPE I BEDDING UNDER 4.5 M OF COVER AND TYPE II BEDDING OVER 4.5M OF COVER. ALL SEWER BEDDING MUST BE COMPACTED TO 95% STANDARD MAXIMUM DRY DENSITY (MINIMUM)
16. THE STRUCTURAL DESIGN OF SEWERS IS BASED ON THE TRANSITION WIDTH UNLESS OTHERWISE NOTED.
17. ALL STORM AND SANITARY SEWERS/SERVICES AND CATCHBASIN LEADS SHALL HAVE APPROVED RUBBER GASKET JOINTS + BE INSTALLED USING A LASER LEVEL.
18. 2.0m LENGTHS OF 150mm DIAMETER PERFORATED FILTER WRAPPED HDPE PIPE ARE TO BE INSTALLED AS SUBDRAINS CONNECTED TO TWO SIDES OF EACH CATCHBASIN AND CATCHBASIN MANHOLE WITHIN PAVED AREAS. THE SUBDRAINS ARE TO BE LOCATED JUST BELOW SUBGRADE ELEVATION
19. NO FOUNDATION DRAIN CONNECTIONS WILL BE PERMITTED INTO THE SANITARY SEWERS AND NO DIRECT GRAVITY CONNECTIONS FROM THE FOUNDATION DRAINS WILL BE PERMITTED TO THE STORM SYSTEM UNLESS THE STORM SYSTEM HAS THE CAPACITY TO PROVIDE FOR SUCH CONNECTIONS TO THE SATISFACTION OF THE MUNICIPALITY'S ENGINEERING DEPARTMENT.
20. ALL LINE PAINTING TO BE COMPLETED IN ACCORDANCE WITH THE MTO STANDARDS, IF REQUIRED.
21. ALL SUBSTITUTIONS MUST BE APPROVED BY THE MUNICIPALITY'S ENGINEERING DEPARTMENT.

AS CONSTRUCTED SERVICES	COMPLETION		No.	REVISIONS	D/M/Y	BY
		DESIGN KEK	1	FOR ENVIRONMENTAL IMPACT STUDY	18/12/13	KAM
		DRAWN KEK				
		CHECKED KAM				
		APPROVED KAM				
		DATE 05-11-13				
		CAD 13-084				

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KAM ENGINEERING LTD.
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LONDON, ONTARIO, N6H 0B7
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ENGINEER'S STAMP
LICENSED PROFESSIONAL ENGINEER K. A. MUNOZ 100126604 DEC. 18/13 PROVINCE OF ONTARIO

ENGINEER'S STAMP

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WATERLOO, ON N2L 6C7
P:1.888.519.2346
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SCALE
AS NOTED

TITLE
NOTES, DETAILS AND CROSS-SECTIONS
WHITE CEDAR ESTATES
LANDSDOWN DRIVE
GUELPH, ONTARIO

PROJECT No.
KAM-13-084

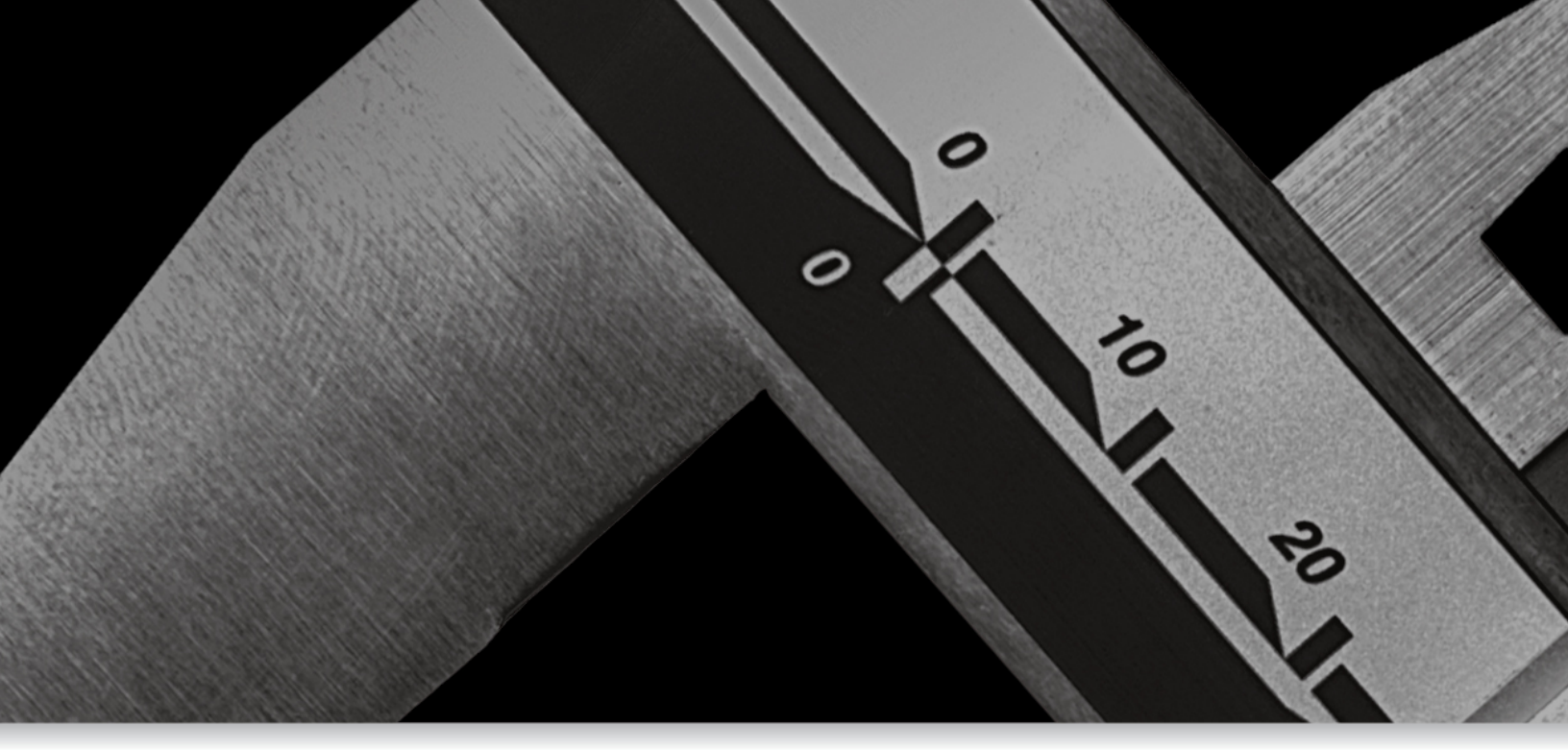
SHEET No.
C3

PLAN FILE No.
-

K:\2013 Projects\KAM-13-084 Dunsire-White Cedar Estates\KAM CAD\KAM-13-084 Dunsire - Landsdown - 13-12-18.dwg

APPENDIX B

Geotechnical Report



REPORT: T040938a1

DUNSIRE (LANDSDOWN) INC.
c/o DUNSIRE DEVELOPMENTS INC.
Geotechnical Investigation Report
Proposed Residential Development
24, 26, 28, and 32 Landsdown Drive
Guelph, Ontario

October 7, 2013

INSPEC-SOL
ENGINEERING SOLUTIONS

Mississauga, October 7, 2013

Mr. Shawn Keeper
Dunsire (Landsdown) Inc.
c/o Dunsire Developments Inc.
203-465 Philip Street
Waterloo, Ontario N2L 2C7

Subject: Geotechnical Investigation Report
(T040938a1)
Proposed Residential Development
24, 26, 28, and 32 Landsdown Drive, Guelph, Ontario

Dear Mr. Keeper;

It is with pleasure that we provide you with our Geotechnical Investigation report (T040938a1) regarding your project located at 24, 26, 28, and 32 Landsdown Drive in Guelph, Ontario. We thank you for having retained Inspec-Sol for technical and professional services and we hope to have the privilege of serving you again in the future.

The Inspec-Sol team is committed to exceeding the expectations of its clients.

Do not hesitate to contact us for any further information.

Best regards,

INSPEC-SOL INC.

Karl Roechner, M.A.Sc., P.Eng.
Vice President

FG/KR/sm

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DUNSIRE (LANDSDOWN) INC.
c/o DUNSIRE DEVELOPMENTS INC.

Geotechnical Investigation Report
Proposed Residential Development
24, 26, 28, and 32 Landsdown Drive
Guelph, Ontario

Date :	**October 7, 2013**	Our Ref. :	**T040938a1**

INSPEC-SOL
ENGINEERING SOLUTIONS

DUNSIRE (LANDSDOWN) INC.
c/o DUNSIRE DEVELOPMENTS INC.
203-465 Philip Street
Waterloo (Ontario) N2L 2C7

Geotechnical Investigation Report
Proposed Residential Development
24, 26, 28, and 32 Landsdown Drive
Guelph, Ontario

Ref.: T040938a1
October 7, 2013

Prepared by :

Fathi Gergis, P.Eng.
Project Manager

Approved by :

Karl Roechner, M.A.Sc., P.Eng.
Vice President

Distribution : Dunsire (Landsdown) Inc. – Shawn Keeper
(Copy by e-mail: shawn.keeper@dunsire.com)

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TABLE OF CONTENTS

1.0 INTRODUCTION

Inspec-Sol Inc. (Inspec-Sol) was retained by Dunsire (Landsdown) Inc. c/o Dunsire Developments Inc. (Client) to conduct a Geotechnical Investigation for a proposed residential development located at 24, 26, 28, and 32 Landsdown Drive in Guelph, Ontario. A Site Location Plan is provided as Figure 1.

The Site comprises of rear portion of three individual residential lots on Landsdown Drive 24, 26, and 32 and property 28 including existing house. It is our understanding that the proposed development activities include construction of a new residential subdivision consisting of two storey and single storey single family dwellings with a basement level below the ground surface. The development will be serviced by paved roads with municipal water and sewers. The proposed development features relative to the property lines are presented on Figure 2.

The purpose of the geotechnical investigation is to assess the subsurface soil and groundwater conditions within the area of the proposed development and to provide recommendations for the design and construction of building foundations, basement slabs, pavements, and site servicing for the proposed development. The anticipated construction conditions pertaining to excavation, backfilling and groundwater control are discussed also, but only with regard to how these might influence the design.

2.0 FIELD PROCEDURES

The scope of work included drilling five shallow boreholes (identified as BH1-13 to BH5-13) to a depth of 5.2 m below existing grade. The boreholes were located within the area of proposed residential development. The borehole locations are shown on Figure 2.

Prior to initiating the subsurface investigation activities, all applicable utility companies (gas, bell, cable, fiber, hydro, water and waste water) were contacted through Ontario One-Call and Peel Region to demarcate the location of their respective underground utilities to ensure the lines are not damaged during the investigation work. Inspec-Sol also retained Mark It Locates Inc. (a private locator) to locate and demarcate any private buried utilities that may be potentially present at the site.

The borings were advanced on August 6, 2013. The detailed results of the individual boreholes are recorded on the accompanying Borehole Logs provided in Appendix A (Enclosures 1 to 5).

The stratigraphy at each borehole location has been referenced to the current grade level. The ground surface elevation at the borehole locations have been surveyed to a temporary benchmark set as the top elevation of an existing fire hydrant located in front of the property No. 26 Landsdown Drive, as shown on Figure 2. The benchmark was given an elevation of 100.0 m.

The drilling work was carried out by a drilling contractor under the full-time supervision of an Inspec-Sol senior technician. The borings were advanced using a continuous flight power auger machine using solid and hollow stem augers. Representative disturbed samples of the strata penetrated were obtained during drilling utilizing a 50 mm diameter split-barrel sampler, advanced by dropping a 63.5 kg hammer approximately 760 mm, in accordance with the standard penetration test method (ASTM D1586). The results of these penetration tests are reported as N-values on the borehole logs at the corresponding depths.

Strength properties of cohesive soil layers were determined by using a pocket penetrometer to measure unconfined compressive strength on intact cohesive soil samples extracted from the boreholes.

The supervising technician logged the borings and examined the samples as they were obtained. The extracted samples were sealed in clean, airtight containers and transferred to the Inspec-Sol laboratory where they were further reviewed by a senior geotechnical engineer.

Groundwater observations were made in the boreholes during and upon completion of drilling. No long-term groundwater monitoring provisions were made in this investigation program.

Geotechnical laboratory testing consisted of moisture content tests on all recovered samples and grain size analysis (Hydrometer Test) on two selected samples. The results of the moisture content determinations are recorded on the borehole logs at their corresponding depths. The grain size test result is provided in Appendix B.

3.0 SUBSURFACE CONDITIONS

Details of the subsurface conditions encountered at the Site are summarized below and are also presented on the Borehole Logs provided in Appendix A. It should be noted that the subsurface conditions are confirmed at the borehole locations only, and may vary at other locations. The boundaries between the various strata, as shown on the borehole logs, are based on non-continuous sampling. The boundaries for non-continuous sampling represent an inferred transition between the various strata, rather than a precise plane of geological change.

3.1 Statigraphy

3.1.1 Proposed Building Areas (BH1 through BH5)

Ground Cover: A surficial layer of grass vegetation/topsoil was encountered at the ground surface in all boreholes. The thickness of the topsoil layer was found to be approximately 100 mm overlying an earth fill layer.

Earth Fill: Beneath the surficial vegetation and topsoil, the boreholes encountered earth fill mainly consisting of sand silt/clayey silt some gravel to sand and gravel. The earth fill extended to a depth ranging between 2.3 m to 3.0 m below grade surface (bgs).

The relative density of the fill materials was assessed by carrying out Standard Penetration Test (SPT). The SPT results obtained using standard sampling procedures yielded 'N' values ranging from 2 to 43 blows per 300 mm of penetration, indicating a very loose to dense condition.

The moisture content of fill samples extracted from the borings generally varied between 5 and 20 percent by weight, indicating a moist to very moist condition.

Native Clayey Silt Till/Silty Sand Till to Sandy Silt Till: The undisturbed stratigraphy in the boreholes is a glacial till with a matrix comprising predominantly of clayey silt to silty sand with trace gravel, and becomings sandy silt some clay and gravel size particles as depth increased. As is typical of glacial till, embedded gravel, cobbles and boulders may be present. The till deposit was encountered beneath the earth fill layer at 2.3 to 3.0 m bgs and extended to the maximum depth of investigation, i.e. 5.2 m bgs. The penetration resistance 'N' values measured in the till deposit by standard sampling procedures yielded results

ranging from 13 blows to greater than 100 blows per 300 mm of penetration, indicating a very dense to hard or very dense condition.

Grain size distribution analyses were carried out on two (2) representative samples of the native soils, at a depth of 2.3 to 2.9 m bgs in BH3 and BH4. The results of the test indicate the soil samples are classified as a SM according to the Unified Soil Classification System. The composition of the native soil samples are summarized below and are presented in Appendix B.

Borehole No./ Sample No.	*Sample Depth*	*% Gravel*	*% Sand*	*% Clay &Silt*
BH3-13/SS-4	2.3 to 2.9 m	1	47	52
BH4-13/SS-4	2.3 to 2.9 m	3	53	44

The Hazen method was used to estimate the hydraulic conductivity value using the grain size analyses results for the soil samples collected from the native sand and silt to silty sand till. The calculated hydraulic conductivity values that could be used for stormwater management and infiltration in these areas is estimated to be $1.0x10^{-5}$ centimetres per second (cm/s).

The moisture content of native samples extracted from the borings generally varied between 7 and 12 percent by weight, indicating a moist condition.

3.2 Groundwater

Groundwater observations were made in each of the boreholes as they were drilled and after completion of drilling. Water seepage was encountered in some boreholes (BH1, BH2, and BH4) and the water level at the completion of drilling was 0.65 m in BH1, 1.85 m in BH2, and 0.85 m in BH4. As such it should be expected that a perched groundwater table within the shallow fill layer and within the coarse sand seams in the till deposit will be encountered. The other boreholes (BH3 and BH5) remained dry upon completion of drilling.

It should be noted that groundwater levels are transient and tend to fluctuate with the seasons and periods of precipitation and temperature.

4.0 ENGINEERING DISCUSSION AND RECOMMENDATIONS

4.1 General

It is our understanding that the proposed development activities include construction of a new residential subdivision. The new development consists of two storey and single storey single family dwellings with a basement level below the ground surface. The development will be serviced by paved roads, with municipal water and sewers. The proposed development features relative to the property lines are presented on Figure 2.
Based on the results of the geotechnical investigation, the subsurface soil stratigraphy at the Site can generally be described as follows:

- Ground cover comprising of grass and topsoil at the ground surface with a thickness of about 100 mm overlying an earth fill layer.
- Earth fill generally comprising of very loose to dense sand silt/clayey silt some gravel to sand and gravel that extended to a depth ranging between 2.3 to 3.0 m bgs.
- Very stiff to hard clayey silt till with trace gravel that becomes very dense sandy silt till with increased depth and extended to the maximum depth of investigation , i.e. 5.2 m bgs.
- Groundwater was observed in three boreholes (BH1, BH2, and BH4), and the water level ranged between 0.65 m and 1.85 m below grade upon the completion of drilling.

4.2 Site Preparation and Grading

The boreholes advanced across the Site encountered grass and topsoil at the ground surface overlying a layer of earth fill to a depth of 2.3 to 3.0 m bgs. Based on SPT results, the relative density of the fill is variable and there is no evidence to suggest it has been compacted and approved as an engineering fill. As part of site grading activity all soft/loose earth fill, or earth fill containing significant amounts of topsoil should be removed. Prior to any filling the exposed subgrade should visually inspected, heavily proofrolled, and compacted. Subgrade preparation in proposed building and pavement areas are discussed further in Section 4.5 and 4.6.

The earth fill and native soils are generally suitable for reuse as backfill to raise site grades where required, provided it is free of organic material and is within the optimum moisture content. Based on laboratory water content measurements and visual examination of soil samples extracted from the borings, the soils are generally within acceptable limits for effective compaction. Some of the fill materials contained slightly high water contents and

these soils may need to be dried prior to reuse. Materials found to be wet may be left aside to dry, or mixed with drier material. Also, some of the samples extracted from the boreholes contained intermixed topsoil and roots. Fill materials containing excessive amounts of organics will need to be separated and not used as backfill in settlement sensitive areas.

All fill placed as part of Site grading activity should be laid in thin lifts not exceeding 150 mm and thoroughly compacted with heavy rollers to a minimum of 98 percent Standard Proctor Maximum Dry Density (SPMDD).

4.3 Foundation Design Parameters

Based on the subsurface investigation results, the proposed residential structures can be supported on conventional spread and strip footings placed on the undisturbed native clayey silt till / silty sand till and proportioned to an allowable bearing pressure of 150 kPa for a Service Limit State (SLS) design and 225 kPa for an Ultimate Limit State (ULS) design.

The minimum founding depth at the borehole locations located in proposed building areas is summarized in the table below. Footings must be founded at least 0.3 m into the undisturbed native deposit for the allowable bearing capacity value provided.

Location	***Minimum Founding Depth/Elevation***
BH1-13	3.0 m / 85.51 m
BH2-13	2.3 m / 89.71 m
BH3-13	2.3 m / 89.42 m
BH4-13	2.3 m / 92.07 m
BH5-13	2.3 m / 94.30 m

Alternatively, in order to avoid stepping down the footings, depending on the depth/elevation of the native soil, consideration could be given to removing all existing fill from beneath the proposed footing areas to expose the underlying competent native soils and raise grades with engineered fill, where required. Prior to engineered fill placement the exposed subgrade surface should be visually inspected and proof rolled to confirm the presence of competent soils. The engineered fill pad should extend beyond the limits of the proposed footing/slab equivalent to a distance equal to the fill height plus 0.5 m. The engineered fill should be placed in 150 mm thick layers and compacted to 98 percent SPMDD. Foundations placed on engineered fill can be proportioned to an allowable bearing pressure of 100 kPa for a SLS design and 150 kPa for a ULS design.

The settlement of footings established on the native soils at this design bearing pressure is expected to be less than a total of 25 mm with a maximum differential settlement of 19mm. It is recommended that the minimum footing width be 450 mm.

Footings exposed to freezing temperatures must be provided with at least 1.2 meters of earth cover for frost protection or equivalent insulation.

4.4 Earthquake Consideration

The Ontario Building Code (OBC) requires the assignment of a Seismic Site Class for calculations of earthquake design forces and the structural design based on a two percent probability of exceedance in 50 years. According to the OBC, the Seismic Site Class is a function of soil profile and is based on the average properties of the subsoil strata to a depth of 30 m below the ground surface. The OBC provides the following three methods to obtain the average properties for the top 30 m of the subsoil strata:

- Average shear wave velocity
- Average Standard Penetration Test (SPT) values (uncorrected for overburden); or
- Average undrained shear strength.

Based on the results of the recent geotechnical investigation, the depths of boreholes extend to maximum depth of 5.2 m bgs only and the subsurface profile below this depth is not known. For a preliminary design purposes, based on the criteria listed in Table 4.1.8.4.A. of the OBC and our knowledge of the regional geology, a Seismic Site Class ‘D’ can be used for the design of proposed structures.

According to the Table 1.2 of the Supplementary Standard SB-1 of the 2006 OBC, for the Guelph area mapped Spectral Response Acceleration (Sa) value of 0.21 should be used for short duration of 0.2 second and 0.049 for one-second duration.

Based on the Tables 4.1.8.4.B. and 4.1.8.4.C. of the 2006 OBC, a value of 1.3 and 1.4 can be used for the Site Coefficients Fa and Fv, respectively.

4.5 Basement Slab Design Parameters

Depending on the final site grading levels selected for the residential buildings, the subgrade for the basement slab construction will consist of competent native clayey silt till to silty sand till, or earth fill. These materials are considered suitable to support the basement slab.

Prior to the placement of the basement slab, it is recommended that the subgrade be inspected for obvious soft or loose areas. Areas found to be soft should be subexcavated and replaced with compacted fill as described in Section 4.2.

The modulus of subgrade reaction (k_v) for the very stiff clayey silt to dense silty sand till ranges from 75 pci (21,000 kN/m³) to 120 pci (33,000 kN/m³) as derived from ACI 330R. For design purposes an average k_v value of 100 pci (27,700 kN/m³) should be considered.

The floor slab should be founded on a 200 mm thick layer of well-graded granular base material consisting of 19 mm crusher run limestone (or equivalent).

If the floor slab is constructed within one meter of the stabilized water table, a subfloor drainage system leading to a frost-free sump should be provided. Details of a subfloor drainage system can be provided, if required. Based on water level measurements obtained from the boreholes advanced in the area of the proposed buildings, the static water level appears to vary between 0.65 and 1.85 m below grade, and is generally above or within basement finished floor elevation. The water is likely perched within sandy zone within the till deposit and could pose a problem for basement foundations. Based on this information a subfloor drainage system with a sump may be required.

Perimeter drainage of the structure is recommended where there is pavement adjacent to the building face or finished floor level in the structure is not at least 200 mm above the prevailing exterior grade level. Surface drainage should be directed away from the building.

4.6 Pavement Design for Pavement Areas – Interior Roads and Driveways

The surficial topsoil and any loose in-situ fill materials should be removed from the proposed pavement areas prior to placing new fill materials. It is anticipated that the pavement subgrade will consist of existing earth fill materials, undisturbed native soils, or compacted earth fill that had been placed during the site servicing/grading operations. These materials are considered suitable to support the pavement structure provided they are proven competent by proof rolling.

Where undisturbed soil or competent fill materials are encountered at the design subgrade level, it is recommended that the soil be cut neatly to grade. The area should be proof rolled using large axially loaded equipment and any soft or unacceptable areas be removed as directed by the Engineer and replaced with suitable fill materials compacted to a minimum of 98 percent SPMDD.

The long-term performance of the pavement structure is highly dependent upon the subgrade support conditions. Stringent construction control procedures should be maintained to ensure that uniform subgrade moisture and density conditions are achieved as much as is practically possible.

The most severe loading conditions on pavement areas and the subgrade may occur during construction. Consequently, special provisions such as end dumping and forward spreading of subbase fills, restricted construction lanes, and half-loads during paving may be required, especially if construction is carried out during wet weather conditions.

The following asphaltic concrete and granular pavement thicknesses may be used for the design of the proposed parking and driveway areas. The pavement designs include a Standard Duty for roads and driveways and are based on a design life of 20 years.

Pavement Layer	***Compaction Requirements***	***Light Duty Pavement Design (Roads/Driveways)***
Surface Course Asphaltic Concrete HL3 (OPSS 1150)	92% to 96.5% Maximum Relative Density (OPSS 310)	40 mm
Base Course Asphaltic Concrete HL8 (OPSS 1150)	92% to 96.5% Maximum Relative Density (OPSS 310)	50 mm
Base Course: Granular 'A' or 19mm Crusher Run	100% Standard Proctor Maximum Dry Density	150 mm
Subbase Course: Granular B or 50mm Crusher Run	98% Standard Proctor Maximum Dry Density	300 mm

If pavement construction occurs in wet inclement weather it may be necessary to provide additional subgrade support for construction traffic by increasing the thickness of the granular subbase.

5.0 CONSTRUCTION RECOMMENDATIONS

5.1 Excavation

Excavations must be carried out in accordance with the *Occupational Health and Safety Act and Regulations for Construction Projects*. These regulations designate four broad classifications of soils to stipulate appropriate measures for excavation safety. The earth fill

encountered at the site is considered to be a Type 3 soil. The undisturbed native soil layers encountered at the site are considered to be a Type 2 soil.

Where workmen must enter a trench or excavation carried deeper than 1.2 meters the trench or excavation must be suitably sloped and/or braced in accordance with the regulation requirements. The regulation stipulates maximum slopes of excavation by soil type as follows:

Soil Type	*Base of Slope*	*Maximum Slope Inclination*
1	Within 1.2 meters of bottom of trench	1 horizontal to 1 vertical
2	Within 1.2 meters of bottom of trench	1 horizontal to 1 vertical
3	From bottom of trench	1 horizontal to 1 vertical
4	From bottom of trench	3 horizontal to 1 vertical

Minimum support system requirements for steeper excavations are stipulated in Sections 235 through 238 and 241 of the Act and Regulations and include provisions for timbering, shoring and moveable trench boxes.

Seepage is anticipated in localized excavated areas during excavation activity from surface drainage and seepage from perched water within any preferentially permeable features in the earth fill or glacial till, such as sand seams or layers. It is noted that water levels measured in three of the boreholes (BH1, BH2, and BH9) varied between 0.65 and 1.85 mbgs. Since the earth fill and native soils are, in general, of low permeability, the volume of water to be anticipated is such that temporary pumping from the excavations should suffice to control groundwater. It is recommended that test pits be excavated to the underside of any proposed sewer or basement, prior to construction so that contractors can assess the most appropriate dewatering requirements.

The deposits to be penetrated for excavations at this site will be found to contain larger particle sizes than are indicated on the Borehole Logs. It should be anticipated that cobbles and boulders will be encountered that are intrinsic to the native deposits. The frequency and distribution of these fragments within the till matrices is unpredictable.

It is expected that shallow excavations, which extend into the very stiff native materials can be handled by conventional mechanical excavation equipment.

5.2 Site Services

Underground storm and sanitary sewers can be founded on the undisturbed native soils, or suitably compacted fill materials. These materials will provide adequate support of buried services on conventional well-graded granular bedding. Where disturbance of the trench base has occurred, such as due to groundwater seepage or construction traffic, the disturbed soils should be sub-excavated and replaced with suitable compacted granular fill.

Structures such as catchbasins and manholes founded within the existing fill layer should be supported on a granular pad extending at least 0.3 m beyond the footprint of these structures in order to distribute their loads evenly.

The bedding for trenched (open-cut) services should consist of materials meeting City of Guelph specifications. The bedding should have a minimum thickness of 150 mm below the pipe and 300 mm above and adjacent to the pipe and should comply with the City of Guelph Standards. The bedding and cover materials should be compacted to a minimum of 95 percent of their standard Proctor maximum dry density (SPMDD) to provide support and protection to the service pipes.

Where wet conditions are encountered, the use of 'clear stone' bedding (such as 19 mm clear stone, OPSS 1004) may be considered, only in conjunction with a suitable geotextile filter. Without proper filtering, there may be entry of fines from native soils and trench backfill into the bedding. This loss of fine soil particles could result in loss of support to the pipes and possible surface settlements.

5.3 Trench Backfill

The trench backfill operations should be conducted with the following minimum requirements:

- adequate heavy vibratory compaction equipment is used to compact the material;
- loose lift thickness should not exceed 300 mm;
- soils should be at suitable moisture contents to achieve compaction of 95 percent Proctor Maximum Dry Density (SPMDD) up to a depth of 1 m below the pavement subgrade level and 98 percent SPMDD within 1 m of the pavement subgrade level; and
- general backfill materials used to raise grades up to design subgrade levels may consist of on site or imported granular fill comprised of well-graded soils, with no material in size greater than 150 mm, and no topsoil or other deleterious materials

The excavated fill and the native soils encountered at the Site are considered suitable as trench backfill provided the moisture content of the backfill soils is within 2 percent of the optimum moister content of the soil as determined by standard Proctor (ASTM D 698) test method. Care will be required to ensure that any excavated soils that are too wet for adequate compaction or containing excessive amounts of topsoil are not utilized as backfill material. Oversized material should be removed. All backfill operations and materials should be inspected and tested by qualified geotechnical personnel to confirm that proper material is utilized and that adequate compaction is attained.

6.0 CONSTRUCTION MONITORING

The foundation installations must be monitored and evaluated by qualified personnel to ensure that the founding achieved is consistent with the design bearing intended by the geotechnical engineer. The on-site review of the condition of the foundation soil as the foundations are constructed is an integral part of the geotechnical design function and is required by Section 4.2.2.2 of the 2006 Ontario Building Code.

All backfilling should be supervised to ensure that proper materials are employed and that adequate compaction is achieved. Strict quality control guidelines should be followed during the placement of fill materials.

7.0 LIMITATIONS OF THE INVESTIGATION

This report is intended solely for Dunsire Development Inc (Client) and other parties explicitly identified in the report and is prohibited for use by others without Inspec-Sol's prior written consent. This report is considered Inspec-Sol's professional work product and shall remain the sole property of Inspec-Sol. Any unauthorized reuse, redistribution of or reliance on the report shall be at the Client and recipient's sole risk, without liability to Inspec-Sol. Client shall defend, indemnify and hold Inspec-Sol harmless from any liability arising from or related to Client's unauthorized distribution of the report. No portion of this report may be used as a separate entity; it is to be read in its entirety and shall include all supporting drawings and appendices.

The recommendations made in this report are in accordance with our present understanding of the project, the current site use, ground surface elevations and conditions, and are based

on the work scope approved by the Client and described in the report. The services were performed in a manner consistent with that level of care and skill ordinarily exercised by members of geotechnical engineering professions currently practicing under similar conditions in the same locality. No other representations, and no warranties or representations of any kind, either expressed or implied, are made. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties.

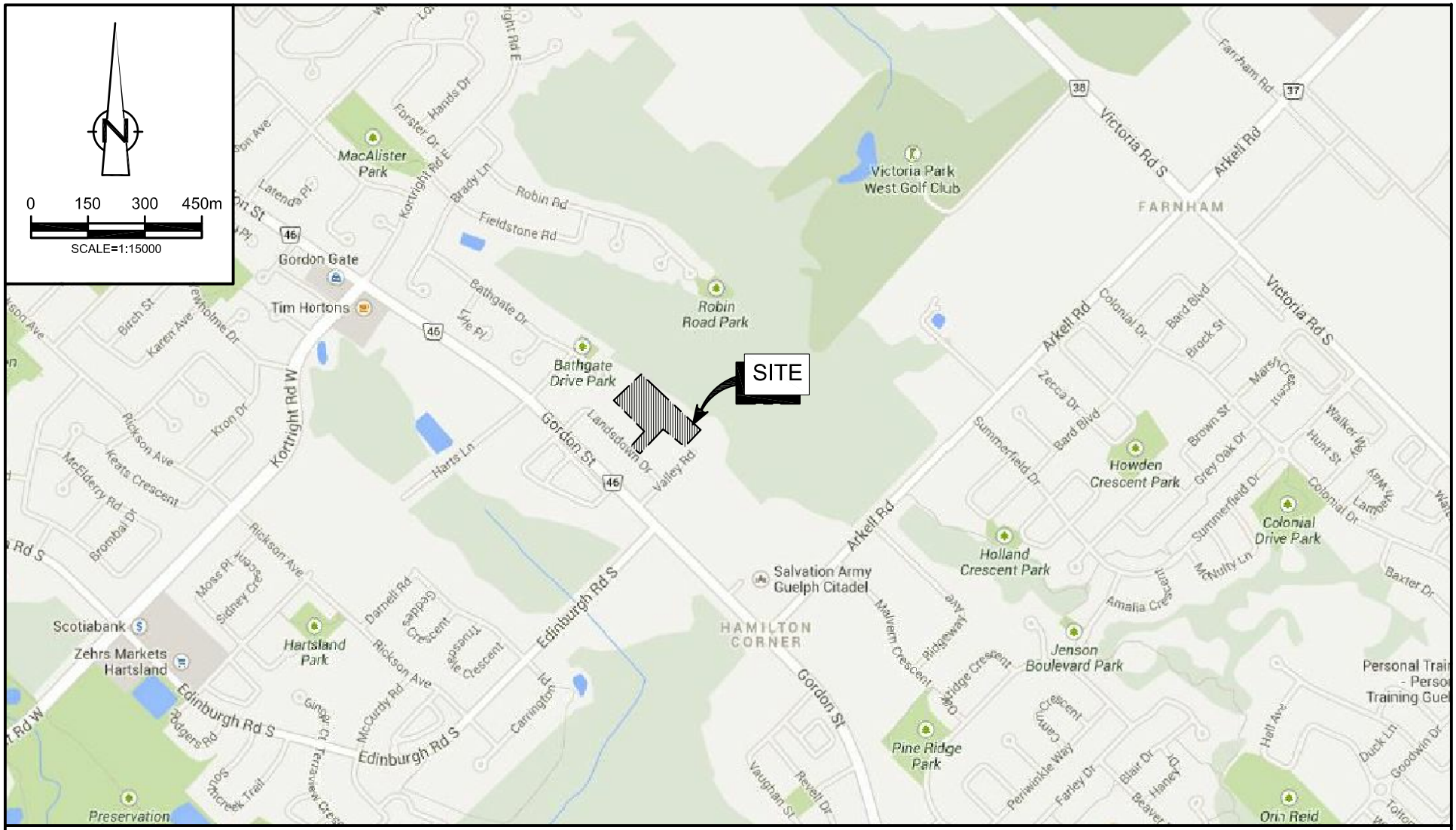
All details of design and construction are rarely known at the time of completion of a geotechnical study. The recommendations and comments made in the study report are based on our subsurface investigation and resulting understanding of the project, as defined at the time of the study. We should be retained to review our recommendations when the drawings and specifications are complete. Without this review, Inspec-Sol will not be liable for any misunderstanding of our recommendations or their application and adaptation into the final design.

By issuing this report, Inspec-Sol is the geotechnical engineer of record. It is recommended that Inspec-Sol be retained during construction of all foundations and during earthwork operations to confirm the conditions of the subsoil are actually similar to those observed during our study. The intent of this requirement is to verify that conditions encountered during construction are consistent with the findings in the report and that inherent knowledge developed as part of our study is correctly carried forward to the construction phases.

It is important to emphasize that a soil investigation is, in fact, a random sampling of a site and the comments included in this report are based on the results obtained at the test locations only five boreholes (BH1-13 to BH5-13). The subsurface conditions confirmed at the five test locations may vary at other locations. The subsurface conditions can also be significantly modified by the construction activities on site (ex. excavation, dewatering and drainage, blasting, pile driving, etc.). These conditions can also be modified by exposure of soils or bedrock to humidity, dry periods or frost. Soil and groundwater conditions between and beyond the test locations may differ both horizontally and vertically from those encountered at the test locations and conditions may become apparent during construction, which could not be detected or anticipated at the time of our investigation. Should any conditions at the site be encountered which differ from those found at the test locations, we request that we be notified immediately in order to permit a reassessment of our recommendations. If changed conditions are identified during construction, no matter how

minor, the recommendations in this report shall be considered invalid until sufficient review and written assessment of said conditions by Inspec-Sol is completed.

Figures



Source :
Google Map

figure 1

SITE LOCATION PLAN
GEOTECHNICAL INVESTIGATION - PROPOSED DEVELOPMENT
24,26,28 & 32 LANDSDOWN DRIVE, GUELPH, ONTARIO
Dunsire Developments Inc.

iNSPEC·SOL

T040938-A1(001)GN-TO001 Aug./2013

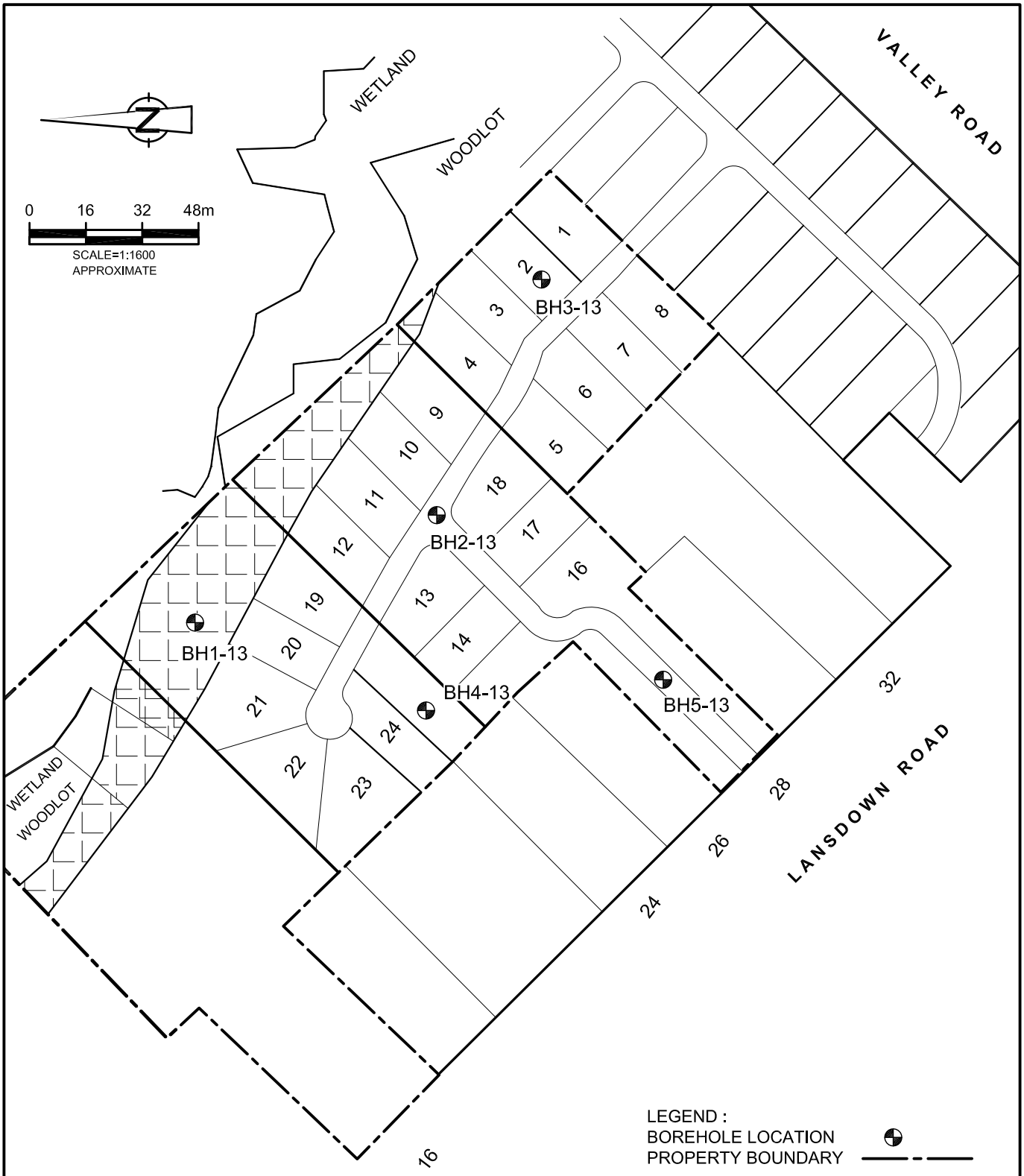


figure 2

BOREHOLE LOCATION PLAN
GEOTECHNICAL INVESTIGATION - PROPOSED DEVELOPMENT
24,26,28 & 32 LANDSDOWN DRIVE, GUELPH, ONTARIO
Dunsire Developments Inc.

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T040938-A1(001)GN-TO002 Aug./2013

Appendix A

- Borehole Logs

REFERENCE No.: T040938a1 ENCLOSURE No.: 1

INSPEC·SOL

BOREHOLE No.: BH1-13
ELEVATION: 88.56 m

BOREHOLE REPORT

Page: 1 of 1

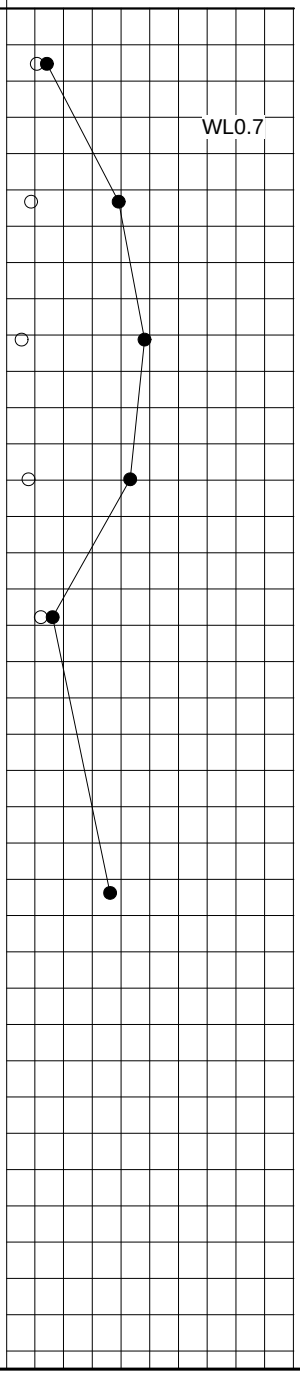
CLIENT: Dunsire Developments Inc.
PROJECT: Geotechnical Investigation - Proposed Development
LOCATION: 24, 26, 28, and 32 Landsdown Drive, Guelph Ontario
DESCRIBED BY: R. Khabbaznia CHECKED BY: S. Shahangian
DATE (START): August 6, 2013 DATE (FINISH): August 6, 2013

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- AU - AUGER PROBE
- ▼ - WATER LEVEL

Depth Feet	Depth Metres	Elevation (m) 88.56	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery %	Moisture Content	Blows per 6 in. / 15 cm	Penetraion Index N
	0.10	88.46		TOPSOIL with vegetation : 100 mm						
1				FILL : SANDY SILT, some gravel, trace topsoil and rootlets, brown, moist, compact		SS-1	67	11	0-5-9-10	14
2										
	0.76	87.80		SAND and GRAVEL, some clay, grey, moist, dense						
3	1.0					SS-2	83	9	9-16-23-23	39
4										
5	1.52	87.04		cobble fragments, damp						
6						SS-3	42	5	9-12-36-33	48
7	2.0									
8						SS-4	58	8	9-17-26-25	43
9										
10	3.0									
	3.05	85.51		NATIVE : CLAYEY SILT TILL, trace gravel, brown, moist, very stiff to hard		SS-5	25	12	7-7-9-10	16
11										
12										
13	4.0									
14										
15	4.57	83.99		hard						
16						SS-6	--	--	8-18-18-20	36
	5.0									
17	5.18	83.38		**END OF BOREHOLE**						
18										
19				NOTE : End of Borehole at 5.18 bgs Groundwater level measured at 0.65 m depth upon completion Borehole caved to 1.85 m depth bgs denotes 'below ground surface						
20	6.0									
21										
22										
23	7.0									
24										

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)



SOIL LOG WITH GRAPH+WELL T040938A1.GPJ INSPEC_SOL.GDT 8/20/13

REFERENCE No.: T040938a1 ENCLOSURE No.: 2

INSPEC·SOL

BOREHOLE No.: BH2-13
ELEVATION: 92.00 m

BOREHOLE REPORT

Page: 1 of 1

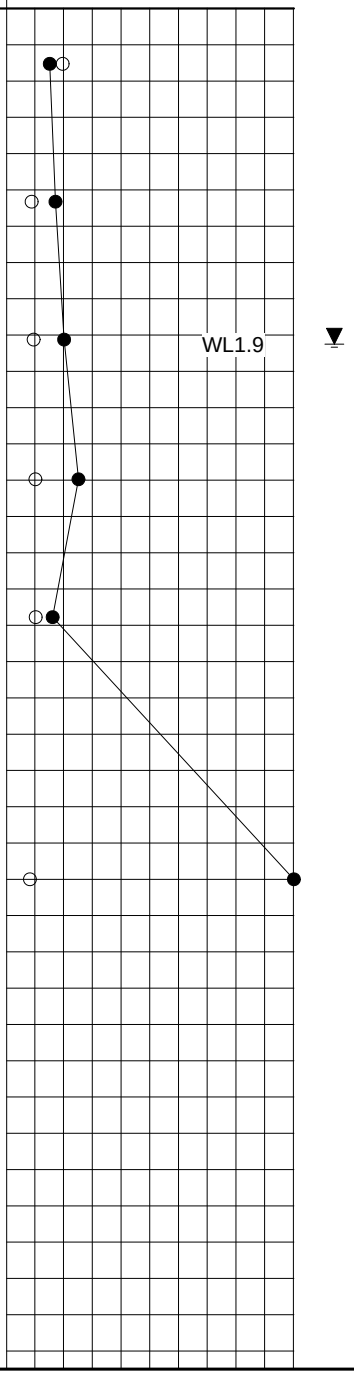
CLIENT: Dunsire Developments Inc.
PROJECT: Geotechnical Investigation - Proposed Development
LOCATION: 24, 26, 28, and 32 Landsdown Drive, Guelph Ontario
DESCRIBED BY: R. Khabbaznia CHECKED BY: S. Shahangian
DATE (START): August 6, 2013 DATE (FINISH): August 6, 2013

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- AU - AUGER PROBE
- ▼ - WATER LEVEL

Depth (Feet)	Depth (Metres)	Elevation (m) 92.00	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery %	Moisture Content	Blows per 6 in. / 15 cm	Penetraion Index N
	0.10	91.90		TOPSOIL with vegetation : 100 mm						
1				FILL : SANDY SILT, some clay, trace topsoil and rootlets, brown, very moist, compact		SS-1	92	20	3-9-6-4	15
2	0.76	91.24		some gravel, trace clay, brownish grey						
3	1.0					SS-2	42	9	6-7-10-9	17
4										
5	1.52	90.48		trace topsoil						
6	2.0					SS-3	50	9	7-10-10-9	20
7										
	2.29	89.71		NATIVE : CLAYEY SILT TILL, some sand and gravel, brown, moist, very stiff						
8						SS-4	58	10	9-17-8-7	25
9										
10	3.0									
11						SS-5	33	10	8-8-8-10	16
12										
13	4.0									
14										
15	4.57	87.43		SANDY SILT TILL, some gravel, trace clay, brownish grey, moist, very dense						
16						SS-6	67	8	48-49-50/ 150mm	100
	5.0 5.03	86.97		**END OF BOREHOLE**						
17				NOTE : End of Borehole at 5.03 bgs due to auger refusal						
18				Groundwater level measured at 1.85 m depth upon completion						
19				Borehole caved to 2.14 m bgs						
20	6.0			bgs denotes 'below ground surface						
21										
22										
23	7.0									
24										

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)



SOIL LOG WITH GRAPH+WELL T040938A1.GPJ INSPEC_SOL.GDT 8/16/13

REFERENCE No.: T040938a1 ENCLOSURE No.: 3

INSPEC·SOL

BOREHOLE No.: BH3-13
ELEVATION: 91.71 m

BOREHOLE REPORT

Page: 1 of 1

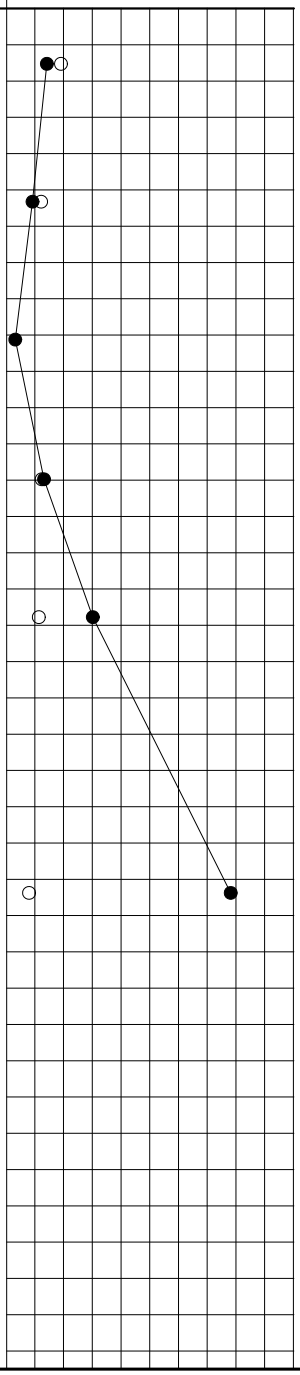
CLIENT: Dunsire Developments Inc.
PROJECT: Geotechnical Investigation - Proposed Development
LOCATION: 24, 26, 28, and 32 Landsdown Drive, Guelph Ontario
DESCRIBED BY: R. Khabbaznia CHECKED BY: S. Shahangian
DATE (START): August 6, 2013 DATE (FINISH): August 6, 2013

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- AU - AUGER PROBE
- ▼ - WATER LEVEL

Depth (Feet)	Depth (Metres)	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery %	Moisture Content	Blows per 6 in. / 15 cm	Penetraion Index N
		91.71		GROUND SURFACE						
	0.10	91.61		TOPSOIL with vegetation : 100 mm						
1				FILL : SANDY SILT, some clay and gravel, trace topsoil and rootlets, brown, very moist to wet, compact		SS-1	58	19	2-6-8-10	14
2	0.76	90.95		CLAYEY SILT, some gravel, trace to some sand, brown, moist, firm						
3	1.0					SS-2	42	12	3-6-3-4	9
4										
5				trace sand, soft						
6						SS-3	58	--	1-1-2-1	3
7	2.0									
8	2.29	89.42		NATIVE : SILTY SAND TILL, some clay and gravel, brown, very moist, stiff		SS-4	67	12	9-6-7-8	13
9										
10	3.0			grey, hard						
11	3.05	88.66				SS-5	67	11	12-14-16-15	30
12										
13	4.0									
14										
15	4.57	87.14		SANDY SILT TILL, some clay and gravel, brown, moist, very dense						
16						SS-6	50	8	14-38-40-42	78
17	5.0									
	5.18	86.53		**END OF BOREHOLE**						
18				NOTE : End of Borehole at 5.18 bgs						
19				Borehole dry upon completion						
20	6.0			Borehole caved to 1.25 m bgs						
21				bgs denotes 'below ground surface						
22										
23	7.0									
24										

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)



SOIL LOG WITH GRAPH+WELL T040938A1.GPJ INSPEC_SOL.GDT 8/16/13

REFERENCE No.: T040938a1 ENCLOSURE No.: 4

INSPEC·SOL

BOREHOLE No.: BH4-13
ELEVATION: 94.36 m

BOREHOLE REPORT

Page: 1 of 1

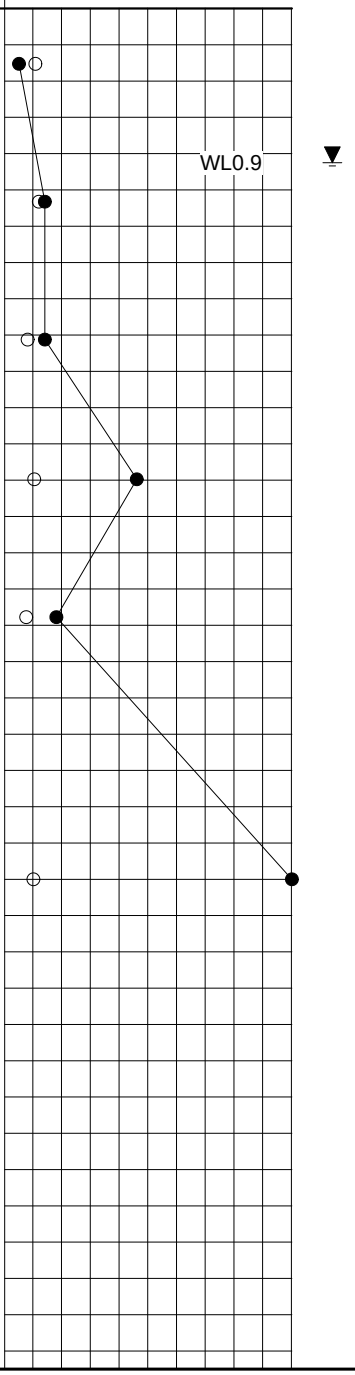
CLIENT: Dunsire Developments Inc.
PROJECT: Geotechnical Investigation - Proposed Development
LOCATION: 24, 26, 28, and 32 Landsdown Drive, Guelph Ontario
DESCRIBED BY: R. Khabbaznia CHECKED BY: S. Shahangian
DATE (START): August 6, 2013 DATE (FINISH): August 6, 2013

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- AU - AUGER PROBE
- ▼ - WATER LEVEL

Depth Feet	Depth Metres	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery %	Moisture Content	Blows per 6 in. / 15 cm	Penetraion Index N
		94.36		GROUND SURFACE						
	0.10	94.26		TOPSOIL with vegetation : 100 mm						
1				FILL : SANDY SILT, some clay and gravel, trace topsoil and rootlets, brown, moist, loose		SS-1	58	11	1-2-3-1	5
2										
3	1.0					SS-2	42	12	1-2-3-1	14
4										
5				trace to some clay, compact						
6						SS-3	25	8	7-8-6-13	14
7	2.0									
	2.29	92.07		NATIVE : SILTY SAND TILL, some gravel, trace clay, brown, moist, dense						
8						SS-4	17	10	17-22-24-26	46
9										
10	3.0									
	3.05	91.31		CLAYEY SILT TILL, some sand and gravel, brown, moist, very stiff						
11						SS-5	50	8	11-11-7-8	18
12										
13	4.0									
	4.57	89.79		SANDY SILT TILL, some clay and gravel, brownish grey, moist, very dense						
14						SS-6	78	10	30-35-50/ 150mm	100
15										
16	5.0									
	5.03	89.33		**END OF BOREHOLE**						
17				NOTE : End of Borehole at 5.03 bgs Groundwater level observed at 0.85 m bgs upon completion Borehole caved to 1.04 m bgs bgs denotes 'below ground surface						
18										
19										
20	6.0									
21										
22										
23	7.0									
24										

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)



SOIL LOG WITH GRAPH+WELL T040938A1.GPJ INSPEC_SOL.GDT 8/16/13

REFERENCE No.: T040938a1 ENCLOSURE No.: 5

INSPEC·SOL

BOREHOLE No.: BH5-13
ELEVATION: 96.59 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Dunsire Developments Inc.
PROJECT: Geotechnical Investigation - Proposed Development
LOCATION: 24, 26, 28, and 32 Landsdown Drive, Guelph Ontario
DESCRIBED BY: R. Khabbaznia CHECKED BY: S. Shahangian
DATE (START): August 6, 2013 DATE (FINISH): August 6, 2013

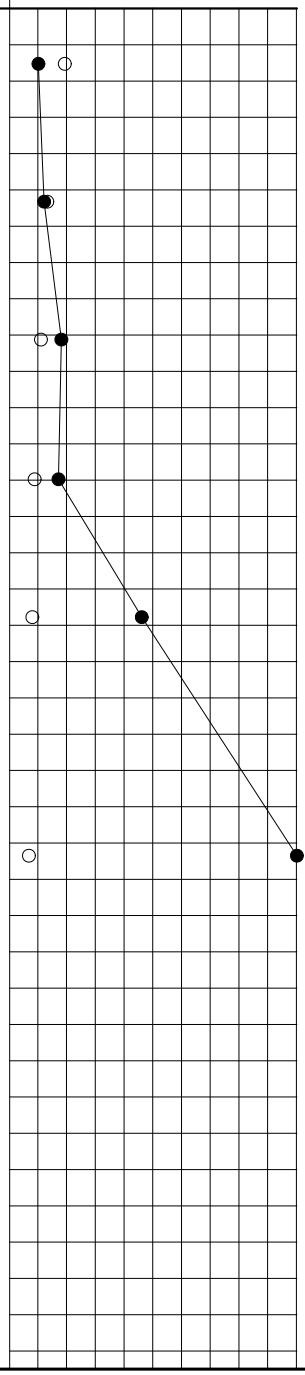
LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- AU - AUGER PROBE
- ▼ - WATER LEVEL

Depth Feet	Depth Metres	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery %	Moisture Content	Blows per 6 in. / 15 cm	Penetraion Index N
		96.59		GROUND SURFACE						
	0.10	96.49		TOPSOIL with vegetation : 100 mm						
1				FILL : SILTY CLAY, some gravel, trace topsoil and rootlets, brown, very moist to wet, stiff		SS-1	25	19	4-4-6-7	10
2	0.76	95.83		SANDY SILT, some clay and gravel, brown to dark brown, very moist, compact						
3	1.0					SS-2	92	13	5-6-6-7	12
4										
5	1.52	95.07		brownish grey						
6						SS-3	75	11	6-8-10-6	18
7	2.0									
8	2.29	94.30		NATIVE : CLAYEY SILT TILL, some sand and gravel, brownish grey, moist, very stiff		SS-4	83	9	7-8-9-10	17
9										
10	3.0 3.05	93.54		SANDY SILT TILL, some clay and gravel, brownish grey, damp to moist, dense		SS-5	83	8	13-22-24-20	46
11										
12										
13	4.0									
14										
15	4.57	92.02		SANDY SILT, some gravel, trace clay, brown, damp, very dense		SS-6	75	7	48-50/ 50mm	100
16	4.77	91.82		**END OF BOREHOLE**						
17	5.0			NOTE : End of Borehole at 4.77 bgs Borehole dry upon completion Borehole caved to 2.14 m bgs bgs denotes 'below ground surface						
18										
19										
20	6.0									
21										
22										
23	7.0									
24										

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90



SOIL LOG WITH GRAPH+WELL T040938A1.GPJ INSPEC_SOL.GDT 8/16/13

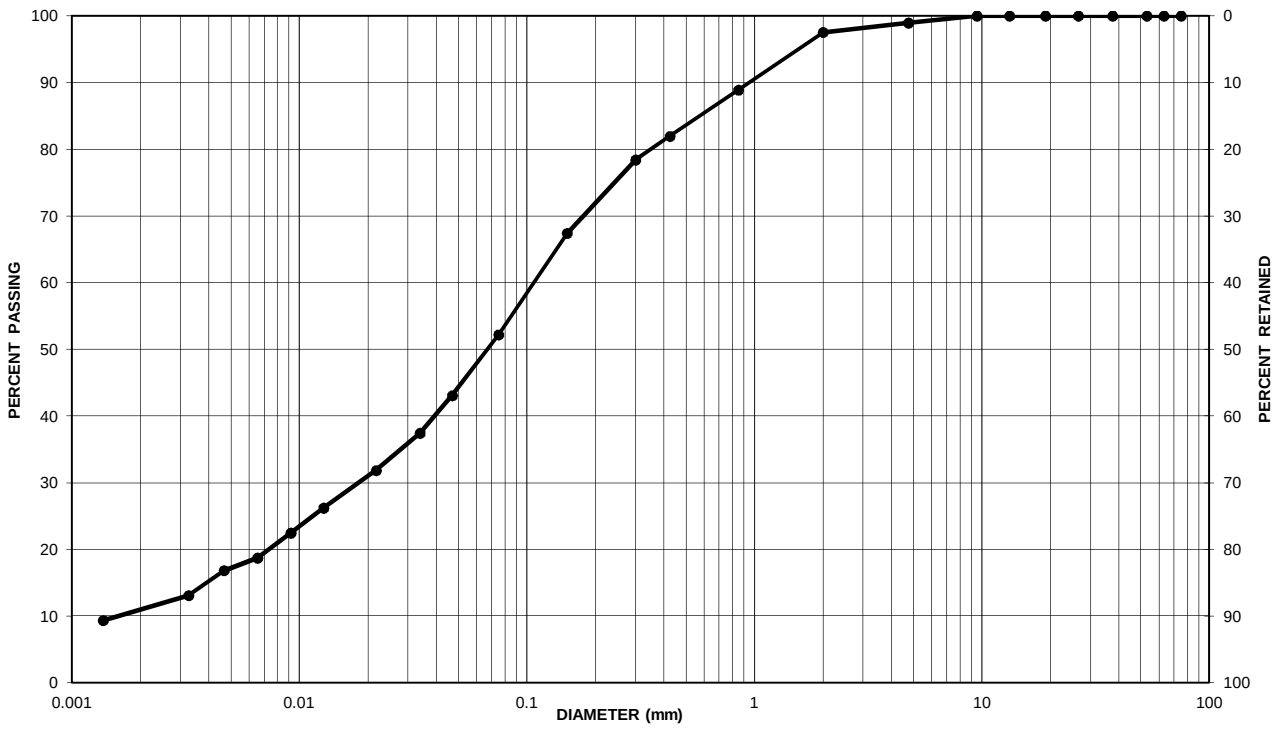
Appendix B

- Lab Test Results

iNSPEC·SOL
ENGINEERING SOLUTIONS

PARTICLE-SIZE ANALYSIS OF SOILS (USCS) (ASTM D422)

CLIENT:	Dunsire Developments Inc	**LAB No.:**	G0478
PROJECT/ SITE:	24, 26, 28, and 32 Landsdown Drive, Guelph Ontario	**PROJECT No.:**	T040938a1
Borehole No.:	BH3-13	Sample No.:	SS-4
Depth:	2.3m - 2.9m	Enclosure:	



CLAY & SILT	SAND			GRAVEL	
	FINE	MEDIUM	COARSE	FINE	COARSE
UNIFIED SOIL CLASSIFICATION SYSTEM					

Soil Description	Gravel	Sand	Clay & Silt
Silty Sand, Some Clay, Trace Gravel	1	47	52

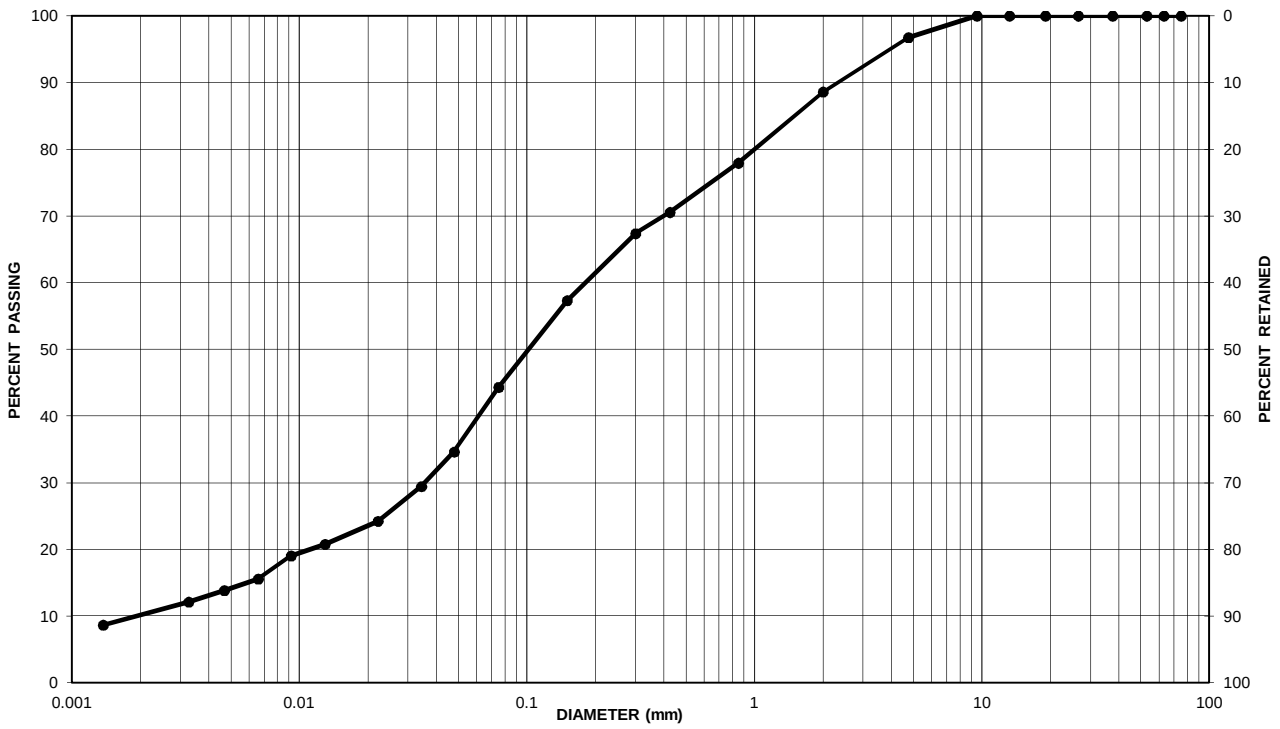
REMARKS: Gravel 1%, Sand 47%, Silt 41%, Clay 11%

PERFORMED BY:	Anwar Rehani	**DATE:**	14/08/2013
VERIFIED BY:	Raj Kadia, C.E.T.	**DATE:**	15/08/2013

INSPEC·SOL
ENGINEERING SOLUTIONS

PARTICLE-SIZE ANALYSIS OF SOILS (USCS) (ASTM D422)

CLIENT:	Dunsire Developments Inc	**LAB No.:**	G0478
PROJECT/ SITE:	24, 26, 28, and 32 Landsdown Drive, Guelph Ontario	**PROJECT No.:**	T040938a1
Borehole No.:	BH4-13	Sample No.:	SS-4
Depth:	2.3m - 2.9m	Enclosure:	



CLAY & SILT	SAND			GRAVEL	
	FINE	MEDIUM	COARSE	FINE	COARSE
UNIFIED SOIL CLASSIFICATION SYSTEM					

Soil Description	Gravel	Sand	Clay & Silt
Silty Sand, Trace Clay, Trace Gravel	3	53	44

REMARKS: Gravel 3%, Sand 53%, Silt 34%, Clay 10%

PERFORMED BY:	Anwar Rehani	**DATE:**	14/08/2013
VERIFIED BY:	Raj Kadia, C.E.T.	**DATE:**	15/08/2013

APPENDIX C

Stormwater Management Calculations

KAM ENGINEERING LTD.
1828 BLUE HERON DR., UNIT 21
LONDON, ONTARIO, N6H 0B7
t: 519 474 0410 f: 519 471 0034
e: kam@kameng.ca w: www.kameng.ca

SWM Calculations

DATE: December 18, 2013
JOB N0.: KAM-13-084

Client: **Dunsire Developments**
Project: **White Cedar Estates**
Location: **Guelph, ON**

PRE-DEVELOPMENT (A0)

	Area (m^2)	C	A*C
Total Site Area:	16238.54		
Building Area:	59.25	0.9	53.32302
Concrete/Asphalt:	2.16	0.9	1.94211
Gravel:	0.00	0.7	0
Landscaped/Open:	17859.59	0.15	2678.939145
Totals:	17921		2734.204275
C_{eq} = Sum(A*C)/Sum(A) =	0.15		

Pre Develeopment Flows

C = 0.15
Time to concentration t_c = 10 min
Intensity, i (@ t_c) = 109.68 mm/hr
Pre Development Flow, Q_r = 2.78*C*i*A = 75.54 l/s

*As per the Region of Waterloo and Area Municipalities 'Design Guidelines and Supplemental Specifications for Municipal Services' February 2013 the runoff coefficient for Detached Single family suburban is 0.4-0.45. Therefore a runoff coefficient value of 0.45 was conservatively selected.

Post-Development 100-Yr Flows

C = 0.45
Time to concentration t_c = 10 min
Intensity, i (@ t_c) = 196.54 mm/hr
Pre Development Flow, Q_r = 2.78*C*i*A = 399.25 l/s

RAINFALL DATA

Rainfall Data - Guelph 100yr
Rainfall Intensity Duration

A = 4688
B = 17.00
C = 0.9624

Duration (min.)	Intensity "i" (mm/hr)
5	239.35
10	196.54
15	166.89
30	115.28
60	71.69
120	41.17
360	15.54
720	8.15
1440	4.23

STORAGE CALCULATIONS

Inflow, Q_i 2.78*C*i*A (l/s)	Volume In Q_i*t*60/1000 (m^3)	Outflow, Q_o (l/s)	Volume Out Q_o*t*60/1000 (m^3)	Difference/ Storage (m^3)
486.23	145.87	75.54	22.66	123.21
399.25	239.55	75.54	45.33	194.23
339.03	305.13	75.54	67.99	237.14
234.19	421.54	75.54	135.98	285.56
145.62	524.25	75.54	271.95	252.30
83.64	602.21	75.54	543.90	58.30
31.57	681.98	75.54	1631.71	-949.72
16.56	715.53	75.54	3263.41	-2547.89
8.60	742.66	75.54	6526.82	-5784.16

Required Storage Volume (m^3) = 285.56

PROVIDED STORAGE VOLUME CALCULATIONS

Location	Area (m^2)	Depth(m)	Volume (m^3)
Pond Lower Portion (V=A_{top}*D/3)			
	581.75	0.46	89.20
Pond Upper Portion (V=A_{ave}*D)			
A_{top} =	1021.806		
A_{bot} =	581.75	0.33	264.59
Provided Storage Volume (m^3) =			353.79

ORIFICE RESTRICTION CALCULATIONS

Orifice diameter is based on Bernoulli's equation, Q=C_d*A*(2gH)^0.5
Rearranging, A= Q/[C_d*(2gH)^0.5], where:

Restricted Flow Rate, Q = 75.54 l/s
Orifice Coefficient, C_d = 0.63
Gravitational Acceleration, g = 9.81 m/s^2
Top of Ponding Elevlation = 334.70 m
Centre of Orifice Elevation = 333.61 m
Hydralic Head on Orifice, H = 1.090 m
Required Cross-Sectional Area, A = 0.02593 m^2
Required Diameter, d = ((4*A)/pi)^0.5 = 0.182 m
Minimum orifice diameter = **76** **mm**
Therefore, proposed orifice diameter = **182** **mm**

APPENDIX D

Stormceptor STC 750 Design Summary

Stormceptor Design Summary

PCSWMM for Stormceptor

Project Information

Date	18/12/2013
Project Name	White Cedar Estates
Project Number	KAM-13-084
Location	Landsdown Drive, Guelph, ON

Designer Information

Company	KAM Engineering Ltd.
Contact	Kevin Moniz

Notes

N/A

Drainage Area

Total Area (ha)	1.048
Imperviousness (%)	40

The Stormceptor System model STC 750 achieves the water quality objective removing 80% TSS for a Fine (organics, silts and sand) particle size distribution and 93% runoff volume.

Rainfall

Name	WATERLOO WELLINGTON A
State	ON
ID	9387
Years of Records	1970 to 2003
Latitude	43°27'N
Longitude	80°23'W

Water Quality Objective

TSS Removal (%)	80
Runoff Volume (%)	90

Upstream Storage

Storage (ha-m)	Discharge (L/s)
0	0

Stormceptor Sizing Summary

Stormceptor Model	TSS Removal %	Runoff Volume %
STC 300	72	81
STC 750	**80**	**93**
STC 1000	80	93
STC 1500	81	93
STC 2000	85	96
STC 3000	86	96
STC 4000	89	98
STC 5000	89	98
STC 6000	91	99
STC 9000	93	99
STC 10000	93	99
STC 14000	95	100

Particle Size Distribution

Removing silt particles from runoff ensures that the majority of the pollutants, such as hydrocarbons and heavy metals that adhere to fine particles, are not discharged into our natural water courses. The table below lists the particle size distribution used to define the annual TSS removal.

Fine (organics, silts and sand)

Particle Size µm	Distribution %	Specific Gravity	Settling Velocity m/s		Particle Size µm	Distribution %	Specific Gravity	Settling Velocity m/s
20	20	1.3	0.0004					
60	20	1.8	0.0016					
150	20	2.2	0.0108					
400	20	2.65	0.0647					
2000	20	2.65	0.2870					

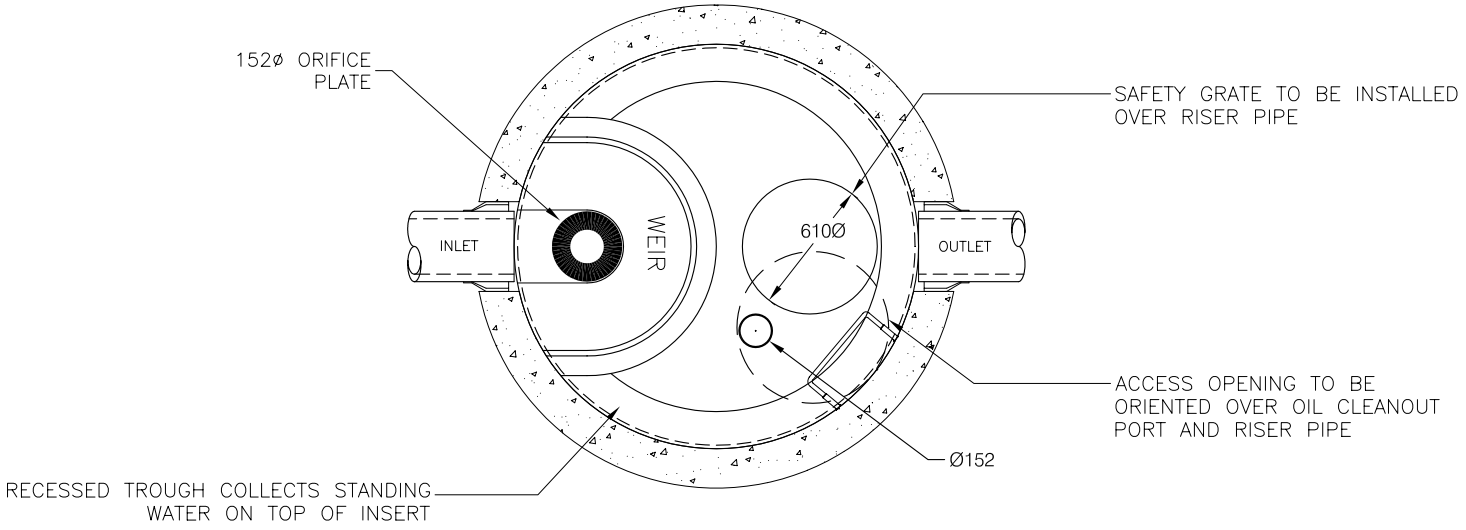
Stormceptor Design Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor version 1.0
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal.
- Only the STC 300 is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 750 to STC 6000 may accommodate multiple inlet pipes.
- Inlet and outlet invert elevation differences are as follows:

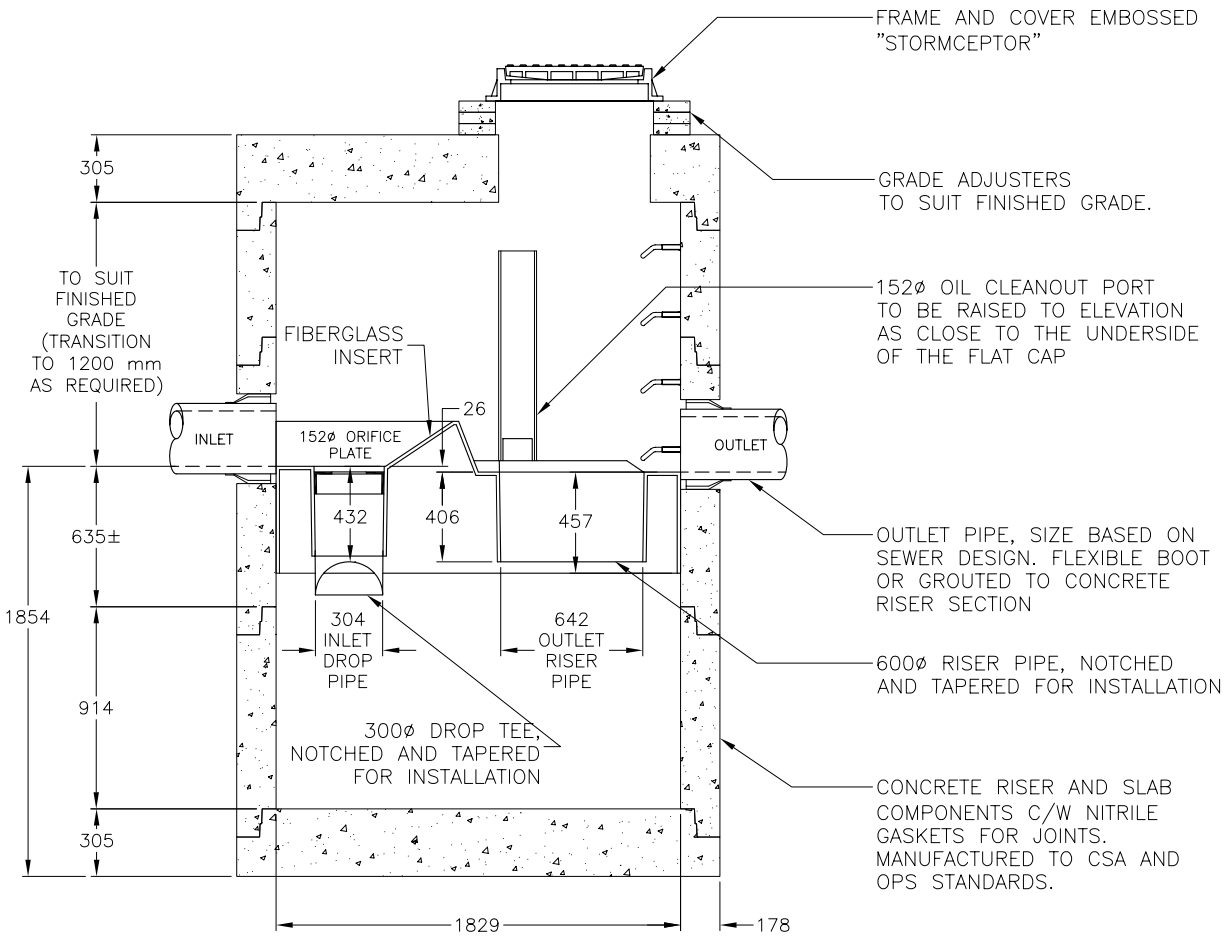
Inlet and Outlet Pipe Invert Elevations Differences

Inlet Pipe Configuration	STC 300	STC 750 to STC 6000	STC 9000 to STC 14000
Single inlet pipe	75 mm	25 mm	75 mm
Multiple inlet pipes	75 mm	75 mm	Only one inlet pipe.

- Design estimates are based on stable site conditions only, after construction is completed.
- Design estimates assume that the storm drain is not submerged during zero flows. For submerged applications, please contact your local Stormceptor representative.
- Design estimates may be modified for specific spills controls. Please contact your local Stormceptor representative for further assistance.
- For pricing inquiries or assistance, please contact Imbrium Systems Inc., 1-800-565-4801.



PLAN VIEW



SECTION VIEW

STC 750 CAPACITIES		
SEDIMENT CAPACITY (L)	OIL CAPACITY (L)	TOTAL CAPACITY L (IMP GAL)
3000	915	4070 (895)

****NOT FOR CONSTRUCTION****

THE STORMCEPTOR SYSTEM IS PROTECTED BY ONE OR MORE OF THE FOLLOWING PATENTS:

CANADIAN PATENT NO. 2,009,208
CANADIAN PATENT NO. 2,137,942
CANADIAN PATENT NO. 2,175,277
CANADIAN PATENT NO. 2,180,305
CANADIAN PATENT NO. 2,180,383
CANADIAN PATENT NO. 2,206,338

Hanson
Stormceptor
R.R. 2, CAMBRIDGE, ONTARIO N1R 5S3
TEL. 519-622-7574
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FAX 519-621-8233 MAIN OFFICE
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IN-LINE STORMCEPTOR MODEL STC 750

DATE:	D.B.	UNITS:	DWG No.
14 OCT 03	S.K.	METRIC	G-2

APPENDIX E

Water Balance Calculations

KAM ENGINEERING LTD.
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PRE-DEVELOPMENT WATER BALANCE CALCULATIONS

DATE: December 18, 2013
JOB N0.: KAM-13-084

Client: **Dunsire Developments**
Project: **White Cedar Estates**
Location: **Guelph, ON**

Parameters:

Catchment Area (ha) = 1.62
Soil Type*: SM
Hydrologic Soil Group**: B
Vegetation**: Urban Lawn/Shallow Rooted Crops
Soil Moisture Retention Capacity (mm)** = 75
Infiltration Factor** = 0.600 (Hilly, Sandy Loam, Cultivated Land)
Runoff Factor** = 0.400
Total Runoff Factor** = 0.400

Percent Impervious = 0.0%
Imp. Evapotranspiration Factor = 0.100
Impervious Runoff Factor = 0.900

Water Balance Method*:**

	Units	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	**Total Yearly**
Temperature	deg. C	-7.6	-6.9	-1.3	5.9	12.3	16.9	19.7	18.6	14.1	7.9	2.4	-4.0	
Heat Index (i)	-	0.0	0.0	0.0	1.3	3.9	6.3	8.0	7.3	4.8	2.0	0.3	0.0	**33.9**
Unadjusted PET (UPET)	mm	0.0	0.0	0.0	0.9	2.0	2.8	3.3	3.1	2.3	1.3	0.4	0.0	
Latitude Correction (r)	-	24.3	24.6	30.6	33.6	37.8	38.4	38.7	36.0	31.2	28.5	24.3	23.1	
Potential Evapotranspiration (PET)	mm	0.0	0.0	0.0	30.2	75.6	107.5	127.7	111.6	71.8	37.1	9.7	0.0	
Precipitation (P)****	mm	56.4	50.8	72.1	78.3	79.9	76.0	88.5	95.9	92.1	69.2	86.3	77.7	**923.2**
P - PET	mm	56.4	50.8	72.1	48.1	4.3	-31.5	-39.2	-15.7	20.3	32.2	76.6	77.7	
Soil Moisture Retention (Storage)	mm	75.0	75.0	75.0	75.0	75.0	49.3	29.2	23.7	44.0	75.0	75.0	75.0	
Storage Change	mm	0.0	0.0	0.0	0.0	0.0	-25.7	-20.1	-5.5	20.3	31.0	0.0	0.0	
AET (Actual ET)	mm	0.0	0.0	0.0	30.2	75.6	101.7	108.6	101.4	71.8	37.1	9.7	0.0	**536.1**
Soil Moisture Surplus	mm	0.0	0.0	0.0	48.1	4.3	0.0	0.0	0.0	0.0	1.2	76.6	0.0	**130.1**
Water Runoff (Assumption 1)	mm	9.7	4.9	2.4	25.2	14.8	7.4	3.7	1.8	0.9	1.1	38.8	19.4	**130.1**
Accumulated Snow (Assumption 2)	mm	0.0	0.0	0.0	257.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**257.0**
Snow Runoff (Assumption 3)	mm	0.0	0.0	0.0	25.7	116.1	58.3	29.3	14.7	7.4	3.7	1.9	0.0	**257.0**
Total Recharge & Runoff	mm	9.7	4.9	2.4	50.9	130.9	65.7	33.0	16.5	8.3	4.8	40.7	19.4	**387.1**
Actual Runoff	mm	3.9	1.9	1.0	20.4	52.4	26.3	13.2	6.6	3.3	1.9	16.3	7.8	**154.8**
Runoff Volume	m^3	62.9	31.4	15.7	330.1	848.1	425.6	213.5	107.1	53.8	30.8	263.6	125.8	**2508.4**

Assumptions:
1 - Water Runoff in each month is assumed to be 50% of the Soil Moisture Surplus in that month plus 50% of the remaining Water Runoff from the previous month
2 - All Snow is accumulated and stored on the surface during sub-zero months and melts during the first above-zero month
3 - Snow Runoff is assumed to be 10% of the accumulated snow in the first above-zero month and then approximately 50% of the remaining Snow Runoff in each following month

References:
*Geotechnical Report T040938a1 by Inspec-Sol Inc.
**Stormwater Management Planning & Design Manual (Ministry of the Environment, 2003)
***Instructions and Tables for Computing Potential Evapotranspiration and the Water Balance (Thornthwaite & Mather, 1957)
****Environment Canada Climate Normals 1971-2000 - Guelph Arboretum

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POST-DEVELOPMENT WATER BALANCE CALCULATIONS

DATE: December 18, 2013
JOB N0.: KAM-13-084

Client: Dunsire Developments
Project: White Cedar Estates
Location: Guelph, ON

Parameters:

Catchment Area (ha) = 1.62
Soil Type*: SM
Hydrologic Soil Group**: B
Vegetation**: Urban Lawn
Soil Moisture Retention Capacity (mm)** = 75
Infiltration Factor** = 0.600 (Hilly, Sandy Loam, Cultivated Land)
Runoff Factor** = 0.400
Total Runoff Factor** = 0.600

Percent Impervious = 40.0% (roads, driveways, bldg envelopes)
Imp. Evapotranspiration Factor = 0.100
Imp. Runoff Factor = 0.900

Water Balance Method*:**

	Units	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total Yearly
Temperature	deg. C	-7.6	-6.9	-1.3	5.9	12.3	16.9	19.7	18.6	14.1	7.9	2.4	-4.0	
Heat Index (i)	-	0.0	0.0	0.0	1.3	3.9	6.3	8.0	7.3	4.8	2.0	0.3	0.0	**33.9**
Unadjusted PET (UPET)	mm	0.0	0.0	0.0	0.9	2.0	2.8	3.3	3.1	2.3	1.3	0.4	0.0	
Latitude Correction (r)	-	24.3	24.6	30.6	33.6	37.8	38.4	38.7	36.0	31.2	28.5	24.3	23.1	
Potential Evapotranspiration (PET)	mm	0.0	0.0	0.0	30.2	75.6	107.5	127.7	111.6	71.8	37.1	9.7	0.0	
Precipitation (P)****	mm	56.4	50.8	72.1	78.3	79.9	76.0	88.5	95.9	92.1	69.2	86.3	77.7	**923.2**
P - PET	mm	56.4	50.8	72.1	48.1	4.3	-31.5	-39.2	-15.7	20.3	32.2	76.6	77.7	
Soil Moisture Retention (Storage)	mm	75.0	75.0	75.0	75.0	75.0	49.3	29.2	23.7	44.0	75.0	75.0	75.0	
Storage Change	mm	0.0	0.0	0.0	0.0	0.0	-25.7	-20.1	-5.5	20.3	31.0	0.0	0.0	
AET (Actual ET)	mm	0.0	0.0	0.0	19.4	48.4	65.1	69.5	64.9	45.9	23.7	6.2	0.0	**343.1**
Soil Moisture Surplus	mm	0.0	0.0	0.0	58.9	31.5	36.6	39.1	36.5	25.8	14.5	80.1	0.0	**323.1**
Water Runoff (Assumption 1)	mm	12.9	6.4	3.2	31.1	31.3	34.0	36.5	36.5	31.2	22.8	51.5	25.7	**323.1**
Accumulated Snow (Assumption 2)	mm	0.0	0.0	0.0	257.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**257.0**
Snow Runoff (Assumption 3)	mm	0.0	0.0	0.0	25.7	116.1	58.3	29.3	14.7	7.4	3.7	1.9	0.0	**257.0**
Total Recharge & Runoff	mm	12.9	6.4	3.2	56.8	147.4	92.3	65.8	51.2	38.5	26.5	53.3	25.7	**580.1**
Actual Runoff	mm	7.7	3.9	1.9	34.1	88.4	55.4	39.5	30.7	23.1	15.9	32.0	15.4	**348.1**
Runoff Volume	m^3	125.1	62.5	31.3	551.9	1432.8	896.7	639.4	497.7	374.7	258.1	518.3	250.1	**5638.5**

Assumptions:
1 - Water Runoff in each month is assumed to be 50% of the Soil Moisture Surplus in that month plus 50% of the remaining Water Runoff from the previous month
2 - All Snow is accumulated and stored on the surface during sub-zero months and melts during the first above-zero month
3 - Snow Runoff is assumed to be 10% of the accumulated snow in the first above-zero month and then approximately 50% of the remaining Snow Runoff in each following month

References:
*Geotechnical Report T040938a1 by Inspec-Sol Inc.
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