Functional Servicing and Stormwater Management Report
Proposed 9 Lot Residential Development
Golf Course Road

TPC Marlwood Inc.
31 Marlwood Avenue
Wasaga Beach ON L9Z 1S8

R.J. Burnside & Associates Limited
3 Ronell Crescent
Collingwood ON L9Y 4J6 CANADA

February 2020
300039210.0000

Distribution List

No. of Hard Copies	PDF	Email	Organization Name
0	Yes	Yes	TPC Marlwood Inc.
4	Yes	Yes	Loft Planning

Record of Revisions

Revision	Date	Description
0	April 2017	Initial Draft Submission to Planner, Client and Team
2	September 2017	Town of Wasaga Beach
3	February 2020	Second Submission (Town & NVCA)

R.J. Burnside & Associates Limited

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EDT:cv

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1.0 Introduction

R.J. Burnside & Associates Limited (Burnside) has been retained by TPC at Marlwood Inc. to prepare a Functional Servicing and Stormwater Management Report (FSR) for the proposed 9 lot residential development located east of Golf Course Road and within a portion of the current Marlwood Golf and Country Club in the Town of Wasaga Beach.

This report presents a functional design of sanitary sewer, water supply, grading and stormwater management in support of an Official Plan Amendment (OPA), a Zoning By-Law Amendment (ZBA), and draft plan approval for the development. The site location plan is shown on Figure 1.

The same proponent is also proposing the development of 51 lots south of Marlwood Estates, which will be covered under a separate FSR as the two properties are independent of each other from a grading, servicing and drainage perspective. The property subject to this report can be thought of as an “infill” development as no new roads are required, and services are already available with the simple extension of service laterals.

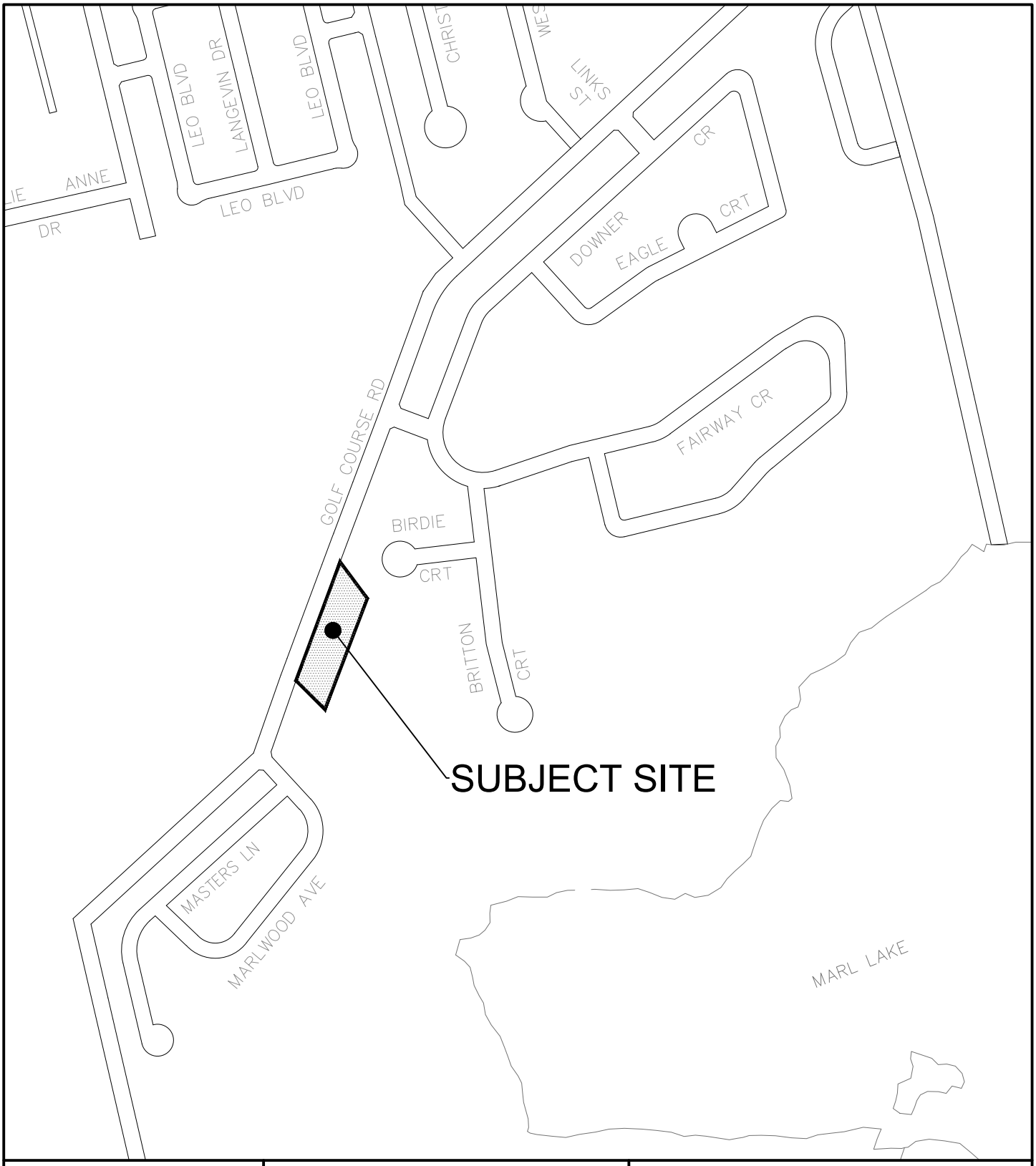
1.1 Site Description

The existing site is partially vacant with trees, including the remnants of the old entrance to the golf course. A 10m wide drainage easement exists in the south portion of the site between the existing residential development and the proposed site. The site is located east of Golf Course Road within the Town of Wasaga Beach and between existing residential homes to the north and south.

A severance of approximately 0.87 ha from the Marlwood Golf and Country Club is intended to accommodate the proposed development of 9 single-family homes fronting onto Golf Course Road with approximate frontages of 18.5 m and a drainage easement along the rear of the lots.

There is no existing infrastructure on the site. Adjacent to the proposed lots (within the right-of-way of Golf Course Road), there exists a 400 mm watermain, 250 mm sanitary forcemain, 250 mm sanitary sewer on the western side of the road. All existing utilities are located on the eastern boulevard, including underground Bell, Cable, and Gas as well as aboveground hydro lines

Refer to Figure 2 for the Draft Plan dated January 14, 2020 and Figure 3 for the Existing Conditions.



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BURNSIDE

3 Ronell Crescent, Collingwood, Ontario, L9Y 4J6
telephone (705) 446-0515 **fax** (705) 446-2399

Client

TPC MARLWOOD INC.

31 MARLWOOD AVENUE
WASAGA BEACH, ON
L9Z1S8

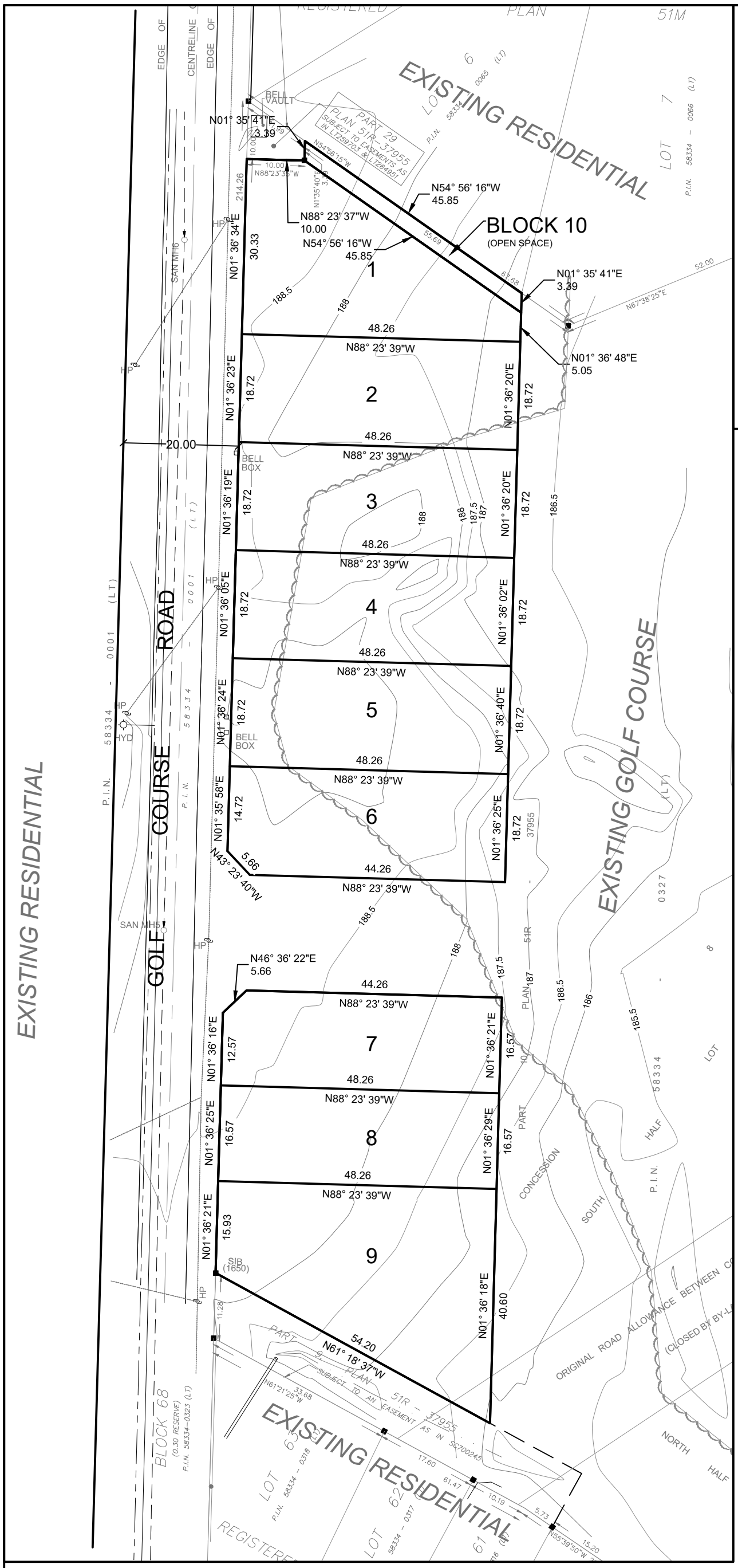
Drawing Title

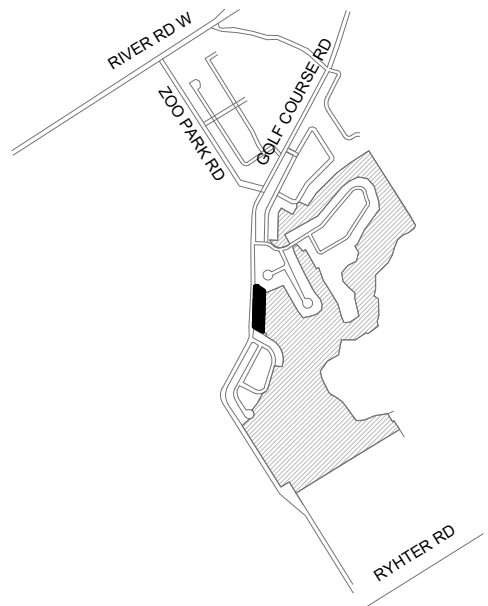
MARLWOOD (9 LOTS)

SITE LOCATION PLAN

Drawn	Checked	Date	Drawing No.
KAG	EDT	17/09/25	1
Scale		Project No.	
NTS		300039210	

File Name: 039210 - KEY MAP.dwg Date Plotted: November 29, 2019 - 5:02 PM





KEY PLAN
N.T.S.

SUBJECT PROPERTY
ADDITIONAL LANDS OWNED BY APPLICANT

ADDITIONAL INFORMATION

As required under Section 51(17) of the Planning Act.

a), b), e), f), g) & j) – on plan
c) – on key plan
d) – see statistics
h) – piped water to be installed by developer
i) – sandy
k) – all municipal services to be made available
l) – DO WE HAVE TO INCLUDE THE BELL EASEMENT AND DRAINAGE BLOCK TO THE SOUTH IN THIS DRAFT PLAN

STATISTICS

PROPOSED LAND USE	LOT/BLOCK	AREA
SINGLE DETACHED RESIDENTIAL	1-9	0.84ha
OPEN SPACE	10	0.01ha

APPROVED SUBJECT TO CONDITIONS IN ACCORDANCE WITH SECTION 51(31) OF THE PLANNING ACT, RSO, CAP. P.13, AS AMENDED,

THIS _____ DAY OF _____,_____

DIRECTOR OF PLANNING, DEVELOPMENT AND TOURISM, COUNTY OF SIMCOE

OWNER'S CERTIFICATE

We authorize LOFT Planning Inc. to prepare and submit this Plan of Subdivision for approval.

A.S.O. _____

TPC MARLWOOD INC. date

SURVEYOR'S CERTIFICATE

I hereby certify that the boundaries of the lands being subdivided and their relationship to the adjacent lands are accurately and correctly shown.

RUDY MAK SURVEYING LTD. date

I-T-0003
DRAFT PLAN OF SUBDIVISION
Part of south half of Lot 26
Concession 7
Town of Wasaga Beach
County of Simcoe
(Geographic Township of Flos)

Date: January 14, 2020

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Figure Title

MARLWOOD (9 LOTS)

EXISTING CONDITIONS

Client

TPC MARLWOOD INC.

Drawn	Checked	Date	Figure No.
KAG	EDT	17/09/25	**3**
Scale		Project No.	
1:750		300039210	

File: \\OSCAR\Shared Work Areas\039210 - Marlwood Golf Course 10 Lots\04_Preliminary\003_ProductionDwg\039210 - Existing Conditions.dwg Date Plotted: November 26, 2019 - 5:54 PM

1.2 Background Reports

The design concepts and stormwater strategy presented in this submission have been developed in accordance with the following reports and guidelines. Pre-consultation notes are included as Appendix A.

- Preliminary Geotechnical Investigation, Marlwood Golf and Country Club, 31 Marlwood Avenue, Wasage Beach, Ontario, prepared by WSP, dated January 07, 2020.
- Environmental Impact Study (EIS), prepared by Azimuth Environmental Consulting Inc. (Azimuth), dated September 2017.
- Water Balance Assessment, 31 Marlwood Avenue, Town of Wasaga Beach, prepared by Azimuth, dated February 2020.
- Engineering Standards, Town of Wasaga Beach, dated March 2015.
- NVCA Stormwater Technical Guide, Nottawasaga Valley Conservation Authority (NVCA), dated December 2013.

1.3 Development Limits

Development limits as noted are Golf Course Road municipal right-of-way (R.O.W.) and existing neighborhoods to the north and south. An existing easement along the south end of the proposed nine lots is a drainage swale in favour of the Town of Wasaga Beach. It appears this drainage easement services the drainage from Municipal Addresses 1, 3 and 5 Marlwood Avenue. It also appears to be an allowance for drainage of a future overland flow route from Golf Course Road through the golf course towards Marl Lake. The easement description and purpose are provided in Appendix A.

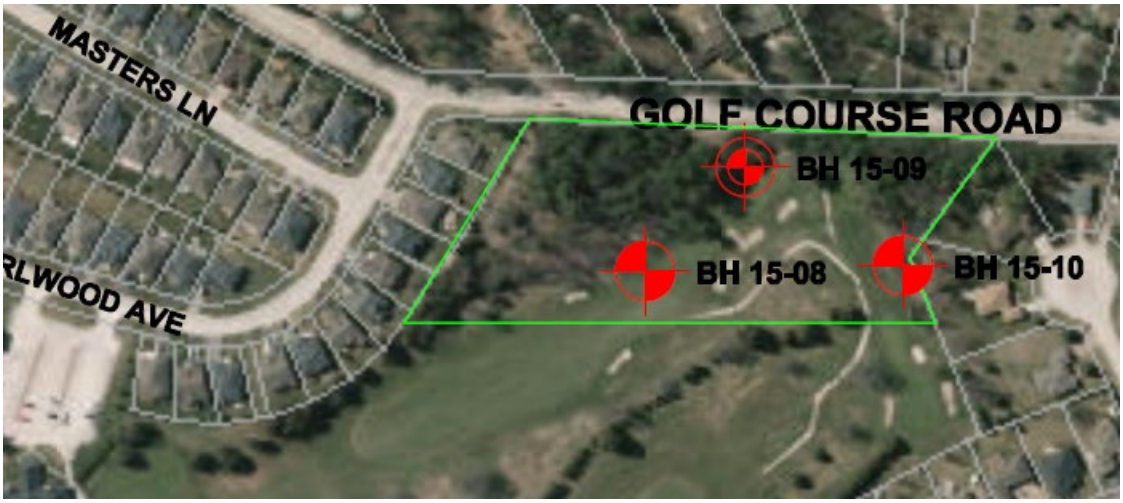
The proposed 0.86 ha development is not adjacent to any wetlands or watercourse features within 200 m. However, the woodlot component of the area has been assessed through an EIS prepared by Azimuth under separate cover. It was noted as medium constraint.

The Draft Plan lot fabric has also been established, based on respecting existing municipal and utility infrastructure on Golf Course Road, to have utilities at property lines where possible (examples would include hydro poles and utility pedestals). The lot fabric also establishes frontages and lot sizes similar to those immediately to the north and south.

1.4 Geotechnical Investigation

The preliminary geotechnical report prepared by WSP is provided in Appendix B. Boreholes and groundwater monitoring wells were completed at the locations identified in Image 1 below.

Image 1: Borehole Locations



1.4.1 Soil Types

In general, the subsurface conditions at the borehole locations comprised of a surficial layer of topsoil, underlain by native cohesive and non-cohesive deposits of clayey silt, Marl, sand to silty sand and sand and gravel. Sandy soils predominate the site and were encountered in all boreholes. The marl encountered in boreholes BH15-08, BH15-09 and BH15-10 generally ranged in depths between 0.3 m to 2.3 m below ground surface.

Removal of all topsoil, disturbed soils and marl will be required to facilitate the development of the site.

1.4.2 Groundwater Conditions

Groundwater was encountered in all boreholes during the drilling and at the completion of drilling. On-site monitoring of the groundwater in BH15-09 began in September 2015 and continued until August 2016. A summary of the groundwater level measurements is provided below and included in the geotechnical report in Appendix B.

Table 1: Groundwater Readings

Date	Groundwater Level Measurements	
	BH15-09 (Ground Elev. ~ 190)	
	mbg	masl
September 3, 2015	~4.8	~185.2
October 14, 2015	4.87	185.13
December 31, 2015	4.91	185.09
January 28, 2016	4.91	185.09
February 29, 2016	4.88	185.12

Date	Groundwater Level Measurements	
	BH15-09 (Ground Elev. ~ 190)	
March 31, 2016	4.54	185.46
April 30, 2016	4.38	185.62
May 31, 2016	4.44	185.56
June 10, 2016	4.48	185.52
June 30, 2016	4.50	185.50
July 31, 2016	4.56	185.44
August 23, 2016	4.62	185.38

1.4.3 Infiltration Estimation

Based on the laboratory grain size analysis performed by WSP, estimated percolation time and permeability of the soils were completed. These values were converted to an estimated infiltration rate based on the 1997 "*Ontario Ministry of Municipal Affairs and House Supplementary Guidelines to the Ontario Building Code*" document which provides approximate relationships between hydraulic conductivity, percolation time and infiltration rate. Infiltration rates were therefore estimated to range from 75 mm/hr to 300 mm/hr.

2.0 Water Supply and Distribution

Water servicing for the proposed single family lots will be an extension of service laterals from the existing watermain on Golf Course Road. It is understood that the Town will run the additional demand of these 9 lots to confirm there is adequate capacity within the water network.

Based on the available information shown on Town of Wasaga Beach Record Drawing SW6-RD (refer to Appendix C), the existing water infrastructure in proximity to the site consists of a 400 mm diameter watermain along the north side of Golf Course Road that provides an existing fire hydrant located centrally in front of proposed Lot 5 of 9 on the opposite side of the road.

The water demand for the development has been calculated to be 0.74 L/s + 38 L/s fire flow, for a total of 38.74 L/s. Water Demand Calculations for the proposed development have been included in Appendix D.

Refer to Drawing Site Servicing Plan (Figure 4) for the proposed water service layouts.

3.0 Sanitary Servicing

Sanitary servicing for the 9 proposed lots will be an extension of sanitary laterals from the 250 mm PVC sewer generally running down the centerline of Golf Course Road. Refer to Appendix C, Drawings SW6-RD and FM5-RD for existing as-built conditions. The sewer has sufficient depth to allow for a full basement construction if desired for any of the nine proposed lots. The sewer continues across the entire frontage of the proposed nine lots.

The sanitary service connection to each lot will be 125 mm and is to be constructed as per the Town of Wasaga Beach STD. DWG. No. 12.

Refer to Drawing Site Servicing Plan (Figure 4) for the proposed sanitary lateral layout.

GOLF COURSE ROAD

25mmØ PE160 WATER SERVICE CONNECTION TO BE INSTALLED AS PER OPSD 1104.010, WITH APPROVED SERVICE SADDLE

SANITARY SERVICE CONNECTION TO TIE INTO EXISTING 250mmØ PVC SANITARY SEWER VIA 250x125mm INSERT-A-TEE, AND INSTALLED AS PER TOWN OF WASAGA BEACH STANDARD DRAWING No. 12 (TYP.)

DRIVEWAYS ILLUSTRATED CONCEPTUALLY AS 9.0m WIDE TO SERVICE MAXIMUM 3 CAR GARAGE HOME DESIGN UNLESS NOTED OTHERWISE (TYP.)

SANITARY SERVICE CLEANOUT TO BE INSTALLED AS PER TOWN OF WASAGA BEACH STANDARD DRAWING No. 12 (TYP.)

WATER SERVICE CURB STOP TO BE APPROVED MATERIAL, AND BROUGHT FLUSH TO FINISHED GRADE. IF LOCATED IN DRIVEWAY, A FROST COLLAR PER TOWN STANDARDS IS TO BE INSTALLED.

SOAKAWAY PITS PER TOWN OF WASAGA BEACH STANDARD DRAWING No. 11 (MODIFIED) TO BE INSTALLED IN EACH LOT IN LOWEST REAR YARD CORNER, SIZED TO ACCOMMODATE 5mm RUNOFF VOLUME FROM ROOFTOP AREAS. HOUSE LOT COVERAGE OF 50% CONSERVATIVELY ASSUMED (TYP.)
REFER TO CHART ON THIS DWG FOR INDIVIDUAL PIT SIZING DETAILS.

ENHANCED GRASSED SWALE WITHIN DRAINAGE EASEMENT (WIDTH TO BE CONFIRMED DURING DETAILED DESIGN). INFILTRATION TRENCH TO BE PROVIDED UNDER ENHANCED GRASSED SWALE, SIZED TO ACCOMMODATE ADDITIONAL 20mm RUNOFF VOLUME FROM ROOFTOP AREAS.

LOT	DIMENSIONS (L x W x H) (m)
1	4.0 x 2.4 x 1.0
2	3.5 x 2.2 x 1.0
3	3.5 x 2.2 x 1.0
4	3.5 x 2.2 x 1.0
5	3.5 x 2.2 x 1.0
6	3.5 x 2.2 x 1.0
7	3.5 x 2.0 x 1.0
8	3.5 x 2.0 x 1.0
9	4.0 x 3.0 x 1.0
INFILTRATION TRENCH	195.0 x 1.5 x 1.0

LEGEND

- SANITARY SEWER/MANHOLE
- SANITARY SINGLE HOUSE CONNECTION WITH CLEANOUT
- WATER CONNECTION
- EXISTING SANITARY SEWER
- EXISTING WATERMAIN
- SOAKAWAY PIT / INFILTRATION TRENCH

0 10 20 40 60
Metres

BURNSIDE

Client: **TPC MARLWOOD INC.**

Figure Title: **MARLWOOD (9 LOTS)**

PRELIMINARY UNDERGROUND SERVICING

Drawn	Checked	Date	Figure No.
KAG	EDT	17/09/25	4
Scale		Project No.	
1:750		300039210	

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4.0 Stormwater Management (SWM)

4.1 Design Criteria

This report will demonstrate that the stormwater management design adheres to the Town of Wasaga Beach, NVCA and MOECC design standards and guidelines. In the case of conflicting criteria between agencies, the more conservative design criteria were respected. Specific design criteria are summarized as follows:

- Quantity control shall be provided to maintain post-development flows to pre-development levels for the 2 through 100-year storm design storm events.
- Quality control shall be provided to a minimum 80% removal of total suspended solids (TSS), consistent with Enhanced level treatment per the March 2003 Ontario Ministry of the Environment (MOE) Planning and Design Guidelines.
- A phosphorus loading analysis of pre and post-development conditions with a “best efforts” target of achieving phosphorus balance for the site through SWM facilities and LID measures is required.
- At a minimum, the first 5 mm of rainfall shall be retained on site using Low Impact Development (LID) measures to achieve both water balance and erosion control requirements.
- Pre-development annual infiltration volume targets shall be maintained under post-development conditions using LID measures.
- Provide an erosion and sediment control plan to be employed during construction of the project.

4.2 Existing Conditions

The existing site generally drains east to southeast within the golf course and towards an existing pond on the golf course property.

A local high point exists on Golf Course Road roughly midway along the frontage of the site. From this high point, flows on Golf Course Road generally drain either to low point at the south limit of the site to a drainage easement through the golf course property and to Marl Lake, or to a low point at the north limit of the site, through the golf course and ultimately into Marl Lake.

There is no existing internal stormwater infrastructure on the site or within the Golf Course Road right-of-way along the frontage of the subject site.

4.3 External Drainage

An external drainage area of approximately 11 ha from the west of Golf Course Road currently drains towards the site. Flows that spill over the crown of the road will drain to the low points at the north and south limits of the site.

Under post-development conditions, external flows that spill over the crown of the road will be routed either through the existing drainage easement at the south of the site or to a proposed drainage easement at the north of the site.

4.4 Proposed Conditions

Under post-development conditions, the 9 lots will be served by low impact development (LID) measures such as private rear yard soakaway pits on each lot, as well as an enhanced grassed swale and an infiltration trench located along the rear of the proposed lots, in order to achieve the required stormwater management criteria for the site, including stormwater quantity control, quality control, water balance and erosion control requirements.

4.4.1 Soakaway Pits

Drainage from clean roof areas, assumed to roughly cover 50% of each lot, will be conveyed to private soakaway pits on each lot, sized to infiltrate the first 5 mm of every rainfall event. Given the estimated infiltration values provided by WSP, which were determined through laboratory analysis of borehole samples and not field conducted testing, a conservatively estimated infiltration rate of 15 mm/hr has been used for the functional design of the soakaway pits. Infiltration rates shall be confirmed using in-situ methods at the detailed design phase. The soakaway pits have been sized to drawdown within 19 hours at the conservatively assumed infiltration rate of 15 mm/hr and will accommodate a proposed runoff reduction of approximately 22 m^3. The preliminary dimensions of the soakaway pits for each lot are summarized in Table 1.

Table 2: Infiltration Gallery Functional Design Summary

Lot No.	Assumed Roof Area (m^2)	5 mm Runoff Volume (m^3)	Soakaway Footprint (m^2)	Soakaway Depth (m)
Lot 1	558	2.8	9.7	1.0
Lot 2	450	2.3	7.8	1.0
Lot 3	453	2.3	7.9	1.0
Lot 4	453	2.3	7.9	1.0
Lot 5	453	2.3	7.9	1.0
Lot 6	450	2.3	7.8	1.0
Lot 7	400	2.0	6.9	1.0
Lot 8	400	2.0	6.9	1.0
Lot 9	700	3.5	12.2	1.0

The soakaway pits will be designed to be 1.0 m above the groundwater table. A maximum infiltration depth of 0.72 m was calculated based on the assumed infiltration

rate and required drawdown time (per MECP standards), however, Town of Wasaga Beach standard drawing No. 11 requires a minimum gallery depth of 1.0 m.

Preliminary sizing calculations and details for the soakaway pits are provided in Appendix E.

Note that any marl layers encountered during construction of the soakaway pits shall be excavated (removed). Excavated marl will not be used as fill elsewhere within the development but disposed of off-site.

Groundwater levels reported should not impact the design of the proposed rear yard soakaway pits.

4.4.2 Enhanced Grassed Swale

Overflow from the roof areas (in excess of the 5 mm rainfall), as well as flows from the remainder of each lot will be directed to an enhanced grassed swale. Although the majority of the flows draining to the enhanced grassed swale are considered clean, the swale will provide stormwater quality treatment via the proposed vegetation and filter media as well as additional surface storage under emergency conditions. The proposed swale, graded at 0.25%, is approximately 200 m long with a 2 m wide bottom width, 3:1 side slopes.

4.4.3 Infiltration Trench

Flows entering the enhanced grassed swale will percolate through the proposed filter media and into the infiltration trench, which has been sized to accommodate the 20 mm runoff volume from the rooftop areas. The infiltration trench has been sized to drawdown the 20 mm runoff volume within 19 hours at an assumed infiltration rate of 15 mm/hr and will accommodate a proposed runoff reduction of approximately 86 m^3. The preliminary dimensions of the trench are 200 m long by 1.5 m wide by 1.0 deep.

Similar to the soakaway pit design, the infiltration trench will be designed to be 1.0 m above the groundwater table. A maximum infiltration depth of 0.72 m was calculated based on the assumed infiltration rate and required drawdown time (per MECP standards), however, based on the Town standard drawing No. 11, which requires a minimum gallery depth of 1.0 m for soakaway pits, the minimum infiltration trench depth provided will follow the same protocol.

Preliminary sizing calculations and details are provided in Appendix E.

Note, that any marl layers encountered during construction of the infiltration trench shall be excavated (removed). Excavated marl will not be used as fill elsewhere within the development but disposed of off-site.

Groundwater levels reported should not impact the design of the proposed infiltration trench.

4.4.4 Quantity Control Sensitivity Analysis

As part of good engineering practices, an analysis was completed to confirm the combination of soakaway pits and infiltration trench would provide adequate quantity control up to the 100-year storm event. As such, a Modified Rational Method computation was completed to confirm that the storage volumes proposed within the infiltration trenches would accommodate the required 100-year storm event. Specifically, a rational method calculation was completed to determine existing pre-development peak flows. Intensity-duration-frequency (IDF) rainfall data values were retrieved online using the Ontario Ministry of Transportation (MTO) IDF curve lookup tool. Using the pre-development peak flows as targets, a modified rational method calculation was completed to determine the storage volumes required to control post-development flows to pre-development levels. Results of the analysis indicated that the storage volumes required were less than the infiltrated runoff volumes. Quantity control of post-development flows have therefore been accommodated within the proposed soakaway pits and infiltration trench. Table 2 summarizes the results of the analysis. Refer to Appendix E for detailed calculations.

Table 3: Quantity Control Analysis

<table>
<tr><th>Runoff Volume Analysis</th><th>Required Volume (m^3)</th><th>Modified Rational Method Analysis</th><th>Required Volume (m^3)</th></tr>
<tr><td>Soakaway Pits (Sized to accommodate the 5 mm runoff volume from rooftop areas)</td><td>22</td><td rowspan="3">100-year Storm Volume Required to control Post-Development Flows to Pre-Development Levels</td><td rowspan="3">105</td></tr>
<tr><td>Infiltration Trench (Sized to accommodate the 20 mm runoff volume from rooftop areas)</td><td>86</td></tr>
<tr><td>Total 25 mm Runoff Volume Provided in Soakaway Pits and Infiltration Trench</td><td>108</td></tr>
</table>

4.4.5 Phosphorus Removal

Phosphorus removal will be provided in the proposed soakaway pits, enhanced grassed swale and the infiltration trench. Loading calculations for pre and post-development conditions have been completed using the online NVCA phosphorus loading tool.

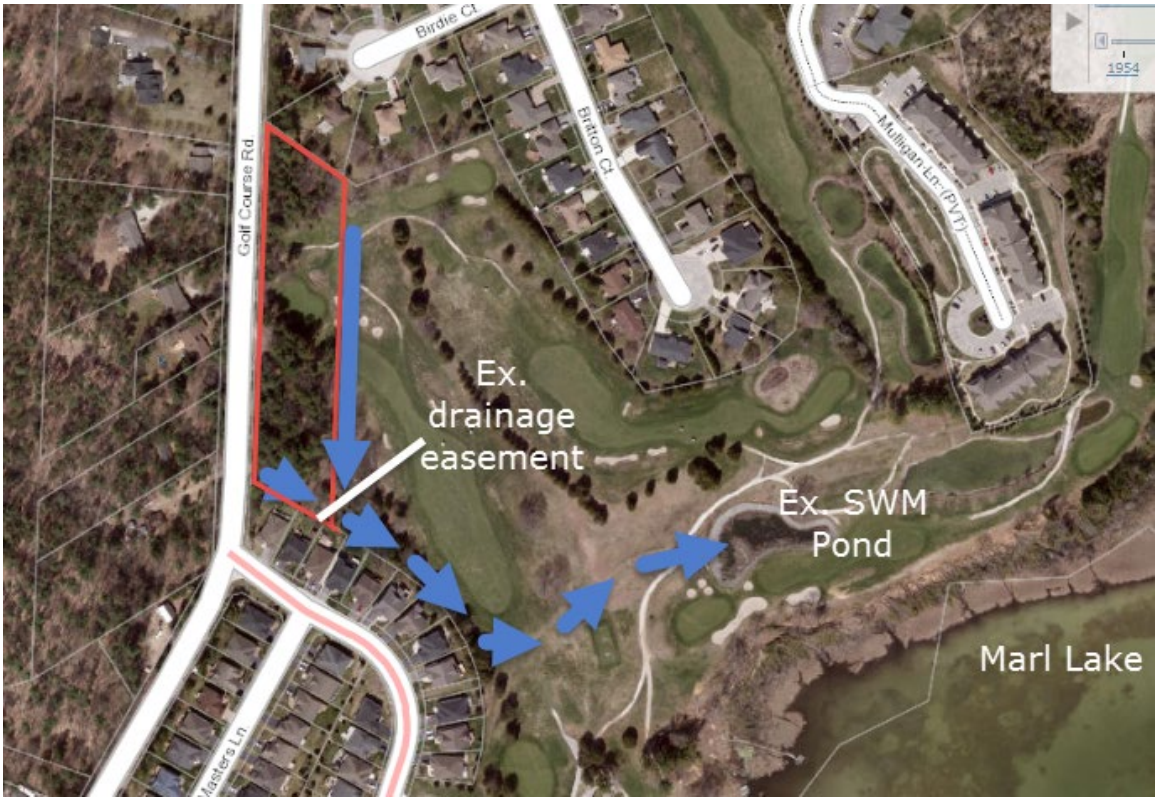
Results indicate no net increase in Phosphorus loading as a result of the proposed measures.

For further details, refer to the water quality calculations in Appendix E.

4.4.6 Overland Flow Route

In the event all flows are not infiltrated in the soakaway pits, infiltration trench or evapotranspirated by the vegetation in the enhanced swale, the swale has been graded to outlet to the existing drainage easement located at the south of the site, which drains to an existing pond within the golf course lands and ultimately to Marl Lake. Image 2 illustrates the overland flow route to Marl Lake. Refer to Figure 5 for details.

Image 2: Overland Flow Route



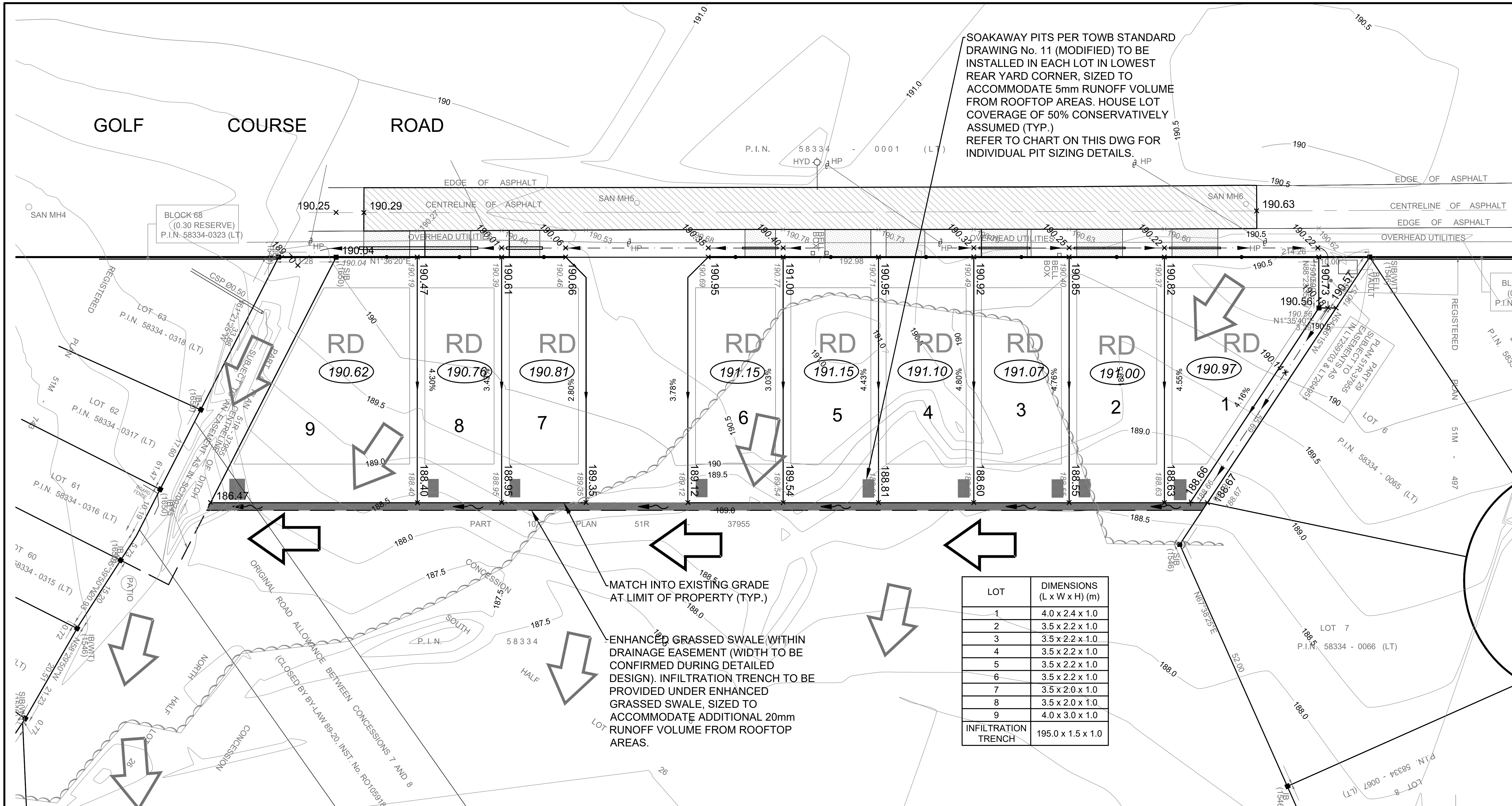
5.0 Site Grading

The proposed development will be graded to ensure that runoff from the development will not adversely affect adjacent private property and will be directed to stormwater management system(s) including LID.

The site grading design will take into consideration the following requirements and constraints:

- Conform to the Town of Wasaga Beach grading criteria.
- Match existing and proposed boundary grading conditions.
- Minimize required earthworks.
- Provide more than minimum cover on proposed servicing.
- Provide a design that is compatible with the proposed grading for the adjacent lands.
- Achieve the stormwater management objectives required for the site.
- Excavated marl will not be used as fill elsewhere within the proposed development but disposed of off-site.

An emergency overland flow route will direct runoff to the golf course drainage system and ultimately spill to Marl Lake. This arrangement conforms to the pre-development drainage patterns on site. See the Preliminary Grading Plan Figure 5.



LOT	DIMENSIONS (L x W x H) (m)
1	4.0 x 2.4 x 1.0
2	3.5 x 2.2 x 1.0
3	3.5 x 2.2 x 1.0
4	3.5 x 2.2 x 1.0
5	3.5 x 2.2 x 1.0
6	3.5 x 2.2 x 1.0
7	3.5 x 2.0 x 1.0
8	3.5 x 2.0 x 1.0
9	4.0 x 3.0 x 1.0
INFILTRATION TRENCH	195.0 x 1.5 x 1.0

LEGEND

Symbol	Description
× 227.20 / 227.20	PROPOSED GRADE WITH EXISTING GRADE
(227.20)	APRON GRADE (MINIMUM 300mm ABOVE EDGE OF PAVEMENT)
(line with arrow)	PROPOSED SWALE
(hatched bar)	MAXIMUM 3:1 SLOPE UNLESS OTHERWISE NOTED
SD	SPLIT DRAINAGE LOT TYPE
(shaded square)	SOAKAWAY PIT / INFILTRATION TRENCH
(open arrow)	EXISTING OVERLAND FLOW ROUTE
(bold arrow)	PROPOSED OVERLAND FLOW ROUTE

0 10 20 40 60
Metres

BURNSIDE

Figure Title
MARLWOOD (9 LOTS)
PRELIMINARY GRADING

Client
TPC MARLWOOD INC.

Drawn	Checked	Date	Figure No.
KAG	EDT	17/09/25	5
Scale		Project No.	
1:750		300039210	

6.0 Erosion and Sediment Control

Given the generally flat topography and the small drainage area, the site is considered to have a low to moderate erosive potential. Effective environmental and sedimentation controls must be in place on a temporary basis both during the construction period, and as permanent features of the completed development of the site.

To ensure stormwater quality control during construction, it is imperative that effective environmental and sedimentation control be in place on a temporary basis throughout the entire area prior to construction activities.

It is recommended that during the construction phase the following practices be implemented and maintained throughout to mitigate the off-site transportation of eroded soils:

- Restoration of exposed surfaces with vegetative and non-vegetative material as soon as construction schedules permit.
- Provision of silt control fences for the duration of construction activities in all areas where surface drainage flows over distributed area and off the site.
- The proposed soakaway pits and enhanced grassed swale and infiltration basin shall be kept offline until the site has been fully vegetated and established.

Prior to the commencement of construction activities, a siltation control fence and or environmental chain link should be installed in strategic locations so as to filter such surface runoff and limit the construction activities out of key natural heritage features. This fencing will delineate areas for construction activities.

All proposed catchbasins and landscape area drains on site shall have the underside of the grates covered with Terrafix 270R non-woven geotextile material and include a sediment containment ring around these inlets during construction period to protect them from filling with sediment. The contractor shall regularly clean the sediment and debris filtered out by these structures. The contractor shall remove and dispose of the geotextile material at the end of the construction period.

Through the implementation of the proposed construction practices discussed above and regular maintenance of these controls, it can be ensured that satisfactory protection of the surrounding areas will occur during the construction stage of the proposed development.

Bi-weekly erosion and sediment control inspection reports are to be completed and forwarded to the Town for their information. Any deficiencies noted within the reports are to be repaired by the contractor within 2 weeks or before any anticipated storm events with greater than 5 mm of precipitation.

The above erosion and sediment control measures shall remain in place until construction and stabilization of the development is complete.

7.0 Conclusion and Recommendations

This report has presented a functional-level analysis and design of site servicing at the proposed site. Further refinement will be performed at the detailed design stage. Functional design for the proposed development can be summarized as follows:

- The development will be serviced by connecting water services to the existing 400 mm watermain on Golf Course Road.
- Sanitary is to be serviced through extensions of service laterals from the existing 250 mm sanitary sewer on Golf Course Road.
- Stormwater will be managed onsite using low impact development (LID) measures including soakaway pits, an enhanced grassed swale and infiltration trench. The proposed LID measures will provide stormwater quantity, quality and erosion control as well as water balance recharge requirements.
- An overland flow route outletting the site will be provided in post-development conditions.
- The site has been appropriately graded in accordance with Town of Wasaga Beach design standards.
- Traditional erosion and sediment control measures will be implemented on site to mitigate the offsite transportation of eroded soils.
- LID measures (soakaway pits, enhanced grassed swale and infiltration trench) will be kept offline until the site is vegetated and established.

BURNSIDE

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Appendix A

Drainage Easement Description

EASEMENT IN GROSS

1. Grant of Easement

The Transferor does hereby grant, convey, and transfer unto the Transferee, its successors and assigns, the right, liberty, privilege, and easement in, over, along, upon, under and through the lands or tract herein described to lay down, construct, operate, maintain, inspect, patrol, alter, remove, replace, reconstruct, or repair or use for municipal works purposes required by the Transferee, including without limitation all such structures, communication systems, equipment and appurtenances whether or not similar to that foregoing as may be necessary, useful or convenient in connection therewith or incidental thereto for the purposes of storm sewer and surface water drainage.

2. Right of Ingress and Egress

Together with the right of ingress and egress to, from, in an over the tract for itself, its servants, agents, contractors, subcontractors, with or without vehicles, machinery and equipment for all purposes, useful or convenient in connection with or incidental to the exercise and enjoyment of the right, privilege, and easement herein granted, conveyed and transferred as and from the date hereof and continuing in perpetuity or until the Transferee shall execute and deliver a surrender thereof.

3. Terms and Conditions

The aforesaid right, liberty, privilege and easement is herein granted, conveyed and transferred on the following terms, stipulations and conditions which are hereby mutually covenanted and agreed to by and between the Transferee and Transferor and such other parties as are designated herein.

(a) Right of Transferor

The Transferor shall have the right fully to use and enjoy the tract including without limitation:

(i) the right to construct such work or works as the Transferor may be obligated to construct pursuant to any agreement or undertaking given to the Transferee;

(ii) the right to repair existing drains and fences, except as may be necessary for any of the purposes hereby granted, conveyed and transferred to the Transferee;

(iii) provided that without the prior written consent of the Transferee the Transferor shall not, after construction of the works, remove or permit to be removed any soil from the Tract nor shall the Transferor excavate, drill, install, erect or permit to be excavated, drilled, installed or erected in, over, upon, under or through the tract, any pit, well, foundation, pavement, building or other structure or other installation;

(iv) notwithstanding the foregoing, the Transferee upon request shall consent to the Transferor erecting new fences, constructing new drains, repairing the existing drains, regrading or landscaping the tract, surfacing or repairing lanes, roads, driveways, pathways and walks across, on and over the tract or any portion or portions thereof, provided that before commencing any of the work referred to herein, the Transferor:

(A) shall give the Transferee 30 days notice of the work to be carried out;
(B) shall exercise a high degree of care in carrying out such work;
(C) shall perform any such work in such a manner as not to endanger or damage any municipal works therein.

(b) Transferee's Rights Not to be Interrupted

The Transferee performing and observing the covenants and conditions on its part to be observed and performed, shall and may peaceably hold and enjoy the right, liberty, privilege and easement herein granted, conveyed, and transferred without hindrance, molestation or interruption on the part of the Transferor or by any person claiming by, through, under or in trust for the Transferor.

(c) Transferor' Title

If it shall appear that at the date hereof the Transferor is not the sole owner of the tract, this Indenture shall nevertheless bind the Transferor to the full extent of his interest therein, and if he shall after acquire a greater or the entire interest, this Indenture shall likewise be extended to such after-acquired interests.

(d) Additional Documents

The Transferor will, if so requested by the Transferee, execute such further and other documents of title and assurances in respect of the tract as may be requisite and such documents shall be prepared at the expense of the Transferee.

(e) Condition of Easement Tract

The Transferee covenants after the performance of any work on the tract, to restore the surface of the tract as far as practicable to the same condition as it was prior to the commencement of any work performed by the Transferee.

(f) Notices

All Notices to be given hereunder may be given by registered letter addressed to:

Transferor at Unit 12, 1140 Sheppard Ave.West, North York, Ontario M3K 2A2
Transferee at 30 Lewis Street,Wasaga Beach, Ontario L9Z 1A1

or such other address as the Transferor and Transferee may respectively from time to time designate in writing, and any such Notice shall be deemed to have been given and received by the addressee three (3) days after the mailing thereof, postage prepaid and registered.

4. Covenants

(a) Running with the Land - The right, liberty, privilege and easement herein granted, conveyed and transferred, and the burden herein set forth, shall be of the same force and effect to all intents and purposes as a covenant running with the tract, and each and every part thereof.

5. Successors and Assigns

This Indenture, including all the covenants and conditions herein contained shall extend to, be binding upon and enure to the benefit of each of the parties hereto, all of the heirs, executors, administrators, successors-in-title, and assigns of the parties hereto respectively and wherever the singular or masculine is used in this Indenture, it shall be construed as if the plural or the feminine or the neuter, as the case may be, had been used, where the context of the Party or Parties hereto so require, and the rest of the sentence shall be construed as if the grammatical and terminological changes thereby rendered necessary had been made.

Properties

PIN 58334 − 0327 LT *Interest/Estate* Fee Simple ☑ Add Easement

Description PT N1/2 LT 26 CON 7 FLOS, PT S1/2 LT 26 CON 8 FLOS, PT ORIG RDAL BTN CON 7 & 8 FLOS (STOPPED UP & CLOSED BY BY−LAW 89−20 AS IN RO1059183), PART 1, PLAN 51R35934; WASAGA BEACH

Address WASAGA BEACH

Consideration

Consideration $2.00

Transferor(s)

The transferor(s) hereby transfers the easement to the transferee(s).

Name MARLWOOD GOLF & COUNTRY CLUB INC.

Address for Service Unit 12, 1140 Sheppard Avenue West
North York, Ontario
M3K 2A2

I, Ralph Canonaco, A.S.O., have the authority to bind the corporation.

This document is not authorized under Power of Attorney by this party.

Transferee(s) *Capacity* *Share*

Name THE CORPORATION OF THE TOWN OF WASAGA BEACH

Address for Service 30 Lewis Street
Wasaga Beach, Ontario
L9Z 1A1

Statements

Schedule: See Schedules

Signed By

Janet Lynne White		150 Hurontario St., PO Box 100 Collingwood L9Y 3Z4	acting for Transferor(s)	Signed	2008 11 19
Tel	7054454930				
Fax	7054451871				
Janet Lynne White		150 Hurontario St., PO Box 100 Collingwood L9Y 3Z4	acting for Transferee(s)	Signed	2008 11 19
Tel	7054454930				
Fax	7054451871				

Submitted By

BAULKE AUGAITIS STAHR LLP	150 Hurontario St., PO Box 100 Collingwood L9Y 3Z4		2008 12 15
Tel 7054454930			
Fax 7054451871			

Fees/Taxes/Payment

Statutory Registration Fee	$60.00
Provincial Land Transfer Tax	$0.00
Total Paid	$60.00

LAND TRANSFER TAX STATEMENTS

In the matter of the conveyance of: 58334 − 0327 PT N1/2 LT 26 CON 7 FLOS, PT S1/2 LT 26 CON 8 FLOS, PT ORIG RDAL BTN CON 7 & 8 FLOS (STOPPED UP & CLOSED BY BY−LAW 89−20 AS IN RO1059183), PART 1, PLAN 51R35934; WASAGA BEACH

BY: MARLWOOD GOLF & COUNTRY CLUB INC.

TO: THE CORPORATION OF THE TOWN OF WASAGA BEACH

1. GEORGE VADENBONCOEUR

I am

- ☐ (a) A person in trust for whom the land conveyed in the above−described conveyance is being conveyed;
- ☐ (b) A trustee named in the above−described conveyance to whom the land is being conveyed;
- ☐ (c) A transferee named in the above−described conveyance;
- ☑ (d) The authorized agent or solicitor acting in this transaction for THE CORPORATION OF THE TOWN OF WASAGA BEACH described in paragraph(s) (c) above.
- ☐ (e) The President, Vice−President, Manager, Secretary, Director, or Treasurer authorized to act for _____ described in paragraph(s) (_) above.
- ☐ (f) A transferee described in paragraph() and am making these statements on my own behalf and on behalf of _____who is my spouse described in paragraph(_) and as such, I have personal knowledge of the facts herein deposed to.

3. **The total consideration for this transaction is allocated as follows:**

(a) Monies paid or to be paid in cash	2.00
(b) Mortgages (i) assumed (show principal and interest to be credited against purchase price)	0.00
(ii) Given Back to Vendor	0.00
(c) Property transferred in exchange (detail below)	0.00
(d) Fair market value of the land(s)	0.00
(e) Liens, legacies, annuities and maintenance charges to which transfer is subject	0.00
(f) Other valuable consideration subject to land transfer tax (detail below)	0.00
(g) Value of land, building, fixtures and goodwill subject to land transfer tax (total of (a) to (f))	2.00
(h) VALUE OF ALL CHATTELS −items of tangible personal property	0.00
(i) Other considerations for transaction not included in (g) or (h) above	0.00
(j) Total consideration	2.00

4.

Explanation for nominal considerations:

o) Transfer of easement or right of way for no consideration.

5. The land is subject to encumbrance

PROPERTY Information Record

A. Nature of Instrument: Transfer Easement

LRO 51 Registration No. SC700245 Date: 2008/11/19

B. Property(s): PIN 58334 − 0327 Address WASAGA BEACH Assessment Roll No −

C. Address for Service: 30 Lewis Street
Wasaga Beach, Ontario
L9Z 1A1

D. (i) Last Conveyance(s): PIN 58334 − 0327 Registration No. SC621858

(ii) Legal Description for Property Conveyed: Same as in last conveyance? Yes ☐ No ☑ Not known ☐

E. Tax Statements Prepared By: Janet Lynne White
150 Hurontario St., PO Box 100
Collingwood L9Y 3Z4

BURNSIDE

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Appendix B

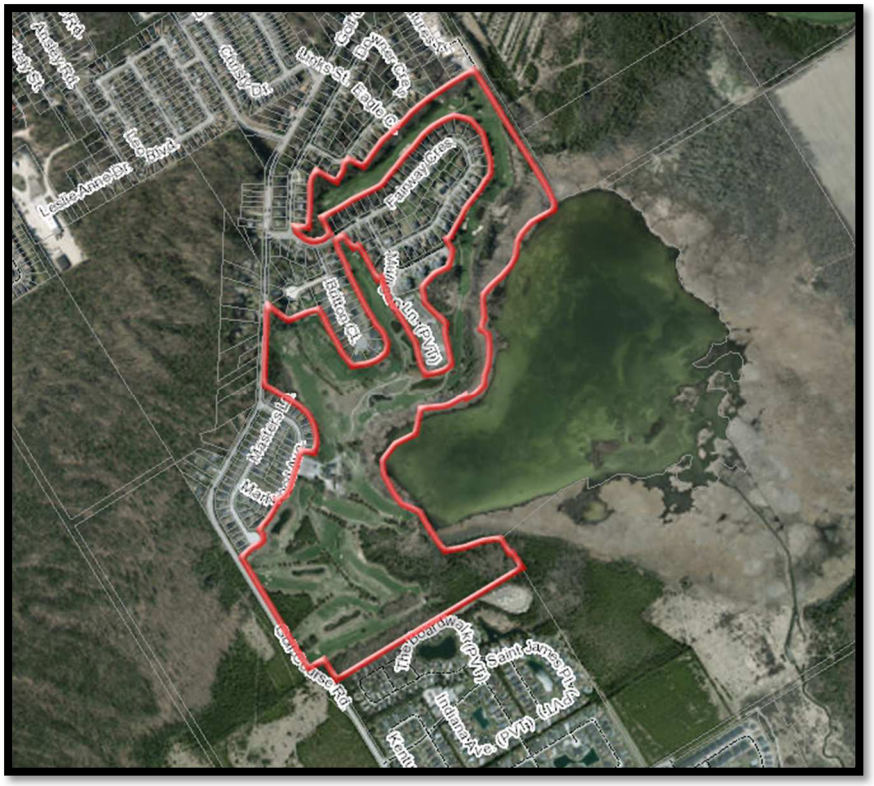
Geotechnical and Water Balance Reports

MARLWOOD GOLF & COUNTRY CLUB

31 MARLWOOD AVENUE, WASAGA BEACH, ONTARIO

PRELIMINARY GEOTECHNICAL INVESTIGATION

JANUARY 07, 2020



wsp

31 MARLWOOD AVENUE, WASAGA BEACH, ONTARIO

PRELIMINARY GEOTECHNICAL INVESTIGATION

MARLWOOD GOLF & COUNTRY CLUB

PRELIMINARY REPORT

PROJECT NO.: 151-62944-00

DATE: JANUARY 07, 2020

WSP
UNITS C AND D
561 BRYNE DRIVE
BARRIE, ON, CANADA L4N 9Y3

T: +1 705 735-9771
F: +1 705 735-6450
WSP.COM

January 07, 2020

Marlwood Golf & Country Club
c/o R.J. Burnside and Associates Limited
3 Ronnell Cresecent
Collingwood, ON
L9Y 4J6

Attention: Marlwood Golf & Country Club

Dear Mr. E. Tjeerdsma,

Subject: 31 Marlwood Avenue, Wasaga Beach, Ontario - Preliminary Geotechnical Investigation

WSP Canada Inc. was retained to update the Preliminary Geotechnical Investigation at the above noted site. The purpose of the preliminary investigation is to identify the subsurface conditions at the borehole locations and to provide design recommendations toward the design of the proposed development, as well as identify any potential geotechnical related constraints which may be encountered during construction.

Kind regards,

Kent Malcolm, P.Eng.
Senior Geotechnical Engineer

Gord Jarvis
Team Lead, Environment

MKM/ham

WSP ref.: 151-62944-00

Units C and D
561 Bryne Drive
Barrie, ON, Canada L4N 9Y3

T: +1 705 735-9771
F: +1 705 735-6450
wsp.com

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ENCLOSURES 1 – 12: BOREHOLE LOGS
ENCLOSURES 13: LABORATORY RESULTS

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1 INTRODUCTION

SPL Consultants Limited now operating as **WSP Canada Inc. (WSP),** was retained by R.J. Burnside and Associates Limited on behalf of the Marlwood Golf & Country Club to provide an update to the Preliminary Geotechnical Investigation for the proposed residential development of Marlwood Golf & Country Club located at 31 Marlwood Avenue, in Wasaga Beach, Ontario.

The scope of this preliminary investigation update was to obtain information about the subsurface conditions through the advancement of twelve (12) boreholes and based upon the findings of the boreholes ultimately provide recommendations herein pertaining to the following:

- General soil conditions;
- Soil parameters for excavations for grading, utilities, subdivision roads;
- Excavation and backfill;
- Groundwater levels and preliminary comments for a EASR or PTTW;
- Soil bearing capacity; and,
- Site seismic classification.

This report deals with geotechnical issues only.

This report is provided based on the terms of reference presented above and, on the assumption, that the design will be in accordance with the applicable codes and standards. If there are any changes in the design features relevant to the geotechnical analyses, or if any questions arise concerning the geotechnical aspects of the codes and standards, this office should be contacted to review the design.

The site investigation and recommendations follow generally accepted practice for Geotechnical Consultants in Ontario. The format and contents are guided by client specific needs and economics and do not conform to generalized standards for services. Laboratory testing follows ASTM or CSA Standards or modifications of these standards that have become standard practice.

This report has been prepared for R.J. Burnside and Associates Limited on behalf of Marlwood Golf & Country Club. Third party use of this report without WSP consent is prohibited.

2 SITE BACKGROUND AND PROJECT DESCRIPTION

The subject property (site) is identified by civic address 31 Marlwood Avenue in the Town of Wasaga Beach. The site is situated on a relatively flat to gently sloping terrain, and abuts Golf Course Road, Marlwood Avenue and Masters Lane on the west side, Birdie Court, Britton Court, Mulligan Lane on the north side. The residential development of Park Place is located along the south boundary and Marl Lake is located along the east boundary. The property currently occupies Marlwood Golf and Country Club.

It is understood that the proposed development will consist of single-family residential dwellings and will include internal roads and associated municipal sewers and water supply. Although the previously proposed new clubhouse is not depicted on the updated plans, we currently understand that the construction of a Storm Water Management Pond (SWMP) and Pumping Station are now being considered, within Blocks 52 and 54, respectively. The layout plan of the proposed development as shown on the R.J. Burnside preliminary drawings are provided in ***Appendix A***. Neither detailed drawings nor Plan and Profile drawings have not been prepared yet, as such, the proposed footing founding elevations of the proposed construction and the invert of the site services is not known to us at the time of writing this report.

3 INVESTIGATION METHODOLOGY

The field investigation consisted of drilling twelve (12) boreholes (BH15-01 to BH15-12), at the site between September 3 and 9, 2015. The locations of each site are shown on the attached ***Borehole Location Plan – Figure 1.***

The boreholes were advanced to depths ranging from 5.2 metres below site grades (mbgs) to 8.2 mbgs. The boreholes were drilled with hollow stem continuous flight auger equipment.

Drilling equipment was supplied and operated by a drilling sub-contractor under the direction and supervision of WSP personnel. Samples were retrieved at regular intervals with a 50 mm O.D. split-barrel sampler driven with a hammer in accordance with the Standard Penetration Test (ASTM D 1586) method. This sampling method recovers samples from the soil strata, and the number of blows required to drive the sampler a 0.3 m depth into the undisturbed soil (SPT 'N' values) gives an indication of the compactness condition or consistency of the sampled soil material. The SPT 'N' values are indicated on the ***Borehole Logs - Enclosures 1-12***.

Soil samples were visually classified in the field and re-evaluated by a senior engineer in our laboratory. All soil samples were tested for moisture contents. Laboratory Grain Size Analyses were carried out on representative samples and the results are provided in ***Laboratory Results - Enclosures 13.***

Water level observations were made during the drilling and in the open boreholes upon the completion of drilling operations. Monitoring wells (50mm diameter) were installed at five (5) borehole locations; WSP returned to the site after the drilling operations to obtain groundwater levels at the site.

Selected soil samples were subjected to chemical analysis to assess the environmental quality of the soils to assist in determining off-site disposal options. Chemical testing results are presented in ***Appendix C.***

4 SITE AND SUBSURFACE CONDITIONS

Details of the subsurface conditions encountered are presented on the Borehole Logs ***(Enclosures 1-12)*** and summarized in the following sections. It is noted that subsurface conditions can change between boreholes and the details provided below refer to soil conditions that were encountered at the borehole locations only.

4.1 GENERAL SUBSURFACE CONDITIONS

Based on the results of the field investigation, the subsurface conditions at the borehole locations generally comprised a surficial layer of topsoil. The surficial cover was underlain by both native cohesive and non-cohesive deposits, which extended beyond the final depth investigated. Some of the non-cohesive deposits appeared to be reworked and as such are considered to be Disturbed Soils.

4.1.1 SURFICIAL COVER

Topsoil was encountered surficially in each of the boreholes; while Disturbed Soils were encountered below the topsoil at BH15-01, BH15-05 and BH15-07. The Disturbed Soils comprised silty sand with trace organic matter and roots. A summary of the thicknesses at each of the borehole locations is summarized below.

It should be noted that topsoil/Disturbed Soil quantities should not be calculated from the borehole information, as large variations in depth may exist between boreholes. A detailed topsoil/Disturbed Soils layer thickness survey is required to determine an accurate evaluation of quantity.

BOREHOLE	MATERIAL TYPE	DEPTH (cm)	MATERIAL THICKNESS (cm)
15-01	Topsoil	23	23
	Disturbed Soil	23-80	57
15-02	Topsoil	18	18
15-03	Topsoil	13	13
15-04	Topsoil	13	13
15-05	Topsoil	10	10
	Disturbed Soil	10-80	70
15-06	Topsoil	15	15
15-07	Topsoil	15	15
	Disturbed Soil	15-60	45
15-08	Topsoil	15	15
15-09	Topsoil	13	13
15-10	Topsoil	5	5
15-11	Topsoil	18	18
15-12	Topsoil	20	20

4.1.2 COHESIVE SOIL

A cohesive deposit of clayey silt resembling Marl was encountered in boreholes BH15-02, BH15-04 and BH15-06 to BH15-12, at varying depths but generally underlying the topsoil and/or Disturbed Soils. The clayey silt, Marl, included some sand to sandy, trace organic matter and occasional shell fragments. The Marl was beige in colour, moist and extended to depths ranged between 0.3 meters below existing ground surface (mbgs) to 2.3 mbgs.

Standard Penetration Tests performed in the Marl deposit yielded 'N'-values generally ranging from 5 to 16 blows per 0.3 m penetration indicating a soft to firm condition. The measured natural moisture content of the samples from these materials ranges from 8% to 41%, indicating moist to saturated condition.

It should be noted that the Marl deposit encountered throughout the site is not considered suitable for supporting structures such as buildings and roads. These deposits should be completely removed in areas where such structures are proposed.

A grain size analyses of one sample of the cohesive deposit acquired from BH15-04/SS4 was completed and the gradation curve is presented in ***Enclosure 13***. A review of the grain size analysis indicates the following ranges of clay, silt, sand and gravel percentages:

- Gravel: 0%
- Sand: 20%
- Silt: 52%
- Clay: 28%

4.1.3 NON-COHESIVE SOIL

A non-cohesive deposit comprised of sand to silty sand and sand and gravel was encountered in each of the boreholes underlying the surface cover and cohesive Marl deposits. Marl seams or pockets within the non-cohesive deposit between 3 cm and 10 cm in thickness were encountered in BH15-05, BH15-06 and BH15-09, as deep as 3.1 mbgs.

Standard Penetration Tests performed of the non-cohesive deposits comprised predominantly of sand yielded 'N'-values generally ranging from 2 to 100 blows per 0.3 m penetration indicating a very loose to very dense condition. More importantly, very loose to loose conditions were encountered within the non-cohesive sand deposits at the depths tabulated below.

BOREHOLE	MATERIAL TYPE	N VALUES	DEPTH (cm)	MATERIAL THICKNESS (cm)
15-03	Sand	7 - 8	10 - 150	140
15-05	Sand some clayey silt layers	2 - 4	80 - 350	270
15-06	Sand some clayey pockets	5	310 - 390	80
15-07	Sand some gravel	4	460 - 540	90
15-08	Sand	4	20 - 80	60
15-09	Sand	5	10 - 80	70
15-10	Sand some silt trace clay	5	300 - 380	80
15-11	Sand some silt trace gravel	2 - 6	230 - >520	>290

The measured natural moisture content of the predominant sand samples ranged from 2% to 27%, indicating moist to saturated condition.

Grain size analyses of samples of the non-cohesive deposits predominantly of sand were acquired from BH15-07/SS6 and BH15-09/SS5 were completed and the gradation curves are presented in ***Enclosure 13***. A review of the grain size analyses indicates the following ranges of clay, silt, sand and gravel percentages:

- Gravel: 0%
- Sand: 95% to 96%
- Silt: 2% to 5%
- Clay: 0% to 2%

Standard Penetration Tests performed of the non-cohesive deposits predominantly comprised of sand and gravel at BH15-01, BH15-02, BH15-04, BH15-05 and BH15-12, yielded 'N'-values generally ranging from 20 to 88 blows per 0.3 m penetration indicating a compact to very dense condition. The measured natural moisture content of the samples from these materials ranged from 1% to 18%, indicating moist to saturated condition.

Grain size analyse of a sample of the non-cohesive deposits predominantly of sand and gravel were acquired from BH15-02/SS5 was completed and the gradation curve is presented in ***Enclosure 13***. A review of the grain size analyses indicates the following ranges of clay, silt, sand and gravel percentages:

- Gravel: 45%
- Sand: 48%
- Silt: 5%
- Clay: 2%

4.2 GROUNDWATER

During drilling and at the completion of drilling, groundwater and/or wet soil conditions were found in all boreholes at various depths as indicated in the individual borehole logs (***Enclosures 1-12***).

The water levels observed in the monitoring wells installed at borehole locations BH 15-01, BH 15-05, BH 15-07, BH 15-09 and BH 15-12 between September 3rd and August 23rd, 2016 were recorded at depths ranging between 0.99 m (BH15-05) and 4.91 m (BH15-09) below the existing ground surface and as high as an approximate elevation of 186.63 m (BH15-01) on March 31, 2016.

A summary of the groundwater conditions encountered at the site are summarized in the tables below.

BOREHOLE	DATE	GROUNDWATER DEPTH (MBGS)	MEASUREMENT SOURCE
15-01	September 9, 2015	~3.1	Open Borehole
15-02	September 9, 2015	~2.2	Open Borehole
15-03	September 8, 2015	~3.1	Open Borehole
15-04	September 8, 2015	~2.5	Open Borehole
15-05	September 8, 2015	~1.4	Open Borehole
15-06	September 4, 2015	~2.0	Open Borehole
15-07	September 4, 2015	~3.2	Open Borehole
15-08	September 3, 2015	~4.0	Open Borehole

BOREHOLE	DATE	GROUNDWATER DEPTH (MBGS)	MEASUREMENT SOURCE
15-09	September 3, 2015	~4.8	Open Borehole
15-10	September 3, 2015	~2.4	Open Borehole
15-11	September 4, 2015	~1.7	Open Borehole
15-12	September 9, 2015	~2.1	Open Borehole

BOREHOLE:	BH15-01		BH15-05		BH15-07		BH15-09		BH15-12	
GROUND ELEVATION (masl)	~189		~187		~187		~190		~188	
	Groundwater Level Measurements									
DATE	mbgs	masl	mbgs	masl	mbgs	masl	mbgs	masl	mbgs	masl
Oct. 14, 2015	3.13	185.87	1.48	185.52	3.22	183.78	4.87	185.13	2.20	185.80
Dec. 31, 2015	3.07	185.93	1.35	185.65	3.19	183.81	4.91	185.09	2.12	185.88
Jan. 28, 2016	3.01	185.99	1.34	185.66	3.16	183.84	4.91	185.09	2.06	185.94
Feb. 29, 2016	2.96	186.04	1.28	185.72	3.12	183.88	4.88	185.12	2.02	185.98
Mar. 31, 2016	2.37	**186.63**	**0.99**	186.01	2.77	184.23	4.54	185.46	1.44	185.56
Apr. 30, 2016	2.51	186.49	1.15	185.85	3.17	183.83	4.38	185.62	1.56	185.44
May 31, 2016	2.70	186.30	1.25	185.75	3.27	183.73	4.44	185.56	1.74	185.26
Jun. 10, 2016	2.75	186.25	1.24	185.76	3.09	183.91	4.48	185.52	1.80	185.20
Jun. 30, 2016	2.85	186.15	1.33	185.67	3.11	183.89	4.50	185.50	1.91	185.09
Jul. 31, 2016	2.95	186.05	1.44	185.56	3.14	183.86	4.56	185.44	2.04	185.96
Aug. 23, 2016	3.02	185.98	1.42	185.58	3.13	183.87	4.62	185.38	2.11	185.89

It should be noted that the groundwater levels can vary and are subject to seasonal fluctuations in response to major weather events.

5 DISCUSSIONS/RECOMMENDATIONS

5.1 GENERAL

The following recommendations for the proposed site development are based on the information obtained from the borehole investigation and laboratory testing, which we believe fairly represents the subsurface conditions of the site. These recommendations are intended for the guidance of the design engineer to establish constructability and should not be construed as instructions to contractors. If significant differences in the subsurface conditions described above are found, we request to be contacted immediately to review and revise our findings and recommendations, if necessary.

The construction methods described in this report must not be considered as being specifications or recommendations to the prospective contractors, or as being the only suitable methods. Prospective contractors should evaluate all the information, obtain additional subsurface information as they might deem necessary and should select their construction methods, sequencing and equipment based on their own experience in similar ground conditions. The readers of this report are also reminded that the conditions are known only at the borehole locations and in view of the generally wide spacing of the boreholes, conditions may vary significantly between boreholes.

5.2 SITE BACKGROUND

The subject property is situated on a relatively flat to gently sloping terrain, and abuts Golf Course Road, Marlwood Avenue and Masters Lane on the west side, Birdie Court, Britton Court, Mulligan Lane on the north side. The residential development of Park Place is located along the south boundary and Marl Lake is located along the east boundary. The property currently occupies Marlwood Golf and Country Club.

Based on the results of the field investigation, the subsurface conditions at the borehole locations generally comprised a surficial layer of topsoil and Disturbed Soils. The surface cover was underlain by native cohesive and non-cohesive deposits of clayey silt, Marl, sand to silty sand and sand and gravel. Sandy soils predominate the site and are encountered in all boreholes. Marl was encountered in boreholes BH15-02, BH15-04 and BH15-06 to BH15-12 and extended to depths ranged between 0.3 mbgs to 2.3 mbgs surface.

Groundwater levels varied across the site and measured as high as 1.4 mbgs.

It is understood that the proposed development will consist of single-family residential dwellings and will include internal roads, associated municipal sewers and water supply. Although the previously proposed new clubhouse is not included in the updated Preliminary drawings, we understand that the construction of a SWMP and Pumping Station is being considered within Blocks 52 and 54, respectively. The layout plan of the proposed development as shown on the R.J. Burnside preliminary drawings are provided in ***Appendix A***. Neither detailed drawings nor Plan and Profile drawings have not been prepared yet, as such, the proposed footing founding elevations of the proposed construction and the invert of the site services is not known to us at the time of writing this report.

5.3 SITE PREPARATION AND GRADING

Removal of all topsoil, Disturbed Soils and/or Marl as well as any fill materials in both cut and fill areas will be required to facilitate future development of the site. To avoid settlement of the proposed structures, the Disturbed Soils and Marl deposits must be completely removed.

The thicknesses and extents of unsuitable soil should be further refined across the site, it is therefore recommended that a test pit program be completed at the site by WSP prior to construction. Regarding the reuse of the site topsoil

and fill, these materials may be reused in landscaping applications or other non-structural fill applications. WSP should be contacted to review all proposed topsoil and fill reuse on site.

Any fill required for re-grading the site or backfill should be select, clean material, free of topsoil, organic or other foreign and unsuitable matter. It should be noted that some of the excavated native materials will be wet and must be aerated and left to dry out before they can be used as backfill. Non-structural fill should be placed in thin layers and compacted to at least 95% of its SPMDD. The degree of compaction should be increased to 98% within the top 1.0 m of the subgrade, or as per Town Standards. The compaction of the new fill should be checked by frequent field density tests.

It is unknown if engineered fill will be required at the site to facilitate grading. If fill thicknesses greater than 1 m are required at the site, WSP should be contacted to provide input toward potential long-term consolidation of the cohesive deposits.

After the completion of the required stripping and removal of all unsuitable materials, the sub-grade should be proof-rolled and inspected by experienced WSP geotechnical engineering personnel. The proof-rolling and compaction of the exposed sub-grade is recommended to be conducted using a vibratory compactor with a minimum static weight of 10 tonnes. The proof-rolling program should consist of a minimum of six (6) passes per unit area and be tested to assure that the sub-grade is compacted to a minimum of 98% of the exposed material's Standard Proctor Maximum Dry Density (SPMDD). Any loose/soft or wet areas identified at the time of proof-rolling that cannot be uniformly compacted are recommended to be sub-excavated and backfilled with approved engineered fill consistent with the recommendations provided in ***Appendix B***.

Where engineered fill is required to develop the design grades and elevations or for use in backfilling excavations created through the removal of unsuitable materials or soils as described above, the excavated on-site materials may be re-used, subject that these are free of organic and other unsuitable materials and have appropriate moisture content. Boulders or cobbles greater than 200 mm in size should be removed from the fill prior to or during placement.

Alternatively, Ontario Provincial Standard Specification (OPSS) Granular B – Type I, OPSS Select Subgrade Material (SSM) or approved equal may be used.

All fill materials imported to the site must meet all applicable municipal, provincial and federal guidelines and requirements associated with environmental characterization of the materials.

Engineered fill is to be placed in maximum 200 mm thick loose lifts under full time supervision of qualified geotechnical personnel. Each lift is to be uniformly compacted to achieve a minimum of 100% of the material's SPMDD. Additional information related to the placement and compaction of engineered fill can be found in ***Appendix B***.

5.4 TEMPORARY EXCAVATIONS AND GROUNDWATER CONTROL

The details for the proposed services installations are not available at the time of preparing this report. The recommendations provided below assume that conventional depths for services will be carried out (approximately 3 m to 5 m below existing site grades).

Based upon the subsurface conditions at the borehole locations, excavations can be carried out with heavy hydraulic back-hoes. It is recommended that provision be carried in the contract for the excavation and disposal of obstructions on site, including cobbles and boulders.

All temporary excavations must be carried out in accordance with the Occupational Health and Safety Act (OHSA). In accordance with OHSA, the soils (assuming they are above the groundwater table or properly dewatered) would be classified as a Type 3 soil. Below the groundwater level the soil would be classified as a Type 4 soil. If space limitations exist due to adjacent structures or facilities, consideration could be given to the construction of a

temporary support system to provide protection to the structures and/or facilities. All excavated spoil should be placed at least the depth of the trench away from the edge of the trench for safety reasons.

As noted above, at the time of investigation, the groundwater levels were encountered between 1.4 mbgs and 4.9 mbgs below the existing grades. Dewatering will be required for any excavation in the sand to silty sand, or sand and gravel deposits below the water table. Where the anticipated trench base is below the groundwater level, positive dewatering such as well points/eductors will be required to lower the water table to at least 1.0 m below the excavation base. Otherwise, it will result in an unstable base and flowing sides.

As such, depending on site grading requirements and excavation depths there is a strong likelihood that dewatering will be required at the Site and an Environmental Activity and Sector Registry (EASR) or a Permit to Take Water (PTTW) will be required for the excavations for general servicing and deep replacement of unsuitable soil / fill. It should be noted that the requirements for a PTTW, issued by the Ontario Ministry of the Environment and Climate Change (MOECC) have recently changed; daily water takings of 50 m^3/day require registration of the MOECC EASR database, and daily water takings of 400 m^3/day require a PTTW. Both the EASR and the PTTW require a hydrogeological assessment report to support the specific application. In addition, a permit to discharge the collected water to the sewer system/water body will be required from the applicable agency.

In the planning of the excavation and shoring of trenches, the presence of any adjacent existing buried service pipes should be considered. In addition to the stability of any existing adjacent pipes, which must be maintained without detrimental settlements; the backfill in these trenches and especially the granular bedding surrounding the existing service pipes, manholes, etc. may be a source of water, which, if encountered, must be dealt with.

In the sand to silty sand deposits where the soil exhibits dilatancy during construction and due to the high groundwater levels encountered, the soils may have to be stabilized. Any form of soil stabilization and/or dewatering to facilitate construction (e.g. well points, etc.) must be designed and performed being cognizant of the fact that dewatering may induce settlements of existing structures in the vicinity, including existing service pipes. Although unlikely, basal instability could possibly occur if a relatively coarser stratum (such as silty sand with gravel) under excess hydrostatic pressure occurs below the base of an excavation comprised of relatively impervious soils (e.g. sandy silt/clayey silt/silty clay). Should this occur, these layers must be depressurized. For this reason, the bases of the excavated trenches should be monitored for evidence of basal heave.

For all these reasons, it would be prudent to open the trenches in relatively short sections and carry out the laying of the pipe and backfilling expeditiously in order to reduce the length of time the trench would be open. It is further recommended that the excavations for service trenches below the groundwater table be carried out in short sections using a suitable ‘geofabric’ below the bedding (fine migration prevention) and backfilling the trench section immediately after service placement.

We provide the following soil parameters to determine the earth pressure acting on the sheeting and bracing.

γ = Unit weight of soil above groundwater table, assuming 20 kN/m^3;

γ_1 = Submerged unit weight of soil below water table, assuming 10 kN/m^3;

A determination of the actual lateral earth pressure can be provided, if required, after design has been finalized.

5.5 PIPE BEDDING AND COVER

The native soils above the groundwater level, or properly dewatered if encountered below the groundwater level, will provide adequate support for the sewer pipes and allow the use of normal Class B type bedding. The recommended minimum thickness of granular bedding below the invert of the pipes is 150 mm. The thickness of the bedding may, however, be increased depending on the pipe diameter or in accordance with local standards or if wet or weak subgrade conditions are encountered, especially when the soil at the trench base level consists of wet, dilatant silt. The bedding material should consist of well graded granular material such as Granular ‘A’ or equivalent. After installing the pipe on the bedding, a granular surround of approved bedding material, which extends at least 300 mm above the obvert of the pipe, or as set out by the local authority or municipality, should be

placed. It is recommended that WSP be on site during excavations to assess the suitability of the subgrade materials to support the pipes.

If localized wet trench conditions are encountered, a uniformly graded clear stone may be used provided a suitable, approved filter fabric (geotextile) is placed in conjunction with the clear stone. The geotextile must extend underneath the clear stone, along the sides of the trench, and wrapped on top of the clear stone such that **the clear stone is fully wrapped by the geotextile.** A minimum geotextile overlap of 1 m is required; alternatively stitching of the geotextile could be considered.

Alternatively, localized, wet and unstable soils encountered within generally stable soil zones can be commonly stabilized by 'punching' a 50 mm well graded crusher run limestone pad into the soft subgrade prior to bedding placement. The thickness of the 'pad' will depend on field conditions and should be examined by WSP personnel during the construction operations.

In areas where the soils become wet, unstable and dilatant (easily disturbed) such as saturated silts, careful construction techniques and dewatering should be followed, as discussed earlier. If the pipes are laid on disturbed, dilatant soil, significant post-construction settlements could occur after the trenches are backfilled. In such cases, the bottom of the trenches will have to be stabilized by dewatering.

Sewer pipe bedding recommended for wet, unstable soils is a Class 'A' bedding. The rigid concrete bedding (lean mix) should be laid from manhole to manhole and this concrete 'pad' may sit directly on disturbed native subgrade. In isolated situations, where exposed subgrade tends to be wet and unstable, the concrete 'pad' should be poured on a HL-6 stone layer. It is recommended that the HL-6 bed be encircled with an approved filter fabric to prevent the migration of fines.

Where the sewer pipe is placed in water bearing soils below the water table, the joints connecting the sewer sections should be very well sealed to prevent piping of fines into the sewer pipe and manhole catch basin risers.

5.6 TRENCH BACKFILL

Approved excavated soils can be used as construction backfill provided their moisture content at the time of placement is within 2% of the optimum moisture content and that the soils do not contain organic content. Some moisture conditioning may be required is excess pore air and pore water pressures are generated during compaction process. If bulking is noted, delaying the placement of subsequent lifts may be necessary, to allow for the dissipation of such induced excess pressures. Boulders or cobbles greater than 200 mm in size should be removed from the trench backfill. WSP should be on site during all trench backfilling operations to confirm the suitability of the material being used.

For the granular soils, smooth drum type vibratory rollers are recommended. Cohesive soils, if encountered, should be compacted with sheepsfoot type vibratory compactors. The trench backfill should be placed in maximum 0.3 m lift thickness and compacted to at least 98 percent of its SPMDD. Trench backfilling operations should be avoided during freezing weather.

It is preferable that the native soils be re-used from approximately the position at which they are excavated so that frost response characteristics of the soils after construction remain essentially similar. If required, consideration may also be given to backfilling trenches with a well graded, compacted granular soil such as Granular 'B' material or Select Subgrade Material. The use of such material, if thoroughly compacted, would reduce the post construction settlements to a negligible amount and may also expedite the compaction process. In this instance, however, frost response characteristics of non-frost susceptible granular fill and the frost susceptible indigenous soils would be different giving rise to differential frost heave. In this case, it would be prudent to use as backfill the on-site excavated naturally occurring soils to match the existing conditions within the frost zone (i.e. within about 1.5 m below the road surface elevation) as well as to provide a frost taper zone (i.e. to provide a zone of taper to prevent a sudden change in frost heave characteristics to reduce the effects of frost heave).

It should be noted that the excavated soils are subject to moisture content increase during wet weather which would make these materials too wet for adequate compaction. Stockpiles should therefore be compacted at the surface or be covered with tarpaulins to help minimize moisture uptake.

The degree of compaction of the trench backfill under the roads or other areas where future settlements would be of concern should be at least 98% Standard Proctor Maximum Dry Density (SPMDD) within 2 m of the road surface. The granular pavement sub-base and base materials should be compacted to at least 100% of their respective SPMDD.

5.7 PAVEMENT DESIGN

The investigation has shown that the predominant subgrade soils encountered at the site, after stripping any topsoil, Disturbed Soils, Marl, organic matter or otherwise unsuitable soil will be non-cohesive deposits, or possibly newly compacted fill.

Prior to the placement of granular materials as part of the pavement structure, the subgrade should be prepared and heavily proof-rolled under the supervision of WSP. Any poorly performing areas should be sub-excavated and replaced with either granular earth fill approved by WSP or imported Granular B, Type I material conforming to the requirements of OPSS.

Based on the above and if traffic usage will be residential minor local, the following minimum pavement thickness is recommended:

PAVEMENT LAYER	COMPACTION REQUIREMENTS	LOCAL ROADS	COLLECTOR ROADS
Asphaltic Concrete	92.0 to 96.5% Maximum Relative Density (MRD)	40 mm HL 3 or	50 mm HL 3
		50 mm HL 8	90 mm HL 8
OPSS Granular A Base	100% SPMDD	200 mm	200 mm
OPSS Granular B	100% SPMDD	300 mm	400 mm

We note that the pavement design noted above should be considered preliminary only. If required, a more refined pavement structure design can be performed based on specific traffic data and design life requirements and will involve specific laboratory tests to determine frost susceptibility and strength characteristics of the subgrade soils, as well as specific data input from the client.

The site subgrade and weather conditions (i.e. if wet) at the time of construction may necessitate the placement of geogrid/filter fabric and/or thicker granular sub-base layer in order to facilitate the construction. Furthermore, heavy construction equipment may have to be kept off the newly constructed roads before the placement of asphalt and/or immediately thereafter, to avoid damaging the weak subgrade by heavy truck traffic.

Installation of full-length subdrains is required on all roads. The subdrains should be properly filtered to prevent the loss of (and clogging by) soil fines.

All paved surfaces should be sloped to provide satisfactory drainage towards catch basins. All water trapped in the granular sub-base materials should be drained rapidly towards subdrains or other interceptors.

5.8 PRELIMINARY FOUNDATION RECOMMENDATIONS

Details of the proposed development such as underside of footing elevations were not available at the time when this report was prepared. When this information is available, the recommendations provided below should be reviewed by WSP to confirm that the recommendations are still valid based on the design information.

Currently, it is our understanding that single family residential dwellings are proposed to be constructed as well as a Pumping Station situated in Block 54.

Based on the borehole information, the proposed structures can be supported by conventional spread and strip footings founded on either undisturbed native soils or engineered fill.

5.8.1 FOOTINGS ON NATIVE SOILS

Boreholes BH15-01 to BH15-05 and BH15-08 to BH15-10 and BH15-12 advanced in the proposed residential development area revealed native sand and sand and gravel below the surface cover and deposits of Disturbed Soil and/or Marl. While boreholes BH15-06 and BH15-07 were advanced in the area that was previously being considered for a clubhouse relocation which revealed subsurface conditions comprised of similar materials.

Although the Pumping Station was not included at the time of the geotechnical field work, Borehole BH15-05 was situated relatively close to the proposed Pumping Station. Borehole BH15-05, revealed loose to very loose sand extended to an approximate depth of 3.5 mbgs. It is currently understood that the inlet for the station will be at an elevation of approximately 183.25 m which will require a cut in the order of 4.0 mbgs.

Based upon field testing and observations, it is our considered opinion that proposed structures may be supported by conventional spread and strip footings founded on the compact undisturbed sand and sand and gravel. Furthermore, Standard Penetration Testing has established that a Design Bearing Resistance of at least 75 kPa at the Serviceability Limit States (SLS), and for a factored geotechnical resistance of 125 kPa at the Ultimate Limit States (ULS).

The bearing values and the corresponding founding elevations at the borehole locations are summarized on Table 1.

BH NO.	MATERIAL	BEARING CAPACITY AT SLS (KPA)	FACTORED GEOTECHNICAL RESISTANCE AT ULS (KPA)	MINIMUM DEPTH BELOW EXISTING GROUND (M)	NOTE (IF ANY)
BH15-01	Sand	100	150	0.9	Reworked soil in area
BH15-02	Sand	150	225	0.9	Marl in area
BH15-03	Sand	150	225	1.6	Fill in area
BH15-04	Sand	150	225	2.1	Marl in area
BH15-05	Sand	150	225	3.5	Very loose soil in area
BH15-06	Sand	150	225	0.9	Marl in area
BH15-07	Sand	100	150	1.8	Marl in area

BH NO.	MATERIAL	BEARING CAPACITY AT SLS (KPA)	FACTORED GEOTECHNICAL RESISTANCE AT ULS (KPA)	MINIMUM DEPTH BELOW EXISTING GROUND (M)	NOTE (IF ANY)
BH15-08	Sand	100	150	1.8	Marl in area
BH15-09	Sand	150	225	2.4	Marl in area
BH15-10	Sand	150	225	0.6	Marl in area
BH15-11	Sand	75	125	0.7	Marl in area
BH15-12	Sand	150	225	1.1	Marl in area

Variations in the soil conditions are expected in between the borehole locations, and during construction, the soil bearing pressures should be confirmed by the Geotechnical Engineer.

Foundations designed to the specified bearing capacities at the serviceability limit states (SLS) are expected to settle less than 25 mm total and 20 mm differential.

5.8.2 FOUNDATIONS ON ENGINEERED FILL

For the construction of single-family dwellings, where the grades need to be raised, proposed structures may be supported by spread and strip footings founded on engineered fill. The engineered fill can provide a geotechnical reaction of 75 kPa at SLS, and a factored geotechnical resistance of 125 kPa at ULS, provided the requirements for the Construction of Engineered Fill as provided in ***Appendix B*** are adhered to.

Prior to the placement of the engineered fill, all unsuitable soils and surficially softened/loosened native soils must be removed and the exposed subgrade proof-rolled. Any soft spots revealed during proof-rolling must be sub-excavated and re-engineered. To reduce the risk of improperly placed engineered compacted fill, full-time supervision of the contractor is essential.

Where engineered fill is used to support the foundations, the floor slab can also be supported by engineered fill.

5.8.3 GENERAL FOUNDATION COMMENTS

All footings exposed to seasonal freezing conditions should be provided with at least 1.5 m of earth cover or equivalent thermal insulation against frost. It is recommended to keep footings as high as possible to avoid or minimize penetration below groundwater levels while considering the minimum frost cover requirement.

Where it is necessary to place footings at different levels, the upper footing must be founded below an imaginary 10 horizontal to 7 vertical line drawn up from the base of the lower footing. The lower footing must be installed first to help minimize the risk of undermining the upper foundations.

Silty soils at the base of footings can be easily disturbed by construction machinery and foot traffic or lose their strength in contact with surface water. We recommend that an allowance be made for placing a 50-mm thick skim coat of low-strength concrete on the founding subgrade immediately after its approval, to prevent its disturbance by construction activities and from ground or surface water, where necessary.

During winter construction, foundations and slab on grades must not be poured on frozen soil. Foundations must be adequately protected always from cold weather and freezing conditions.

In the vicinity of the existing buried utilities, all footings must be lowered to undisturbed native soils, or alternatively the services must be structurally bridged.

Based upon preliminary findings, dewatering will be required for any excavation in the sand to silty sand, or gravelly sand below the water table level. Otherwise, it will result in an unstable excavation base and flowing sides. The groundwater table must be lowered one (1) meter below the lowest excavation level. Test pits should be carried out in the area prior to the excavation to further explore the groundwater and seepage conditions. A specialized dewatering contractor should install the dewatering system.

Standard geotechnical site investigations will not determine dewatering requirements for situations where there is planned excavation or construction below the groundwater table. To quantify conditions for dewatering purposes and to apply for required permits, both for construction and long-term drainage, hydrogeological study and carefully controlled pumping tests are necessary to adequately engineer a construction dewatering system and/or permanent groundwater control. WSP advises that the geotechnical conditions at this site require such hydrogeological study and analysis. The company is qualified and prepared to undertake this analysis upon proper authorization. Otherwise WSP accepts no responsibility for the design and construction of the dewatering details.

Depending on site grading requirements and excavation depths an Environmental Activity and Sector Registry (EASR) or a Permit to Take Water (PTTW) may be required for the excavations. A hydrogeological investigation would assess potential dewatering rates and determine the need for an EASR or PTTW from the MOECC, and is recommended for this site.

It is essential that imported free-draining OPSS Granular 'B' type fill be used as backfill against foundation walls and used as 'under-floor' (structural fill). Backfilling of the footing wall excavations (and under-floor) is recommended to be placed in 200 mm thick lifts, compacted to 100% SPMDD to proposed sub-grade elevations (***Figure 2***).

It should be noted that the recommended geotechnical resistances have been calculated by WSP from the borehole information for the preliminary design stage only. Additional input may be required as new design information becomes available and is refined. For example, more specific information is available with respect to conditions between boreholes when construction is underway. In this regard, the interpretation between boreholes and the recommendations of this report must therefore be checked through field inspections provided by WSP to validate the information for use during the construction stage.

5.9 EARTHQUAKE CONSIDERATIONS

The parameters for determination of Site Classification for Seismic Site Response are set out in Table 4.1.8.4A of the Ontario Building Code (2012). The classification is based on the determination of the average shear wave velocity in the top 30 meters of the site stratigraphy, where shear wave velocity measurements have been taken or alternatively estimated based on rational analysis of un-drained shear strength or penetration resistance.

It is our opinion that the Average Standard Penetration Resistance (N_{60}) can be taken as between 15 and 50. Therefore, for seismic design purposes, the site designation for seismic analysis is Class D (OBC 4.1.8.4 Table 4.1.8.4.A.).

5.10 FLOOR SLAB CONSTRUCTION AND DRAINAGE

If basements are being considered in the proposed design of the residential buildings and/or clubhouse, these floor slabs as well as the lowest slab of the Pumping Station can be supported on the stripped prepared grade. The floor slabs can be supported on grade provided the base is thoroughly proof rolled and any soft and unstable areas detected are sub-excavated and replaced with compacted fill materials. Fill required to raise the grade can consist of inorganic soil, placed in shallow lifts and compacted to at least 98 percent of Standard Proctor Maximum Dry Density (SPMDD).

For bedding and moisture barrier purposes, a 200-mm thick layer of 19 mm clear crushed stone must be provided under the concrete basement floor slab. Where wet and/or fine-grained soil conditions exist, the moisture barrier should be separated from the subgrade by a geotextile fabric to avoid loss of soil/fines and settlement problems.

Where the floor slab is below the water table, the foundation walls must be water proofed and both perimeter and underfloor drainage must be installed. A typical drainage and excavation scheme are shown on ***Figure 2***. As sandy soils with varying silt content are exposed below the groundwater table, filter cloth such as Terrafix 270R or equivalent must cover the subgrade, all drains, clear stone and other openings.

It is recommended to keep footings as high as possible to avoid or minimize penetration below groundwater levels, as de-watering will be required below the groundwater table.

5.11 INFILTRATION CHARACTERISTICS

Graphical depictions of the laboratory grain size analysis performed on samples recovered from the boreholes are attached as ***Enclosure 13***. Based on the gradation results, the materials encountered are tabulated below.

MATERIAL	BOREHOLE SAMPLE	PERMEABILITY (CM/SEC)	PERCOLATION TIME PERMEABILTY (MIN/CM)	COMMENT
Sand and Gravel	BH15-02, Sample 5	10^{-1} to 10^{-3}	2 to 10*	Below groundwater level
Marl	BH15-04, Sample 3	--	--	Unsuitable
Sand	BH15-07, Sample 6	10^{-1} to 10^{-3}	2 to 8*	Below groundwater level
Sand	BH15-09, Sample 5	10^{-1} to 10^{-3}	2 to 8	In an unsaturated state

*Applicable to unsaturated soil

We note that the Percolation Time ("T" time) or Permeability of the subsoil sampled was estimated. The material, as defined in the Ministry of the Environment Manual of Policy, Procedures and Guidelines for Onsite Sewage Systems, in the appendices 6.3.1 and 6.3.2, mostly resembles soil with medium permeability. We must state that this value is strictly for an unsaturated soil.

The value is solely based on the grain size distribution analysis shown in appendices 6.3.1 and 6.3.2 in the Ministry of the Environment Manual of Policy, Procedures and Guidelines for Onsite Sewage Systems. Furthermore, the estimate provided is indicative of the sample in a disturbed state only. We must emphasize that factors between boreholes such as, but not limited to, structure, consistency, density, organic content and degree of saturation influence the estimates.

An accurate analysis of soil infiltration characteristic is best determined with on-site permeameter testing at the location and level of the proposed infiltration condition.

5.12 CHEMICAL CHARACTERIZATION OF SOILS

Forty-four (44) selected soil samples and five (5) duplicate samples (DUP 1 to DUP 5) were collected from the geotechnical boreholes advanced on the property in September 2015 to assess the environmental quality of the soils, to assist in determining off-site disposal options. The chemical testing report and results are enclosed in ***Appendix C.***

5.13 DESIGN REVIEW, TESTING AND INSPECTIONS

WSP requests to be afforded the opportunity to complete a final review of the proposed development discussed in this report to verify that geotechnical recommendations are appropriate. If not given this opportunity, we cannot assume liability for omissions, misinterpretations or deficiencies in our recommendations.

WSP should be contacted to provide geotechnical testing and inspections during construction operations. Exposed subgrade soils for all structures are to be inspected to confirm the material is stable and competent. Inspections of seepage and groundwater conditions during construction are also required, as discussed in this report. Testing and inspections for general QA/QC are to include sampling and laboratory testing of fill materials and asphalt, compaction testing for the placement of fill materials and asphalt, and field and laboratory testing of concrete (including mix design reviews)

ENCLOSURES

ENCLOSURES 1 – 12: BOREHOLE LOGS

ENCLOSURES 13: LABORATORY RESULTS

LOG OF BOREHOLE BH15-01

PROJECT: Geotechnical Investigation
CLIENT: Marlwood Golf & Country Club
PROJECT LOCATION: 31 Marlwood Avenue, Wasaga Beach, ON
DATUM: Geodetic
BH LOCATION:

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Sep/09/2015

REF. NO.: 10002397
ENCL NO.: 2

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS / 0.3 m	GROUND WATER CONDITIONS	ELEVATION	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL:** 230mm							OC Pesticides
0.2	**SILTY SAND(reworked):** some sand layers, trace organics, trace rootlets, brown, moist, loose		1	SS	9			
0.8	**SAND:** trace silt, light brown, damp, compact		2	SS	13			OC Pesticides, Metals & Inorganics
			3	SS	16			
2.0	stratified colours							
2.3	some gravel to gravelly, large gravel/cobble pieces at 2.4 and 2.7m, very dense		4	SS	100			
3.1	**SAND AND GRAVEL:** trace silt, brown, wet, very dense		5	SS	74		W. L. 3.1 mBGL Oct 14, 2015	PHCs & VOCs
4.7	**SAND:** some silt to silty, grey, wet, very dense		6	SS	78			
5.2	**END OF BOREHOLE**							

Notes:
-Installed monitoring well upon completion
-Water level was 3.06 mbg upon completion

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

POCKET PEN. (C_U) (kPa)
NATURAL UNIT WT (kN/m³)

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

SPL SOIL LOG 10002397 BH LOGS.GPJ SPL.GDT 11/20/15

LOG OF BOREHOLE BH15-02

PROJECT: Geotechnical Investigation
CLIENT: Marlwood Golf & Country Club
PROJECT LOCATION: 31 Marlwood Avenue, Wasaga Beach, ON
DATUM: Geodetic
BH LOCATION:

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Sep/08/2015

REF. NO.: 10002397
ENCL NO.: 3

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS / 0.3 m	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL:** 180mm					OC Pesticides
0.2	**MARL (Clayey Silt):** some sand to sandy, beige, moist, very stiff		1	SS	16	
0.8	**SAND:** trace silt, light brown, damp, compact		2	SS	23	OC Pesticides, Metals & Inorganics
1.5	some gravel		3	SS	22	
2.3	**SAND AND GRAVEL:** trace silt, trace clay, trace cobble pieces, brown, wet, very dense		4	SS	72	
			5	SS	73	45 48 5 2
4.6	trace to some silt		6	SS	53	
5.2	**END OF BOREHOLE**					

Notes:
-Borehole caved to 2.2mbg upon completion.

GROUND WATER CONDITIONS
ELEVATION

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

POCKET PEN. (C_U) (kPa)
NATURAL UNIT WT (kN/m³)

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

SPL SOIL LOG 10002397 BH LOGS.GPJ SPL.GDT 11/20/15

LOG OF BOREHOLE BH15-03

PROJECT: Geotechnical Investigation
CLIENT: Marlwood Golf & Country Club
PROJECT LOCATION: 31 Marlwood Avenue, Wasaga Beach, ON
DATUM: Geodetic
BH LOCATION:

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Sep/08/2015

REF. NO.: 10002397
ENCL NO.: 4

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS / 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (C_u) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL:** 130mm											
0.1	**SAND (reworked):** trace silt, trace rootlets, light brown, damp, loose		1	SS	8							OC Pesticides
1			2	SS	7				○			OC Pesticides, Metals & Inorganics
1.5	**SAND:** trace silt, light brown, damp, stratified colours, compact		3	SS	20				○			
2			4	SS	28				○			
3.1	some gravel to gravelly, wet		5	SS	26				○			
4												
4.6	trace to some silt, trace gravel, wet, compact to dense		6	SS	32				○			
5												
6			7	SS	12				○			
7												
8			8	SS	37				○			PHCs & VOCs
8.2	**END OF BOREHOLE** Notes: -Borehole caved to 3.1mbg upon completion.											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

SPL SOIL LOG 10002397 BH LOGS.GPJ SPL.GDT 11/20/15

LOG OF BOREHOLE BH15-04

PROJECT: Geotechnical Investigation
CLIENT: Marlwood Golf & Country Club
PROJECT LOCATION: 31 Marlwood Avenue, Wasaga Beach, ON
DATUM: Geodetic
BH LOCATION:

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Sep/08/2015

REF. NO.: 10002397
ENCL NO.: 5

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS / 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (C_u) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL:** 130mm											
0.1	**SAND(reworked):** trace silt, trace rootlets, orangish brown, damp, loose		1	SS	6							OC Pesticides
0.4	**MARL (Clayey Silt):** some sand to sandy, beige, moist, layers of topsoil/organics, firm		2	SS	6							OC Pesticides, Metals & Inorganics
1			3	SS	5					40.6		0 20 52 28
2.0	**SAND:** trace silt, brown, moist, loose compact to dense		4	SS	30				○			
2.6	**SAND AND GRAVEL:** trace silt, brown, some black, wet, compact to dense		5	SS	20				○			
3												
4												
5			6	SS	25				○			
5.2	**END OF BOREHOLE** Notes: -Borehole caved to 2.5mbg upon completion.											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ $^{\varepsilon}$=3% Strain at Failure

SPL SOIL LOG 10002397 BH LOGS.GPJ SPL.GDT 11/20/15

LOG OF BOREHOLE BH15-05

PROJECT: Geotechnical Investigation
CLIENT: Marlwood Golf & Country Club
PROJECT LOCATION: 31 Marlwood Avenue, Wasaga Beach, ON
DATUM: Geodetic
BH LOCATION:

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Sep/08/2015

REF. NO.: 10002397
ENCL NO.: 6

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS / 0.3 m	GROUND WATER CONDITIONS	ELEVATION	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL:** 100mm							
0.1	**SILTY SAND(reworked):** some sand layers, trace organics, trace rootlets, brown, moist, compact		1	SS	14			OC Pesticides
0.8	**SAND:** trace silt, brown, moist, very loose		2	SS	2			Metals & Inorganics
1.3	some clayey silt layers, wet, very loose to loose		3	SS	2		W. L. 1.5 mBGL Oct 14, 2015	OC Pesticides
			4	SS	4			
3.1	30mm clayey silt seam at 3.1 mbg, loose		5	SS	9			
3.5	**SAND AND GRAVEL:** trace silt, brown, wet, loose							
4.9	**SAND:** some silt to silty, grey, wet, dilitant, compact		6	SS	22			
5.2	**END OF BOREHOLE**							

Notes:
-Installed monitoring well upon completion
-Water level was 1.44 mbg upon completion

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)
POCKET PEN. (C_U) (kPa)
NATURAL UNIT WT (kN/m³)

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

SPL SOIL LOG 10002397 BH LOGS.GPJ SPL.GDT 11/20/15

LOG OF BOREHOLE BH15-06

PROJECT: Geotechnical Investigation
CLIENT: Marlwood Golf & Country Club
PROJECT LOCATION: 31 Marlwood Avenue, Wasaga Beach, ON
DATUM: Geodetic
BH LOCATION:

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Sep/04/2015

REF. NO.: 10002397
ENCL NO.: 7

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS / 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (C_u) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL:** 150mm											
0.2	**MARL (Clayey Silt):** some sand to sandy, beige, moist, layers of topsoil/organics, stiff		1	SS	12							OC Pesticides
0.8	**SAND:** trace silt, brown, moist, gravel piece at 1.3 mbg, compact		2	SS	19				○			Metals & Inorganics
1.5	very dense		3	SS	52				○			OC Pesticides
2.3	trace gravel, wet, compact		4	SS	13				○			PHCs & VOCs
3.1	clayey pockets at 3.1 mbg, loose		5	SS	5				○			
3.5	orangish brown											
4.6	some gravel to gravelly, compact		6	SS	18				○			
5.2	**END OF BOREHOLE** Notes: -Borehole caved to 2.0mbg upon completion.											

SPL SOIL LOG 10002397 BH LOGS.GPJ SPL.GDT 11/20/15

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH15-07

PROJECT: Geotechnical Investigation
CLIENT: Marlwood Golf & Country Club
PROJECT LOCATION: 31 Marlwood Avenue, Wasaga Beach, ON
DATUM: Geodetic
BH LOCATION:

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Sep/04/2015

REF. NO.: 10002397
ENCL NO.: 8

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL:** 150mm							OC Pesticides
0.2	**SILTY SAND(reworked):** some sand layers, trace organics, trace rootlets, brown, moist, compact		1	SS	22			
0.6	**MARL (Clayey Silt):** some sand to sandy, beige, moist, trace topsoil/organics, stiff		2	SS	14			OC Pesticides, Metals & Inorganics
1.7	**SAND:** trace silt, brown, damp to moist, compact		3	SS	12			
2.3	trace gravel, dense		4	SS	31			
3.1	some gravel, wet, compact		5	SS	22	W. L. 3.2 mBGL Oct 14, 2015		PHCs & VOCs
4.6	occassional gravel, very loose to loose		6	SS	4			0 96 2 2
6.1	compact		7	SS	12			
			8	SS	25			
8.2	**END OF BOREHOLE**							

Notes:
-Installed monitoring well upon completion
-Water level was 3.19 mbg upon completion

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)
POCKET PEN. (C_U) (kPa)
NATURAL UNIT WT (kN/m³)

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

SPL SOIL LOG 10002397 BH LOGS.GPJ SPL.GDT 11/20/15

LOG OF BOREHOLE BH15-08

PROJECT: Geotechnical Investigation
CLIENT: Marlwood Golf & Country Club
PROJECT LOCATION: 31 Marlwood Avenue, Wasaga Beach, ON
DATUM: Geodetic
BH LOCATION:

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Sep/03/2015

REF. NO.: 10002397
ENCL NO.: 9

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS / 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (C_U) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL:** 150mm											
0.2	**SAND:** trace organics, dry to damp, very loose to loose		1	SS	4							OC Pesticides
0.8	**MARL (Clayey Silt):** some sand to sandy, beige, moist, layers of topsoil/organics, firm to stiff		2	SS	8				○			Metals & Inorganics
1.7	**SAND:** trace silt, brown, damp to moist, stratified colours, compact		3	SS	11				○			OC Pesticides
			4	SS	22				○			
3.1	loose to compact		5	SS	10				○			
4.6	trace to some silt, wet, dilitant, dense		6	SS	35				○			
5.2	**END OF BOREHOLE** Notes: -Borehole caved to 3.96mbg upon completion.											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ $^{\varepsilon}$=3% Strain at Failure

SPL SOIL LOG 10002397 BH LOGS.GPJ SPL.GDT 11/20/15

LOG OF BOREHOLE BH15-09

PROJECT: Geotechnical Investigation
CLIENT: Marlwood Golf & Country Club
PROJECT LOCATION: 31 Marlwood Avenue, Wasaga Beach, ON
DATUM: Geodetic
BH LOCATION:

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Sep/03/2015

REF. NO.: 10002397
ENCL NO.: 10

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL:** 130mm							OC Pesticides
0.1	**SAND:** trace silt, trace organics, orangish brown, dry to damp, loose		1	SS	5			
0.8	100mm wood/organic layer							Metals & Inorganics
0.9	brown, moist, stratified colours, loose to compact		2	SS	10			
			3	SS	10			OC Pesticides
1.8	**MARL (Clayey Silt):** some sand to sandy, beige, moist, layers of topsoil/organics, stiff							
2.3	**SAND:** trace silt, trace mollusks, brown, moist, compact		4	SS	26			
			5	SS	27			0 95 5 0
								PHCs & VOCs
4.9	wet, compact to dense		6	SS	30		W. L. 4.9 mBGL Oct 14, 2015	
6.1	some silt to silty, brown/grey, 50mm orange layer, dense		7	SS	40			
7.6	trace to some gravel, compact		8	SS	29			
8.2	**END OF BOREHOLE** -Installed monitoring well upon completion -Water level was 4.78 mbg upon completion							

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

POCKET PEN. (C_U) (kPa)
NATURAL UNIT WT (kN/m³)

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
$+^3$, $\times^3$: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

SPL SOIL LOG 10002397 BH LOGS.GPJ SPL.GDT 11/20/15

LOG OF BOREHOLE BH15-10

PROJECT: Geotechnical Investigation
CLIENT: Marlwood Golf & Country Club
PROJECT LOCATION: 31 Marlwood Avenue, Wasaga Beach, ON
DATUM: Geodetic
BH LOCATION:

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Sep/03/2015

REF. NO.: 10002397
ENCL NO.: 11

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" BLOWS / 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa): ○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE & Sensitivity, × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (C_u) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL:** 50mm											
0.1	**MARL (Clayey Silt):** some sand to sandy, beige, moist, layers of topsoil/organics, stiff		1	SS	11							OC Pesticides
0.3	**SAND:** trace silt, brown, moist, compact											
1			2	SS	21				○			OC Pesticides, Metals & Inorganics
2			3	SS	26				○			
2.3	stratified colours		4	SS	15				○			
3												
3.1	some silt to silty, trace clay, greyish brown, wet, dilitant, loose		5	SS	5				○			
4												
4.9	grey, some silt, very dense		6	SS	57				○			
5												
5.2	**END OF BOREHOLE**											

Notes:
-Borehole caved to 2.44mbg upon completion.

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

SPL SOIL LOG 10002397 BH LOGS.GPJ SPL.GDT 11/20/15

LOG OF BOREHOLE BH15-11

PROJECT: Geotechnical Investigation
CLIENT: Marlwood Golf & Country Club
PROJECT LOCATION: 31 Marlwood Avenue, Wasaga Beach, ON
DATUM: Geodetic
BH LOCATION:

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Sep/04/2015

REF. NO.: 10002397
ENCL NO.: 12

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS / 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (C_U) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL:** 180mm											
0.2	**MARL (Clayey Silt):** some sand to sandy, beige, moist, layers of topsoil/organics, stiff		1	SS	12							
0.5	**SAND:** trace silt, brown, damp, compact											
0.8	100mm silty sand layer, brown, moist		2	SS	18				○			
1												
			3	SS	14				○			
2												
2.3	trace to some silt, wet, loose		4	SS	6				○			
3												
3.1	trace to some gravel		5	SS	6				○			
4												
4.6	very loose		6	SS	2				○			
5												
5.2	**END OF BOREHOLE**											

Notes:
-Borehole caved to 1.7mbg upon completion.

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

SPL SOIL LOG 10002397 BH LOGS.GPJ SPL.GDT 11/20/15

LOG OF BOREHOLE BH15-12

PROJECT: Geotechnical Investigation
CLIENT: Marlwood Golf & Country Club
PROJECT LOCATION: 31 Marlwood Avenue, Wasaga Beach, ON
DATUM: Geodetic
BH LOCATION:

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Sep/09/2015

REF. NO.: 10002397
ENCL NO.: 13

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS / 0.3 m	GROUND WATER CONDITIONS	ELEVATION	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL:** 200mm							OC Pesticides
0.2	**MARL (Clayey Silt):** some sand to sandy, beige, moist, layers of topsoil/organics, stiff		1	SS	10			
1.0	**SAND:** trace silt, brown, damp, dense		2	SS	32			Metals & Inorganics
1.5	some gravel		3	SS	33			OC Pesticides
2.3	**SAND AND GRAVEL:** trace silt, brown, wet, compact		4	SS	27		W. L. 2.2 mBGL Oct 14, 2015	
3.1	very dense		5	SS	88/ 280mm			PHCs & VOCs
4.6	**SAND:** trace silt, trace gravel, brown, wet, compact		6	SS	29			
5.2	**END OF BOREHOLE** Notes: -Borehole caved to 1.7mbg upon completion.							

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE

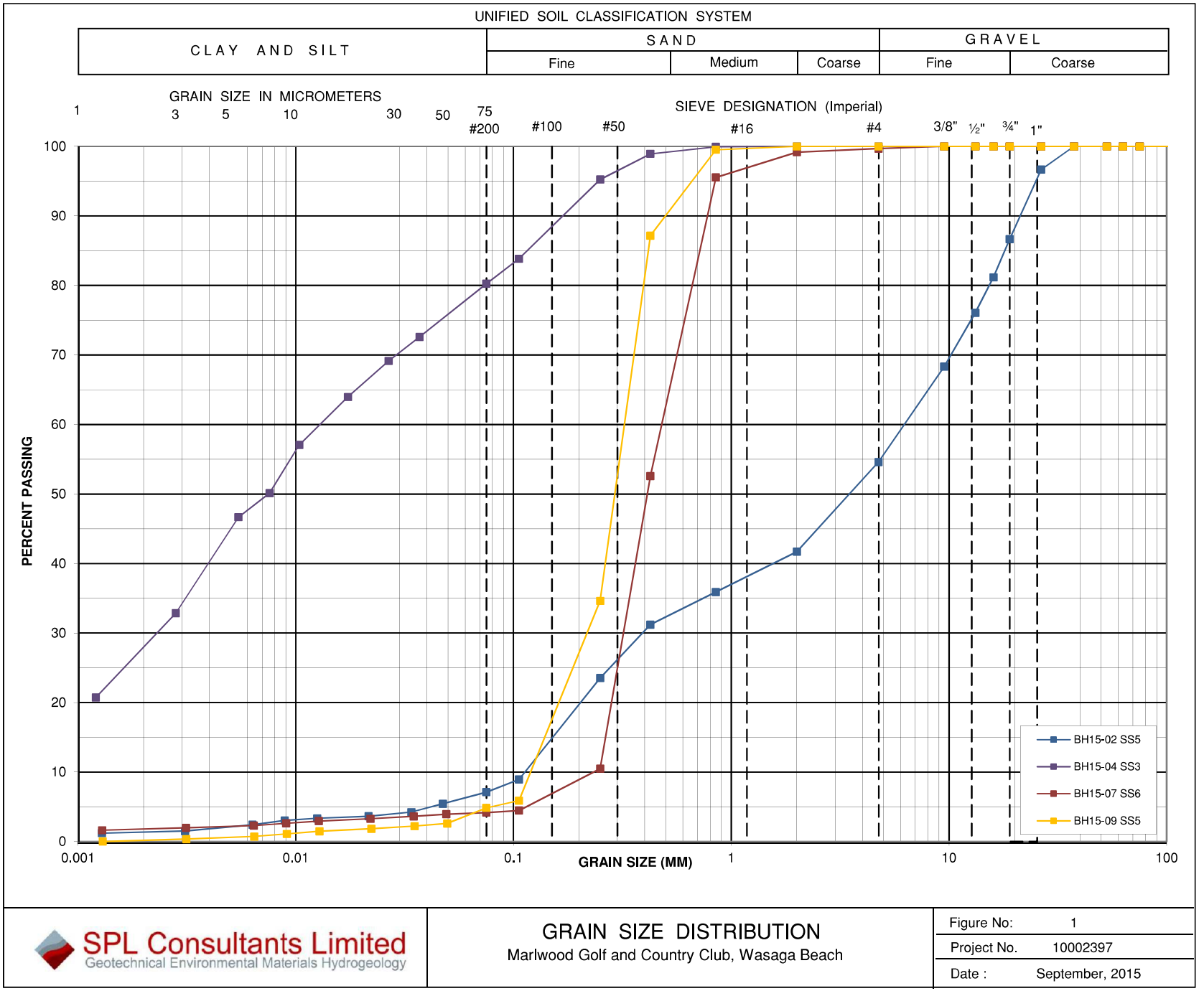
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

POCKET PEN. (C_U) (kPa)
NATURAL UNIT WT (kN/m³)

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
$+^3$, $\times^3$: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

SPL SOIL LOG 10002397 BH LOGS.GPJ SPL.GDT 11/20/15



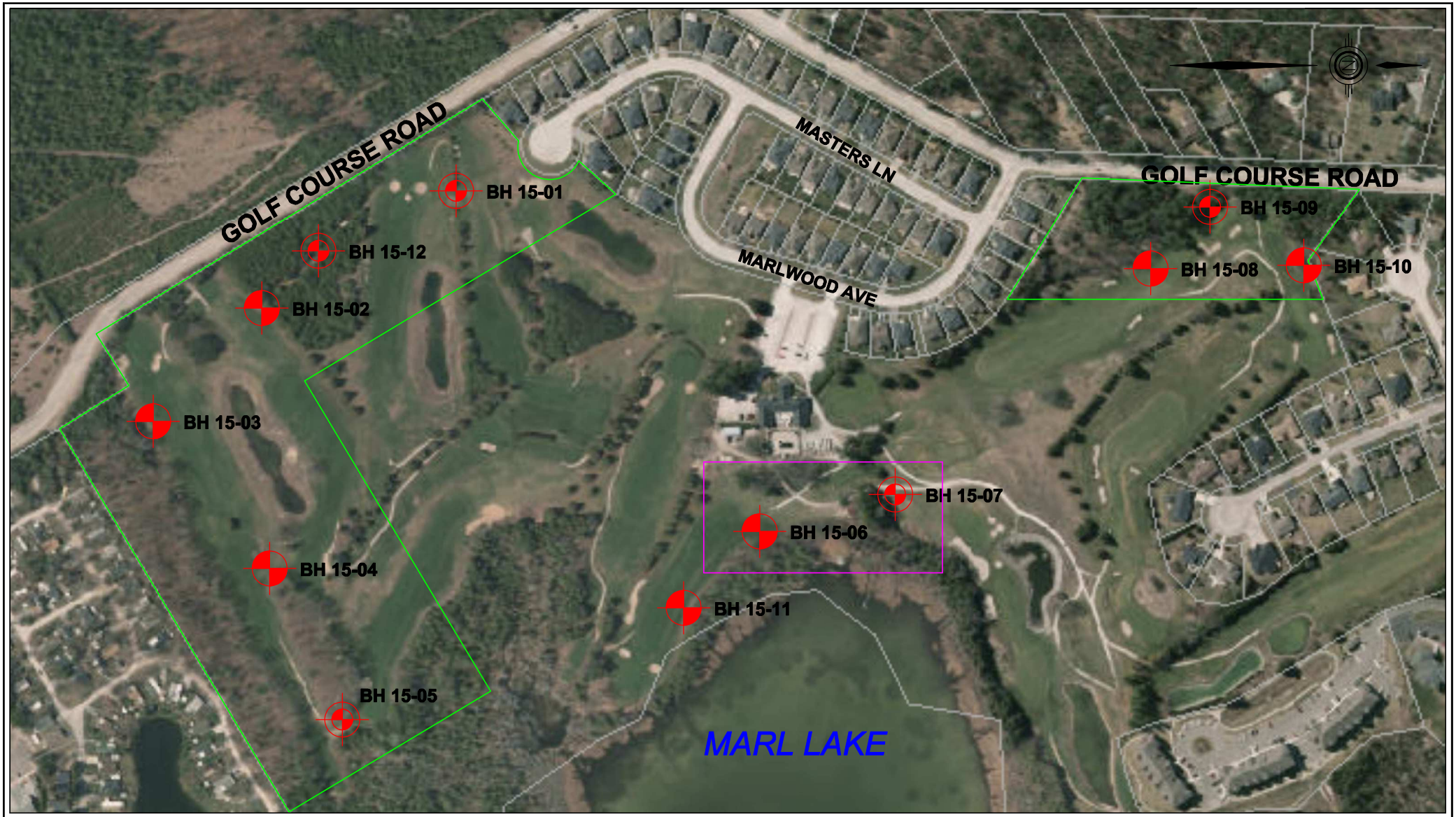
SPL Consultants Limited
Geotechnical Environmental Materials Hydrogeology

GRAIN SIZE DISTRIBUTION

Marlwood Golf and Country Club, Wasaga Beach

Figure No:	1
Project No.	10002397
Date :	September, 2015

FIGURES



LEGEND

BH 15-XX Borehole Location

BH 15-XX Borehole Location with Groundwater Monitoring Well Installed

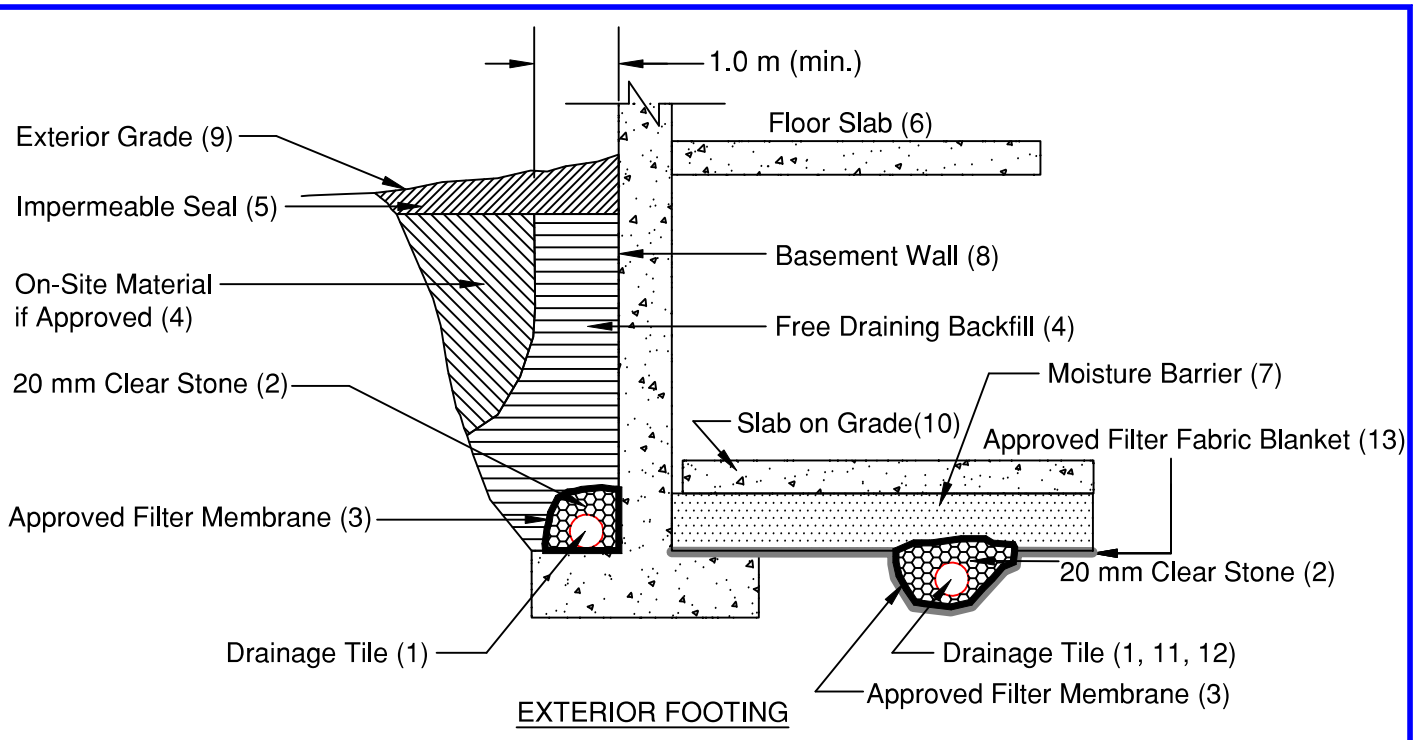
APRROXIMATE SCALE

0m 10m 25m 50m 100m

Approximate Area of Investigation for Proposed Residential Development

Approximate Area of Investigation for Proposed Relocation of Clubhouse

Client:	MARLWOOD GOLF AND COUNTRY CLUB			Project No.: 10002397	Figure No.: 1
Drawn:	MV	Approved:	GJ	Title:	BOREHOLE LOCATION PLAN
Date:	NOVEMBER, 2015	Scale:	AS SHOWN	Project:	PRELIMINARY GEOTECHNICAL INVESTIGATION 31 MARLWOOD AVE, WASAGA BEACH, ONTARIO
Original Size:	TABLOID	Rev:	1		SPL Consultants Limited | ENGINEERING SOLUTIONS



Notes

1. Drainage tile to consist of 100 mm (4") diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet.
2. 20 mm (3/4") clear stone - 150 mm (6") top and side of drain. If drain is not on footing, place100 mm (4 inches) of stone below drain .
3. Wrap the clear stone with an approved filter membrane (Terrafix 270R or equivalent).
4. Free Draining backfill - OPSS Granular B or equivalent compacted to the specified density. Do not use heavy compaction equipment within 450 mm (18") of the wall. Use hand controlled light compaction equipment within 1.8 m (6') of wall. The minimum width of the Granular 'B' backfill must be 1.0 m.
5. Impermeable backfill seal - compacted clay, clayey silt or equivalent. If original soil is free-draining, seal may be omitted. Maximum thickness of seal to be 0.5 m.
6. Do not backfill until wall is supported by basement and floor slabs or adequate bracing.
7. Moisture barrier to be at least 200 mm (8") of compacted clear 20 mm (3/4") stone or equivalent free draining material. A vapour barrier may be required for specialty floors.
8. Basement wall to be damp proofed /water proofed.
9. Exterior grade to slope away from building.
10. Slab on grade should not be structurally connected to the wall or footing.
11. Underfloor drain invert to be at least 300 mm (12") below underside of floor slab.
12. Drainage tile placed in parallel rows 6 to 8 m (20 to 25') centers one way. Place drain on 100 mm (4") clear stone with 150 mm (6") of clear stone on top and sides. Enclose stone with filter fabric as noted in (3).
13. The entire subgrade to be sealed with approved filter fabric (Terrafix 270R or equivalent) if non-cohesive (sandy) soils below ground water table encountered.
14. Do not connect the underfloor drains to perimeter drains.
15. Review the geotechnical report for specific details.

DRAINAGE AND BACKFILL RECOMMENDATIONS
Basement with Underfloor Drainage

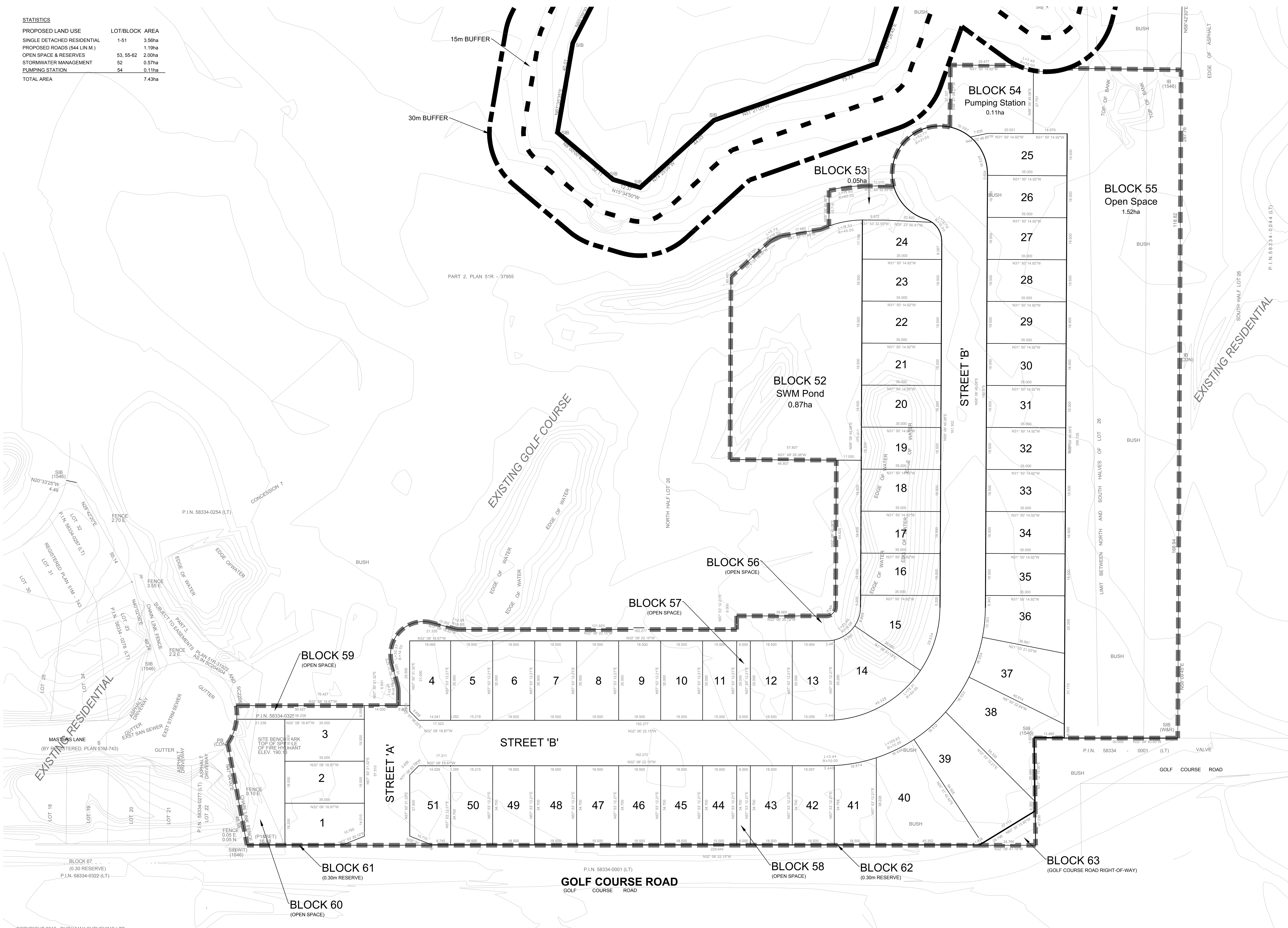
(not to scale)

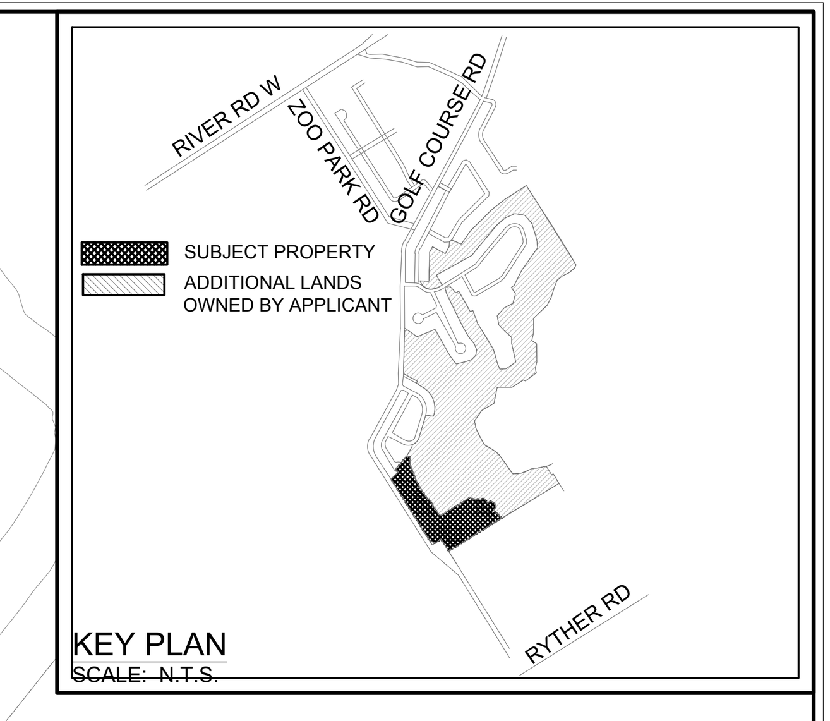
APPENDIX

A R.J. BURNSIDE DEVELOPMENT PLANS

STATISTICS

PROPOSED LAND USE	LOT/BLOCK	AREA
SINGLE DETACHED RESIDENTIAL	1-51	3.56ha
PROPOSED ROADS (544 LIN.M.)		1.19ha
OPEN SPACE & RESERVES	53, 55-62	2.00ha
STORMWATER MANAGEMENT	52	0.57ha
PUMPING STATION	54	0.11ha
TOTAL AREA		7.43ha





ADDITIONAL INFORMATION

As required under Section 51(17) of the Planning Act.

a), b), e), f), g) & j) – on plan
c) – on key plan
d) – see statistics
h) – piped water to be installed by developer
i) – sandy
k) – all municipal services to be made available
l) – nil

APPROVED SUBJECT TO CONDITIONS IN ACCORDANCE WITH SECTION 51(31) OF THE PLANNING ACT, RSO, CAP. P.13, AS AMENDED,

THIS_______ DAY OF ________________,__________

DIRECTOR OF PLANNING, DEVELOPMENT AND TOURISM, COUNTY OF SIMCOE

OWNER'S CERTIFICATE

We authorize LOFT Planning Inc. to prepare and submit this Plan of Subdivision for approval.

________________________ A.S.O. ____________
TPC MARLWOOD INC. date

SURVEYOR'S CERTIFICATE

I hereby certify that the boundaries of the lands being subdivided and their relationship to the adjacent lands are accurately and correctly shown.

________________________ ____________
RUDY MAK SURVEYING LTD. date

LOFT Planning Inc.

0 50 100 200 300 400
Metres

BURNSIDE

Client
TPC MARLWOOD INC.

Figure Title
MARLWOOD MASTER'S LANE EXTENSION
PRELIMINARY DRAFT PLAN

Drawn	Checked	Date	Figure No.
EDT	JO	19/02/15	2
Scale		Project No.	
1:750		300037815	

File: \\collingwood\Shared Work Areas\037815 - Marlwood Preliminary Engineering\07_Figures\190604 (Draft Plan Option

15m BUFFER

30m BUFFER

STAKED WETLAND BOUNDARY

SANITARY PUMPING STATION (TO BE DESIGNED DURING DETAILED DESIGN)

MH45
TOP=183.71
SW INV=183.42

HDWL3
TOP=185.65
SW INV=185.15

MH14
TOP=186.66
SE INV=180.86
W INV=185.78

CBMH13
TOP=187.76
SW INV=186.10
NW INV=186.02

54.0m - STM @ 1.50%

30.0m - STM @ 3.33%

MH38
TOP=188.57
W INV=185.31
NE INV=185.21

50mm PE WATERMAIN LOOP

HDWL2
TOP=188.15
E INV=183.65

HDWL1
TOP=188.15
INV=183.55

MH17
TOP=188.61
SW INV=183.83
NE INV=183.80

CBMH11
TOP=188.17
SW INV=186.31
NE INV=186.28

CONCEPTUAL SWM FACILITY
FOREBAY BOTTOM ELEV. 184.60
MAIN CELL BOTTOM ELEV. 184.80
PERM. POOL ELEV. 185.60
TOP ELEV. 187.30

150mmØ WATERMAIN

CBMH10
TOP=188.80
SW INV=186.10
NE INV=186.49

1.0x1.5x1.5m DEPTH SOAKAWAY PIT PER TOWB STANDARD DRAWING No. 11 TO BE INSTALLED IN EACH LOT IN LOWEST REAR YARD CORNER, CONSERVATIVELY ASSUMED HOUSE LOT COVERAGE OF 40% (TYP.)

PROPOSED SANITARY FORCEMAIN (TO BE SIZED DURING DETAILED DESIGN)

MH09
TOP=188.50
W INV=184.54
NE INV=184.49

CBMH9
TOP=188.42
W INV=186.34
NE INV=186.34

MH10
TOP=188.39
NW INV=184.82
E INV=184.77

SANITARY FORCEMAIN TO TIE INTO MH

MH48
TOP=0.00
SE INV=187.97
NW INV=187.94

MH47
TOP=189.30
NW INV=188.30

EXMH3A

23.6m - SAN @ 1.50%

64.2m - SAN @ 0.52%

MH12
TOP=189.03
NW INV=185.54
SE INV=185.51

MH16
TOP=189.63
NW INV=185.10
SE INV=185.05

CBMH7
TOP=188.31
NW INV=186.75
E INV=186.46

MASTERS LANE

MH13
TOP=189.06
SW INV=186.18
SE INV=186.10

150mmØ WATERMAIN

113.0m - SAN @ 0.50%

STREET 'B'

80.6m - SAN @ 0.50%

60.0m - STM @ 0.44%

60.0m - STM @ 3.04%

60.0m - STM @ 0.40%

BELL VAULT / POST & SERVICE PANEL

VALVE

PROPOSED WATERMAIN TO TIE INTO EXISTING WATERMAIN

CBMH2
TOP=189.44
SE INV=187.89

CBMH3
TOP=189.13
NW INV=187.62
SE INV=188.97

CBMH5
TOP=188.85
NW INV=187.14
SE INV=187.14

CBMH6
TOP=188.54
NW INV=186.90
SE INV=186.90

GOLF COURSE ROAD

MH49
TOP=0.00
NE INV=186.50

50.0m - SAN @ 1.00%

STREET 'A'

CLEANWATER CSP CULVERT @ 0.25%
W. INV. 187.76
E. INV 187.59

PROPOSED WATERMAIN TO TIE INTO EXISTING WATERMAIN

SOAKAWAY PITS TO BE INSTALLED IN BOULEVARD OF GOLF COURSE ROAD SIZED TO INFILTRATE RUN-OFF FROM PORTION OF STREET 'A'. REFER TO POST DEVELOPMENT DRAINAGE AREA PLAN

NOTES:

1. 25mmØ PE160 WATER SERVICE CONNECTION TO BE INSTALLED AS PER OPSD 1104.010, WITH APPROVED SERVICE SADDLE

2. SANITARY SERVICE CONNECTION TO BE INSTALLED AS PER TOWN STANDARD DRAWING No. 12 (TYP.)

3. SANITARY SERVICE CLEANOUT TO BE INSTALLED AS PER TOWN STANDARD DRAWING No. 12 (TYP.)

LEGEND

- SANITARY SEWER/MANHOLE
- EXISTING SANITARY SEWER
- WATERMAIN
- EXISTING WATERMAIN
- STORM SEWER/MANHOLE
- EXISTING STORM SEWER
- HYDRANT

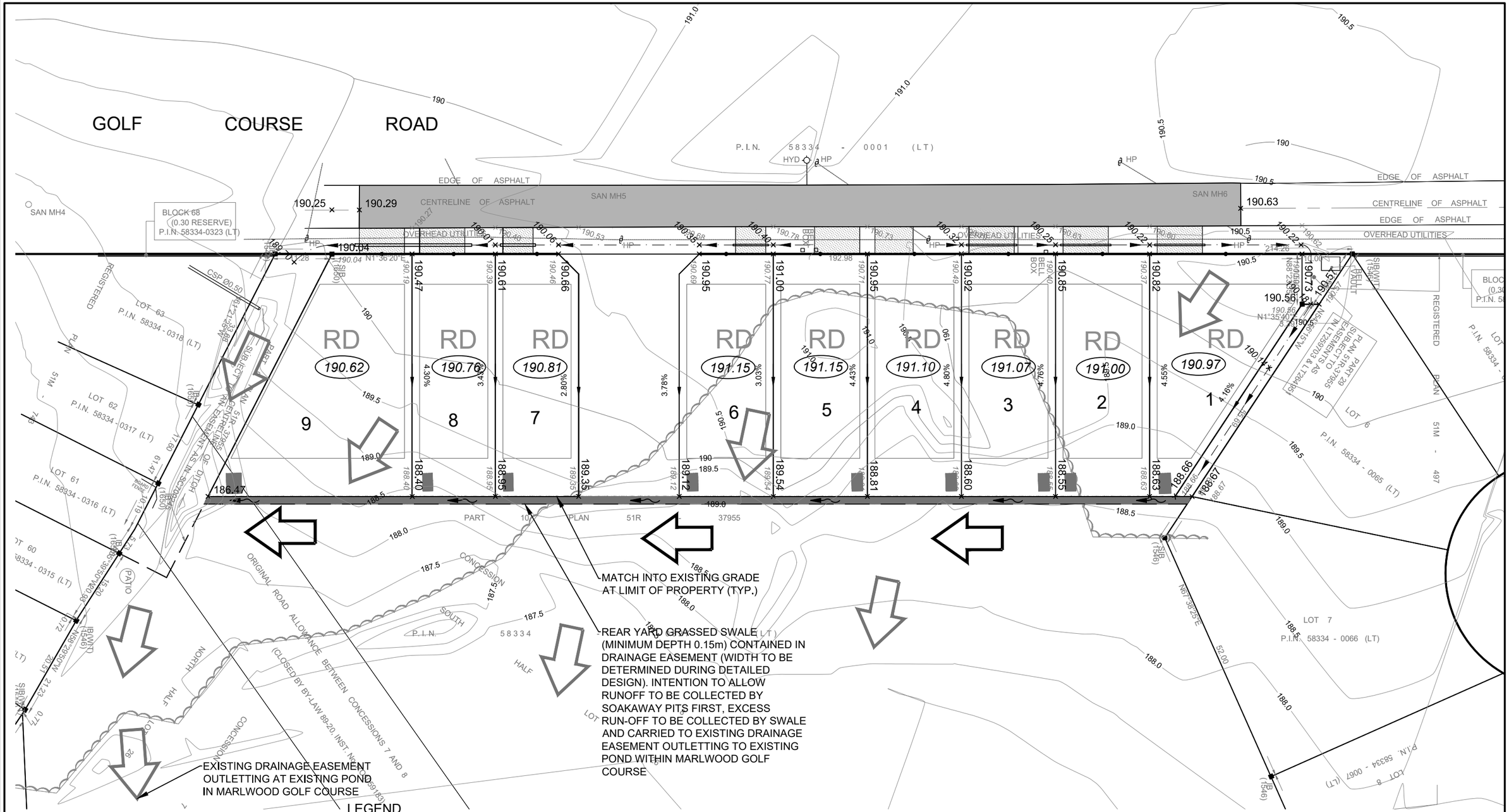
0 10 20 40 60
Metres

BURNSIDE

Figure Title
MARLWOOD MASTER'S LANE EXTENSION
PRELIMINARY UNDERGROUND SERVICING

Client
TPC MARLWOOD INC.

Drawn	Checked	Date	Figure No.
KAG	DM	17/10/23	4
Scale		Project No.	
1:750		300037815	



LEGEND

227.20 / 227.20	PROPOSED GRADE WITH EXISTING GRADE
227.20	APRON GRADE (MINIMUM 300mm ABOVE EDGE OF PAVEMENT)
	PROPOSED SWALE
	MAXIMUM 3:1 SLOPE UNLESS OTHERWISE NOTED
SD	SPLIT DRAINAGE LOT TYPE
	SOAKAWAY PIT
	EXISTING OVERLAND FLOW ROUTE
	PROPOSED OVERLAND FLOW ROUTE

0 10 20 40 60 Metres

BURNSIDE

Figure Title: **MARLWOOD (9 LOTS)**

PRELIMINARY GRADING

Client: **TPC MARLWOOD INC.**

Drawn	Checked	Date	Figure No.
KAG	EDT	17/09/25	5

Scale: 1:750 | Project No.: 300039210

File: \\OSCAR\Shared Work Areas\039210 - Marlwood Golf Course 10 Lots\04_Preliminary\003_ProductionDwg\039210 - PRELIMINARY GRADING.dwg Date Plotted: November 26, 2019 - 5:55 PM

15m BUFFER

30m BUFFER

STAKED WETLAND BOUNDARY

PROPOSED OVERLAND FLOW ROUTE FROM POND TO BE DIRECTED TO PROPOSED HEADWALL; MAJOR SYSTEM

HDWL3

BLOCK 54
Pumping Station
0.11ha

BLOCK 53
0.05ha

BLOCK 55
Open Space
1.52ha

MH10

CBMH09

188.10

188.25

MH38

INLET HEADWALL
INV. 185.65 m

HDWL1

100YR WL = 186.78
REGIONAL (TIMMINS) WL = 186.64
25mm WL = 186.01

BLOCK 52
SWM Pond
0.57ha

CONCEPTUAL SWM FACILITY
FOREBAY BOTTOM ELEV. 184.60
MAIN CELL BOTTOM ELEV. 184.60
PERM. POOL ELEV. 185.60
TOP ELEV. 187.55

DITCH TO OUTLET TO PROPOSED POND. ACCESS ROAD TO BE DEPRESSED IN AREA OF DITCH INLET TO PROVIDE POSITIVE OUTLET FOR DITCH FLOWS.

STREET 'B'

CBMH08

CBMH07

CBMH06

CBMH05

CBMH04

CBMH03

CBMH02

CBMH01

BLOCK 56
(OPEN SPACE)

BLOCK 57
(OPEN SPACE)

BLOCK 59
(OPEN SPACE)

BLOCK 60
(OPEN SPACE)

BLOCK 61
(0.30m RESERVE)

BLOCK 58
(OPEN SPACE)

BLOCK 62
(0.30m RESERVE)

BLOCK 63
(GOLF COURSE ROAD RIGHT-OF-WAY)

STREET 'A'

MASTERS LANE
(BY REGISTERED PLAN 51M-747)

EXISTING RESIDENTIAL

EXISTING GOLF COURSE

GOLF COURSE ROAD

MATCH INTO EXISTING GRADE AT LIMIT OF PROPERTY (TYP.)

PROPOSED DITCH TO PROVIDE OUTLET FOR EXISTING LOW POINT ON GOLF COURSE ROAD. SWALE TO BE AT A MINIMUM OF 0.25%

LEGEND

- 188.14 / 188.14 — PROPOSED GRADE WITH EXISTING GRADE
- PROPOSED SWALE
- MAXIMUM 3:1 SLOPE UNLESS OTHERWISE NOTED
- SD — SPLIT DRAINAGE LOT TYPE
- WO — WALK OUT DRAINAGE LOT TYPE
- SOAKAWAY PIT
- PROPOSED OVERLAND FLOW ROUTE
- EXISTING OVERLAND FLOW ROUTE

0 10 20 40 60
Metres

BURNSIDE

Figure Title
MARLWOOD MASTER'S LANE EXTENSION
PRELIMINARY GRADING

Client
TPC MARLWOOD INC.

Drawn	Checked	Date
EDT	JO	19/11/26

Scale 1:750
Project No. 300037815
Figure No. **6**

APPENDIX

B ENGINEERED FILL

GENERAL REQUIREMENTS FOR ENGINEERED FILL

Compacted imported soil that meets specific engineering requirements and is free of organics and debris and that has been continually monitored on a full-time basis by a qualified geotechnical representative is classified as engineered fill. Engineered fill that meets these requirements and is bearing on suitable native subsoil can be used for the support of foundations.

Imported soil used as engineered fill can be removed from other portions of a site or can be brought in from other sites. In general, most of Ontario soils are too wet to achieve the 100% Standard Proctor Maximum Dry Density (SPMDD) and will require drying and careful site management if they are to be considered for engineered fill. Imported non-cohesive granular soil is preferred for all engineered fill. For engineered fill, we recommend use of OPSS Granular 'B' sand and gravel fill material.

Adverse weather conditions such as rain make the placement of engineered fill to the required degree of density difficult or impossible; engineered fill cannot be placed during freezing conditions, i.e. normally not between December 15 and April 1 of each year.

The location of the foundations on the engineered fill pad is critical and certification by a qualified surveyor that the foundations are within the stipulated boundaries is mandatory. Since layout stakes are often damaged or removed during fill placement, offset stakes must be installed and maintained by the surveyors during the course of fill placement so that the contractor and engineering staff are continually aware of where the engineered fill limits lie. Excavations within the engineered fill pad must be backfilled with the same conditions and quality control as the original pad.

To perform satisfactorily, engineered fill requires the cooperation of the designers, engineers, contractors and all parties must be aware of the requirements. The minimum requirements are as follows, however, the geotechnical report must be reviewed for specific information and requirements.

1. Prior to site work involving engineered fill, a site meeting to discuss all aspects must be convened. The surveyor, contractor, design engineer and geotechnical engineer must attend the meeting. At this meeting, the limits of the engineered fill will be defined. The contractor must make known where all fill material will be obtained from and samples must be provided to the geotechnical engineer for review, and approval before filling begins.

2. Detailed drawings indicating the lower boundaries as well as the upper boundaries of the engineered fill must be available at the site meeting and be approved by the geotechnical engineer.

3. The building footprint and base of the pad, including basements, garages, etc. must be defined by offset stakes that remain in place until the footings and service connections are all constructed. Confirmation that the footings are within the pad, service lines are in place, and that the grade conforms to drawings, must be obtained by the owner in writing from the surveyor and WSP Canada Inc. Without this confirmation no responsibility for the performance of the structure can be accepted by WSP Canada Inc. Survey drawing of the pre and post fill location and elevations will also be required.

4. The area must be stripped of all topsoil and fill materials. Subgrade must be proof-rolled. Soft spots must be dug out. The stripped native subgrade must be examined and approved by a WSP Canada Inc. engineer prior to placement of fill.

5. The approved engineered fill material must be compacted to 100% Standard Proctor Maximum Dry Density throughout. Engineered fill should not be placed during the winter months. Engineered fill compacted to 100% SPMDD will settle under its own weight approximately 0.5% of the fill height and the structural engineer must be aware of this settlement. In addition to the settlement of the fill, additional settlement due to consolidation of the underlying soils from the structural and fill loads will occur and should be evaluated prior to placing the fill.

6. Full-time geotechnical inspection by WSP Canada Inc. during placement of engineered fill is required. Work cannot commence or continue without the presence of the WSP Canada Inc. representative.

7. The fill must be placed such that the specified geometry is achieved. Refer to the attached sketches for minimum requirements. Take careful note that the projection of the compacted pad beyond the footing at footing level is a minimum of 2 m. The base of the compacted pad extends 2 m plus the depth of excavation beyond the edge of the footing.

8. A bearing capacity of 150 kPa at SLS (225 kPa at ULS) can be used provided that all conditions outlined above are adhered to. A minimum footing width of 500 mm (20 inches) is suggested and footings must be provided with nominal steel reinforcement.

9. All excavations must be done in accordance with the Occupational Health and Safety Regulations of Ontario.

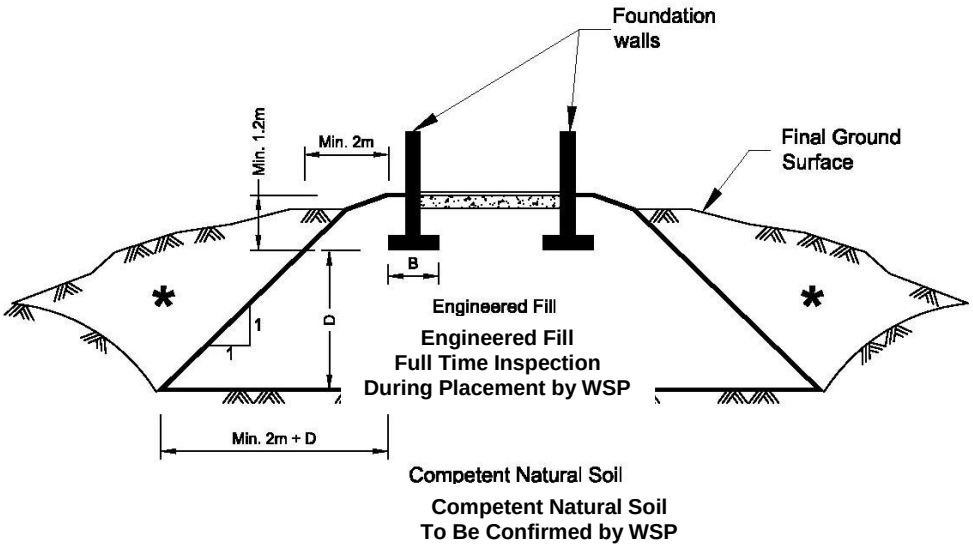
10. After completion of the engineered fill pad a second contractor may be selected to install footings. The prepared footing bases must be evaluated by engineering staff from WSP Canada Inc. prior to footing concrete placements. All excavations must be backfilled under full time supervision by WSP Canada Inc. to the same degree as the engineered fill pad. Surface water cannot be allowed to pond in excavations or to be trapped in clear stone backfill. Clear stone backfill can only be used with the approval of WSP Canada Inc.

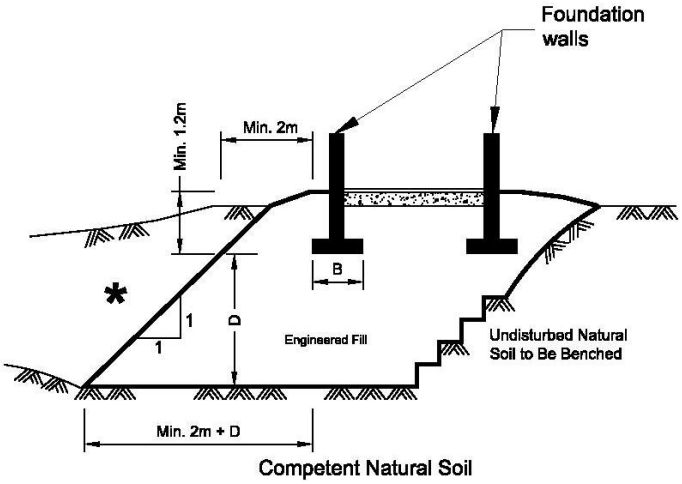
11. After completion of compaction, the surface of the engineered fill pad must be protected from disturbance from traffic, rain and frost. During the course of fill placement, the engineered fill must be smooth-graded, proof-rolled and sloped/crowned at the end of each day, prior to weekends and any stoppage in work in order to promote rapid runoff of rainwater and to avoid any ponding surface water. Any stockpiles of fill intended for use as engineered fill must also be smooth-bladed to promote runoff and/or protected from excessive moisture take up.

12. If there is a delay in construction, the engineered fill pad must be inspected and accepted by the geotechnical engineer. The location of the structure must be reconfirmed that it remains within the pad.

13. The geometry of the engineered fill as illustrated in these General Requirements is general in nature. Each project will have its own unique requirements. For example, if perimeter sidewalks are to be constructed around the building, then the projection of the engineered fill beyond the foundation wall may need to be greater.

14. These guidelines are to be read in conjunction with WSP Canada Inc. report attached.





* **Backfill in this area to be as per WSP report.**

APPENDIX

C SOIL QUALITY TESTING

SPL Consultants Limited | ENGINEERING SOLUTIONS

Project: 10002397-110 **October 7, 2015**

Marlwood Golf and Country Club
31 Marlwood Avenue
Wasaga Beach, Ontario
L9Z 1S8

Attention: Mr. Alex Smardenka

Re: Soil Quality Assessment Letter
Marlwood Golf and Country Club, Wasaga Beach, Ontario

SPL Consultants (SPL) was retained by Marlwood Golf and Country Club to provide a soil quality assessment at the Marlwood Golf and Country Club in Wasaga Beach, Ontario.

In order to assess options for potential offsite disposal of soils during the proposed residential development, a total of forty-four (44) soil samples and five (5) duplicate soil samples (DUP 1 to DUP 5) were collected from the geotechnical boreholes advanced on the property in September 2015. The borehole locations are shown on the attached Figure 1. Soil samples were collected by SPL and submitted for analysis of Organochlorine pesticides (OC Pesticides), metals and inorganics (M&Is), petroleum hydrocarbons (PHCs) and volatile organic compounds (VOCs), as set out in O.Reg. 153/04 as amended, Section XV.1 of the Environmental Protection Act (EPA). The **Certificates of Analysis** are attached. Sampling locations and parameters analyzed are provided in the following table.

TABLE 1: SOIL QUALITY SAMPLING AND ANALYSIS PROGRAM

Sample ID	Sample Date	Parameter(s)	Location	Depth (mbg)
BH15-01 SS1	September 9, 2015	OC Pesticides	South portion of the site	0-0.6 Top soil overlying sandy silt with trace organics
BH15-01 SS2	September 9, 2015	OC Pesticides, M&Is	South portion of the site	0.8-1.4 Sand, trace silt
BH15-01 SS5	September 9, 2015	PHCs, VOCs	South portion of the site	3.1-3.7 Sand and Gravel, trace silt
BH15-02 SS1	September 8, 2015	OC Pesticides (DUP 4)	South portion of the site	0-0.6 Top soil overlying clayey silt, some sand
BH15-02 SS2	September 8, 2015	OC Pesticides, M&Is	South portion of the site	0.8-1.4 Sand, trace silt
BH15-03 SS1	September 8, 2015	OC Pesticides	South portion of the site	0-0.6 Top soil overlying sand, trace silt
BH15-03 SS2	September 8, 2015	OC Pesticides, M&Is	South portion of the site	0-0.6 Sand, trace silt

Sample ID	Sample Date	Parameter(s)	Location	Depth (mbg)
BH15-03 SS8	September 8, 2015	PHCs, VOCs	South portion of the site	7.6-8.2 Sand, trace silt, trace gravel
BH15-04 SS1	September 8, 2015	OC Pesticides (DUP 3)	South portion of the site	0-0.6 Top soil overlying sand trace silt
BH15-04 SS2	September 8, 2015	OC Pesticides, M&Is	South portion of the site	0.8-1.4 Clayey silt, some sand
BH15-05 SS1	September 8, 2015	OC Pesticides	South portion of the site	0-0.6 Top soil overlying sandy silt with trace organics
BH15-05 SS2	September 8, 2015	M&Is	South portion of the site	0.8-1.4 Sand, trace silt
BH15-05 SS3	September 8, 2015	OC Pesticides	South portion of the site	1.5-2.1 Sand, trace silt
BH15-06 SS1	September 4, 2015	OC Pesticides	Central portion of the site	0-0.6 Top soil overlying clayey silt, some sand
BH15-06 SS2	September 4, 2015	M&Is	Central portion of the site	0.8-1.4 Sand, trace silt
BH15-06 SS3	September 4, 2015	OC Pesticides	Central portion of the site	1.5-2.1 Sand, trace silt
BH15-06 SS4	September 4, 2015	PHCs, VOCs (DUP 4)	Central portion of the site	2.3-2.9 Sand, trace silt, trace gravel
BH15-07 SS1	September 4, 2015	OC Pesticides (DUP 1)	Central portion of the site	0-0.6 Top soil overlying sandy silt with trace organics
BH15-07 SS2	September 4, 2015	OC Pesticides, M&Is	Central portion of the site	0.8-1.4 Clayey silt, some sand
BH15-07 SS5	September 4, 2015	PHCs, VOCs	Central portion of the site	3.1-3.7 Sand, some gravel
BH15-08 SS1	September 3, 2015	OC Pesticides	West Central portion of the site	0-0.6 Top soil overlying sand, trace silt with trace organics
BH15-08 SS2	September 3, 2015	M&Is	West Central portion of the site	0.8-1.4 Clayey silt, some sand
BH15-08 SS3	September 3, 2015	OC Pesticides	West Central portion of the site	1.5-2.1 Sand, trace silt
BH15-09 SS1	September 3, 2015	OC Pesticides	West Central portion of the site	0-0.6 Top soil overlying, trace silt with trace organics

Sample ID	Sample Date	Parameter(s)	Location	Depth (mbg)
BH15-09 SS2	September 3, 2015	M&Is	West Central portion of the site	0.8-1.4 Sand, trace silt
BH15-09 SS3	September 3, 2015	OC Pesticides	West Central portion of the site	1.5-2.1 Sand, trace silt overlying clayey silt, some sand
BH15-09 SS6	September 3, 2015	PHCs, VOCs	West Central portion of the site	4.6-5.2 Sand, trace silt
BH15-10 SS1	September 3, 2015	OC Pesticides	West Central portion of the site	0-0.6 Top soil overlying clayey silt, some sand
BH15-10 SS2	September 3, 2015	OC Pesticides, M&Is	West Central portion of the site	0.8-1.4 Sand, trace silt
BH15-12 SS1	September 9, 2015	OC Pesticides (DUP 5)	South portion of the site	0-0.6 Top soil overlying clayey silt, some sand
BH15-12 SS2	September 9, 2015	M&Is	South portion of the site	Clayey Silt, some sand overlying sand, trace silt
BH15-12 SS3	September 9, 2015	OC Pesticides	South portion of the site	1.5-2.1 Silt, trace silt, some gravel
BH15-12 SS5	September 9, 2015	PHCs, VOCs	South portion of the site	3.1-3.7 Sand and Gravel

Soil samples were collected and handled in accordance with generally accepted procedures used by the environmental consulting industry. Prior to each sampling event, new disposable gloves were used to transfer samples in plastic bags and glass jars supplied by the laboratory. All soil samples were kept under refrigerated conditions during field storage and transportation to the environmental analytical laboratory.

No visual or olfactory evidence of environmental impact (debris or staining) was noted in any of the soil samples collected.

The chemical analysis was conducted by ALS Environmental (ALS) located in Mississauga, Ontario. ALS is a member of the Canadian Association for Laboratory Accreditation (CALA) and meets the requirements of Section 47 of O.Reg. 153/04 certifying that the analytical laboratory be accredited in accordance with the International Standard ISO/IEC 17025 and with standards developed by the Standards Council of Canada.

For the purposes of soil disposal, the results of chemical analyses were compared to the Background Site Condition Standards for Use within 30 m of a Water Body in a Non-Potable Groundwater Condition for All Property Uses other than Agricultural as contained in Table 9 of the “Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act,” published by the Ministry of Environment (MOE) on April 15, 2011.

Based on the results of the chemical analysis, SPL provides the following conclusions/recommendations:

- When compared to MOE Table 9 property use standards all samples meet with the exception of Dieldrin from sample BH13-07 SS1;
- When compared to MOE Table 9 property use standards, assessment against the guide limit could not be made due to the detection limit exceeding the guide limit for Endrin in BH15-09 SS1;
- The vertical and lateral extents of the exceedances are unknown.
- Separation and re-testing may be an option to reduce disposal cost.
- The results of this testing evaluates the environmental quality of the soil and does not pertain to the geotechnical suitability of the material.
- Acceptance of any excavated soil will be at the discretion of the receiving site.

The purpose of this testing was to chemically characterize the soils analyzed and does not constitute a Phase Two Environmental Site Assessment as defined in O.Reg.153/04, as amended.

It should be noted that if any aesthetically impacted soils are identified during excavation it is recommended that SPL be notified in order to conduct further assessment and/or testing of the material in question.

This report was prepared for Marlwood Golf and Country Club. The material in this report reflects SPL's judgment in light of the information available to it at the time of preparation. Any use, which a Third Party not noted above makes of this report, or any reliance on decisions to be made based on it, are the responsibility of such Third Parties. SPL Consultants Limited accepts no responsibility for damages, if any, suffered by any Third Party as a result of decisions made or actions based on this report.

Thank you for the opportunity to be of service on this project. Should you have any questions or wish to review the contents of this letter in more detail, please do not hesitate to contact the undersigned.

Yours Very Truly,

SPL Consultants Limited

Gord Jarvis
Branch Manager, Collingwood

Attachments:

Figure 1

Laboratory Certificates of Analysis

SPL CONSULTANTS LIMITED (Collingwood)
ATTN: NICOLE COLLINS
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7

Date Received: 11- SEP- 15
Report Date: 22- SEP- 15 14:57 (MT)
Version: FINAL

Client Phone: 705- 445- 0064

Certificate of Analysis

Lab Work Order #: L1672015

Project P.O. #: NOT SUBMITTED
Job Reference: 10002397
C of C Numbers: 14- 465016, 14- 465017, 14- 465018, 14- 465019
Legal Site Desc:

Emerson Perez, B.S.E
Account Manager

Ontario Regulation 153/04 - April 15, 2011 Standards - Physical Tests (SOIL)

			ALS ID	L1672015-1	L1672015-2	L1672015-3	L1672015-4	L1672015-5	L1672015-6
			Sampled Date	09-SEP-15	09-SEP-15	09-SEP-15	08-SEP-15	08-SEP-15	08-SEP-15
			Sampled Time	-	-	-	12:00	12:00	12:00
			Sample ID	**BH15-01 SS1**	**BH15-01 SS2**	**BH15-01 SS5**	**BH15-02 SS1**	**BH15-02 SS2**	**BH15-03 SS1**
Analyte	Unit	**Guide Limit							
Conductivity	mS/cm	0.7		0.0801			0.0749	
% Moisture	%	-	17.0	9.13	13.1	16.0	21.0	10.8
pH	pH units	-		7.96			7.94	

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Physical Tests (SOIL)

			ALS ID	L1672015-7	L1672015-8	L1672015-9	L1672015-10	L1672015-11	L1672015-12
			Sampled Date	08-SEP-15	08-SEP-15	08-SEP-15	08-SEP-15	08-SEP-15	08-SEP-15
			Sampled Time	12:00	12:00	-	-	-	-
			Sample ID	**BH15-03 SS2**	**BH15-03 SS8**	**BH15-04 SS1**	**BH15-04 SS2**	**BH15-05 SS1**	**BH15-05 SS2**
Analyte	Unit	**Guide Limit							
Conductivity	mS/cm	0.7		0.0774			0.140		0.145
% Moisture	%	-		22.5	19.7	36.2	21.6	14.0	7.12
pH	pH units	-		8.01			7.67		7.60

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Physical Tests (SOIL)

			ALS ID	L1672015-13	L1672015-14	L1672015-15	L1672015-16	L1672015-17	L1672015-18
			Sampled Date	08-SEP-15	04-SEP-15	04-SEP-15	04-SEP-15	04-SEP-15	04-SEP-15
			Sampled Time	-	-	-	-	-	-
			Sample ID	**BH15-05 SS3**	**BH15-06 SS1**	**BH15-06 SS2**	**BH15-06 SS3**	**BH15-06 SS4**	**BH15-07 SS1**
Analyte	Unit	**Guide Limit							
Conductivity	mS/cm	0.7				0.0937			
% Moisture	%	-		21.1	25.4	7.01	5.87	19.8	24.2
pH	pH units	-				7.92			

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Physical Tests (SOIL)

			ALS ID	L1672015-19	L1672015-20	L1672015-21	L1672015-22	L1672015-23	L1672015-24
			Sampled Date	04-SEP-15	04-SEP-15	03-SEP-15	03-SEP-15	03-SEP-15	03-SEP-15
			Sampled Time	-	-	-	-	-	-
			Sample ID	**BH15-07 SS2**	**BH15-07 SS5**	**BH15-08 SS1**	**BH15-08 SS2**	**BH15-08 SS3**	**BH15-09 SS1**
Analyte	Unit	**Guide Limit							
Conductivity	mS/cm	0.7		0.128			0.135		
% Moisture	%	-		22.3	20.4	25.1	23.6	30.7	6.36
pH	pH units	-		7.81			7.71		

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Physical Tests (SOIL)

			ALS ID	L1672015-25	L1672015-26	L1672015-27	L1672015-28	L1672015-29	L1672015-30
			Sampled Date	03-SEP-15	03-SEP-15	03-SEP-15	03-SEP-15	03-SEP-15	09-SEP-15
			Sampled Time	-	-	-	12:00	12:00	-
			Sample ID	**BH15-09 SS2**	**BH15-09 SS3**	**BH15-09 SS6**	**BH15-10 SS1**	**BH15-10 SS2**	**BH15-12 SS1**
Analyte	Unit	**Guide Limit							
Conductivity	mS/cm	0.7		0.0722				0.0593	
% Moisture	%	-		17.3	16.1	21.4	6.54	19.1	31.3
pH	pH units	-		7.78				8.01	

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Physical Tests (SOIL)

			ALS ID	L1672015-31	L1672015-32	L1672015-33	L1672015-34	L1672015-35	L1672015-36
			Sampled Date	09-SEP-15	09-SEP-15	09-SEP-15	09-SEP-15	09-SEP-15	09-SEP-15
			Sampled Time	-	-	-	-	-	-
			Sample ID	**BH15-12 SS2**	**BH15-12 SS3**	**BH15-12 SS5**	**DUP1**	**DUP2**	**DUP3**
Analyte	Unit	**Guide Limit							
Conductivity	mS/cm	0.7		0.139					
% Moisture	%	-		22.9	7.54	11.9	16.6	19.8	15.0
pH	pH units	-		8.02					

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Physical Tests (SOIL)

		ALS ID	L1672015-37	L1672015-38
		Sampled Date	09-SEP-15	09-SEP-15
		Sampled Time	-	-
		Sample ID	**DUP4**	**DUP5**
Analyte	Unit	**Guide Limit		
Conductivity	mS/cm	0.7		
% Moisture	%	-	16.3	28.9
pH	pH units	-		

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Cyanides (SOIL)

			ALS ID	L1672015-2	L1672015-5	L1672015-7	L1672015-10	L1672015-12	L1672015-15
			Sampled Date	09-SEP-15	08-SEP-15	08-SEP-15	08-SEP-15	08-SEP-15	04-SEP-15
			Sampled Time	-	12:00	12:00	-	-	-
			Sample ID	**BH15-01 SS2**	**BH15-02 SS2**	**BH15-03 SS2**	**BH15-04 SS2**	**BH15-05 SS2**	**BH15-06 SS2**
Analyte	Unit	**Guide Limit							
Cyanide, Weak Acid Diss	ug/g	0.051		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Ontario Regulation 153/04 - April 15, 2011 Standards - Cyanides (SOIL)

			ALS ID	L1672015-19	L1672015-22	L1672015-25	L1672015-29	L1672015-31
			Sampled Date	04-SEP-15	03-SEP-15	03-SEP-15	03-SEP-15	09-SEP-15
			Sampled Time	-	-	-	12:00	-
			Sample ID	**BH15-07 SS2**	**BH15-08 SS2**	**BH15-09 SS2**	**BH15-10 SS2**	**BH15-12 SS2**
Analyte	Unit	**Guide Limit						
Cyanide, Weak Acid Diss	ug/g	0.051		<0.050	<0.050	<0.050	<0.050	<0.050

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Saturated Paste Extractables (SOIL)

Analyte	Unit	**Guide Limit	ALS ID: L1672015-2 Sampled Date: 09-SEP-15 Sampled Time: - Sample ID: **BH15-01 SS2**	ALS ID: L1672015-5 Sampled Date: 08-SEP-15 Sampled Time: 12:00 Sample ID: **BH15-02 SS2**	ALS ID: L1672015-7 Sampled Date: 08-SEP-15 Sampled Time: 12:00 Sample ID: **BH15-03 SS2**	ALS ID: L1672015-10 Sampled Date: 08-SEP-15 Sampled Time: - Sample ID: **BH15-04 SS2**	ALS ID: L1672015-12 Sampled Date: 08-SEP-15 Sampled Time: - Sample ID: **BH15-05 SS2**	ALS ID: L1672015-15 Sampled Date: 04-SEP-15 Sampled Time: - Sample ID: **BH15-06 SS2**
SAR	SAR	5	<0.10 SAR:Q	<0.10 SAR:Q	<0.10 SAR:Q	<0.10 SAR:Q	<0.10 SAR:Q	<0.10 SAR:Q
Calcium (Ca)	mg/L	-	30.7	45.1	50.9	64.3	51.2	49.7
Magnesium (Mg)	mg/L	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Sodium (Na)	mg/L	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Ontario Regulation 153/04 - April 15, 2011 Standards - Saturated Paste Extractables (SOIL)

Analyte	Unit	**Guide Limit	ALS ID: L1672015-19 Sampled Date: 04-SEP-15 Sampled Time: - Sample ID: **BH15-07 SS2**	ALS ID: L1672015-22 Sampled Date: 03-SEP-15 Sampled Time: - Sample ID: **BH15-08 SS2**	ALS ID: L1672015-25 Sampled Date: 03-SEP-15 Sampled Time: - Sample ID: **BH15-09 SS2**	ALS ID: L1672015-29 Sampled Date: 03-SEP-15 Sampled Time: 12:00 Sample ID: **BH15-10 SS2**	ALS ID: L1672015-31 Sampled Date: 09-SEP-15 Sampled Time: - Sample ID: **BH15-12 SS2**
SAR	SAR	5	<0.10 SAR:Q	<0.10	<0.10 SAR:Q	<0.10 SAR:Q	<0.10 SAR:Q
Calcium (Ca)	mg/L	-	26.7	26.3	37.2	18.4	60.9
Magnesium (Mg)	mg/L	-	<1.0	1.0	<1.0	<1.0	<1.0
Sodium (Na)	mg/L	-	<1.0	1.7	<1.0	<1.0	<1.0

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Metals (SOIL)

Analyte	Unit	**Guide Limit	ALS ID: L1672015-2 Sampled Date: 09-SEP-15 Sampled Time: - Sample ID: BH15-01 SS2	L1672015-5 08-SEP-15 12:00 BH15-02 SS2	L1672015-7 08-SEP-15 12:00 BH15-03 SS2	L1672015-10 08-SEP-15 - BH15-04 SS2	L1672015-12 08-SEP-15 - BH15-05 SS2	L1672015-15 04-SEP-15 - BH15-06 SS2
Antimony (Sb)	ug/g	1.3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic (As)	ug/g	18	<1.0	<1.0	<1.0	1.8	1.4	<1.0
Barium (Ba)	ug/g	220	8.8	14.9	13.7	129	89.2	16.5
Beryllium (Be)	ug/g	2.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Boron (B)	ug/g	36	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Boron (B), Hot Water Ext.	ug/g	1.5	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Cadmium (Cd)	ug/g	1.2	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Chromium (Cr)	ug/g	70	5.1	5.2	4.1	8.0	7.4	4.3
Cobalt (Co)	ug/g	22	1.3	1.6	1.4	2.0	2.0	1.1
Copper (Cu)	ug/g	92	1.1	1.6	1.3	8.9	5.3	1.5
Lead (Pb)	ug/g	120	1.2	1.4	<1.0	2.1	3.2	<1.0
Mercury (Hg)	ug/g	0.27	<0.0050	<0.0050	<0.0050	0.0068	0.0187	<0.0050
Molybdenum (Mo)	ug/g	2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Nickel (Ni)	ug/g	82	3.6	3.7	3.3	8.3	4.8	2.5
Selenium (Se)	ug/g	1.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	ug/g	0.5	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Thallium (Tl)	ug/g	1	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Uranium (U)	ug/g	2.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Vanadium (V)	ug/g	86	14.1	10.9	8.3	15.6	11.3	9.3
Zinc (Zn)	ug/g	290	<5.0	5.6	5.4	9.1	12.3	<5.0

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Metals (SOIL)

	ALS ID	L1672015-19	L1672015-22	L1672015-25	L1672015-29	L1672015-31
	Sampled Date	04-SEP-15	03-SEP-15	03-SEP-15	03-SEP-15	09-SEP-15
	Sampled Time	-	-	-	12:00	-
	Sample ID	**BH15-07 SS2**	**BH15-08 SS2**	**BH15-09 SS2**	**BH15-10 SS2**	**BH15-12 SS2**
Analyte	Unit	**Guide Limit				
Antimony (Sb)	ug/g	1.3	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic (As)	ug/g	18	<1.0	<1.0	<1.0	<1.0	<1.0
Barium (Ba)	ug/g	220	159	107	6.8	11.3	121
Beryllium (Be)	ug/g	2.5	<0.50	<0.50	<0.50	<0.50	<0.50
Boron (B)	ug/g	36	<5.0	<5.0	<5.0	<5.0	<5.0
Boron (B), Hot Water Ext.	ug/g	1.5	<0.10	<0.10	<0.10	<0.10	<0.10
Cadmium (Cd)	ug/g	1.2	<0.50	<0.50	<0.50	<0.50	<0.50
Chromium (Cr)	ug/g	70	6.5	6.2	4.6	10.3	4.1
Cobalt (Co)	ug/g	22	2.0	<1.0	1.2	2.1	1.3
Copper (Cu)	ug/g	92	6.6	1.9	<1.0	1.7	9.5
Lead (Pb)	ug/g	120	1.9	1.8	<1.0	1.2	1.3
Mercury (Hg)	ug/g	0.27	0.0137	0.0205	<0.0050	<0.0050	<0.0050
Molybdenum (Mo)	ug/g	2	<1.0	<1.0	<1.0	<1.0	<1.0
Nickel (Ni)	ug/g	82	4.7	2.3	2.9	3.8	2.9
Selenium (Se)	ug/g	1.5	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	ug/g	0.5	<0.20	<0.20	<0.20	<0.20	<0.20
Thallium (Tl)	ug/g	1	<0.50	<0.50	<0.50	<0.50	<0.50
Uranium (U)	ug/g	2.5	<1.0	<1.0	<1.0	<1.0	<1.0
Vanadium (V)	ug/g	86	11.0	5.6	10.5	33.4	7.1
Zinc (Zn)	ug/g	290	8.1	7.5	<5.0	7.2	<5.0

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Speciated Metals (SOIL)

			ALS ID	L1672015-2	L1672015-5	L1672015-7	L1672015-10	L1672015-12	L1672015-15
			Sampled Date	09-SEP-15	08-SEP-15	08-SEP-15	08-SEP-15	08-SEP-15	04-SEP-15
			Sampled Time	-	12:00	12:00	-	-	-
			Sample ID	**BH15-01 SS2**	**BH15-02 SS2**	**BH15-03 SS2**	**BH15-04 SS2**	**BH15-05 SS2**	**BH15-06 SS2**
Analyte	Unit	**Guide Limit							
Chromium, Hexavalent	ug/g	0.66		<0.20	<0.20	<0.20	0.24	<0.20	<0.20

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Ontario Regulation 153/04 - April 15, 2011 Standards - Speciated Metals (SOIL)

			ALS ID	L1672015-19	L1672015-22	L1672015-25	L1672015-29	L1672015-31
			Sampled Date	04-SEP-15	03-SEP-15	03-SEP-15	03-SEP-15	09-SEP-15
			Sampled Time	-	-	-	12:00	-
			Sample ID	**BH15-07 SS2**	**BH15-08 SS2**	**BH15-09 SS2**	**BH15-10 SS2**	**BH15-12 SS2**
Analyte	Unit	**Guide Limit						
Chromium, Hexavalent	ug/g	0.66		<0.20	<0.20	<0.20	<0.20	<0.20

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Volatile Organic Compounds (SOIL)

Analyte	Unit	**Guide Limit	ALS ID: L1672015-3 Sampled Date: 09-SEP-15 Sampled Time: - Sample ID: BH15-01 SS5	L1672015-8 08-SEP-15 12:00 BH15-03 SS8	L1672015-17 04-SEP-15 - BH15-06 SS4	L1672015-20 04-SEP-15 - BH15-07 SS5	L1672015-27 03-SEP-15 - BH15-09 SS6	L1672015-33 09-SEP-15 - BH15-12 SS5
Acetone	ug/g	0.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Benzene	ug/g	0.02	<0.0068	<0.0068	<0.0068	<0.0068	<0.0068	<0.0068
Bromodichloromethane	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Bromoform	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Bromomethane	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Carbon tetrachloride	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chlorobenzene	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Dibromochloromethane	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloroform	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,2-Dibromoethane	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,2-Dichlorobenzene	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,3-Dichlorobenzene	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,4-Dichlorobenzene	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Dichlorodifluoromethane	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,1-Dichloroethane	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,2-Dichloroethane	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,1-Dichloroethylene	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
cis-1,2-Dichloroethylene	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
trans-1,2-Dichloroethylene	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,3-Dichloropropene (cis & trans)	ug/g	0.05	<0.042	<0.042	<0.042	<0.042	<0.042	<0.042
Methylene Chloride	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,2-Dichloropropane	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
cis-1,3-Dichloropropene	ug/g	-	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
trans-1,3-Dichloropropene	ug/g	-	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Ethylbenzene	ug/g	0.05	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018
n-Hexane	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Methyl Ethyl Ketone	ug/g	0.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Methyl Isobutyl Ketone	ug/g	0.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
MTBE	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Styrene	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,1,1,2-Tetrachloroethane	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,1,2,2-Tetrachloroethane	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Tetrachloroethylene	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Toluene	ug/g	0.2	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080
1,1,1-Trichloroethane	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Volatile Organic Compounds (SOIL)

	ALS ID	L1672015-35
	Sampled Date	09-SEP-15
	Sampled Time	-
	Sample ID	DUP2
Analyte	Unit	**Guide Limit	
Acetone	ug/g	0.5	<0.50
Benzene	ug/g	0.02	<0.0068
Bromodichloromethane	ug/g	0.05	<0.050
Bromoform	ug/g	0.05	<0.050
Bromomethane	ug/g	0.05	<0.050
Carbon tetrachloride	ug/g	0.05	<0.050
Chlorobenzene	ug/g	0.05	<0.050
Dibromochloromethane	ug/g	0.05	<0.050
Chloroform	ug/g	0.05	<0.050
1,2-Dibromoethane	ug/g	0.05	<0.050
1,2-Dichlorobenzene	ug/g	0.05	<0.050
1,3-Dichlorobenzene	ug/g	0.05	<0.050
1,4-Dichlorobenzene	ug/g	0.05	<0.050
Dichlorodifluoromethane	ug/g	0.05	<0.050
1,1-Dichloroethane	ug/g	0.05	<0.050
1,2-Dichloroethane	ug/g	0.05	<0.050
1,1-Dichloroethylene	ug/g	0.05	<0.050
cis-1,2-Dichloroethylene	ug/g	0.05	<0.050
trans-1,2-Dichloroethylene	ug/g	0.05	<0.050
1,3-Dichloropropene (cis & trans)	ug/g	0.05	<0.042
Methylene Chloride	ug/g	0.05	<0.050
1,2-Dichloropropane	ug/g	0.05	<0.050
cis-1,3-Dichloropropene	ug/g	-	<0.030
trans-1,3-Dichloropropene	ug/g	-	<0.030
Ethylbenzene	ug/g	0.05	<0.018
n-Hexane	ug/g	0.05	<0.050
Methyl Ethyl Ketone	ug/g	0.5	<0.50
Methyl Isobutyl Ketone	ug/g	0.5	<0.50
MTBE	ug/g	0.05	<0.050
Styrene	ug/g	0.05	<0.050
1,1,1,2-Tetrachloroethane	ug/g	0.05	<0.050
1,1,2,2-Tetrachloroethane	ug/g	0.05	<0.050
Tetrachloroethylene	ug/g	0.05	<0.050
Toluene	ug/g	0.2	<0.080
1,1,1-Trichloroethane	ug/g	0.05	<0.050

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Volatile Organic Compounds (SOIL)

	ALS ID	L1672015-3	L1672015-8	L1672015-17	L1672015-20	L1672015-27	L1672015-33
	Sampled Date	09-SEP-15	08-SEP-15	04-SEP-15	04-SEP-15	03-SEP-15	09-SEP-15
	Sampled Time	-	12:00	-	-	-	-
	Sample ID	**BH15-01 SS5**	**BH15-03 SS8**	**BH15-06 SS4**	**BH15-07 SS5**	**BH15-09 SS6**	**BH15-12 SS5**
Analyte	Unit	**Guide Limit					
1,1,2-Trichloroethane	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Trichloroethylene	ug/g	0.05	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Trichlorofluoromethane	ug/g	0.25	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Vinyl chloride	ug/g	0.02	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
o-Xylene	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
m+p-Xylenes	ug/g	-	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Xylenes (Total)	ug/g	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Surrogate: 4-Bromofluorobenzene	%	-	91.2	93.0	89.1	91.7	87.1	97.1
Surrogate: 1,4-Difluorobenzene	%	-	96.8	96.9	95.1	96.3	95.6	97.5

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Volatile Organic Compounds (SOIL)

	ALS ID	L1672015-35
	Sampled Date	09-SEP-15
	Sampled Time	-
	Sample ID	DUP2
Analyte	Unit	**Guide Limit
1,1,2-Trichloroethane	ug/g	0.05	<0.050
Trichloroethylene	ug/g	0.05	<0.010
Trichlorofluoromethane	ug/g	0.25	<0.050
Vinyl chloride	ug/g	0.02	<0.020
o-Xylene	ug/g	-	<0.020
m+p-Xylenes	ug/g	-	<0.030
Xylenes (Total)	ug/g	0.05	<0.050
Surrogate: 4-Bromofluorobenzene	%	-	91.3
Surrogate: 1,4-Difluorobenzene	%	-	97.3

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Ontario Regulation 153/04 - April 15, 2011 Standards - Hydrocarbons (SOIL)

	ALS ID	L1672015-3	L1672015-8	L1672015-17	L1672015-20	L1672015-27	L1672015-33
	Sampled Date	09-SEP-15	08-SEP-15	04-SEP-15	04-SEP-15	03-SEP-15	09-SEP-15
	Sampled Time	-	12:00	-	-	-	-
	Sample ID	BH15-01 SS5	BH15-03 SS8	BH15-06 SS4	BH15-07 SS5	BH15-09 SS6	BH15-12 SS5
Analyte	Unit	**Guide Limit					
F1 (C6-C10)	ug/g	25	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
F1-BTEX	ug/g	25	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
F2 (C10-C16)	ug/g	10	<10	<10	<10	<10	<10	<10
F3 (C16-C34)	ug/g	240	<50	<50	<50	<50	<50	50
F4 (C34-C50)	ug/g	120	<50	<50	<50	<50	<50	<50
Total Hydrocarbons (C6-C50)	ug/g	-	<72	<72	<72	<72	<72	<72
Chrom. to baseline at nC50	No Unit	-	YES	YES	YES	YES	YES	YES
Surrogate: 2-Bromobenzotrifluoride	%	-	86.1	90.0	94.5	91.1	85.0	81.3
Surrogate: 3,4-Dichlorotoluene	%	-	98.3	97.7	93.1	94.0	80.5	113.5

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Organochlorine Pesticides (SOIL)

			L1672015-1	L1672015-2	L1672015-4	L1672015-5	L1672015-6	L1672015-7
ALS ID								
Sampled Date			09-SEP-15	09-SEP-15	08-SEP-15	08-SEP-15	08-SEP-15	08-SEP-15
Sampled Time			-	-	12:00	12:00	12:00	12:00
Sample ID			**BH15-01 SS1**	**BH15-01 SS2**	**BH15-02 SS1**	**BH15-02 SS2**	**BH15-03 SS1**	**BH15-03 SS2**
Analyte	Unit	**Guide Limit						
Aldrin	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
gamma-hexachlorocyclohexane	ug/g	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
a-chlordane	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Chlordane (Total)	ug/g	0.05	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
g-chlordane	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
op-DDD	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
pp-DDD	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Total DDD	ug/g	0.05	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
o,p-DDE	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
pp-DDE	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Total DDE	ug/g	0.05	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
op-DDT	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
pp-DDT	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Total DDT	ug/g	1.4	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
Dieldrin	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Endosulfan I	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Endosulfan II	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Endosulfan (Total)	ug/g	0.04	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
Endrin	ug/g	0.04	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Heptachlor	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Heptachlor Epoxide	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Hexachlorobenzene	ug/g	0.02	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Hexachlorobutadiene	ug/g	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Hexachloroethane	ug/g	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Methoxychlor	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Surrogate: 2-Fluorobiphenyl	%	-	93.8	97.3	94.5	96.7	93.5	96.2
Surrogate: d14-Terphenyl	%	-	98.1	106.8	94.2	99.9	95.3	101.9

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Organochlorine Pesticides (SOIL)

Analyte	Unit	**Guide Limit	ALS ID / Sampled Date / Sampled Time / Sample ID: L1672015-9 / 08-SEP-15 / - / BH15-04 SS1	L1672015-10 / 08-SEP-15 / - / BH15-04 SS2	L1672015-11 / 08-SEP-15 / - / BH15-05 SS1	L1672015-13 / 08-SEP-15 / - / BH15-05 SS3	L1672015-14 / 04-SEP-15 / - / BH15-06 SS1	L1672015-16 / 04-SEP-15 / - / BH15-06 SS3
Aldrin	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
gamma-hexachlorocyclohexane	ug/g	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
a-chlordane	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Chlordane (Total)	ug/g	0.05	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
g-chlordane	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
op-DDD	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
pp-DDD	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Total DDD	ug/g	0.05	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
o,p-DDE	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
pp-DDE	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Total DDE	ug/g	0.05	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
op-DDT	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
pp-DDT	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Total DDT	ug/g	1.4	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
Dieldrin	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Endosulfan I	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Endosulfan II	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Endosulfan (Total)	ug/g	0.04	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
Endrin	ug/g	0.04	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Heptachlor	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Heptachlor Epoxide	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Hexachlorobenzene	ug/g	0.02	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Hexachlorobutadiene	ug/g	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Hexachloroethane	ug/g	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Methoxychlor	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Surrogate: 2-Fluorobiphenyl	%	-	93.8	94.9	99.7	96.9	92.7	97.6
Surrogate: d14-Terphenyl	%	-	99.3	99.0	104.0	101.4	104.7	98.9

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Organochlorine Pesticides (SOIL)

Analyte	Unit	**Guide Limit	ALS ID: L1672015-18 Sampled Date: 04-SEP-15 Sampled Time: - Sample ID: BH15-07 SS1	L1672015-19 04-SEP-15 - BH15-07 SS2	L1672015-21 03-SEP-15 - BH15-08 SS1	L1672015-23 03-SEP-15 - BH15-08 SS3	L1672015-24 03-SEP-15 - BH15-09 SS1	L1672015-26 03-SEP-15 - BH15-09 SS3
Aldrin	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
gamma-hexachlorocyclohexane	ug/g	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
a-chlordane	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Chlordane (Total)	ug/g	0.05	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
g-chlordane	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
op-DDD	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
pp-DDD	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Total DDD	ug/g	0.05	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
o,p-DDE	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
pp-DDE	ug/g	-	0.033	<0.020	<0.020	<0.020	<0.020	<0.020
Total DDE	ug/g	0.05	0.033	<0.028	<0.028	<0.028	<0.028	<0.028
op-DDT	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
pp-DDT	ug/g	-	0.027	<0.020	<0.020	<0.020	<0.020	<0.020
Total DDT	ug/g	1.4	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
Dieldrin	ug/g	0.05	0.063	<0.020	<0.020	<0.020	<0.020	<0.020
Endosulfan I	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.045 DLUI	<0.020
Endosulfan II	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Endosulfan (Total)	ug/g	0.04	<0.028	<0.028	<0.028	<0.028	<0.049	<0.028
Endrin	ug/g	0.04	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Heptachlor	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Heptachlor Epoxide	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Hexachlorobenzene	ug/g	0.02	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Hexachlorobutadiene	ug/g	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Hexachloroethane	ug/g	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Methoxychlor	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Surrogate: 2-Fluorobiphenyl	%	-	93.7	94.7	92.8	89.7	93.4	91.4
Surrogate: d14-Terphenyl	%	-	93.2	94.8	92.2	93.8	89.8	98.1

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Organochlorine Pesticides (SOIL)

	ALS ID	L1672015-28	L1672015-29	L1672015-30	L1672015-32	L1672015-34	L1672015-36
	Sampled Date	03-SEP-15	03-SEP-15	09-SEP-15	09-SEP-15	09-SEP-15	09-SEP-15
	Sampled Time	12:00	12:00	-	-	-	-
	Sample ID	**BH15-10 SS1**	**BH15-10 SS2**	**BH15-12 SS1**	**BH15-12 SS3**	**DUP1**	**DUP3**
Analyte	Unit	**Guide Limit					
Aldrin	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
gamma-hexachlorocyclohexane	ug/g	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
a-chlordane	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Chlordane (Total)	ug/g	0.05	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
g-chlordane	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
op-DDD	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
pp-DDD	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Total DDD	ug/g	0.05	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
o,p-DDE	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
pp-DDE	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Total DDE	ug/g	0.05	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
op-DDT	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
pp-DDT	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Total DDT	ug/g	1.4	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
Dieldrin	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	0.025	<0.020
Endosulfan I	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Endosulfan II	ug/g	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Endosulfan (Total)	ug/g	0.04	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
Endrin	ug/g	0.04	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Heptachlor	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Heptachlor Epoxide	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Hexachlorobenzene	ug/g	0.02	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Hexachlorobutadiene	ug/g	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Hexachloroethane	ug/g	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Methoxychlor	ug/g	0.05	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Surrogate: 2-Fluorobiphenyl	%	-	92.8	100.6	93.1	94.8	95.5	93.4
Surrogate: d14-Terphenyl	%	-	94.3	102.9	99.5	103.3	100.6	93.9

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Ontario Regulation 153/04 - April 15, 2011 Standards - Organochlorine Pesticides (SOIL)

	ALS ID	L1672015-37	L1672015-38
	Sampled Date	09-SEP-15	09-SEP-15
	Sampled Time	-	-
	Sample ID	**DUP4**	**DUP5**
Analyte	Unit	**Guide Limit	
Aldrin	ug/g	0.05	<0.020	<0.020
gamma-hexachlorocyclohexane	ug/g	-	<0.010	<0.010
a-chlordane	ug/g	-	<0.020	<0.020
Chlordane (Total)	ug/g	0.05	<0.028	<0.028
g-chlordane	ug/g	-	<0.020	<0.020
op-DDD	ug/g	-	<0.020	<0.020
pp-DDD	ug/g	-	<0.020	<0.020
Total DDD	ug/g	0.05	<0.028	<0.028
o,p-DDE	ug/g	-	<0.020	<0.020
pp-DDE	ug/g	-	<0.020	<0.020
Total DDE	ug/g	0.05	<0.028	<0.028
op-DDT	ug/g	-	<0.020	<0.020
pp-DDT	ug/g	-	<0.020	<0.020
Total DDT	ug/g	1.4	<0.028	<0.028
Dieldrin	ug/g	0.05	<0.020	<0.020
Endosulfan I	ug/g	-	<0.020	<0.020
Endosulfan II	ug/g	-	<0.020	<0.020
Endosulfan (Total)	ug/g	0.04	<0.028	<0.028
Endrin	ug/g	0.04	<0.020	<0.020
Heptachlor	ug/g	0.05	<0.020	<0.020
Heptachlor Epoxide	ug/g	0.05	<0.020	<0.020
Hexachlorobenzene	ug/g	0.02	<0.010	<0.010
Hexachlorobutadiene	ug/g	0.01	<0.010	<0.010
Hexachloroethane	ug/g	0.01	<0.010	<0.010
Methoxychlor	ug/g	0.05	<0.020	<0.020
Surrogate: 2-Fluorobiphenyl	%	-	93.0	96.9
Surrogate: d14-Terphenyl	%	-	98.2	100.9

**T9-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
Analytical result for this parameter exceeds Guide Limit listed on this report.
* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLUI	Detection Limit Raised: Unknown Interference generated an apparent false positive test result.
SAR:Q	Qualified SAR value: actual SAR is lower but is incalculable due to Na, Ca or Mg below detection limit.

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
B-HWS-R511-WT	Soil	Boron-HWE-O.Reg 153/04 (July 2011)	HW EXTR, EPA 6010B

A dried solid sample is extracted with calcium chloride, the sample undergoes a heating process. After cooling the sample is filtered and analyzed by ICP/OES.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

CHLORDANE-T-CALC-WT	Soil	Chlordane Total sums	CALCULATION

Aqueous sample is extracted by liquid/liquid extraction with a solvent mix. After extraction, a number of clean up techniques may be applied, depending on the sample matrix and analyzed by GC/MS.

CN-WAD-R511-WT	Soil	Cyanide (WAD)-O.Reg 153/04 (July 2011)	MOE 3015/APHA 4500CN I-WAD

The sample is extracted with a strong base for 16 hours, and then filtered. The filtrate is then distilled where the cyanide is converted to cyanogen chloride by reacting with chloramine-T, the cyanogen chloride then reacts with a combination of barbituric acid and isonicotinic acid to form a highly colored complex.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

CR-CR6-IC-WT	Soil	Hexavalent Chromium in Soil	SW846 3060A/7199

This analysis is carried out using procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846, Method 7199, published by the United States Environmental Protection Agency (EPA). The procedure involves analysis for chromium (VI) by ion chromatography using diphenylcarbazide in a sulphuric acid solution.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

DDD-DDE-DDT-CALC-WT	Soil	DDD, DDE, DDT sums	CALCULATION

Aqueous sample is extracted by liquid/liquid extraction with a solvent mix. After extraction, a number of clean up techniques may be applied, depending on the sample matrix and analyzed by GC/MS.

EC-R511-WT	Soil	Conductivity-O.Reg 153/04 (July 2011)	MOEE E3138

A representative subsample is tumbled with de-ionized (DI) water. The ratio of water to soil is 2:1 v/w. After tumbling the sample is then analyzed by a conductivity meter.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

ENDOSULFAN-T-CALC-WT	Soil	Endosulfan Total sums	CALCULATION

Aqueous sample is extracted by liquid/liquid extraction with a solvent mix. After extraction, a number of clean up techniques may be applied, depending on the sample matrix and analyzed by GC/MS.

F1-F4-511-CALC-WT	Soil	F1-F4 Hydrocarbon Calculated Parameters	CCME CWS-PHC, Pub #1310, Dec 2001-S

Analytical methods used for analysis of CCME Petroleum Hydrocarbons have been validated and comply with the Reference Method for the CWS PHC.

Hydrocarbon results are expressed on a dry weight basis.

In cases where results for both F4 and F4G are reported, the greater of the two results must be used in any application of the CWS PHC guidelines and the gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.
In samples where BTEX and F1 were analyzed , F1-BTEX represents a value where the sum of Benzene, Toluene, Ethylbenzene and total Xylenes has been subtracted from F1.

In samples where PAHs, F2 and F3 were analyzed, F2-Naphth represents the result where Naphthalene has been subtracted from F2. F3-PAH represents a result where the sum of Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Dibenzo(a,h)anthracene,

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**

Fluoranthene, Indeno(1,2,3-cd)pyrene, Phenanthrene, and Pyrene has been subtracted from F3.

Unless otherwise qualified, the following quality control criteria have been met for the F1 hydrocarbon range:
1. All extraction and analysis holding times were met.
2. Instrument performance showing response factors for C6 and C10 within 30% of the response factor for toluene.
3. Linearity of gasoline response within 15% throughout the calibration range.

Unless otherwise qualified, the following quality control criteria have been met for the F2-F4 hydrocarbon ranges:
1. All extraction and analysis holding times were met.
2. Instrument performance showing C10, C16 and C34 response factors within 10% of their average.
3. Instrument performance showing the C50 response factor within 30% of the average of the C10, C16 and C34 response factors.
4. Linearity of diesel or motor oil response within 15% throughout the calibration range.

F1-HS-511-WT Soil F1-O.Reg 153/04 (July 2011) E3398/CCME TIER 1-HS

Fraction F1 is determined by extracting a soil or sediment sample as received with methanol, then analyzing by headspace-GC/FID.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

F2-F4-511-WT Soil F2-F4-O.Reg 153/04 (July 2011) MOE DECPH-E3398/CCME TIER 1

Fractions F2, F3 and F4 are determined by extracting a soil sample with a solvent mix. The solvent recovered from the extracted soil sample is dried and treated to remove polar material. The extract is analyzed by GC/FID.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

HG-200.2-CVAA-WT Soil Mercury in Soil by CVAAS EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAAS.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

MET-200.2-CCMS-WT Soil Metals in Soil by CRC ICPMS EPA 200.2/6020A (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CRC ICPMS.

Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may be environmentally available. This method does not dissolve all silicate materials and may result in a partial extraction. depending on the sample matrix, for some metals, including, but not limited to Al, Ba, Be, Cr, Sr, Ti, Tl, and V.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

MOISTURE-WT Soil % Moisture Gravimetric: Oven Dried

PEST-OC-511-WT Soil OC Pesticides-O.Reg 153/04 (July 2011) SW846 8270 (511)

Soil sample is extracted in a solvent, after extraction a number of clean up techniques may be applied, depending on the sample matrix and analyzed by GC/MS.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

PH-R511-WT Soil pH-O.Reg 153/04 (July 2011) MOEE E3137A

A minimum 10g portion of the sample is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil and then analyzed using a pH meter and electrode.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

SAR-R511-WT Soil SAR-O.Reg 153/04 (July 2011) SW846 6010C

A dried, disaggregated solid sample is extracted with deionized water, the aqueous extract is separated from the solid, acidified and then analyzed using a ICP/OES.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
VOC-1,3-DCP-CALC-WT	Soil	Regulation 153 VOCs	SW8260B/SW8270C
VOC-511-HS-WT	Soil	VOC-O.Reg 153/04 (July 2011)	SW846 8260 (511)

Soil and sediment samples are extracted in methanol and analyzed by headspace-GC/MS.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

XYLENES-SUM-CALC-WT	Soil	Sum of Xylene Isomer Concentrations	CALCULATION

Total xylenes represents the sum of o-xylene and m&p-xylene.

**ALS test methods may incorporate modifications from specified reference methods to improve performance.

Chain of Custody numbers:

14-465016 14-465017 14-465018 14-465019

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L1672015 Report Date: 22-SEP-15

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
B-HWS-R511-WT	Soil							
Batch R3267134								
WG2171575-3 DUP		**L1672107-1**						
Boron (B), Hot Water Ext.		0.48	0.47		ug/g	1.1	40	16-SEP-15
WG2171575-2 IRM		**SALINITY_SOIL4**						
Boron (B), Hot Water Ext.			83.0		%		70-130	16-SEP-15
WG2171575-1 MB								
Boron (B), Hot Water Ext.			<0.10		ug/g		0.1	16-SEP-15
WG2171575-4 MS		**L1672107-1**						
Boron (B), Hot Water Ext.			87.2		%		60-140	16-SEP-15
CN-WAD-R511-WT	Soil							
Batch R3267097								
WG2171216-3 DUP		**L1672015-12**						
Cyanide, Weak Acid Diss		<0.050	<0.050	RPD-NA	ug/g	N/A	35	16-SEP-15
WG2171216-2 LCS								
Cyanide, Weak Acid Diss			94.1		%		80-120	16-SEP-15
WG2171216-1 MB								
Cyanide, Weak Acid Diss			<0.050		ug/g		0.05	16-SEP-15
WG2171216-4 MS		**L1672015-12**						
Cyanide, Weak Acid Diss			93.7		%		70-130	16-SEP-15
Batch R3268457								
WG2170709-3 DUP		**L1671979-1**						
Cyanide, Weak Acid Diss		<0.050	<0.050	RPD-NA	ug/g	N/A	35	17-SEP-15
WG2170709-2 LCS								
Cyanide, Weak Acid Diss			100.3		%		80-120	17-SEP-15
WG2170709-1 MB								
Cyanide, Weak Acid Diss			<0.050		ug/g		0.05	17-SEP-15
WG2170709-4 MS		**L1671979-1**						
Cyanide, Weak Acid Diss			91.4		%		70-130	17-SEP-15
CR-CR6-IC-WT	Soil							
Batch R3267157								
WG2171215-4 CRM		**WT-SQC012**						
Chromium, Hexavalent			85.0		%		70-130	16-SEP-15
WG2171215-3 DUP		**L1672015-2**						
Chromium, Hexavalent		<0.20	<0.20	RPD-NA	ug/g	N/A	35	16-SEP-15
WG2171215-2 LCS								
Chromium, Hexavalent			87.8		%		80-120	16-SEP-15
WG2171215-1 MB								
Chromium, Hexavalent			<0.20		ug/g		0.2	16-SEP-15

Quality Control Report

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
EC-R511-WT	Soil							
Batch R3267005								
WG2171578-4 DUP		**WG2171578-3**						
Conductivity		0.0593	0.0681		mS/cm	14	20	16-SEP-15
WG2171760-1 LCS								
Conductivity			98.9		%		90-110	16-SEP-15
WG2171578-1 MB								
Conductivity			<0.0040		mS/cm		0.044	16-SEP-15
F1-HS-511-WT	Soil							
Batch R3266043								
WG2169950-4 DUP		**WG2169950-3**						
F1 (C6-C10)		<5.0	<5.0	RPD-NA	ug/g	N/A	50	15-SEP-15
WG2169950-2 LCS								
F1 (C6-C10)			89.9		%		80-120	15-SEP-15
WG2169950-1 MB								
F1 (C6-C10)			<5.0		ug/g		5	15-SEP-15
Surrogate: 3,4-Dichlorotoluene			82.9		%		60-140	15-SEP-15
WG2169950-7 MS		**WG2169950-6**						
F1 (C6-C10)			96.8		%		60-140	15-SEP-15
Batch R3266448								
WG2170539-4 DUP		**WG2170539-3**						
F1 (C6-C10)		<5.0	<5.0	RPD-NA	ug/g	N/A	50	15-SEP-15
WG2170539-2 LCS								
F1 (C6-C10)			100.4		%		80-120	15-SEP-15
WG2170539-1 MB								
F1 (C6-C10)			<5.0		ug/g		5	15-SEP-15
Surrogate: 3,4-Dichlorotoluene			84.9		%		60-140	15-SEP-15
WG2170539-7 MS		**WG2170539-6**						
F1 (C6-C10)			93.0		%		60-140	15-SEP-15
F2-F4-511-WT	Soil							
Batch R3267561								
WG2170737-3 CRM		**ALS PHC2 IRM**						
F2 (C10-C16)			103.8		%		70-130	16-SEP-15
F3 (C16-C34)			118.4		%		70-130	16-SEP-15
F4 (C34-C50)			123.5		%		70-130	16-SEP-15
WG2170737-5 DUP		**WG2170737-4**						
F2 (C10-C16)		<10	<10	RPD-NA	ug/g	N/A	40	16-SEP-15
F3 (C16-C34)		<50	<50	RPD-NA	ug/g	N/A	40	16-SEP-15
F4 (C34-C50)		<50	<50	RPD-NA	ug/g	N/A	40	16-SEP-15

Quality Control Report

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F2-F4-511-WT	Soil							
Batch R3267561								
WG2170737-2 LCS								
F2 (C10-C16)			93.8		%		80-120	16-SEP-15
F3 (C16-C34)			107.4		%		80-120	16-SEP-15
F4 (C34-C50)			108.6		%		80-120	16-SEP-15
WG2170737-1 MB								
F2 (C10-C16)			<10		ug/g		10	16-SEP-15
F3 (C16-C34)			<50		ug/g		50	16-SEP-15
F4 (C34-C50)			<50		ug/g		50	16-SEP-15
Surrogate: 2-Bromobenzotrifluoride			84.9		%		60-140	16-SEP-15
WG2170737-6 MS		**WG2170737-4**						
F2 (C10-C16)			89.5		%		60-140	16-SEP-15
F3 (C16-C34)			105.3		%		60-140	16-SEP-15
F4 (C34-C50)			110.5		%		60-140	16-SEP-15
Batch R3269040								
WG2169937-3 CRM		**ALS PHC2 IRM**						
F2 (C10-C16)			87.7		%		70-130	16-SEP-15
F3 (C16-C34)			109.2		%		70-130	16-SEP-15
F4 (C34-C50)			111.1		%		70-130	16-SEP-15
WG2169937-8 DUP		**WG2169937-7**						
F2 (C10-C16)		<10	<10	RPD-NA	ug/g	N/A	40	16-SEP-15
F3 (C16-C34)		<50	<50	RPD-NA	ug/g	N/A	40	16-SEP-15
F4 (C34-C50)		<50	<50	RPD-NA	ug/g	N/A	40	16-SEP-15
WG2169937-2 LCS								
F2 (C10-C16)			84.4		%		80-120	16-SEP-15
F3 (C16-C34)			108.3		%		80-120	16-SEP-15
F4 (C34-C50)			113.1		%		80-120	16-SEP-15
WG2169937-1 MB								
F2 (C10-C16)			<10		ug/g		10	16-SEP-15
F3 (C16-C34)			<50		ug/g		50	16-SEP-15
F4 (C34-C50)			<50		ug/g		50	16-SEP-15
Surrogate: 2-Bromobenzotrifluoride			87.0		%		60-140	16-SEP-15
WG2169937-9 MS		**WG2169937-7**						
F2 (C10-C16)			92.9		%		60-140	16-SEP-15
F3 (C16-C34)			111.9		%		60-140	16-SEP-15
F4 (C34-C50)			125.2		%		60-140	16-SEP-15
HG-200.2-CVAA-WT	Soil							

Quality Control Report

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
HG-200.2-CVAA-WT	Soil							
Batch R3267026								
WG2171581-2 CRM		**WT-CANMET-TILL1**						
Mercury (Hg)			90.6		%		70-130	16-SEP-15
WG2171581-6 DUP		**WG2171581-5**						
Mercury (Hg)		<0.0050	<0.0050	RPD-NA	ug/g	N/A	40	16-SEP-15
WG2171581-4 LCS								
Mercury (Hg)			96.6		%		80-120	16-SEP-15
WG2171581-1 MB								
Mercury (Hg)			<0.0050		mg/kg		0.005	16-SEP-15
MET-200.2-CCMS-WT	Soil							
Batch R3268559								
WG2171581-2 CRM		**WT-CANMET-TILL1**						
Antimony (Sb)			114.6		%		70-130	16-SEP-15
Arsenic (As)			119.7		%		70-130	16-SEP-15
Barium (Ba)			122.1		%		70-130	16-SEP-15
Beryllium (Be)			113.2		%		70-130	16-SEP-15
Cadmium (Cd)			116.3		%		70-130	16-SEP-15
Chromium (Cr)			122.6		%		70-130	16-SEP-15
Cobalt (Co)			117.4		%		70-130	16-SEP-15
Copper (Cu)			113.9		%		70-130	16-SEP-15
Lead (Pb)			107.1		%		70-130	16-SEP-15
Molybdenum (Mo)			109.6		%		70-130	16-SEP-15
Nickel (Ni)			117.5		%		70-130	16-SEP-15
Selenium (Se)			102.6		%		70-130	16-SEP-15
Silver (Ag)			118.2		%		70-130	16-SEP-15
Thallium (Tl)			121.1		%		70-130	16-SEP-15
Uranium (U)			129.8		%		70-130	16-SEP-15
Vanadium (V)			125.1		%		70-130	16-SEP-15
Zinc (Zn)			115.8		%		70-130	16-SEP-15
WG2171581-6 DUP		**WG2171581-5**						
Antimony (Sb)		<0.10	<0.10	RPD-NA	ug/g	N/A	30	16-SEP-15
Arsenic (As)		0.62	0.51		ug/g	21	30	16-SEP-15
Barium (Ba)		8.83	7.28		ug/g	19	40	16-SEP-15
Beryllium (Be)		<0.10	<0.10	RPD-NA	ug/g	N/A	30	16-SEP-15
Boron (B)		<5.0	<5.0	RPD-NA	ug/g	N/A	30	16-SEP-15
Cadmium (Cd)		<0.020	<0.020	RPD-NA	ug/g	N/A	30	16-SEP-15

Quality Control Report

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	Soil							
Batch R3268559								
WG2171581-6 DUP		**WG2171581-5**						
Chromium (Cr)		5.09	4.05		ug/g	23	30	16-SEP-15
Cobalt (Co)		1.30	1.14		ug/g	13	30	16-SEP-15
Copper (Cu)		1.13	1.01		ug/g	11	30	16-SEP-15
Lead (Pb)		1.18	0.77	J	ug/g	0.41	1	16-SEP-15
Molybdenum (Mo)		0.14	<0.10	RPD-NA	ug/g	N/A	40	16-SEP-15
Nickel (Ni)		3.65	3.10		ug/g	16	30	16-SEP-15
Selenium (Se)		<0.20	<0.20	RPD-NA	ug/g	N/A	30	16-SEP-15
Silver (Ag)		<0.10	<0.10	RPD-NA	ug/g	N/A	40	16-SEP-15
Thallium (Tl)		<0.050	<0.050	RPD-NA	ug/g	N/A	30	16-SEP-15
Uranium (U)		0.453	0.309	DUP-H	ug/g	38	30	16-SEP-15
Vanadium (V)		14.1	11.0		ug/g	25	30	16-SEP-15
Zinc (Zn)		4.8	4.4		ug/g	7.9	30	16-SEP-15
WG2171581-3 LCS								
Antimony (Sb)			115.3		%		80-120	16-SEP-15
Arsenic (As)			109.6		%		80-120	16-SEP-15
Barium (Ba)			111.5		%		80-120	16-SEP-15
Beryllium (Be)			110.7		%		80-120	16-SEP-15
Boron (B)			104.2		%		80-120	16-SEP-15
Cadmium (Cd)			113.7		%		80-120	16-SEP-15
Chromium (Cr)			107.7		%		80-120	16-SEP-15
Cobalt (Co)			108.4		%		80-120	16-SEP-15
Copper (Cu)			106.3		%		80-120	16-SEP-15
Lead (Pb)			111.3		%		80-120	16-SEP-15
Molybdenum (Mo)			112.5		%		80-120	16-SEP-15
Nickel (Ni)			107.0		%		80-120	16-SEP-15
Selenium (Se)			108.4		%		80-120	16-SEP-15
Silver (Ag)			116.4		%		80-120	16-SEP-15
Thallium (Tl)			114.3		%		80-120	16-SEP-15
Uranium (U)			113.6		%		80-120	16-SEP-15
Vanadium (V)			110.4		%		80-120	16-SEP-15
Zinc (Zn)			103.7		%		80-120	16-SEP-15
WG2171581-1 MB								
Antimony (Sb)			<0.10		mg/kg		0.1	16-SEP-15
Arsenic (As)			<0.10				0.1	

Quality Control Report

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	Soil							
Batch R3268559								
WG2171581-1 MB								
Arsenic (As)			<0.10		mg/kg		0.1	16-SEP-15
Barium (Ba)			<0.50		mg/kg		0.5	16-SEP-15
Beryllium (Be)			<0.10		mg/kg		0.1	16-SEP-15
Boron (B)			<5.0		mg/kg		5	16-SEP-15
Cadmium (Cd)			<0.020		mg/kg		0.02	16-SEP-15
Chromium (Cr)			<0.50		mg/kg		0.5	16-SEP-15
Cobalt (Co)			<0.10		mg/kg		0.1	16-SEP-15
Copper (Cu)			<0.50		mg/kg		0.5	16-SEP-15
Lead (Pb)			<0.50		mg/kg		0.5	16-SEP-15
Molybdenum (Mo)			<0.10		mg/kg		0.1	16-SEP-15
Nickel (Ni)			<0.50		mg/kg		0.5	16-SEP-15
Selenium (Se)			<0.20		mg/kg		0.2	16-SEP-15
Silver (Ag)			<0.10		mg/kg		0.1	16-SEP-15
Thallium (Tl)			<0.050		mg/kg		0.05	16-SEP-15
Uranium (U)			<0.050		mg/kg		0.05	16-SEP-15
Vanadium (V)			<0.20		mg/kg		0.2	16-SEP-15
Zinc (Zn)			<2.0		mg/kg		2	16-SEP-15
MOISTURE-WT	Soil							
Batch R3265992								
WG2170362-3 DUP		**L1672015-8**						
% Moisture		19.7	19.3		%	2.2	20	15-SEP-15
WG2170362-2 LCS								
% Moisture			97.2		%		90-110	15-SEP-15
WG2170362-1 MB								
% Moisture			<0.10		%		0.1	15-SEP-15
Batch R3266783								
WG2170782-3 DUP		**L1672015-25**						
% Moisture		17.3	17.8		%	2.8	20	16-SEP-15
WG2170782-2 LCS								
% Moisture			104.1		%		90-110	16-SEP-15
WG2170782-1 MB								
% Moisture			<0.10		%		0.1	16-SEP-15

Quality Control Report

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MOISTURE-WT	Soil							
Batch R3266786								
WG2170740-3 DUP		**L1672015-27**						
% Moisture		21.4	21.5		%	0.8	20	16-SEP-15
WG2170740-2 LCS								
% Moisture			102.0		%		90-110	16-SEP-15
WG2170740-1 MB								
% Moisture			<0.10		%		0.1	16-SEP-15
Batch R3266788								
WG2171157-3 DUP		**L1672015-1**						
% Moisture		17.0	16.3		%	3.8	20	16-SEP-15
WG2171157-2 LCS								
% Moisture			96.2		%		90-110	16-SEP-15
WG2171157-1 MB								
% Moisture			<0.10		%		0.1	16-SEP-15
Batch R3271950								
WG2175261-2 LCS								
% Moisture			95.7		%		90-110	22-SEP-15
WG2175261-1 MB								
% Moisture			<0.10		%		0.1	22-SEP-15
PEST-OC-511-WT	Soil							
Batch R3269371								
WG2170719-4 DUP		**WG2170719-3**						
Aldrin		<0.020	<0.020	RPD-NA	ug/g	N/A	40	18-SEP-15
a-chlordane		<0.020	<0.020	RPD-NA	ug/g	N/A	40	18-SEP-15
g-chlordane		<0.020	<0.020	RPD-NA	ug/g	N/A	40	18-SEP-15
op-DDD		<0.020	<0.020	RPD-NA	ug/g	N/A	40	18-SEP-15
pp-DDD		<0.020	<0.020	RPD-NA	ug/g	N/A	40	18-SEP-15
o,p-DDE		<0.020	<0.020	RPD-NA	ug/g	N/A	40	18-SEP-15
pp-DDE		<0.020	<0.020	RPD-NA	ug/g	N/A	40	18-SEP-15
op-DDT		<0.020	<0.020	RPD-NA	ug/g	N/A	40	18-SEP-15
pp-DDT		<0.020	<0.020	RPD-NA	ug/g	N/A	40	18-SEP-15
Dieldrin		<0.020	<0.020	RPD-NA	ug/g	N/A	40	18-SEP-15
Endosulfan I		<0.020	<0.020	RPD-NA	ug/g	N/A	40	18-SEP-15
Endosulfan II		<0.020	<0.020	RPD-NA	ug/g	N/A	40	18-SEP-15
Endrin		<0.020	<0.020	RPD-NA	ug/g	N/A	40	18-SEP-15
gamma-hexachlorocyclohexane		<0.010	<0.010	RPD-NA	ug/g	N/A	40	18-SEP-15
Heptachlor		<0.020	<0.020	RPD-NA	ug/g	N/A	40	18-SEP-15

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
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Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PEST-OC-511-WT	Soil							
Batch R3269371								
WG2170719-4 DUP		**WG2170719-3**						
Heptachlor Epoxide		<0.020	<0.020	RPD-NA	ug/g	N/A	40	18-SEP-15
Hexachlorobenzene		<0.010	<0.010	RPD-NA	ug/g	N/A	40	18-SEP-15
Hexachlorobutadiene		<0.010	<0.010	RPD-NA	ug/g	N/A	40	18-SEP-15
Hexachloroethane		<0.010	<0.010	RPD-NA	ug/g	N/A	40	18-SEP-15
Methoxychlor		<0.020	<0.020	RPD-NA	ug/g	N/A	40	18-SEP-15
WG2170719-2 LCS								
Aldrin			106.1		%		50-140	18-SEP-15
a-chlordane			98.0		%		50-140	18-SEP-15
g-chlordane			101.1		%		50-140	18-SEP-15
op-DDD			88.4		%		50-140	18-SEP-15
pp-DDD			87.4		%		50-140	18-SEP-15
o,p-DDE			91.2		%		50-140	18-SEP-15
pp-DDE			89.1		%		50-140	18-SEP-15
op-DDT			100.6		%		50-140	18-SEP-15
pp-DDT			96.4		%		50-140	18-SEP-15
Dieldrin			91.8		%		50-140	18-SEP-15
Endosulfan I			94.2		%		50-140	18-SEP-15
Endosulfan II			96.6		%		50-140	18-SEP-15
Endrin			89.0		%		50-140	18-SEP-15
gamma-hexachlorocyclohexane			90.5		%		50-140	18-SEP-15
Heptachlor			91.2		%		50-140	18-SEP-15
Heptachlor Epoxide			93.9		%		50-140	18-SEP-15
Hexachlorobenzene			88.2		%		50-140	18-SEP-15
Hexachlorobutadiene			93.2		%		50-140	18-SEP-15
Hexachloroethane			90.9		%		50-140	18-SEP-15
Methoxychlor			87.4		%		50-140	18-SEP-15
WG2170719-1 MB								
Aldrin			<0.020		ug/g		0.02	18-SEP-15
a-chlordane			<0.020		ug/g		0.02	18-SEP-15
g-chlordane			<0.020		ug/g		0.02	18-SEP-15
op-DDD			<0.020		ug/g		0.02	18-SEP-15
pp-DDD			<0.020		ug/g		0.02	18-SEP-15
o,p-DDE			<0.020		ug/g		0.02	18-SEP-15
pp-DDE			<0.020		ug/g		0.02	18-SEP-15

Quality Control Report

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PEST-OC-511-WT	Soil							
Batch	**R3269371**							
WG2170719-1	**MB**							
op-DDT			<0.020		ug/g		0.02	18-SEP-15
pp-DDT			<0.020		ug/g		0.02	18-SEP-15
Dieldrin			<0.020		ug/g		0.02	18-SEP-15
Endosulfan I			<0.020		ug/g		0.02	18-SEP-15
Endosulfan II			<0.020		ug/g		0.02	18-SEP-15
Endrin			<0.020		ug/g		0.02	18-SEP-15
gamma-hexachlorocyclohexane			<0.010		ug/g		0.01	18-SEP-15
Heptachlor			<0.020		ug/g		0.02	18-SEP-15
Heptachlor Epoxide			<0.020		ug/g		0.02	18-SEP-15
Hexachlorobenzene			<0.010		ug/g		0.01	18-SEP-15
Hexachlorobutadiene			<0.010		ug/g		0.01	18-SEP-15
Hexachloroethane			<0.010		ug/g		0.01	18-SEP-15
Methoxychlor			<0.020		ug/g		0.02	18-SEP-15
Surrogate: 2-Fluorobiphenyl			101.0		%		50-140	18-SEP-15
Surrogate: d14-Terphenyl			101.9		%		50-140	18-SEP-15
WG2170719-5	**MS**	**WG2170719-3**						
Aldrin			101.0		%		50-140	18-SEP-15
a-chlordane			101.3		%		50-140	18-SEP-15
g-chlordane			111.9		%		50-140	18-SEP-15
op-DDD			96.7		%		50-140	18-SEP-15
pp-DDD			94.6		%		50-140	18-SEP-15
o,p-DDE			102.4		%		50-140	18-SEP-15
pp-DDE			97.8		%		50-140	18-SEP-15
op-DDT			110.1		%		50-140	18-SEP-15
pp-DDT			104.0		%		50-140	18-SEP-15
Dieldrin			92.2		%		50-140	18-SEP-15
Endosulfan I			98.1		%		50-140	18-SEP-15
Endosulfan II			90.3		%		50-140	18-SEP-15
Endrin			106.8		%		50-150	18-SEP-15
gamma-hexachlorocyclohexane			87.6		%		50-140	18-SEP-15
Heptachlor			95.8		%		50-140	18-SEP-15
Heptachlor Epoxide			99.7		%		50-140	18-SEP-15
Hexachlorobenzene			86.5		%		50-140	18-SEP-15
Hexachlorobutadiene			93.3		%		50-140	18-SEP-15

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PEST-OC-511-WT	Soil							
Batch R3269371								
WG2170719-5 MS		WG2170719-3						
Hexachloroethane			91.3		%		50-140	18-SEP-15
Methoxychlor			95.3		%		50-140	18-SEP-15
Batch R3270747								
WG2170866-4 DUP		WG2170866-3						
Aldrin		<0.020	<0.020	RPD-NA	ug/g	N/A	40	21-SEP-15
a-chlordane		<0.020	<0.020	RPD-NA	ug/g	N/A	40	21-SEP-15
g-chlordane		<0.020	<0.020	RPD-NA	ug/g	N/A	40	21-SEP-15
op-DDD		<0.020	<0.020	RPD-NA	ug/g	N/A	40	21-SEP-15
pp-DDD		<0.020	<0.020	RPD-NA	ug/g	N/A	40	21-SEP-15
o,p-DDE		<0.020	<0.020	RPD-NA	ug/g	N/A	40	21-SEP-15
pp-DDE		<0.020	<0.020	RPD-NA	ug/g	N/A	40	21-SEP-15
op-DDT		<0.020	<0.020	RPD-NA	ug/g	N/A	40	21-SEP-15
pp-DDT		<0.020	<0.020	RPD-NA	ug/g	N/A	40	21-SEP-15
Dieldrin		<0.020	<0.020	RPD-NA	ug/g	N/A	40	21-SEP-15
Endosulfan I		<0.020	<0.020	RPD-NA	ug/g	N/A	40	21-SEP-15
Endosulfan II		<0.020	<0.020	RPD-NA	ug/g	N/A	40	21-SEP-15
Endrin		<0.020	<0.020	RPD-NA	ug/g	N/A	40	21-SEP-15
gamma-hexachlorocyclohexane		<0.010	<0.010	RPD-NA	ug/g	N/A	40	21-SEP-15
Heptachlor		<0.020	<0.020	RPD-NA	ug/g	N/A	40	21-SEP-15
Heptachlor Epoxide		<0.020	<0.020	RPD-NA	ug/g	N/A	40	21-SEP-15
Hexachlorobenzene		<0.010	<0.010	RPD-NA	ug/g	N/A	40	21-SEP-15
Hexachlorobutadiene		<0.010	<0.010	RPD-NA	ug/g	N/A	40	21-SEP-15
Hexachloroethane		<0.010	<0.010	RPD-NA	ug/g	N/A	40	21-SEP-15
Methoxychlor		<0.020	<0.020	RPD-NA	ug/g	N/A	40	21-SEP-15
WG2170866-2 LCS								
Aldrin			95.4		%		50-140	21-SEP-15
a-chlordane			97.2		%		50-140	21-SEP-15
g-chlordane			101.1		%		50-140	21-SEP-15
op-DDD			90.6		%		50-140	21-SEP-15
pp-DDD			93.6		%		50-140	21-SEP-15
o,p-DDE			86.4		%		50-140	21-SEP-15
pp-DDE			92.9		%		50-140	21-SEP-15
op-DDT			98.5		%		50-140	21-SEP-15

Quality Control Report

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PEST-OC-511-WT	Soil							
Batch	**R3270747**							
WG2170866-2	**LCS**							
pp-DDT			95.7		%		50-140	21-SEP-15
Dieldrin			87.4		%		50-140	21-SEP-15
Endosulfan I			89.0		%		50-140	21-SEP-15
Endosulfan II			92.4		%		50-140	21-SEP-15
Endrin			122.0		%		50-140	21-SEP-15
gamma-hexachlorocyclohexane			92.6		%		50-140	21-SEP-15
Heptachlor			92.7		%		50-140	21-SEP-15
Heptachlor Epoxide			95.7		%		50-140	21-SEP-15
Hexachlorobenzene			89.9		%		50-140	21-SEP-15
Hexachlorobutadiene			95.7		%		50-140	21-SEP-15
Hexachloroethane			95.2		%		50-140	21-SEP-15
Methoxychlor			101.0		%		50-140	21-SEP-15
WG2170866-1	**MB**							
Aldrin			<0.020		ug/g		0.02	21-SEP-15
a-chlordane			<0.020		ug/g		0.02	21-SEP-15
g-chlordane			<0.020		ug/g		0.02	21-SEP-15
op-DDD			<0.020		ug/g		0.02	21-SEP-15
pp-DDD			<0.020		ug/g		0.02	21-SEP-15
o,p-DDE			<0.020		ug/g		0.02	21-SEP-15
pp-DDE			<0.020		ug/g		0.02	21-SEP-15
op-DDT			<0.020		ug/g		0.02	21-SEP-15
pp-DDT			<0.020		ug/g		0.02	21-SEP-15
Dieldrin			<0.020		ug/g		0.02	21-SEP-15
Endosulfan I			<0.020		ug/g		0.02	21-SEP-15
Endosulfan II			<0.020		ug/g		0.02	21-SEP-15
Endrin			<0.020		ug/g		0.02	21-SEP-15
gamma-hexachlorocyclohexane			<0.010		ug/g		0.01	21-SEP-15
Heptachlor			<0.020		ug/g		0.02	21-SEP-15
Heptachlor Epoxide			<0.020		ug/g		0.02	21-SEP-15
Hexachlorobenzene			<0.010		ug/g		0.01	21-SEP-15
Hexachlorobutadiene			<0.010		ug/g		0.01	21-SEP-15
Hexachloroethane			<0.010		ug/g		0.01	21-SEP-15
Methoxychlor			<0.020		ug/g		0.02	21-SEP-15
Surrogate: 2-Fluorobiphenyl			91.9		%		50-140	21-SEP-15

Quality Control Report

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PEST-OC-511-WT	Soil							
Batch R3270747								
WG2170866-1 MB								
Surrogate: d14-Terphenyl			93.1		%		50-140	21-SEP-15
WG2170866-5 MS		**WG2170866-3**						
Aldrin			94.6		%		50-140	21-SEP-15
a-chlordane			96.5		%		50-140	21-SEP-15
g-chlordane			101.8		%		50-140	21-SEP-15
op-DDD			92.8		%		50-140	21-SEP-15
pp-DDD			96.8		%		50-140	21-SEP-15
o,p-DDE			89.7		%		50-140	21-SEP-15
pp-DDE			94.7		%		50-140	21-SEP-15
op-DDT			92.1		%		50-140	21-SEP-15
pp-DDT			89.4		%		50-140	21-SEP-15
Dieldrin			94.1		%		50-140	21-SEP-15
Endosulfan I			80.8		%		50-140	21-SEP-15
Endosulfan II			97.3		%		50-140	21-SEP-15
Endrin			107.2		%		50-150	21-SEP-15
gamma-hexachlorocyclohexane			87.7		%		50-140	21-SEP-15
Heptachlor			82.4		%		50-140	21-SEP-15
Heptachlor Epoxide			97.7		%		50-140	21-SEP-15
Hexachlorobenzene			83.8		%		50-140	21-SEP-15
Hexachlorobutadiene			88.1		%		50-140	21-SEP-15
Hexachloroethane			86.0		%		50-140	21-SEP-15
Methoxychlor			93.8		%		50-140	21-SEP-15
PH-R511-WT	Soil							
Batch R3267065								
WG2171079-1 DUP		**L1672015-2**						
pH		7.96	7.95	J	pH units	0.01	0.3	16-SEP-15
WG2171755-2 LCS								
pH			7.05		pH units		6.7-7.3	16-SEP-15
Batch R3269545								
WG2171253-1 DUP		**L1672015-10**						
pH		7.67	7.70	J	pH units	0.03	0.3	18-SEP-15
WG2173681-1 LCS								
pH			6.97		pH units		6.7-7.3	18-SEP-15
SAR-R511-WT	Soil							

Quality Control Report

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SAR-R511-WT	Soil							
Batch R3267169								
WG2171578-4 DUP		**WG2171578-3**						
Calcium (Ca)		20.1	18.4		mg/L	8.6	40	16-SEP-15
Sodium (Na)		<1.0	<1.0	RPD-NA	mg/L	N/A	40	16-SEP-15
Magnesium (Mg)		<1.0	<1.0	RPD-NA	mg/L	N/A	40	16-SEP-15
WG2171578-2 IRM		**WT SAR1**						
Calcium (Ca)			97.0		%		70-130	16-SEP-15
Sodium (Na)			98.5		%		70-130	16-SEP-15
Magnesium (Mg)			95.6		%		70-130	16-SEP-15
WG2171578-1 MB								
Calcium (Ca)			<1.0		mg/L		1	16-SEP-15
Sodium (Na)			<1.0		mg/L		1	16-SEP-15
Magnesium (Mg)			<1.0		mg/L		1	16-SEP-15
VOC-511-HS-WT	Soil							
Batch R3266043								
WG2169950-4 DUP		**WG2169950-3**						
1,1,1,2-Tetrachloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
1,1,2,2-Tetrachloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
1,1,1-Trichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
1,1,2-Trichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
1,1-Dichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
1,1-Dichloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
1,2-Dibromoethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
1,2-Dichlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
1,2-Dichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
1,2-Dichloropropane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
1,3-Dichlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
1,4-Dichlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
Acetone		<0.50	<0.50	RPD-NA	ug/g	N/A	40	17-SEP-15
Benzene		<0.0068	<0.0068	RPD-NA	ug/g	N/A	40	17-SEP-15
Bromodichloromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
Bromoform		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
Bromomethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
Carbon tetrachloride		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
Chlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15

Quality Control Report

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	Soil							
Batch R3266043								
WG2169950-4 DUP		**WG2169950-3**						
Chloroform		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
cis-1,2-Dichloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
cis-1,3-Dichloropropene		<0.030	<0.030	RPD-NA	ug/g	N/A	40	17-SEP-15
Dibromochloromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
Dichlorodifluoromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
Ethylbenzene		<0.018	<0.018	RPD-NA	ug/g	N/A	40	17-SEP-15
n-Hexane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
Methylene Chloride		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
MTBE		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
m+p-Xylenes		<0.030	<0.030	RPD-NA	ug/g	N/A	40	17-SEP-15
Methyl Ethyl Ketone		<0.50	<0.50	RPD-NA	ug/g	N/A	40	17-SEP-15
Methyl Isobutyl Ketone		<0.50	<0.50	RPD-NA	ug/g	N/A	40	17-SEP-15
o-Xylene		<0.020	<0.020	RPD-NA	ug/g	N/A	40	17-SEP-15
Styrene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
Tetrachloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
Toluene		<0.080	<0.080	RPD-NA	ug/g	N/A	40	17-SEP-15
trans-1,2-Dichloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
trans-1,3-Dichloropropene		<0.030	<0.030	RPD-NA	ug/g	N/A	40	17-SEP-15
Trichloroethylene		0.032	0.033		ug/g	3.5	40	17-SEP-15
Trichlorofluoromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	17-SEP-15
Vinyl chloride		<0.020	<0.020	RPD-NA	ug/g	N/A	40	17-SEP-15
WG2169950-2 LCS								
1,1,1,2-Tetrachloroethane			96.3		%		60-130	15-SEP-15
1,1,2,2-Tetrachloroethane			99.5		%		60-130	15-SEP-15
1,1,1-Trichloroethane			98.3		%		60-130	15-SEP-15
1,1,2-Trichloroethane			98.8		%		60-130	15-SEP-15
1,1-Dichloroethane			96.9		%		60-130	15-SEP-15
1,1-Dichloroethylene			91.0		%		60-130	15-SEP-15
1,2-Dibromoethane			97.4		%		70-130	15-SEP-15
1,2-Dichlorobenzene			100.6		%		70-130	15-SEP-15
1,2-Dichloroethane			98.3		%		60-130	15-SEP-15
1,2-Dichloropropane			99.5		%		70-130	15-SEP-15
1,3-Dichlorobenzene			98.9		%		70-130	15-SEP-15

Quality Control Report

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	Soil							
Batch R3266043								
WG2169950-2 LCS								
1,4-Dichlorobenzene			101.9		%		70-130	15-SEP-15
Acetone			115.0		%		60-140	15-SEP-15
Benzene			98.7		%		70-130	15-SEP-15
Bromodichloromethane			96.1		%		50-140	15-SEP-15
Bromoform			96.6		%		70-130	15-SEP-15
Bromomethane			85.7		%		50-140	15-SEP-15
Carbon tetrachloride			96.2		%		70-130	15-SEP-15
Chlorobenzene			99.2		%		70-130	15-SEP-15
Chloroform			98.9		%		70-130	15-SEP-15
cis-1,2-Dichloroethylene			98.1		%		70-130	15-SEP-15
cis-1,3-Dichloropropene			97.1		%		70-130	15-SEP-15
Dibromochloromethane			100.9		%		60-130	15-SEP-15
Dichlorodifluoromethane			49.5	MES	%		50-140	15-SEP-15
Ethylbenzene			93.4		%		70-130	15-SEP-15
n-Hexane			100.2		%		70-130	15-SEP-15
Methylene Chloride			98.8		%		70-130	15-SEP-15
MTBE			95.8		%		70-130	15-SEP-15
m+p-Xylenes			95.4		%		70-130	15-SEP-15
Methyl Ethyl Ketone			110.7		%		60-140	15-SEP-15
Methyl Isobutyl Ketone			104.1		%		60-140	15-SEP-15
o-Xylene			93.7		%		70-130	15-SEP-15
Styrene			93.4		%		70-130	15-SEP-15
Tetrachloroethylene			95.6		%		60-130	15-SEP-15
Toluene			96.1		%		70-130	15-SEP-15
trans-1,2-Dichloroethylene			98.3		%		60-130	15-SEP-15
trans-1,3-Dichloropropene			93.2		%		70-130	15-SEP-15
Trichloroethylene			97.0		%		60-130	15-SEP-15
Trichlorofluoromethane			91.5		%		50-140	15-SEP-15
Vinyl chloride			77.3		%		60-140	15-SEP-15
WG2169950-1 MB								
1,1,1,2-Tetrachloroethane			<0.050		ug/g		0.05	15-SEP-15
1,1,2,2-Tetrachloroethane			<0.050		ug/g		0.05	15-SEP-15
1,1,1-Trichloroethane			<0.050		ug/g		0.05	15-SEP-15
1,1,2-Trichloroethane			<0.050		ug/g		0.05	15-SEP-15

Quality Control Report

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	Soil							
Batch R3266043								
WG2169950-1 MB								
1,1-Dichloroethane			<0.050		ug/g		0.05	15-SEP-15
1,1-Dichloroethylene			<0.050		ug/g		0.05	15-SEP-15
1,2-Dibromoethane			<0.050		ug/g		0.05	15-SEP-15
1,2-Dichlorobenzene			<0.050		ug/g		0.05	15-SEP-15
1,2-Dichloroethane			<0.050		ug/g		0.05	15-SEP-15
1,2-Dichloropropane			<0.050		ug/g		0.05	15-SEP-15
1,3-Dichlorobenzene			<0.050		ug/g		0.05	15-SEP-15
1,4-Dichlorobenzene			<0.050		ug/g		0.05	15-SEP-15
Acetone			<0.50		ug/g		0.5	15-SEP-15
Benzene			<0.0068		ug/g		0.0068	15-SEP-15
Bromodichloromethane			<0.050		ug/g		0.05	15-SEP-15
Bromoform			<0.050		ug/g		0.05	15-SEP-15
Bromomethane			<0.050		ug/g		0.05	15-SEP-15
Carbon tetrachloride			<0.050		ug/g		0.05	15-SEP-15
Chlorobenzene			<0.050		ug/g		0.05	15-SEP-15
Chloroform			<0.050		ug/g		0.05	15-SEP-15
cis-1,2-Dichloroethylene			<0.050		ug/g		0.05	15-SEP-15
cis-1,3-Dichloropropene			<0.030		ug/g		0.03	15-SEP-15
Dibromochloromethane			<0.050		ug/g		0.05	15-SEP-15
Dichlorodifluoromethane			<0.050		ug/g		0.05	15-SEP-15
Ethylbenzene			<0.018		ug/g		0.018	15-SEP-15
n-Hexane			<0.050		ug/g		0.05	15-SEP-15
Methylene Chloride			<0.050		ug/g		0.05	15-SEP-15
MTBE			<0.050		ug/g		0.05	15-SEP-15
m+p-Xylenes			<0.030		ug/g		0.03	15-SEP-15
Methyl Ethyl Ketone			<0.50		ug/g		0.5	15-SEP-15
Methyl Isobutyl Ketone			<0.50		ug/g		0.5	15-SEP-15
o-Xylene			<0.020		ug/g		0.02	15-SEP-15
Styrene			<0.050		ug/g		0.05	15-SEP-15
Tetrachloroethylene			<0.050		ug/g		0.05	15-SEP-15
Toluene			<0.080		ug/g		0.08	15-SEP-15
trans-1,2-Dichloroethylene			<0.050		ug/g		0.05	15-SEP-15
trans-1,3-Dichloropropene			<0.030		ug/g		0.03	15-SEP-15

Quality Control Report

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	Soil							
Batch	**R3266043**							
WG2169950-1	**MB**							
Trichloroethylene			<0.010		ug/g		0.01	15-SEP-15
Trichlorofluoromethane			<0.050		ug/g		0.05	15-SEP-15
Vinyl chloride			<0.020		ug/g		0.02	15-SEP-15
Surrogate: 1,4-Difluorobenzene			106.6		%		70-130	15-SEP-15
Surrogate: 4-Bromofluorobenzene			103.3		%		70-130	15-SEP-15
WG2169950-5	**MS**	**WG2169950-3**						
1,1,1,2-Tetrachloroethane			104.1		%		50-140	17-SEP-15
1,1,2,2-Tetrachloroethane			106.5		%		50-140	17-SEP-15
1,1,1-Trichloroethane			102.9		%		50-140	17-SEP-15
1,1,2-Trichloroethane			109.3		%		50-140	17-SEP-15
1,1-Dichloroethane			102.5		%		50-140	17-SEP-15
1,1-Dichloroethylene			94.4		%		50-140	17-SEP-15
1,2-Dibromoethane			105.1		%		50-140	17-SEP-15
1,2-Dichlorobenzene			98.2		%		50-140	17-SEP-15
1,2-Dichloroethane			101.9		%		50-140	17-SEP-15
1,2-Dichloropropane			102.7		%		50-140	17-SEP-15
1,3-Dichlorobenzene			92.9		%		50-140	17-SEP-15
1,4-Dichlorobenzene			95.5		%		50-140	17-SEP-15
Acetone			126.7		%		50-140	17-SEP-15
Benzene			103.2		%		50-140	17-SEP-15
Bromodichloromethane			104.0		%		50-140	17-SEP-15
Bromoform			101.9		%		50-140	17-SEP-15
Bromomethane			86.9		%		50-140	17-SEP-15
Carbon tetrachloride			99.5		%		50-140	17-SEP-15
Chlorobenzene			101.7		%		50-140	17-SEP-15
Chloroform			103.9		%		50-140	17-SEP-15
cis-1,2-Dichloroethylene			100.4		%		50-140	17-SEP-15
cis-1,3-Dichloropropene			89.1		%		50-140	17-SEP-15
Dibromochloromethane			108.5		%		50-140	17-SEP-15
Dichlorodifluoromethane			44.6	MES	%		50-140	17-SEP-15
Ethylbenzene			92.0		%		50-140	17-SEP-15
n-Hexane			103.2		%		50-140	17-SEP-15
Methylene Chloride			104.8		%		50-140	17-SEP-15
MTBE			97.3		%		50-140	17-SEP-15

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	Soil							
Batch R3266043								
WG2169950-5 MS		**WG2169950-3**						
m+p-Xylenes			94.3		%		50-140	17-SEP-15
Methyl Ethyl Ketone			102.1		%		50-140	17-SEP-15
Methyl Isobutyl Ketone			95.3		%		50-140	17-SEP-15
o-Xylene			91.9		%		50-140	17-SEP-15
Styrene			87.5		%		50-140	17-SEP-15
Tetrachloroethylene			94.7		%		50-140	17-SEP-15
Toluene			95.5		%		50-140	17-SEP-15
trans-1,2-Dichloroethylene			102.6		%		50-140	17-SEP-15
trans-1,3-Dichloropropene			87.4		%		50-140	17-SEP-15
Trichloroethylene			98.2		%		50-140	17-SEP-15
Trichlorofluoromethane			95.4		%		50-140	17-SEP-15
Vinyl chloride			78.9		%		50-140	17-SEP-15
Batch R3266448								
WG2170539-4 DUP		**WG2170539-3**						
1,1,1,2-Tetrachloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
1,1,2,2-Tetrachloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
1,1,1-Trichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
1,1,2-Trichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
1,1-Dichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
1,1-Dichloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
1,2-Dibromoethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
1,2-Dichlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
1,2-Dichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
1,2-Dichloropropane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
1,3-Dichlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
1,4-Dichlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
Acetone		<0.50	<0.50	RPD-NA	ug/g	N/A	40	15-SEP-15
Benzene		<0.020	<0.0068	RPD-NA	ug/g	N/A	40	15-SEP-15
Bromodichloromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
Bromoform		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
Bromomethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
Carbon tetrachloride		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
Chlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15

Quality Control Report

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	Soil							
Batch R3266448								
WG2170539-4 DUP		**WG2170539-3**						
Chloroform		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
cis-1,2-Dichloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
cis-1,3-Dichloropropene		<0.030	<0.030	RPD-NA	ug/g	N/A	40	15-SEP-15
Dibromochloromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
Dichlorodifluoromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
Ethylbenzene		<0.050	<0.018	RPD-NA	ug/g	N/A	40	15-SEP-15
n-Hexane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
Methylene Chloride		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
MTBE		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
m+p-Xylenes		<0.030	<0.030	RPD-NA	ug/g	N/A	40	15-SEP-15
Methyl Ethyl Ketone		<0.50	<0.50	RPD-NA	ug/g	N/A	40	15-SEP-15
Methyl Isobutyl Ketone		<0.50	<0.50	RPD-NA	ug/g	N/A	40	15-SEP-15
o-Xylene		<0.020	<0.020	RPD-NA	ug/g	N/A	40	15-SEP-15
Styrene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
Tetrachloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
Toluene		<0.20	<0.080	RPD-NA	ug/g	N/A	40	15-SEP-15
trans-1,2-Dichloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
trans-1,3-Dichloropropene		<0.030	<0.030	RPD-NA	ug/g	N/A	40	15-SEP-15
Trichloroethylene		<0.050	<0.010	RPD-NA	ug/g	N/A	40	15-SEP-15
Trichlorofluoromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	15-SEP-15
Vinyl chloride		<0.020	<0.020	RPD-NA	ug/g	N/A	40	15-SEP-15
WG2170539-2 LCS								
1,1,1,2-Tetrachloroethane			100.3		%		60-130	15-SEP-15
1,1,2,2-Tetrachloroethane			105.7		%		60-130	15-SEP-15
1,1,1-Trichloroethane			103.5		%		60-130	15-SEP-15
1,1,2-Trichloroethane			104.0		%		60-130	15-SEP-15
1,1-Dichloroethane			101.2		%		60-130	15-SEP-15
1,1-Dichloroethylene			88.9		%		60-130	15-SEP-15
1,2-Dibromoethane			99.7		%		70-130	15-SEP-15
1,2-Dichlorobenzene			97.8		%		70-130	15-SEP-15
1,2-Dichloroethane			120.3		%		60-130	15-SEP-15
1,2-Dichloropropane			103.0		%		70-130	15-SEP-15
1,3-Dichlorobenzene			93.3		%		70-130	15-SEP-15

Quality Control Report

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	Soil							
Batch	**R3266448**							
WG2170539-2	**LCS**							
1,4-Dichlorobenzene			98.3		%		70-130	15-SEP-15
Acetone			121.9		%		60-140	15-SEP-15
Benzene			97.9		%		70-130	15-SEP-15
Bromodichloromethane			106.5		%		50-140	15-SEP-15
Bromoform			107.1		%		70-130	15-SEP-15
Bromomethane			87.0		%		50-140	15-SEP-15
Carbon tetrachloride			100.0		%		70-130	15-SEP-15
Chlorobenzene			96.7		%		70-130	15-SEP-15
Chloroform			107.5		%		70-130	15-SEP-15
cis-1,2-Dichloroethylene			98.7		%		70-130	15-SEP-15
cis-1,3-Dichloropropene			115.7		%		70-130	15-SEP-15
Dibromochloromethane			106.3		%		60-130	15-SEP-15
Dichlorodifluoromethane			33.8	RRQC	%		50-140	15-SEP-15
Ethylbenzene			79.7		%		70-130	15-SEP-15
n-Hexane			89.0		%		70-130	15-SEP-15
Methylene Chloride			101.2		%		70-130	15-SEP-15
MTBE			89.0		%		70-130	15-SEP-15
m+p-Xylenes			85.4		%		70-130	15-SEP-15
Methyl Ethyl Ketone			108.7		%		60-140	15-SEP-15
Methyl Isobutyl Ketone			89.6		%		60-140	15-SEP-15
o-Xylene			83.4		%		70-130	15-SEP-15
Styrene			89.0		%		70-130	15-SEP-15
Tetrachloroethylene			90.0		%		60-130	15-SEP-15
Toluene			83.6		%		70-130	15-SEP-15
trans-1,2-Dichloroethylene			98.3		%		60-130	15-SEP-15
trans-1,3-Dichloropropene			95.5		%		70-130	15-SEP-15
Trichloroethylene			95.8		%		60-130	15-SEP-15
Trichlorofluoromethane			91.1		%		50-140	15-SEP-15
Vinyl chloride			66.9		%		60-140	15-SEP-15
COMMENTS: RRQC-Although recoveries failed to meet ALS DQO's samples are believed to be unaffected.								
WG2170539-1	**MB**							
1,1,1,2-Tetrachloroethane			<0.050		ug/g		0.05	15-SEP-15
1,1,2,2-Tetrachloroethane			<0.050		ug/g		0.05	15-SEP-15
1,1,1-Trichloroethane			<0.050		ug/g		0.05	15-SEP-15

Quality Control Report

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	Soil							
Batch R3266448								
WG2170539-1 MB								
1,1,2-Trichloroethane			<0.050		ug/g		0.05	15-SEP-15
1,1-Dichloroethane			<0.050		ug/g		0.05	15-SEP-15
1,1-Dichloroethylene			<0.050		ug/g		0.05	15-SEP-15
1,2-Dibromoethane			<0.050		ug/g		0.05	15-SEP-15
1,2-Dichlorobenzene			<0.050		ug/g		0.05	15-SEP-15
1,2-Dichloroethane			<0.050		ug/g		0.05	15-SEP-15
1,2-Dichloropropane			<0.050		ug/g		0.05	15-SEP-15
1,3-Dichlorobenzene			<0.050		ug/g		0.05	15-SEP-15
1,4-Dichlorobenzene			<0.050		ug/g		0.05	15-SEP-15
Acetone			<0.50		ug/g		0.5	15-SEP-15
Benzene			<0.0068		ug/g		0.0068	15-SEP-15
Bromodichloromethane			<0.050		ug/g		0.05	15-SEP-15
Bromoform			<0.050		ug/g		0.05	15-SEP-15
Bromomethane			<0.050		ug/g		0.05	15-SEP-15
Carbon tetrachloride			<0.050		ug/g		0.05	15-SEP-15
Chlorobenzene			<0.050		ug/g		0.05	15-SEP-15
Chloroform			<0.050		ug/g		0.05	15-SEP-15
cis-1,2-Dichloroethylene			<0.050		ug/g		0.05	15-SEP-15
cis-1,3-Dichloropropene			<0.030		ug/g		0.03	15-SEP-15
Dibromochloromethane			<0.050		ug/g		0.05	15-SEP-15
Dichlorodifluoromethane			<0.050		ug/g		0.05	15-SEP-15
Ethylbenzene			<0.018		ug/g		0.018	15-SEP-15
n-Hexane			<0.050		ug/g		0.05	15-SEP-15
Methylene Chloride			<0.050		ug/g		0.05	15-SEP-15
MTBE			<0.050		ug/g		0.05	15-SEP-15
m+p-Xylenes			<0.030		ug/g		0.03	15-SEP-15
Methyl Ethyl Ketone			<0.50		ug/g		0.5	15-SEP-15
Methyl Isobutyl Ketone			<0.50		ug/g		0.5	15-SEP-15
o-Xylene			<0.020		ug/g		0.02	15-SEP-15
Styrene			<0.050		ug/g		0.05	15-SEP-15
Tetrachloroethylene			<0.050		ug/g		0.05	15-SEP-15
Toluene			<0.080		ug/g		0.08	15-SEP-15
trans-1,2-Dichloroethylene			<0.050		ug/g		0.05	15-SEP-15

Quality Control Report

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	Soil							
Batch	**R3266448**							
WG2170539-1	**MB**							
trans-1,3-Dichloropropene			<0.030		ug/g		0.03	15-SEP-15
Trichloroethylene			<0.010		ug/g		0.01	15-SEP-15
Trichlorofluoromethane			<0.050		ug/g		0.05	15-SEP-15
Vinyl chloride			<0.020		ug/g		0.02	15-SEP-15
Surrogate: 1,4-Difluorobenzene			110.9		%		70-130	15-SEP-15
Surrogate: 4-Bromofluorobenzene			108.9		%		70-130	15-SEP-15
WG2170539-5	**MS**	**WG2170539-3**						
1,1,1,2-Tetrachloroethane			94.4		%		50-140	15-SEP-15
1,1,2,2-Tetrachloroethane			99.0		%		50-140	15-SEP-15
1,1,1-Trichloroethane			90.2		%		50-140	15-SEP-15
1,1,2-Trichloroethane			100.3		%		50-140	15-SEP-15
1,1-Dichloroethane			89.8		%		50-140	15-SEP-15
1,1-Dichloroethylene			81.6		%		50-140	15-SEP-15
1,2-Dibromoethane			97.9		%		50-140	15-SEP-15
1,2-Dichlorobenzene			92.6		%		50-140	15-SEP-15
1,2-Dichloroethane			100.6		%		50-140	15-SEP-15
1,2-Dichloropropane			93.6		%		50-140	15-SEP-15
1,3-Dichlorobenzene			87.9		%		50-140	15-SEP-15
1,4-Dichlorobenzene			88.2		%		50-140	15-SEP-15
Acetone			117.5		%		50-140	15-SEP-15
Benzene			89.6		%		50-140	15-SEP-15
Bromodichloromethane			91.8		%		50-140	15-SEP-15
Bromoform			96.8		%		50-140	15-SEP-15
Bromomethane			81.5		%		50-140	15-SEP-15
Carbon tetrachloride			86.0		%		50-140	15-SEP-15
Chlorobenzene			92.7		%		50-140	15-SEP-15
Chloroform			92.6		%		50-140	15-SEP-15
cis-1,2-Dichloroethylene			90.4		%		50-140	15-SEP-15
cis-1,3-Dichloropropene			102.2		%		50-140	15-SEP-15
Dibromochloromethane			100.1		%		50-140	15-SEP-15
Dichlorodifluoromethane			28.3	RRQC	%		50-140	15-SEP-15
Ethylbenzene			84.9		%		50-140	15-SEP-15
n-Hexane			84.4		%		50-140	15-SEP-15
Methylene Chloride			91.7		%		50-140	15-SEP-15

Quality Control Report

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	Soil							
Batch R3266448								
WG2170539-5 MS		**WG2170539-3**						
MTBE			85.2		%		50-140	15-SEP-15
m+p-Xylenes			84.8		%		50-140	15-SEP-15
Methyl Ethyl Ketone			98.2		%		50-140	15-SEP-15
Methyl Isobutyl Ketone			81.8		%		50-140	15-SEP-15
o-Xylene			88.0		%		50-140	15-SEP-15
Styrene			91.1		%		50-140	15-SEP-15
Tetrachloroethylene			90.5		%		50-140	15-SEP-15
Toluene			86.7		%		50-140	15-SEP-15
trans-1,2-Dichloroethylene			90.4		%		50-140	15-SEP-15
trans-1,3-Dichloropropene			93.5		%		50-140	15-SEP-15
Trichloroethylene			87.6		%		50-140	15-SEP-15
Trichlorofluoromethane			82.1		%		50-140	15-SEP-15
Vinyl chloride			67.1		%		50-140	15-SEP-15

COMMENTS: RRQC-Although recoveries failed to meet ALS DQO's samples are believed to be unaffected.

Quality Control Report

Workorder: L1672015 Report Date: 22-SEP-15

Client: SPL CONSULTANTS LIMITED (Collingwood)
14 Ronell Crescent, Unit 1
Collingwood ON L9Y 4J7
Contact: NICOLE COLLINS

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.
J	Duplicate results and limits are expressed in terms of absolute difference.
MES	Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.
RRQC	Refer to report remarks for information regarding this QC result.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

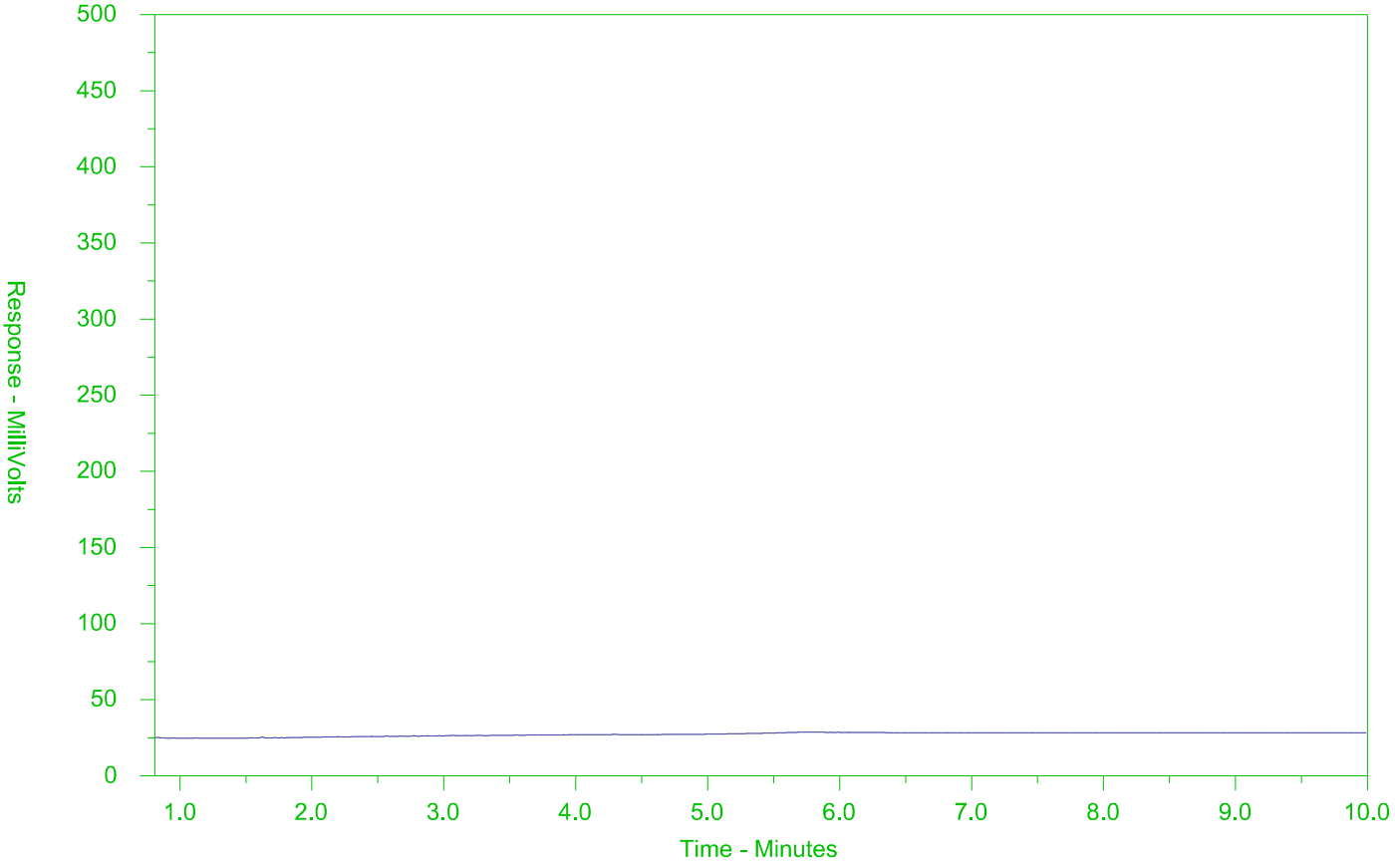
ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1672015-3
Client Sample ID: BH15-01 SS5



← F2 →	← F3 →	← F4 →	
nC10	nC16	nC34	nC50
174°C	287°C	481°C	75°C
346°F	549°F	898°F	1067°F
← Gasoline →		← Motor Oils/ Lube Oils/ Grease →	
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

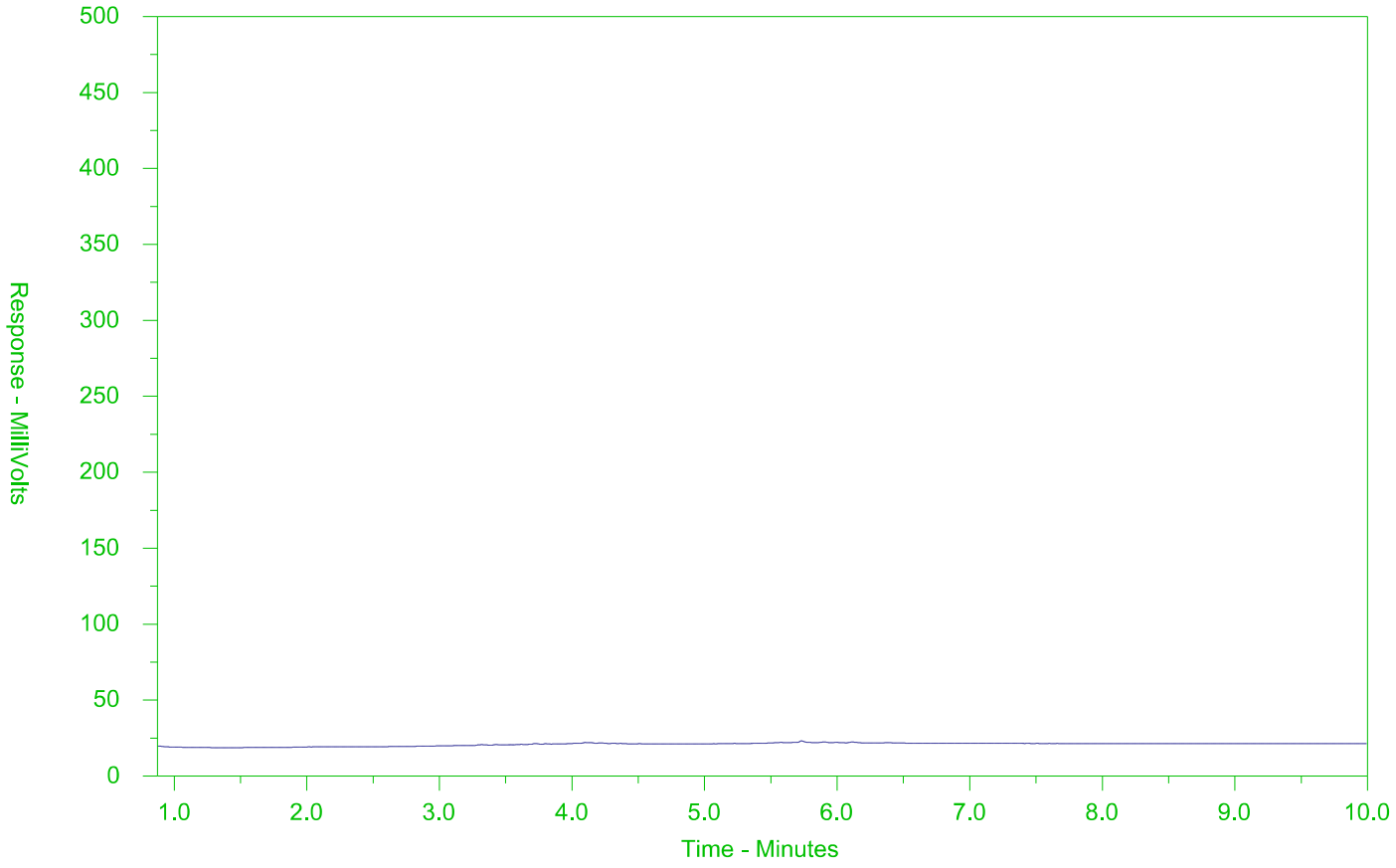
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1672015-8
Client Sample ID: BH15-03 SS8



← F2 →	← F3 →	← F4 →	
nC10	nC16	nC34	nC50
174°C	287°C	481°C	75°C
346°F	549°F	898°F	1067°F
← Gasoline →		← Motor Oils/ Lube Oils/ Grease →	
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

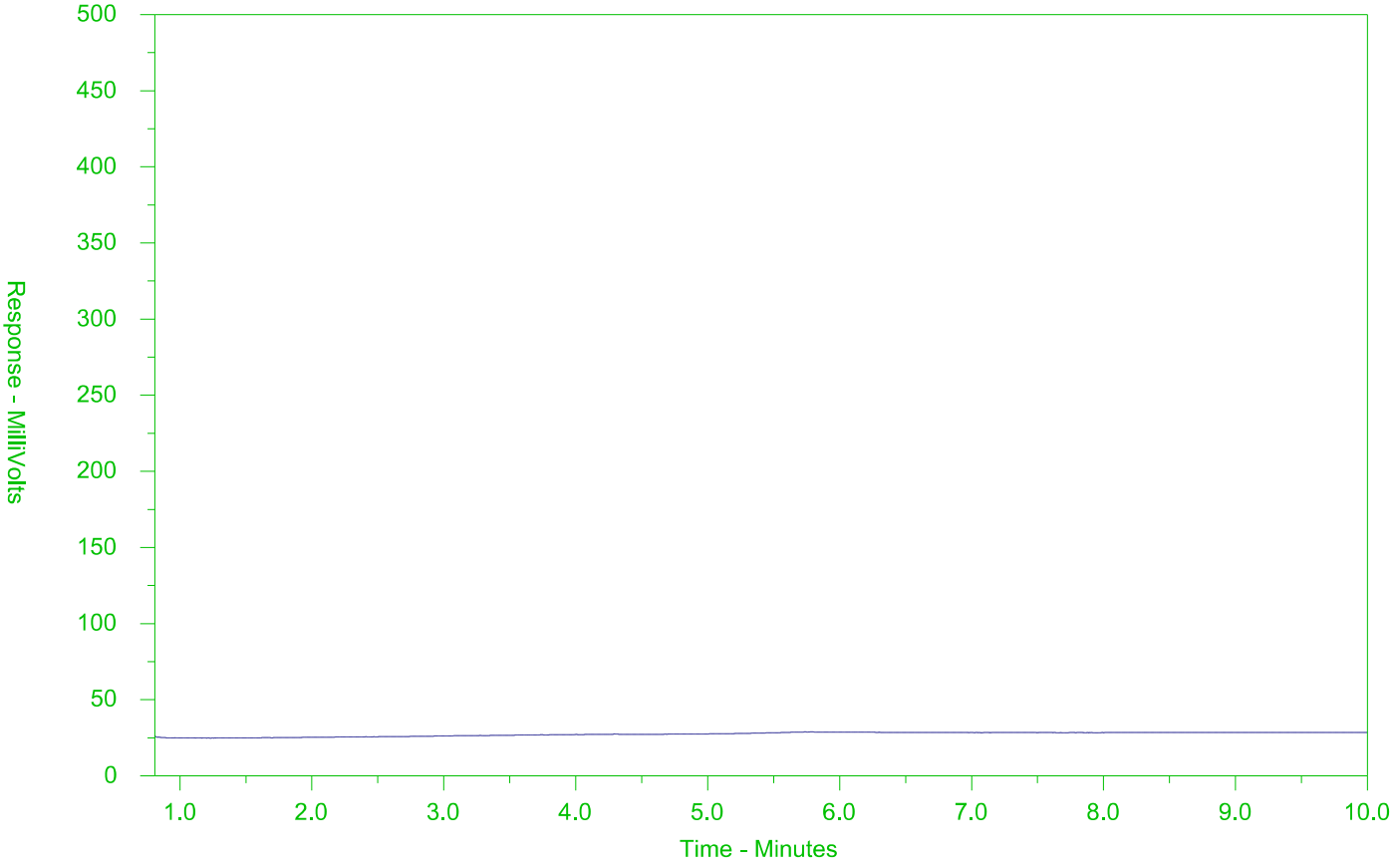
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1672015-17
Client Sample ID: BH15-06 SS4



← F2 →	← F3 →	← F4 →	
nC10	nC16	nC34	nC50
174°C	287°C	481°C	75°C
346°F	549°F	898°F	1067°F
← Gasoline →		← Motor Oils/ Lube Oils/ Grease →	
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

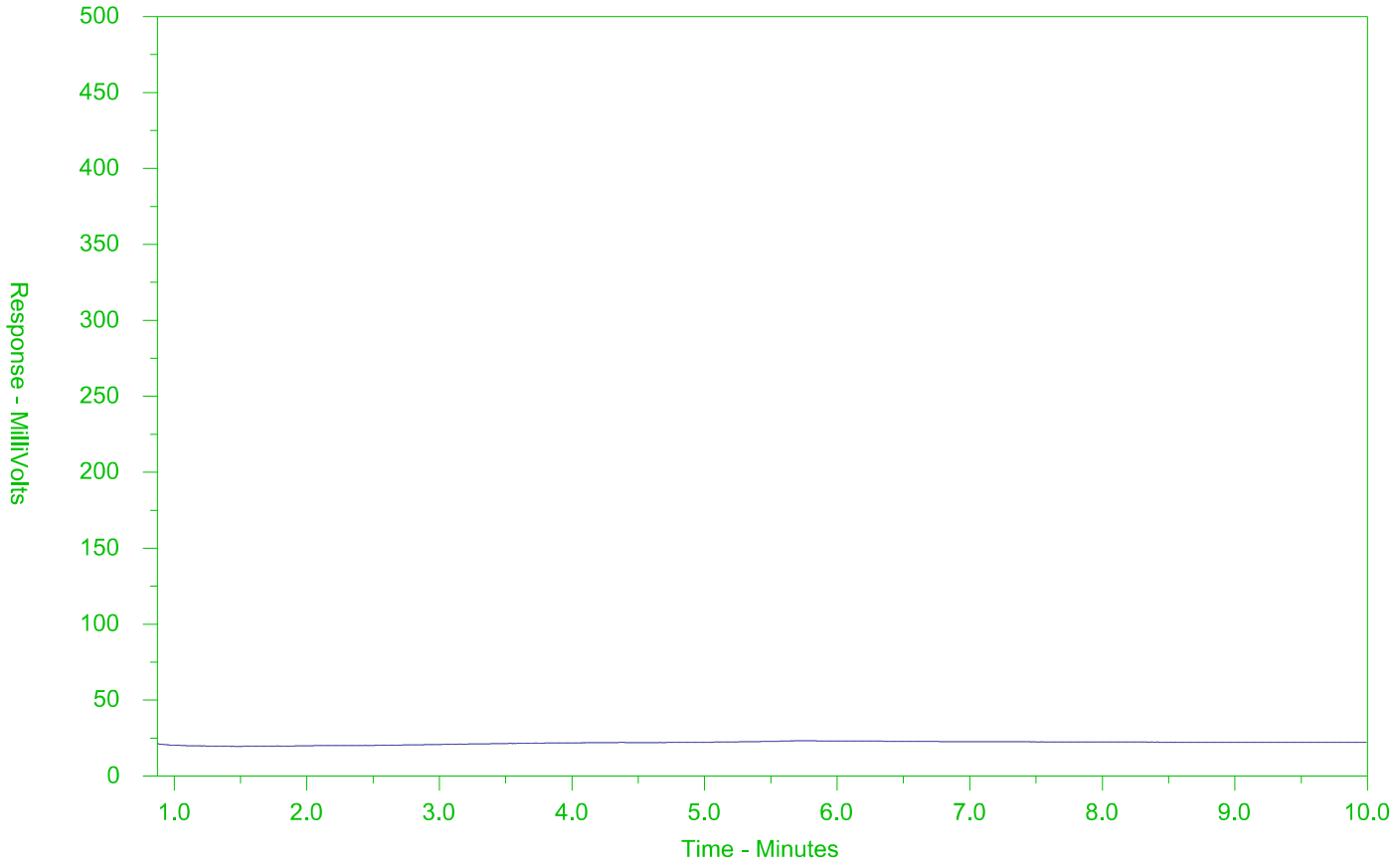
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1672015-20
Client Sample ID: BH15-07 SS5



← F2 →	← F3 →	← F4 →	
nC10	nC16	nC34	nC50
174°C	287°C	481°C	75°C
346°F	549°F	898°F	1067°F
← Gasoline →		← Motor Oils/ Lube Oils/ Grease →	
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

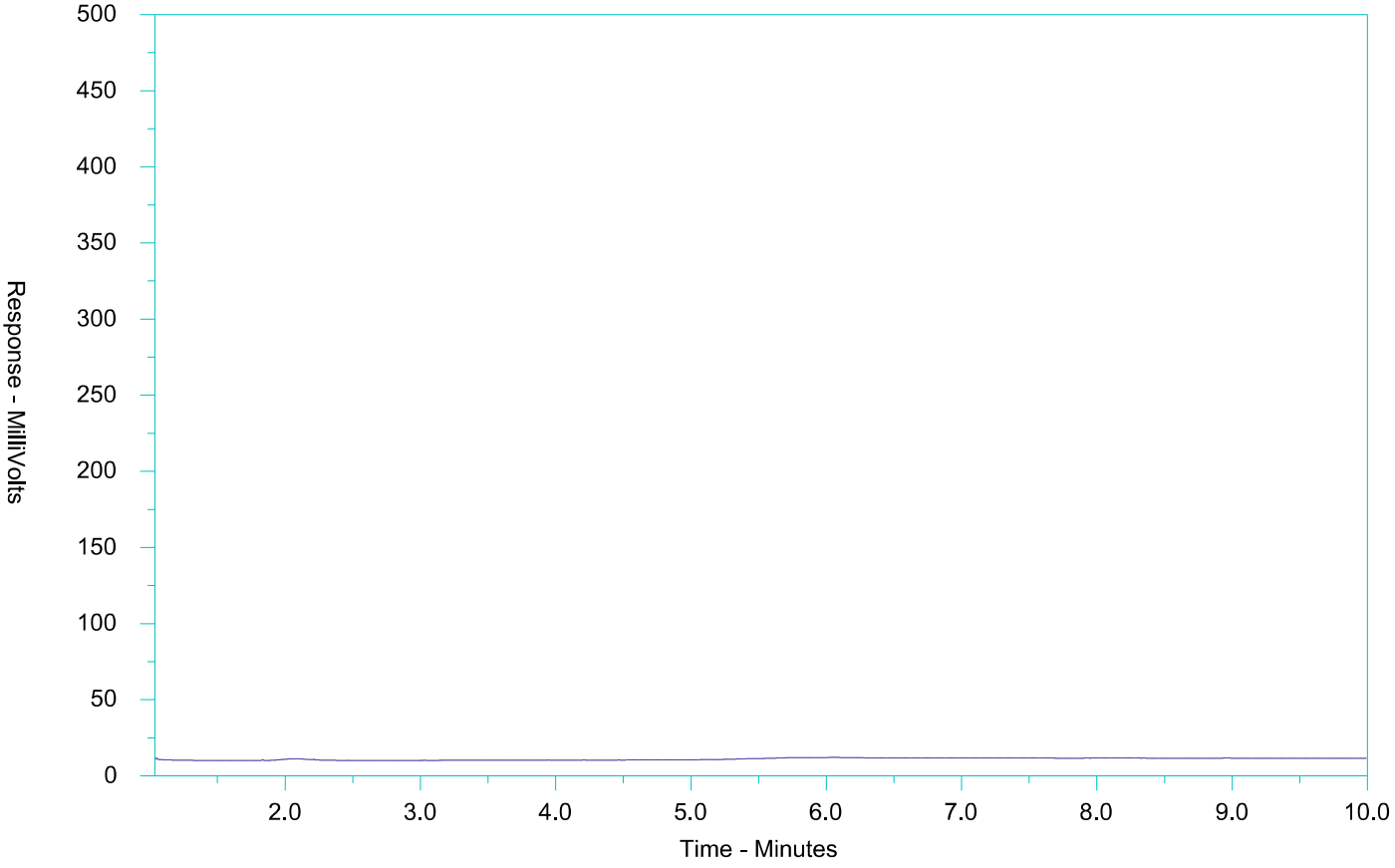
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1672015-27
Client Sample ID: BH15-09 SS6



← F2 →	← F3 →	← F4 →	
nC10	nC16	nC34	nC50
174°C	287°C	481°C	75°C
346°F	549°F	898°F	1067°F
← Gasoline →		← Motor Oils/ Lube Oils/ Grease →	
← Diesel/ Jet Fuels →			

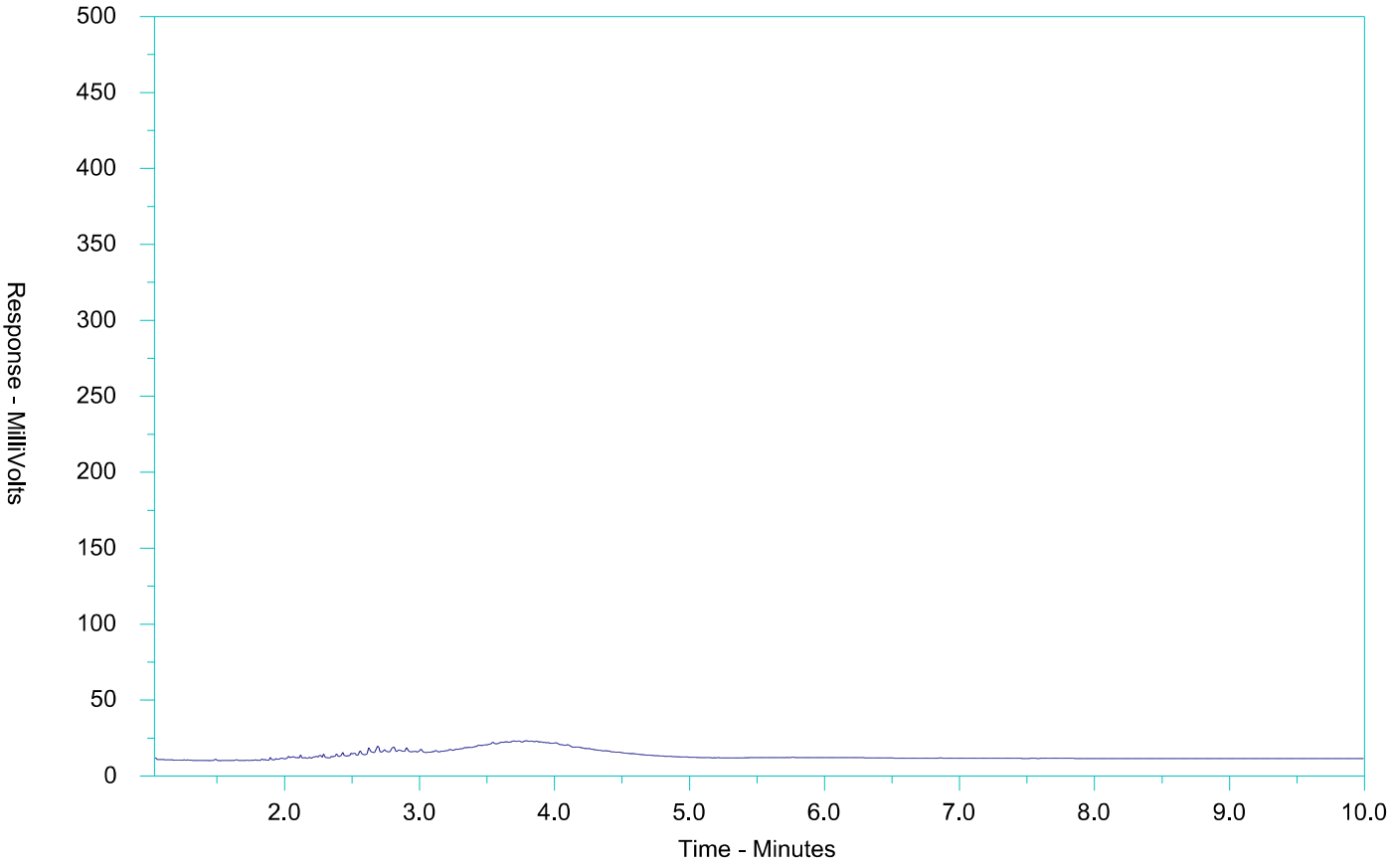
The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

ALS Sample ID: L1672015-33
Client Sample ID: BH15-12 SS5



ALS www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1672015-COFC

COC Number: 14 - 465018

Page 1 of 4

Report To		Report Format / Distribution		Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)
Company:	SPL Consultants Limited	Select Report Format:	☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)	R ☒ Regular (Standard TAT if received by 3pm)
Contact:	Nicole Collins	Quality Control (QC) Report with Report	☒ Yes ☐ No	P ☐ Priority (2-4 business days if received by 3pm)
Address:	14 Ronell Cres. Unit 1 Collingwood, ON	☐ Criteria on Report - provide details below if box checked		E ☐ Emergency (1-2 business days if received by 3pm)
Phone:	(705) 445-0064	Select Distribution:	☒ EMAIL ☐ MAIL ☐ FAX	E2 ☐ Same day or weekend emergency if received by 10am – contact ALS for surcharge.
		Email 1 or Fax	ncollins@splconsultants.ca	Specify Date Required for E2,E or P:
		Email 2	gjarvis@splconsultants.ca	

Invoice To		Invoice Distribution	
	Same as Report To ☐ Yes ☒ No	Select Invoice Distribution:	☒ EMAIL ☐ MAIL ☐ FAX
	Copy of Invoice with Report ☐ Yes ☐ No	Email 1 or Fax	accounts@splconsultants.ca
Company:	SPL Consultants Limited	Email 2	
Contact:	Saren Jensen		

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:		Approver ID:	Cost Center:
Job #:	10002397	GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact: Emerson Perez	Sampler: NC

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Metals	OC Pest	PHCs	VOCs	Number of Containers
1	BH15-01 SS1	09/09/15	AM	Soil		X			
2	BH15-01 SS2	↓	↓		X	X			
3	BH15-01 SS5	↓	↓				X	X	
4	BH15-02 SS1	09/08/15	PM			X			
5	BH15-02 SS2	↓	↓		X	X			
6	BH15-03 SS1	09/08/15	PM			X			
7	BH15-03 SS2	↓	↓		X	X			
8	BH15-03 SS8	↓	↓				X	X	
9	BH15-04 SS1	09/08/15	AM			X			
10	BH15-04 SS2	↓	↓		X	X			
11	BH15-05 SS1	09/08/15	AM			X			
12	BH15-05 SS2	↓	↓	↓	X				

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)
Are samples taken from a Regulated DW System? ☐ Yes ☒ No	Please compare to Table 9 for residential
Are samples for human drinking water use? ☐ Yes ☒ No	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐	SIF Observations	Yes ☐	No ☐
Ice packs	Yes ☒	No ☐	Custody seal intact	Yes ☒ No ☐
Cooling Initiated	☐			

INITIAL COOLER TEMPERATURES °C		FINAL COOLER TEMPERATURES °C			
8.1			4.9		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Nicole Collins	Date: 09/10/15	Time: 1:00pm	Received by:	Date: 11-SEP-15	Time: 12:10	Received by:	Date: 11/9/15	Time: 18:05

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PUROLATOR 330531533595

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Contact:	Nicole Collins	Quality Control (QC) Report with Report	Yes No	P Priority (2-4 business days if received by 3pm)
Address:	14 Ronell Cres. Unit 1 Collingwood, ON	Criteria on Report - provide details below if box checked		E Emergency (1-2 business days if received by 3pm)
Phone:		Select Distribution:	EMAIL MAIL FAX	E2 Same day or weekend emergency if received by 10am – contact ALS for surcharge.
		Email 1 or Fax		Specify Date Required for E2,E or P:
		Email 2		

Invoice To	Same as Report To	Yes No	Invoice Distribution	
	Copy of Invoice with Report	Yes No	Select Invoice Distribution:	EMAIL MAIL FAX
Company:			Email 1 or Fax	
Contact:			Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:		Approver ID:	Cost Center:
Job #:	10062397	GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact:	Sampler:

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ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Metals	OC Pest	PHCs	VOCs									Number of Containers
13	BH15-05 SS3	09/08/15	AM	Soil		X											
14	BH15-06 SS1	09/04/15	AM			X											
15	BH15-06 SS2	↓	↓		X												
16	BH15-06 SS3					X											
17	BH15-06 SS4						X	X									
18	BH15-07 SS1	09/04/15	AM			X											
19	BH15-07 SS2	↓	↓		X	X											
20	BH15-07 SS5						X	X									
21	BH15-08 SS1	09/03/15	AM			X											
22	BH15-08 SS2	↓	↓		X												
23	BH15-08 ~~SS5~~ SS3					X											
24	BH15-09 SS1	09/03/15	AM	↓		X											

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)
Are samples taken from a Regulated DW System? Yes No	Please compere to Table 9 residential
Are samples for human drinking water use? Yes No	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen		SIF Observations	Yes	No	
Ice packs	Yes No	Custody seal intact	Yes	No	
Cooling Initiated					

INITIAL COOLER TEMPERATURES °C		FINAL COOLER TEMPERATURES °C	
8.1		4.9	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Nicole Collins	09/10/15	1:00pm		11-SEP-15	12:10		11/9/15	18:05

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ALS FM-0326r v09 Front04 January 2014

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COC Number: 14 - 465017

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Contact:	Nicole Collins	Quality Control (QC) Report with Report	Yes No	P Priority (2-4 business days if received by 3pm)
Address:	14 Ronell Cres, Unit 1 Collingwood, ON	Criteria on Report - provide details below if box checked		E Emergency (1-2 business days if received by 3pm)
Phone:	(705)445-0064	Select Distribution:	EMAIL MAIL FAX	E2 Same day or weekend emergency if received by 10am - contact ALS for surcharge.
		Email 1 or Fax	ncollins@splconsultants.ca	Specify Date Required for E2,E or P:
		Email 2		

Invoice To	Same as Report To	Yes No	Invoice Distribution	
	Copy of Invoice with Report	Yes No	Select Invoice Distribution:	EMAIL MAIL FAX
Company:			Email 1 or Fax	
Contact:			Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:		Approver ID:	Cost Center:
Job #:		GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	
ALS Lab Work Order # (lab use only):		ALS Contact:	Sampler:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	MHIS	OC Pest	PHCs	VOCs	Number of Containers
25	BHIS-09 SS2	09/03/15	AM	Soil	X	X			
26	BHIS-09 SS3	↓	↓		X	X			
27	BHIS-09 SS6	↓	↓				X	X	
28	BHIS-10 SS1	09/03/15	PM			X			
29	BHIS-10 SS2	↓	↓		X	X			
30	BHIS-12 SS1	09/09/15	AM			X			
31	BHIS-12 SS2	↓	↓		X				
32	BHIS-12 SS3	↓	↓			X			
33	BHIS-12 SS5	↓	↓				X	X	
34	DUP 1					X			
35	DUP 2							X	
36	DUP 3			↓		X			

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)
Are samples taken from a Regulated DW System? Yes No	Please compare to Table 9 residential
Are samples for human drinking water use? Yes No	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen		SIF Observations	Yes	No	
Ice packs	Yes X	No	Custody seal intact	Yes X	No
Cooling Initiated					

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
8.1			4.1		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Nicole Collins	09/10/15	1:00pm		11-SEP-15	12:10		11/9/15	15:05

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1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

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COC Number: 14 - 465016

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Company:	SPL Consultants Limited	Select Report Format:	☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)	R ☒ Regular (Standard TAT if received by 3pm)
Contact:	Nicole Collins	Quality Control (QC) Report with Report	☐ Yes ☐ No	P ☐ Priority (2-4 business days if received by 3pm)
Address:	14 Ronell Cres, Unit 7 Collingwood, ON	☐ Criteria on Report - provide details below if box checked		E ☐ Emergency (1-2 business days if received by 3pm)
Phone:	(705) 445-0064	Select Distribution:	☐ EMAIL ☐ MAIL ☐ FAX	E2 ☐ Same day or weekend emergency if received by 10am – contact ALS for surcharge.
		Email 1 or Fax	ncollins@splconsultants.ca	Specify Date Required for E2,E or P:
		Email 2		

Invoice To	Same as Report To ☐ Yes ☐ No	Invoice Distribution	
	Copy of Invoice with Report ☐ Yes ☐ No	Select Invoice Distribution:	☐ EMAIL ☐ MAIL ☐ FAX
Company:		Email 1 or Fax	
Contact:		Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:		Approver ID:	Cost Center:
Job #:		GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact:	Sampler:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	OC Pest	Number of Containers
37	DUP 4			soil	X	
38	DUP 5			↓	X	

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)
Are samples taken from a Regulated DW System? ☐ Yes ☒ No	Please compare to Table 9 residential
Are samples for human drinking water use? ☐ Yes ☒ No	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐		SIF Observations	Yes	☐	No	☐
Ice packs	Yes ☒	No ☐	Custody seal intact	Yes	☐	No	☐
Cooling Initiated	☐						

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
8.1			4.9		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Nicole Collins	09/10/15	1:00pm	[illegible]	11-SEP-15	12:10	[illegible]	11/9/15	15:05

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Water Balance Assessment

31 Marlwood Avenue

Town of Wasaga Beach

Prepared for:
Loft Planning Inc.

Prepared by:
Azimuth Environmental
Consulting, Inc.

Updated February 2020

AEC 15-273

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Environmental Assessments & Approvals

February 5th 2020 AEC 15-273

Loft Planning Inc.
P.O. Box 246 STN MAIN
Collingwood, Ontario
L9Y 3Z5

Attention: Kristine Loft, MCIP RPP

Re: **Water Balance Assessment**
31 Marlwood Avenue, Town of Wasaga Beach, Ontario

Dear Ms. Loft:

Azimuth Environmental Consulting, Inc. (Azimuth) is pleased to provide our Water Balance Assessment for the property located at 31 Marlwood Avenue within the Town of Wasaga Beach (the "Site"). This evaluation focused on the existing soil and ground water regime underlying the Site and the potential for the proposed development to impact the existing conditions. The Water Balance Assessment has been revised to reflect recent changes to the Site Plan.

Should you have any questions or wish to discuss the report in greater detail, please do not hesitate to contact the undersigned.

Yours truly,
AZIMUTH ENVIRONMENTAL CONSULTING, INC.

JMillington

Jennifer Millington, M.A.Sc., P.Geo.
Hydrogeologist

Mike Jones, M.Sc., P.Geo.
President

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1.0 INTRODUCTION

Azimuth Environmental Consulting, Inc. ("Azimuth") has been retained by Loft Planning Inc. to conduct a Water Balance for the proposed development located at 31 Marlwood Avenue within the Town of Wasaga Beach, Ontario (the "Site")(Figure 1).

The Site is approximately 55.0 hectares (ha) in size and currently contains the Marlwood Golf Course. The Site fronts onto Golf Course Road, and the current clubhouse is accessible off of Marlwood Crescent (Figure 2).

It is our understanding that a portion of the Site will be developed into 60 single detached residential homes in two phases. The proposed development will take a portion of the existing golf course land, with the remaining land to be redesigned to maintain the golf course use. The proposed residential lots will be serviced with municipal services. The purpose of this assessment is to characterize the existing hydrogeological conditions at the Site and the potential for the proposed development to impact the existing environmental conditions.

The first phase of development will include 9 detached residential units along the western boundary of the golf course between existing residential homes on Briton Court and Marlwood Avenue. The lots will have frontage on Golf Course Road. Phase 1 is approximately 0.85 ha in size.

The second phase of development will include 51 detached residential units in the southwest portion of the golf course. The lots are situated in an L-shape and will be accessible off of Golf Course Road. Phase 2 is approximately 7.43ha in size.

A Draft Plan (dated January 14th 2020) for both Phases of development are provided in Appendix B.

2.0 ENVIRONMENTAL SETTING

2.1 Soil

The soil map of Simcoe County (Soil Survey Report No. 29, Scale 1:63,360) shows the uppermost soil at the Site to be composed of Minesing marly clay or Tioga sandy loam (Hoffman *et al.*, 1962). Minesing marly clay is classified within hydrologic soil group "C". Group C represent soils which have low infiltration rates when thoroughly wet and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine texture. Tioga sandy loam is classified within hydrologic soil group "A". Group A represents soils with a low runoff potential and high infiltration

rates even when thoroughly wet. They consist chiefly of deep, well to excessively drained sand or gravel. The proposed development is primarily located in the Minesing marly clay.

2.2 Physiography

The Ontario Geologic Survey (Chapman and Putnam, 1984) describes the area as being located within the Simcoe Lowlands physiographic region, specifically within the Nottawasaga Basin. The Simcoe Lowlands were at one time part of the floor of glacial Lake Algonquin and its surface beds are therefore deposits of deltaic and lacustrine origin.

2.3 Topography and Drainage

According to local topographic mapping the Site is found at an elevation of 185 to190 m above sea level (masl). In general, the Site is sloped toward Marl Lake, with local gradients toward the golf course ponds and forest area along Golf Course Road. A Provincially Significant Wetland (Jack's Lake Wetland) is located on the south west corner of Marl Lake, immediately adjacent to the golf course property. Marl Lake is drained by Marl Creek, which is part of the Lower Nottawasaga River subwatershed and drains into Georgian Bay. The Marl Lake outlet into Marl Creek is controlled by a man made outfall structure constructed in the 1990s. The outfall structure is constructed using a sheet pile barrier wall and removable members to allow for adjustment of water levels and maintenance of habitat within both the lake and its associated wetland.

The existing surface water catchment areas were delineated by R.J. Burnside & Associates (Appendix B).

In Phase 1, the Site topography generally drains east to south east towards the golf course and the existing pond feature within the golf course. There is currently no storm water infrastructure along Golf Course Road along the frontage of Phase 1. After development, runoff will therefore be directed into soak away pits and an infiltration trench within each lot. An emergency overland flow route will direct runoff toward the golf course via the public easement where it will travel 200m toward the existing golf course pond adjacent to Marl Lake. For Phase 1, the pre- and post-development drainage pathways are maintained and therefore can be considered one catchment for the water balance assessment.

In Phase 2, the existing Site topography is generally sloped toward two golf course ponds to the east, and to the forest to the south. The regional topography is sloped toward Marl Lake. According to information provided in Appendix B the proposed drainage patterns

will generally be maintained compared to pre-development conditions. A centralized storm water management pond will be used to collect runoff and will outlet into an open channel which will dissipate energy prior to entering the adjacent wetland.

The Marlwood Golf Course currently pumps water directly from Marl Lake for irrigation. This is facilitated through the use of a submersible pump that is suspended within the lake (~2 m below water surface) through the base of a small wooden shed that is constructed at the end of an approximately 20 m long wooden pier structure. From the lake, pumped water is transferred up to an irrigation head pond (dugout type) situated on the 9th hole of the golf course using a 203 mm∅ I.D. HDPE (partially) buried forcemain. From the irrigation head pond, water is utilized on an as-needed basis by the irrigation system.

2.4 Bedrock Geology

The Ontario Geologic Survey Earth Database shows that the uppermost bedrock unit at the subject property consists of limestone and shale of the Verulam Formation of the Simcoe Group (OGS, 2017). The Verulam Formation is Middle Ordovican in age. Bedrock is sufficiently deep (70m+) and does not influence the water balance assessment.

2.5 Quaternary Geology

The surficial material for the Site is consists of lacustrine deposits which may be composed of both silt and clay associated with basin or quiet water deposits, or sand, gravelly sand and gravel associated with near shore and beach deposits (OGS, 2017).

2.6 Hydrogeology

The Ontario Ministry of the Environment, Conservation, and Parks (MECP) Water Well Records were references for any recorded well information in the vicinity of the Subject Site (GIN, 2017; Table 1). Well records can be used to gain subsurface information which can provide insight into geological formations within the area.

Table 1: MOECC Water Well Database Summary[1]

Well ID	Elevation (masl)	Date Drilled	Static Water Level (mbgs)	Depth to Bedrock (m)	Total Depth (m)	Well Type	Primary Use
5729422	186	1992-06-12	9.2	-	41.2	Overburden	Domestic
5734995	186	2000-03-21	4.6	-	13.1	Overburden	Domestic
5726707	186	1990-06-06	9.1	-	41.5	Overburden	Domestic
5733732	197	1998-08-17	11.6	-	53.0	Overburden	Domestic
5731265	193	1994-11-24	10.1	-	44.5	Overburden	Domestic
5709060	191	1971-08-06	-	74.4	79.3	Bedrock	Abandoned
5709061	191	1971-08-13	-	-	54.9	Overburden	Test Hole
5733570	186	1998-06-24	8.5	-	41.4	Overburden	Domestic

Notes: [1] - values rounded for presentation purposes

The surrounding wells in the MECP database were drilled primarily for domestic use, with one well listed for test hole purposes and one well listed as abandoned. In general, wells were advanced primarily through a thick (11-25 m) surficial sand unit overlying a clay or silt layer which overlies a second, confined sand or gravel unit. Bedrock was encountered in one record at a depth of 74 mbgs. The static water table upon borehole completion was between 4.6 – 11.6 mbgs with an average depth of 8.9 mbgs.

A portion of the Site is considered a Significant Ground Water Recharge Area (SGRA) and a Highly Vulnerable Aquifer (HVA). The Site overlaps with a Wellhead Protection Area (WHPA) and is classified as WHPA-D. A portion of the Site is also located within the Nottawasaga Valley Conservation Authority (NVCA) Regulated Area.

The Oak Ridges Moraine Ground water Program (ORMGP, 2018) includes a water table layer which was created by contouring the static water levels from all wells where the well screen is less than 20 m deep. This layer is meant to represent an average water table since the values used in its creation were collected from all seasons over time. ORMGP (2018) suggests that the actual water table at any given time of the year may be up to 2-3m lower or higher than the values indicated on the water table layer. According to ORMGP (2018) the water table at the Site is found between 189 to 183 masl. The ground water flow is toward Marl Lake. Maps from the ORMGP (2018) are included in Appendix D.

3.0 MONITORING

3.1 Geotechnical Program

A preliminary geotechnical program was completed for the Site by SPL Consultants Limited in November 2015, and updated by WSP in January 2020. The geotechnical program included advancing twelve (12) boreholes (BH15-01 to BH15-12) at the Site within the Phase 1, Phase 2, and existing golf course lands. The boreholes were drilled to depths between 5.2 and 8.2 mbgs.

The SPL (2015) and WSP (2020) reports indicates the subsurface geology to be composed of topsoil overlying silty sand to sandy silt fill, overlying sand to silty sand and gravel. Marl was observed in six boreholes at various depths and extended up to 2.3mbgs.

3.2 Ground Water Elevations

Ground water measurements were collected at five installed monitoring wells (BH15-01, BH15-05, BH15-07, BH15-09, & BH15-12) on a monthly basis between October 2015

and August 2016. These wells overlapped with both the Phase 1 and Phase 2 lands. A summary of the water measurements are found in the below Table 2:

Table 2: Summary of Ground Water Measurements (WSP, 2020)

Borehole ID	High Ground Water Level		Low Ground Water Level		Range (m)
	mbgs	masl	mbgs	masl	
BH15-01	2.37	186.63	3.13	185.87	0.76
BH15-05	0.99	186.01	1.48	185.52	0.49
BH15-07	2.77	184.23	3.27	183.73	0.50
BH15-09	4.38	185.62	4.91	185.09	0.53
BH15-12	1.44	188.56	2.20	187.80	0.76

The high ground water level at the Site is therefore between 188.56 and 184.23 masl or 4.38 and 0.99 mbgs. The local ground water flow direction is toward Marl Lake. It should be noted that the water table elevation will fluctuate seasonally and will display the highest value in the spring months (March or June). The complete set of borehole logs and ground water measurements can be found in WSP (2020).

4.0 WATER BALANCE

In order to determine the potential changes to the natural ground water recharge conditions, a pre- and post-development water balance assessment has been completed using the Thornthwaite and Mather method (1957). This method evaluates evapotranspiration based on precipitation and temperature. Residual soil saturation is a function of topography and soil type. Monthly data are tabulated from daily average temperature and precipitation, and the water budget is a continuous calculation over the period of record. To clarify, the method and the approach used by many individuals in examining infiltration resets annual conditions (moisture deficit, snow storage, etc) over the winter months because of the general lack of infiltration during the frost period. However, we maintain those records and carry them forward from month to month during the entire period of record.

Values were determined on a monthly basis, compiled from daily Environment Canada meteorological data station located in Collingwood, Ontario between 1960 and 2010 (Collingwood Climate Data). The calculations are based on the average conditions during this period. The average precipitation was 888 millimeters (mm), rainfall was 656 mm, evapotranspiration was 495 mm, and the surplus was 393 mm per year.

4.1 Land Use

4.1.1 Pre-Development

Using an aerial image, the Site was classified according to land use/ vegetation type. Land within the pre-development area can be classified as forest, landscaped grass, and surface water (Table 3).

Table 3: Pre Development Area Classification

Land Use	Land Area (m^2)
Phase 1	
Forest	6,127
Landscaped Grass	2,373
Phase 1 TOTAL	**8,500**
Phase 2	
Forest	29,736
Landscaped Grass	42,799
Surface Water	1,765
Phase 2 TOTAL	**74,300**
Site TOTAL	**82,800**

Land within the pre-development scenario is considered 2% impervious. The impervious area is associated with the existing surface water "hazards" within the golf course.

4.1.2 Post-Development

To determine the post-development land use designations, the following assumptions have been made:

- The rooftop area was obtained from information reviewed within Appendix B and is assumed to be 50% of lot area. The total rooftop area in Phase 1 is 4,315 m^2 and the total rooftop area in Phase 2 is 16,524 m^2;
- The average driveway is 40 m^2;
- The internal road area within Phase 2 is 11,900 m^2. Phase 1 does not contain any internal roads other than driveways;
- The storm water pond in Phase 2 will be lined and considered 50% impervious. The pumping station within Phase 2 is also considered 50% impervious;
- About 15,200 m^2 of land will remain forest in the post-development scenario of Phase 2 (Block 55)
- All additional land within each lot and the storm water pond block is assumed to be landscaped grass;

Land within the post-development Site is summarized in the below Table 4:

Table 4: Post-Development Area Classification

Land Use	Land Area (m^2)
Phase 1	
Structures	4,315
Driveway	360
Landscaped Grass	3,825
Phase 1 TOTAL	**8,500**
Phase 2	
Structures	16,524
Driveway	2,040
Landscaped Grass	21,836
Forest	15,200
Roads	11,900
Storm Water Pond & Pumping Station - Impervious	6,800
Phase 2 TOTAL	**74,300**
Site TOTAL	**82,800**

Land within the post-development scenario is considered 51 % impervious. The impervious area is associated with the structures, driveways, storm water management pond, pump station, and internal road.

4.2 Infiltration

Infiltration is generated one of two ways: (1) directly from rainfall impact on pervious surfaces; and (2) indirectly when runoff from impervious surfaces is diverted into adjacent naturalized areas.

Infiltration factors for the Site were estimated based on the underlying soil, local topography, and ground cover as per Table 2 of the Ministry of Environment and Energy (MOEE) Hydrogeological Technical Information Requirements for Land Development Applications (1995).

The soil variable factor was determined by taking into account information obtained from the regional geologic mapping (Section 3.0) and the geotechnical program completed for the Site (Section 4.1). This information suggests that the dominant soil type in the area is sand, with some local marl deposits near Marl Lake. The soil is therefore considered a sandy loam for the purpose of the water balance assessment. The infiltration factors utilized in the water balance assessment are summarized in Table 5 below.

The topography factor was based on the pre- and post-development slope information provided on the Preliminary Grading Plans for each Phase included within the Burnside

(2017a & 2017b) reports. Based on the information reviewed, the pre- and post-development land can be classified as rolling land for both Phase 1 and Phase 2.

Table 5: Summary of Pervious Land Infiltration Factor (See Appendix E)

Scenario	Land Use	Infiltration Factor	Assumption
Pre-Development	Forest	0.80	Rolling land, sandy loam soil, woodland
	Landscaped Grass	0.65	Rolling land, sandy loam soil, grass
	Surface Water	0.0	Saturated soil does not promote infiltration
Post-Development	Forest	0.80	Rolling land, sandy loam soil, woodland
	Landscaped Grass	0.65	Rolling land, sandy loam soil, grass
	Stormwater Pond	0.0	The storm water pond will be lined and therefore no infiltration will occur.

4.2.1 Pre-Development

Pre-development infiltration was determined by multiplying the annual average surplus amount, the area of each land use, and the infiltration factor for each land use. The pre-development annual infiltration is therefore 22,815 m^3/year which includes 2,533m^3/year from Phase 1 and 20,282 m^3/year from Phase 2. (Appendix E).

4.2.2 Post-Development

Post-development infiltration (without mitigation) was determined by multiplying the annual average surplus amount, the area of each land use, and the infiltration factor for each land use. The post-development annual direct infiltration is therefore 11,334 m^3/year, which includes 977 m^3/year from Phase 1 and 10,357 m^3/year from Phase 2. There is therefore a decrease across the entire Site in infiltration of 11,481 m^3/year from pre- to post-development without mitigation which represents 50%. This represents a decrease of 1,555 m^3/year in Phase 1 (61%) and 9,925 m^3/year in Phase 2 (49%).

Additional infiltration will also be gained through low impact development (LID). According to the information provided by Burnside (Appendix B), soakaway pits will be used at the lot scale to collect and infiltrate runoff from rooftop surfaces. In Phase 1, the soakaway pits will infiltrate up to the 5mm event, and the remaining rooftop runoff (up to the 25mm event) will be infiltrated through an infiltration trench. In Phase 2, the soakaway pits will infiltrate up to the 12mm event from the rooftop area.

In order to correlate event based rainfall data, for which the LID's are designed (i.e. 20 mm rainfall event), to annual averages, as is what is utilized in water balances, an event based assessment has been completed for a climate station in Southern Ontario (Barrie). Rainfall events over the past 5 years of complete data (2013 – 2017) were broken down by event size, such that total volumes for each of these events could be calculated. It was determined that an event rainfall depth of 5mm or less represents 46% of annual rainfall, an event rainfall depth of 12mm or less represents 76% of annual rainfall, and an event rainfall depth of 25mm or less represents 93% of annual rainfall.

If the soakaway pit/infiltration trench combinations in Phase 1 are designed to capture up to the 25mm storm event over the 4,315 m^2 impervious area, an additional 2,632 m^3 of runoff will be incorporated as infiltration (93% x 656 mm x 4,315 m^2). Half of the remaining rooftop runoff that is not captured will be directed to the adjacent landscaped grass. The other half will be directed to the front lawn/driveway which would drain to the storm water infrastructure. This infiltration represents 52 m^3/year (7% x 656 mm x 4,315 m^2 x 0.65 x 80% x 50%). This value is also multiplied by the infiltration coefficient of the grass and includes a 20% loss factor for evapotranspiration.

If the soak away pits in Phase 2 are designed to capture up to the 12mm storm event over the 16,524 m^2 rooftop area, an additional 8,238 m^3 of runoff will be incorporated as infiltration (76% x 656 mm x 16,524 m^2). As in Phase 1, half of the remaining rooftop runoff that is not captured will be directed to the adjacent landscaped grass. This infiltration represents 676 m^3/year (54% x 656 mm x 16,524 m^2 x 0.65 x 80% x 50%).

The total post-development infiltration for the entire Site after incorporating mitigation measures is therefore 22,933 m^3, which is 100% of pre-development levels. This represents an increase of 45% from pre- to post-development in Phase 1 and a decrease of 5% from pre- to post-development in Phase 2.

4.3 Water Balance Summary

Using the climate model data and calculations mentioned above, the water balance was completed for pre-development, post-development, and post-development with mitigation (Appendix E).

The total infiltration at the Site is 22,815 m^3 in the pre-development scenario, which represents 2,533 m^3 from Phase 1 and 20,282 m^3 from Phase 2. The total infiltration is reduced by 50% when no mitigation measures are employed. This decrease is associated with the increase in impervious surfaces such as roads, driveways, and structures.

The decrease is eliminated when runoff from rooftops is incorporated into soak away pits, infiltration trenches, or is directed onto grassed surfaces in the post-development scenario. An additional 2,684 m^3/year is incorporated into Phase 1, and an additional 8,915 m^3/year is incorporated into Phase 2. The total Phase 1 infiltration after mitigation is 3,661 m^3, and the total Phase 2 infiltration after mitigation is 19,271 m^3. The total post-development infiltration after mitigation is 22,933 m^3, which represents 100% of the pre-development volume.

4.4 Sensitive Features: Jack's Lake Wetland

In the pre-development scenario, the existing conditions within Phase 1 contained approximately 2,533 m^3 of infiltration and 808 m^3 of runoff. The runoff drained via sheet flow east to south east towards the golf course and the existing pond feature within the golf course. In the post-development with mitigation scenario, Phase 1 contains approximately 3, 661 m^3 of infiltration and 637 m^3 of runoff. The infiltration will therefore increase, with a slight decrease in runoff. The runoff flow path for Phase 1 is also maintained, since the flow will be directed toward the golf course via the public easement where it will travel 200m toward the existing golf course pond.

In the pre-development scenario, the existing conditions within Phase 2 contained approximately 20,282 m^3 of infiltration and 9,478 m^3 of runoff. The runoff drained toward Master's Lane, the existing Golf Course ponds, Golf Course Road, or south toward residential homes along "The Boardwalk". According to Burnside (Appendix B) the proposed drainage patterns will generally be maintained compared to pre-development conditions. A centralized storm water management pond will be used to collect runoff and will outlet into an open channel which will dissipate energy prior to entering the adjacent wetland. In the post-development with mitigation scenario, Phase 2 contains approximately 19,271 m^3 of infiltration which represents 95% of pre-development levels. Phase 2 also contains 21,756 m^3 of runoff.

Based on the local topography, the Jack's Lake wetland feature likely receives some sheet flow runoff from the adjacent golf course land. Based on the information provided above, the total runoff will increase from pre- to post-development. Since the proposed drainage patterns will generally be maintained, the runoff contributions to the wetland feature should increase from pre- to post development.

The wetland is located around the vicinity of a large surface water feature, and therefore the primary contributing source of water within the wetland is Marl Lake. As identified above, the outlet of Marl Lake into Marl Creek is controlled through a man made outfall structure. When considering Phase 1 and Phase 2 together, there will be no decrease in the amount of infiltration into Marl Lake after development. When considering only

Phase 2, there will be a slight (5%) decrease after development. This isolated deficit is not considered significant. The slight decrease (5%) in infiltration at Phase 2 will be offset by the increase in infiltration from Phase 1, and the increase in runoff contributions into Marl Lake from both Phase 1 and Phase 2 within the proposed storm water pond. The pond will outlet via an open channel which will dissipate energy prior to entering the adjacent wetland. Based on this assessment, no significant changes in the water level of Jack's Lake Wetland are anticipated as a result of the proposed development.

5.0 SUMMARY AND CONCLUSIONS

Azimuth was retained by Loft Planning Inc. to conduct a Water Balance for the proposed development located at 31 Marlwood Avenue within the Town of Wasaga Beach, Ontario. The Site is approximately 55.0 hectares (ha) in size and currently contains the Marlwood Golf Course. The Site fronts onto Golf Course Road, and the current clubhouse is accessible off of Marlwood Crescent

It is our understanding that a portion of the Site will be developed into 60 single detached residential homes in two phases. The proposed development will take a portion of the existing golf course land, with the remaining land to be redesigned to maintain the golf course use. The proposed residential lots will be serviced with municipal services. The purpose of this assessment is to characterize the existing hydrogeological conditions at the Site and the potential for the proposed development to impact the existing environmental conditions.

The Site is found at an elevation of 185 to190 m above sea level (masl). In general, the Site is sloped toward Marl Lake, with local gradients toward the golf course ponds and forest area along Golf Course Road. A Provincially Significant Wetland (Jack's Lake Wetland) is located on the south west corner of Marl Lake, immediately adjacent to the golf course property. Marl Lake is drained by Marl Creek, which is part of the Lower Nottawasaga River subwatershed and drains into Georgian Bay. The Marl Lake outlet into Marl Creek is controlled by a man made outfall structure constructed in the 1990s.

A geotechnical evaluation was completed for the Site by SPL Consultants Limited in November 2015 and updated by WSP in 2020. The surficial material is composed of topsoil overlying silty sand to sandy silt fill, overlying sand to silty sand and gravel. Marl was observed in four boreholes and extended up to 2.3mbgs. Five monitoring wells were installed as part of the geotechnical program. The high ground water level at the Site is therefore between 188.56 and 184.23 masl or 4.38 and 0.99 mbgs. The local ground water flow direction is toward Marl Lake.

A pre- and post-development water balance assessment was completed to assess any impacts to the infiltration rate at the Site. The post-development with mitigation runoff contributions will increase, while the post-development with mitigation infiltration volume will not change.

When considering Phase 1 and Phase 2 together, there will be no decrease in the amount of infiltration into Marl Lake after development. When considering only Phase 2, there will be a slight (5%) decrease after development. This isolated deficit is not considered significant. The slight decrease (5%) in infiltration at Phase 2 will be offset by the increase in infiltration from Phase 1, and the increase in runoff contributions into Marl Lake from both Phase 1 and Phase 2 within the proposed storm water pond. The pond will outlet via an open channel which will dissipate energy prior to entering the adjacent wetland. Based on this assessment, no significant changes in the water level of Jack's Lake Wetland are anticipated as a result of the proposed development.

Based upon our assumptions above and the interpretation of the available data it is concluded that the present hydrogeological conditions of the Site and surrounding area will not experience a significant change due to the proposed development.

6.0 REFERENCES

Barnett, P.J., Cowan, W.R. and Henry, A.P. 1991. Quaternary Geology of Ontario, Ontario Geological Survey, Map 2556, Scale 1:1,000,000.

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Thornthwaite, C.W., and Mather, J.R., 1957. Instructions and tables for computing potential evapotranspiration and the water balance. Climatology, v

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APPENDICES

Appendix A: Figures
Appendix B: Engineering Drawings & Draft Site Plans
Appendix C: MECP Well Records
Appendix D: ORMGP (2018) Maps
Appendix E: Water Balance Information

APPENDIX A

Figures

LEGEND:

Approx. Study Area

250m 0 750m

HORIZONTAL SCALE 1:25,000

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Study Area Location

Golf Course Rd.,
Wasaga Beach, ON

DATE ISSUED: *September 2015*	Figure No.
CREATED BY: *JLM*	
PROJECT NO.: *15-273*	1
REFERENCE: *MNRF*	

DAYSTAMP: M:\15 Projects\15-273 Marlwood GG EIS\04.0 - Drafting\15-273.dwg

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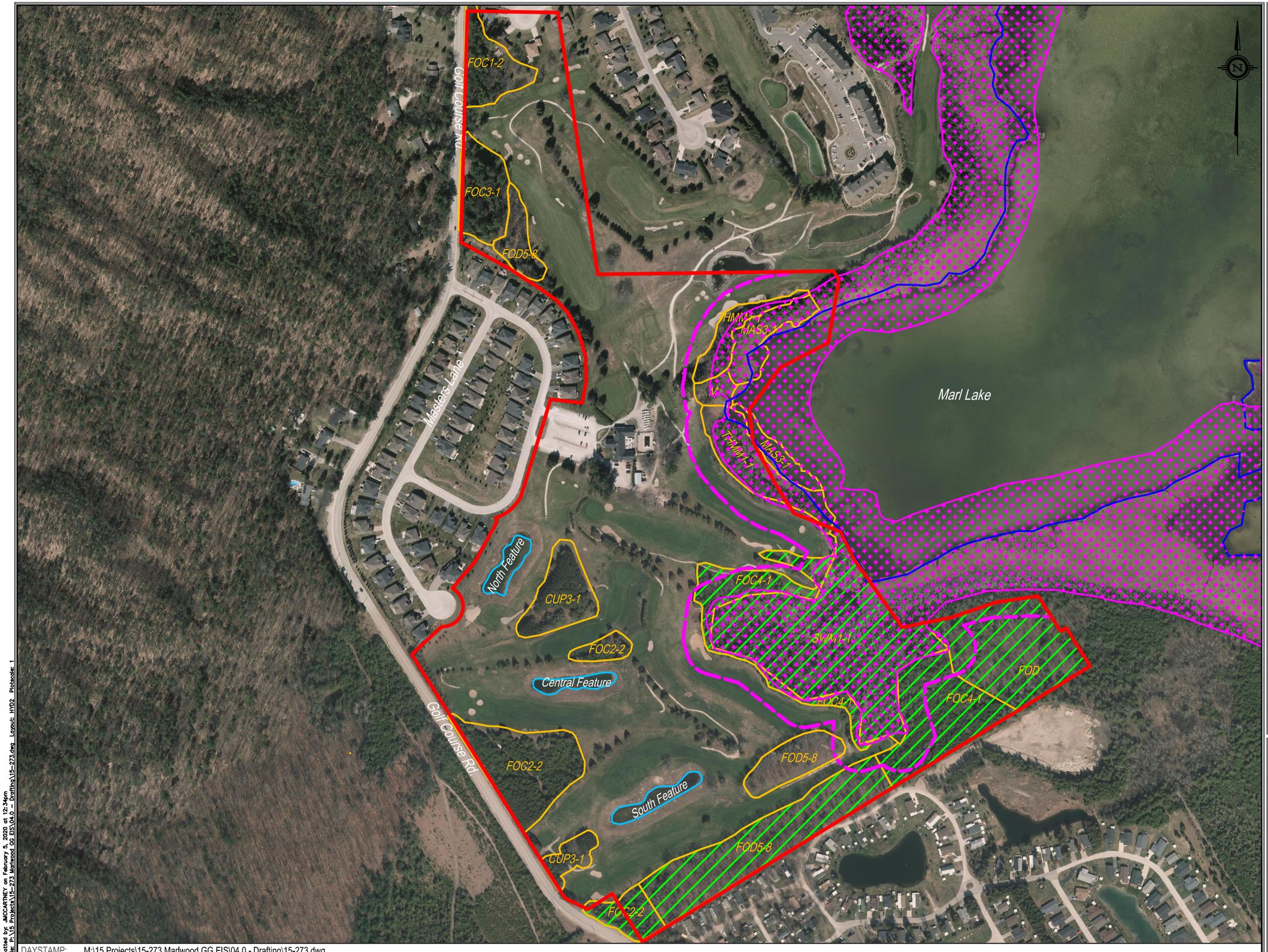


LEGEND:

- Approx. Study Area
- Lake
- Offline Water Hazard Feature
- Jack's Lake PSW (LIO)
- 30m Wetland Buffer
- Significant Woodland
- Vegetation Communities

CUP3-1	Red Pine Coniferous Plantation
FOC1-2	Dry-Fresh White Pine-Red Pine Coniferous Forest Type
FOC2-2	Dry-Fresh White Cedar Coniferous Forest
FOC3-1	Fresh-Moist Hemlock Coniferous Forest
FOC4-1	Fresh-Moist White Cedar Coniferous Forest Type
FOD	Deciduous Forest Type
FOD5-8	Dry-Fresh Sugar Maple-White Ash Deciduous Forest Type
MAS3-1	Cattail Organic Shallow Marsh
M	Maintained Lands
SWM1-1	White Cedar-Hardwood Organic Mixed Swamp
THMM1-1	Dry-Fresh Native Mixed Regeneration Thicket Type

60m 0 120m

HORIZONTAL SCALE 1:4,000

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Existing Conditions

Marlwood
Wasaga Beach, ON

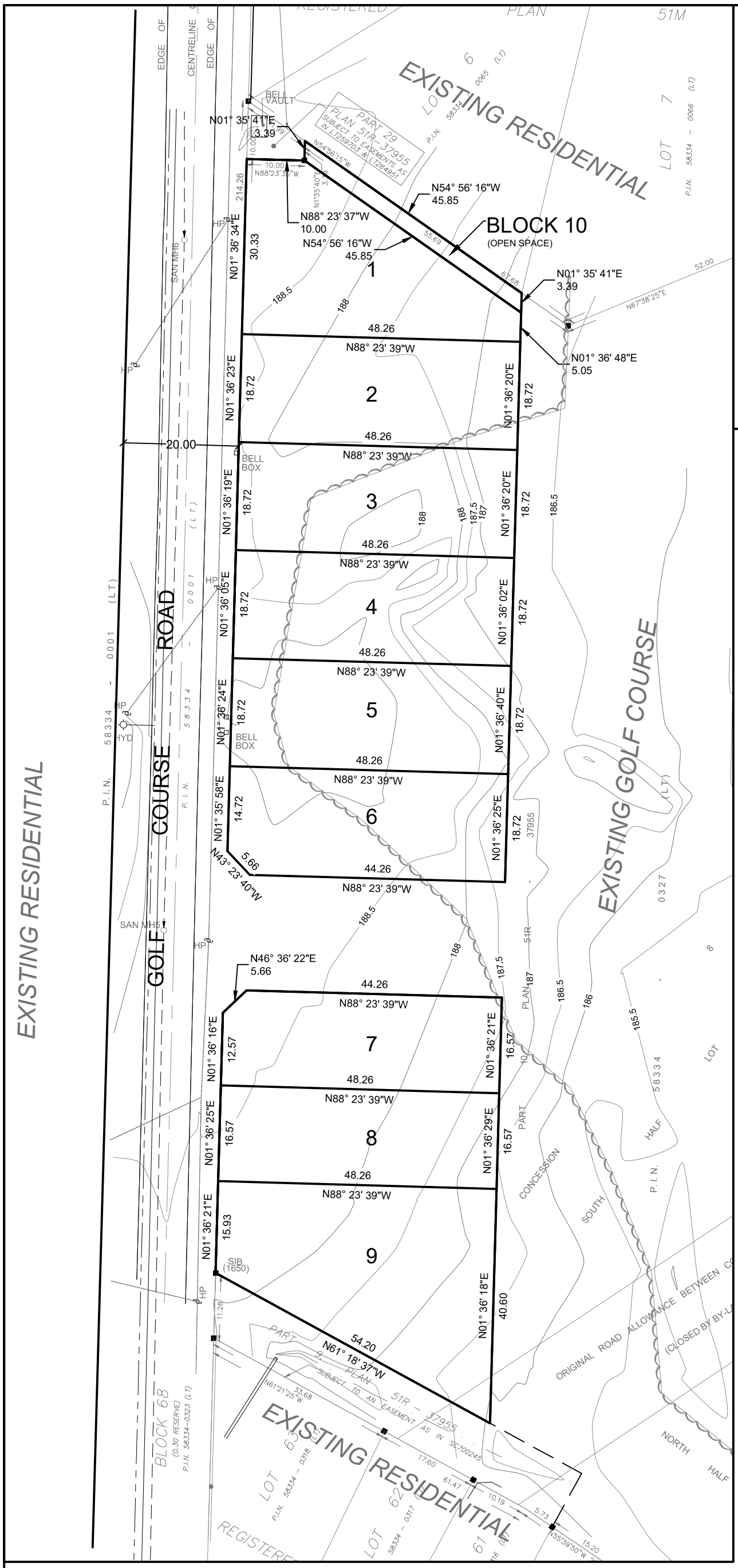
DATE ISSUED:	December 2019	Figure No.
CREATED BY:	JLM	2
PROJECT NO.:	15-273	
REFERENCE:	Simcoe County Mapping	

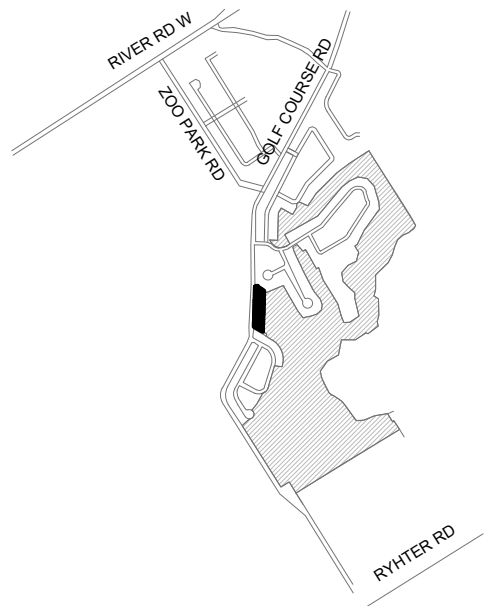
DAYSTAMP: M:\15 Projects\15-273 Marlwood GG EIS\04.0 - Drafting\15-273.dwg

Plotted by: JMCCARTNEY on February 5, 2020 at 12:34pm
File: P:\15 Projects\15-273 Marlwood GG EIS\04.0 - Drafting\15-273.dwg Layout: HY02 Plotscale: 1

APPENDIX B

Engineering Drawings & Draft Site Plans





KEY PLAN
N.T.S.

SUBJECT PROPERTY
ADDITIONAL LANDS OWNED BY APPLICANT

ADDITIONAL INFORMATION

As required under Section 51(17) of the Planning Act.

a), b), e), f), g) & j) – on plan
c) – on key plan
d) – see statistics
h) – piped water to be installed by developer
i) – sandy
k) – all municipal services to be made available
l) – DO WE HAVE TO INCLUDE THE BELL EASEMENT AND DRAINAGE BLOCK TO THE SOUTH IN THIS DRAFT PLAN

STATISTICS

PROPOSED LAND USE	LOT/BLOCK	AREA
SINGLE DETACHED RESIDENTIAL	1-9	0.84ha
OPEN SPACE	10	0.01ha

APPROVED SUBJECT TO CONDITIONS IN ACCORDANCE WITH SECTION 51(31) OF THE PLANNING ACT, RSO, CAP. P.13, AS AMENDED,

THIS _____ DAY OF _____,_____

DIRECTOR OF PLANNING, DEVELOPMENT AND TOURISM, COUNTY OF SIMCOE

OWNER'S CERTIFICATE

We authorize LOFT Planning Inc. to prepare and submit this Plan of Subdivision for approval.

A.S.O. _____

TPC MARLWOOD INC. date

SURVEYOR'S CERTIFICATE

I hereby certify that the boundaries of the lands being subdivided and their relationship to the adjacent lands are accurately and correctly shown.

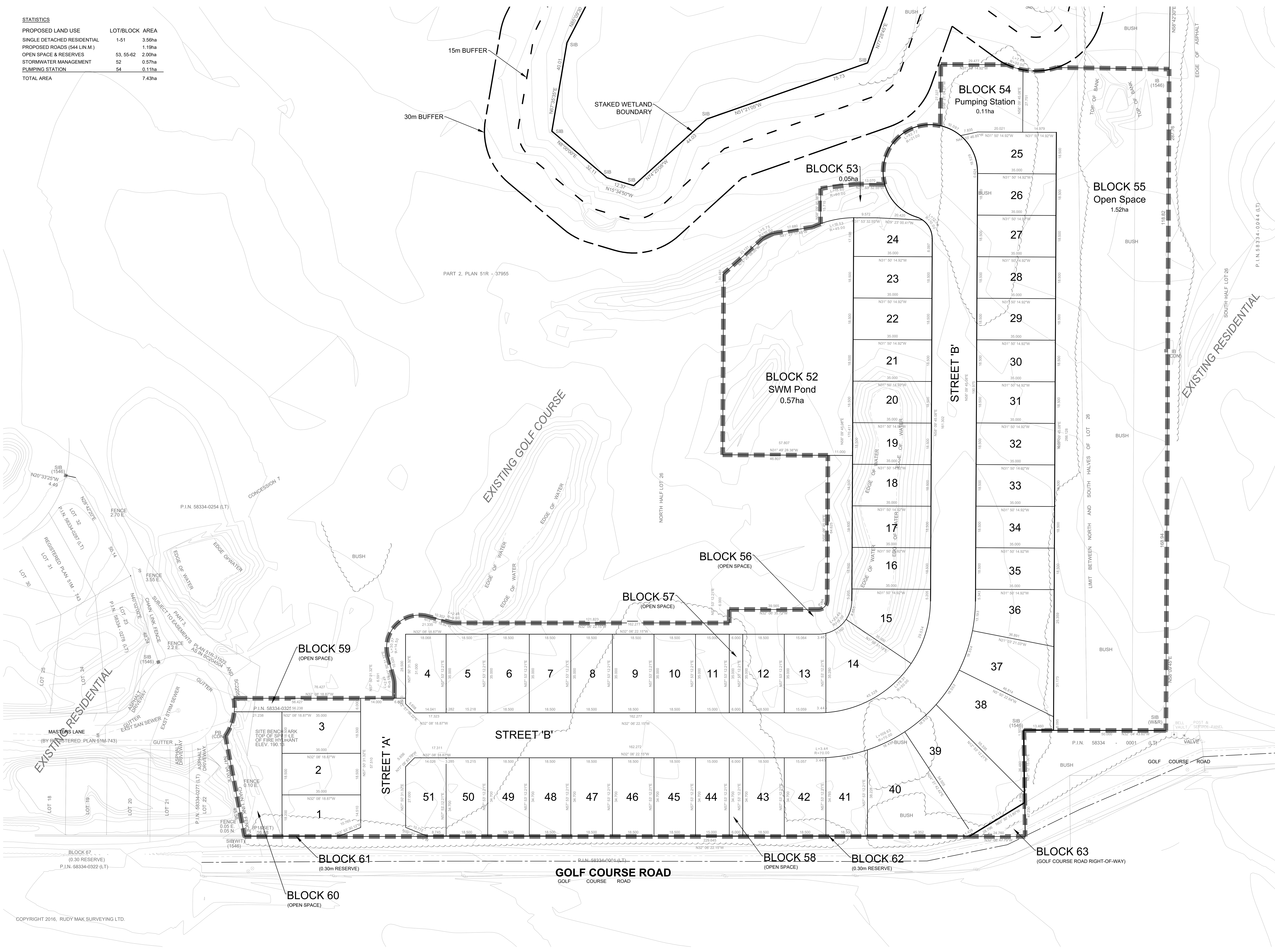
RUDY MAK SURVEYING LTD. date

I-T-0003
DRAFT PLAN OF SUBDIVISION
Part of south half of Lot 26
Concession 7
Town of Wasaga Beach
County of Simcoe
(Geographic Township of Flos)

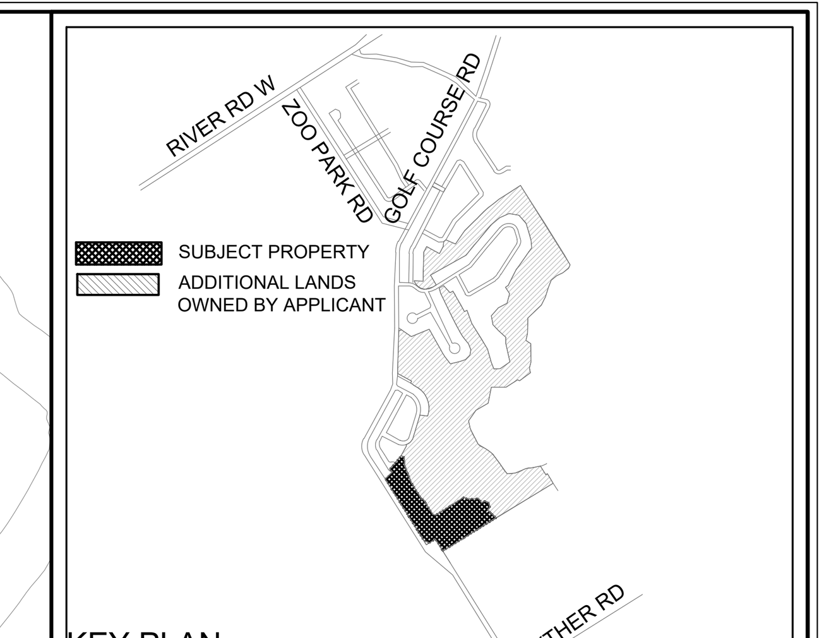
Date: January 14, 2020

STATISTICS

PROPOSED LAND USE	LOT/BLOCK	AREA
SINGLE DETACHED RESIDENTIAL	1-51	3.56ha
PROPOSED ROADS (544 LIN.M.)		1.19ha
OPEN SPACE & RESERVES	53, 55-62	2.00ha
STORMWATER MANAGEMENT	52	0.57ha
PUMPING STATION	54	0.11ha
TOTAL AREA		7.43ha



COPYRIGHT 2016, RUDY MAK SURVEYING LTD.



KEY PLAN
SCALE: N.T.S.

ADDITIONAL INFORMATION

As required under Section 51(17) of the Planning Act.

a), b), e), f), g) & j) – on plan
c) – on key plan
d) – see statistics
h) – piped water to be installed by developer
i) – sandy
k) – all municipal services to be made available
l) – nil

APPROVED SUBJECT TO CONDITIONS IN ACCORDANCE WITH SECTION 51(31) OF THE PLANNING ACT, RSO, CAP. P.13, AS AMENDED,

THIS_______ DAY OF _________________,___________

DIRECTOR OF PLANNING, DEVELOPMENT AND TOURISM, COUNTY OF SIMCOE

OWNER'S CERTIFICATE

We authorize LOFT Planning Inc. to prepare and submit this Plan of Subdivision for approval.

_________________ A.S.O. _____________

TPC MARLWOOD INC. date

SURVEYOR'S CERTIFICATE

I hereby certify that the boundaries of the lands being subdivided and their relationship to the adjacent lands are accurately and correctly shown.

_________________ _____________

RUDY MAK SURVEYING LTD. date

LEGEND

PROPERTY LINE
LOT LINE

LOFT Planning Inc
LAND USE PLANNING | PROJECT MANAGEMENT
T 705.446.1168 | E Kristine@loftplanning.com

0 50 100 200 300 400
Metres

BURNSIDE

Client
TPC MARLWOOD INC.

Figure Title
MARLWOOD MASTER'S LANE EXTENSION

PRELIMINARY DRAFT PLAN

Drawn	Checked	Date	Figure No.
EDT	JO	20/01/14	1
Scale		Project No.	
1:750		300037815	

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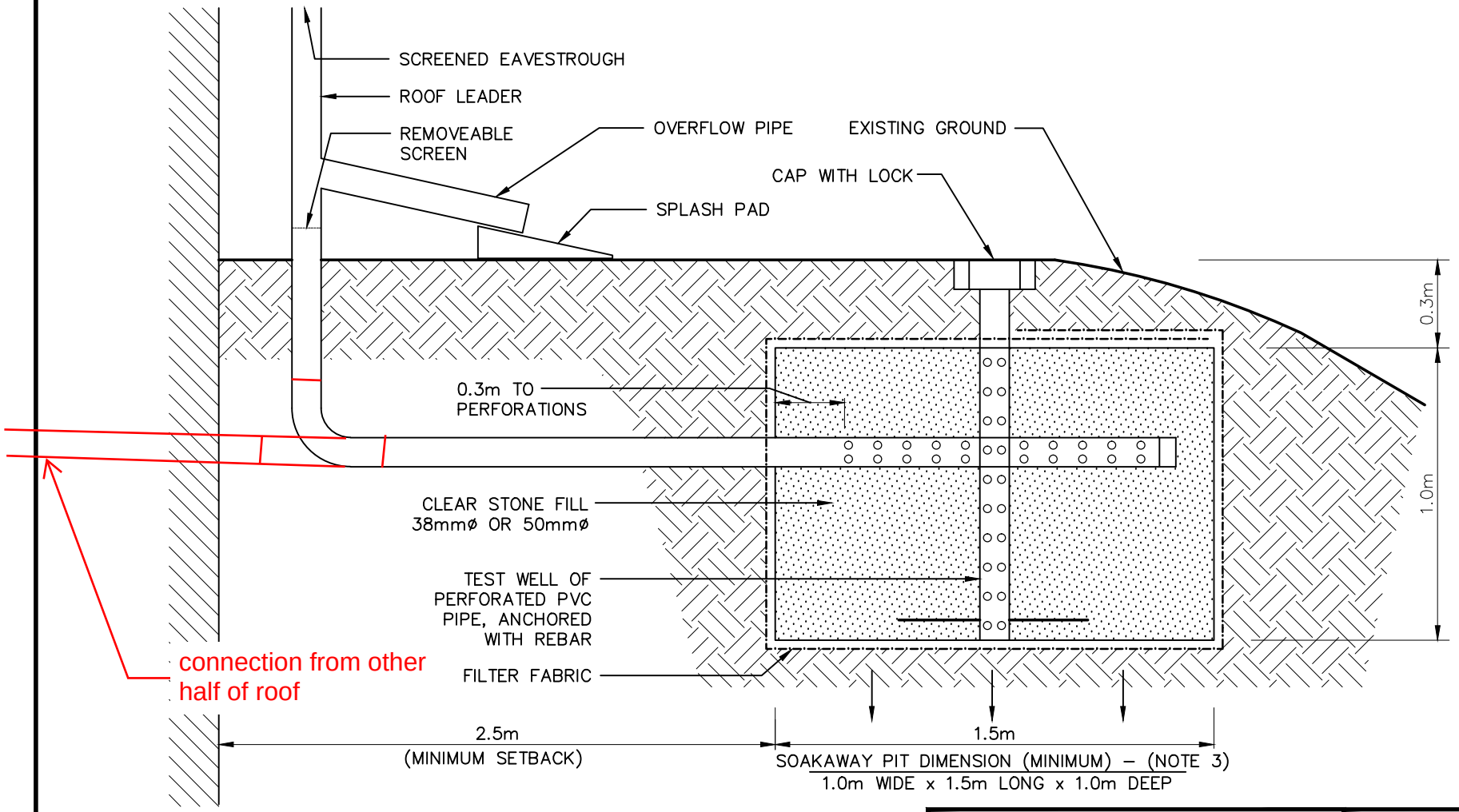

NOTE:

1. FILTER FABRIC TERRAFIX 270R OR EQUAL.
2. PROVIDE MINIMUM 0.5m CLEARANCE TO WATER TABLE FROM BOTTOM OF PIT.
3. SOAKAWAY PIT DIMENSIONS SHALL BE SIZED PER DESIGN ENGINEER RECOMMENDATION.
4. SOAKAWAY PIT TO BE INSPECTED BY DEVELOPER'S ENGINEER PRIOR TO BACKFILL.

TOWN OF WASAGA BEACH

ROOF LEADER
SOAKAWAY PIT DETAIL

DRAWN: TMM	SCALE: N.T.S.
DESIGN: MJP	PLOT: 1=1
CHECKED: MJP	DATE: MAR 2015

TOWN OF WASAGA BEACH • INCORPORATED 1974 •

STD.DWG.No.11

Soakaway Pit Sizing - 51 Lots

TPC Marlwood Inc.
31 Marlwood Ave, Wasaga Beach ON

Project #: 300037815
Date: 4-Dec-19
Designed: AH
Checked: JS

Runoff Depth to be Infiltrated: 12 mm
Design Infiltration Rate: 15 mm/hr
Maximum Drawdown Time: 48 hrs

Catchment ID	Roof Coverage (Full Roof)	Lot Area (m^2)	Area to be Infiltrated (Roof) (m^2)	Runoff to be Infiltrated (m)	Required Runoff Volume to be Infiltrated (m^3)	Drawdown Time (hrs)	Drawdown Rate (m^3/hr)	Design Infiltration Rate (m/hr)	Minimum Infiltration Gallery Footprint Area (m^2)	Length (m) *Minimum 1.5m	Width (m) *Minimum 1.0m	Infiltration Height (m) * Minimum 1.0m	Soakaway Pit Footprint Volume (m^3)	Void Ratio	Available Volume (m^3)
Typical Lot	50%	648	324	0.012	3.89	19	0.20	0.015	13.5	4.0	3.4	0.72	9.71	0.4	3.9

Soakaway Pit and Infiltration Trench Sizing - 9 Lots

TPC Marlwood Inc.
31 Marlwood Ave, Wasaga Beach ON

BURNSIDE
[THE DIFFERENCE IS OUR PEOPLE]

Project #: 300037815
Date: 14-Nov-19
Designed: AH
Checked: JS

Runoff Depth to be Infiltrated on Private Lots	5	mm
Runoff Depth to be Infiltrated within Proposed Easement	25	mm
Design Infiltration Rate:	15	mm/hr
Maximum Drawdown Time:	48	hrs

Catchment ID	Roof Coverage	Lot Area (m^2)	Area to be Infiltrated (Roof) (m^2)	Runoff to be Infiltrated (m)	Required Runoff Volume to be Infiltrated (m^3)	Drawdown Time (hrs)	Drawdown Rate (m^3/hr)	Design Infiltration Rate (m/hr)	Minimum Infiltration Gallery Footprint Area (m^2)	Length (m) *Minimum 1.5m	Width (m) *Minimum 1.0m	Infiltration Height (m) * Minimum 1.0m	Soakaway Pit Footprint Volume (m^3)	Void Ratio	Available Volume (m^3)
Lot 1 - Soakaway	50%	1115	558	0.005	2.8	19	0.15	0.015	9.7	4.0	2.4	0.72	6.97	0.4	2.8
Lot 2 - Soakaway	50%	900	450	0.005	2.3	19	0.12	0.015	7.8	3.5	2.2	0.72	5.63	0.4	2.3
Lot 3 - Soakaway	50%	905	453	0.005	2.3	19	0.12	0.015	7.9	3.5	2.2	0.72	5.66	0.4	2.3
Lot 4 - Soakaway	50%	905	453	0.005	2.3	19	0.12	0.015	7.9	3.5	2.2	0.72	5.66	0.4	2.3
Lot 5 - Soakaway	50%	905	453	0.005	2.3	19	0.12	0.015	7.9	3.5	2.2	0.72	5.66	0.4	2.3
Lot 6 - Soakaway	50%	900	450	0.005	2.3	19	0.12	0.015	7.8	3.5	2.2	0.72	5.63	0.4	2.3
Lot 7 - Soakaway	50%	800	400	0.005	2.0	19	0.10	0.015	6.9	3.5	2.0	0.72	5.00	0.4	2.0
Lot 8 - Soakaway	50%	800	400	0.005	2.0	19	0.10	0.015	6.9	3.5	2.0	0.72	5.00	0.4	2.0
Lot 9 - Soakaway	50%	1400	700	0.005	3.5	19	0.18	0.015	12.2	4.0	3.0	0.72	8.75	0.4	3.5
Remaining rooftop volume up to 25 mm - Infiltration Trench	50%	8630	4315	0.020	86.3	19	4.49	0.015	299.7	200.0	1.5	0.72	215.75	0.4	86.3

APPENDIX C

MECP Well Records

Groundwater Information Network
Réseau d'Information sur les Eaux Souterraines

Water Well

Identity : ca.on.waterWell.5729422
External identity : ca.on.waterWell.5729422
Source : Ontario Ministry of Environment
Online resource : http://www.ene.gov.on.ca/environment/en/subject/wells/index.htm
Length : 41.15m
Elevation : NaNm
Water level : 9.14m
Water yield : 36.37lpm
Water use : Domestic
Well status : Water Supply
Well type : Unknown
Screen components : From 39.9288 to 41.15m.

Well Log

Depth from (m)	Depth to (m)	GIN Lithology	Original Lithology	Porosity*	Hydraulic Conductivity*
0.00	12.50	**Sand**	SAND	[26,53]%	[2E-7,6E-3]m.s-1
12.50	24.99	**Sand**	SAND CLAY	[26,53]%	[2E-7,6E-3]m.s-1
		Clay		[34,57]%	[1E-11,4.7E-9]m.s-1
24.99	39.93	**Silt**	SILT	[34,61]%	[1E-9,2E-5]m.s-1
39.93	41.15	**Sand**	MEDIUM SAND	[26,53]%	[2E-7,6E-3]m.s-1
41.15	41.15	**Clay**	CLAY STONES	[34,57]%	[1E-11,4.7E-9]m.s-1
		Gravel		[24,44]%	[3E-4,3E-2]m.s-1

*Note: Porosity and hydraulic conductivity values are NOT measured but are derived from tables showing statistical averages for lithologies

Groundwater Information Network
Réseau d'Information sur les Eaux Souterraines

Water Well

Identity : ca.on.waterWell.5734995
External identity : ca.on.waterWell.5734995
Source : Ontario Ministry of Environment
Online resource : http://www.ene.gov.on.ca/environment/en/subject/wells/index.htm
Length : 13.11m
Elevation : NaNm
Water level : 4.57m
Water yield : 31.82lpm
Water use : Domestic
Well status : Water Supply
Well type : Unknown
Sealing components : From 0.00 to 4.57m.
Screen components : From 11.5824 to 12.80m.

Well Log

Depth from (m)	Depth to (m)	GIN Lithology	Original Lithology	Porosity*	Hydraulic Conductivity*
0.00	4.27	**Sand**	SAND	[26,53]%	[2E-7,6E-3]m.s-1
4.27	8.53	**Sand** **Silt** **Unknown material**	SAND SILT CEMENTED	[26,53]% [34,61]%	[2E-7,6E-3]m.s-1 [1E-9,2E-5]m.s-1
8.53	11.58	**Sand**	MEDIUM SAND	[26,53]%	[2E-7,6E-3]m.s-1
11.58	12.80	**Sand**	FINE SAND	[26,53]%	[2E-7,6E-3]m.s-1
12.80	13.11	**Sand** **Clay**	SAND CLAY	[26,53]% [34,57]%	[2E-7,6E-3]m.s-1 [1E-11,4.7E-9]m.s-1

*Note: Porosity and hydraulic conductivity values are NOT measured but are derived from tables showing statistical averages for lithologies

Groundwater Information Network
Réseau d'Information sur les Eaux Souterraines

Water Well

Identity : ca.on.waterWell.5726707
External identity : ca.on.waterWell.5726707
Source : Ontario Ministry of Environment
Online resource : http://www.ene.gov.on.ca/environment/en/subject/wells/index.htm
Length : 41.45m
Elevation : NaNm
Water level : 9.14m
Water yield : 45.46lpm
Water use : Domestic
Well status : Water Supply
Well type : Unknown
Sealing components : From 2.44 to 3.05m.
Screen components : From 40.5384 to 41.76m.

Well Log

Depth from (m)	Depth to (m)	GIN Lithology	Original Lithology	Porosity*	Hydraulic Conductivity*
0.00	12.80	**Sand**	SAND	[26,53]%	[2E-7,6E-3]m.s-1
12.80	23.47	**Sand**	SAND CLAY SANDY	[26,53]%	[2E-7,6E-3]m.s-1
		Clay		[34,57]%	[1E-11,4.7E-9]m.s-1
		Sand		[26,53]%	[2E-7,6E-3]m.s-1
23.47	31.09	**Clay**	CLAY HARD	[34,57]%	[1E-11,4.7E-9]m.s-1
		Unknown material			
31.09	39.01	**Sand**	FINE SAND	[26,53]%	[2E-7,6E-3]m.s-1
39.01	41.45	**Sand**	SAND CLEAN WATER-BEARING	[26,53]%	[2E-7,6E-3]m.s-1
		Unknown material			
		Unknown material			

*Note: Porosity and hydraulic conductivity values are NOT measured but are derived from tables showing statistical averages for lithologies

Groundwater Information Network
Réseau d'Information sur les Eaux Souterraines

Water Well

Identity : ca.on.waterWell.5733732
External identity : ca.on.waterWell.5733732
Source : Ontario Ministry of Environment
Online resource : http://www.ene.gov.on.ca/environment/en/subject/wells/index.htm
Length : 53.04m
Elevation : NaNm
Water level : 11.58m
Water yield : 54.55lpm
Water use : Domestic
Well status : Water Supply
Well type : Unknown
Sealing components : From 1.52 to 3.66m.
Screen components : From 52.1208 to 53.34m.

Well Log

Depth from (m)	Depth to (m)	GIN Lithology	Original Lithology	Porosity*	Hydraulic Conductivity*
0.00	7.01	**Sand**	SAND	[26,53]%	[2E-7,6E-3]m.s-1
7.01	12.50	**Sand**	SAND WOOD FRAGMENTS	[26,53]%	[2E-7,6E-3]m.s-1
		Organic material			
12.50	16.46	**Sand**	SAND CLAY LAYERED	[26,53]%	[2E-7,6E-3]m.s-1
		Clay		[34,57]%	[1E-11,4.7E-9]m.s-1
		Unknown material			
16.46	20.42	**Clay**	CLAY HARD	[34,57]%	[1E-11,4.7E-9]m.s-1
		Unknown material			
20.42	29.26	**Clay**	CLAY SOFT HARD	[34,57]%	[1E-11,4.7E-9]m.s-1
		Unknown material			
		Unknown material			
29.26	36.88	**Clay**	CLAY SAND GRAVEL	[34,57]%	[1E-11,4.7E-9]m.s-1
		Sand		[26,53]%	[2E-7,6E-3]m.s-1
		Gravel		[24,44]%	[3E-4,3E-2]m.s-1
36.88	42.06	**Clay**	CLAY HARD	[34,57]%	[1E-11,4.7E-9]m.s-1
		Unknown material			
42.06	44.81	**Sand**	SAND CLAY SANDY	[26,53]%	[2E-7,6E-3]m.s-1
		Clay		[34,57]%	[1E-11,4.7E-9]m.s-1
		Sand		[26,53]%	[2E-7,6E-3]m.s-1

Depth from (m)	Depth to (m)	GIN Lithology	Original Lithology	Porosity*	Hydraulic Conductivity*
44.81	51.82	**Clay**	CLAY HARD SOFT	[34,57]%	[1E-11,4.7E-9]m.s-1
		Unknown material			
		Unknown material			
51.82	53.04	**Sand**	SAND CLEAN WATER-BEARING	[26,53]%	[2E-7,6E-3]m.s-1
		Unknown material			
		Unknown material			

*Note: Porosity and hydraulic conductivity values are NOT measured but are derived from tables showing statistical averages for lithologies

Groundwater Information Network
Réseau d'Information sur les Eaux Souterraines

Water Well

Identity : ca.on.waterWell.5731265
External identity : ca.on.waterWell.5731265
Source : Ontario Ministry of Environment
Online resource : http://www.ene.gov.on.ca/environment/en/subject/wells/index.htm
Length : 44.50m
Elevation : NaNm
Water level : 10.06m
Water yield : 90.92lpm
Water use : Domestic
Well status : Water Supply
Well type : Unknown
Sealing components : From 1.83 to 3.35m.
Screen components : From 43.5864 to 44.50m.

Well Log

Depth from (m)	Depth to (m)	GIN Lithology	Original Lithology	Porosity*	Hydraulic Conductivity*
0.00	14.94	**Sand**	SAND	[26,53]%	[2E-7,6E-3]m.s-1
14.94	17.37	**Clay**	CLAY SOFT	[34,57]%	[1E-11,4.7E-9]m.s-1
		Unknown material			
17.37	27.43	**Clay**	CLAY SOFT	[34,57]%	[1E-11,4.7E-9]m.s-1
		Unknown material			
27.43	42.06	**Clay**	CLAY SAND GRAVEL	[34,57]%	[1E-11,4.7E-9]m.s-1
		Sand		[26,53]%	[2E-7,6E-3]m.s-1
		Gravel		[24,44]%	[3E-4,3E-2]m.s-1
42.06	44.50	**Sand**	SAND CLEAN WATER-BEARING	[26,53]%	[2E-7,6E-3]m.s-1
		Unknown material			
		Unknown material			

*Note: Porosity and hydraulic conductivity values are NOT measured but are derived from tables showing statistical averages for lithologies

Groundwater Information Network
Réseau d'Information sur les Eaux Souterraines

Water Well

Identity : ca.on.waterWell.5709060
External identity : ca.on.waterWell.5709060
Source : Ontario Ministry of Environment
Online resource : http://www.ene.gov.on.ca/environment/en/subject/wells/index.htm
Length : 79.25m
Elevation : 190.50m
Well status : Abandoned-Supply
Well type : Unknown

Well Log

Depth from (m)	Depth to (m)	GIN Lithology	Original Lithology	Porosity*	Hydraulic Conductivity*
0.00	11.58	**Sand**	MEDIUM SAND	[26,53]%	[2E-7,6E-3]m.s-1
11.58	25.91	**Clay**	CLAY	[34,57]%	[1E-11,4.7E-9]m.s-1
25.91	43.59	**Sand**	MEDIUM SAND	[26,53]%	[2E-7,6E-3]m.s-1
		Clay	CLAY	[34,57]%	[1E-11,4.7E-9]m.s-1
43.59	53.64	**Gravel**	GRAVEL	[24,44]%	[3E-4,3E-2]m.s-1
53.64	57.30	**Sand**	COARSE SAND	[26,53]%	[2E-7,6E-3]m.s-1
57.30	74.37	**Clay**	CLAY MEDIUM	[34,57]%	[1E-11,4.7E-9]m.s-1
		Sand	SAND	[26,53]%	[2E-7,6E-3]m.s-1
74.37	79.25	**Limestone**	LIMESTONE	[7,56]%	[1E-9,6E-6]m.s-1

*Note: Porosity and hydraulic conductivity values are NOT measured but are derived from tables showing statistical averages for lithologies

Groundwater Information Network
Réseau d'Information sur les Eaux Souterraines

Water Well

Identity : ca.on.waterWell.5709061
External identity : ca.on.waterWell.5709061
Source : Ontario Ministry of Environment
Online resource : http://www.ene.gov.on.ca/environment/en/subject/wells/index.htm
Length : 54.86m
Elevation : 190.50m
Well status : Test Hole
Well type : Unknown
Screen components : From 40.8432 to 46.94m.

Well Log

Depth from (m)	Depth to (m)	GIN Lithology	Original Lithology	Porosity*	Hydraulic Conductivity*
0.00	11.58	**Sand**	MEDIUM SAND	[26,53]%	[2E-7,6E-3]m.s-1
11.58	25.91	**Clay**	CLAY	[34,57]%	[1E-11,4.7E-9]m.s-1
25.91	43.59	**Sand**	MEDIUM SAND	[26,53]%	[2E-7,6E-3]m.s-1
		Clay	CLAY	[34,57]%	[1E-11,4.7E-9]m.s-1
43.59	51.82	**Gravel**	GRAVEL MEDIUM	[24,44]%	[3E-4,3E-2]m.s-1
		Sand	SAND	[26,53]%	[2E-7,6E-3]m.s-1
51.82	54.86	**Clay**	CLAY MEDIUM	[34,57]%	[1E-11,4.7E-9]m.s-1
		Sand	SAND	[26,53]%	[2E-7,6E-3]m.s-1

*Note: Porosity and hydraulic conductivity values are NOT measured but are derived from tables showing statistical averages for lithologies

Groundwater Information Network
Réseau d'Information sur les Eaux Souterraines

Water Well

Identity : ca.on.waterWell.5733570
External identity : ca.on.waterWell.5733570
Source : Ontario Ministry of Environment
Online resource : http://www.ene.gov.on.ca/environment/en/subject/wells/index.htm
Length : 41.15m
Elevation : NaNm
Water level : 8.53m
Water yield : 136.38lpm
Water use : Domestic
Well status : Water Supply
Well type : Unknown
Sealing components : From 2.44 to 3.66m.

Well Log

Depth from (m)	Depth to (m)	GIN Lithology	Original Lithology	Porosity*	Hydraulic Conductivity*
0.00	17.07	**Sand** **Gravel**	SAND STONES	[26,53]% [24,44]%	[2E-7,6E-3]m.s-1 [3E-4,3E-2]m.s-1
17.07	23.77	**Clay** **Unknown material**	CLAY SOFT	[34,57]%	[1E-11,4.7E-9]m.s-1
23.77	31.39	**Clay** **Gravel**	CLAY STONES	[34,57]% [24,44]%	[1E-11,4.7E-9]m.s-1 [3E-4,3E-2]m.s-1
31.39	37.80	**Clay** **Sand** **Unknown material**	CLAY SAND CEMENTED	[34,57]% [26,53]%	[1E-11,4.7E-9]m.s-1 [2E-7,6E-3]m.s-1
37.80	39.32	**Clay** **Unknown material** **Unknown material**	CLAY HARD LAYERED	[34,57]%	[1E-11,4.7E-9]m.s-1
39.32	41.15	**Sand** **Unknown material** **Unknown material**	SAND CLEAN WATER-BEARING	[26,53]%	[2E-7,6E-3]m.s-1

*Note: Porosity and hydraulic conductivity values are NOT measured but are derived from tables showing statistical averages for lithologies

APPENDIX D

ORMGP (2018) Maps

41 Marlwood Avenue Ground Water (masl)

Legend

- CAMC Boundary
- Oak Ridges Moraine Boundary
- Well
- Strahler Class 4 to 7 Streams

Water Table (mASL)

High : 530.229

Low : 45.0948

AZIMUTH ENVIRONMENTAL CONSULTING, INC.
Environmental Assessments & Approvals

229.3 0 114.66 229.3 Metres

1: 4,514

Map Compiled by the Conservation Authorities Moraine Coalition
101 Exchange Avenue, Vaughan, Ontario, M3N 1S4

This map is for information purposes only and the Conservation Authorities Moraine Coalition takes no responsibility for, nor guarantees, the accuracy of all the information contained within the map.

SOURCE: CAMC, 2018; MNR, 2018;

PROJECTION: WGS_1984_Web_Mercator_Auxiliary Sphere

DATE PRINTED: November 23, 2018

41 Marlwood Avenue Ground Water (masl)

Legend

- CAMC Boundary
- Oak Ridges Moraine Boundary
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PROJECTION: WGS_1984_Web_Mercator_Auxiliary Sphere

DATE PRINTED: November 23, 2018

APPENDIX E

Water Balance

Water Balance Summary Table - Pre-Development

Catchment Designation	Phase 1		Phase 2			Total
	Forest	Landscaped	Forest	Landscaped	Surface Water	
Area (m^2)	6,127	2,373	29,736	42,799	1,765	82,800
Pervious Area (m^2)	6,127	2,373	29,736	42,799	-	81,035
Impervious Area (m^2)	-	-	-	-	1,765	1,765
Infiltration Factors						
Topography Infiltration Factor	0.2	0.2	0.2	0.2	0	
Soil Infiltration Factor	0.4	0.4	0.4	0.4	0	
Land Cover Infiltration Factor	0.2	0.05	0.2	0.05	0	
Infiltration Factor	0.8	0.65	0.8	0.65	0	
Run-Off Coefficient	0.2	0.35	0.2	0.35	1	
Run-Off From Impervious Surfaces	0.8	0.8	0.8	0.8	0.8	
Inputs (Per Unit Area)						
Precipitation (mm/yr)	888	888	888	888	888	888
Rainfall (mm/yr)	656	656	656	656	656	656
Run-On (mm/yr)	0	0	0	0	0	0
Other Inputs (mm/yr)	0	0	0		0	0
Total Inputs (mm/yr)	**888**	**888**	**888**	**888**	**888**	888
Outputs (Per Unit Area)						
Precipitation Surplus (mm/yr)	393	393	393	393	710	
Net Surplus (mm/yr)	393	393	393	393	710	
Evapotranspiration (mm/yr)	495	495	495	495	178	
Infiltration (mm/yr)	314	255	314	255	0	
Supplemental Infiltration (mm/yr)	0	0	0	0	0	
Total Infiltration (mm/yr)	314	255	314	255	0	
Run-Off Pervious Areas (mm/yr)	79	138	79	138	0	
Run-Off Impervious Areas (mm/yr)	0	0	0	0	710	
Total Run-Off (mm/yr)	79	138	79	138	710	
Total Outputs (mm/yr)	**888**	**888**	**888**	**888**	**888**	
Difference (Inputs - Outputs)	**0**	**0**	**0**	**0**	**0**	
Inputs (Volumes)						
Precipitation (m^3/yr)	5,441	2,107	26,406	38,006	1,567	73,526
Run-On (m^3/yr)	0	0	0	0	0	0
Other Inputs (m^3/yr)	0	0	0	0	0	0
Total Inputs (m^3/yr)	**5,441**	**2,107**	**26,406**	**38,006**	**1,567**	**73,526**
Outputs (Volumes)						
Precipitation Surplus (m^3/yr)	2,408	933	11,686	16,820	1,254	33,101
Net Surplus (m^3/yr)	2,408	933	11,686	16,820	1,254	33,101
Evapotranspiration (m^3/yr)	3,033	1,175	14,719	21,186	313	40,426
Infiltration (m^3/yr)	1,926	606	9,349	10,933	0	22,815
Rooftop Infiltration (m^3/yr)	0	0	0	0	0	0
Total Infiltration (m^3/yr)	***1,926***	***606***	***9,349***	***10,933***	***0***	22,815
Run-Off Pervious Areas (m^3/yr)	482	326	2,337	5,887	0	9,032
Run-Off Impervious Areas (m^3/yr)	0	0	0	0	1,254	1,254
Total Run-Off (m^3/yr)	482	326	2,337	5,887	1,254	10,286
Total Outputs (m^3/yr)	**5,441**	**2,107**	**26,406**	**38,006**	**1,567**	**73,526**
Difference (Inputs - Outputs)	**0**	**0**	**0**	**0**	**0**	**0**

Water Balance Summary Table - Post-Development (no mitigation)

Catchment Designation	Phase 1			Phase 2						Total
	Structure	Driveway	Landscaped	Structure	Driveway	Roads	Impervious SWM Pond & Pumping Station	Forest	Landscaped	
Area (m^2)	4315	360	3825	16524	2040	11900	6800	15,200	21,836	82,800
Pervious Area (m^2)	0	0	3825	0	0	0	0	15,200	21,836	40,861
Impervious Area (m^2)	4315	360	0	16524	2040	11900	6800	0	0	41,939
Infiltration Factors										
Topography Infiltration Factor	0	0	0.2	0	0	0	0	0.2	0.2	
Soil Infiltration Factor	0	0	0.4	0	0	0	0	0.4	0.4	
Land Cover Infiltration Factor	0	0	0.05	0	0	0	0	0.2	0.05	
Infiltration Factor	0	0	0.65	0	0	0	0	0.8	0.65	
Run-Off Coefficient	1	1	0.35	1	1	1	1	0.2	0.35	
Run-Off From Impervious Surfaces	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.8	
Inputs (Per Unit Area)										
Precipitation (mm/yr)	888	888	888	888	888	888	888	888	888	
Rainfall (mm/yr)	656	656	656	656	656	656	656	656	656	
Run-On (mm/yr)	0	0	0	0	0	0	0	0	0	
Other Inputs (mm/yr)	0	0	0	0	0	0	0	0	0	
Total Inputs (mm/yr)	**888**	**888**	**888**	**888**	**888**			**888**	**888**	888
Outputs (Per Unit Area)										
Precipitation Surplus (mm/yr)	710	710	393	710	710	710	710	393	393	
Net Surplus (mm/yr)	710	710	393	710	710	710	710	393	393	
Evapotranspiration (mm/yr)	178	178	495	178	178	178	178	495	495	
Infiltration (mm/yr)	0	0	255	0	0	0	0	314	255	
Supplemental Infiltration (mm/yr)	0	0	0	0	0	0	0	0	0	
Total Infiltration (mm/yr)	0	0	255	0	0	0	0	314	255	
Run-Off Pervious Areas (mm/yr)	0	0	138	0	0	0	0	79	138	
Run-Off Impervious Areas (mm/yr)	710	710	0	710	710	710	710	0	0	
Total Run-Off (mm/yr)	710	710	138	710	710	710	710	79	138	
Total Outputs (mm/yr)	**888**	**888**	**888**	**888**	**888**	**888**	**888**	**888**	**888**	
Difference (Inputs - Outputs)	**0**	**0**	**0**	**0**	**0**	**888**	**888**	**0**	**0**	
Inputs (Volumes)										
Precipitation (m^3/yr)	3,832	320	3,397	14,673	1,812	10,567	6,038	13,498	19,390	73,526
Run-On (m^3/yr)	0	0	0	0	0	0	0	0	0	0
Other Inputs (m^3/yr)	0	0	0	0	0	0	0	0	0	0
Total Inputs (m^3/yr)	**3,832**	**320**	**3,397**	**14,673**	**1,812**	**10,567**	**6,038**		**19,390**	**73,526**
Outputs (Volumes)										
Precipitation Surplus (m^3/yr)	3,065	256	1,503	11,739	1,449	8,454	4,831	5,974	8,582	45,852
Net Surplus (m^3/yr)	3,065	256	1,503	11,739	1,449	8,454	4,831	5,974	8,582	45,852
Evapotranspiration (m^3/yr)	766	64	1,893	2,935	362	2,113	1,208	7,524	10,809	27,675
Infiltration (m^3/yr)	0	0	977	0	0	0	0	4,779	5,578	11,334
Rooftop Infiltration (m^3/yr)	0	0	0	0	0	0	0	0	0	0
Total Infiltration (m^3/yr)	***0***	***0***	***977***	***0***	***0***	***0***	***0***	***4,779***	***5,578***	11,334
Run-Off Pervious Areas (m^3/yr)	0	0	526	0	0	0	0	1,195	3,004	4,724
Run-Off Impervious Areas (m^3/yr)	3,065	256	0	11,739	1,449	8,454	4,831	0	0	29,793
Total Run-Off (m^3/yr)	3,065	256	526	11,739	1,449	8,454	4,831	1,195	3,004	34,518
Total Outputs (m^3/yr)	3,832	320	3,397	14,673	1,812	10,567	6,038	13,498	19,390	73,526
Difference (Inputs - Outputs)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**13,498**	**0**	**0**

Water Balance Summary Table - Post-Development (with mitigation)

Catchment Designation	Phase 1			Phase 2						Total
	Structure	Driveway	Landscaped	Structure	Driveway	Roads	SWM Pond	Forest	Landscaped	
Area (m^2)	4315	360	3825	16524	2040	11900	6800	15,200	21,836	82,800
Pervious Area (m^2)	0	0	3825	0	0	0	0	15,200	21,836	40,861
Impervious Area (m^2)	4315	360	0	16524	2040	11900	6800	0	0	41,939
Infiltration Factors										
Topography Infiltration Factor	0	0	0.2	0	0	0	0	0.2	0.2	
Soil Infiltration Factor	0	0	0.4	0	0	0	0	0.4	0.4	
Land Cover Infiltration Factor	0	0	0.05	0	0	0	0	0.2	0.05	
Infiltration Factor	0	0	0.65	0	0	0	0	0.8	0.65	
Run-Off Coefficient	1	1	0.35	1	1	1	1	0.2	0.35	
Run-Off From Impervious Surfaces	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.8	
Inputs (Per Unit Area)										
Precipitation (mm/yr)	888	888	888	888	888	888	888	888	888	
Rainfall (mm/yr)	656	656	656	656	656	656	656	656	656	
Run-On (mm/yr)	0	0	0	0	0	0	0	0	0	
Other Inputs (mm/yr)	0	0	0	0	0	0	0	0	0	
Total Inputs (mm/yr)	**888**	**888**	**888**	**888**	**888**	**888**	**888**	**888**	**888**	
Outputs (Per Unit Area)										
Precipitation Surplus (mm/yr)	710	710	393	710	710	710	710	393	393	
Net Surplus (mm/yr)	710	710	393	710	710	710	710	393	393	
Evapotranspiration (mm/yr)	178	178	495	178	178	178	178	495	495	
Infiltration (mm/yr)	0	0	255	0	0	0	0	314	255	
Supplemental Infiltration (mm/yr)	622	0	0	539	0	0	0	0	0	
Total Infiltration (mm/yr)	622	0	255	539	0	0	0	314	255	
Run-Off Pervious Areas (mm/yr)	0	0	138	0	0	0	0	79	138	
Run-Off Impervious Areas (mm/yr)	88	710	0	171	710	710	710	0	0	
Total Run-Off (mm/yr)	88	710	138	171	710	710	710	79	138	
Total Outputs (mm/yr)	**888**	**888**	**888**	**888**	**888**	**888**	**888**	**888**	**888**	
Difference (Inputs - Outputs)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
Inputs (Volumes)										
Precipitation (m^3/yr)	3,832	320	3,397	14,673	1,812	10,567	6,038	13,498	19,390	73,526
Run-On (m^3/yr)	0	0	0	0	0	0	0	0	0	0
Other Inputs (m^3/yr)	0	0	0	0	0	0	0	0	0	0
Total Inputs (m^3/yr)	**3,832**	**320**	**3,397**	**14,673**	**1,812**	**10,567**	**6,038**		**19,390**	**73,526**
Outputs (Volumes)										
Precipitation Surplus (m^3/yr)	3,065	256	1,503	11,739	1,449	8,454	4,831	5,974	8,582	45,852
Net Surplus (m^3/yr)	3,065	256	1,503	11,739	1,449	8,454	4,831	5,974	8,582	45,852
Evapotranspiration (m^3/yr)	766	64	1,893	2,935	362	2,113	1,208	7,524	10,809	27,675
Infiltration (m^3/yr)	0	0	977	0	0	0	0	4,779	5,578	11,334
Supplemental Infiltration (m^3/yr)	2,684	0	0	8,915	0	0	0	0	0	11,599
Total Infiltration (m^3/yr)	***2,684***	***0***	***977***	***8,915***	***0***	***0***	***0***	***4,779***	***5,578***	22,933
Run-Off Pervious Areas (m^3/yr)	0	0	526	0	0	0	0	1,195	3,004	4,724
Run-Off Impervious Areas (m^3/yr)	381	256	0	2,824	1,449	8,454	4,831	0	0	18,195
Total Run-Off (m^3/yr)	381	256	526	2,824	1,449	8,454	4,831	1,195	3,004	22,919
Total Outputs (m^3/yr)	3,832	320	3,397	14,673	1,812	10,567	6,038	13,498	19,390	73,526
Difference (Inputs - Outputs)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**13,498**	**0**	**0**

Overall Water Balance Summary Table

Characteristic	Site						
	Pre-Development	Post-Development	Change (Pre to Post)		Post-Development with Mitigation	Change (Pre to Post with Mitigation)	
Inputs (Volume)							
Precipitation (m^3/yr)	73,526	73,526	0	0%	73,526	0	0%
Run-On (m^3/yr)	0	0	0	0%	0	0	-
Other Inputs (m^3/yr)	0	0	0	0%	0	0	-
Total Inputs (m^3/yr)	73,526	73,526	0	0%	73,526	0	0%
Outputs (Volume)							
Precipitation Surplus (m^3/yr)	33,101	45,852	12,751	39%	45,852	12,751	39%
Net Surplus (m3/yr)	33,101	45,852	12,751	39%	45,852	12,751	39%
Evapotranspiration (m^3/yr)	40,426	27,675	-12,751	-32%	27,675	-12,751	-32%
Infiltration (m^3/yr)	22,815	11,334	-11,481	-50%	11,334	-11,481	-50%
Supplemental Infiltration (m^3/yr)	0	0	0	0%	11,599	11,599	-
Total Infiltration (m^3/yr)	***22,815***	***11,334***	***-11,481***	***-50%***	22,933	***118***	***0.52%***
Run-Off Pervious Areas (m^3/yr)	9,032	4,724	-4,308	-48%	4,724	-4,308	-48%
Run-Off Impervious Areas (m^3/yr)	1,254	29,793	28,540	0%	18,195	16,941	-
Total Run-Off (m^3/yr)	10,286	34,518	24,232	236%	22,919	12,633	123%
Total Outputs (m^3/yr)	**73,526**	**73,526**	**0**	0%	73,526	0	0%

BURNSIDE

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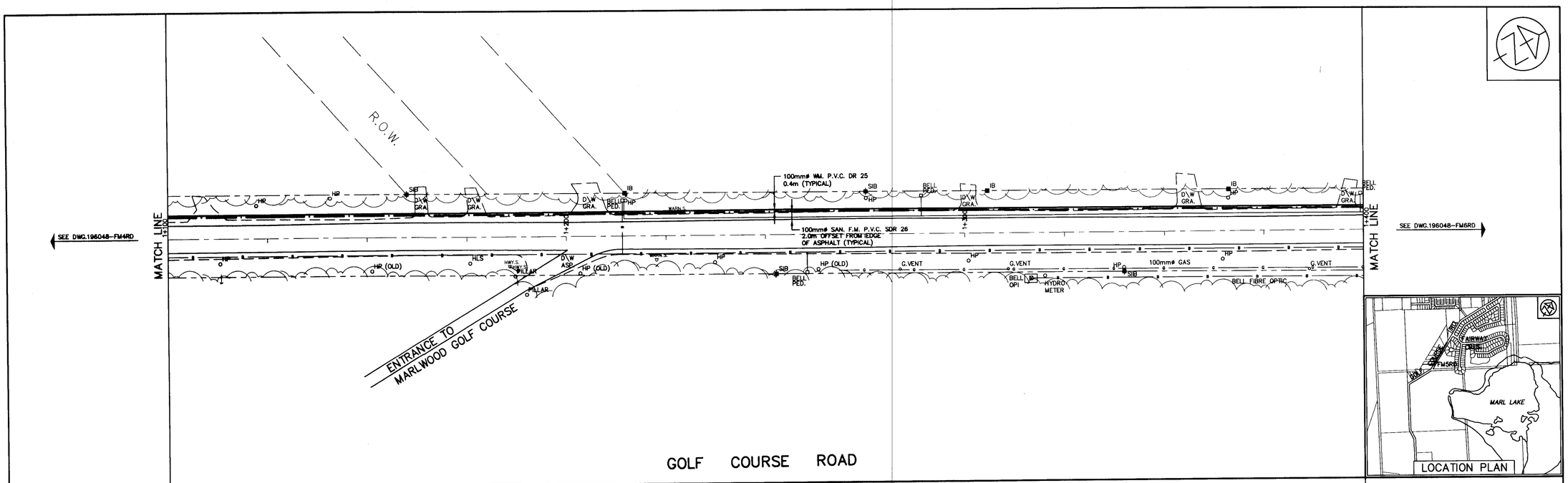
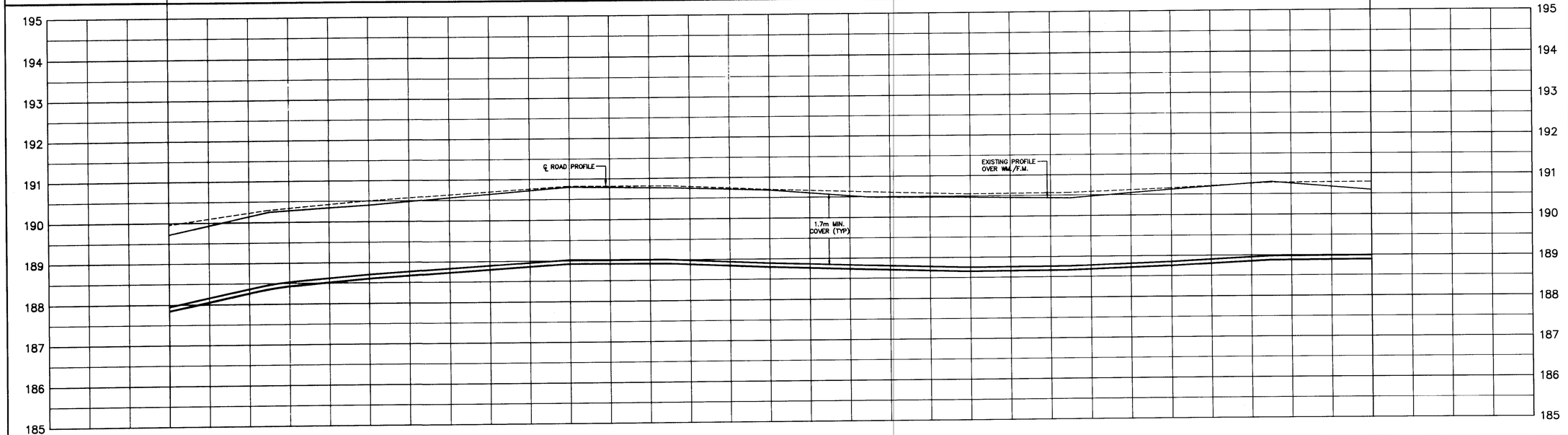
Appendix C

As-Built Drawings – Golf Course Road





CHAINAGE	1+100	1+125	1+150	1+175	1+200	1+225	1+250	1+275	1+300	1+325	1+350	1+375	1+400
℄ ROAD	189.95	190.29	190.50	190.66	190.82	190.81	190.70	190.62	190.055	190.56	190.65	190.78	190.79
℄ WM./F.M.	189.72	190.25	190.40	190.60	190.80	190.76	190.68	190.49	190.47	190.43	190.62	190.80	190.59

LEGEND

- PROPERTY LINE
- BURIED BELL CABLE
- BURIED BELL CONDUIT
- BURIED GAS MAIN
- PROPOSED WATER MAIN AND VALVE
- EX. SANITARY SEWER & M.H.
- PROPOSED SANITARY FORCEMAIN
- GV. PROPOSED GATE VALVE

NOTES :
1) LOCATION OF UTILITIES ARE APPROXIMATE.

PLOT: 1=5

RECORD DRAWING

COMPILED BY: D.H.	DATE: MAR. 1998
CHECKED BY: R.H.M.	DATE: MAR. 1998
DRAWN BY: D.H.	DATE: SEP. 1998
CHECKED BY: R.H.M.	DATE: SEP. 1998

NO.	REVISIONS	DATE	INITIAL
	REVISED RECORD DRAWING	SEP. 1998	R.H.M.

RECORD DRAWING
NOTICE TO USERS

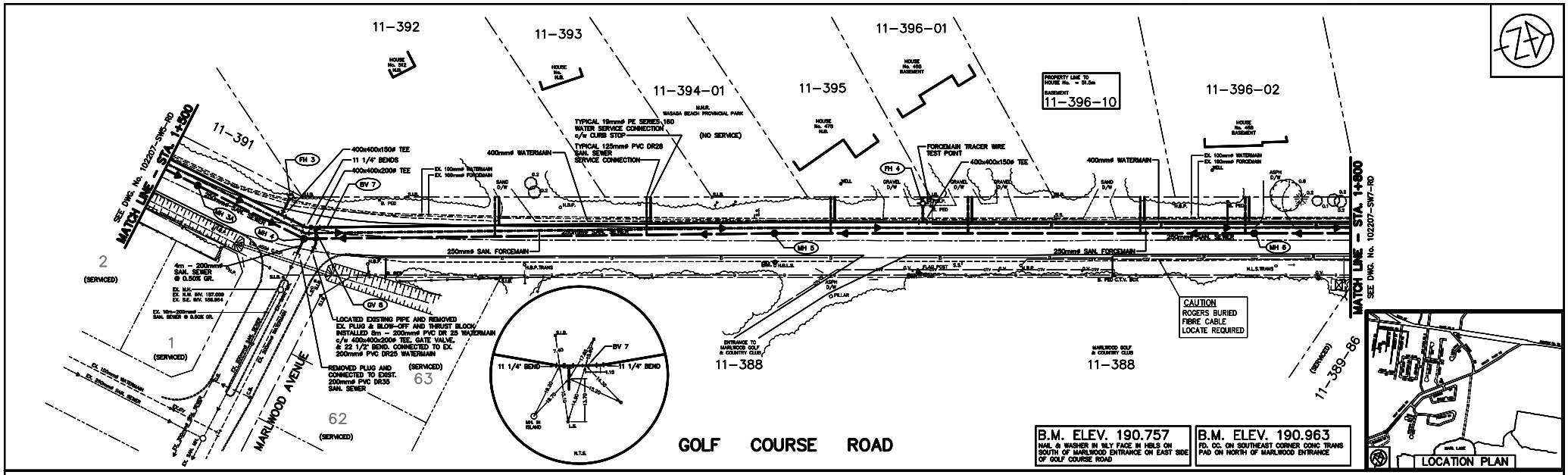
This Record Drawing may include information provided by others. Ainley & Associates Limited believes this information to be reliable but has not verified its accuracy and/or completeness and, accordingly, shall not be responsible for any errors or omissions which may result from its incorporation herein.

TOWN OF WASAGA BEACH
PROPOSED R.V. PARK SERVICING

PLAN & PROFILE
GOLF COURSE RD. STA. 1+100 TO SAT. 1+400

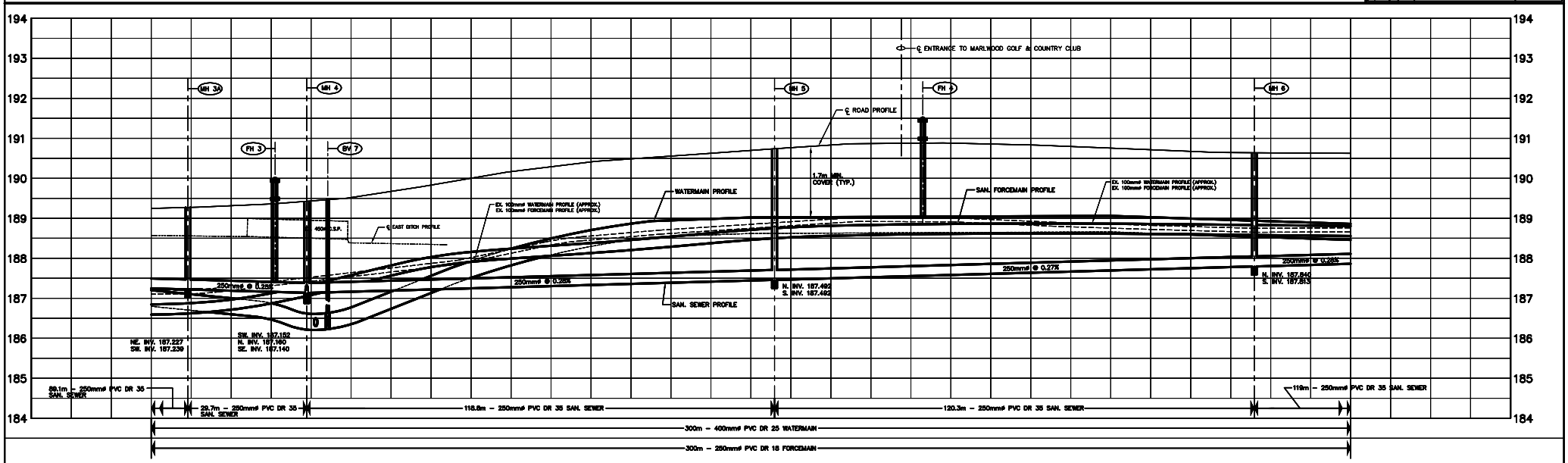
Ainley & Associates Limited
Consulting Engineers and Planners
Collingwood – Barrie – Belleville – Ottawa

SCALE: HORIZ: 1:500 VERT: 1:50			
DESIGN: R.H.M.	CHECKED: D.B.E.	DWG. 196048-FM5RD
DRAWN: D.P.	DATE: FEB. 1997	



B.M. ELEV. 190.757
NAIL & WASHER IN WLY FACE IN HBLS ON SOUTH OF MARLWOOD ENTRANCE ON EAST SIDE OF GOLF COURSE ROAD

B.M. ELEV. 190.963
FD. CC. ON SOUTHEAST CORNER CONC TRANS PAD ON NORTH OF MARLWOOD ENTRANCE



CHAINAGE: 1+500 | 1+525 | 1+550 | 1+575 | 1+600 | 1+625 | 1+650 | 1+675 | 1+700 | 1+725 | 1+750 | 1+775 | 1+800
PLOT 1=0.5

LEGEND

- PROPERTY LINE
- BURIED BELL CABLE
- BURIED GAS MAIN
- EXISTING WATER MAIN AND VALVE
- EX. SANITARY SEWER & M.H.
- PROPOSED WATER MAIN AND VALVE
- PROPOSED SANITARY SEWER
- PROPOSED SANITARY FORCEMAIN

- MH PROPOSED SANITARY M.H.
- GV PROPOSED GATE VALVE
- FH PROPOSED FIRE HYDRANT, VALVE & HYDRANT LEAD
- BV PROPOSED BUTTERFLY VALVE

NOTE : 1) LOCATIONS OF UTILITIES ARE APPROXIMATE.

RECORD DRAWING

COMPILED BY: J.S.	DATE: OCT. 2004	
CHECKED BY: J.S.	DATE: OCT. 2004	
DRAWN BY: L.G.B.	DATE: OCT. 2004	
CHECKED BY: D.B.E.	DATE: OCT. 2004	

NO.	REVISIONS	DATE	INITIAL
	REVISED AS RECORD DRAWING	OCT. 2004	D.B.E.

RECORD DRAWING
NOTICE TO USERS

Information contained on this drawing may have changed since the completion of construction. Further, this drawing may contain information provided by others. While Ainley & Associates Limited believes this information to be reliable and correct as of the completion of construction, no warranty is provided as to its accuracy and/or completeness. As such, Ainley & Associates Limited shall not be responsible for any errors or omissions which may result from incorporation of the information herein.

SCALE:	HORZ. 1=250 VERT. 1=50
DESIGN:	D.B.E.
DRAWN:	P.C.S.
CHECKED:	B.K.O.
DATE:	MAR. 2004

TOWN OF WASAGA BEACH

EAST END SERVICING

PLAN & PROFILE
GOLF COURSE ROAD
STA. 1+500 TO STA. 1+800

Ainley Group — CONSULT ENGINEER PLANNER

CONTRACT No. 7A | DWG. 102207-SW6-RD

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix D

Water Demand Calculations

BURNSIDE

2017/09/26 | 039210 | C. Scoble
Date | File No. | Name

Marlwood G.C Development - FSR
Project

Units : 9

Residential Density : 2.8 PPU

Population : 26

Domestic Water Demand: 270 - 450 $\frac{L}{Cap.\ Day}$ (MOECC, 3-9)

Peaking Factor: 5.4

Peak Water Demand: $= 450 \frac{L}{Cap.\ Day} \times 26 \times 5.4$

$= 0.74\ L/s$

Min. Fire Flow = 38 L/s @ 20.3 PSI (MOECC Standard)

Total Flow = 0.74 + 38
= 38.74 L/s

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix E

Stormwater Management Calculations

SOAKAWAY PIT SIZING

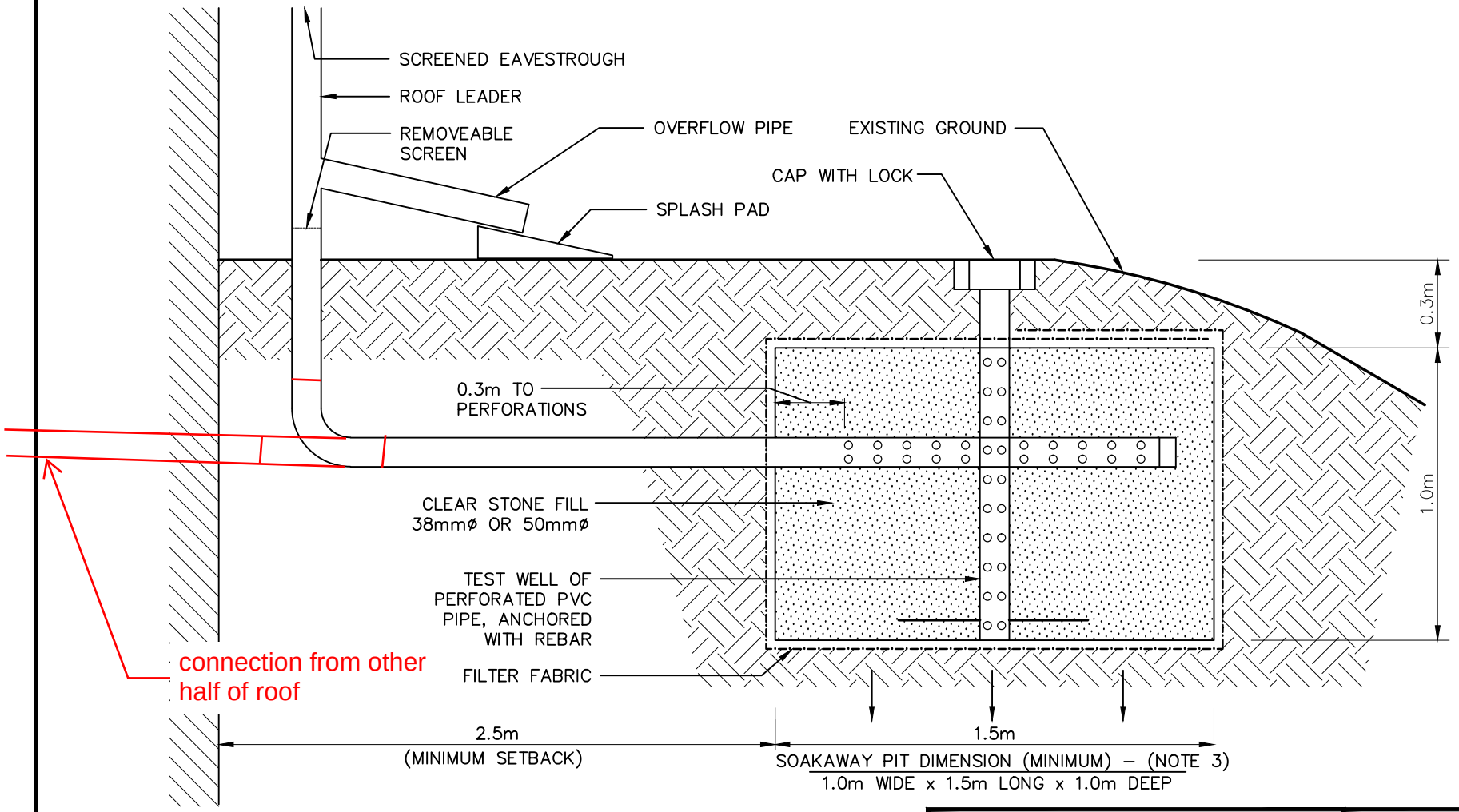
TPC Marlwood Inc.
31 Marlwood Ave, Wasaga Beach ON

BURNSIDE
[THE DIFFERENCE IS OUR PEOPLE]

Project #: 300037815
Date: 14-Jan-20
Designed: AH
Checked: JS

Runoff Depth to be Infiltrated on Private Lots	5	mm
Runoff Depth to be Infiltrated within Proposed Easement	25	mm
Design Infiltration Rate:	15	mm/hr
Maximum Drawdown Time:	48	hrs

Catchment ID	Roof Coverage	Lot Area (m^2)	Area to be Infiltrated (Roof) (m^2)	Runoff to be Infiltrated (m)	Required Runoff Volume to be Infiltrated (m^3)	Drawdown Time (hrs)	Drawdown Rate (m^3/hr)	Design Infiltration Rate (m/hr)	Minimum Infiltration Gallery Footprint Area (m^2)	Length (m) *Minimum 1.5m	Width (m) *Minimum 1.0m	Infiltration Height (m) * Minimum 1.0m	Soakaway Pit Footprint Volume (m^3)	Void Ratio	Available Volume (m^3)
Lot 1	50%	1115	558	0.005	2.8	19	0.15	0.015	9.7	4.0	2.4	0.72	6.97	0.4	2.8
Lot 2	50%	900	450	0.005	2.3	19	0.12	0.015	7.8	3.5	2.2	0.72	5.63	0.4	2.3
Lot 3	50%	905	453	0.005	2.3	19	0.12	0.015	7.9	3.5	2.2	0.72	5.66	0.4	2.3
Lot 4	50%	905	453	0.005	2.3	19	0.12	0.015	7.9	3.5	2.2	0.72	5.66	0.4	2.3
Lot 5	50%	905	453	0.005	2.3	19	0.12	0.015	7.9	3.5	2.2	0.72	5.66	0.4	2.3
Lot 6	50%	900	450	0.005	2.3	19	0.12	0.015	7.8	3.5	2.2	0.72	5.63	0.4	2.3
Lot 7	50%	800	400	0.005	2.0	19	0.10	0.015	6.9	3.5	2.0	0.72	5.00	0.4	2.0
Lot 8	50%	800	400	0.005	2.0	19	0.10	0.015	6.9	3.5	2.0	0.72	5.00	0.4	2.0
Lot 9	50%	1400	700	0.005	3.5	19	0.18	0.015	12.2	4.0	3.0	0.72	8.75	0.4	3.5
Remaining rooftop volume up to 25 mm	50%	8630	4315	0.020	86.3	19	4.49	0.015	299.7	195.0	1.5	0.72	215.75	0.4	86.3



NOTE:

1. FILTER FABRIC TERRAFIX 270R OR EQUAL.
2. PROVIDE MINIMUM 0.5m CLEARANCE TO WATER TABLE FROM BOTTOM OF PIT.
3. SOAKAWAY PIT DIMENSIONS SHALL BE SIZED PER DESIGN ENGINEER RECOMMENDATION.
4. SOAKAWAY PIT TO BE INSPECTED BY DEVELOPER'S ENGINEER PRIOR TO BACKFILL.

TOWN OF WASAGA BEACH

ROOF LEADER
SOAKAWAY PIT DETAIL

DRAWN: TMM	SCALE: N.T.S.
DESIGN: MJP	PLOT: 1=1
CHECKED: MJP	DATE: MAR 2015

TOWN OF WASAGA BEACH • INCORPORATED 1974 •

STD.DWG.No.11

Development Export Summary

Development :TPC Marlwood 9 Lot

Pre-Development Phosphorus Export

DEVELOPMENT : TPC Marlwood 9 Lot

Landuse	Area (ha)	P coeff (kg/ha)	Pload (kg/yr)
Natural Heritage			
Forest	0.61	0.06	0.04
Turf/Sod	0.26	0.11	0.03
Natural Heritage Land use Class Total :	**0.87**		**0.07**
Development Total :	**0.87**		**0.07**

Cropland Site Sediment & Phosphorus Pre-Development Export

DEVELOPMENT : TPC Marlwood 9 Lot

COLOUR KEY : Site Specific Input | Constant / Lookup | Calculation

SubArea :

Slope Area (ha)	R (rainfall / runoff for Lake Simcoe)
Surface Slope Gradient (%)	K (soil errodability factor)
Length of Slope (m)	NN (determined by slope)
Cropt Type Factor)	LS (slope length gradient factor)
Tillage Type Factor	C (crop management factor)
	P (prevention + capture)
	Soil Loss (kg/year)
	Phosphorus export (kg/ha/yr)
	Phosphorus load (kg/yr)

PRE Developed Area (ha) :

Phosphorus export (kg/ha/yr) :

Phosphorus load (kg/yr) :

Updated : Sept 2014

Post-Development Phosphorus Export

DEVELOPMENT : TPC Marlwood 9 Lot

Landuse	Area (ha)	P coeff (kg/ha)	Pload (kg/yr)
Urban			
Residential	0.87	0.41	0.36
Urban Land use Class Total :	**0.87**		**0.36**
Development Total :	**0.87**		**0.36**

Updated : Sept 2014

Cropland Site Sediment & Phosphorus Post-Development Export

DEVELOPMENT : TPC Marlwood 9 Lot

COLOUR KEY : Site Specific Input | Constant / Lookup | Calculation

SubArea :

Slope Area (ha)	R (rainfall / runoff for Lake Simcoe)
Surface Slope Gradient (%)	K (soil errodability factor)
Length of Slope (m)	NN (determined by slope)
Cropt Type Factor)	LS (slope length gradient factor)
Tillage Type Factor	C (crop management factor)
	P (prevention + capture)
	Soil Loss (kg/year)
	Phosphorus export (kg/ha/yr)
	Phosphorus load (kg/yr)

PRE Developed Area (ha) :

Phosphorus export (kg/ha/yr) :

Phosphorus load (kg/yr) :

Updated : Sept 2014

Post Dev BMP

Area (ha)	Treated Area %	P coefficient	P coefficient	P Load Reduction (kg/yr)	Rationale
Best Management Practices (BMP) Applied (and Rationale)					
Residential					
0.87	100	0.41	60 %	0.21	Soakaway pits on each lot.
Soakaways - Infiltration Trenches					
Residential					
0.87	100	0.41	100 %	0.36	Enhanced grassed swale to outlet.
Enhanced Grass/Water Quality Swales					

Updated : Sept 2014

Development Area P and BMP Summary

Total PreDevelopment Area (ha):	0.87
PreDevelopment Area excluding Wetlands (ha):	0.87
Total PostDevelopment Area (ha):	0.87
Total Area treated by BMP's (ha):	1.74
Treated Area total:	1.74
Total PreDevelopment Load (kg/yr):	0.07
Total PostDevelopment Load (kg/yr):	0.36
Total P Load Reduction with BMP's (kg/yr):	0.57
Minimum P Load Reduction Required:	0.29
Total PostDevelopment Load with BMP's (kg/yr)	-0.21

Conclusion : No Net Increase in P Load.

Updated : Sept 2014

Post Dev Construction

Project: Marlwood Estates 9 Lot
Project No.: 300039210
Modelled By: J.Smith
Date: 2020/01/14

RATIONAL METHOD
UNCONTROLLED FLOWS

Rainfall IDF Coefficients	100	-year		
A =	47.5		A =	
C =	-0.699		B =	
			C =	

Rational Method Calculation

Area =	0.44	ha	LOTS MINUS ROOFTOP AREA
Runoff Coefficient, C =	0.31	(C = 0.25 + 25%)	
C*A =	0.14		
Time of Concentration, t_c =	15.0	min	
Rainfall Intensity, i =	125.18	mm/hr	
Target Release Rate =	47	L/s	

Project: Marlwood Estates 9 Lot
Project No.: 300039210
Modelled By: J.Smith
Date: 2020/01/14

MODIFIED RATIONAL METHOD
POST-DEVELOPMENT CONTROLLED FLOWS

Rainfall IDF Coefficients 100 -year

A =	47.5	A =	
C =	-0.699	B =	
		C =	

Rational Method Calculation

Area =	0.44	ha	ROOFTOP AREA ONLY (ESTIMATE 50% COVERAGE)
Runoff Coefficient, C =	1.00		
C*A =	0.44		
Time of Concentration, t_c =	15.0	min	
Storm Duration Increment =	5.0	min	
Target Release Rate =	95	L/s	
Constant Inflow =	0	L/s	
Uncontrolled Outflow =	47	L/s	SITE MINUS ROOFTOP AREA
Max. Allowable Outflow =	47	L/s	

Storm Duration (min)	Rainfall Intensity (mm/hr)	Max. Runoff Flow (L/s)	Runoff Volume (m^3)	Released Volume (m^3)	Storage Volume (m^3)	Max. Storage Volume Required (m^3)
15.0	125.18	151.26	136	43	94	
20.0	102.38	123.71	148	50	99	
25.0	87.59	105.84	159	57	102	
30.0	77.11	93.18	168	64	104	
35.0	69.23	83.66	176	71	105	
40.0	63.06	76.20	183	78	105	105
45.0	58.08	70.18	189	85	104	
50.0	53.96	65.20	196	92	103	
55.0	50.48	61.00	201	99	102	
60.0	47.50	57.40	207	106	100	
65.0	44.92	54.27	212	113	98	
70.0	42.65	51.53	216	121	96	
75.0	40.64	49.11	221	128	93	
80.0	38.85	46.94	225	135	91	
85.0	37.24	44.99	229	142	88	
90.0	35.78	43.23	233	149	85	

Project: Marlwood Estates 9 Lot
Project No.: 300039210
Modelled By: J.Smith
Date: 2020/01/14

RATIONAL METHOD
PRE-DEVELOPMENT SITE FLOWS

Rainfall IDF Coefficients	100	-year			
A =	47.5		A =		
C =	-0.699		B =		
			C =		

Rational Method Calculation

Area =	0.87	ha
Runoff Coefficient, C =	0.31	(C = 0.25 + 25%)
C*A =	0.27	
Time of Concentration, t_c =	15.0	min
Rainfall Intensity, i =	125.18	mm/hr
Target Release Rate =	95	L/s