Conservation Meadows Subdivision – Phase 2 City of Waterloo Functional Servicing and Stormwater Management Report



Prepared for:
Activa Holdings Inc.
Columbia Corporate Centre
55 Columbia Street East, Suite 1
Waterloo ON N2J 4N7

Prepared by:
Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4

603-08671
September 2017

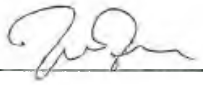
Sign-off Sheet

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Prepared by 

(signature)

Joe Grubb, C.E.T., L.E.L.
Project Manager

Prepared by 

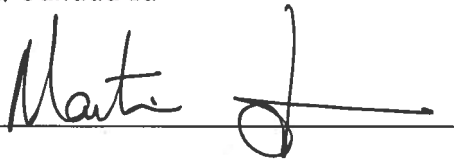
(signature)

Trevor Fraser, P.Eng.
Surface Water Resources Engineer

Prepared by 

(signature)

Steve Brown, MBA, P.Eng.
Surface Water Lead, Canada East

Approved by 

(signature)

Martin Jones, P.Eng.
Vice President, Community Development

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1.0 INTRODUCTION

1.1 GENERAL

The purpose of this report is to outline how the subject lands can be developed with municipal services, including sanitary, storm drainage, domestic water and utilities. This report is in support of Draft Plan approval of the subject lands.

Now that sanitary servicing is being planned for the area, Activa Holdings Inc. is proposing to develop Phase 2 of the Conservation Meadows Subdivision.

In reference to Site Location Plan, Figure 1, the site is bounded by Conservation Drive to the south, Roy Schmidt Road to the west, existing Phase 1 residential area to the north and existing residential area to the east.

The site is approximately 8.0 hectares in size and was previously used for agricultural purposes. Since the development of Stage 1, the lands have been vacant.

There is a 2 storey house located in the northwest area of the site with access off Roy Schmidt Road which is planned to be demolished for new development in this area. It is noted that a Record of Site Condition was undertaken in 2016 for the lands of this dwelling.

The North Waterloo Scoped Watershed Study was completed in 2013 and the City of Waterloo is currently completing final design upgrades for Conservation Drive and Beaver Creek Road, which will include sanitary and storm outlets for the development.



May, 2017
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Figure No.
1

Title
SITE LOCATION PLAN

2.0 EXISTING CONDITIONS

2.1 GENERAL

Figure 2 illustrates the existing conditions of the site. The site contains Hydro One twin overhead pole line, a temporary emergency access from the Kawartha Street Stub to Conservation Drive, and a temporary road (Rideau River Street) from Wasaga Crescent to Conservation Drive. The temporary road was constructed without curb and gutter and includes a watermain connection to Conservation Drive.

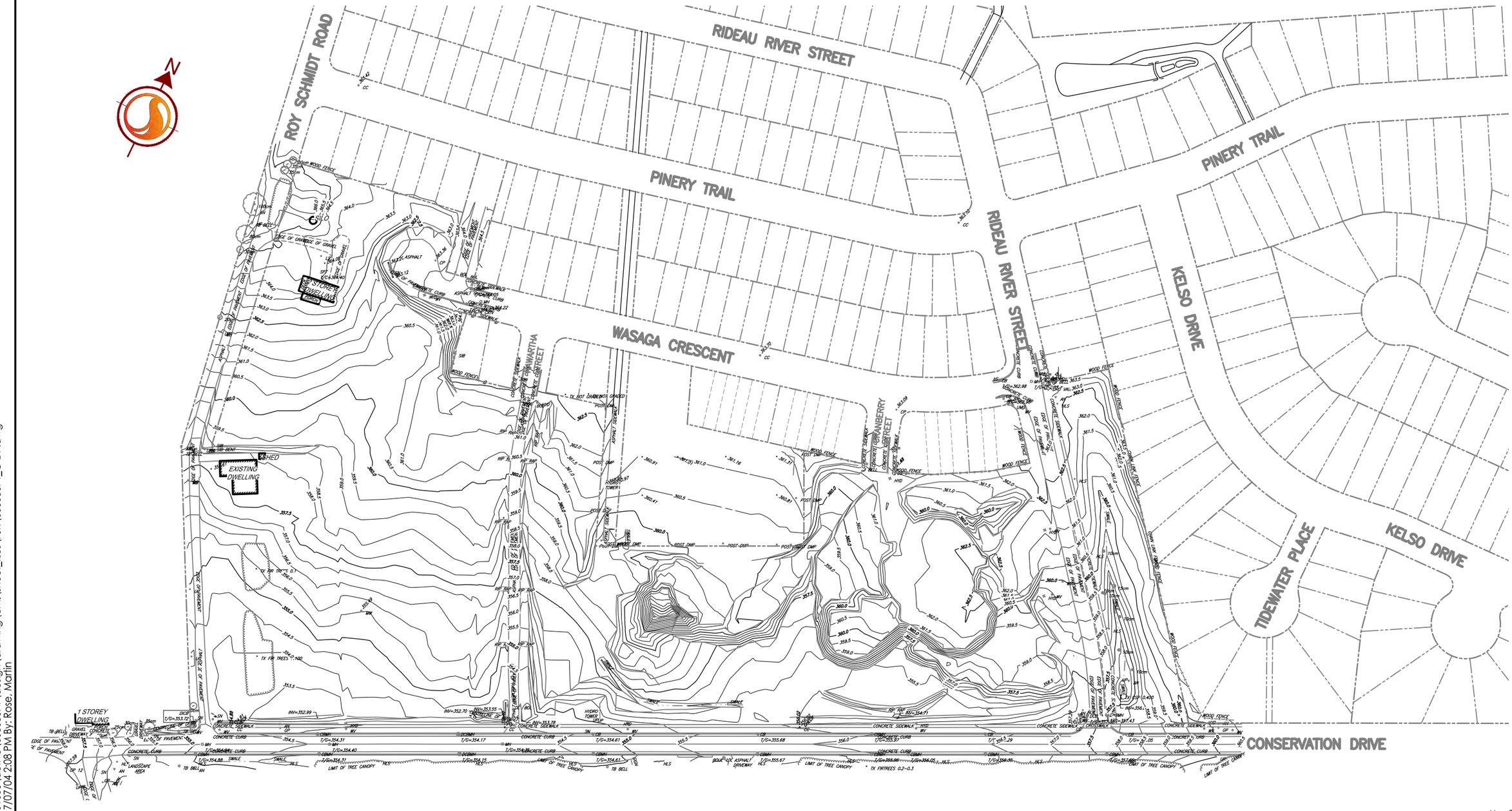
2.2 EXISTING TOPOGRAPHY

The site slopes from north to south. On the west part of the site existing grades range from approximately 363.5 MASL to 354.0 MASL, resulting in a topographical relief of 9.5 metres. On the east part of the site, existing grades range from approximately 363.0 MASL to 357.0 MASL resulting in a topographical relief of 6.0 metres.

2.3 GEOTECHNICAL CONDITIONS

The subsurface stratigraphy of the site generally comprises of topsoil overlaying native mineral soils. The native deposits comprise primarily silt in the southwest end of the site. The extreme north part of the site comprises glacial fill overlying sand in the east and primarily sand in the west. Topsoil was encountered throughout the property. Topsoil general ranges between 300 mm to 600 mm in thickness. Topsoil in isolated hollows ranges up to 1900 mm thick.

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ELEVATION	+324.311	BOLLARD	BLRD
CONTOUR	349.0	POST	POST
STANDARD IRON BAR	SIB	BELL PEDESTAL	BPED
IRON BAR	IB	HYDRO POLE	HP
CATCHBASIN	CB	GUY WIRE	HGUY
MANHOLE	MH	SIGN	SIGN
HYDRANT SET	HYD GWV	TREES	
		SHRUB	SHRUB

Notes

1:2000 — 0 20 60 100m

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Figure No.
2

Title
EXISTING CONDITIONS PLAN

3.0 PROPOSED DRAFT PLAN

Figure 3 illustrates the proposed Draft Plan for the site. The Draft Plan was prepared by MHBC and land uses include single residential, multiple residential, trails, walkways and road. As part of the process for development of these and the adjacent lands to the west, it is anticipated that portions of the existing Roy Schmidt Road allowance will be closed.

The site includes an easement in favour of Hydro One which accommodates an overhead twin pole line. In Phase 1 of the development, a trail is also located in this easement. It is proposed that the trail be extended through the remainder of the easement as Phase 2 is developed.

It is anticipated that the plan will contain between 63 to 103 single family houses, 119 street townhouses and 120 low rise apartments resulting in a population range between 524 and 809 people.



Legal Description

PART OF LOT 28, GERMAN COMPANY TRACT,
(GEOGRAPHIC TOWNSHIP OF WATERLOO),
CITY OF WATERLOO,
REGIONAL MUNICIPALITY OF WATERLOO

Owner's Certificate

I AUTHORIZE MACNAUGHTON HERMSEN BRITTON CLARKSON PLANNING LIMITED TO SUBMIT THIS PLAN FOR APPROVAL.

DATE: June 27/17

Lou Maiorano - Vice President, Planning and Development
Activa Management Corporation

Surveyor's Certificate

I HEREBY CERTIFY THAT THE BOUNDARIES OF THE LAND TO BE SUBDIVIDED ON THIS PLAN AND THEIR RELATIONSHIP TO THE ADJACENT LANDS ARE ACCURATELY AND CORRECTLY SHOWN.

DATE: June 27/17

Brian Campbell - OLS,
Stantec Geomatics Ltd.

Key Plan



Subject Lands

north

Not to Scale

Additional Information Required Under Section 51(17) of the Planning Act R.S.O. 1990, c.P.13 as Amended

A. As Shown — B. As Shown — C. As Shown
D. Residential, Trail, Stormwater Management
E. As Shown — F. As Shown
G. As Shown — H. Municipal Water Supply — I. Sandy Loam
J. As Shown — K. All Services As Required — L. As Shown

Area Schedule — 30T - ____

Description	STAGE 1 Lots/Blks	Area	Singles (min./max.)	Multiple Residential Street Towns (no.)	Multiple Residential Low Rise Apart's (max.)	TOTAL Lots/Blks	Area	Total Units (min./max.)
Residential (1)	1-13	3.347	63-103			13	3.347	63-103
Street Towns (2)	14-18,21	1.148		56		6	1.148	56-56
Multiple Residential (2,3)	22,23	0.967		38	58	2		38-58
Multiple Residential / Mixed Use (2,4)	19,20	0.620		25	62	2	0.620	25-62
Walkways	24,25	0.038				2	0.038	
Trail / Park	26,27	0.147				2	0.147	
Roads		1.739					1.739	
TOTAL	27	8.003	63-103	119	120	27	8.003	182-279

Notes:
(1) Residential Unit Yield based on 13.7m Lots (min) and 9.0m Lots (max).
(2) Street Towns - minimum lot width 5.0m.
(3) Low Rise Apartments calculated at 60 Units per Hectare.
(4) Low Rise Apartments calculated at 100 Units per Hectare

No.	Date	Issued / Revision	By
1	September 11,2017	Edits to Area Schedule and Units Yields	LHB

MHBC PLANNING URBAN DESIGN & LANDSCAPE ARCHITECTURE
200-540 BINGEMANS CENTRE DR. KITCHENER, ON. N2B 3X9 | P: 519.576.3650 F: 519.576.0121 | WWW.MHBCPLAN.COM

Approval Stamp	Date: September 11,2017
	File No.: 8784Y
	Plan Scale: 1:1,000
	Drawn By: L.H.B.
	Checked By: P.B. / D.A.

Client: **Activa Holdings Inc.**
55 Columbia Street East,
Waterloo, Ontario
N2J 4N7
519.886.9400
www.activagroup.ca

File Name: **DRAFT PLAN OF SUBDIVISION**

K:\87847_ACTIVA_CONSERVATIONDR\DP\DP SEPTEMBER 11 2017.DWG

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September, 2017
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Notes

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Figure No.
3

Title
PROPOSED DRAFT PLAN

4.0 OVERALL GRADING AND DRAINAGE

4.1 ROAD PROFILE DESIGN CONSTRAINTS

Road profiles were established based on the proposed street pattern. Constraints in the design of road profile are as follows:

- Match road grades at each of the existing development accesses and match into the existing grades of Conservation Drive.
- Ensure adequate cover over sanitary, storm sewer and watermain.
- Ensure "major" overland flow routes are directed to downstream conveyance storm sewer and ultimately to the Laurel Creek Reservoir.
- Ensure sufficient clearance between Hydro One electrical wires and road crossings.
- Comply with municipal standards for minimum and maximum road grades.
- Provide for a cut/fill balance as much as possible.

The road profiles are design to match in smoothly with the existing street stubs of the Phase 1 development. The road profiles are illustrated on Drawing C-200 and C-201 in Appendix B of this report.

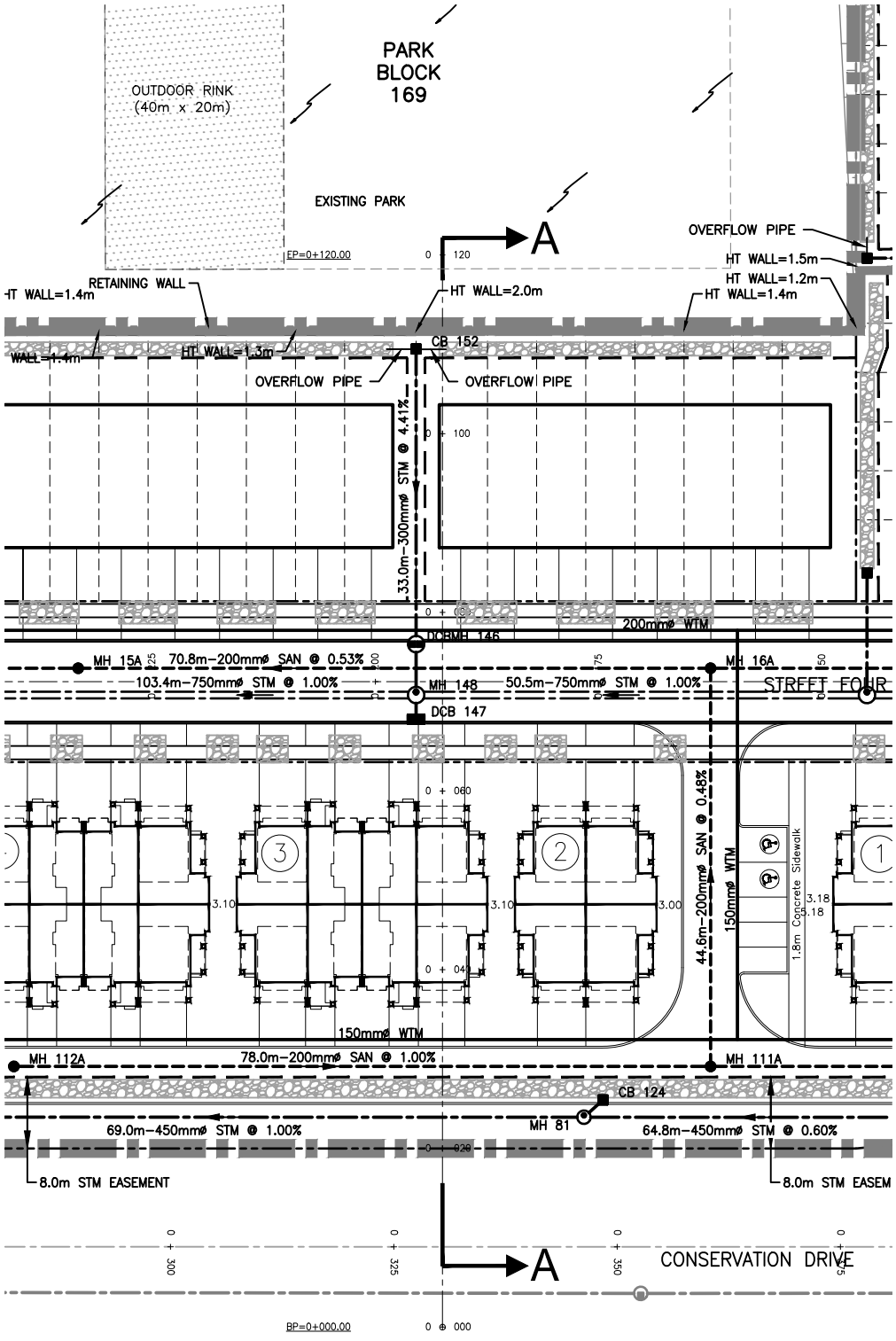
4.2 PROPOSED SITE GRADING

It is noteworthy that at the time Phase 1 was designed, the proposed road pattern for Phase 2 included only one connection to Conservation Drive (Rideau River Street) and a significant amount of grade difference was planned to be taken up with walk-out lots between Conservation Drive and Street 4. The two additional street connections to Conservation Drive have added additional constraints and as a result, the road profiles have become relatively steep (up to 6.0%). On Street 4 there are two localized low points to capture 100-year flows (refer to storm drainage and stormwater management section of this report).

The profile design of Kawartha Street at 6.0% sets the centerline elevation of Street 4. Just east of Street 4 there exists the Hydro One Twin Pole line with the proposed trail within the easement and alongside of the existing park. Due to the interconnection of Kawartha Street and Street 4, the trail connection to Street 4 becomes steep due to the need for a lower elevation on Street 4 than what was originally planned for. It is proposed to remove and regrade part of the trail (back to the existing twin poles adjacent the park), such that the grade can be reduced down to 6.8% (Refer to Drawing C-400) in Appendix B of this report.

Also, due to the additional constraints resulting from the street connections to Conservation Drive, a retaining wall will be required between the park and the street townhouses fronting on Street 4. Drawings C-400 shows the concept grading plan for the development with the street pattern and on assumed lot fabric that will be revised upon final design. Figures A and A1 illustrate a cross section between Conservation Drive and the park that illustrates the retaining wall and proposed servicing within the multiple block.

Preliminary earthwork calculations were performed and due to the change in the proposed Draft Plan with additional street connections to Conservation Drive and the lowering of the south end of the site, it is expected there will be a surplus of both topsoil and earth in amounts of approximately 20,000 and 50,000 cubic metres respectively.



V:\01603\active\60308671\design\drawing\civil\sheet_files\FSR\60308671_FIGURE A.dwg
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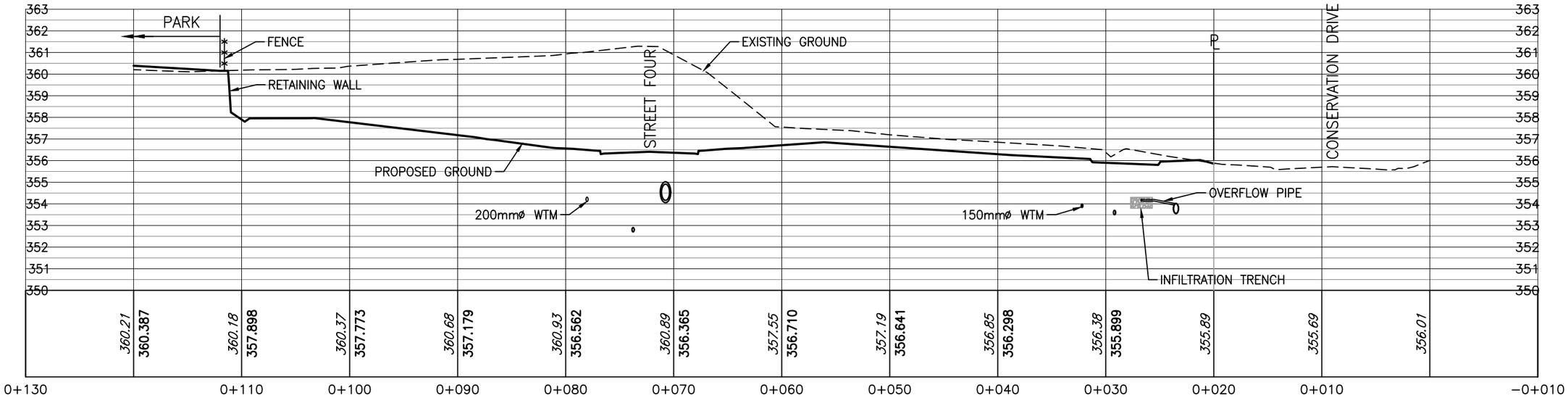
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Figure No.
A

Title
SECTION A-A
PLAN VIEW



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0 2 6 10m

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Figure No.
A-1

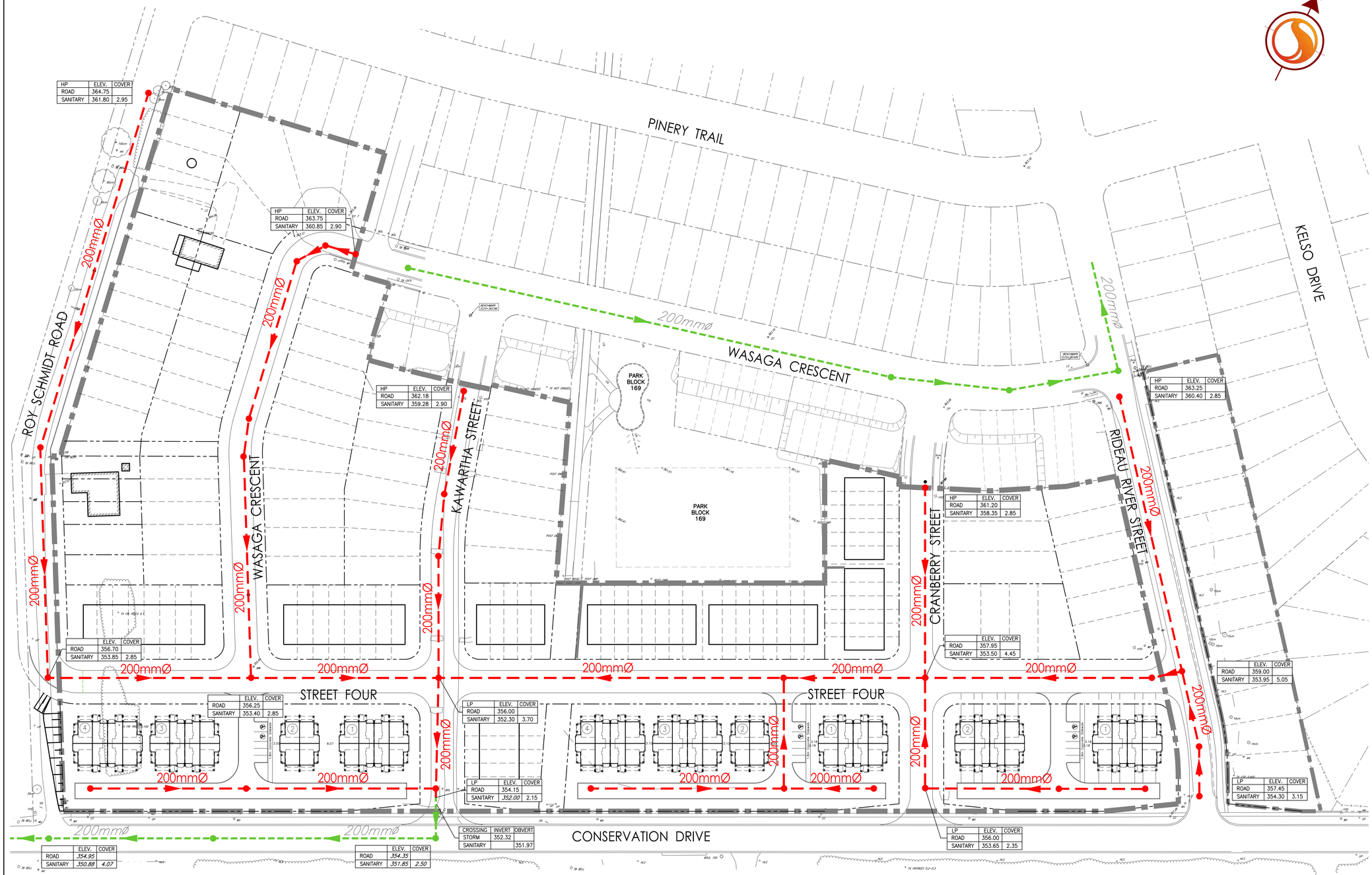
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SECTION A-A
PROFILE VIEW

5.0 SANITARY SERVICING

During the reconstruction of Conservation Drive between Rideau River Street and Roy Schmidt Road in 2010, a sanitary sewer was installed between the future intersection on Conservation Drive and Kawartha Street, extending to the west to Roy Schmidt Road (refer to Figure 4). It was known that this sewer would be required to convey flows to a future sewage pumping station on Beaver Creek Road.

As noted in Section 3.0, the proposed Draft Plan provides for a population between 482 to 859 people. Although the sanitary sewer was originally designed for a lower density development, a review of the design flows confirms the existing sewer has adequate capacity to convey the flows from the proposed development. Figure 4 illustrates the extension of the sewer within the proposed development, including the sewer for the back to back or stacked townhouses adjacent Conservation Drive.

It is intended that the sanitary sewers within the condominium sites will be privately owned and maintained.



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Notes
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CUT CROSS IN CONCRETE CURB, NORTH EAST CORNER OF RIDEAU RIVER STREET AND WASAGA CRESCENT, CITY OF WATERLOO.
ELEVATION = 363.82m
2. TOPOGRAPHIC SURVEY BY STANTEC CONSULTING LTD. DATED APRIL 2016. ELEVATIONS ARE REFFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1929:1978)
3. DRAFT PLAN FOR LANDS PROVIDED BY MHBC DATED OCTOBER 21, 2016

Legend
PROPERTY LINE
PROPOSED SANITARY SEWER
EXISTING SANITARY SEWER

LP	ELEV.	COVER
ROAD	363.20	
SANITARY	360.40	2.80

ROAD STATUS (LP = LOW POINT, HP = HIGH POINT)
ROAD ELEVATION
COVER OVER SEWER (TO OBVERT)
SEWER OBVERT ELEVATION

Revision	By	Appd.	YY.MM.DD
File Name: 60308671_C-UG-SANITARY.dwg	M.A.R. Dwn.	J.L.G. Chkd.	M.A.R. Dsgn.	17.03.01 YY.MM.DD

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Title
SANITARY SERVICING CONCEPT PLAN

Project No. 60308671
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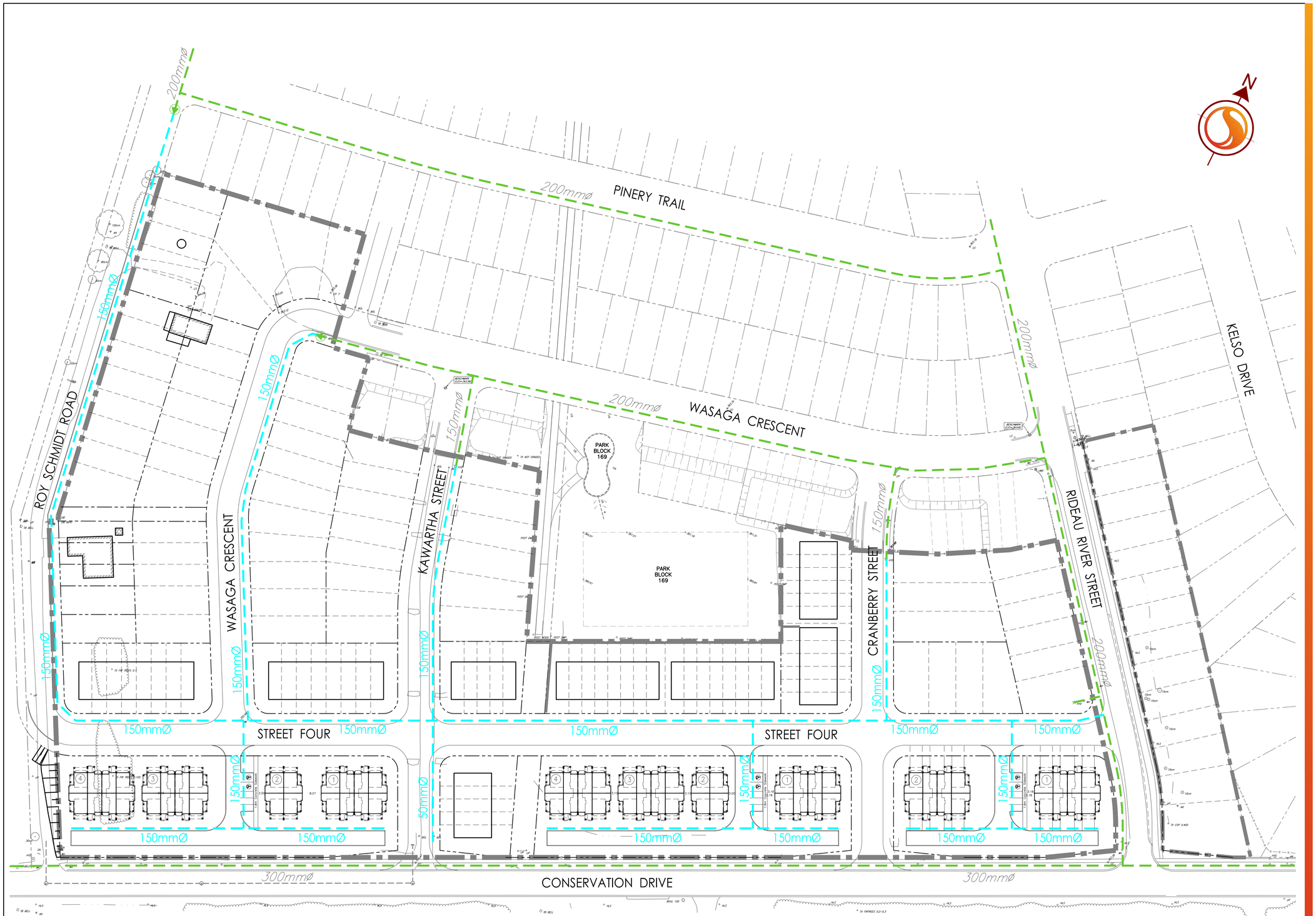
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6.0 WATER SERVICING

The site is serviced within the Lakeshore West booster pumping area known as Pressure Zone 4C, which has a nominal hydraulic grade line (HGL) of 404 MASL. The booster station services lands within an elevation range of 350 to 369 MASL. Within the proposed development, proposed grades will range from 354.0 to 363.5 MASL and therefore are well within the design limits of the station. More specifically, residential pressures within the new development under static conditions will vary between 490 kPa (71 psi) and 400 kPa (58 psi). As illustrated in Figure 5 an existing 300 mm diameter watermain on Conservation Drive connects to a 200 mm watermain on Rideau River Street. These watermains, as well as the existing 150 mm watermain on the street stubs of Cranberry, Kawartha and Wasaga provides ample supply to the new development.

As part of the Beaver Creek Road and Conservation Drive upgrades that are planned for development of the Beaver Creek Meadows District, trunk watermains will be extended on Erbsville Road, Conservation Drive, and Beaver Creek Road, which will form a complete loop for the northwest portion of Waterloo. This will also interconnect Pressure Zone 5 and Pressure Zone 4C (both operate at the same HGL) and provide greater redundancy and water supply security.



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3. DRAFT PLAN FOR LANDS PROVIDED BY MHBC DATED OCTOBER 21, 2016

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PROPOSED WATERMAIN
EXISTING WATERMAIN
EXISTING REDUCER

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File Name: 60308671_C-UG-WATER.dwg	M.A.R. Dwn.	J.L.G. Chkd.	M.A.R. Dsgn.	17.03.02 YY.MM.DD

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Waterloo, ON.

Title
WATERMAIN SERVICING
CONCEPT PLAN

Project No.	Scale
60308671	1:750 (0 7.5 22.5 37.5m)
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Figure 5	of 0

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7.0 STORMWATER MANAGEMENT (SWM)

7.1 STUDY APPROACH

A stormwater management (SWM) strategy for the site (Figure 1.0 – Location Map) has been developed to mitigate against potential changes to the hydrologic regime associated with the development of the subject lands.

The SWM design involved the following study components:

- Review the existing North Waterloo Scoped Subwatershed Study with respect to the existing land uses, hydrology, proposed development, and SWM objectives.
- Outline the approach to offsite conveyance of 100-year flows and on water quality treatment of the minor flows into the Beaver Creek Meadows community SWM facility.
- Complete a water balance for the site to compare existing and proposed infiltration for the site and estimate preliminary infiltration targets for proposed conditions.
- Complete the preliminary sizing design of infiltration trenches to meet the water balance objectives of the subwatershed.
- Summarize the study through preliminary design and recommendations.

7.2 BACKGROUND

The following reports and primary guidance documents were referenced in the completion of the proposed SWM design:

- *North Waterloo Scoped Subwatershed Study (NWSSS)*, Ecoplans/MHBC/Stantec Consulting, November 2013.
- *Low Impact Development Stormwater Management Planning and Design Guide (LID SWMPD)*, Credit Valley Conservation Authority and Toronto and Region Conservation Authority, 2010.
- *Stormwater Management Planning and Design (SWMPD) Manual*, Ministry of the Environment (MOE), March 2003
- *Geotechnical Investigation – Proposed Residential Subdivision, Activa Conservation Lands, Waterloo Ontario*, Naylor Engineering Associates Ltd., February 2003.
- *Laurel Creek Watershed Study (LCWS)*, Grand River Conservation Authority, 1992.

7.3 STORMWATER MANAGEMENT DESIGN CRITERIA

The site is a part of the Laurel Creek watershed with site runoff draining south to Conservation Drive and, ultimately, the Laurel Creek Reservoir. The goals, objectives and requirements for the Laurel Creek watershed are outlined in the LCWS (1992) with specific hydrologic and SWM targets provided on a subwatershed scale in the NWSSS (2013). The design criteria listed below are not all site-specific but apply to the larger, North Waterloo Subwatershed (bold criteria are directly from the NWSSS with regular text describing the applicability of the bolded criteria to the site):

- *Water Quality* – **Provide Enhanced water quality control including extended detention storage in accordance with the MOE SWMP Manual (2003)** and **use a treatment train approach to stormwater management**. A future water quality SWM facility will be located upstream of the Laurel Creek Reservoir and will provide 'Enhanced' control for the upstream development lands, including the subject site. Infiltration facilities proposed on-site will function as part of the overall treatment train approach to water quality control.
- *Water Quantity* – **Subwatershed 310 surface drainage shall be directed to the Laurel Creek Reservoir. Major system flows may not be required for this area, provided that peak flows from this area are not delayed;** therefore, no on-site water quantity control is required; provide sufficient capacity to convey major peak flows from the site to the Laurel Creek Reservoir.
- *Erosion Control* – **Provide erosion control by maintaining existing flow duration characteristics**.
- *Water Balance* – **Maintain or improve infiltration rates as compared to existing conditions**. The annual infiltration target volume for the site is 183.4 mm.
- *Thermal Mitigation* – **Implement thermal mitigation measures for stormwater discharge to Beaver Creek**. The site does not discharge to Beaver Creek so no thermal mitigation is required for the site.

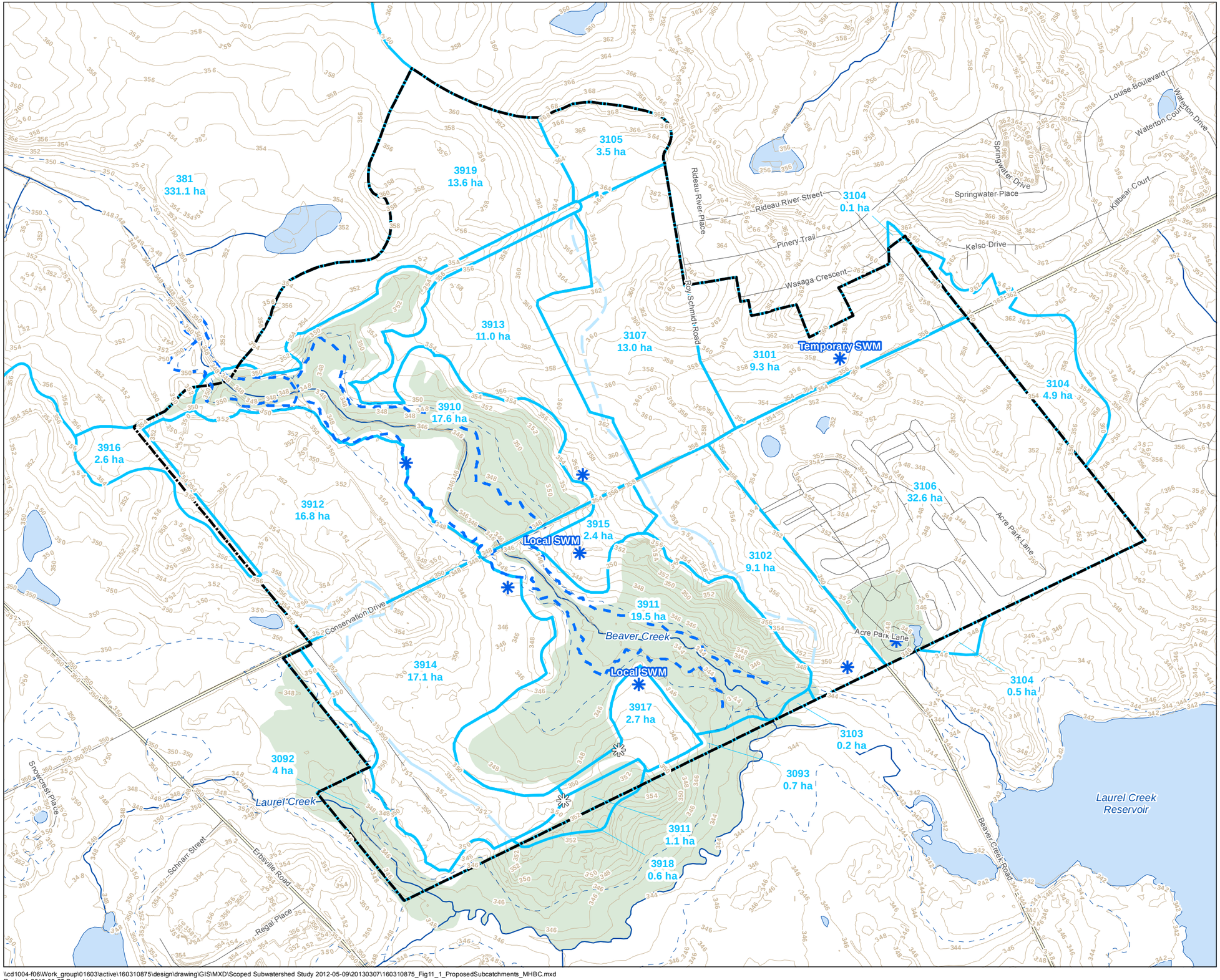
7.4 EXISTING CONDITIONS

7.4.1 Topography and Surface Drainage

The site is relatively steep with elevations ranging from approximately 353.5 mASL at Conservation Drive to 364.0 mASL at the north end of the proposed development area. Average grades generally range from 3 – 5% across the site with steeper grades located closer to Conservation Drive. An east-west high point divides drainage from the site and the neighbouring development to the north with the site's runoff draining south to Conservation Drive into the North Waterloo Subwatershed. The site is located in Catchment 3101 of the NWSSS, east of Roy Schmidt Road and north of Conservation Drive (see Figure 6 and Figure 7).

NORTH WATERLOO SCOPED SUBWATERSHED STUDY

PROPOSED SUBCATCHMENTS



- Site Boundary
- SWM Facility
- Future Study Area
- Highway
- Major Road
- Local Road
- Topographic Contour (mAMSL)
- Watercourse
- Waterbody
- Delineated Floodplain
- GRCA Floodplain
- Proposed Detailed Subcatchment
- Existing Detailed Subcatchment
- Natural Heritage Features

NOTES

1. Coordinate System: UTM NAD 83 - Zone 17 (N).
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2011.

NORTH

0 50 100 200 300 400 m

1:7,500

March 2013

PLANNING URBAN DESIGN & LANDSCAPE ARCHITECTURE
MHBC
200-540 BINGEMANS CENTRE DR, KITCHENER, ON, N2B 3X9
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Figure 6

160310875

\\cd1004-f06\Work_group\01603\active\160310875\design\drawing\GIS\MXD\Scoped Subwatershed Study 2012-05-09\20130307\160310875_Fig11_1_ProposedSubcatchments_MHBC.mxd
Revised: 2013-03-25 By: mkirkpatrick

High points along Conservation Drive are located at the intersection of Rideau River Street and Conservation Drive and Beaver Creek Road and Conservation Drive. Runoff along Conservation Drive drains to a low point at Kawartha Street (Figure 7) and spills to the south to the neighbouring Martin lands (Martin lands located in Catchment 3106 on Figure 6).

7.4.2 Geotechnical Information

As identified in the *Geotechnical Investigation* (Naylor Engineering, 2003), the subsurface soils for the site and neighbouring development to the north generally consist of clay over silty clay, silt, glacial till, and small pockets of sand. Seasonal high groundwater is at least 4 m below ground surface within the site.

Based on the silty clay soils encountered within the site during the investigation, an infiltration rate of 4 mm/hr. has been assumed for all subsurface soils.

7.5 STORMWATER MANAGEMENT DESIGN

7.5.1 Current Hydrologic Modeling and the NWSSS

An extensive hydrologic model was completed for the North Waterloo Subwatershed, including the site, as part of the NWSSS. The Study included an existing conditions model to establish targets for the individual subcatchments as well as a proposed conditions model outlining infiltration targets for each subcatchment and necessary SWM controls to meet all target criteria for the NWSSS. The models were completed using the hydrologic software program, GAWSER. For more detailed information concerning the models, hydrologic parameters and assumptions, please refer to the NWSSS.

As mentioned above, the site is part of Catchment 3101, as shown on Figure 6 of the NWSSS. Under the developed scenario, the catchment containing the site has been refined based on more accurate topographic information, resulting in a developed area of 10.7 ha compared to the high-level estimate of 9.3 ha in the NWSSS.

According to the NWSSS, a downstream SWM facility will be constructed to provide water quality treatment for runoff from the developed Catchments 3101, 3102, 3106, and 3107. The NWSSS also identified an interim SWM facility on this property. The purpose of that facility was to reduce post-development flows to the capacity of the existing storm sewer for conveyance to the downstream water quality facility. Through additional design work and consultation with the City and agencies, it has been determined that the interim facility is not required if the 100-year flows can be conveyed safely downstream. The proposed design collects the 100-year runoff from the Conservation Meadows, Phase 2 site, into the storm sewer system and therefore no SWM facility is proposed on site. Water quality controls on site include infiltration of (clean) rooftop runoff, and passive treatment of parts of the site in grassed swales for conveyance.



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Notes

Legend

- EX. STORM MAINTENANCE HOLE
- EX. STORM CATCHBASIN MAINTENANCE HOLE
- EX. CATCHBASIN
- EX. SANITARY MAINTENANCE HOLE
- EX. STORM SEWER
- EX. SANITARY SEWER
- EX. FENCE
- EX. SLOPE (3:1 UNLESS NOTED OTHERWISE)
- 349.0 EX. CONTOUR
- EX. SWALE
- EX. OVERLAND DRAINAGE
- DRAINAGE AREA BOUNDARY
- 3101 / 10.68 CATCHMENT ID / AREA (ha)

Revision	By	Appd.	YY.MM.DD
File Name: 60308671_C-SD-EX.dwg	Dwn.	Chkd.	17.03.09
		Dsgn.	YY.MM.DD

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ACTIVA HOLDINGS INC.

CONSERVATION MEADOWS SUBDIVISION
PHASE 2
Waterloo, ON.

Title
EXISTING OVERLAND DRAINAGE

Project No.	Scale
603108671	1:1000 (0, 10, 30, 50m)
Drawing No.	Sheet / Revision
Figure 7	of 0

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2017/07/04 2:30 PM By: Kosek, Martin

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The community SWM facility is located on Beaver Creek Road at the south limit of the trailer park lands. Various agreements for purchase of the lands, cost sharing and the completing of various studies, and the design of the SWM facility are underway with design completion anticipated by the Fall of 2017. The design of the SWM facilities is to achieve the NWSSS requirements.

7.5.2 Stormwater Quantity Control and Conveyance

As discussed above, no water quantity controls are required for the site since drainage is directed to the Laurel Creek Reservoir downstream (Catchments 3101, 3102, 3106, and 3107 on Figure 6).

Runoff from major storms flows overland in the upstream areas of the site until it reaches two (2) low points, as indicated on Figure 10. Double catchbasins are proposed at these points with sufficient capacity to allow the overland flow from the roadways into the sewer system. The storm sewer system at this point near Conservation Drive has been designed to convey the peak flow rates from the 100-year design storm per City of Waterloo parameters. Due to the steep grades on the site and lack of ponding depths at the intersection of Cranberry Street and Rideau River Street, it is anticipated a small amount of overland flow draining south may bypass the catchbasins at these entrances to the site. The exact volumes and flow rates will be determined at final design.

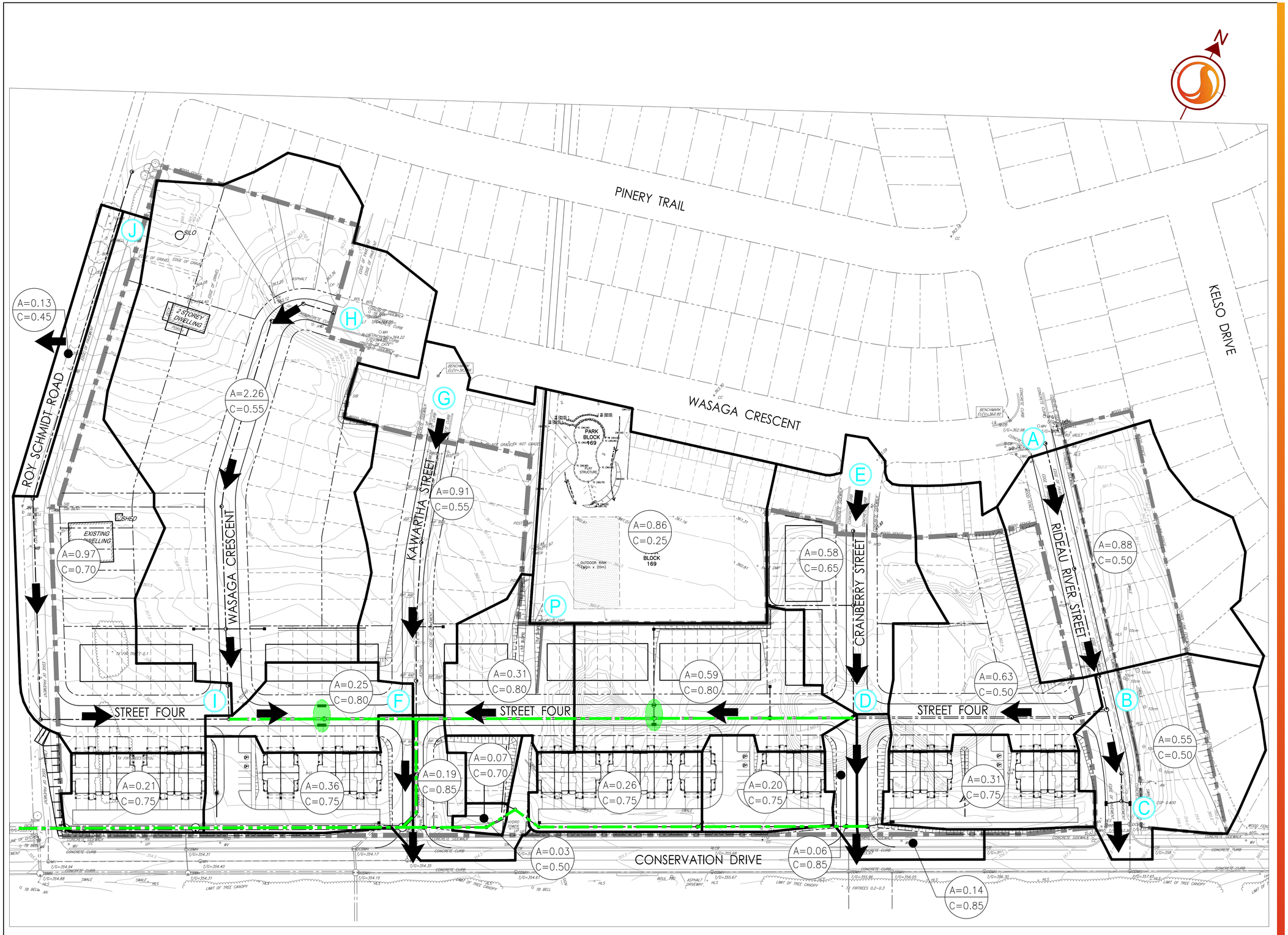
The City of Waterloo is currently completing the design for the reconstruction of Beaver Creek Road and Conservation Drive with a storm sewer connecting to the storm outlet for the subdivision. Figure 8 and Figure 13 illustrate the proposed storm conveyance and outlet location.

7.5.3 Water Balance and Infiltration Assessment

The NWSSS provides annual infiltration targets for each subcatchment within the subwatershed. For the site and its adjacent subcatchments (3101, 3102, and 3105), the annual water balance values are listed in Table 1. The total annual precipitation is 844.8 mm and is taken from a 54-year dataset from the Waterloo-Wellington Airport gauge as per the NWSSS.

Table 1: Annual Water Balance Values

Evapotranspiration (mm)	507.2
Infiltration (mm)	183.4
Runoff (mm)	154.2



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Notes

Legend

- STORM MAINTENANCE HOLE
- CATCHBASIN
- STORM SEWER
- SWALE
- SLOPE (3:1 UNLESS NOTED OTHERWISE)
- EXISTING CONTOUR
- A=0.20 / C=0.90 — AREA (ha) / RUNOFF COEFFICIENT
- DRAINAGE AREA BOUNDARY
- STORM PIPE SIZED FOR 100 YEAR FLOW
- 100 YEAR ENTRY AT ROAD LOW POINT
- MAJOR OVERLAND FLOW DIRECTION
- A — JUNCTION LOCATIONS FOR DESIGN SHEET

Revision	By	Appd.	YY.MM.DD
File Name: 60308671_C-110SD.dwg	M.A.R. Dwn.	J.L.G. Chkd.	M.A.R. Dsgn.	16.11.25 YY.MM.DD

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CONSERVATION MEADOWS SUBDIVISION
PHASE 2
Waterloo, ON.

Title
PROPOSED
STORM DRAINAGE AREA PLAN

Project No.	Scale	Sheet	Revision
60308671	1:750 (0 7.5 22.5 37.5m)		
Drawing No.			
Figure 8		of	0

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2017/07/04 2:34 PM By: Ross, Martin

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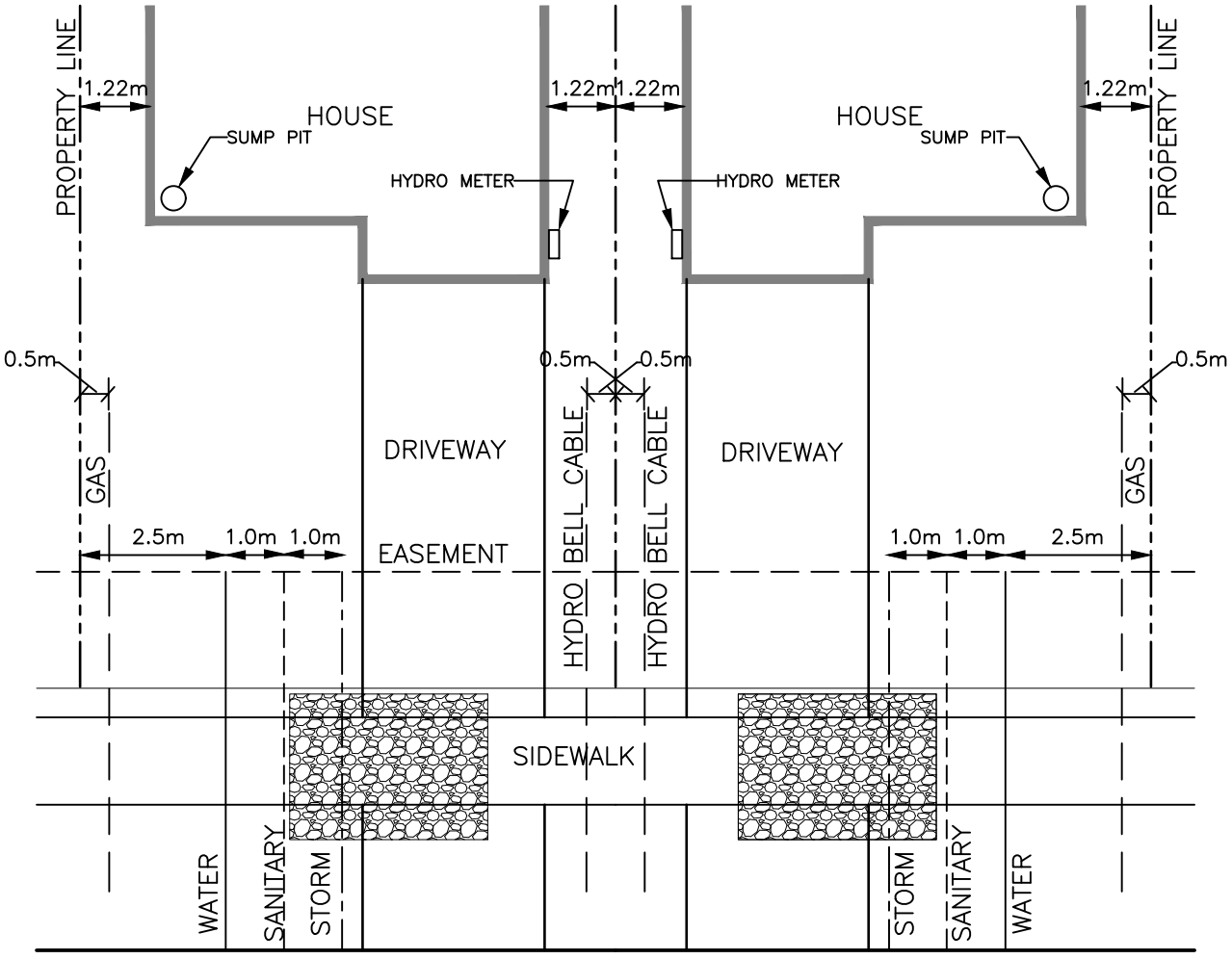
To meet the water balance criteria, infiltration of runoff from all rooftop areas within the site is proposed for the first 25 mm of rainfall which represents approximately 80-90% of the average annual rainfall volume. Rooftop runoff is generally considered 'clean' and does not require any initial treatment prior to infiltration. Large, shared infiltration trenches are proposed within the multiblocks with roof leaders from each unit connected into a single, large trench running parallel to the units while single lots have individual trenches.

The current draft plan provides a high-level concept of the proposed configuration of the multiblock and single units within the site. At this stage in the design process, it is difficult to determine infiltration volume targets for each block within the site. Therefore, it is recommended that all infiltration trenches are 0.5 m deep to minimize drawdown times and have a unit footprint of 0.2 m^2/sq. m of roof area. Please refer to Appendix A for a summary of the infiltration trench input parameters, assumptions, and sizing.

Based on the preliminary design of the site, matching the existing annual infiltration volumes cannot be achieved by infiltrating only the roof areas within the site. As such, it is proposed that runoff from the lawn areas located within the multiblocks along Conservation Drive also be directed to the infiltration trenches to promote additional groundwater recharge. Catchbasins located within these blocks receive overland runoff during most storm events and connect directly into the subsurface trenches. If necessary during final design, additional lawn areas within other blocks may be connected in to the trenches as well to achieve the infiltration target. An overflow to the storm sewer is provided at each trench to ensure an outlet during infrequent rainfall events or if maintenance of the trenches is required.

Drawings C-400 (Appendix B) and Figures 9, 10 and 11 illustrate the locations and details of the trenches for the single lots, rear yards and the multiblocks within the site. The Servicing Plan illustrates the trench locations. All infiltration trenches on site will have overflow connections to the storm sewers.

The infiltration of the roof water within the site helps to reduce the total volume of runoff in the system, reducing erosion potential due to development and helping to maintain existing flow duration curves. In addition, while thermal mitigation is not required for the site due to its location in the watershed, infiltration helps to mitigate against temperature increases of runoff. Groundwater recharge keeps baseflow of nearby systems maintained and cools down stormwater naturally.



NOTES:
1. INFILTRATION GALLERIES APPLY ONLY WHERE SHOWN ON PLAN
2. TYPICAL LOCATION OF SERVICE LATERALS, UNLESS SHOWN OTHERWISE IN PLAN VIEW.

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2017/07/04 2:38 PM By: Rose, Martin

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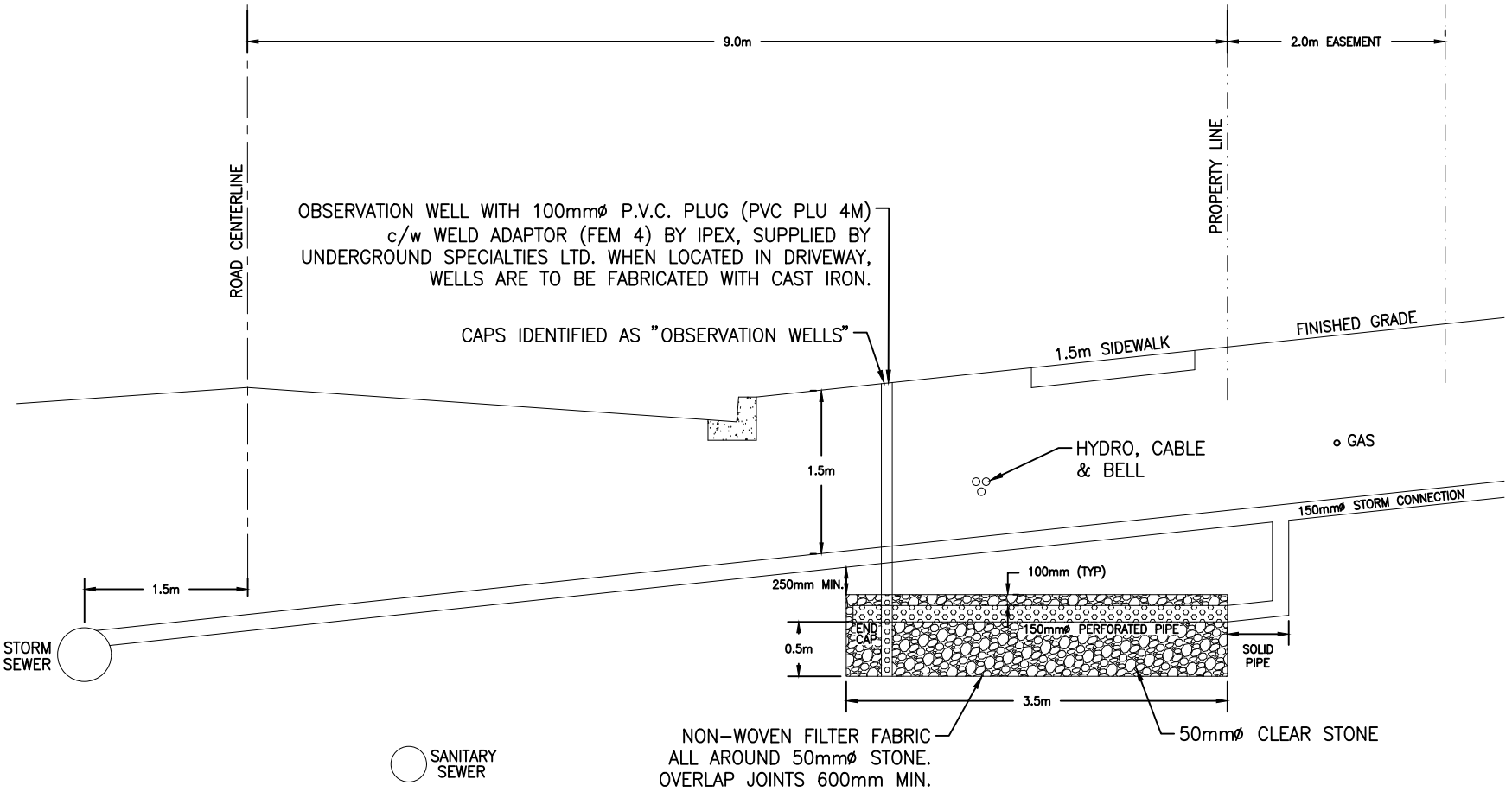
May 2017
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Waterloo, ON, N2L 0A4
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Figure No.
Figure 9

Title
TYPICAL LOT SERVICING DETAIL



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2017/07/04 2:42 PM By: Rose, Martin

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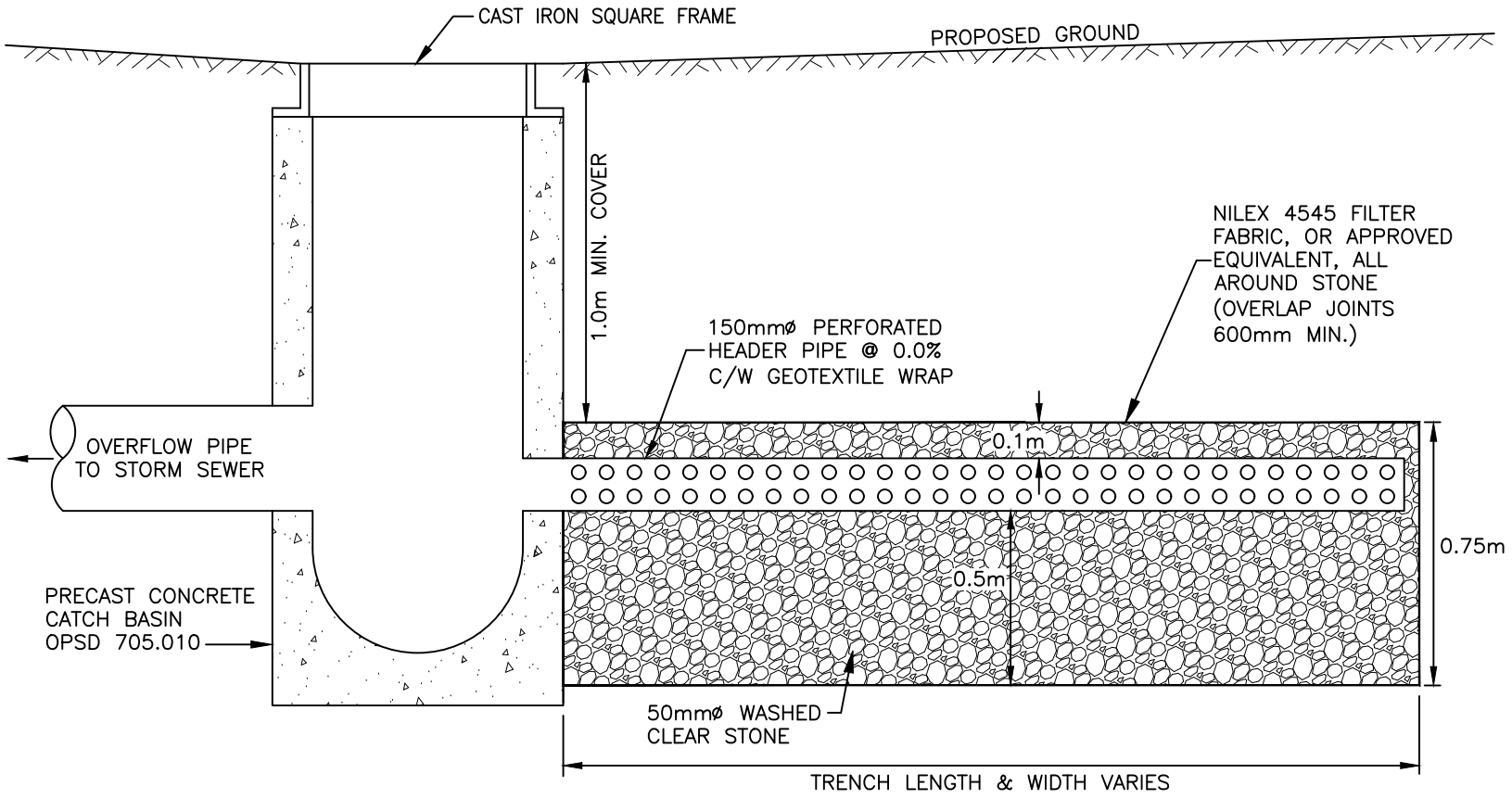
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Figure No.
Figure 10

Title
INFILTRATION GALLERY DETAIL
in boulevard - Single Lot



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2017/07/04 2:44 PM By: Rose, Martin

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Figure No.
Figure 11

Title
REAR YARD
INFILTRATION GALLERY

7.6 SUMMARY

Based on the preceding, the following summary can be drawn for the site:

- Water quality control for the site will be provided by a SWM facility located on the Martin Lands to the south, upstream of the Laurel Creek Reservoir as per the recommendations of the North Waterloo Scoped Subwatershed Study.
- No water quantity control is required for the site since the Laurel Creek Reservoir is located downstream of the site; the on-site storm sewer system has sufficient capacity to convey the 100-year storm.
- Lot level infiltration trenches on both the multiblocks and single lots infiltrate the first 25 mm of clean roof runoff to help maintain the site water balance and meet the NWSSS design criteria.

Based on the findings of this report, the following recommendations are provided:

- The SWM measures provided in this report be implemented for the proposed development.
- The water balance for the site be revisited at detailed design to ensure the NWSSS target criteria are being achieved following the final site layout.

7.7 EROSION AND SEDIMENT CONTROL PLAN

To control erosion and transportation of sediment offsite, an erosion and sediment control plan will be required during the construction process. This Plan will focus on the protection of downstream watercourses and lands.

7.7.1 Erosion Potential Impact

The "Greater Golden Horseshoe Area Conservation Authorities' Erosion and Sediment Control Guideline for Urban Construction" (2006) was used to determine the erosion potential of the site. The erosion potential is based on slope gradient, slope length and soil texture and is then used to determine the appropriate erosion control methods.

Site slope gradients for the development can be summarized as moderate slopes (2-10%) with an average slope in the order of 5%. The slope lengths are generally long (greater than 30 m). Site soils are comprised primarily of silt clays which are considered to represent a medium to high erodibility potential. Thus, the overall erosion potential for the site is "moderate" to "high", depending on the specific location on the site.

7.7.2 Erosion and Sediment Control Plan

The following approach to erosion and sediment control onsite has been prepared to minimize the potential impacts associated with onsite erosion and/or offsite transport of sediment to the Laurel Creek Reservoir, the ultimate receiver of the site runoff.

At the time of final design and prior to any grading or servicing works commencing onsite, an erosion and sedimentation control plan will be prepared for implementation prior to or during construction as applicable. The proposed erosion and sedimentation controls may include but not limited to the following items:

- Steep slopes (>3:1) shall have erosion blankets.
- Light and/or heavy duty silt fencing will be erected on all site boundaries where there is potential for runoff to be discharged offsite, to protect adjacent and downstream lands from migration of sediment in overland flow. The location of this fencing will be adjacent to the limit of grading. Silt fence attached to paige wire fencing will be installed throughout the site adjacent to sensitive areas.
- Erosion control berms/swales will be located in appropriate (critical) areas to divert flows to the sediment basins.
- Storm service outlets will be installed during servicing and roadwork construction to provide lot level dead and live storage outlets.
- A construction entrance feature ("mud mat") will be provided at all site entrances to minimize the offsite transport of sediment via construction vehicles.
- Runoff will be directed to a temporary sedimentation basin via swales to minimize untreated runoff discharged from site.
- Swales constructed onsite will use small weirs to help attenuate flows and encourage deposition of suspended sediment where appropriate.
- All disturbed areas where construction is not expected for 30 days are to be re-vegetated with 50 mm of topsoil and hydro-seeded according to OPSS 572.
- During construction, all catchbasins are to be sealed until roads are paved to prevent sediment deposition in the batch basin's sumps and conveyance of silt to the downstream storm sewer system on Conservation Drive.
- Following completion of construction, and site stabilization, all erosion and sediment control measures and accumulated sediment are to be removed.

The erosion control measures are to be maintained in good repair during the entire construction period, and shall only be removed as contributing drainage areas are restored and stabilized. In addition, the condition of erosion control works, their overall performance, and any repairs replacement or modifications to the installed item shall be noted in monitoring reports submitted to the GRCA and the City of Waterloo. Monitoring reports should be submitted bi-monthly

(quarterly during periods of inactivity) and should be based on inspection completed bi-weekly or after any significant rainfall events (> 13mm), whichever is more frequent.

7.8 MONITORING, MAINTENANCE, AND MITIGATION PROGRAM

Monitoring and maintenance activities are important parts of a SWM Plan to ensure that the designed features continue to operate as intended.

7.8.1 Infiltration trench

It is recommended that a monitoring program for the proposed infiltration trenches be developed at the detailed design stage following discussions with the Grand River Conservation Authority and the City of Waterloo.

8.0 STORM DRAINAGE

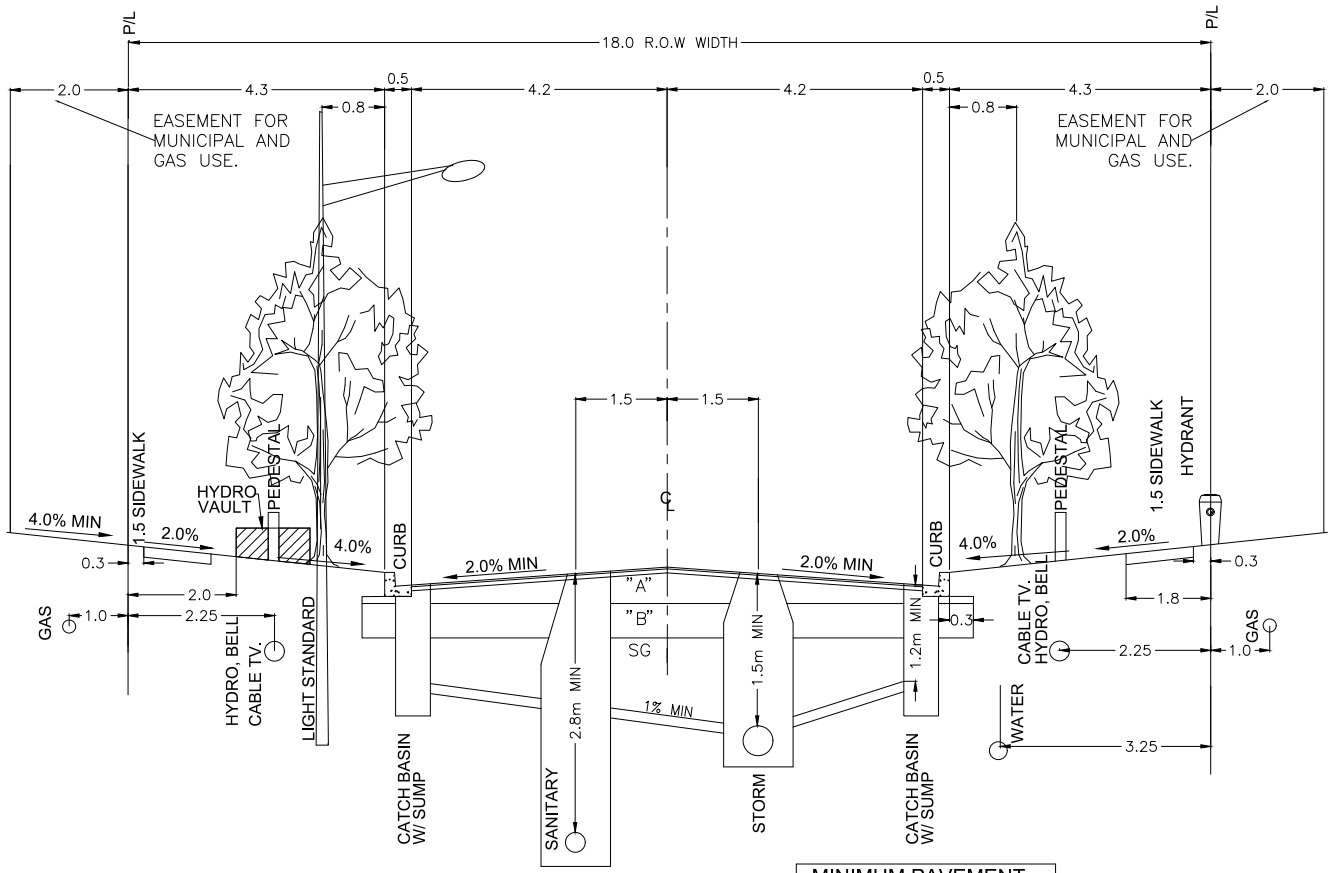
As explained in Section 7.0 of this report, the stormwater management water quality for this site is being managed in a community SWM facility on Beaver Creek Road. Stormwater quality control is not required, however, in order to prevent flooding in the trail park immediately south of Conservation Drive, 100-year flow are being conveyed by the internal and external storm sewers to the stormwater management facility on Beaver Creek Road. At this location, minor flows will be conveyed into the SWM facility, while major flows by-pass the facility and discharge into a swale outletting into the Laurel Creek Reservoir.

In order to practically provide for multiple catchbasins within the site to get the 100-year flows into the storms sewers, a minor change in the road cross section is proposed. Figure 12 illustrates the cross section where no catchbasin manholes are proposed to allow for 3 or more, catchbasins at the gutter line to be installed side by side.

It is noted that a storm sewer already exists on Conservation Drive which was installed during road construction in 2011 and discharges to the south toward the trailer park lands.

Figure 13 illustrates the concept plan for storm servicing. In order to avoid reconstruction works of installing a second storm sewer on Conservation Drive, the 100-year storm sewer is proposed to be installed within an easement immediately adjacent to Conservation Drive. This sewer will be used for the dual purpose of conveying 100-year flows and is also being used as an overflow outlet from the infiltration galleries at the rear of the back to back or stacked townhouses backing onto Conservation Drive. It is noted that once this sewer connects to the storm sewer on Conservation Drive (at the extreme west limit of the site). It is noted that this area of Conservation Drive is within the limits being reconstructed by the City with a new cross section, road profile and storm sewer.

To avoid vertical conflicts with the existing sanitary sewer on Kawartha Street, the existing sanitary sewer on Conservation Drive near the storm sewer outlet, and to match into the City storm design on Conservation Drive, the storm sewer is expected to be H.E. equivalent 1,350 mm diameter at 0.30%. This is limited to the last reach of storm sewer on the easement between Kawartha Street and the west limit of the subdivision.



CROSS SECTIONAL POINTS	
DESCRIPTION	OFFSET FROM CENTERLINE
EDGE OF PAVEMENT	-0.084
TOP OF CURB	+0.041
FRONT OF WALK	+0.141
BACK OF WALK	+0.171
PROPERTY LINE	+0.191

UTILITY	MIN. COVER
SANITARY	3.0
STORM	1.5
WATER	2.0
HYDRO	0.9
BELL	0.76
CABLE	0.76
GAS	0.76

MINIMUM PAVEMENT THICKNESS (NOTE 2)
40 mm HL3
50 mm HL8
150 mm G.B.C. "A"
450 mm G.B.C. "B"
1200 mm COMPACTED SUBGRADE

SCALE: N.T.S.

NOTES:
1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
2. WHERE THE SOILS CONSULTANT'S RECOMMENDATIONS EXCEED MINIMUMS NOTED, THE SOILS CONSULTANT'S RECOMMENDATIONS SHALL BE USED.

BASED ON CITY OF WATERLOO STANDARD DRAWING W-202

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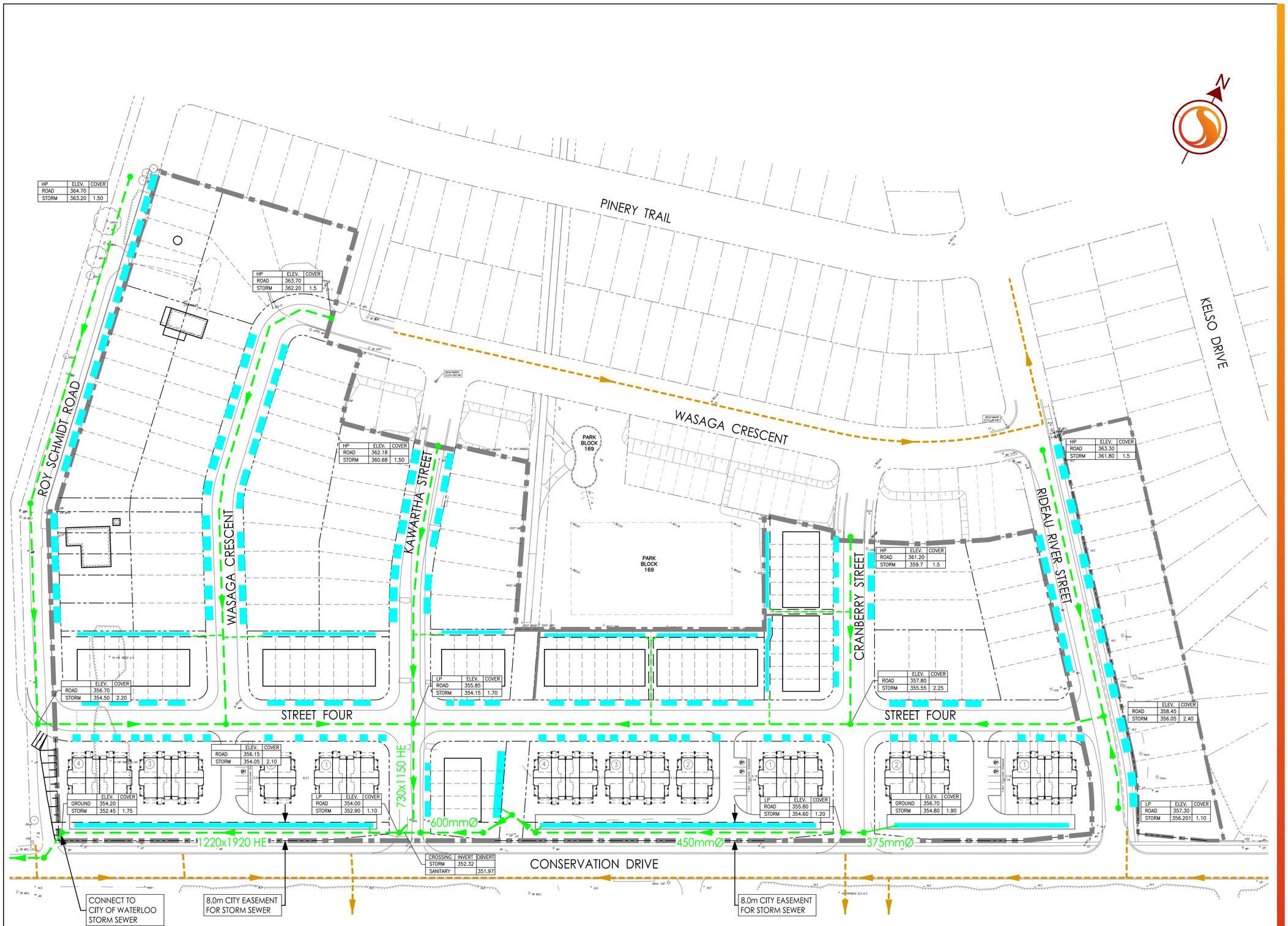
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Figure No.
12

Title
PROPOSED ROAD CROSS-SECTION
18.0m R.O.W. - 9.0m ROAD



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Notes

1. BENCHMARK:
   CUT CROSS IN CONCRETE CURB, NORTH EAST CORNER OF RIDEAU RIVER STREET AND WASAGA CRESCENT, CITY OF WATERLOO.
   ELEVATION = 363.82m
2. TOPOGRAPHIC SURVEY BY STANTEC CONSULTING LTD. DATED APRIL 2016. ELEVATIONS ARE REFFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (COVD-1929:1978)
3. DRAFT PLAN FOR LANDS PROVIDED BY MHBC DATED OCTOBER 21, 2016

Legend

- PROPERTY LINE
- PROPOSED STORM SEWER
- EXISTING STORM SEWER
- PROPOSED INFILTRATION GALLERY
- PROPOSED INDIVIDUAL INFILTRATION GALLERIES - 1 PER LOT

LP	ELEV.	COVER
ROAD	363.20	
STORM	361.70	1.50

ROAD STATUS (LP = LOW POINT, HP = HIGH POINT)
ROAD ELEVATION
COVER OVER SEWER (TO OBVERT)
SEWER OBVERT ELEVATION

Revision	By	Appd.	YY.MM.DD
File Name: 60308671_C-UG-STORM.dwg	M.A.R. Dwn.	J.L.G. Chkd.	M.A.R. Dsgn.	17.03.06 YY.MM.DD

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CONSERVATION MEADOWS SUBDIVISION PHASE 2
Waterloo, ON.

Title
STORM SERVICING CONCEPT PLAN

Project No.	Scale	Drawing No.	Sheet	Revision
60308671	1:750 (0, 7.5, 22.5, 37.5m)	Figure 13	of	0

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2017/07/04 2:24 PM By: Ross, Martin

ORIGINAL SHEET - ARCH D

9.0 UTILITIES

9.1 WATERLOO NORTH HYDRO

In conjunction with the reconstruction of Conservation Drive starting from Roy Schmidt Road and to the west, Waterloo North Hydro is relocating and rebuilding their overhead pole line. Waterloo North Hydro advises along with the overhead pole line on Conservation Drive, they currently have underground plant on Wasaga Crescent, Pinery Trail and Rideau River Street that have the capacity to service the proposed development.

Specifically, Waterloo North Hydro advises of the following:

- Waterloo North Hydro standard conditions in effect at the time of servicing will apply.
- Decreased setbacks (if proposed) may necessitate the installation of non-combustible barrier walls between Waterloo North Hydro padmounted transformers and the housing unit as per the Ontario Electrical Safety Code, Section 26-014. This installation would be at 100% the developer's cost and may require a revised right-of-way cross section to facilitate the installation due to the proximity of the padmounted transformer to the sidewalk.
- Waterloo North Hydro requires a minimum 1.2 metres (4') wide clear access in front of and around the meter location on the side of the lot where the services stub is located. If less than 1.2 metres (4') is provided, a registered easement on the adjacent lot must be granted at no cost to Waterloo North Hydro. This easement is to be free of encumbrances, including fences. If this access/easement cannot be provided, the meter must be placed on the front face of the house.
- For on-street townhouse blocks, ganged meter bases must be placed on the end units in accordance with Waterloo North Hydro's final design. A blanket easement is required over all townhouse blocks.
- Additional easements may be required.
- Any relocation of existing Waterloo North Hydro facilities, if possible, will be at 100% the applicant's cost.
- Prior to completion of final design by Waterloo North Hydro, the final lot fabric must be established and engineering drawings forwarded to Waterloo North Hydro, a minimum of 3 months before the start of Waterloo North Hydro's installation.
- An overhead electrical distribution line exists along Conservation Drive. A minimum of 3 metre clearance must be maintained from overhead electrical distribution circuits to a building to comply with the Occupational Health and Safety Act, to accommodate initial construction and maintenance activities on the building. This will require any buildings to be a minimum of 5 metres back from the nearest conductor on the overhead line.
- The applicant will be responsible for the removal of the pole line on Rideau River Street.
- Any changes to the existing distribution system to continue to supply any existing customers will be at 100% the applicant's cost.

9.2 BELL CANADA

Bell Canada advises this development will be served with fiber technology. However, the surrounding existing area is serviced with copper. Bell plans to extend their structure from Lake Louise Boulevard to pull the new fiber through to service this development. They will coordinate their work with the hydro servicing plan and would most likely be installed in a joint trench with Hydro and Rogers. Inside the development, Bell plans on placing a CSP (fibre splice box) that will service the development on municipal property.

9.3 UNION GAS

Union Gas has existing plant on Rideau River Street, Cranberry Street, Kawartha Street and Wasaga Crescent. It is expected that these services will be extended throughout the subdivision to service the site.

9.4 ROGERS CABLE

Rogers advises they have no constraints to providing service. They advised they will service the development from the existing plant on Conservation Drive and Rideau River Street.

10.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the finding of this report, it is concluded that:

- The proposed Conservation Meadows Subdivision, Phase 2 can be adequately services by municipal sewage, storm drainage, water services and utilities.
- Municipal servicing and roadworks can be provided in accordance with the City of Waterloo standards.
- SWM measures provided onsite and offsite can be provided in accordance with various agency guidelines.
- Streets within the subdivision can be constructed according to City of Waterloo standards.
- The subdivision can be serviced with Hydro, Bell, Cable and Gas extended from existing facilities surrounding the site.

It is further recommended that:

- The report be circulated to the City, Region and various approval agencies in support of the Draft Plan Application for the Conservation Meadows Subdivision, Phase 2.
- Detailed grading and servicing design drawings be prepared, and a Final Stormwater Management Report and Erosion and Sediment Control Plan be completed once the subject lands have been Draft Plan Approved.

APPENDIX A
WATER BALANCE AND INFILTRATION CALCULATIONS

Stantec

60308671 Activa Conservation Drive

Preliminary Annual Water Balance and Infiltration Calculations

Existing Drainage Conditions - Targets from NWSSS (2013)

Average Infiltration Rate 183.2 mm/yr (1)

Area with	Total Area		% Impervious		Open Water	
	10.7 ha		0%		0.0	ha

	Total Area		
Precipitation	844.8	mm/yr (2)	
Evapotranspiration	507.2	mm/yr (3)	(ET*(1-%IMP))
Infiltration	183.4	mm/yr (4)	(INFIL*(1-%IMP))
Evaporation (Open Water)	0.0	mm/yr (5)	
Runoff	154.2	mm/yr (6)	

Total Infiltration (pre)	**19,624 m^3/yr**	**183.4 mm/yr**
Total Runoff (pre)	**16,499 m^3/yr**	**154.2 mm/yr**

Proposed Drainage Conditions - Activa Conservation Drive

Surface Water Regime

Average Infiltration Rate 183.2 mm/yr (7)
Average Evapotranspiration 507.2 mm/yr (8)

Area with	Total Area		% Impervious		Open Water (9)	
	10.7 ha		55%		0.0	ha

	Total Area		
Precipitation	844.8	mm/yr (2)	
Evapotranspiration	228.2	mm/yr	(ET*(1-%IMP))
Infiltration	82.4	mm/yr	(INFIL*(1-%IMP))
Evaporation	0.0	mm/yr (5)	
Runoff	534.1	mm/yr (6)	

Total Infiltration (post)	**8,821 m^3/yr**	**82.4 mm/yr**
Total Runoff (post)	**57,161 m^3/yr**	**534 mm/yr**
Total Infiltration Deficit (pre to post)	**-10,803 m^3/yr**	**-101 mm/yr**

Infiltration Augmentation

Assumed Single House Roof Area	150 m^2	
Lot level single house roof area to rearyard infiltration trench, based on 68 single units per Draft Plan (assume 80% of total roof area reaches trench)	8160 m^2	
Total rooftop area from multi blocks to infiltration trenches based on proposed units fronting on Conservation Drive, this area doubled to represent remaining multi block units to the north; end units are 50 sq m, middle units are 45 sq m (assume 80% of rooftop reaches trench)	6192 m^2	
Multi block rear yards on Conservation Drive to infiltration trenches (Blocks 19, 20, 22, 23)	1500 m^2	
Infiltration trench sized to capture first 25 mm of runoff from rooftop areas	725 mm/yr (10)	
Infiltration trench sized to capture annual runoff from lawn area	242 mm/yr (11)	
Lot level single house infiltration (total rooftop area)	5916 m^3/yr	
Additional town-home block infiltration (total rooftop area plus rear yards)	4853 m^3/yr	
Total Rooftop Infiltration	**10,769 m^3/yr**	
Total Post-Development Infiltration	**19,590 m^3/yr**	**183 mm/yr**
Total Infiltration Surplus (pre to post)	**-34 m^3/yr**	**0 mm/yr**
Total Runoff Surplus (pre to post)	**21,062 m^3/yr**	**197 mm/yr**

(1) Estimated infiltration rate from North Waterloo Scoped Subwatershed Study (2013) for Catchment 3101, approximately 31.8 ha total
(2) Precipitation based on meteorological data set recorded at the Waterloo Wellington Airport located approximately 15 km east of the site, data set from 1951-2005 (54 years), varies slightly from 908 mm/yr reported by MOECC, all other values have been adjusted accordingly
(3) Estimated ET rate from North Waterloo Scoped Subwatershed Study (2013) for Catchment 3101, approximately 31.8 ha total
(4) Estimated infiltration rate from North Waterloo Scoped Subwatershed Study (2013) for Catchment 3101, approximately 31.8 ha total with impervious coverage considered
(5) Open water evaporation (650 mm/yr) based on Environment Canada Calculated Lake Evaporation Data, 1951-1980 (Ontario Climate Centre)
(6) Estimated runoff volumes from North Waterloo Scoped Subwatershed Study (2013) for Catchment 3101, approximately 31.8 ha total
(7) The proposed average infiltration rate was assumed to be the same as the existing conditions annual volumes from the NWSSS
(8) The proposed average evapotranspiration rate was assumed to be the same as the annual volume from the NWSSS
(9) Water areas based on permanent pool area during post-development conditions
(10) 725 mm based on approximately 85% of the annual rainfall volume
(11) Based on post-development MOE values for clay with lawn assuming 844.8 mm of rainfall per year

60308671 - Activa Conservation Drive
Summary of Infiltration Trench Sizing

Assumptions

- All trenches are 0.5 m depth based on 48-hour maximum drawdown time
- Precipitation event based on 4-hour, 25 mm rainfall per City of Waterloo parameters
- Footprint of trenches varies depending on contributing area
- Safety factor of 25% applied to all trench footprints to account for clogging, removal, etc.
- No ponding occurs above the trench

Input Parameters

Lawn Areas		
Subsoil exfilfiltration rate:	4	mm/hr
Soil depth:	150	mm
Soil porosity:	0.35	
Soil field capacity:	0.15	
Soil wilting point:	0.1	
Soil infil. rate	3.5	mm/hr
Soil wilt point vol:	0	cu.m
Soil porosity vol:	0	cu.m
Soil field cap vol:	0	cu.m
Soil initial vol:	0	cu.m

Infiltration Trench Physical Properties

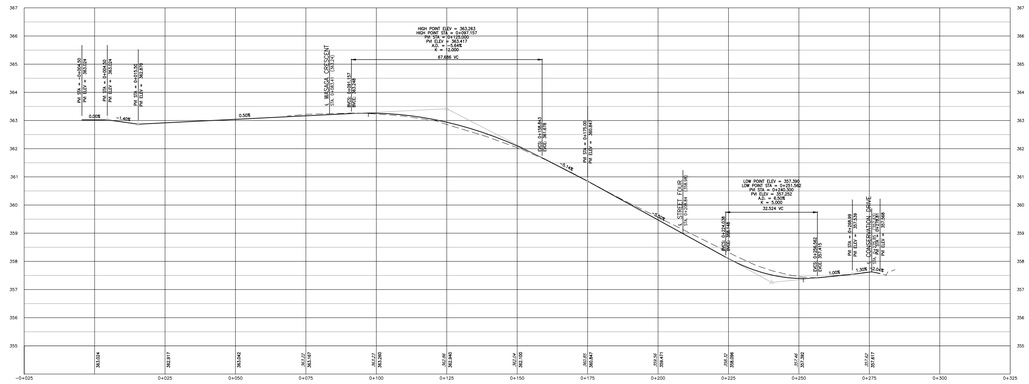
Trench depth:	0.5	m
Trench porosity:	0.35	

Sizing Summary

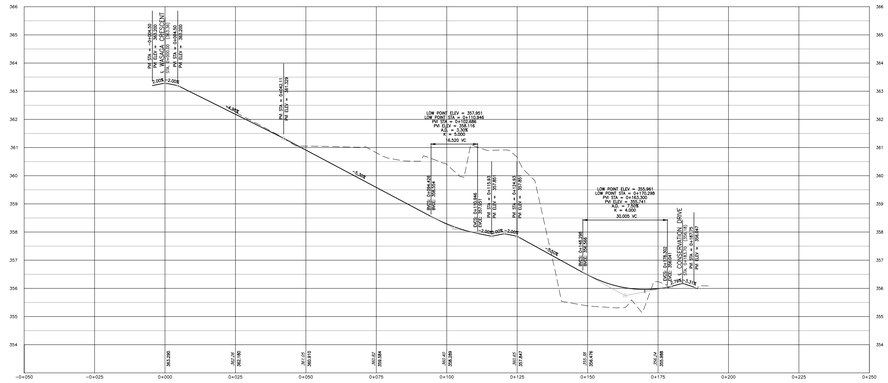
Average sq. m of trench per sq. m of roof (based on all multiblocks and singles)	0.16	sq m/sq m
25% safety factor	0.20	sq m/sq m

APPENDIX B
DRAWINGS

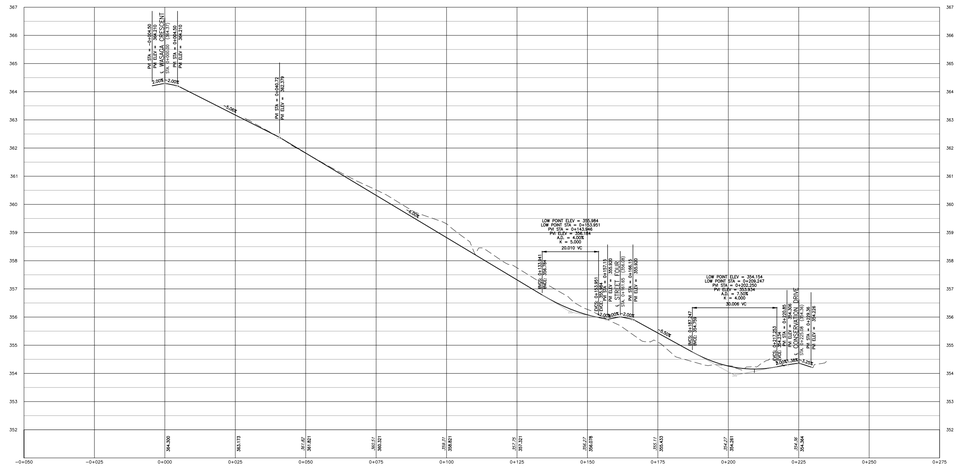
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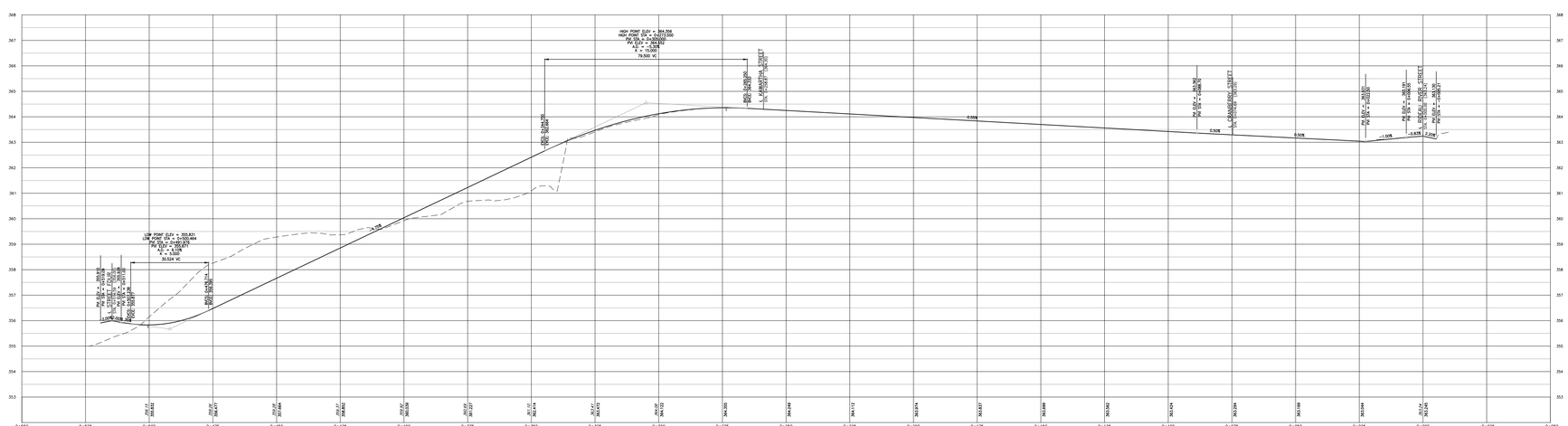
RIDEAU RIVER STREET



CRANBERRY STREET



KAWARTHA STREET



WASAGA CRESCENT

KAWARTHA STREET

Stantec
300 Hagey Blvd. Suite 100
Waterloo, ON, N2L 0A4
Tel. 519.579.4410
www.stantec.com

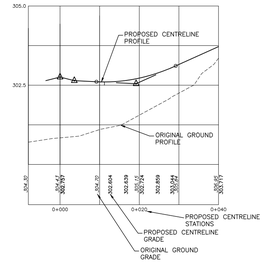
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Notes

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   CUT CROSS IN CONCRETE CURB, NORTH EAST CORNER OF RIDEAU RIVER STREET AND WASAGA CRESCENT, CITY OF WATERLOO.
   ELEVATION = 363.82m
2. TOPOGRAPHIC SURVEY BY STANTEC CONSULTING LTD. DATED APRIL 2016. ELEVATIONS ARE REFFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (COVD-1929:1978)
3. DRAFT PLAN FOR LANDS PROVIDED BY MHBC DATED OCTOBER 21, 2016

Legend



Revision	By	Appd.	YY.MM.DD
File Name: 60308671_C-200ST.dwg	M.A.R. Dwn.	J.L.G. Chkd.	M.A.R. Dsgn.	17.01.12 YY.MM.DD

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Client/Project
ACTIVA HOLDINGS INC.

CONSERVATION MEADOWS SUBDIVISION
PHASE 2
Waterloo, ON.

Title
CONCEPTUAL ROAD PROFILES

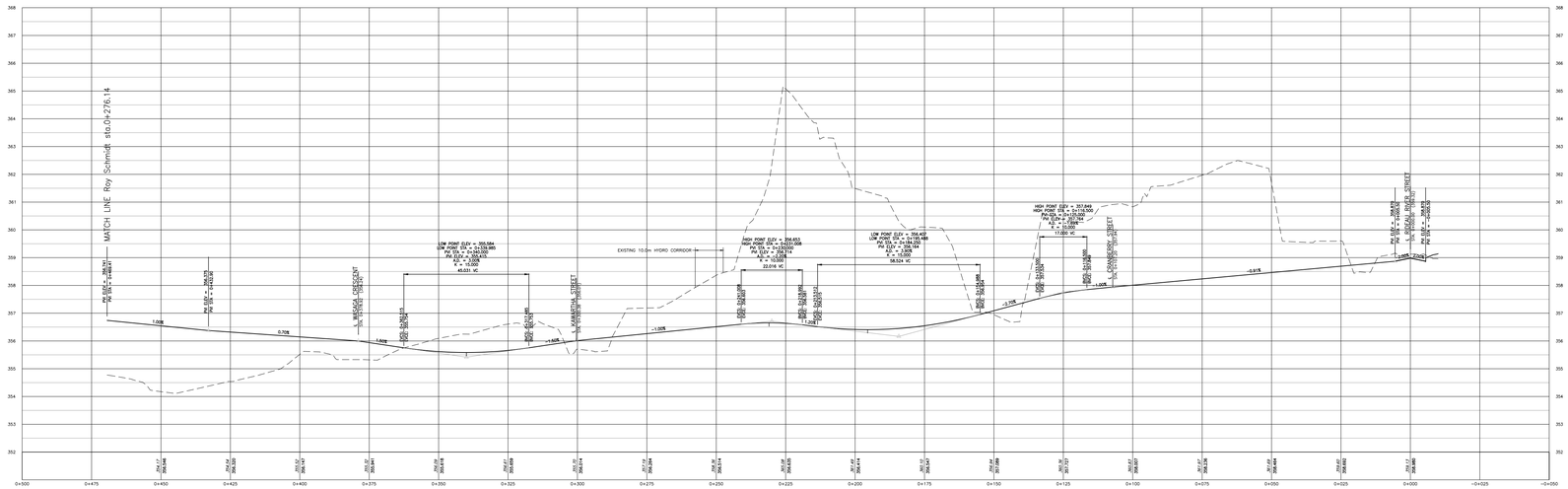
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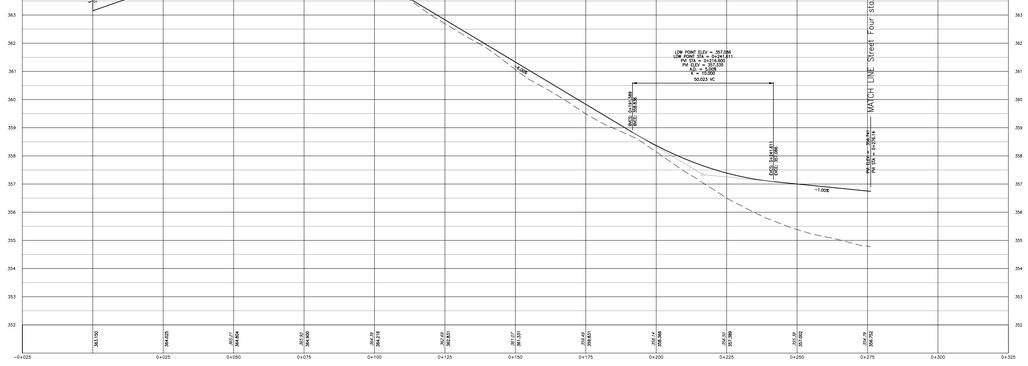
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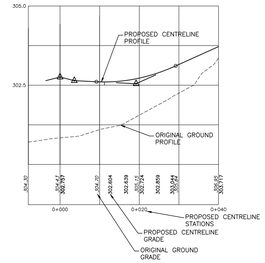
ROY SCHMIDT ROAD

Stantec
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Waterloo, ON, N2L 0A4
Tel. 519.579.4410
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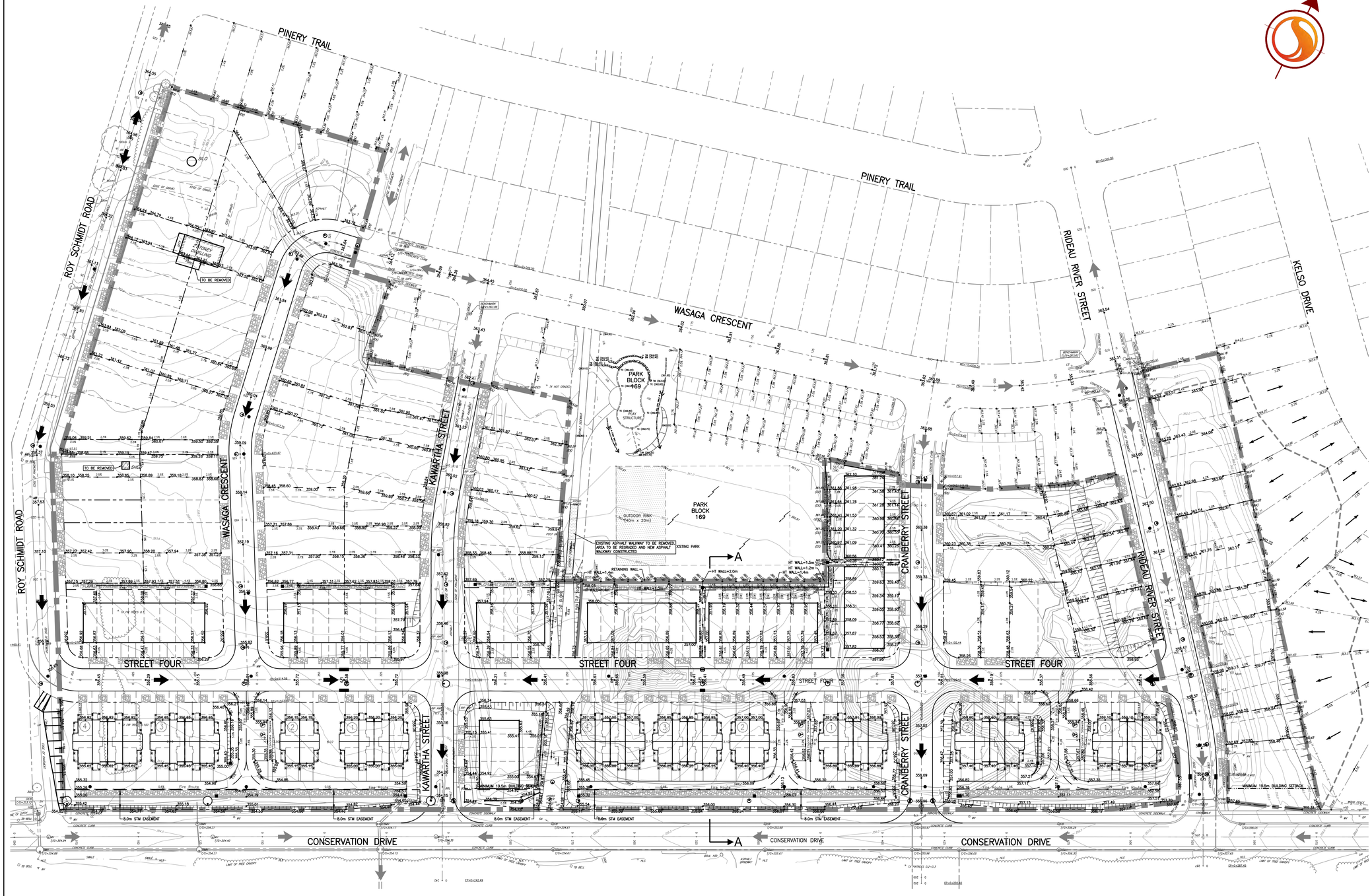
Client/Project
ACTIVA HOLDINGS INC.

CONSERVATION MEADOWS SUBDIVISION PHASE 2
Waterloo, ON.

Title
CONCEPTUAL ROAD PROFILES

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Revision 0

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3. DRAFT PLAN FOR LANDS PROVIDED BY MHBC DATED APRIL 7, 2017

Legend

- PROPERTY LIMIT
- 352.82 (EX) — EXISTING ELEVATION
- 352.92 — PROPOSED ELEVATION
- 2.0% 2.0% — FLOW DIRECTION AND GRADE
- 349.00 — EXISTING CONTOUR (SURVEYED)
- EXISTING CONTOUR (CITY OF CAMBRIDGE)
- PROPOSED STORM MANHOLE
- PROPOSED SANITARY MANHOLE
- PROPOSED HYDRANT
- EXISTING STORM MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING HYDRANT
- PROPOSED SLOPE (3:1 UNLESS NOTED OTHERWISE)
- OVERLAND FLOW DIRECTION
- EXISTING OVERLAND FLOW DIRECTION
- BH — BOREHOLE
- TP — TEST PIT
- MW — MONITORING WELL
- EXSITING TREE
- EXSITING DRIP LINE
- RETAINING WALL (BY OTHERS)
- INFILTRATION TRENCH

Revision	By	Appd.	YY.MM.DD
File Name: 60308671_C-400GP.dwg	M.A.R. Dwn.	J.L.G. Chkd.	M.A.R. Dsgn. 17.01.09 YY.MM.DD

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Title

CONCEPTUAL GRADING PLAN

Project No.	Scale	Revision
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Drawing No.	Sheet	
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