Stantec

220 Arkell Road, Guelph

Revised Preliminary Servicing, Grading and Stormwater Management Report

April 4, 2023

Prepared for:

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Prepared by:

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Project Number: 161423338

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1.0 INTRODUCTION

1.1 SITE LOCATION

The 220 Arkell Road site is located along the southeast limit of the City of Guelph, approximately 0.6 km west of the Arkell Road and Victoria Road South intersection as illustrated in Figure 1.0. The subject property is comprised of approximately 7.16 ha and is bounded by Victoria Park Village (VPV) Subdivision to the north, existing agricultural lands to the east, existing Arkell Meadows Subdivision to the South and Torrance Creek Swamp (Provincially Significant Wetlands [PSW]) to the west. The Proposed Draft Plan consists of 30 Single-Family Lots on a single road and a 1.71 ha Multiple-Family Residential Block, as well as a Stormwater Management (SWM) Block, Park Block and Ecological Linkage Block. The described are illustrated on Figure 1.0 – Site Location Plan and the Proposed Draft Plan included in Appendix A.

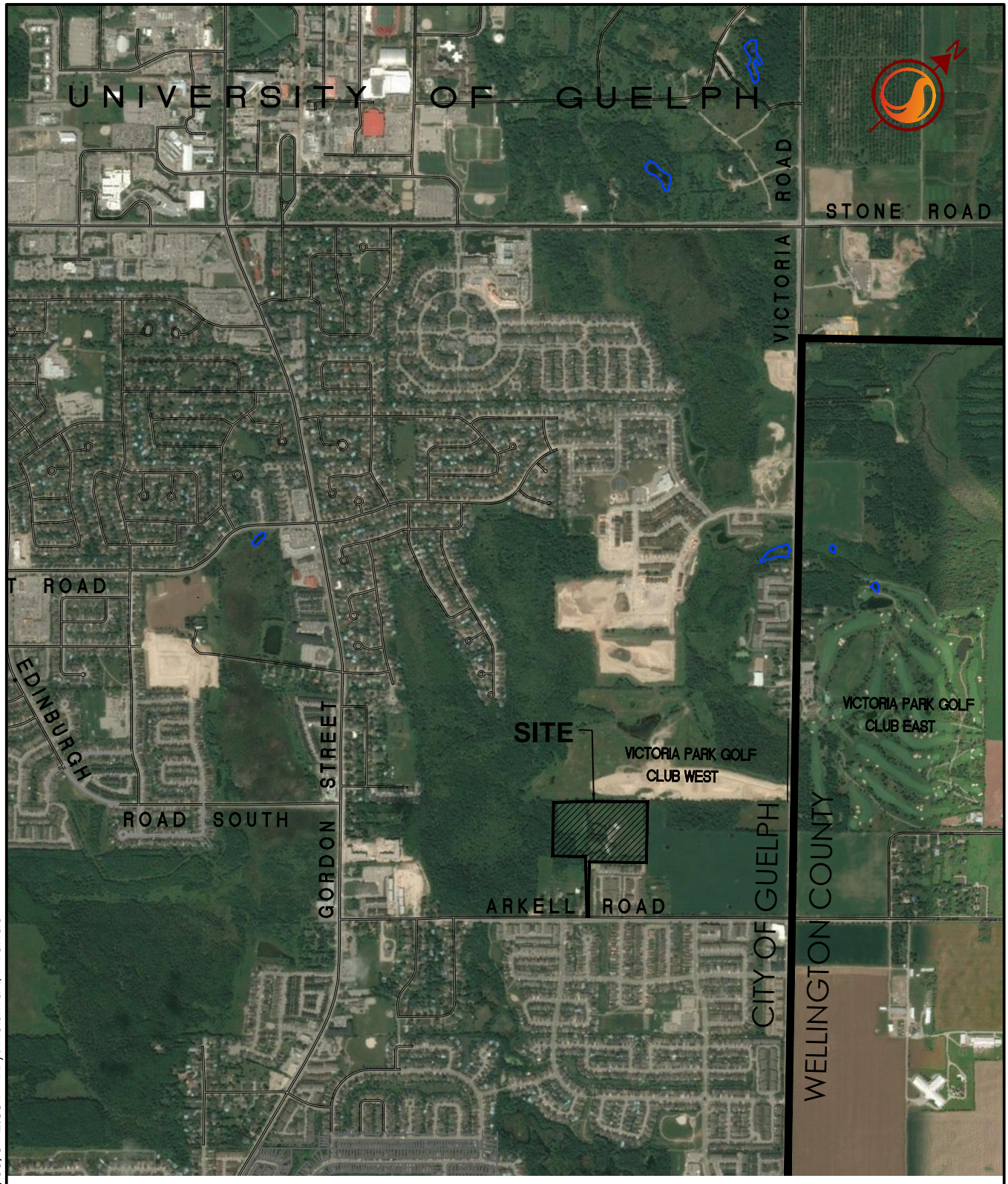
1.2 PURPOSE OF THIS REPORT

The purpose of this Preliminary Servicing, Grading and Stormwater Management Report is to outline how the proposed 220 Arkell Road lands can be supplied with adequate services, including sanitary, municipal water, storm drainage, SWM, and utilities. This report is prepared in support of the Draft Plan Application. Please refer to the Proposed Draft Plan illustrated on Figure 2.0.

Supplementary reports that should be read in conjunction with this report include:

- Tree Preservation Plan, prepared by Stantec Consulting Ltd., May 2019
    - Updated Tree Preservation Plan dated May 18, 2021
- Hydrological Assessment, prepared by Stantec Consulting Ltd., May 2019
    - Hydrogeological Feature Water Balance Memo Dated March 2023
- Environmental Impact Study (EIS), prepared by Stantec Consulting Ltd., May 2019
    - Environmental Impact Study Addendum Dated March 2023
- Geotechnical Investigation, prepared by Stantec Consulting Ltd., May 2019
- Phase 1 Environmental Site Assessment, prepared by Stantec Consulting Ltd., May 2019
    - Updated Phase I and II Reports Dated May 6, 2021

This Report demonstrates that the 220 Arkell Road lands can be developed with full municipal servicing, SWM, and utilities to the requirements of the various approval agencies.



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March, 2019
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Figure No.
1.0

Title
SITE LOCATION PLAN

The servicing strategies presented in this Report are conceptual. Detailed engineering drawings (for construction) and a Final SWM Report will be submitted as part of the final engineering design process once the proposed Subdivision has received Draft Plan Approval.

1.3 ENVIRONMENTAL ASSESSMENT REQUIREMENTS

Under the procedures set out in the Municipal Class Environmental Assessment Act (Class EA), projects completed by the Private Sector through a Planning Act Process are considered as having fulfilled the Class EA requirements, except for some specific Schedule 'C' projects that are outlined in the Act.

All of the works required for the 220 Arkell Road lands are described in the subsequent sections of this Report. The plans, included in this Report, show the location of the proposed sanitary and storm sewers, proposed watermains, as well as grading and utilities. The intent of this Report and the Supplementary Reports is to ensure that the commenting agencies and the Public are made aware of the servicing strategies for the proposed Development.

As above, all of the other works, and in particular all of the works required for the 220 Arkell Road lands will be completed by the Developer (i.e., by the Private Sector), are clearly described/shown in this Report in support of the Draft Plan and, therefore, is exempt from the Class EA.

2.0 OVERALL GRADING AND DRAINAGE

2.1 EXISTING LAND USE AND SITE TOPOGRAPHY

The existing site conditions for the subject site are illustrated on Drawing No. C-050 included in Appendix A.

The subject lands are presently used as a single-family home and former horse pasture. Existing vegetation surrounds the north, east and west property lines.

The topography of the site is generally rolling with elevations ranging from approximately 340.0 m at the center and southeast corner of the site, falling northeast to approximately 337.0 m, or falling southwest towards the Torrance Creek Swamp at approximately 333.50 m. The site slopes range from 0.5% to 15% with the high point situated in the centre of the property. There are two major existing drainage patterns; the first and largest drains approximately 4.70 ha to Torrance Creek Swamp along the southwest property line; and the second drains approximately 2.47 ha via sheet flow, uncontrolled offsite to the northeast corner. This area then flows via sheet flow to an existing woodlot approximately 70.0 m east of the property line. This is illustrated on the Existing Conditions Plan, Drawing No. C-050, included in Appendix A.

2.2 ROAD PROFILE AND DESIGN CONSTRAINTS

Constraints in designing the road profiles and lot grading are as follows:

- Match existing grades, where possible, to minimize grading and cut/fill quantities and minimize changes to the surface hydrology and hydrogeology of the area
- Maintain grades along the north limits of the property as it is identified to be protected with a 50.0 m wide ecological linkage for wildlife preservation
- Account for future urbanization of adjacent lands
- Match Hutchison Road elevations proposed for Victoria Park Village
- Satisfy the City of Guelph requirements for minimum and maximum road grades
- Provide a major overland flow route for flows in excess of the storm sewer capacity
- Maintain adequate cover over storm, sanitary sewers and watermain
- Match existing grades along the entire perimeter of the site
- Provide sufficient Parkland Area and ensure 80% of park area is suitable table land (i.e., 2 to 3% slope)

2.3 PROPOSED ROAD PROFILES AND OVERALL SITE GRADING

A preliminary road profile within the subject site was established based on the proposed street pattern to satisfy the constraints outlined in the previous Section 2.2. The road profile has been designed with grades ranging from 0.5% to 2.00% in order to match perimeter grades as well as meet criteria and optimized grading for the proposed servicing solution.

The proposed centerline road elevations are illustrated on the Servicing Concept Plan, Drawing No. C-100, and the Road Profile Concept Drawing No C-200, all included in Appendix A.

The subject lands have a narrow frontage onto the north side of Arkell Road. This narrow frontage facilitates an existing driveway access, constrained by the property boundary which tapers from 6.0 m wide at the Arkell Road Right-of-Way to 14.0 m wide at the end of the access approximately 190.0 m north of Arkell Road. Due to this restriction, the Draft Plan supports one road access through the VPV Subdivision which provides connection to Victoria Road. A 10.0 m wide Temporary Emergency Access will be provided from the proposed internal road, through the Park Block connecting to the existing road Dawes Avenue, located in the Arkell Meadows Subdivision. The proposed Emergency Access Profile identifying the access grades and slopes is shown on Figure 2.0. This Emergency Access strategy has been reviewed with the City prior to proceeding with the Reports and Plans to support the Draft Plan Subdivision. Additional coordination with the Consultant for the adjacent Developer for 190-216 Arkell Road has occurred to coordinate the future profile of Dawes Avenue and impacts to the Emergency Access connection as shown on Figure 3.0. Additional coordination has occurred with the adjacent Developer such to identify the conceptual trail connection from Dawes Ave, south to Arkell Road as shown on the Conceptual Grading Plan, Drawing C-400 included in Appendix A.

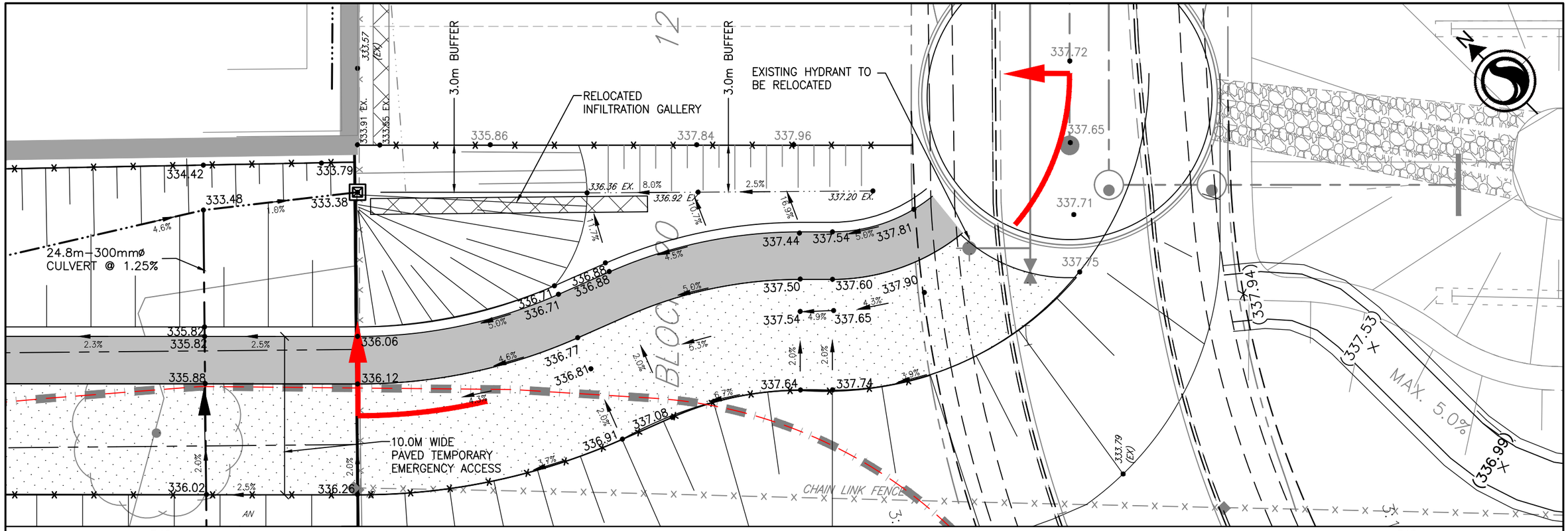
A 17.0 m Right-of-Way cross-section in accordance with City Standards is proposed as it is a continuation of the existing road cross-section for the Development lands to the north for the single-family road, shown on Figure 4.0 – 17 m Right-of Way.

A typical road cross-section, similar to the other multiple residential Developments constructed in the City, has been prepared for the Multiple-Residential Block, during the preliminary review of the Development. The 6.1 m wide road cross-section is shown on Figure 5.0 and will be further reviewed during the Site Plan process.

The proposed lot grading within the site ranges from 2.0% to a maximum of 5.0%, with 3:1 transition slopes or retaining walls utilized to accommodate the various grade changes within the proposed subdivision and at various perimeter locations. A combination of Type ‘A’ (back to front drainage), and Type ‘D’ (split drainage) or Type ‘B’ (walkout) are used in the proposed design. No Type ‘C’ (front walk-ins) lots are anticipated. The proposed lot grading is illustrated on the Conceptual Grading Plan, Erosion & Sediment Control Plan, Drawing No. C-400 included in Appendix A.

Preliminary earthwork calculations have been performed for the subject property which indicates that there is a fill shortage of +/-20,000 cum such to ensure proper separation from the seasonal high groundwater table with surplus of topsoil planned to be used as fill in park areas. A Preliminary Cut-Fill Plan, Drawing No. C-900 demonstrates the extents of earth cut/fill and is included in Appendix A.

At detailed design, profiles and grading will be refined to minimize the required earth cut/fill volumes.



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Legend

Scale

1:250H 0 2.5 7.5 12.5m
1:50V 0 0.5 1.5 2.5m

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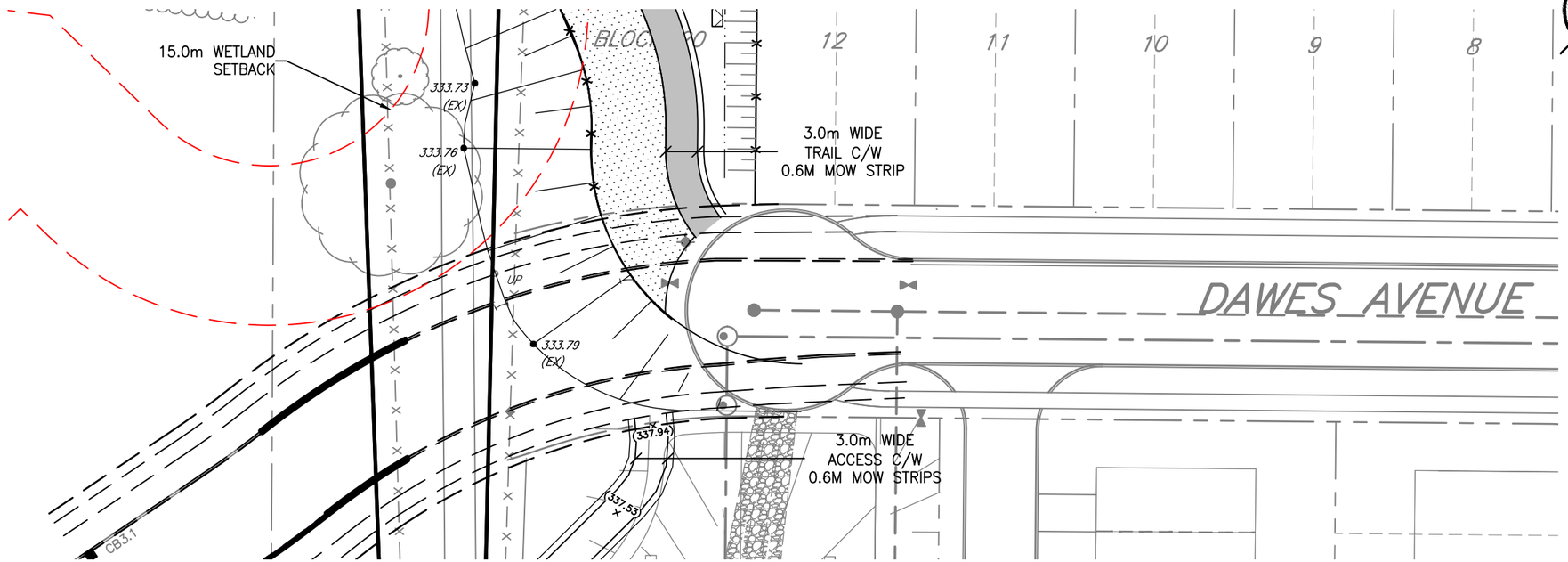
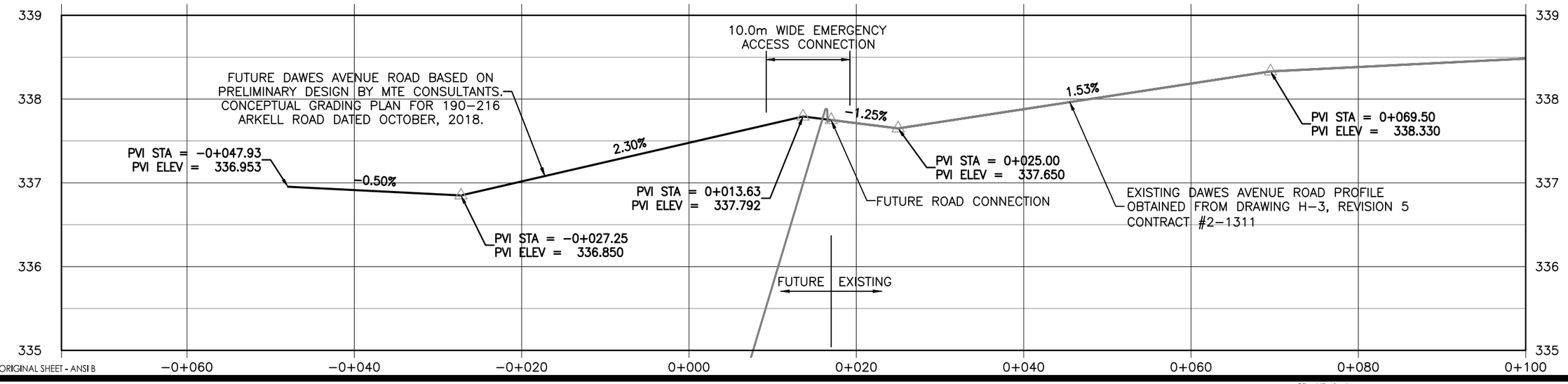
Figure No.
2.0

Title
EMERGENCY ACCESS PROFILE
INTERIM & ULTIMATE





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Scale

1:500H 0 5 15 25m
1:50V 0 0.5 1.5 2.5m

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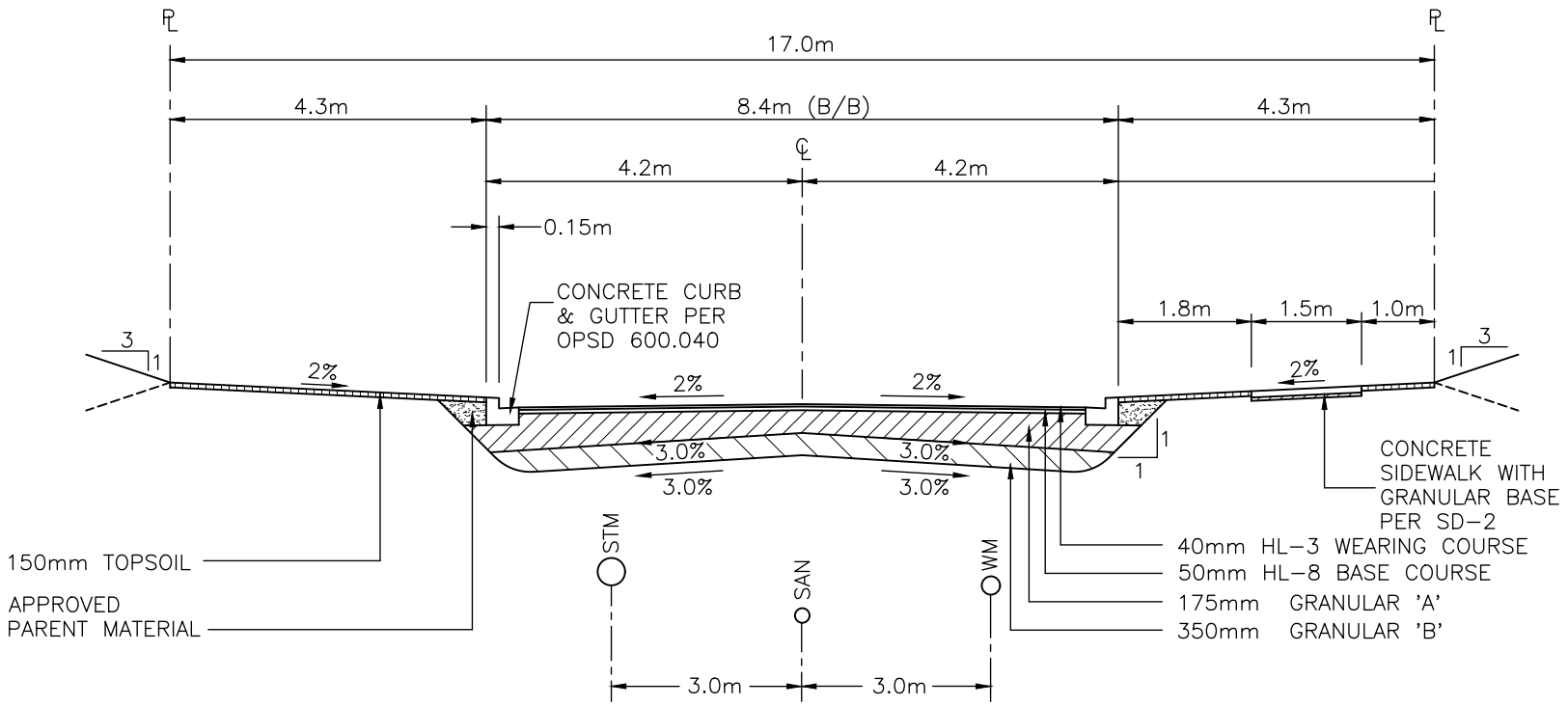
Figure No.
3.0

Title
DAWES AVENUE
CROSS-SECTION & PROFILE



CROSS SECTIONAL POINTS		
DESCRIPTION	VERTICAL OFFSET FR. C/L	HORIZONTAL OFFSET FR. C/L
EDGE / PAVEMENT	-0.074	3.70
GUTTER LINE	-0.099	4.00
TOP / CURB	+0.051	4.20
FRONT / WALK	+0.087	6.00
BACK / WALK	+0.117	7.50
PROPERTY LINE	+0.137	8.50

TYPICAL ROAD CROSS-SECTION
17.0m R.O.W. (8.4m ROAD)
STREET 'A'
STA. 0+000 TO END

NTS

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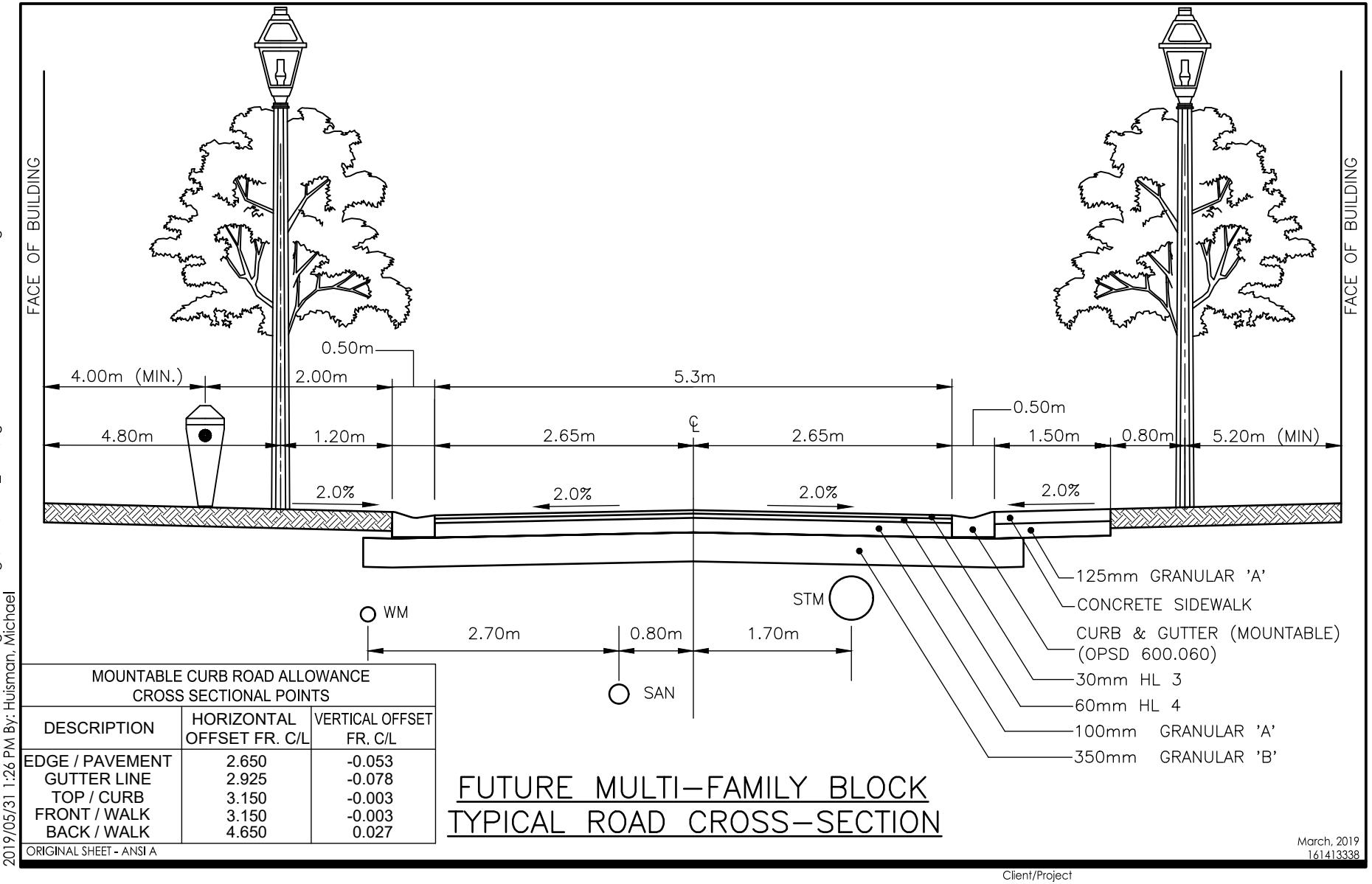
Figure No.
4.0

Title
17.0m RIGHT OF WAY
TYPICAL ROAD CROSS-SECTION



MOUNTABLE CURB ROAD ALLOWANCE CROSS SECTIONAL POINTS		
DESCRIPTION	HORIZONTAL OFFSET FR. C/L	VERTICAL OFFSET FR. C/L
EDGE / PAVEMENT	2.650	-0.053
GUTTER LINE	2.925	-0.078
TOP / CURB	3.150	-0.003
FRONT / WALK	3.150	-0.003
BACK / WALK	4.650	0.027

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FUTURE MULTI-FAMILY BLOCK
TYPICAL ROAD CROSS-SECTION

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Figure No.
5.0

Title
MULTI-FAMILY BLOCK
TYPICAL ROAD CROSS-SECTION

3.0 SANITARY SERVICING

3.1 ULTIMATE SERVICING

As part of the VPV Subdivision, a 300 mm dia. sanitary sewer was extended from the trunk line on Victoria Road into the aforementioned Development. This sanitary sewer provides an outlet for the VPV Subdivision as well as makes provision to service the upstream lands south of the VPV Development as shown in the approved Sanitary Drainage Area Plans included in Appendix C.

The VPV sanitary servicing strategy accounted for one 200 mm dia. outlet located on Poole Street to accommodate 7.0 ha of external lands. This outlet is located east of the subject property and access to this outlet is not available.

In 2020, the above noted VPV Subdivision was constructed and a 200 mm dia. sanitary sewer stub was provided at the limits of Hutchison Road south of Jell Street to make provision for the subject Draft Plan Lands.

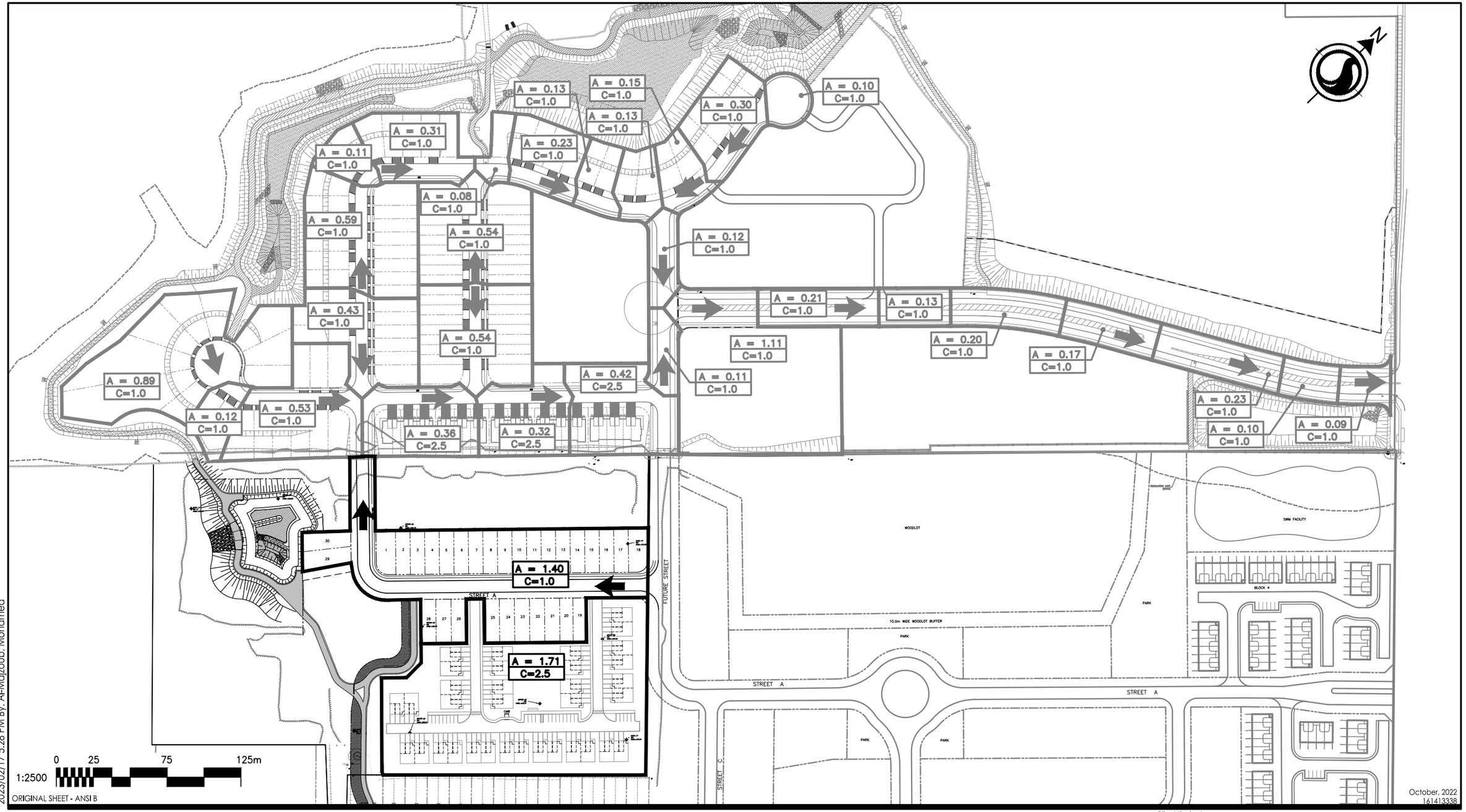
Local sanitary sewers of 200 mm dia. will be constructed throughout the proposed subject lands and within the proposed roadway for Street A and a service stub will be provided for the future Multi-family Block.

Based on the City of Guelph Design Manual, when calculating the sanitary flow, the proposed or future zoning/density for the Development is to be utilized. Single-family homes are designed based on a factor of 1.0 L/s/ha and Multi-family Block based on 2.52 L/s/ha equating to a total flow of 5.64 L/s/ha from the subject Development. Please refer to our Sanitary Drainage Area Plan, Figure 6.0.

With our proposed sanitary servicing strategy of making a connection to the Hutchison Road sewer stub we confirm there is sufficient capacity in the downstream sewers within the VPV Subdivision to accommodate the subject lands. Please refer to our (post-development) Sanitary Design Sheet in Appendix C.

In conclusion, routing the flow from the subject Development up to the Hutchison Road intersection does not adversely affect the sanitary sewers downstream.

Onsite sewers will have adequate capacity and will be installed at sufficient depths to enable servicing the subject lands by gravity. Please refer to the Conceptual Servicing Plan Drawing No. C-100 (Appendix A) for an illustration of the sanitary servicing strategy.



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- A = 1.68 C=2.5 — PROPOSED DRAINAGE AREA (HECTARES) SANITARY CO–EFFICIENT (CUBIC METRES PER SECOND PER HECTARE)
- PROPOSED FLOW DIRECTION
- PROPOSED DRAINAGE BOUNDARY
- A = 1.68 C=2.5 — EXISTING DRAINAGE AREA (HECTARES) SANITARY CO–EFFICIENT (CUBIC METRES PER SECOND PER HECTARE)
- EXISTING FLOW DIRECTION
- EXISTING DRAINAGE BOUNDARY

Notes

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Figure No.
6.0

Title
SANITARY DRAINAGE AREA PLAN

4.0 WATER DISTRIBUTION SYSTEM ANALYSIS

The proposed water servicing layout is show on the Conceptual Servicing Plan, Drawing No. C-100 (Appendix A).

Water supply for domestic water service use and fire protection to the proposed Development will be provided by a single connection in the interim to the existing 150 mm diameter watermain stub on Hutchison Road.

The Internal watermains will be terminated at the east limits of Street A with the intention of 'looping' the watermain back to the adjacent Development to the east providing the ultimate connection back to existing Poole Street to the north.

The proposed residential units will be provided with 25 mm dia. water service connections from the 150 mm dia. watermain and a 150 mm dia. water stub will be provided at the property limits of the Multi-family Block.

Watermain flow and pressure analysis to confirm appropriate supply and capacity for the subject Development will be completed by the City of Guelph at a later time

5.0 STORMWATER MANAGEMENT

5.1 OVERVIEW

This section has been completed in support of the proposed development located at 220 Arkell Road within the Torrance Creek watershed in the City of Guelph. As mentioned in previous sections of this Report, the subject property is approximately 7.2 ha in size and is generally bounded by Victoria Park Village Subdivision to the North, existing woodlot and greenfield property to the East, developed and established Arkell Meadows Subdivision to the South and a large wetland and woodland to the West. The Proposed Draft Plan consists of 30 single-family lots on a single road, a multiple-family residential block, a SWM Block, a wildlife corridor, and a wetland setback. The total developable area is 4.4 ha. The described areas are illustrated on Figure 1.0 – Site Location Plan and the Proposed Draft Plan included in Appendix A.

This section outlines the analysis undertaken to assess the existing hydrology for the site and design a SWM system to meet the City of Guelph criteria using traditional SWM and Low Impact Development (LID) features to achieve the water quantity and water quality targets.

5.2 BACKGROUND

The following sources have been referenced for the preparation of the SWM plan in addition to the documents referenced in Chapter 1.0, Section 1.2, and should be read in conjunction with this Report:

- *Letter Re: 220 Arkell Road – Response to Stormwater Management City Comments Dated July 19, 2018,* Stantec Consulting Ltd., November 5, 2018
- *City of Guelph Development Engineering Manual*, City of Guelph, January 2019
- *Low Impact Development Stormwater Management Planning and Design Guide*, Credit Valley Conservation Authority and Toronto and Region Conservation Authority, 2010
- *Stormwater Management Planning and Design Manual (SWMPD Manual),* Ontario Ministry of the Environment, March 2003
- *Torrance Creek Subwatershed Study (TCSS), Management Strategy Addendum*, Totten Sims Hubucki et al, January 1999
- *Eramosa River Watershed Hydrology Study*, H.O. Schroeter and D.K. Boyd, 1998

5.3 DESIGN CRITERIA

SWM criteria were established based on the *Torrance Creek Subwatershed Study* (TCSS) and the characteristics of the receiving systems. The SWM criteria applied to the site are as follows:

- Water Quality – Provide quality control to meet MECP Enhanced (Level 1) criteria as identified in Table 3.2 of the SWMPD Manual.
- Water Quantity – Control post-development peak flows to pre-development levels for all design events (2- to 100-year events).
- Extended Detention – Provide at least 24 hours of extended detention of the 25 mm event.
- Infiltration – Evaluate the infiltration potential on site as it relates to the existing water budget and maintain existing infiltration rates on the site where possible. The preliminary infiltration target for this area per section 6.2.2 of the TCSS is 150 mm/yr.
- Temperature – The thermal impacts of stormwater discharge to Torrance Creek be assessed and appropriate mitigation practices implemented.
- Erosion and Sediment Control – Provide appropriate erosion and sediment control during construction to protect neighbouring properties and downstream receivers from potential siltation.

5.4 EXISTING CONDITIONS

5.4.1 Geotechnical Information

As identified in the Geotechnical Investigation, the soils for the site are comprised of sand or fill overlaying glacial till, which is generally comprised of silty sand and gravel till.

Groundwater was measured in four (4) onsite boreholes with measurements during spring conditions in April 2017 ranging from 333.19 mASL in the north-west corner of the site to 337.10 mASL in the south-east corner of the site. Groundwater levels were also monitored from April 2017 to May 2018 as part of the *Hydrogeological Assessment* (Stantec, 2019) with the above reported levels representing the seasonally high levels for the site. Groundwater generally flows from east to west towards the Torrance Creek Swamp PSW. Additional groundwater levels were collected at potential infiltration facility locations through six new boreholes being drilled in March 2022 to depths ranging from 6.1 to 9.4 m below ground surface (BGS) and each borehole being equipped with a single monitoring well (i.e., MW101-22 to MW106-22). Data recorded by the Leveloggers installed in MW101-22 to MW106-22 for the period covering from March to November 2022 is presented in the *Revised Water Balance Calculations in Response to First Submission Comments, Draft Plan Application – 220 Arkell Road, City of Guelph* (Stantec, 2023).

Estimates for infiltration rates were calculated based on percolation times determined in the *Geotechnical Investigation* (Stantec, 2019) which were based on soils from borehole logs. Percolation times were estimated

for Glacial Till and Sand onsite and ranged from 8 min/cm to 50 min/cm. Using the approach outlined in the *LID SWM Planning and Design Manual* (CVC/TRCA, 2010), the factored infiltration rates were determined to range from 4.8 mm/hr to 30 mm/hr based on the above percolation times. These factored infiltration rates use the required safety factor of 2.5 for areas where the soil horizon is found to be continuous within 1.5 m below the proposed bottom elevation of the infiltration trench. It is recommended that in-situ infiltration tests be performed during detailed design at the locations and depths of any proposed infiltration measures to confirm that the soils are sufficiently permeable.

For the preliminary design of infiltration facilities in this analysis, areas of the site noted to be on Glacial Till were designed with an infiltration rate of 4.8 mm/hr, while the sandier areas of the site used a factored infiltration rate of 12 mm/hr. For the minimum and maximum infiltration rates used in the hydrologic modelling, the unfactored minimum and maximum rates were used.

5.5 STORWMATER MANAGEMENT DESIGN

5.5.1 Hydrologic Modeling

Per City of Guelph requirements, a hydrologic model was prepared using the software program MIDUSS to simulate drainage conditions for the subject development under existing and proposed conditions. The model was employed to predict flows and design a SWM system to ensure the design criteria are achieved.

Precipitation events were taken from the TCSS and are based on a regional analysis due to a lack of long-term streamflow information for Torrance Creek. A large known rainfall pattern (Hurricane Hazel) was selected and its volume and intensity adjusted to known return-period streamflows in Torrance Creek, similar to the Eramosa River Watershed Hydrology Study (Schroeter and Body, 1998). Table 1 presents the rainfall adjustment factors taken from Table 4.6.3 of the TCSS.

Table 1: Rainfall Factors Applied to the Regional Storm Pattern to Match Frequency Flows in the Eramosa River Watershed

Return Period	Adjustment Factor (Table 4.6.3 in TCSS)	Last 24-hour Volume (mm)
2-year	0.345	81.8
5-year	0.425	100.7
10-year	0.495	117.3
25-year	0.525	124.4
100-year	0.627	148.6

Additionally, the 25 mm, 4-hour Chicago rainfall event was run to aid in the design of infiltration and erosion control measures for the site.

5.5.1.1 Existing Conditions

The existing drainage conditions for the site were originally delineated in the TCSS and have been updated based on new topographic information of the site. The original subcatchments are illustrated on

Figure 4.6.1 from the TCSS (provided in Appendix D). The site covers three (3) of the TCSS subcatchments. A detailed topographic survey of the site was completed to improve the accuracy of the existing drainage patterns. An additional external area was defined for flows from the adjacent subdivision flowing across the site to Torrance Creek.

As per City of Guelph Standards, preliminary estimates for Horton infiltration parameters were used for each catchment based on land use and soil type. Minimum and maximum infiltration rates were based on unfactored rates as determined in the Geotechnical Investigation and described in Section 5.4.1. These catchment parameters along with existing conditions MIDUSS modelling files are provided in Appendix D. Delineation of the existing drainage catchments is provided on Figure 7.0, Existing Catchments, and are summarized as follows:

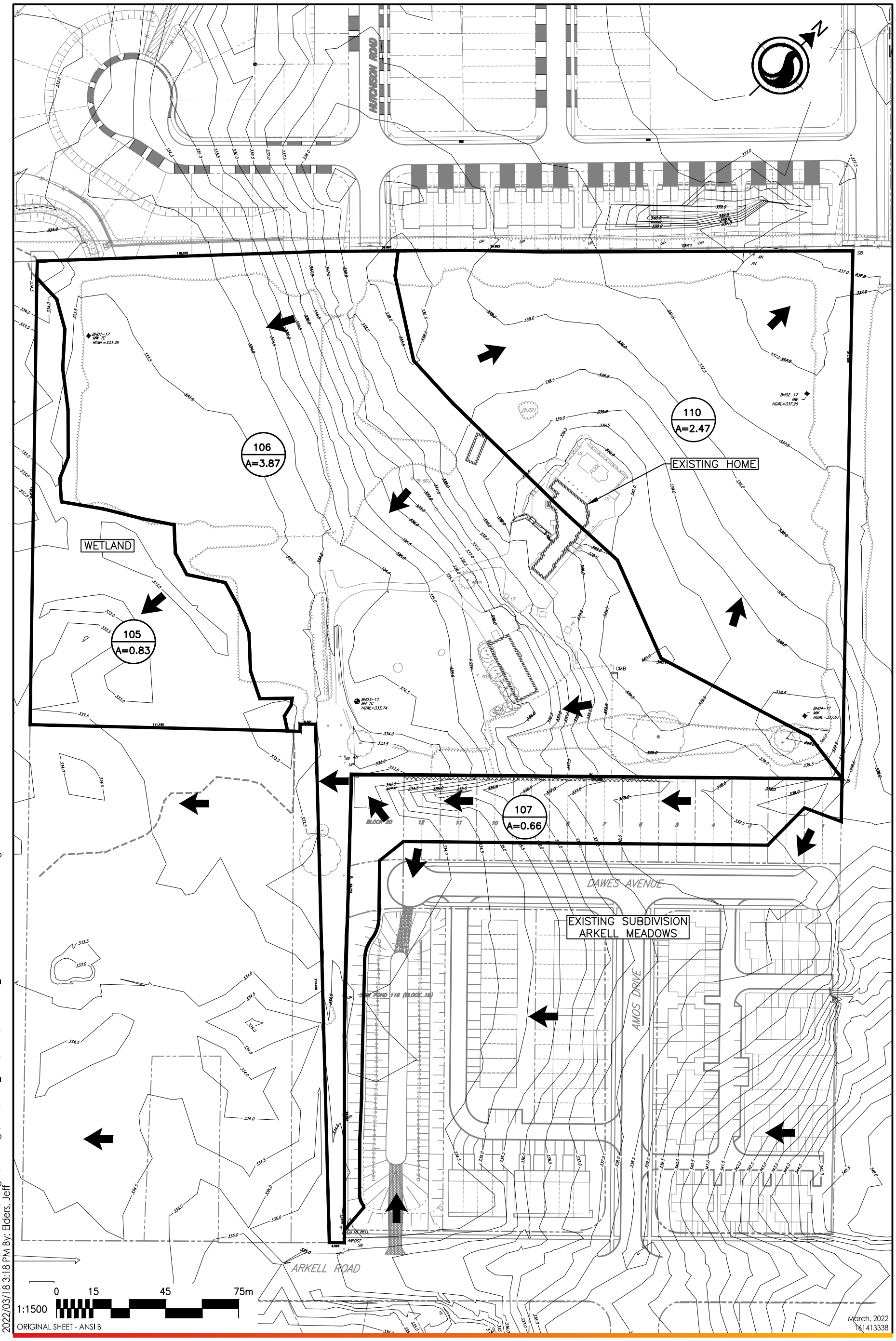
- Catchment 105: 0.83 ha of wooded/wetland area at the west end of the site draining to Torrance Creek
- Catchment 106: 3.87 ha of agricultural land, some forested and lawn coverage, and a residential property including a driveway and several buildings draining west to Torrance Creek
- Catchment 107: 0.66 ha of rooftops, rear yards, and Stormwater Management Facility (SWMF) embankment from the adjacent Arkell Meadows Subdivision draining across the existing driveway west to Torrance Creek
- Catchment 110: 2.47 ha of mostly agricultural and lawn area with a portion of the residential building draining east to the existing woodlot, eventually to Torrance Creek

5.5.1.2 Proposed Conditions

The proposed development incorporates primarily residential land use with an onsite SWMF, located adjacent to the Torrance Creek Swamp PSW. As per City of Guelph Standards, preliminary estimates for Horton infiltration parameters (as stated previously) were used for each catchment based on land use and soil type and are provided in Appendix D.

MIDUSS modelling files for proposed conditions are provided in Appendix D, while delineation of the proposed drainage catchments is provided on Figure 8.0 and is summarized as follows:

- Catchment 200: 2.44 ha of internal drainage from single family homes, Multi-Family Block, and roadway draining to the onsite SWMF
- Catchment 201A: 1.03 ha of naturalized area (ecological linkage) and rear lots draining uncontrolled, offsite to the neighbouring site
- Catchment 201B: 0.09 ha of naturalized area behind the buildings in the Multi-Block on eastern side of site that will remain untouched and drain uncontrolled, offsite to the neighbouring site
- Catchment 202: 0.29 ha of park area draining uncontrolled to Torrance Creek



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2022/03/18 3:18 PM By: Elders, Jeff

Legend

100 / A=1.57 — CATCHMENT ID (FROM TCSS FIG 4.6.1) / CONTRIBUTING AREA (ha)

MAJOR OVERLAND FLOOW ROUTE

DRAINAGE BOUNDARY

REGULATION LIMIT

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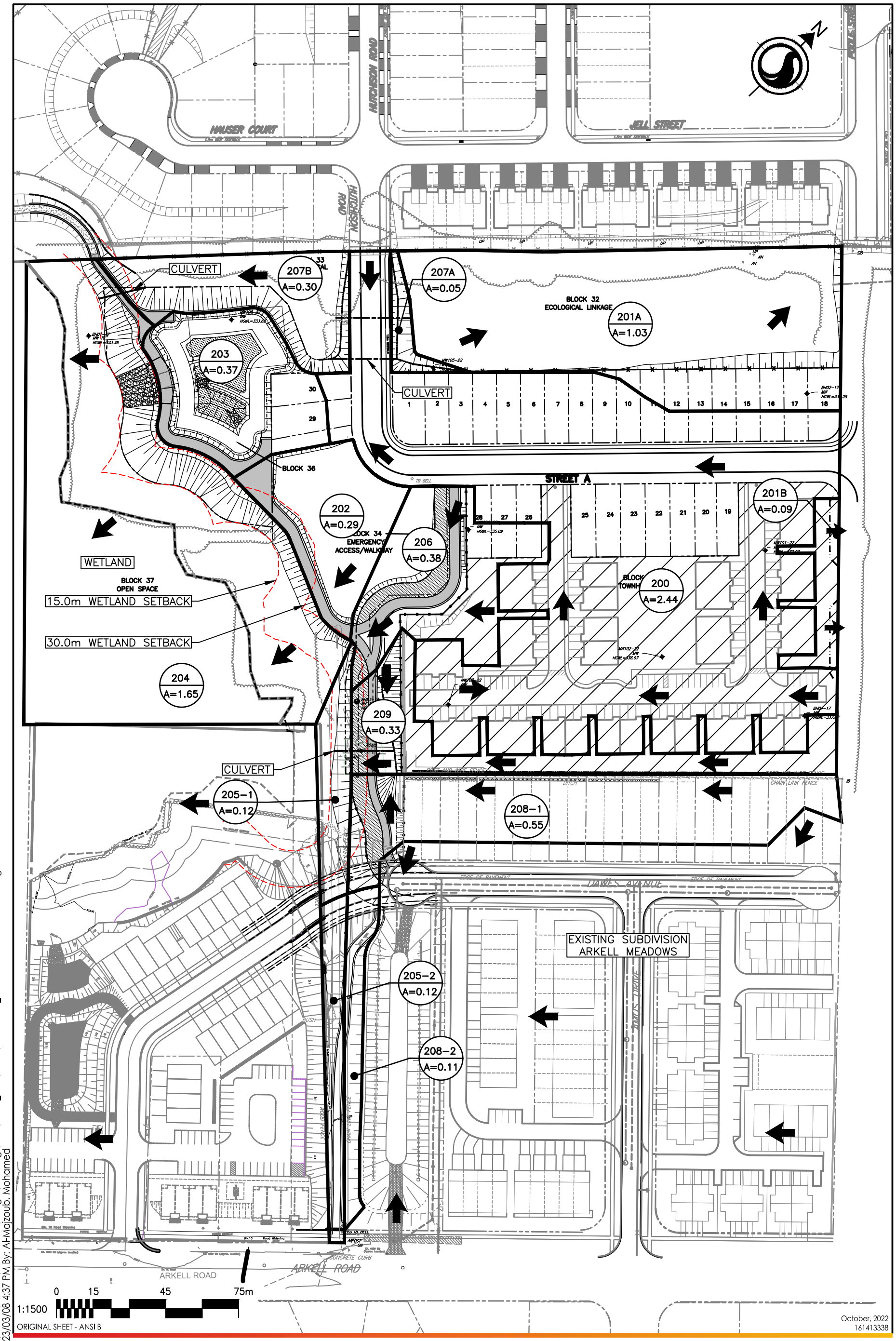
Figure No.
7.0

Title
EXISTING CATCHMENTS

March, 2022
161413338



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2023/03/08 4:37 PM By: Al-Majzoub, Mohamed

Legend

- 100 / A=1.57 — CATCHMENT ID / CONTRIBUTING AREA (ha)
- MAJOR OVERLAND FLOOD ROUTE
- PROPOSED DRAINAGE BOUNDARY
- EXISTING DRAINAGE BOUNDARY FROM TCSS
- REGULATION LIMIT
- MULTI BLOCK

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Figure No.
8.0

Title
PROPOSED CATCHMENTS

- Catchment 203: 0.37 ha representing the onsite SWMF Block
- Catchment 204: 1.65 ha forested/wetland coverage including the required buffer distance remaining undeveloped and draining to Torrance Creek
- Catchment 205-1: 0.12 ha of the mostly naturalized/landscaped area (former driveway) draining uncontrolled west to Torrance Creek
- Catchment 205-2: 0.12 ha of the mostly naturalized/landscaped area (former driveway) draining uncontrolled west to Torrance Creek
- Catchment 206: 0.38ha of asphalt pathway, park, and rear yards draining uncontrolled to Torrance Creek
- Catchment 207A: 0.05 ha of naturalized area (ecological linkage) draining uncontrolled, west through the proposed crossing culvert and subsequently to Torrance Creek (around proposed SWMF)
- Catchment 207B: 0.30 ha of naturalized area (ecological linkage) draining uncontrolled, west to Torrance Creek (around proposed SWMF)
- Catchment 208-1: 0.55 ha of rooftops and rear yards from the adjacent Arkell Meadows Subdivision draining across the existing driveway west to Torrance Creek
- Catchment 208-2: 0.11 ha of the SWMF embankment and trail from the adjacent Arkell Meadows Subdivision draining across the existing driveway west to Torrance Creek
- Catchment 209: 0.33 ha of rear lots from townhome units and trail connection draining to a low-lying area before spilling to Torrance Creek via a proposed culvert. Ponding occurs in the low-lying area, similar to existing conditions, promoting infiltration and delaying flows to the wetland to mimic the current flow regime.

5.6 STORMWATER MANAGEMENT STRATEGY

The proposed stormwater management strategy adheres to the Guidelines as presented in the *SWMPD Manual* (2003) and *City of Guelph Development Engineering Manual* (January 2019).

The strategy incorporates a combination of lot-level and centralized infiltration trenches to promote groundwater recharge of rooftop runoff and an end-of-pipe (EOP) dry SWMF, complete with infiltration gallery, to provide water quality and quantity control along with further infiltration augmentation. A treatment train approach using an Oil/Grit Separator (OGS) unit in series with the dry SWMF (including sediment forebay) has been designed to achieve the required quality control target. The preliminary calculations and design of the SWM components are described in the following sections. All design calculations are provided in Appendix D.

5.6.1 Water Quality Control

The water quality requirement for the site is to achieve the long-term removal of 80% Total Suspended Solids (TSS) (Level 1) from developed areas. This will be achieved using a treatment train approach per City of Guelph criteria. To treat runoff from the developed portion of the site, the grading and servicing has been designed to convey 'clean' runoff (i.e., rooftop areas) to infiltration facilities where a groundwater separation of 1 m (minimum) is achieved. 'Clean' runoff does not require additional treatment to remove TSS prior to entering the subsurface infiltration facilities and is therefore directly connected via dedicated roof leaders to he infiltration facilities. The remaining impervious portions of the site consisting of parking, roadways, and drive isles require treatment prior to infiltration.

Runoff from all roads, driveways and other impervious surfaces enters the onsite storm sewer system which connects to an OGS unit prior to discharging to the EOP facility. The OGS unit provides initial removal of TSS and oil from the runoff while the EOP dry SWMF, complete with forebay, provides additional sediment removal. The forebay has been sized to meet all settling, dispersion, velocity, and cleanout frequency requirements per MECP guidelines (with calculations included in Appendix D) as well as provide an isolated location of sediment deposition to facilitate the cleanout and maintenance of the SWMF. The remaining areas flowing uncontrolled from the site are pervious or undeveloped and do not require water quality treatment.

The proposed OGS unit (First Defense (FD-8HC) or approved equivalent – must meet the Canadian Environmental Technology Verification Program per City of Guelph requirements) has been sized to provide 70% TSS removal for the contributing area (refer to OGS Sizing Calculations in Appendix D); however, it is understood that the City of Guelph assumes OGS units only provide a long-term TSS removal of 50% due to long-term maintenance concerns. Therefore, following treatment by the OGS, runoff flows to a forebay at the inlet of the EOP dry SWMF to provide further treatment (as well as to isolate sediment to facilitate future cleanouts as stated earlier). Per Table 3.2 in the *Stormwater Management Planning and Design Manual* (MOE, 2003), the dry SWMF can provide up to 60% TSS removal if sized appropriately. As shown in the calculations in Appendix D, the dry SWMF has been sized to provide >24-hour drawdown of the water quality volume as well as the 25mm runoff volume. Other measures including berms to increase flow path and a sediment forebay have been incorporated, therefore resulting in the dry SWMF meeting the requirements to achieve 60% TSS removal. In addition, the dry SWMF will promote infiltration through the subsurface system (discussed further in subsequent sections). As such, minimal runoff is anticipated during smaller, more frequent rainfall events thereby reducing sediment loading to the downstream receiver.

Overall, with the OGS achieving a 50% TSS removal efficiency and the dry SWMF achieving another 60% TSS removal minimum (without accounting for the EOP infiltration), the combined TSS removal rate between these two systems achieves the required 80% TSS removal efficiency.

A liner has been proposed within the forebay to prevent contaminants from entering the groundwater. The remaining dry portion of the SWMF can remain unlined to promote passive infiltration after initial treatment in the OGS and forebay. Requirements for and details of the SWMF liner will be revisited at the detailed design stage. A Geotechnical Engineer will need to be consulted to determine liner composition, if required.

5.6.2 Water Quantity Control

To meet the target peak flow rates established in the existing conditions modelling, quantity control for the site will be provided through a combination of lot-level and EOP controls. Lot-level and centralized infiltration trenches provide rooftop retention and infiltration for all storms up to and including the 4-hour, 25 mm rainfall event while an EOP dry SWMF provides detention prior to discharging to the adjacent wetland. Additionally, the EOP dry SWMF will include a subsurface infiltration system that will infiltrate the remaining 25 mm runoff volume from upstream areas (after rooftop infiltration). This system will contain a winter by-pass valve to reduce the potential impact of chlorides on the groundwater during the winter months. Modelling for quantity control events did not include the upstream or EOP infiltration to provide a conservative estimate of volumes and flow rates in the event that infiltration measures are not functioning, turned off, or already full prior to a rainfall event. Further discussion on the infiltration measures is described in Section 5.7.

The proposed EOP SWMF is located at the northwest corner of the site, adjacent to the Torrance Creek Swamp PSW and provides attenuation for runoff from the majority of the developed site including roadways, driveways, rooftops and landscaped coverage. The design uses a dry SWMF configuration complete with a forebay and upstream OGS unit to provide an enhanced level of water quality control (as discussed above) with a maximum ponding elevation of approximately 336.65 m during the 100-year return-period rainfall event.

The quantity control requirement for the proposed site as a whole is to meet pre-development peak flow rates as outlined in the TCSS; however, to aid in the design of the SWMF, unit flow rates for the overall TCSS catchments were generated to provide target release rates from the proposed SWMF. These target release rates were determined from the output of the GAWSER hydrologic model created for the TCSS, with original GAWSER flow rates corresponding to the existing catchments on-site summarized in the table below.

Table 2: Existing Conditions Flow Rates from TCSS GAWSER Model

TCSS Catchment within Subject Lands ID	Catchment Area from TCSS (ha)	Flow Rates (m^3/s)			
		2-year event	5-year event	25-year event	100-year event
105	68.3	0.015	0.018	0.021	0.023
106	18.7	0.078	0.120	0.182	0.236
110	33.3	0.123	0.192	0.294	0.387

In order to apply these flow rates to the much smaller catchment draining to the SWMF on the proposed site, equation 8.31 from the MTO Drainage Management Manual (1997) was applied in order to transpose the flow rates.

$$Q_2 = Q_1 \left(\frac{A_2}{A_1}\right)^{0.75}$$

$Where$:
$Q_1 = known\ peak\ discharge\ (from\ TCSS)$
$Q_2 = unknown\ peak\ discharge\ (target\ from\ SWMF)$
$A_1 = known\ basin\ area\ (from\ TCSS)$
$A_2 = known\ basin\ area\ (to\ SWMF)$

Using the flow rates from GAWSER and the above equation, the following targets were utilized to assist in design of the SWMF. Although the drainage area to the SWMF is 2.81 ha, 1.55 ha was used in establishing the targets as this is the proposed drainage area that exists within the existing catchment 106. The other portion of the proposed area to the SWMF is within Catchment 110 and has not been accounted for in the targets. Table 3 below outlines the target release rates from the SWMF, with proposed flow rates documented in subsequent sections and summarized in Table 5.

Table 3: Target Release Rates for SWMF Design

Developed Area with Existing TCSS Catchment 106 to proposed SWMF	Transposed Flow Rates for Existing Catchment 106 within Developed Area draining to Pond			
	2-year	5-year	25-year	100-year
1.55	0.013	0.019	0.028	0.036

The preliminary outlet structure for the dry SWMF consists of a low flow orifice to meet the peak flow targets established above and an overflow emergency weir in the event the orifice gets clogged or for rainfall events larger than the 100-year event. Details of the outlet structure are provided in Table 4 and shown on the SWMF Drawing C-410, with further details and calculations provided in Appendix D.

Table 4: SWMF Design Characteristics

Parameter	Basin Characteristics
Total Contributing Area (Including Major Flow Drainage)	2.81 ha
Total Contributing Area req. Quality Control	2.81 ha
Total Percent Impervious	58%
Bottom Elevation of forebay	334.00 m
Bottom Elevation Dry Facility	335.00 m
Facility Top Elevation	337.00 m
High Water Level (100-Year Storm Event)	336.65 m
Freeboard Provided Above High Water Level	0.35 m
Orifice Control Outlet	
Orifice 1 Diameter	75 mm
Orifice 1 Invert Elevation	335.00 m
Emergency Weir	
Spillway Width (m)	5 m
Spillway Invert (m)	336.70 m
Side slopes	10:1

Peak flow rates from the proposed SWMF and overall developed site area are summarized in Table 5 with detailed modeling files included in Appendix D. The facility is proposed to discharge to the adjacent Torrance Creek Swamp PSW. To mimic existing conditions flow and reduce potential concentration of flows to the downstream wetland, a surface spreader swale is proposed at the outlet of the pond, as shown on Drawing C-410.

Table 5: SWMF Operating Characteristics

	Rainfall Event				
	25 mm	**2-year**	**5-year**	**25-year**	**100-year**
Existing Peak Flow Rate to Torrance Creek (m^3/s)	**0.069**	**0.017**	**0.058**	**0.121**	**0.202**
Proposed Peak Flow to SWMF (m^3/s)	0.255	0.082	0.114	0.163	0.211
SWMF Target Release Rate (m^3/s)	N/A	0.012	0.019	0.028	0.036
Proposed Peak Flow from SWMF (m^3/s)	0.006	0.011	0.013	0.014	0.015
Proposed Peak Flow from Total Site to Torrance Creek (m^3/s)	**0.039**	**0.019**	**0.036**	**0.082**	**0.144**
Maximum Active Storage Volume (m^3)	321	1,021	1,370	1,810	2,280
Maximum Active Ponding Depth (m)	0.35	0.93	1.16	1.41	1.65
Maximum Active Ponding Elevation (m)	335.35	335.93	336.16	336.41	336.65
Drawdown Time (hours)	29.2	51.0	59.2	68.5	77.6

As shown in Table 5, the peak flow rates from the proposed SWMF are lower than the target release rates established from the TCSS and peak flow rates from the overall site are equal to or less than pre-

development levels for all storm events, with the exception of the 2-year event. Due to the low target flow rates, even with a 75 mm orifice plate there is a negligible increase of 0.002 m³/s during the 2-year event. As lot-level and EOP infiltration has not been included in the MIDUSS modelling, this estimate is conservative and is anticipated to be lower than modelled; therefore, the proposed SWMF design onsite meets the water quantity requirements for Torrance Creek.

Although most of the developed site will be directed west towards the proposed SWMF, the majority of the ecological linkage and a small area of rear yards will be directed eastward, towards the existing woodlot (existing Catchment 110 and proposed Catchment 201). Since this area will be smaller than existing and remain undeveloped/landscaped, peak flow rates to the woodlot under proposed conditions are less than existing, as presented in Table 6 below.

Table 6: Peak Flow Rates East to the Existing Woodlot

	Rainfall Event				
	25 mm	**2-year**	**5-year**	**25-year**	**100-year**
Existing Peak Flow Rate to the Existing Woodlot (m^3/s)	0.022	0.005	0.028	0.062	0.103
Proposed Peak Flow to the Existing Woodlot (m^3/s)	0.010	0.002	0.013	0.028	0.047

5.6.3 Thermal Mitigation

To reduce the thermal impact of the development on Torrance Creek, infiltration measures are provided to infiltrate the smaller, more frequent storm events that have the largest impact on temperature. The infiltration measures discussed through this report will reduce runoff from the site during all events less than 25 mm in the summer months, meaning there will be negligible thermal impact on the downstream Torrance Creek system. The infiltrated water may also return to the downstream Torrance Creek system through interflow or baseflow, which will have provided a cooling effect by flowing through the cooler ground and potentially interacting with the cooler groundwater.

5.7 INFILTRATION ASSESSMENT & WATER BALANCE

5.7.1 Water Balance Analysis

The preliminary infiltration target for this area per Section 6.2.2 of the TCSS is 150 mm/yr; however, a more detailed site water balance was performed to determine a more accurate site-specific value as well as determine the site runoff to the nearby wetland. Water balance calculations were completed as part of the *Hydrogeological Assessment* (Stantec 2019) and updated per the latest *Revised Water Balance Calculations in Response to First Submission Comments, Draft Plan Application – 220 Arkell Road, City of Guelph* (Stantec, 2023) for pre- and post-development conditions to quantify infiltration volumes at the Site and confirm the recharge function.

Under pre-development conditions, the average annual volume of infiltration is estimated at 15,433 m^3/year and while the average annual volume of runoff is split between water flowing to south-west towards Torrance Creek Swamp and north-east towards the woodlot. Pre-development condition runoff towards Torrance Creek is estimated at 8,660 m^3/year, while runoff towards the woodlot is estimated at 4,035 m^3/year. Under post-development conditions without additional infiltration measures, the increase in impervious surfaces results in a projected infiltration volume deficit of 4,067 m^3/year with a runoff surplus to the Torrance Creek Swamp of 17,496 m^3/year. Runoff to the woodlot decreases by 2,481 m^3/year due to site grading changes. Details of the calculations and results can be found in the *Revised Water Balance Calculations in Response to First Submission Comments, Draft Plan Application – 220 Arkell Road, City of Guelph* (Stantec, 2023).

To reduce the infiltration deficit and establish a recharge balance, rear yard soakaway pits and centralized infiltration trenches will be implemented throughout the site and within the EOP SWMF.

Based on the results of the *Geotechnical Investigation* (Stantec 2019), site soils generally consist of a mix of glacial till to sand which are both generally conducive to infiltration practices. As discussed in previous sections, the estimated percolation rates for these soils correspond to factored infiltration rates of 5 – 30 mm/hour; however, per City of Guelph guidelines, it is recommended that in-situ infiltration tests, such as the double-ring infiltrometer or the Guelph permeameter tests, be performed at the detailed design stage at the locations and depths of the proposed infiltration trenches to confirm the underlying soil infiltration rates.

5.7.2 Lot Level and Centralized Infiltration

Rear yard soakaway pits infiltrating roof water are proposed for all single-family homes within the subdivision. Similarly, centralized infiltration trenches are proposed for the Multi-Family Block to direct shared roof areas to recharge locations. Rooftop runoff is considered ‘clean’ and does not require water quality treatment prior to infiltrating. As such, roof leaders from all homes are to be connected to the soakaway pits or centralized trenches via direct connection or via surface flow with an overflow provided at grade for single family lots or an overflow connection to the storm sewer for the centralized trenches. Specific connection details will be provided at detailed design. These galleries have been designed to infiltrate the 25 mm runoff volume in under 48 hours and to ensure 1 m separation from the high groundwater level. Soakaway pits have been sized assuming 40% of the lot is building coverage, which leads to an estimated rooftop area of 120 m^2 for the single-family lots. This value was taken from *Section 5 – Residential Zones* of the City of Guelph Zoning Bylaw. For the Multi-Family Block, the centralized galleries have been sized based on rooftop areas from the latest preliminary Site Plan layout.

All Single-Family and Multi-Block galleries were sized assuming an infiltration rate of 4.8 mm/hr as they will mostly be within the tighter Glacial Till areas of the site. The EOP infiltration system was sized assuming an infiltration rate of 12 mm/hr, representing the low end of factored infiltration rates for the sandier soils. Gallery locations, along with separation to high ground water levels, are shown on Drawing C-400, while gallery sizing for the single family lots are found in Appendix D.

5.7.3 End-of-Pipe Infiltration

End-of-pipe infiltration in the dry SWMF is proposed through the use of a subsurface storage system (ADS Stormtech SC-160LP chambers) to allow for incorporation of a winter bypass. The infiltration system is sized to infiltrate the 25 mm runoff volume from the site, after accounting for rooftop infiltration. The total runoff volume during the 25 mm event from the MIDUSS modelling to the SWMF is approximately 380 m³. Upstream rooftop infiltration will account for infiltration of 165 m³ of this runoff volume (0.714ha of rooftop x 25mm runoff x 0.926 (MIDUSS runoff coefficient for impervious surface in catchment 200)), leaving 214 m³ to infiltrate in the EOP system for the remaining runoff during the 25 mm event.

To infiltrate this additional runoff, a Stormtech SC-160LP (or equivalent system) is proposed to maintain the low profile required to provide groundwater separation and cover. The system will be approximately 39 m in length by 24 m in width and be placed below the dry SWMF, as shown on Drawing C-410. The invert of the chamber will be 334.35 m, which based on the latest spring high groundwater level data from MW 106-22 of 333.69 m, achieves a separation of 0.66 m. Although the recommended 1 m separation is not achieved in the period of highest groundwater levels, the gallery will be above the existing ground surface (through importing fill) and will only not achieve the 1 m of separation during the early spring months as the groundwater level steadily declines through the year. Further calculations and design shall be completed during the detailed design stage to raise the facility if possible or explore other products/structure configurations, to ensure the proposed EOP infiltration system functions year-round. There is a stone layer beneath this chamber invert (0.15 m thick); however, the volume in this stone layer has not been accounted for in order to provide sufficient infiltration volume at a higher separation from the groundwater level. The top of stone for the gallery is at 334.80 m, which is the elevation of the overflow pipe to the wetland, allowing the trench to become fully utilized before flowing downstream. Details on the infiltration system are included on Drawing C-410 as well as in Appendix D.

It should be noted that as the bottom of this infiltration system is above the toe of slope of the outside of the SWMF, a geotechnical engineer will need to be consulted at detail design to determine exact placement of the gallery or implementation of other measures to ensure slope stability.

The post-development water balance values following implementation of the proposed retention practices are presented in Table 7.

Table 7 - Results of Site Water Balance

Site Condition	Annual Volumes (m^3/yr)		
	Runoff to Torrance Creek Swamp	**Runoff to Woodlot**	**Infiltration across the Site**
Pre-Development	8,660	4,035	15,433
Post-Development (unmitigated)	26,156	1,554	11,366
Post-Development (with Infiltration)	14,735	1,554	22,786

By implementing the recharge augmentation practices discussed above, there is a recharge surplus across the site of 7,353 m^3/yr with a runoff surplus to Torrance Creek of 6,075 m^3/yr and a runoff deficit of 2,481 m^3/s to the woodlot.

5.7.4 Consideration of Multi-Block

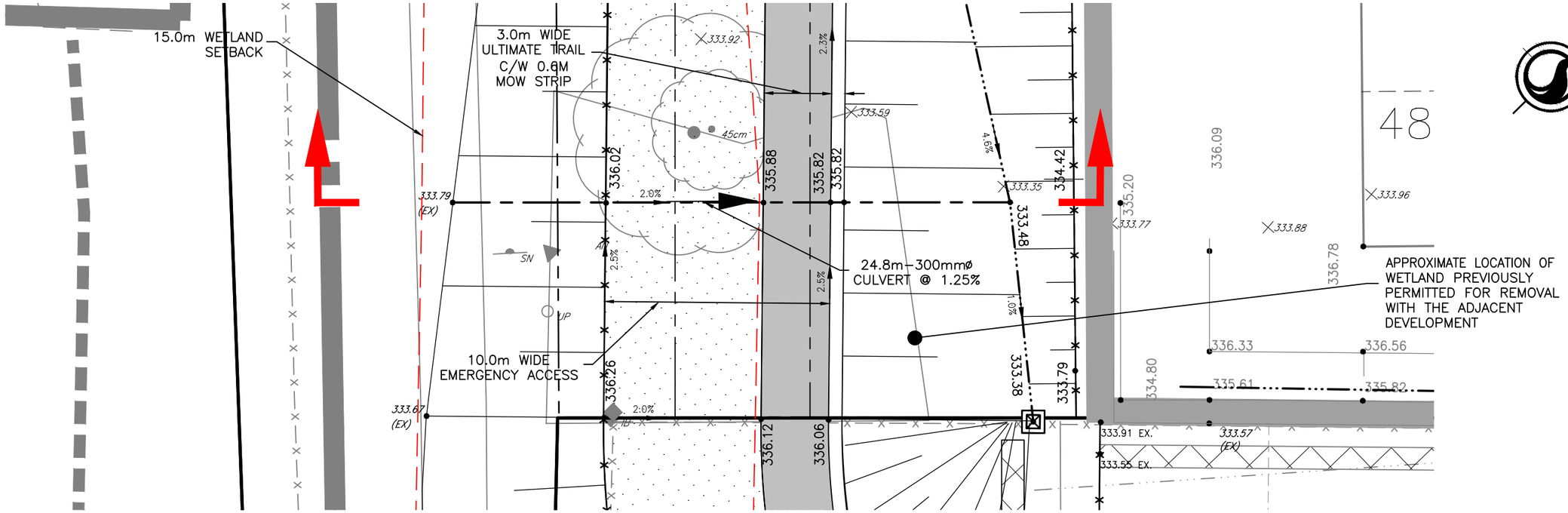
At this stage in the design, the Site Plan for the Multi-Family Block is unknown. It is assumed that all rooftop areas within the Block can and will be directed to centralized infiltration trenches to achieve the intended recharge target. At a minimum, the Multi-Family Block must infiltrate all rainfall events up to and including the 25 mm storm from all rooftops (assumed rooftop coverage is 3,420 m^2) for a total average annual rooftop infiltration volume of 2,526 m^3/yr. This is the target annual recharge volume for the Multi-Block and should be met at the Site Plan Approval Stage.

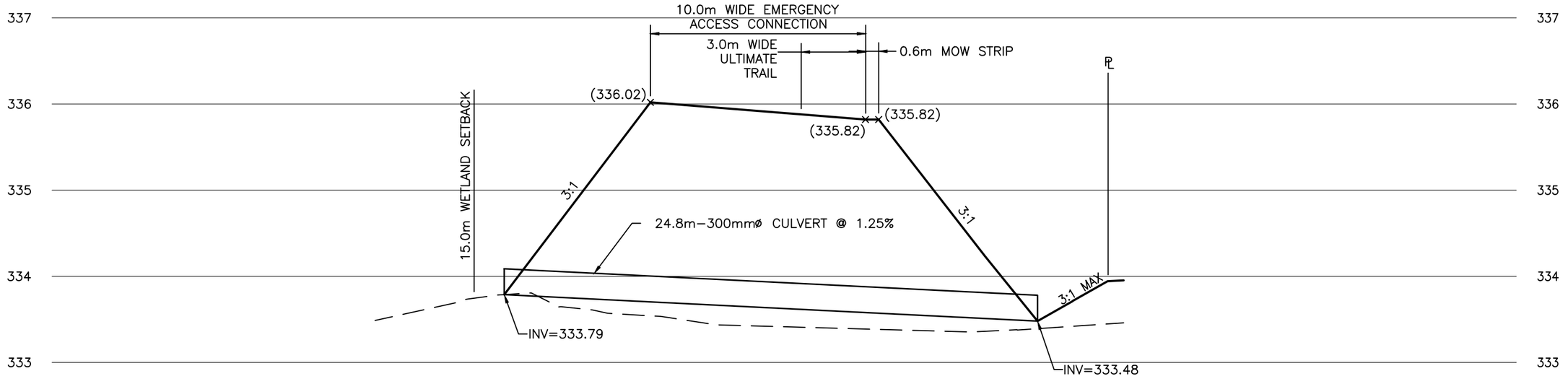
This target does not include the pervious infiltration in the Multi-Block achieved through passive infiltration at an assumed impervious percentage of 75%. If the impervious percentage is higher at the Site Plan design stage, further infiltration measures will be required to offset any increase in impervious coverage. In the current water balance, the pervious infiltration in the Multi-Block accounts for approximately 833 m^3/year of recharge (based on approximately 0.43 ha of pervious coverage in 1.71 ha Multi-Block), for a total site target of 3,359 m^3/yr when combined with rooftop infiltration. Refer to Appendix D for calculations as well as the detailed Water Balance Calculations presented in the *Revised Water Balance Calculations in Response to First Submission Comments, Draft Plan Application – 220 Arkell Road, City of Guelph* (Stantec, 2023).

5.7.5 Surface flow to PSW through Emergency Access Road

The existing Arkell Meadows Subdivision to the south of the proposed site calculated a 41% increase in runoff to the adjacent PSW from pre-development to the current condition (17 mm/yr to 24 mm/yr). With the proposed Emergency Access road from the site running through Block 20 to Dawes Avenue, there was an overall post-development increase in the Arkell Meadows site runoff from 24 mm/yr to 25 mm/yr, or 4%, bringing the overall percentage increase from pre-development to post-development conditions to 47% as identified in City comments in response to *Re: 220 Arkell Road – Response to Stormwater Management City comments dated July 19, 2018* (Stantec, 2018) which is presented in Appendix D. As a result of this concern and as mentioned previously, Stantec proposes the access road culvert configuration to mimic the current hydrologic regime and maintain surface flow to the wetland.

Under current conditions along the existing driveway, there is a low-lying area east of the existing driveway, at the location of the proposed culvert under the Emergency Access Road. At this location, surface water ponds allowing for infiltration and evaporation prior to spilling west to the wetland (contour 333.5 m). Given the location of the proposed Emergency Access Road and ultimate trail alignment illustrated on Figure 9.0, surface water runoff from Catchment 206 flows west through a culvert and under the road/trail to the PSW. As outlined in *Re: 220 Arkell Road – Response to Stormwater Management City comments dated July 19, 2018* (Stantec, 2018), a culvert is proposed to convey surface flows under the Emergency Access Road to maintain this flow west under proposed conditions; however, to attenuate





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Legend

Scale

1:200H 0 2 6 10m
1:50V 0 0.5 1.5 2.5m

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Figure No.
9.0

Title
EMERGENCY ACCESS CULVERT CROSS SECTION

surface flows to address City of Guelph concerns (i.e., reduce surface flow to the wetland and increase evapotranspiration and infiltration), the proposed culvert is reverse sloped to encourage ponding and infiltration, similar to the existing hydrologic regime, and to match existing grades on the site (natural depression within the site). The specific details of this ponding area will be finalized at detailed design.

6.0 STORM SERVICING

Storm drainage for the proposed Development will discharge at a single outlet. The storm sewer system will convey run-off and lot level flows from the single-family units and Multi-Family Block and drain via servicing easement between the Park Block and single-family lotting discharging to a dry pond SWMF along the west limits of the subject Development. The major overland flow for the route follows generally the same path following the servicing easement west into the main cell of the dry pond SWMF.

The proposed storm sewer system will be designed to convey all minor storm events or those less than 5-year return-period, as per the City of Guelph Standards. The conveyance system for major flow events or those greater than a 5-year return-period frequency will be confined to the road Right-of-Ways and generally mimics the direction of the minor system.

The depth of the storm sewer system has been minimized to provide for frost cover due to road profile grading constrains related to matching the existing road connections to the north as well as achieving sewer inverts that work with the proposed SWMF permanent pool elevations and outlet elevation established at the wetland setback. We also note this grading strategy achieves a marginal earth shortfall. That said, it is proposed that the storm sewer infrastructure is minimized such to convey the road drainage only. No storm service laterals are proposed for the development as sump pumps are proposed to discharge to the rear yard grade similar to what was approved for the Victoria Park Village Development to the north.

7.0 EROSION AND SEDIMENT CONTROL PLAN

An Erosion and Sediment Control Strategy will be completed during the final design and implemented during the construction process to minimize the potential for offsite discharge of sediment and the resultant negative environmental impacts. This Plan will focus on the protection of downstream watercourses and lands.

7.1 EROSION POTENTIAL

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, as follows:

- Site Slopes: Moderate (2-10%) – average slope is approximately 3.0%
- Slope Lengths: Long (generally greater than 30 m)
- Erodibility Factor: For Silty Sand, K = high

Therefore, based on this classification, the site has a high erosion potential.

7.2 PRELIMINARY EROSION AND SEDIMENTATION 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.

Prior to any grading or servicing works commencing onsite, erosion and sedimentation control measures shall be implemented as detailed on the Pre-grading, Erosion and Sedimentation Control Plans (prepared during detail design). The erosion and sedimentation controls will include 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 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 periodically throughout the site adjacent to sensitive areas. Silt fencing should be erected before grading begins to protect adjacent and downstream areas from migration of sediment in overland flow
- Double row of Heavy-Duty silt fencing to be installed at the limits of grading adjacent to the existing Torrance Creek PSW to provide addition protection from migration of sediment into the adjacent wetland

- Silt fencing will be erected around the perimeter of all infiltration trench/gallery locations to perform as a barrier to all other site construction activities until the trenches are constructed.
- All construction materials are to be stored down-gradient from excavated infiltration trench/gallery sites wherever possible. Materials stored up-gradient of the excavated site are to be enclosed by appropriate sediment control fencing.
- Storm service outlets will be installed during servicing and roadworks construction to provide lot level dead and live storage
- Erosion control berms/swales will be located in appropriate (critical) areas to divert flows to temporary sediment basins
- A construction entrance feature ("mud-mat") will be provided at all site entrances to minimize the offsite transport of sediment via construction vehicles
- Swales constructed onsite will have temporary rock check dams to help attenuate flows and encourage deposition of suspended sediment where appropriate
- All disturbed areas where construction is not expected for 30 days shall be re-vegetated with 50 mm of topsoil and hydro-seeding according to OPSS 572
- During construction, all catchbasins are to be sealed until roads are paved to prevent sediment deposition in the catchbasin's sumps and conveyance of silt to the SWMF
- Perform street sweeping as necessary to remove soil accumulation caused by construction traffic.
- An Erosion Control Implementation Schedule will be included with the Detailed Erosion and Sedimentation Control Plan, prepared in conjunction with the Pregrading Application and/or Final Engineering Design
- Following completion of construction, defined as 90% house construction, and site stabilization, all erosion and sediment control measures and accumulated sediment are to be removed

Infiltration facilities are particularly vulnerable to failure during the construction phase for two reasons. First, if the construction sequence is not followed correctly, construction sediment can clog the facility. In addition, heavy construction can result in compaction of the soil which can then reduce the soil's infiltration rate. For this reason, a careful construction sequence needs to be followed. This will be developed with the contractor prior to construction.

The erosion control measures shall 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 items shall be noted in Monitoring Reports submitted to the Grand River

Conservation Authority (GRCA) and the City of Guelph. Monitoring Reports should be submitted bi-monthly (quarterly during periods of inactivity or house construction) and should be based on inspection completed bi-weekly or after any significant rainfall events (>13 mm), whichever is more frequent.

7.3 MONITORING, MAINTENANCE AND MITIGATION

Monitoring and maintenance activities are an important part of a SWM Strategy to ensure the designed features continue to operate as intended. As such, it is recommended that regularly scheduled inspections take place to observe any evidence of sediment deposition or malfunctioning of the proposed infiltration trenches or SWMF. Given the proximity of the site to the Torrance Creek Swamp PSW, the details and frequency of these inspections should be discussed with the City and the GRCA with details provided at the detailed design stage. Similarly, upon receipt of an Environmental Compliance Approval (ECA) from the MECP, the maintenance and monitoring schedule outlined in the ECA should be incorporated into the site development. The inspections should occur following significant rainfall events (where possible) and will also include inspection of the conditions of any temporary SWM controls (such as temporary sedimentation basins and sediment traps).

8.0 UTILITIES

8.1 HYDRO

Hydro is currently supplying the property via an overhead system located on the south side of Arkell Road, adjacent the 220 Arkell property. Alectra Utilities (formerly Guelph Hydro) has indicated that an electrical distribution system will be supplied from the Victoria Park Village Subdivision located northwest of the property. There will be no constraints with providing hydro service to the proposed Development.

8.2 BELL CANADA

Bell has indicated that they would supply the proposed Development with a joint trench from Guelph Hydro Electric Systems Inc. They do not foresee any issues servicing the proposed Development.

8.3 ROGERS CABLE

Rogers Cable Systems will follow the services of Bell Canada. It was indicated by Rogers Cable that services will be supplied from the Victoria Park Village Subdivision and do not anticipate any restraints with servicing the proposed Development.

8.4 GAS

Gas service to the 220 Arkell Development would be provided from the Victoria Park Village Subdivision. Union Gas has expressed that they see no constraints with an extension of distribution.

Hydro, Bell, Cable and Gas lines would be buried within the boulevards per the City of Guelph typical road cross-section.

9.0 CONCLUSIONS AND RECOMMENDATIONS

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

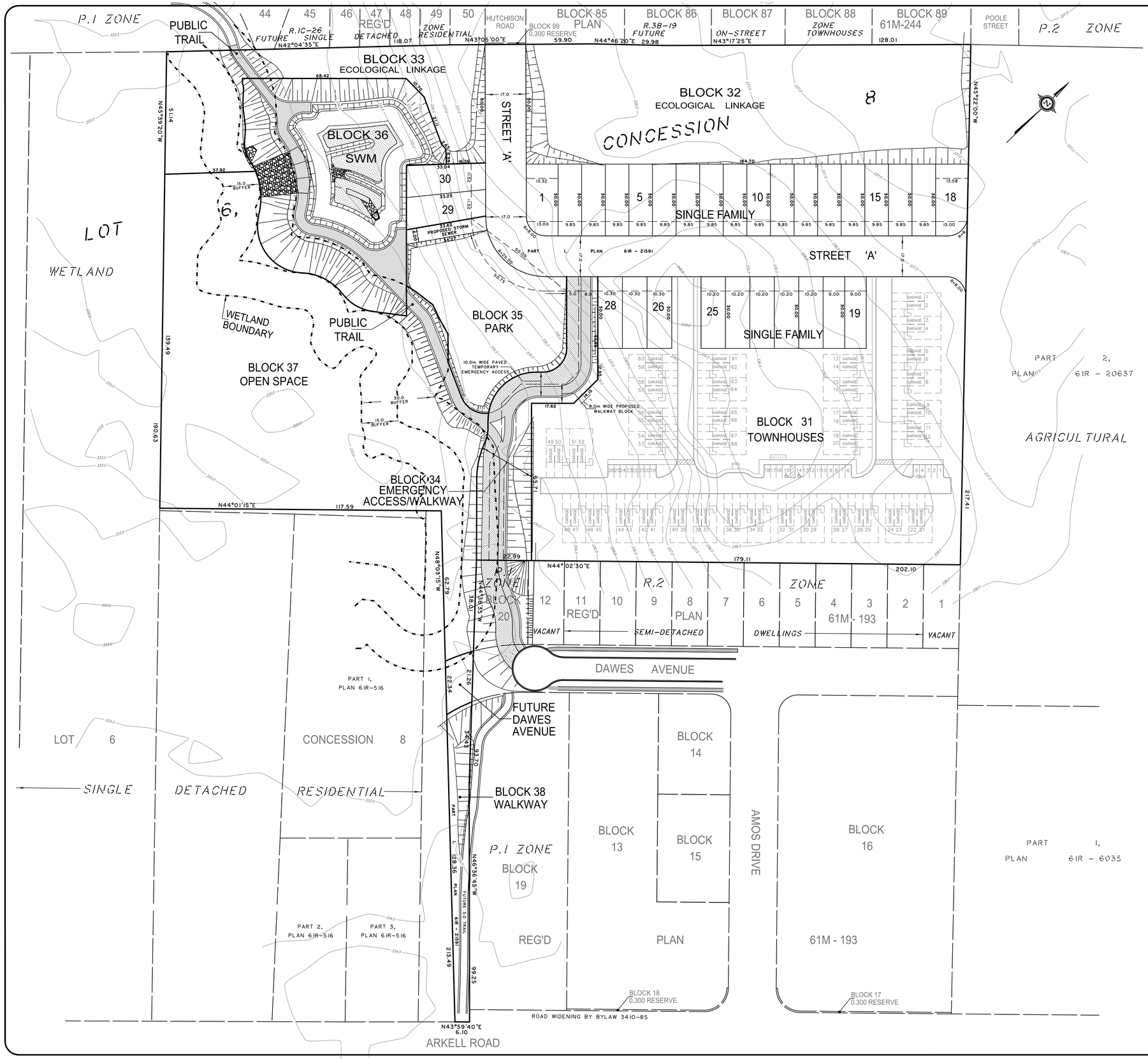
- The proposed 220 Arkell Road Subdivision can be adequately serviced through the connection to the existing sanitary, watermain, and utilities available on Hutchison Road to the north
- Stormwater management for the subject Development can be accommodated by the facility proposed by achieving the targets of the TCSS and water balance requirements

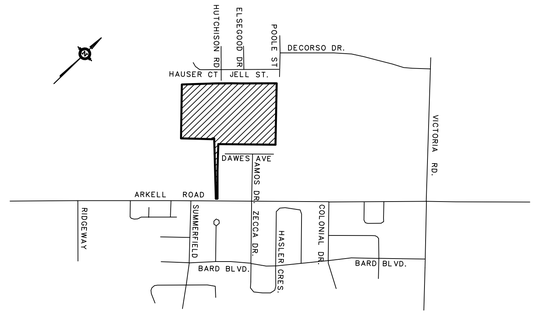
It is further recommended that:

- This report be circulated to the Municipality and various approval agencies in support of Draft Plan of Subdivision Approval for the 220 Arkell Road lands
- In-situ infiltration testing be completed at the infiltration gallery locations (this is anticipated to be completed during detailed design)
- Detailed grading and servicing design drawings be prepared, a Final Stormwater Management Report and Erosion Settlement Control Plan be completed once the Draft Plan of Subdivision for 220 Arkell Road lands has been approved

APPENDIX A

Proposed Draft Plan
Existing Conditions Plan (Drawing No. C-050, Rev 1)
Conceptual Servicing Plan (Drawing No. C-100, Rev 1)
Conceptual Plan and Profiles (Drawing No. C-200, Rev 1)
Conceptual Grading Plan (Drawing No. C-400, Rev 1)
Conceptual Stormwater Management Plan (Drawing No. C-410, Rev 0)
Preliminary Cut/Fill Plan (Drawing No. C-900, Rev 1)





KEY PLAN N.T.S.

SUBJECT LANDS

ADDITIONAL INFORMATION REQUIRED UNDER SECTION 51 (17) OF THE PLANNING ACT

51 (17) (a) – (c) AS SHOWN
(d) SEE SCHEDULE
(e) – (g) AS SHOWN
(h) MUNICIPAL WATER SUPPLY
(i) GUELPH LOAM
(j) AS SHOWN
(k) MUNICIPAL STORM AND SANITARY SEWERS
(l) NONE KNOWN

OWNERS CERTIFICATE

WE HEREBY AUTHORIZE J.D. BARNES LIMITED, TO SUBMIT THIS DRAFT PLAN OF SUBDIVISION.

December 13, 2019
DATE

'SEE ORIGINAL'
ROCKPOINT PROPERTIES INC.

SURVEYOR'S CERTIFICATE

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

December 12, 2019
DATE

'SEE ORIGINAL'
LEO LIU
ONTARIO LAND SURVEYOR

METRIC

DISTANCES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

RELEVANT INFORMATION

LOTS 1 TO 30	SINGLE-DETACHED RESIDENTIAL	30	0.932
BLOCK 31	STACKED TOWNHOUSES	68	1.712
BLOCKS 32 & 33	ECOLOGICAL LINKAGE		1.305
BLOCK 34	EMERGENCY ACCESS / WALKWAY		0.242
BLOCK 35	PARK SITE		0.330
BLOCK 36	STORM WATER MANAGEMENT		0.599
BLOCK 37	OPEN SPACE		1.435
BLOCK 38	WALKWAY		0.103
STREETS	ROADS		0.493
TOTAL		98	7.151 ha.

DRAFT PLAN OF SUBDIVISION

OF PART OF
LOT 6, CONCESSION 8
(GEOGRAPHIC TOWNSHIP OF PUSLINCH)
CITY OF GUELPH
COUNTY OF WELLINGTON

J.D. BARNES LIMITED

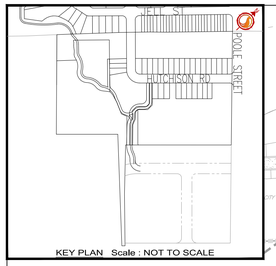
SCALE 1:750

0 10 20 30 40 50 METRES

REVISED FEB. 21, 2023
REVISED JAN. 12, 2023
REVISED OCT. 13, 2022
REVISED AUG. 22, 2022
REVISED AUG. 4, 2022
REVISED JULY 28, 2022

J.D.BARNES LIMITED
LAND INFORMATION SPECIALISTS
SURVEYING MAPPING GIS
257 WOODLAWN ROAD WEST, UNIT 101, GUELPH, ON N1H 8J1
T: (519) 822-4031 F: (519) 822-1220 www.jdbarnes.com

DRAWN BY:	REFERENCE NO.:
KS/DM	16-14-118-00-D
	DATED: DECEMBER 11, 2019



KEY PLAN Scale : NOT TO SCALE

HAUSER COURT

JELL STREET

BLOCK 109 PARK

BLOCK 101 BLOCK 102 BLOCK 103 BLOCK 104 BLOCK 105

VICTORIA PARK VILLAGE SUBDIVISION

DEAD END BARRICADE AS PER SD-32

BLOCK 118 (0.300 RESERVE)

BLOCK 117 (0.300 RESERVE)

SOUTH GRADING LIMITS DETERMINED BASED ON TREE PRESERVATION PLAN 1:500, TO 1:1000 REPORT DATED JANUARY 2019 BY JD BARNES

GRADED BASED ON TREE PRESERVATION PLAN 1:500, TO 1:1000 REPORT DATED JANUARY 2019 BY JD BARNES

TYPE 'C' CHAIN LINK FENCE 450mm THICK RIPRAP C/W GEOTEXTILE

CITY TRAIL

TORRENCE CREEK SWAMP (PSW)

LANDSCAPE AREA

BRICK HOUSE

INTERLOCKING BRICK

SEPTIC

BUSH

ASPHALT

GAZEBO

CONCRETE

STABLE

WOOD SHED

WOOD SHED

PROPANE TANKS

POST AND WIRE FENCE

WETLAND PREVIOUSLY PERMITTED FOR REMOVAL WITH THE ADJACENT DEVELOPMENT

CHAIN LINK FENCE

PENDELL MEADOWS SUBDIVISION

BLOCK 20

DAWES AVENUE

EDGE OF PAVEMENT

AMOS DRIVE

SWM POND 116 (BLOCK 19)

ARKELL ROAD

CONCRETE CURB

MATCH LINE (SEE INSERT THIS SHEET)

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2023/01/30 1:17 PM By: AHassouz, Mohamed

ORIGINAL SHEET - ARCH D

Stantec

300 Hagey Blvd. Suite 100
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Tel. 519.579.4410
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Notes

1. BENCHMARK:
   ND-27 RMW376.3
   GUELPH BENCHMARK #392, BENCHMARK PLATE ON TRAFFIC CONTROL BOX LOCATED ON SOUTH WEST CORNER OF THE INTERSECTION OF ARKELL ROAD AND VICTORIA ROAD. ELEVATION: 336.245m
2. TOPOGRAPHICAL SURVEY BY STANTEC CONSULTING LTD. DATED JULY 2017.
3. LEGAL PLAN PROVIDED BY BLACK, SHOEMAKER, ROBINSON & DONALDSON LIMITED. DATED MARCH 2019.
4. DRAFT PLAN BY J.D. BARNES LIMITED JAN., 2023.

Legend

- PROPERTY BOUNDARY
- 349.00 ORIGINAL GROUND CONTOUR
- EXISTING VEGETATION
- DRIPLINE
- MW GWL MONITORING WELL GROUND WATER LEVEL
- BH BOREHOLE
- HYD HYDRANT
- V&B VALVE & BOX
- VC VALVE CHANBER
- MH STORM MANHOLE
- SANITARY MANHOLE
- CB CATCHBASIN
- FENCE
- HP HYDRO POLE

1.	SECOND SUBMISSION	MALM	KRB	23.02.03
0.	FIRST SUBMISSION	MHH	KRB	19.05.30
Revision		By	Appd.	YY.MM.DD
File Name: 161413338_C-DP-Concept.dwg		Dwn.	Chkd.	Dsgn.
				22.03.30 YY.MM.DD

Permit-Seal

Professional Engineers Ontario

Licensed Engineering Technologist
Name: J. R. K. BROUSSEAU
Number: 100227228
Limitations: Preparation of municipal servicing design and specifications for gravity sanitary sewer, storm sewer watermain layout, site grading, development erosion control and development of local roads.
Association of Professional Engineers of Ontario

PRELIMINARY NOT FOR CONSTRUCTION

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Client/Project

ROCKPOINT PROPERTIES LTD.

220 ARKELL ROAD

Guelph, ON

Title

EXISTING CONDITIONS PLAN

Project No.	Scale	Drawing No.	Sheet	Revision
161413338	1:750 (0, 7.5, 22.5, 37.5m)	C-050	1	

KEY PLAN Scale : NOT TO SCALE

HUTCHISON RD

POOLE STREET

HAUSER COURT

JELL STREET

HUTCHISON ROAD

BLOCK 109 PARK

BLOCK 101 | BLOCK 102 | BLOCK 103 | BLOCK 104 | BLOCK 105

VICTORIA PARK VILLAGE SUBDIVISION

BLOCK 118 (0.300 RESERVE)

BLOCK 117 (0.300 RESERVE)

SANITARY INFORMATION OBTAINED FROM URBANSTON WEST VICTORIA PARK VILLAGE DRAWING No. 101 DWG. 9 JUL 10, 2009

	ELEV.	COVER
ROAD	337.62	
SANITARY	333.50	4.12

1800mmø CSP RISER FULLY PERFORATED (50mm□) C/W GALVANIZED HALF OPENING HINGED TOP WELDED TO CSP FIRST ROW OF HOLES AT PERMANENT POOL ELEV.=335.00m T/G=336.80 INV=335.00

BLOCK 33 ECOLOGICAL LINKAGE

MATCH EXISTING LIMIT

INFILTRATION TRENCH 15C-160UP ADS CHAMBER SYSTEM 29m (L) x 24m (W) CHAMBER INV=334.35 CHAMBER OBV=334.65 (0.35m MIN. COVER REQUIRED) TOP OF STONE=334.80

CULVERT

DRAINAGE CULVERT

50.0m ECOLOGICAL LINKAGE

BLOCK 32 ECOLOGICAL LINKAGE

APPROXIMATE LOCATION OF WILDLIFE CULVERT

	ELEV.	COVER
ROAD	336.90	
SANITARY	333.79	3.11

	ELEV.	COVER
ROAD	337.03	
STORM	335.38	1.65
SANITARY	333.95	3.08

4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

SWM FACILITY

30

	ELEV.	COVER
STORM	335.00	0.5

29

4.0m WIDE ACCESS C/W 0.6m MOW STRIPS

6.0m WIDE EASEMENT

BLOCK 36

	ELEV.	COVER
ROAD	337.20	
STORM	335.52	1.68
SANITARY	334.07	3.13

STREET A

BLOCK 35 PARK

BLOCK 34 EMERGENCY ACCESS/WALKWAY

28 27 26

	ELEV.	COVER
ROAD	337.99	
STORM	336.12	1.87
SANITARY	334.97	3.02

22

	ELEV.	COVER
ROAD	339.53	
STORM	337.49	2.04
SANITARY	336.53	3.00

TORRANCE CREEK SWAMP (PSW)

BLOCK 37 OPEN SPACE

8.0m WIDE PROPOSED WALKWAY BLOCK

BLOCK 31 TOWNHOUSES

4.0m WIDE MAINTENANCE ACCESS C/W 0.6m MOW STRIPS

30.0m WETLAND SETBACK

4.0m WIDE ULTIMATE MAINTENANCE ACCESS LIMIT

10.0m WIDE PAVED TEMP. EMERGENCY ACCESS

	ELEV.	COVER
ROAD	338.09	
STORM	336.40	1.69
SANITARY	335.37	2.72

15.0m WETLAND SETBACK

	ELEV.	COVER
ROAD	338.41	
SANITARY	335.61	2.80

SURVEYED WETLAND LIMIT

3.0m WIDE ULTIMATE TRAIL C/W 0.6M MOW STRIPS

CULVERT

NOTE: INFORMATION FOR THE ADJACENT LANDS BASED ON THE AREA GRADING PLAN PREPARED FOR THE 216 ARKELL ROAD PROPERTIES PROJECT DATED NOV.22/21 BY MTE

TOE OF SLOPE TO MATCH EXISTING OUTSIDE OF THE 15.0m WETLAND SETBACK

SURVEYED WETLAND LIMIT PROVIDED BY NRSI AND APPROVED BY GRCA IN 2015

3:1 SLOPE TO MATCH EXISTING

15.0m WETLAND SETBACK

APPROXIMATE LOCATION OF WETLAND PREVIOUSLY PERMITTED FOR REMOVAL WITH THE ADJACENT DEVELOPMENT

RELOCATED INFILTRATION GALLERY

ARKELL MEADOWS SUBDIVISION

BLOCK 1 | BLOCK 2 | BLOCK 3 | BLOCK 4 | BLOCK 5 | BLOCK 6 | BLOCK 7 | BLOCK 8 | BLOCK 9 | BLOCK 10 | BLOCK 11 | BLOCK 12

DAWES AVENUE

EDGE OF PAVEMENT

SWM POND 116 (BLOCK 13)

3.0m WIDE MAINTENANCE ACCESS C/W 0.6m MOW STRIPS

ALMOS DRIVE

ARKELL ROAD

CONCRETE CURB

MATCH LINE (SEE INSERT THIS SHEET)

INSERT

	ELEV.	COVER
ROAD	338.02	

FUT. CULVERT

	ELEV.	COVER
ROAD	339.81	
SANITARY	336.81	3.00

FUTURE STREET

TREE PROTECTION SILT FENCE

	ELEV.	COVER
HP		
ROAD	340.47	

	ELEV.	COVER
ROAD	339.64	
STORM	338.16	1.48
SANITARY	336.92	2.72

STREET A

	ELEV.	COVER
ROAD	339.79	
SANITARY	337.09	2.70

STREET C

STREET D

Legend

- PROPOSED WATERMAIN
- EXISTING WATERMAIN
- FUTURE WATERMAIN
- PROPOSED SANITARY SEWER
- EXISTING SANITARY SEWER
- FUTURE SANITARY SEWER
- PROPOSED STORM SEWER
- EXISTING STORM SEWER
- FUTURE STORM SEWER
- FUTURE INFILTRATION GALLERY PIPE
- EXISTING OVERLAND FLOW DIRECTION
- OVERLAND FLOW DIRECTION
- FUTURE OVERLAND FLOW DIRECTION

ROAD STATUS (LP = LOW POINT, HP = HIGH POINT)

	ELEV.	COVER
LP		
ROAD	300.82	
STORM	297.88	2.8
SANITARY	297.11	3.4

ROAD ELEVATION
COVER OVER SEWER
SEWER OBVERT ELEVATION

BHF / HGWL — BORE HOLE / GROUND WATER LEVEL

INFILTRATION GALLERY

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

Notes

1. BENCHMARK:
   ND-27 RWM376.3
   GUELPH BENCHMARK #392. BENCHMARK PLATE ON TRAFFIC CONTROL BOX LOCATED ON SOUTH WEST CORNER OF THE INTERSECTION OF ARKELL ROAD AND VICTORIA ROAD. ELEVATION: 336.245m
2. TOPOGRAPHICAL SURVEY BY STANTEC CONSULTING LTD. DATED JULY 2017.
3. LEGAL PLAN PROVIDED BY BLACK, SHOEMAKER, ROBINSON & DONALDSON LIMITED. DATED MARCH 2019.
4. DRAFT PLAN BY J.D. BARNES LIMITED JAN., 2023.

1.	SECOND SUBMISSION	MALM	KRB	23.03.03
0.	FIRST SUBMISSION	MHH	KRB	19.05.30
Revision		By	Appd.	YY.MM.DD
File Name: 161413338_C-UC-Concept.dwg		Dwn.	Chkd.	Dsgn. 23.02.17 YY.MM.DD

Permit-Seal

Professional Engineers Ontario

Licensed Engineering Technologist
Name: J. R. K. BROUSSEAU
Number: 100227228
Limitations: Preparation of municipal servicing design and specifications for gravity sanitary sewer, storm sewer watermain layout, site grading, development erosion control and development of local roads.
Association of Professional Engineers of Ontario

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Client/Project

ROCKPOINT PROPERTIES INC.

220 ARKELL ROAD

Guelph, ON

Title

CONCEPTUAL SERVICING PLAN

Project No.	Scale	Sheet	Revision
161413338	1:750 (0 7.5 22.5 37.5m)		
Drawing No.			
C-100		1	

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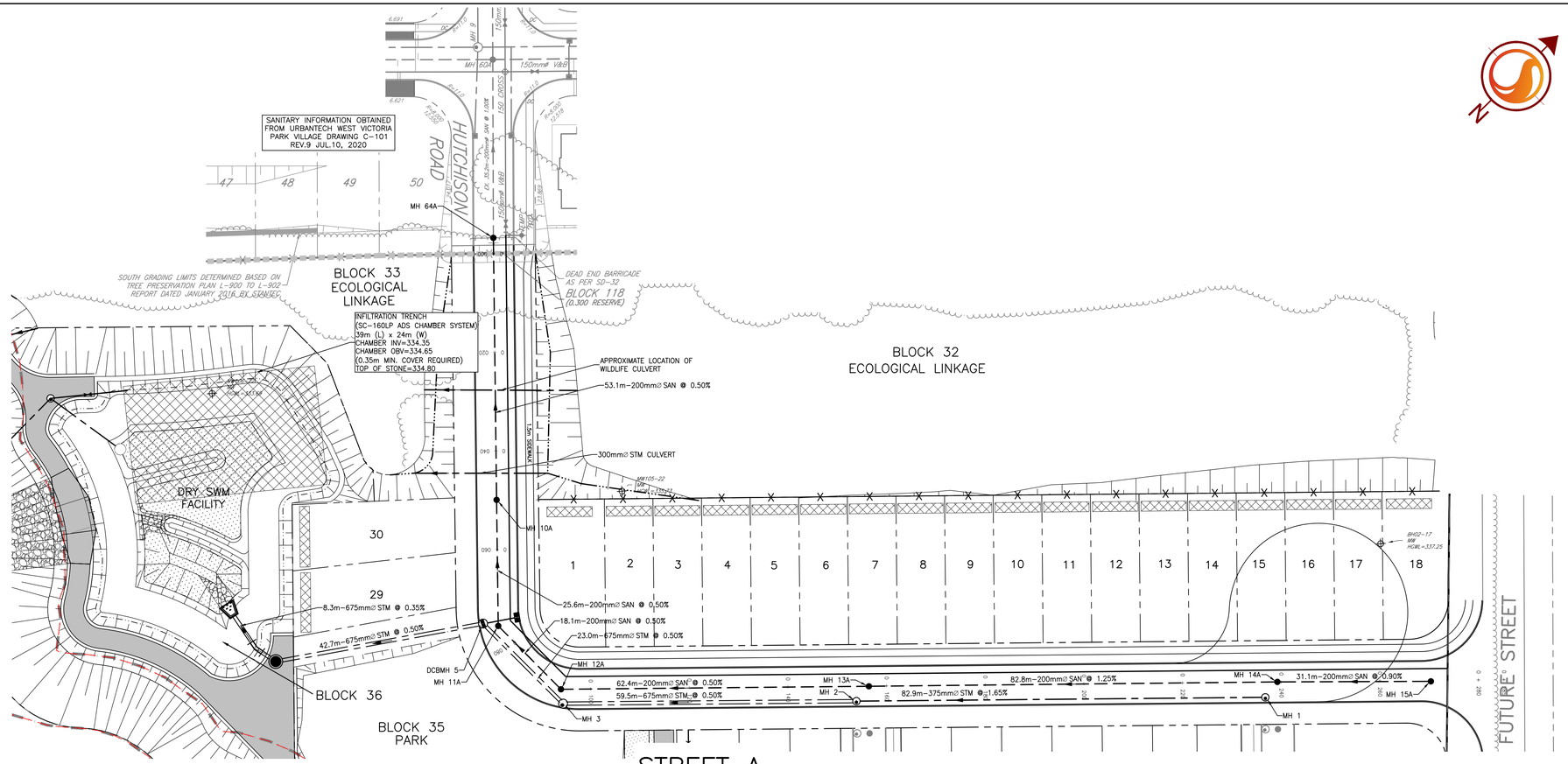

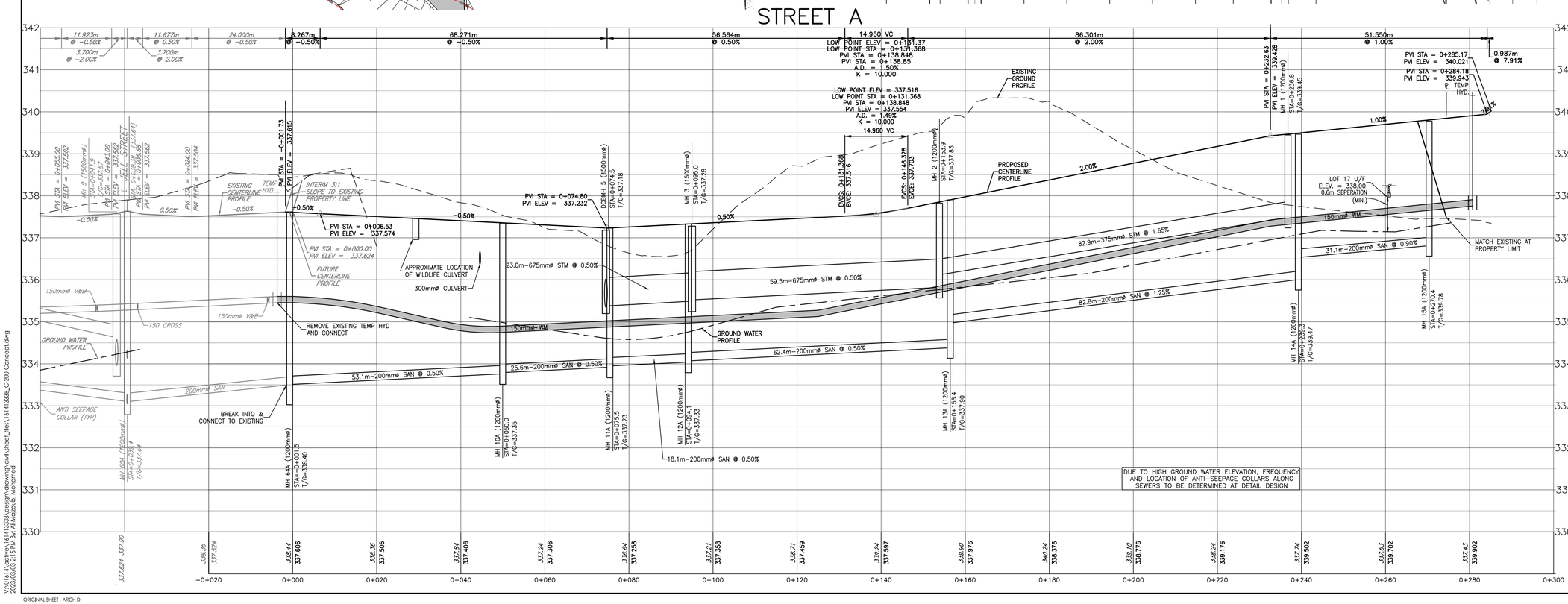

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Legend

Revision	By	Appd.	YY.MM.DD
1. SECOND SUBMISSION	MALM	KRB	23.03.03
0. FIRST SUBMISSION	MHH	KRB	19.05.30
File Name: 161413338_C-200-Concept.dwg	Dwn.	Chkd.	Dsgn. 23.02.17 YY.MM.DD

Permit-Seal

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ROCKPOINT PROPERTIES INC.

220 ARKELL ROAD

Guelph, ON

Title
CONCEPTUAL PLAN AND PROFILES

Project No. 161413338

Scale 1:500H 0 5 15 25m; 1:50V 0 0.5 1.5 2.5m

Drawing No. C-200

Sheet 1

Revision

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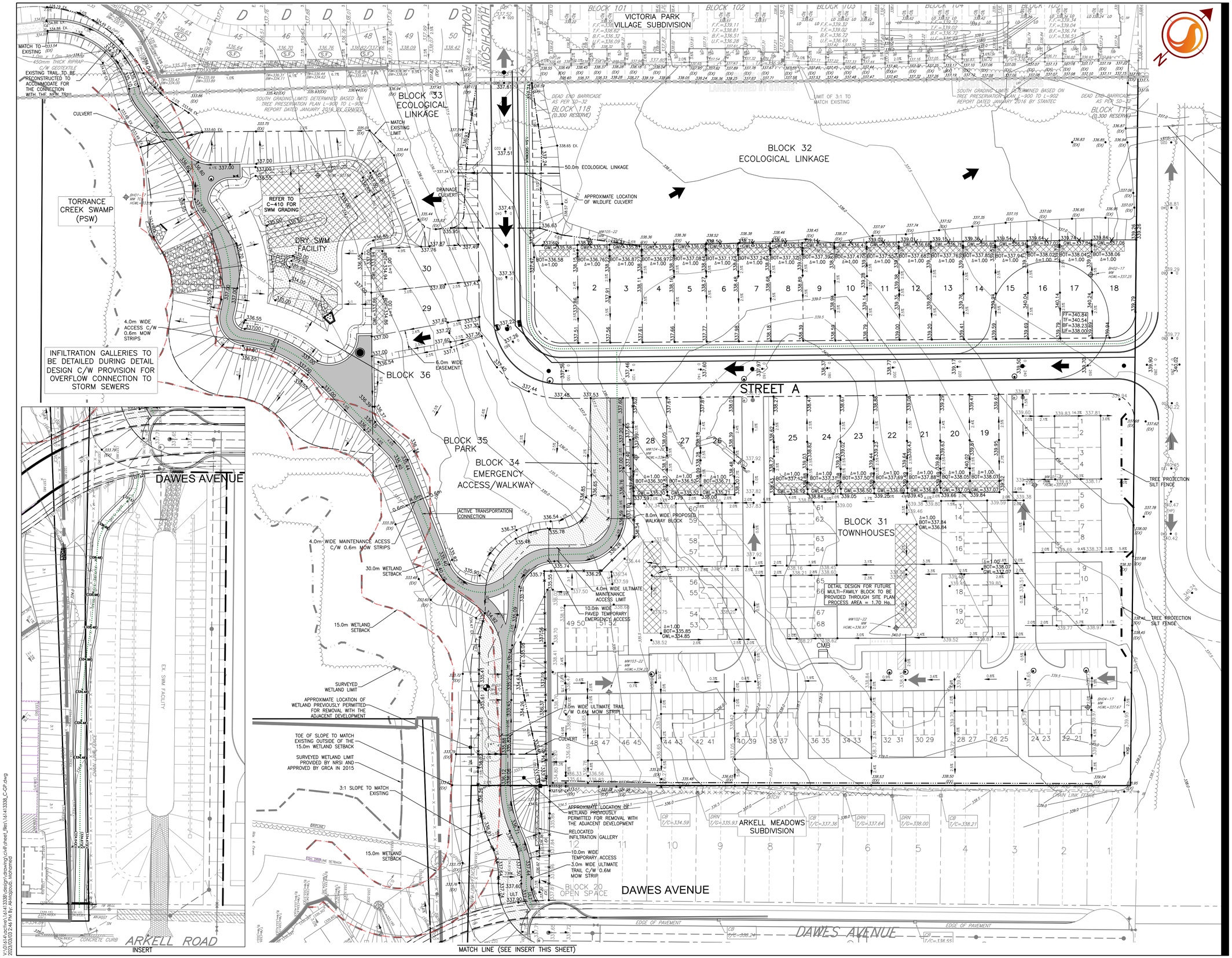

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Notes
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2. TOPOGRAPHICAL SURVEY BY STANTEC CONSULTING LTD. DATED JULY 2017.
3. LEGAL PLAN PROVIDED BY BLACK, SHOEMAKER, ROBINSON & DONALDSON LIMITED. DATED MARCH 2019.
4. DRAFT PLAN BY J.D. BARNES LIMITED JAN., 2023.

Legend
- PHASE LIMIT
- 352.82 ORIGINAL GROUND ELEVATION
- 352.92 PROPOSED ELEVATION
- 351.91 EXISTING ELEVATIONS
- 352.92 FUTURE PROPOSED ELEVATION
- 2.0% 2.0% FLOW DIRECTION
- 349.00 ORIGINAL GROUND CONTOUR
- PROPOSED STORM MANHOLE
- PROPOSED STORM CATCHBASIN MANHOLE
- PROPOSED CATCHBASIN
- PROPOSED DOUBLE CATCHBASIN
- PROPOSED SANITARY MANHOLE
- PROPOSED VALVE & BOX
- PROPOSED HYDRANT
- EXISTING INTERIM SLOPE (3:1 UNLESS NOTED OTHERWISE)
- PROPOSED SLOPE (3:1 UNLESS NOTED OTHERWISE)
- OVERLAND FLOW DIRECTION
- FUTURE OVERLAND FLOW DIRECTION
- BH GWL BORE HOLE GROUND WATER LEVEL
- FUTURE RESTORATION
- INFILTRATION GALLERY
- ACTIVE TRANSPORTATION CONNECTION

1.	SECOND SUBMISSION	MALM	KRB	23.03.03
0.	FIRST SUBMISSION	MHH	KRB	19.05.30
Revision		By	Appd.	YY.MM.DD
File Name: 161413338_C-GP.dwg		Dwn.	Chkd.	23.02.17 Dsgn. YY.MM.DD

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Client/Project
ROCKPOINT PROPERTIES INC.

220 ARKELL ROAD

Guelph, ON

Title
CONCEPTUAL GRADING PLAN

Project No. 161413338
Scale 1:500 (0, 5, 15, 25m)
Drawing No. C-400
Sheet
Revision 1

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2023/03/03 2:44 PM By: Al-Majzoub, Mohamed

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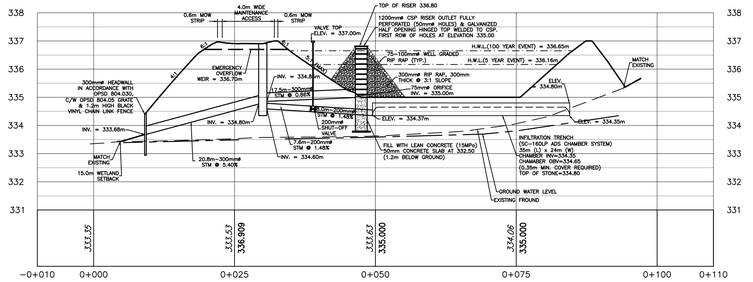
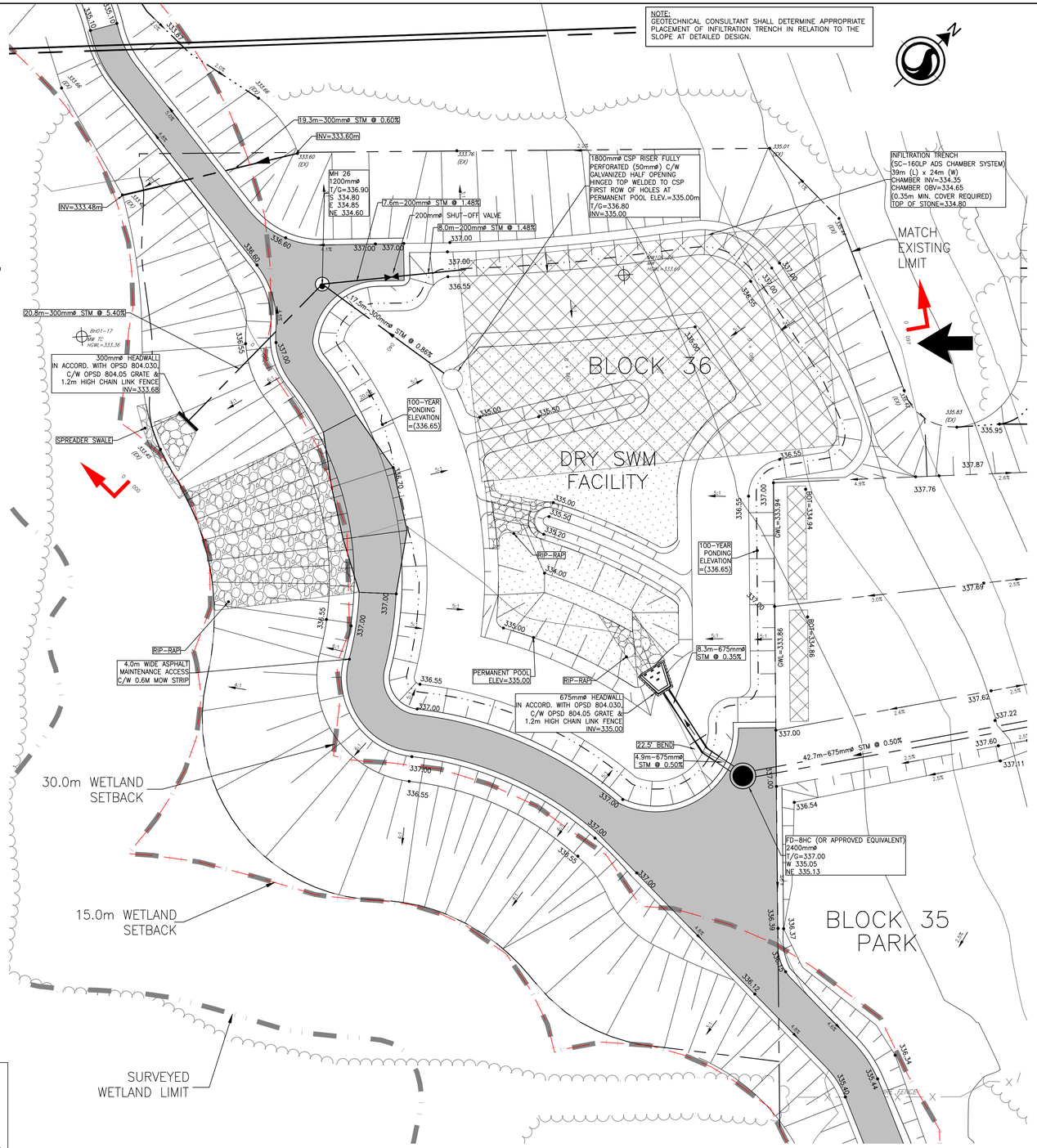
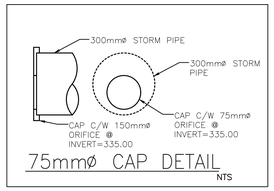




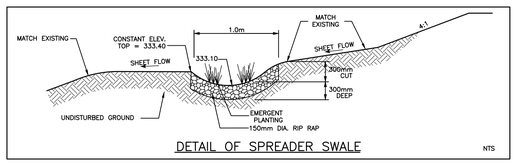


75mmø CAP DETAIL
NTS

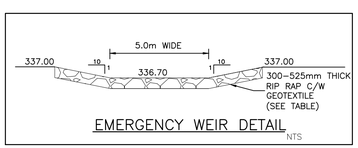
RIP-RAP GRADATION TABLE
100mm RIP-RAP 175mm THICK (MTO)
100% SMALLER THAN 150mm
AT LEAST 20% LARGER THAN 120mm
AT LEAST 50% LARGER THAN 100mm
AT LEAST 80% LARGER THAN 60mm

RIP-RAP GRADATION TABLE
300mm RIP-RAP 525mm THICK (MTO)
100% SMALLER THAN 500mm
AT LEAST 20% LARGER THAN 350mm
AT LEAST 50% LARGER THAN 300mm
AT LEAST 80% LARGER THAN 200mm

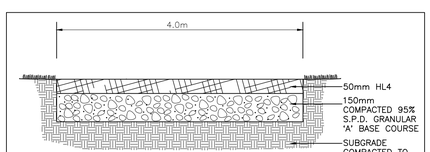
RIP-RAP DETAIL
NTS



DETAIL OF SPREADER SWALE
NTS



EMERGENCY WEIR DETAIL
NTS



NOTES:
1. COMPACT ASPHALT TO 97% MARSHALL MIX DESIGN BULK DENSITY.
2. TRAIL TO MATCH PROPOSED GRADES.
3. TRAIL SURFACE TO BE SMOOTH AND EVEN THROUGHOUT.
4. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.
5. DISTURBED AREAS ARE TO BE RESTORED C/W TOPSOIL AND SEED (TOWN AND COUNTRY PICKSEED). TOPSOIL IS TO BE FINE GRADED AND BOX SCRAPPED WITH ALL AREAS HAVING POSITIVE DRAINAGE.

ASPHALT MAINTENANCE ACCESS/WALKWAY DETAIL
NTS

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

Notes
1. BENCHMARK:
   ND-27 RWW376.3
   GUELPH BENCHMARK #392. BENCHMARK PLATE ON TRAFFIC CONTROL BOX LOCATED ON SOUTH WEST CORNER OF THE INTERSECTION OF ARKELL ROAD AND VICTORIA ROAD. ELEVATION: 336.245m
2. TOPOGRAPHICAL SURVEY BY STANTEC CONSULTING LTD. DATED JULY 2017.
3. LEGAL PLAN PROVIDED BY BLACK, SHOEMAKER, ROBINSON & DONALDSON LIMITED. DATED MARCH 2019.
4. DRAFT PLAN BY J.D. BARNES LIMITED JAN., 2023.

Legend

0.	SECOND SUBMISSION	MALM	KRB	23.03.03
Revision		By	Appd.	YY.MM.DD
File Name: 161413338_C-SWM.dwg		Dwn.	Chkd.	23.02.17
			Dsgn.	YY.MM.DD

Permit-Seal

Professional Engineers Ontario
Licensed Engineering Technologist
Name: J. R. K. BROUSSEAU
Number: 100227228
Limitations: Preparation of municipal servicing design and specifications for gravity sanitary sewer, storm sewer watermain layout, site grading, development erosion control and development of local roads.
Association of Professional Engineers of Ontario

PRELIMINARY NOT FOR CONSTRUCTION
Not for permits, pricing or other official purposes. This document has not been completed or checked and is for general information or comment only.

Client/Project
ROCKPOINT PROPERTIES INC.

220 ARKELL ROAD

Guelph, ON

Title
CONCEPTUAL STORMWATER MANAGEMENT PLAN

Project No.	Scale	Sheet	Revision
161413338	1:250 (0, 2.5, 7.5, 12.5m)		
Drawing No.			
C-410			0

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2023/03/03 2:49 PM By: AHAMDOUD, MOHAMED

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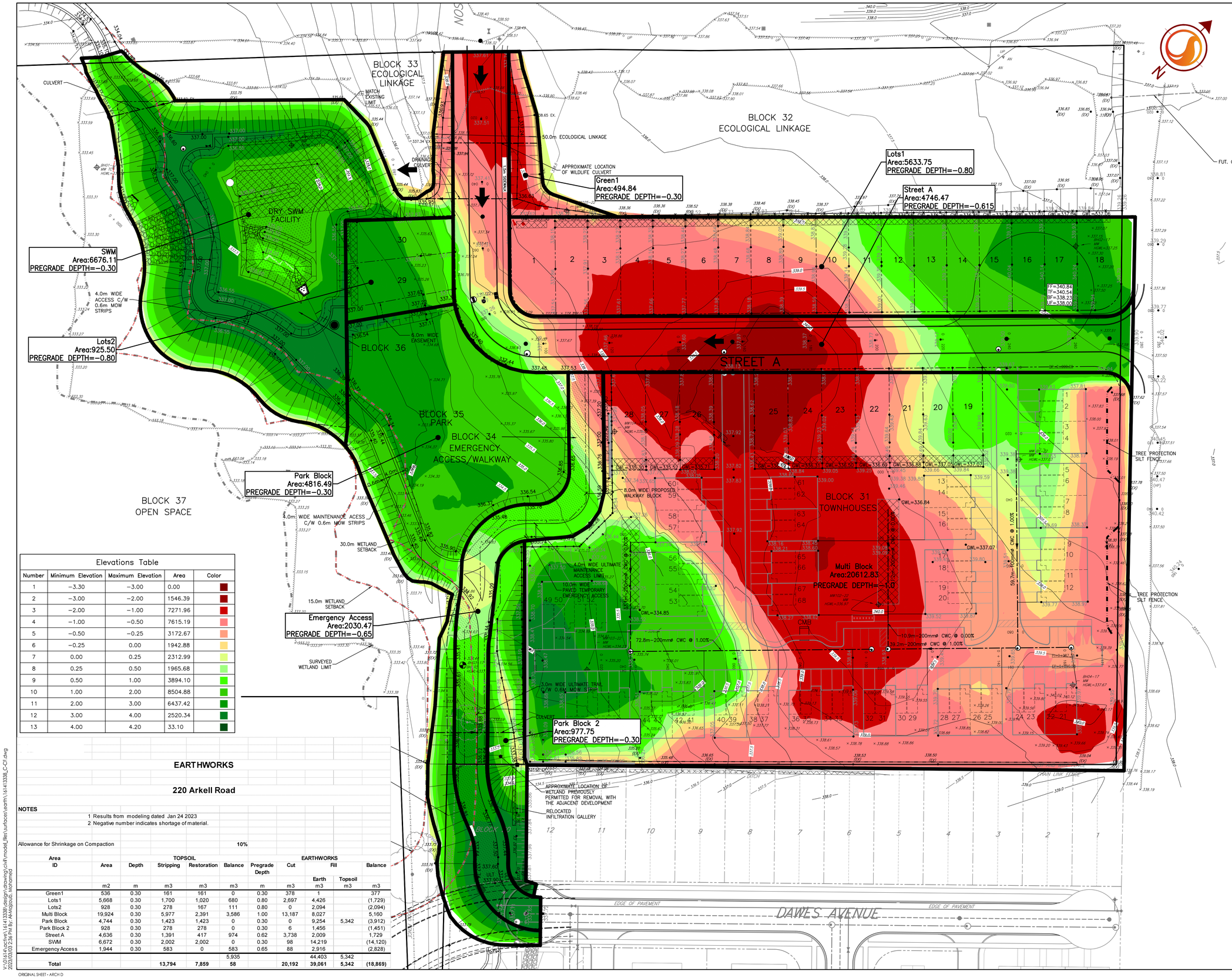

Elevations Table				
Number	Minimum Elevation	Maximum Elevation	Area	Color
1	-3.30	-3.00	0.00	
2	-3.00	-2.00	1546.39	
3	-2.00	-1.00	7271.96	
4	-1.00	-0.50	7615.19	
5	-0.50	-0.25	3172.67	
6	-0.25	0.00	1942.88	
7	0.00	0.25	2312.99	
8	0.25	0.50	1965.68	
9	0.50	1.00	3894.10	
10	1.00	2.00	8504.88	
11	2.00	3.00	6437.42	
12	3.00	4.00	2520.34	
13	4.00	4.20	33.10	

EARTHWORKS

220 Arkell Road

NOTES

1 Results from modeling dated Jan 24 2023
2 Negative number indicates shortage of material.

Allowance for Shrinkage on Compaction **10%**

Area ID	Area	Depth	TOPSOIL Stripping	TOPSOIL Restoration	TOPSOIL Balance	EARTHWORKS Pregrade Depth	EARTHWORKS Cut	EARTHWORKS Fill Earth	EARTHWORKS Fill Topsoil	EARTHWORKS Balance
	m2	m	m3	m3	m3	m	m3	m3	m3	m3
Green1	536	0.30	161	161	0	0.30	378	1		377
Lots1	5,668	0.30	1,700	1,020	680	0.80	2,697	4,426		(1,729)
Lots2	928	0.30	278	167	111	0.80	0	2,094		(2,094)
Multi Block	19,924	0.30	5,977	2,391	3,586	1.00	13,187	8,027		5,160
Park Block	4,744	0.30	1,423	1,423	0	0.30	0	9,254	5,342	(3,912)
Park Block 2	928	0.30	278	278	0	0.30	6	1,456		(1,451)
Street A	4,636	0.30	1,391	417	974	0.62	3,738	2,009		1,729
SWM	6,672	0.30	2,002	2,002	0	0.30	98	14,219		(14,120)
Emergency Access	1,944	0.30	583	0	583	0.65	88	2,916		(2,828)
					5,935			44,403	5,342	
Total			**13,794**	**7,859**	**58**		**20,192**	**39,061**	**5,342**	**(18,869)**

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2023/02/03 2:26 PM By: AhMajeed, Mohamed

ORIGINAL SHEET - ARCH D

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

Notes

1. BENCHMARK:
   NID-27 RWW376.3
   GUELPH BENCHMARK #392. BENCHMARK PLATE ON TRAFFIC CONTROL BOX LOCATED ON SOUTH WEST CORNER OF THE INTERSECTION OF ARKELL ROAD AND VICTORIA ROAD. ELEVATION: 336.245m
2. TOPOGRAPHICAL SURVEY BY STANTEC CONSULTING LTD. DATED JULY 2017.
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4. DRAFT PLAN BY J.D. BARNES LIMITED JAN., 2023.

Legend

Revision	By	Appd.	YY.MM.DD
1. SECOND SUBMISSION	MALM	KRB	23.03.03
0. FIRST SUBMISSION	MHH	KRB	19.05.30
File Name: 161413338_C-CF.dwg	Dwn.	Chkd.	23.02.03
		Dsgn.	YY.MM.DD

Permit-Seal

Professional Engineers Ontario

Licensed Engineering Technologist
Name: J. R. K. BROUSSEAU
Number: 100227228
Limitations: Preparation of municipal servicing design and specifications for gravity sanitary sewer, storm sewer watermain layout, site grading, development erosion control and development of local roads.
Association of Professional Engineers of Ontario

PRELIMINARY NOT FOR CONSTRUCTION

Not for permits, pricing or other official purposes. This document has not been completed or checked and is for general information or comment only.

Client/Project
ROCKPOINT PROPERTIES LTD.

220 ARKELL ROAD

Guelph, ON

Title
CONCEPTUAL CUT/FILL PLAN

Project No.	Scale	Sheet	Revision
161413338	1:500 (0, 5, 15, 25m)		
Drawing No.			
C-900		1	

APPENDIX B

City and Utility Correspondence

APPENDIX B

City and Utility Correspondence

Huisman, Michael

From: Ian Bolton <ibolton@guelphhydro.com>
Sent: Tuesday, March 20, 2018 3:31 PM
To: Huisman, Michael
Subject: RE: 220 Arkell Road, City of Guelph
Attachments: 220 Arkell Rd_Existing.pdf

Michael,
The new development would be supplied from an electrical distribution system that connects to the Victoria Village subdivision to the north. We do not anticipate any supply constraints. The site is presently supplied from an overhead connection on Arkell Rd, along the driveway and then goes underground to supply a pad mount transformer.
Please see attached.
Thanks

Ian

Ian Bolton, C.E.T.
Distribution Design Supervisor
Guelph Hydro Electric Systems Inc.
E: ibolton@guelphhydro.com
P: 519 837-4717 | Cell: 519 241-1447

Guelph Hydro
Electric Systems Inc.
395 Southgate Drive, Guelph, Ontario N1G 4Y1
www.guelphhydro.com | @GuelphHydro

From: Huisman, Michael [mailto:Michael.Huisman@stantec.com]
Sent: March-19-18 12:41 PM
To: SArtt@uniongas.com; Brian A Murray (BrianA.Murray@rci.rogers.com) <BrianA.Murray@rci.rogers.com>; Owen, Crystal (crystal.owen@bell.ca) <crystal.owen@bell.ca>; Ian Bolton <ibolton@guelphhydro.com>
Cc: Brousseau, Kevin <kevin.brousseau@stantec.com>; Vleeming, John <John.Vleeming@stantec.com>
Subject: 220 Arkell Road, City of Guelph

Good afternoon everyone,

We are currently working towards completing the preliminary engineering for the above noted site in support of Draft Plan approval which will follow with detail design.

Please refer to the attached proposed Draft Plan and Site Location plan for your reference.

At this time we understand that a potential/viable proposed utility connection would be subject to the construction of proposed Victoria Park Village Subdivision located at the North West property line. We wish to confirm that your utility has no constraints with providing service to the proposed development and request that you provide any additional available information which shows existing and proposed utilities within the area of the proposed development.

In the case that your organization does not have existing or proposed services within the area please provide a brief description as to how this site will be serviced.

Should you have any questions, please call or email to discuss.

Thank you,

Michael Huisman
C. Tech.
Engineering Technologist, Community Development

Direct: 519-585-7299
Mobile: 905-929-7056
Fax: 519-579-6733

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4 CA

http://www.stantec.com/" style='position:absolute;margin-left:0;margin-top:0;width:75pt;height:20.25pt;z-index:251659264;visibility:visible;mso-wrap-style:square;mso-width-percent:0;mso-height-percent:0;mso-wrap-distance-left:0;mso-wrap-distance-top:0;mso-wrap-distance-right:0;mso-wrap-distance-bottom:0;mso-position-horizontal:left;mso-position-horizontal-relative:text;mso-position-vertical:absolute;mso-position-vertical-relative:line;mso-width-percent:0;mso-height-percent:0;mso-width-relative:page;mso-height-relative:page' o:allowoverlap="f" o:button="t"> http://www.stantec.com/content/dam/stantec/images/esignature/stantec.png" />

Huisman, Michael

From: Ackerman, R. Neil <neil.ackerman1@bell.ca>
Sent: Monday, March 19, 2018 4:34 PM
To: Huisman, Michael
Subject: RE: 220 Arkell Road, City of Guelph

Perfect that is what I thought. My arrow was just the direction from which my fiber feed would come from.

We would be joint use trench with Guelph Hydro.

Bell

Neil Ackerman
Guelph,Acton,Breslau & Rockwood
Specialist - Network Provisioning

F1-575 Riverbend Drive
Kitchener, Ontario
N2K 3S3
P 519.568.5797
C 226.750.5389
neil.ackerman1@bell.ca

From: Huisman, Michael [mailto:Michael.Huisman@stantec.com]
Sent: Monday, March 19, 2018 4:10 PM
To: Ackerman, R. Neil <neil.ackerman1@bell.ca>
Subject: RE: 220 Arkell Road, City of Guelph

Hey Neil,

Sorry if my email wasn't clear. The area is correct but the road connection from Victoria Park Village would be from future Hutchison Road. I've attached a PDF of the road connection, in red, from Victoria Park Village Subdivision to 220 Arkell. If you need any further clarification please let me know.

Regards,

Michael Huisman
C. Tech.
Engineering Technologist, Community Development

Direct: 519-585-7299
Mobile: 905-929-7056
Fax: 519-579-6733

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4 CA

Stantec

From: Ackerman, R. Neil [mailto:neil.ackerman1@bell.ca]
Sent: Monday, March 19, 2018 3:55 PM
To: Huisman, Michael <Michael.Huisman@stantec.com>
Subject: FW: 220 Arkell Road, City of Guelph

Hello Michael

Please can you confirm your site is related to the new development with entrance off Victoria Rd S. See the red box below, this is where I perceive you to be.

From: Huisman, Michael [mailto:Michael.Huisman@stantec.com]
Sent: March-19-18 12:41 PM
To: SArtt@uniongas.com; Brian A Murray (BrianA.Murray@rci.rogers.com) <BrianA.Murray@rci.rogers.com>; Owen,

Crystal <crystal.owen@bell.ca>; ibolton@guelphhydro.com
Cc: Brousseau, Kevin <kevin.brousseau@stantec.com>; Vleeming, John <John.Vleeming@stantec.com>
Subject: 220 Arkell Road, City of Guelph

Good afternoon everyone,

We are currently working towards completing the preliminary engineering for the above noted site in support of Draft Plan approval which will follow with detail design.

Please refer to the attached proposed Draft Plan and Site Location plan for your reference.

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In the case that your organization does not have existing or proposed services within the area please provide a brief description as to how this site will be serviced.

Should you have any questions, please call or email to discuss.

Thank you,

Michael Huisman
C. Tech.
Engineering Technologist, Community Development

Direct: 519-585-7299
Mobile: 905-929-7056
Fax: 519-579-6733

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4 CA

Huisman, Michael

From: Gwen Keep <GKeep@uniongas.com>
Sent: Tuesday, March 20, 2018 9:25 AM
To: Huisman, Michael
Subject: RE: [External] 220 Arkell Road, City of Guelph
Attachments: Victoria Park Page1.pdf

Good Morning Michael,
I am attaching the Union Gas proposal for servicing of the Victoria Park Village subdivision to the north of this proposed development.
There are no constraints with supplying this proposed development with an extension of distribution main from the Victoria Park Village development.

Trusting this is the information required at this time.

Regards,

Gwen Keep
New Business Project Coordinator
Waterloo/Guelph
Union Gas Limited | An Enbridge Company
603 Kumpf Drive P.O. Box 340 | Waterloo, ON N2J 4A4
Tel: 519-885-7400 ext 5067488
gkeep@uniongas.com

Visit www.uniongas.com/GetConnected to electronically submit service requests

---

From: Shawn Artt
Sent: March 19, 2018 12:57 PM
To: Kevin Schimus; Gwen Keep
Subject: Fwd: [External] 220 Arkell Road, City of Guelph

Think this would be something for one of you two to look into!?

Thanks

Shawn

Sent from my iPhone

Begin forwarded message:

> **From:** "Huisman, Michael" <Michael.Huisman@stantec.com>
> **To:** "Shawn Artt" <SArtt@uniongas.com>, "Brian A Murray (BrianA.Murray@rci.rogers.com)" <BrianA.Murray@rci.rogers.com>, "Owen, Crystal (crystal.owen@bell.ca)" <crystal.owen@bell.ca>,

"ibolton@guelphhydro.com" <ibolton@guelphhydro.com>
Cc: "Brousseau, Kevin" <kevin.brousseau@stantec.com>, "Vleeming, John" <John.Vleeming@stantec.com>
Subject: [External] 220 Arkell Road, City of Guelph

Good afternoon everyone,

We are currently working towards completing the preliminary engineering for the above noted site in support of Draft Plan approval which will follow with detail design.

Please refer to the attached proposed Draft Plan and Site Location plan for your reference.

At this time we understand that a potential/viable proposed utility connection would be subject to the construction of proposed Victoria Park Village Subdivision located at the North West property line. We wish to confirm that your utility has no constraints with providing service to the proposed development and request that you provide any additional available information which shows existing and proposed utilities within the area of the proposed development.

In the case that your organization does not have existing or proposed services within the area please provide a brief description as to how this site will be serviced.

Should you have any questions, please call or email to discuss.

Thank you,

Michael Huisman
C. Tech.
Engineering Technologist, Community Development

Direct: 519-585-7299
Mobile: 905-929-7056
Fax: 519-579-6733

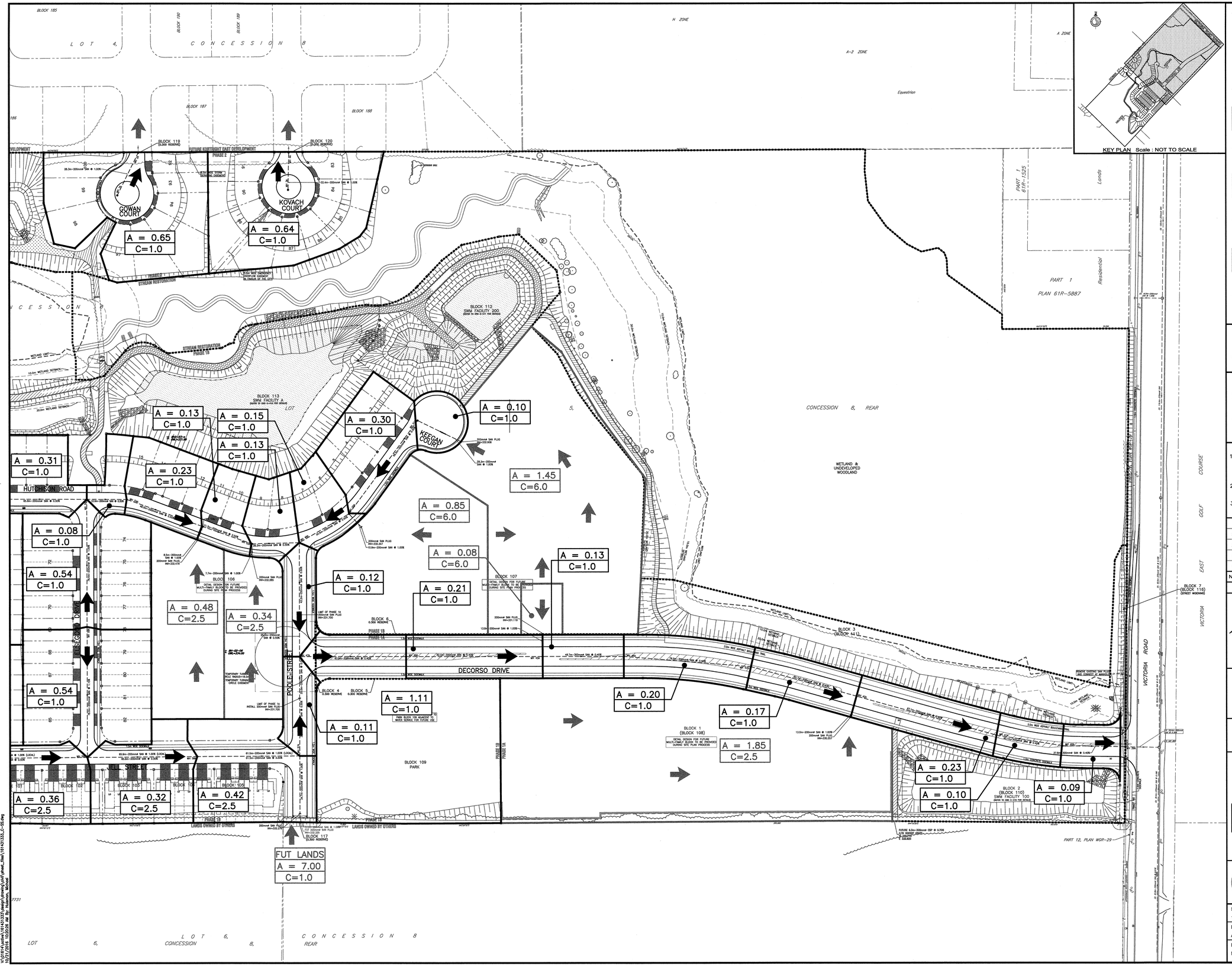
Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4 CA

Stantec

APPENDIX C

VPV Sanitary Drainage Area Plans (Drawing No. C-110 and C-111)
(Post Development) Sanitary Design Sheets

- 000



North:

LEGEND:

- A = 0.50 / C=1.0 — DRAINAGE AREA (HECTARES); SANITARY CO-EFFICIENT (CUBIC METRES PER SECOND PER HECTARE)
- AREA BOUNDARY
- FLOW DIRECTION
- A = 0.50 / C=1.0 — DRAINAGE AREA (HECTARES); EXISTING SANITARY CO-EFFICIENT (CUBIC METRES PER SECOND PER HECTARE)
- EXISTING AREA BOUNDARY
- EXISTING FLOW DIRECTION
- A = 0.50 / C=1.0 — DRAINAGE AREA (HECTARES); FUTURE SANITARY CO-EFFICIENT (CUBIC METRES PER SECOND PER HECTARE)
- FUTURE AREA BOUNDARY
- FUTURE FLOW DIRECTION

ALL DIMENSIONS AND ELEVATIONS ARE IN METRES UNLESS OTHERWISE NOTED.

PIPE SIZES ARE IN MILLIMETRES.

NOTE: LOCATIONS OF UTILITY STRUCTURES ARE APPROX.

- ⊠ ⊙ H BELL PEDESTAL / CABLE PEDESTAL / TRANSFORMER
- HYDRO LIGHT STANDARD
- COMMUNITY MAIL BOX

The position of existing above ground and underground utilities and facilities are not necessarily shown on the drawings, and where shown, the accuracy of the position of such utilities and facilities is not guaranteed. Before starting work, the contractor shall confirm the exact location of all existing utilities and facilities, and shall assume all liability for damage to them. Drawings shall not be used for construction unless sealed. All work to be performed in accordance with the Occupational Health & Safety Act 1990.

GENERAL NOTES:

1. BENCHMARK: GUELPH BENCHMARK #392. BENCHMARK PLATE ON TRAFFIC CONTROL BOX LOCATED ON SOUTH WEST CORNER OF THE INTERSECTION OF ARKELL ROAD AND VICTORIA ROAD. ELEVATION=336.245m
2. LEGAL INFORMATION TAKEN FROM J.D. BARNES LTD. REFERENCE #11-30-246-00 DATED JANUARY 6, 2015.
3. TOPOGRAPHICAL SURVEY DONE BY OTHERS. ADDITIONAL TOPO DONE BY STANTEC DATED FEBRUARY, 2015.

No.	DATE	DESCRIPTION	BY:	CHKD.
3	16.10.19	FOURTH/MOE SUBMISSION	MHH	KRB
2	16.06.24	THIRD SUBMISSION	MHH	KRB
1	15.12.23	SECOND SUBMISSION	MHH	KRB
0	15.04.24	FIRST SUBMISSION	MHH	KRB

SCHEDULE OF REVISIONS

CITY OF Guelph — Making a Difference

ENGINEERING SERVICES

SANITARY DRAINAGE AREA PLAN

VICTORIA PARK VILLAGE

DESIGNED BY:

APPROVED BY:

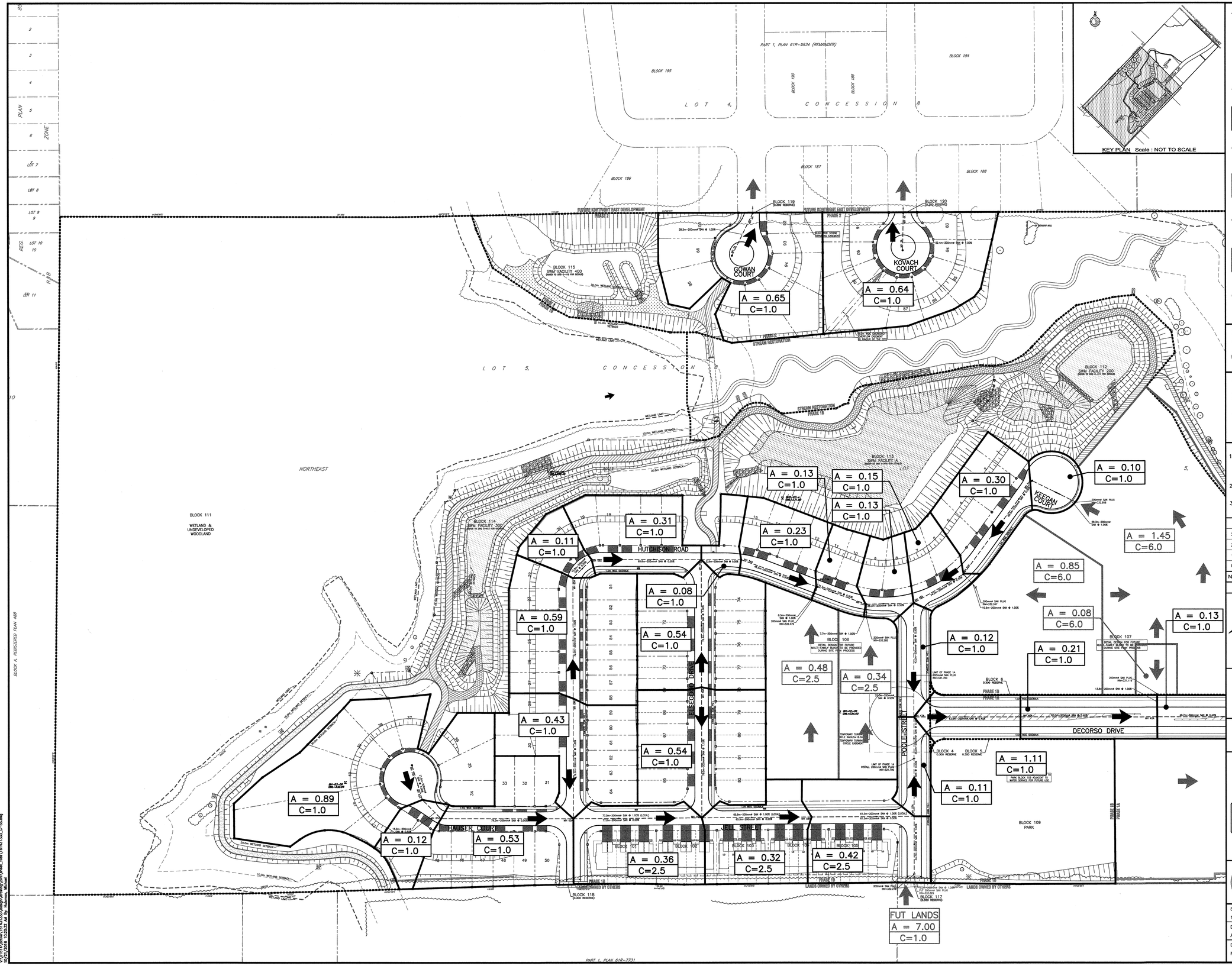
CERTIFIED ENGINEERING TECHNOLOGIST — OACETT — ONTARIO — Oct. 21/16 — KEVIN BROUSSEAU — Nº 804296

LICENSED PROFESSIONAL ENGINEER — K.M. FERGIN — OCT 21/16 — PROVINCE OF ONTARIO

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

SCALES: 1:1000	CHECKED BY: KRB
DATE DRAWN: APRIL 24/15	CONTRACT No. X-XXXX
DRAWN BY: MHH	DRAWING No. C-110

V:\01614\active\161433333\design\civil\drawing\civil\sheet_files\161433333_C-05.dwg
10/21/2016 10:20:08 AM By: Robinson, Michael



North:

LEGEND:

- A = 0.50 / C=1.0 — DRAINAGE AREA (HECTARES) / SANITARY CO-EFFICIENT (CUBIC METRES PER SECOND PER HECTARE)
- AREA BOUNDARY
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- FUTURE AREA BOUNDARY
- FUTURE FLOW DIRECTION

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NOTE: LOCATIONS OF UTILITY STRUCTURES ARE APPROX.
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No.	DATE	DESCRIPTION	BY:	CHKD.
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2	16.06.24	THIRD SUBMISSION	MHH	KRB
1	15.12.23	SECOND SUBMISSION	MHH	KRB
0	15.04.24	FIRST SUBMISSION	MHH	KRB

SCHEDULE OF REVISIONS

CITY OF Guelph — Making a Difference

ENGINEERING SERVICES

SANITARY DRAINAGE AREA PLAN

VICTORIA PARK VILLAGE

DESIGNED BY:

CERTIFIED ENGINEERING TECHNOLOGIST — ONTARIO — KEVIN BROUSSEAU — Nº 804296 — OCT 21/16

APPROVED BY:

LICENSED PROFESSIONAL ENGINEER — K.M. FERGIN — OCT 21/16 — PROVINCE OF ONTARIO

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

SCALES:	CHECKED BY:
1:1000	KRB
DATE DRAWN:	CONTRACT No.
APRIL 24/15	X-XXXX
DRAWN BY:	DRAWING No.
MHH	C-111

- 000

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10/21/2016 10:20:32 AM By: Malcolm Mitchell

SUBDIVISION
VICTORIA PARK VILLAGE
1159 VICTORIA ROAD SOUTH

SANITARY SEWER DESIGN SHEET

DATE: May 27, 2019
DESIGNED BY: KDB
CHECKED BY: KRB
FILE NUMBERS: 23T07506
THIRD SUBMISSION

DESIGN PARAMETERS: City of Guelph — 4.000

AVERAGE DAILY FLOW PER PERSON = 275 l/p/day
MINIMUM VELOCITY = 0.600 m/s
n = 0.013
MAX PEAK FAC.= 4.500
MIN PEAK FAC.= 1.500

RESIDENTIAL: 1.0000 L/s/ha
COMMERCIAL/INDUST: 1.7000 L/s/Ha
SCHOOL/MULTI FAMILY: 2.5000 L/s/Ha
APARTMENT 150U/HA 6.0000 L/s/Ha
APARTMENT 295U/Ha 7.0000 L/s/Ha
RESIDENTIAL HARMON PEAKING FACTOR

LOCATION			RESIDENTIAL AREA				COMM/INDUST				SCHOOL/MULTI-FAMILY				APT				C+I+I	TOTAL	PIPE					
STREET	FROM M.H.	TO M.H.	AREA (ha)	FLOW RATE (L/s/Ha)	FLOW (L/s)	CUMML. FLOW (L/s)	AREA (ha)	FLOW RATE (L/s/Ha)	FLOW (L/s)	CUMML. FLOW (L/s)	AREA (ha)	FLOW RATE (L/s/Ha)	FLOW (L/s)	CUMML. FLOW (L/s)	AREA (ha)	FLOW RATE (L/s/Ha)	FLOW (L/s)	CUMML. FLOW (L/s)	FLOW (L/s)	FLOW (L/s)	DIST (m)	DIA (mm)	SLOPE (%)	CAP. (FULL) (L/s)	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)	% Capacity
PHASE 1																											
HAUSER COURT																											
	70	62	0.89	1.000	0.890	0.890		1.70	0.00	0.00		2.50	0.00	0.00		6.00	0.00	0.00	0.000	0.890	21.60	200	1.0	31.9	1.03	0.41	2.8%
	62	61	0.12	1.000	0.120	1.010		1.70	0.00	0.00		2.50	0.00	0.00		6.00	0.00	0.00	0.000	1.010	15.90	200	0.5	22.6	0.73	0.34	4.5%
	61	60	0.53	1.000	0.530	1.540		1.70	0.00	0.00		2.50	0.00	0.00		6.00	0.00	0.00	0.000	1.540	79.30	200	0.5	22.6	0.73	0.38	6.8%
HUTCHISON RD																											
	64	60	0.43	1.000	0.430	0.430		1.70	0.00	0.00		2.50	0.00	0.00		6.00	0.00	0.00	0.000	0.430	72.00	200	1.3	36.3	1.17	0.00	1.2%
220 Arkel																											
	PLUG	60	1.44	1.000	1.440	1.440		1.70	0.00	0.00	1.68	2.50	4.20	4.20		6.00	0.00	0.00	4.200	5.64	39.70	200	1.0	31.9	1.03	0.74	17.7%
JELL STREET																											
	60	59	0.00	1.000	0.000	1.97		1.70	0.00	0.00	0.36	2.50	0.90	5.10		6.00	0.00	0.00	5.100	7.07	77.00	200	0.5	22.6	0.73	0.64	31.3%
ELSEGOOD DR																											
	56	59	0.54	1.000	0.540	0.540		1.70	0.00	0.00		2.50	0.00	0.00		6.00	0.00	0.00	0.000	0.540	78.00	200	1.15	34.1	1.10	0.00	1.6%
JELL STREET																											
	59	58	0.00	1.000	0.000	2.51		1.70	0.00	0.00	0.32	2.50	0.80	5.90		6.00	0.00	0.00	5.900	8.41	65.90	200	0.5	22.6	0.73	0.66	37.2%
	58	57	0.00	1.000	0.000	2.51		1.70	0.00	0.00	0.42	2.50	1.05	6.95		6.00	0.00	0.00	6.950	9.46	61.50	200	0.5	22.6	0.73	0.69	41.9%
POOLE STREET											(Area reduced from 7.0ha)																
	PLUG	57	0.00	1.000	0.000	0.000		1.70	0.00	0.00	5.00	2.50	12.50	12.50		6.00	0.00	0.00	12.500	12.500	39.70	200	1.0	31.9	1.03	0.95	39.2%
POOLE STREET	57	47	0.11	1.000	0.110	2.62		1.70	0.00	0.00		2.50	0.00	19.45		6.00	0.00	0.00	19.450	22.07	59.40	250	0.5	41.6	0.85	0.86	53.1%
HUTCHISON RD																											
	64	65	0.59	1.000	0.590	0.590		1.70	0.00	0.00		2.50	0.00	0.00		6.00	0.00	0.00	0.000	0.590	72.00	200	1.0	31.9	1.03	0.00	1.8%
	65	66	0.11	1.000	0.110	0.700		1.70	0.00	0.00		2.50	0.00	0.00		6.00	0.00	0.00	0.000	0.700	15.80	200	0.5	22.6	0.73	0.29	3.1%
	66	55	0.31	1.000	0.310	1.010		1.70	0.00	0.00		2.50	0.00	0.00		6.00	0.00	0.00	0.000	1.010	65.80	200	0.5	22.6	0.73	0.34	4.5%
ELSEGOOD DR																											
	56	55	0.54	1.000	0.540	0.540		1.70	0.00	0.00		2.50	0.00	0.00		6.00	0.00	0.00	0.000	0.540	76.30	200	1.0	31.9	1.03	0.00	1.7%
HUTCHISON RD																											
	55	54	0.08	1.000	0.080	1.630		1.70	0.00	0.00		2.50	0.00	0.00		6.00	0.00	0.00	0.000	1.630	23.90	200	0.5	22.6	0.73	0.38	7.2%
	54	53	0.23	1.000	0.230	1.860		1.70	0.00	0.00		2.50	0.00	0.00		6.00	0.00	0.00	0.000	1.860	48.50	200	0.5	22.6	0.73	0.42	8.2%
BLOCK 106 WEST																											
	PLUG	53	0.00	1.000	0.000	0.000		1.70	0.00	0.00	0.48	2.50	1.20	1.20		6.00	0.00	0.00	1.200	1.200	8.50	200	1.0	31.9	1.03	0.41	3.8%
HUTCHISON RD																											
	53	52	0.13	1.000	0.130	1.990		1.70	0.00	0.00		2.50	0.00	1.20		6.00	0.00	0.00	1.200	3.190	31.30	200	0.5	22.6	0.73	0.50	14.1%
BLOCK 106 EAST																											
	PLUG	52	0.00	1.000	0.000	0.000		1.70	0.00	0.00	0.34	2.50	0.85	0.85		6.00	0.00	0.00	0.850	0.850	7.60	200	1.0	31.9	1.03	0.41	2.7%
HUTCHISON RD																											
	52	48	0.13	1.000	0.130	2.120		1.70	0.00	0.00		2.50	0.00	2.05		6.00	0.00	0.00	2.050	4.170	28.30	200	0.5	22.6	0.73	0.54	18.5%
BLOCK 107 EAST																											
	PLUG	51	0.10	1.000	0.100	0.100		1.70	0.00	0.00		2.50	0.00	0.00	1.45	6.00	8.70	8.70	8.700	8.800	29.30	200	1.0	31.9	1.03	0.84	27.6%
	51	50	0.30	1.000	0.300	0.400		1.70	0.00	0.00		2.50	0.00	0.00		6.00	0.00	8.70	8.700	9.100	69.50	200	0.5	22.6	0.73	0.69	40.3%

SUBDIVISION

VICTORIA PARK VILLAGE
1159 VICTORIA ROAD SOUTH

SANITARY SEWER DESIGN SHEET

DATE: May 27, 2019
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n = 0.013
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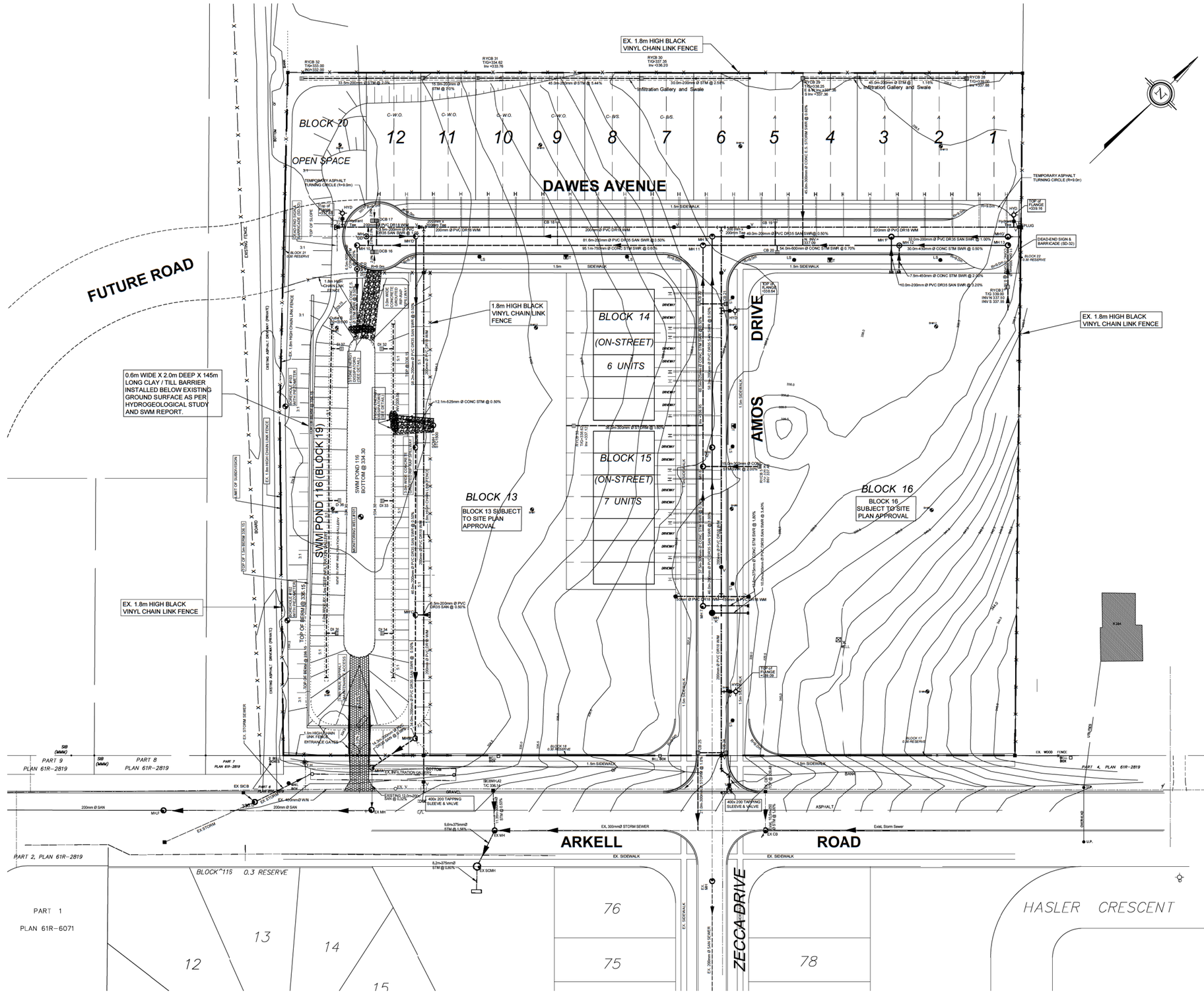
MIN PEAK FAC.= 1.500

RESIDENTIAL: 1.0000 L/s/ha
COMMERCIAL/INDUST: 1.7000 L/s/Ha
SCHOOL/MULTI FAMILY: 2.5000 L/s/Ha
APARTMENT 150U/HA 6.0000 L/s/Ha
APARTMENT 295U/Ha 7.0000 L/s/Ha
RESIDENTIAL HARMON PEAKING FACTOR

LOCATION			RESIDENTIAL AREA				COMM/INDUST				SCHOOL/MULTI-FAMILY				APT				C+I+I	TOTAL	PIPE					
STREET	FROM M.H.	TO M.H.	AREA (ha)	FLOW RATE (L/s/Ha)	FLOW (L/s)	CUMML. FLOW (L/s)	AREA (ha)	FLOW RATE (L/s/Ha)	FLOW (L/s)	CUMML. FLOW (L/s)	AREA (ha)	FLOW RATE (L/s/Ha)	FLOW (L/s)	CUMML. FLOW (L/s)	AREA (ha)	FLOW RATE (L/s/Ha)	FLOW (L/s)	CUMML. FLOW (L/s)	FLOW (L/s)	FLOW (L/s)	DIST (m)	DIA (mm)	SLOPE (%)	CAP. (FULL) (L/s)	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)	% Capacity
BLOCK 107 WEST																										
	PLUG	50	0.00	1.000	0.000	0.000		1.70	0.00	0.00		2.50	0.00	0.00	0.85	6.00	5.10	5.10	5.100	5.100	10.90	200	1.0	31.9	1.03	0.71	16.0%
HUTCHISON RD																										
	50	48	0.15	1.000	0.150	0.550		1.70	0.00	0.00		2.50	0.00	0.00		6.00	0.00	13.80	13.800	14.350	34.50	200	0.5	22.6	0.73	0.77	63.5%
POOLE STREET																										
	48	47	0.12	1.000	0.120	2.79		1.70	0.00	0.00		2.50	0.00	2.05		6.00	0.00	13.80	15.850	18.640	68.20	250	0.5	41.6	0.85	0.82	44.8%
DECORSO DR																										
	47	46	1.11	1.000	1.110	6.52		1.70	0.00	0.00		2.50	0.00	21.50		6.00	0.00	13.80	35.300	41.820	63.90	300	0.4	61.8	0.87	0.94	67.7%
	46	45	0.21	1.000	0.210	6.730		1.70	0.00	0.00		2.50	0.00	21.50		6.00	0.00	13.80	35.300	42.030	82.00	300	0.4	61.8	0.87	0.94	68.0%
BLOCK 107 SOUTH																										
	PLUG	45	0.00	1.000	0.000	0.000		1.70	0.00	0.00		2.50	0.00	0.00	0.08	6.00	0.48	0.48	0.480	0.480	13.80	200	1.0	31.9	1.03	0.00	1.5%
DECORSO DR																										
	45	44	0.13	1.000	0.130	6.860		1.70	0.00	0.00		2.50	0.00	21.50		6.00	0.00	14.28	35.780	42.640	48.70	300	0.4	61.8	0.87	0.94	69.0%
	44	43	0.20	1.000	0.200	7.060		1.70	0.00	0.00		2.50	0.00	21.50		6.00	0.00	14.28	35.780	42.840	76.50	300	0.4	61.8	0.87	0.94	69.3%
	43	42	0.17	1.000	0.170	7.230		1.70	0.00	0.00		2.50	0.00	21.50		6.00	0.00	14.28	35.780	43.010	65.70	300	0.4	61.8	0.87	0.94	69.6%
BLOCK 1																										
	PLUG	42	0.00	1.000	0.000	0.000		1.70	0.00	0.00	1.85	2.50	4.63	4.63		6.00	0.00	0.00	4.630	4.630	13.00	200	1.0	31.9	1.03	0.71	14.5%
DECORSO DR																										
	42	41	0.23	1.000	0.230	7.460		1.70	0.00	0.00		2.50	0.00	26.13		6.00	0.00	14.28	40.410	47.870	87.10	300	0.4	61.8	0.87	0.97	77.5%
	41	40	0.10	1.000	0.100	7.560		1.70	0.00	0.00		2.50	0.00	26.13		6.00	0.00	14.28	40.410	47.970	40.10	300	0.4	61.8	0.87	0.97	77.6%
	40	39	0.09	1.000	0.090	7.650		1.70	0.00	0.00		2.50	0.00	26.13		6.00	0.00	14.28	40.410	48.060	37.80	300	0.4	61.8	0.87	0.97	77.8%
	39	*Ex 38*	*0.00*	*1.000*	*0.000*	*7.650*		*1.70*	*0.00*	*0.00*		*2.50*	*0.00*	*26.13*		*6.00*	*0.00*	*14.28*	*40.410*	*48.060*	*19.60*	*300*	*0.4*	*61.8*	*0.87*	*0.97*	*77.8%*

APPENDIX D

Stormwater Management
Stormwater Management Hydrologic Model
Design Calculations



LEGEND

- CB 19 — CATCH BASIN
- WATERMAIN
- SANITARY SEWER
- STORM SEWER
- VALVE
- LS — LIGHT STANDARD
- TF — TRANSFORMER

THE POSITION OF POLES, LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR SHALL INFORM HIMSELF OF THE EXACT LOCATION OF SUCH UTILITIES AND STRUCTURES, AND SHALL ASSUME ALL LIABILITY FROM DAMAGE TO THEM.

GENERAL NOTES:

FIELD NOTES: PLAN REFERENCES:

BENCH MARK: No. 392 ELEVATION: 336.245

PLAN REFERENCES: TRAFFIC CONTROL BOX PAD SW CORNER OF ARKELL AND VICTORIA RD.

No.	DATE	DESCRIPTION	INTL
6	29/04/14	GENERAL REVISIONS	KJB
5	15/11/13	MHS 'C', 'F', '2','7', 'K' RELOCATED	KJB
4	15/07/13	ISSUED FOR TENDER	KJB
3	03/06/13	GENERAL REVISIONS	KJB
2	29/04/13	GENERAL REVISIONS	KJB
1	12/02/13	GENERAL REVISIONS	KJB

SCHEDULE OF REVISIONS

CITY OF Guelph — Making a Difference

ENGINEERING SERVICES

ARKELL MEADOWS SUBDIVISION GUELPH, ONTARIO

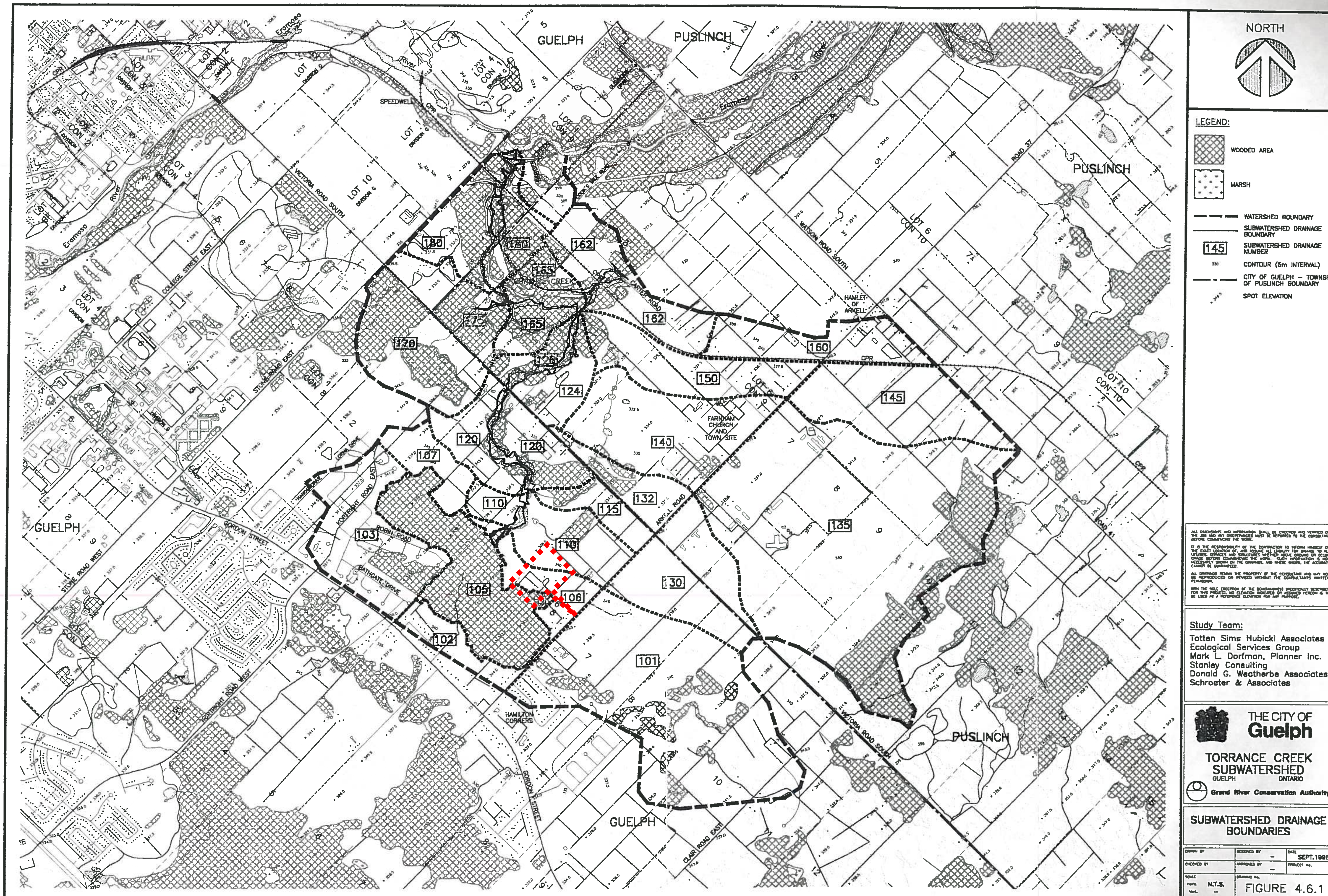
GENERAL SERVICING PLAN

K. J. BEHM — 01/05/14 — PROFESSIONAL ENGINEER — PROVINCE OF ONTARIO

CHECKED: APPROVED:

K. J. BEHM AND ASSOCIATES INC.
CONSULTING ENGINEERS
55 ERB STREET EAST, SUITE 320
WATERLOO, ONTARIO N2J 4K8
PHONE (519) 742 3510 FAX (519) 742 3462

DESIGNED BY: KJB	SCALES Hor.=1:500 Vert.=1:50	DRAWING. NO.	
DRAWN BY: SMS	DATE DRAWN: SEPT 2009	H-1	
CHECKED BY: KJB	CONTRACT NO.: 2-1311		


NORTH
LEGEND:
WOODED AREA
MARSH
WATERSHED BOUNDARY
SUBWATERSHED DRAINAGE BOUNDARY
145 SUBWATERSHED DRAINAGE NUMBER
CONTOUR (5m INTERVAL)
CITY OF GUELPH – TOWNSHIP OF PUSLINCH BOUNDARY
SPOT ELEVATION
GUELPH
PUSLINCH
HAMLET OF ARKELL
FARNHAM CHURCH AND TOWN SITE
HAMILTON CORNERS
VICTORIA ROAD SOUTH
WATSON ROAD SOUTH
STONE ROAD EAST
STONE ROAD WEST
GORDON STREET
COLLEGE STREET EAST
ARKELL ROAD
KORTRIGHT ROAD EAST
KORTRIGHT ROAD WEST
CLAIR ROAD EAST
ROBIN ROAD
BATHGATE DRIVE
SPEEDWELL
CPR
TORRANCE CREEK
Eramosa River
180
160
162
165
175
185
170
176
150
124
160
145
140
120
107
126
110
132
115
135
103
110
105
106
130
102
101
ALL DIMENSIONS AND INFORMATION SHALL BE CHECKED AND VERIFIED ON THE JOB AND ANY DISCREPANCIES MUST BE REPORTED TO THE CONSULTANT BEFORE COMMENCING THE WORK.
IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO INFORM HIMSELF OF THE EXACT LOCATION OF, AND ASSUME ALL LIABILITY FOR DAMAGE TO ALL UTILITIES, SERVICES AND STRUCTURES WHETHER ABOVE GROUND OR BELOW GRADE BEFORE COMMENCING THE WORK. SUCH INFORMATION IS NOT NECESSARILY SHOWN ON THE DRAWINGS, AND WHERE SHOWN, THE ACCURACY CANNOT BE GUARANTEED.
ALL DRAWINGS REMAIN THE PROPERTY OF THE CONSULTANT AND MAY NOT BE REPRODUCED OR REVISED WITHOUT THE CONSULTANTS WRITTEN PERMISSION.
WITH THE SOLE EXCEPTION OF THE BENCHMARK(S) SPECIFICALLY DESCRIBED FOR THIS PROJECT, NO ELEVATION INDICATED OR ASSUMED HEREON IS TO BE USED AS A REFERENCE ELEVATION FOR ANY PURPOSE.
Study Team:
Totten Sims Hubicki Associates
Ecological Services Group
Mark L. Dorfman, Planner Inc.
Stanley Consulting
Donald G. Weatherbe Associates
Schroeter & Associates
THE CITY OF Guelph
TORRANCE CREEK SUBWATERSHED
GUELPH ONTARIO
Grand River Conservation Authority
SUBWATERSHED DRAINAGE BOUNDARIES
DRAWN BY
DESIGNED BY –
DATE SEPT.1998
CHECKED BY
APPROVED BY –
PROJECT No.
SCALE Horiz. N.T.S. Vert. –
DRAWING No.
FIGURE 4.6.1

```
* Torrance Creek   Watershed Model
* ================================================================================
* File created by Dr. H.O. Schroeter, P.Eng., April 17, 1998
* Revised: May 18, 1998; September 17, 1998
* ================================================================================
* Soil Drainage parameters
* ========================
* Note: Here, soil zones defined by infiltrability and cover type.
* Zone Descriptions:
*   1=Impervious
*   2=wetlands
*   3=Low vegetative cover, lacustrine, kame outwash sand, like muck
*   4=Low vegetative cover, Wentworth Till (sandy till)
*   5=Low vegetative cover, Kame, eskers, sand and gravel
*   6=Low vegetative cover, Outwash gravel
*   7=Forest Cover, bedrock
*   8=Forest Cover, Like RU 4 and 5 but lumped together
*   9=Forest Cover, Outwash gravel
*
READ SOIL PARAMETERS  NZONE=9
                          Wet    Low Vegetative Cover      Forest Cover
                     IMP Lands Muck STill S & G Gravel BedR  Sand Gravel
                DS=    2   200     5   5.0   5.0   6.0  10.0  15.0  15.0
                KEFF=  0   0.5   2.0   8.0  16.0  20.0   4.0  40.0  60.0
                CS=    0   0.5   1.5   6.0  12.0  15.0   3.0  30.0  45.0
                D=     0   0.5   0.1   0.4   1.6   2.0   0.4   4.0   6.0
                SAV=   0   200   200   200   200   200   200   200   200
                HI=    0  0.01   100   100   100   150   200   200   200
                SMCI=  0  0.56  0.56  0.46  0.46  0.40  0.40  0.46  0.40
                FCAPI= 0  0.46  0.46  0.23  0.23  0.10  0.10  0.23  0.10
                IMCI=  0  0.46  0.46  0.23  0.23  0.10  0.10  0.23  0.10
                WILTI= 0  0.27  0.27  0.07  0.07  0.04  0.04  0.07  0.04
                HII=   0  0.01   400   800   800  1000   800  1000  1000
                SMCII= 0  0.56  0.56  0.46  0.46  0.40  0.40  0.46  0.40
                FCAPII=0  0.46  0.46  0.23  0.23  0.10  0.10  0.23  0.10
                IMCII= 0  0.46  0.46  0.23  0.23  0.10  0.10  0.23  0.10
                WILTII=0  0.27  0.27  0.07  0.07  0.04  0.04  0.07  0.04
                X=     0    1     1     1     0     0     1     0     0
                FATR=  1    1     1     1     1     1     1     1     1
                INCS=  0   2.0   0.5   0.5   1.0   1.0   2.5   2.5   2.5
*
* Go to event file
*
CHANGE INPUT FILE
*
* Typical off-channel (Flat areas)                                        6
*
COMPUTE RATING CURVE ID=1  VS=     1.000   NSEGS=3
                      MIN EL= 100.00    MAX EL= 100.60
                      CHNSLP= 0.0050    FLNSLP= 0.0050
                      N= 0.350  DIST=   39.15
                      N=-0.150  DIST=   40.85
                      N= 0.350  DIST=   80.00
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  100.60    39.15  100.20    39.75  100.00
                       40.25  100.00    40.85  100.20    80.00  100.60
                     RFN=0.0000 PCODE=1
*
* Typical off-channel (Steep areas)                                       6
*
COMPUTE RATING CURVE ID=5  VS=     2.000   NSEGS=3
                      MIN EL= 100.00    MAX EL= 100.80
                      CHNSLP= 0.0100    FLNSLP= 0.0100
```



```
                      N= 0.350  DIST=   24.45
                      N=-0.150  DIST=   25.55
                      N= 0.350  DIST=   50.00
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  100.80    24.45  100.30    24.75  100.00
                       25.50  100.00    25.55  100.30    50.00  100.80
                     RFN=0.0000 PCODE=1
*
* Part of SW quadrant of Arkell & Victoria Rd Intersect.
* VS=   1.000 is main channel & VS=   2.000 is off-channel
*
COMPUTE FLOWRATE    ID=1 NHD= 130 AREA=   0.5030 Sq km  L=  1230 m  W=   410 m
             SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                    2.0   0.0  0.0   5.0  0.6  92.4  0.0   0.0  0.0
                   RATING CURVES: IDMC=1 IDOC=5 QRMC= 0.50 QROC= 0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
*
* Divert flow from 130 into ground and hold
*
DIVERT FLOWS        INFLO/THRU=1 DIVERT ID=5 HYD=3130 PCODE=1 OPTION=1
                    INLET CAPACITY=   0.4600 CMS  IDFLAG=2 IDSTOR=0
*
* SECTION G-G                                                             16
*
COMPUTE RATING CURVE ID=2  VS= 20062.900   NSEGS=3
                      MIN EL= 322.96    MAX EL= 324.00
                      CHNSLP= 0.0190    FLNSLP= 0.0190
                      N= 0.120  DIST=   18.72
                      N=-0.070  DIST=   30.22
                      N= 0.120  DIST=   70.00
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  323.12     6.89  323.02     7.57  323.05
                       14.21  323.03    18.41  323.17    18.72  323.17
                       22.17  323.15    24.17  322.96    25.00  322.98
                       30.22  323.11    30.85  323.08    31.38  323.05
                       39.24  323.05    39.88  323.05    50.00  323.14
                       70.00  324.00
                     RFN=0.0000 PCODE=1
*
* Route 3130 through reach   30
* Using Valley Section  20062.900 As channel Rating Curve
*
ROUTE CHANNEL       ID=2 HYD NO=  30 INFLOW=5 LENGTH=   800 m  SLOPE=0.0062
                    RCID=2 NS=1 PCODE=1 INDEX=1 PIPE=0 CANOPY=  0.0%
*
* Compute runoff hydrograph from area  132
* VS=   1.000 is main channel & VS=   2.000 is off-channel
*
COMPUTE FLOWRATE    ID=3 NHD= 132 AREA=   0.1730 Sq km  L=   450 m  W=   250 m
             SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                    2.0   0.0  0.0   0.0  0.0  81.3  0.0   5.2 11.5
                   RATING CURVES: IDMC=1 IDOC=5 QRMC= 0.50 QROC= 0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
*
* Sum hydr.  132 &   30 call result  232
*
ADD HYD             ID=4 HYD NO= 232 IDA=3 IDB=2 ICODE=0                  AREA=
```

```
0.173
*
* Area draining U of G Poultry Farm
* VS=   1.000 is main channel & VS=   2.000 is off-channel
*
COMPUTE FLOWRATE    ID=2 NHD= 135 AREA=   2.2800 Sq km  L=  1900 m  W=   650 m
               SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                      2.0   0.0  0.0   8.3  8.8  66.7  0.0  12.9  1.2
                    RATING CURVES: IDMC=1 IDOC=5 QRMC= 0.50 QROC= 0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=2 RBPCODE=0 FACTOR= 0.347
                    ILEVEL= 250.000      HDIFF=    8.0 QO=   0.0000
                    ZG= 250.000 CG=   0.000 EG=   1.000 Gate
                    ZS= 256.000 CS= 100.000 ES=   1.500 Spillway
                    ZO= 250.000  K=  22.000 DZ=     4.0 Recharge
                    AS=  80.000 AN=   0.000  N=   0.000 Storage
                    FSS=0.000 FGW=0.000 GLEVEL=  0.000 QGWI=  0.0000
                    IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0 GWFACT=0.00 GWON=0
*
* Divert flow from 135 into ground and hold
*
DIVERT FLOWS        INFLO/THRU=2 DIVERT ID=5 HYD=3135 PCODE=1 OPTION=1
                    INLET CAPACITY=   0.9000 CMS  IDFLAG=2 IDSTOR=0
*
* Add GW components from 130 and 135 together
*
ADD HYD             ID=3 HYD NO=4135 IDA=1 IDB=2 ICODE=0                  AREA=
0.000
*
* Route flows through Channel 35
* Using Valley Section  20062.900 As channel Rating Curve
*
ROUTE CHANNEL       ID=1 HYD NO=  35 INFLOW=5 LENGTH=   800 m  SLOPE=0.0062
                    RCID=2 NS=1 PCODE=1 INDEX=1 PIPE=0 CANOPY=  0.0%
*
* Part of Southern Tributary thru Golf Course
* VS=   1.000 is main channel & VS=   2.000 is off-channel
*
COMPUTE FLOWRATE    ID=2 NHD= 140 AREA=   0.5890 Sq km  L=   970 m  W=   365 m
               SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                      7.3   0.0  0.0   0.0  0.0  89.3  0.0   0.0  3.3
                    RATING CURVES: IDMC=1 IDOC=5 QRMC= 0.50 QROC= 0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
*
* Sum hydr.  140 &   35 call result  235
*
ADD HYD             ID=5 HYD NO= 235 IDA=2 IDB=1 ICODE=0                  AREA=
0.589
*
* Southern Tributary through Golf Course
*
ADD HYD             ID=1 HYD NO= 240 IDA=5 IDB=4 ICODE=0                  AREA=
0.762
*
* Route  240 through reach   40
* Using Valley Section  20062.900 As channel Rating Curve
*
ROUTE CHANNEL       ID=2 HYD NO=  40 INFLOW=1 LENGTH=   900 m  SLOPE=0.0062
                    RCID=2 NS=1 PCODE=1 INDEX=1 PIPE=0 CANOPY=  0.0%
```



```
*
* Compute runoff hydrograph from area  145
* VS=   1.000 is main channel & VS=   2.000 is off-channel
*
COMPUTE FLOWRATE    ID=1 NHD= 145 AREA=   0.5540 Sq km  L=  1680 m  W=   315 m
               SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                      2.0   0.0  0.0  12.9  0.0  85.1  0.0   0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=5 QRMC= 0.50 QROC= 0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
*
* Divert flow from 145 into ground
*
DIVERT FLOWS        INFLO/THRU=1 DIVERT ID=5 HYD=3145 PCODE=1 OPTION=1
                    INLET CAPACITY=   0.4200 CMS  IDFLAG=2 IDSTOR=0
*
* Add GW components from 145 to running total
*
ADD HYD             ID=4 HYD NO=4145 IDA=3 IDB=1 ICODE=0                  AREA=
0.000
*
* Valley Section for Channel 35                                          5
*
COMPUTE RATING CURVE ID=3  VS=    35.000   NSEGS=3
                      MIN EL= 335.00    MAX EL= 337.50
                      CHNSLP= 0.0010    FLNSLP= 0.0010
                      N= 0.120  DIST=   20.00
                      N=-0.080  DIST=   40.00
                      N= 0.120  DIST=   60.00
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  337.50    20.00  335.20    30.00  335.00
                       40.00  335.20    60.00  337.50
                     RFN=0.0000 PCODE=1
*
* Eastern Side of Arkell U of G Farm
* Using Valley Section     35.000 As channel Rating Curve
*
ROUTE CHANNEL       ID=1 HYD NO=  50 INFLOW=5 LENGTH=  1240 m  SLOPE=0.0010
                    RCID=3 NS=1 PCODE=1 INDEX=1 PIPE=0 CANOPY=  0.0%
*
* Compute runoff hydrograph from area  150
* VS=   1.000 is main channel & VS=   2.000 is off-channel
*
COMPUTE FLOWRATE    ID=3 NHD= 150 AREA=   0.3990 Sq km  L=   500 m  W=   207 m
               SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                      6.6   0.0  0.0   0.0  0.0  87.3  0.0   0.0  6.1
                    RATING CURVES: IDMC=1 IDOC=5 QRMC= 0.50 QROC= 0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
*
* Sum hydr.  150 &   50 call result  245
*
ADD HYD             ID=5 HYD NO= 245 IDA=3 IDB=1 ICODE=0                  AREA=
0.399
*
* Outflow from Southern Tributary =================
*
ADD HYD             ID=1 HYD NO= 250 IDA=2 IDB=5 ICODE=0                  AREA=
1.161
```

```
*
PRINT HYD           ID=1 PCODE=1
*
* Divert flow from 250 into ground
*
DIVERT FLOWS        INFLO/THRU=1 DIVERT ID=5 HYD=3250 PCODE=1 OPTION=5
                    PERCENT INFLOW= 90.00 IDFLAG=2 IDSTOR=0
*
* Add GW from 250 to running total
*
ADD HYD             ID=2 HYD NO=4250 IDA=4 IDB=1 ICODE=0                  AREA=
0.000
*
* Area u/s Arkell Road, inc Hamilton Corners
* VS=   1.000 is main channel & VS=   2.000 is off-channel
*
COMPUTE FLOWRATE    ID=1 NHD= 101 AREA=   1.4200 Sq km  L=  2290 m  W=   625 m
               SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                      3.1   0.0  0.0   7.2 33.2  43.8  0.0   4.5  8.2
                    RATING CURVES: IDMC=1 IDOC=5 QRMC= 0.50 QROC= 0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=2 RBPCODE=0 FACTOR= 0.386
                    ILEVEL= 250.000      HDIFF=    8.0 QO=   0.0000
                    ZG= 250.000 CG=   0.000 EG=   1.000 Gate
                    ZS= 256.000 CS= 100.000 ES=   1.500 Spillway
                    ZO= 250.000  K=  20.000 DZ=     4.0 Recharge
                    AS=  55.230 AN=   0.000  N=   0.000 Storage
                    FSS=0.000 FGW=0.000 GLEVEL=  0.000 QGWI=  0.0000
                    IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0 GWFACT=0.00 GWON=0
*
* Divert flow from 101 into ground
*
DIVERT FLOWS        INFLO/THRU=1 DIVERT ID=6 HYD=3101 PCODE=1 OPTION=1
                    INLET CAPACITY=   0.4800 CMS  IDFLAG=2 IDSTOR=0
*
* Add GW from 101 to running total
*
ADD HYD             ID=3 HYD NO=4101 IDA=2 IDB=1 ICODE=0                  AREA=
0.000
*
* Typical Urban Cross-section                                            6
*
COMPUTE RATING CURVE ID=4  VS=     3.000   NSEGS=3
                     MIN EL= 120.00    MAX EL= 125.00
                     CHNSLP= 0.0050    FLNSLP= 0.0050
                     N= 0.015  DIST=   33.30
                     N=-0.015  DIST=   66.67
                     N= 0.015  DIST=  100.00
                       DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  125.00     0.01  120.00    33.33  120.00
                       66.67  120.00    99.99  120.00   100.00  125.00
                     RFN=0.0000 PCODE=1
*
* Typical Urban Cross-section                                            6
*
COMPUTE RATING CURVE ID=6  VS=     3.000   NSEGS=3
                     MIN EL= 120.00    MAX EL= 125.00
                     CHNSLP= 0.0050    FLNSLP= 0.0050
                     N= 0.015  DIST=   33.30
                     N=-0.015  DIST=   66.67
                     N= 0.015  DIST=  100.00
                       DIST    ELEV     DIST    ELEV     DIST    ELEV
```



```
                        0.00  125.00     0.01  120.00    33.33  120.00
                       66.67  120.00    99.99  120.00   100.00  125.00
                     RFN=0.0000 PCODE=1
*
* Southwestern urban area
* VS=   3.000 is main channel & VS=   3.000 is off-channel
*
COMPUTE FLOWRATE    ID=1 NHD= 102 AREA=   0.1400 Sq km  L=   450 m  W=    50 m
               SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                      25.0   0.0 17.0  58.0  0.0   0.0  0.0   0.0  0.0
                    RATING CURVES: IDMC=4 IDOC=6 QRMC= 0.25 QROC= 0.15
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
*
* Part 1 of Inflow to big swamp
*
ADD HYD             ID=2 HYD NO= 202 IDA=6 IDB=1 ICODE=0                  AREA=
0.140
*
* Compute runoff hydrograph from area  103
* VS=   3.000 is main channel & VS=   3.000 is off-channel
*
COMPUTE FLOWRATE    ID=1 NHD= 103 AREA=   0.4620 Sq km  L=   450 m  W=    50 m
               SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                      35.0   0.0  4.8   4.7 48.1   0.0  0.0   7.4  0.0
                    RATING CURVES: IDMC=4 IDOC=4 QRMC= 0.25 QROC= 0.15
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
*
* Part 2 inflow to big swamp
*
ADD HYD             ID=4 HYD NO= 203 IDA=1 IDB=2 ICODE=0                  AREA=
0.602
*
* Divert flow from 203 into ground
*
DIVERT FLOWS        INFLO/THRU=4 DIVERT ID=6 HYD=3203 PCODE=1 OPTION=1
                    INLET CAPACITY=   0.0008 CMS  IDFLAG=2 IDSTOR=0
*
* Add GW from 250 to running total
*
ADD HYD             ID=1 HYD NO=4203 IDA=3 IDB=4 ICODE=0                  AREA=
0.000
*
* Catchment area directly to swamp
* VS=   1.000 is main channel & VS=   2.000 is off-channel
*
COMPUTE FLOWRATE    ID=2 NHD= 105 AREA=   0.6830 Sq km  L=   826 m  W=   826 m
               SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                      2.0  98.0  0.0   0.0  0.0   0.0  0.0   0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=5 QRMC= 0.50 QROC= 0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 3.0 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
*
* Part 3 inflow to big swamp
*
ADD HYD             ID=3 HYD NO= 205 IDA=2 IDB=6 ICODE=0                  AREA=
```

```
0.683
*
* Compute runoff hydrograph from area  106
* VS=   1.000 is main channel & VS=   2.000 is off-channel
*
COMPUTE FLOWRATE    ID=2 NHD= 106 AREA=   0.1870 Sq km  L=  1000 m  W=   350 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     2.8   0.0  8.0  24.8  0.0  64.4  0.0   0.0  0.0
                   RATING CURVES: IDMC=1 IDOC=5 QRMC= 0.50 QROC= 0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
*
* Part 4 inflow to big swamp
*
ADD HYD             ID=4 HYD NO= 206 IDA=2 IDB=3 ICODE=0                  AREA=
0.870
*
* Compute runoff hydrograph from area  107
* VS=   1.000 is main channel & VS=   2.000 is off-channel
*
COMPUTE FLOWRATE    ID=2 NHD= 107 AREA=   0.1880 Sq km  L=  1000 m  W=   200 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     2.0   0.0  9.0  31.9 51.8   5.3  0.0   0.0  0.0
                   RATING CURVES: IDMC=1 IDOC=5 QRMC= 0.50 QROC= 0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
*
* Part 5 inflow to big swamp
*
ADD HYD             ID=3 HYD NO= 207 IDA=2 IDB=4 ICODE=0                  AREA=
1.058
*
PRINT HYD           ID=3 PCODE=1
*
* Route flows through Big Swamp
*
ROUTE RESERVOIR     ID=2 HYD NO= 505 INFLOW=3 PCODE=0 OPTION=1
                    ILEVEL=  -1.000  HDIFF=    6.0
                    CONSTANT OUTFLOW  QO=   0.0000
                    ZG= 331.100 CG=   0.900 EG=   0.500 Gate
                    ZS= 333.000 CS=   6.000 ES=   1.500 Spillway
                    ZO= 331.000 AS=  30.000 AN=  55.280 N= 2.000
*
* Go to event file: Route flows through Big Swamp
*
CHANGE INPUT FILE
*
* Area contributing to Headwater Pond (No. 8)
* VS=   1.000 is main channel & VS=   2.000 is off-channel
*
COMPUTE FLOWRATE    ID=3 NHD= 110 AREA=   0.3330 Sq km  L=  1030 m  W=   260 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     2.6   0.0  7.7  13.7  8.3  60.7  0.0   0.4  6.6
                   RATING CURVES: IDMC=1 IDOC=5 QRMC= 0.50 QROC= 0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
*
```



```
* Inflow to Pond 8
*
ADD HYD             ID=4 HYD NO= 210 IDA=3 IDB=2 ICODE=0                  AREA=
1.391
*
* Route flows through Pond 8
*
ROUTE RESERVOIR     ID=2 HYD NO= 510 INFLOW=4 PCODE=0 OPTION=1
                    ILEVEL=  -1.000  HDIFF=    6.0
                    CONSTANT OUTFLOW  QO=   0.0000
                    ZG= 330.670 CG=   0.500 EG=   0.500 Gate
                    ZS= 331.400 CS=   4.000 ES=   1.500 Spillway
                    ZO= 330.670 AS=   0.000 AN=   0.150 N= 2.100
*
* SECTION U-U                                                           17
*
COMPUTE RATING CURVE ID=3  VS=  3577.700   NSEGS=3
                      MIN EL= 329.90    MAX EL= 331.26
                      CHNSLP= 0.0062    FLNSLP= 0.0062
                      N= 0.120  DIST=   20.62
                      N=-0.070  DIST=   31.58
                      N= 0.120  DIST=   60.00
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                         0.00  330.81    20.62  330.63    28.86  330.38
                        28.92  330.36    29.59  329.90    29.60  329.91
                        30.00  329.91    30.20  329.94    30.27  329.97
                        31.58  330.54    31.74  330.54    38.81  331.26
                        39.13  331.25    39.71  331.26    40.92  331.23
                        54.92  330.94    60.00  330.59
                     RFN=0.0000 PCODE=1
*
* Route  510 through reach   10
* Using Valley Section   3577.700 As channel Rating Curve
*
ROUTE CHANNEL       ID=3 HYD NO=  10 INFLOW=2 LENGTH=  1030 m  SLOPE=0.0062
                    RCID=3 NS=1 PCODE=1 INDEX=1 PIPE=0 CANOPY=  0.0%
*
* South Central Area (includes Victoria Road)
* VS=   1.000 is main channel & VS=   2.000 is off-channel
*
COMPUTE FLOWRATE    ID=2 NHD= 115 AREA=   0.1250 Sq km  L=   430 m  W=   290 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     2.7   0.0 40.9   0.0  0.0  39.9  0.0  16.5  0.0
                   RATING CURVES: IDMC=1 IDOC=5 QRMC= 0.50 QROC= 0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
*
* Sum hydr.  115 &   10 call result  215
*
ADD HYD             ID=4 HYD NO= 215 IDA=2 IDB=3 ICODE=0                  AREA=
1.516
*
* Remove some flow from groundwater
*
DIVERT FLOWS        INFLO/THRU=1 DIVERT ID=6 HYD= 415 PCODE=1 OPTION=5
                    PERCENT INFLOW= 50.00 IDFLAG=2 IDSTOR=0
*
* Sum hydr.  415 &  215 call result 1215
*
ADD HYD             ID=2 HYD NO=1215 IDA=6 IDB=4 ICODE=0                  AREA=
1.516
```

```
*
* SECTION S-S                                                              16
*
COMPUTE RATING CURVE ID=3  VS=  3101.800   NSEGS=3
                      MIN EL= 328.22    MAX EL= 329.25
                      CHNSLP= 0.0021    FLNSLP= 0.0021
                      N= 0.120  DIST=   10.85
                      N=-0.070  DIST=   11.26
                      N= 0.120  DIST=   50.00
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  328.60     0.62  328.61     1.16  328.62
                        6.20  328.69    10.85  328.47    10.94  328.22
                       11.26  328.44    12.47  328.66    12.52  328.70
                       15.00  328.70    17.49  328.71    20.94  328.72
                       21.20  328.71    23.23  328.72    30.00  328.72
                       50.00  329.25
                     RFN=0.0000 PCODE=1
*
* Route 1215 through reach   20
* Using Valley Section   3101.800 As channel Rating Curve
*
ROUTE CHANNEL       ID=3 HYD NO=  20 INFLOW=2 LENGTH=  1230 m  SLOPE=0.0062
                    RCID=3 NS=1 PCODE=1 INDEX=1 PIPE=0 CANOPY=  0.0%
*
* Compute runoff hydrograph from area  120
* VS=   1.000 is main channel & VS=   2.000 is off-channel
*
COMPUTE FLOWRATE    ID=2 NHD= 120 AREA=   0.4210 Sq km  L=   560 m  W=   383 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     2.0  15.0  2.7  14.9  5.3  47.2  0.0  13.0  0.0
                    RATING CURVES: IDMC=1 IDOC=5 QRMC= 0.50 QROC= 0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 4.0 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
*
* Inflow to Victoria Pond (Number 5)
*
ADD HYD             ID=4 HYD NO= 220 IDA=2 IDB=3 ICODE=0                 AREA=
1.937
*
* Remove some flow from groundwater
*
DIVERT FLOWS        INFLO/THRU=1 DIVERT ID=6 HYD= 420 PCODE=1 OPTION=5
                    PERCENT INFLOW=100.00 IDFLAG=2 IDSTOR=0
*
* Sum hydr.  420 &  220 call result 1220
*
ADD HYD             ID=2 HYD NO=1220 IDA=6 IDB=4 ICODE=0                 AREA=
1.937
*
* Route flows through Victoria Pond
*
ROUTE RESERVOIR     ID=3 HYD NO= 520 INFLOW=2 PCODE=0 OPTION=1
                    ILEVEL=  -1.000  HDIFF=    6.0
                    CONSTANT OUTFLOW  QO=   0.0000
                    ZG= 327.160 CG=   0.000 EG=   0.500 Gate
                    ZS= 327.160 CS=   2.550 ES=   1.500 Spillway
                    ZO= 327.160 AS=   0.000 AN=   0.230 N= 3.000
*
* Go to event file: Route flows through Victoria Pond
*
CHANGE INPUT FILE
```



```
*
* SECTION R-R                                                              24
*
COMPUTE RATING CURVE ID=3  VS=  2556.800   NSEGS=3
                      MIN EL= 326.89    MAX EL= 333.02
                      CHNSLP= 0.0024    FLNSLP= 0.0024
                      N= 0.120  DIST=   44.82
                      N=-0.070  DIST=   49.37
                      N= 0.120  DIST=  100.00
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  333.02     1.19  332.93     8.62  331.41
                       21.46  328.70    24.91  328.60    26.90  328.58
                       42.17  327.63    44.82  327.37    45.02  327.29
                       45.85  326.95    46.42  326.94    48.18  326.89
                       48.82  327.22    48.99  327.31    49.37  327.52
                       50.00  327.52    51.82  327.53    74.47  328.59
                       75.54  328.64    85.80  329.99    89.19  330.44
                       90.09  330.64    99.31  332.78   100.00  332.84
                     RFN=0.0000 PCODE=1
*
* Route  520 through reach   24
* Using Valley Section   2556.800 As channel Rating Curve
*
ROUTE CHANNEL       ID=2 HYD NO=  24 INFLOW=3 LENGTH=   450 m  SLOPE=0.0021
                    RCID=3 NS=1 PCODE=1 INDEX=1 PIPE=0 CANOPY=  0.0%
*
* Route flows through Pond 4
*
ROUTE RESERVOIR     ID=3 HYD NO= 524 INFLOW=2 PCODE=0 OPTION=1
                    ILEVEL=  -1.000  HDIFF=    6.0
                    CONSTANT OUTFLOW  QO=   0.0000
                    ZG= 327.160 CG=   0.000 EG=   0.500 Gate
                    ZS= 327.160 CS=   3.000 ES=   1.500 Spillway
                    ZO= 327.160 AS=   0.030 AN=   0.000 N= 2.000
*
* Compute runoff hydrograph from area  124
* VS=   1.000 is main channel & VS=   2.000 is off-channel
*
COMPUTE FLOWRATE    ID=2 NHD= 124 AREA=   0.1820 Sq km  L=   450 m  W=   251 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     2.0   0.0  0.0  38.1  0.0  35.6  0.0   3.6 20.7
                    RATING CURVES: IDMC=1 IDOC=5 QRMC= 0.50 QROC= 0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
*
* Sum hydr.  524 &  124 call result  224
*
ADD HYD             ID=4 HYD NO= 224 IDA=3 IDB=2 ICODE=0                  AREA=
2.119
*
* Compute runoff hydrograph from area  126
* VS=   1.000 is main channel & VS=   2.000 is off-channel
*
COMPUTE FLOWRATE    ID=2 NHD= 126 AREA=   0.0990 Sq km  L=   200 m  W=   133 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     2.0   0.0  0.0   0.0  1.8  29.2  0.0   7.1 59.6
                    RATING CURVES: IDMC=1 IDOC=5 QRMC= 0.50 QROC= 0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
```

```
*
* Sum hydr.  224 &  126 call result  226
*
ADD HYD             ID=3 HYD NO= 226 IDA=4 IDB=2 ICODE=0                  AREA=
2.218
*
* SECTION M-M                                                            30
*
COMPUTE RATING CURVE ID=3  VS=  2071.500   NSEGS=3
                      MIN EL= 324.84    MAX EL= 326.79
                      CHNSLP= 0.0003    FLNSLP= 0.0003
                      N= 0.250  DIST=   80.14
                      N=-0.150  DIST=   84.87
                      N= 0.250  DIST=  100.00
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                         0.00  326.25    18.67  325.99    19.01  325.98
                        37.50  325.77    38.28  325.76    50.00  325.63
                        56.61  325.56    57.15  325.56    64.38  325.59
                        64.76  325.58    69.10  325.44    69.65  325.45
                        75.10  325.52    75.60  325.47    80.14  325.09
                        80.91  324.84    83.89  324.87    83.97  324.84
                        84.26  324.85    84.82  325.15    84.87  325.17
                        88.17  325.50    88.39  325.52    93.17  325.83
                        93.42  325.84    96.49  326.12    96.59  326.13
                        99.90  326.77    99.93  326.78   100.00  326.79
                     RFN=0.0000 PCODE=1
*
* Main Stem flows u/s confluence with south branch
* Using Valley Section   2071.500 As channel Rating Curve
*
ROUTE CHANNEL       ID=2 HYD NO=  26 INFLOW=3 LENGTH=   450 m  SLOPE=0.0006
                    RCID=3 NS=1 PCODE=1 INDEX=1 PIPE=0 CANOPY=  0.0%
*
* Main Stem Flows d/s of South Tributary ========
*
ADD HYD             ID=3 HYD NO= 251 IDA=2 IDB=5 ICODE=0                  AREA=
2.218
*
* Arkell Tributary, headwaters
* VS=   1.000 is main channel & VS=   2.000 is off-channel
*
COMPUTE FLOWRATE    ID=2 NHD= 160 AREA=   0.3150 Sq km  L=  1500 m  W=   417 m
               SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                      7.0   0.0  0.0  51.6 12.8  28.6  0.0   0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=5 QRMC= 0.50 QROC= 0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
*
* Divert flow from 160 into ground
*
DIVERT FLOWS        INFLO/THRU=2 DIVERT ID=5 HYD=3160 PCODE=1 OPTION=1
                    INLET CAPACITY=   0.3300 CMS  IDFLAG=2 IDSTOR=0
*
* Add GW from 160 to running total
*
ADD HYD             ID=4 HYD NO=4160 IDA=1 IDB=2 ICODE=0                  AREA=
0.000
*
* Valley Section for Channel 35                                          5
*
COMPUTE RATING CURVE ID=3  VS=    35.000   NSEGS=3
```



```
                      MIN EL= 335.00    MAX EL= 337.50
                      CHNSLP= 0.0010    FLNSLP= 0.0010
                      N= 0.120  DIST=   20.00
                      N=-0.080  DIST=   40.00
                      N= 0.120  DIST=   60.00
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                         0.00  337.50    20.00  335.20    30.00  335.00
                        40.00  335.20    60.00  337.50
                     RFN=0.0000 PCODE=1
*
* Route flows alongside CPR Tracks
* Using Valley Section     35.000 As channel Rating Curve
*
ROUTE CHANNEL       ID=1 HYD NO=  60 INFLOW=5 LENGTH=   780 m  SLOPE=0.0010
                    RCID=3 NS=1 PCODE=1 INDEX=1 PIPE=0 CANOPY=  0.0%
*
* Compute runoff hydrograph from area  162
* VS=   1.000 is main channel & VS=   2.000 is off-channel
*
COMPUTE FLOWRATE    ID=2 NHD= 162 AREA=   0.3930 Sq km  L=   350 m  W=   233 m
               SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                      2.0   0.0  0.0  17.9  0.0  52.8  0.0   0.0 27.3
                    RATING CURVES: IDMC=1 IDOC=5 QRMC= 0.50 QROC= 0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
*
* Outflow from Arkell Tributary
*
ADD HYD             ID=5 HYD NO= 260 IDA=1 IDB=2 ICODE=0                  AREA=
0.393
*
* Main Stem Flows d/s Arkell Tributary
*
ADD HYD             ID=1 HYD NO= 262 IDA=3 IDB=5 ICODE=0                  AREA=
2.611
*
* SECTION F-F                                                            13
*
COMPUTE RATING CURVE ID=3  VS=   995.900   NSEGS=3
                      MIN EL= 322.09    MAX EL= 323.25
                      CHNSLP= 0.0011    FLNSLP= 0.0011
                      N= 0.250  DIST=   38.70
                      N=-0.120  DIST=   63.96
                      N= 0.250  DIST=  100.00
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                         0.00  322.45    30.98  322.29    35.89  322.31
                        38.70  322.30    45.52  322.09    45.94  322.09
                        48.21  322.10    63.96  322.20    76.96  322.47
                        77.06  322.47    91.89  322.55    95.46  322.97
                       100.00  323.25
                     RFN=0.0000 PCODE=1
*
* Route  262 through reach   65
* Using Valley Section    995.900 As channel Rating Curve
*
ROUTE CHANNEL       ID=2 HYD NO=  65 INFLOW=1 LENGTH=   535 m  SLOPE=0.0021
                    RCID=3 NS=1 PCODE=1 INDEX=1 PIPE=0 CANOPY=  0.0%
*
* Compute runoff hydrograph from area  165
* VS=   1.000 is main channel & VS=   2.000 is off-channel
*
```

```
COMPUTE FLOWRATE    ID=1 NHD= 165 AREA=   0.2390 Sq km  L=   550 m  W=   367 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     2.0   0.0  0.0   0.0  2.7  24.5  0.0   2.4 68.4
                   RATING CURVES: IDMC=1 IDOC=5 QRMC= 0.50 QROC= 0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
*
* Sum hydr.  165 &   65 call result  265
*
ADD HYD             ID=3 HYD NO= 265 IDA=1 IDB=2 ICODE=0                  AREA=
2.850
*
* Divert flow from 265 into ground
*
DIVERT FLOWS        INFLO/THRU=3 DIVERT ID=5 HYD=3265 PCODE=1 OPTION=5
                    PERCENT INFLOW= 75.00 IDFLAG=2 IDSTOR=0
*
* Add GW from 265 to running total
*
ADD HYD             ID=1 HYD NO=4265 IDA=4 IDB=3 ICODE=0                  AREA=
0.000
*
* Compute runoff hydrograph from area  170
* VS=   1.000 is main channel & VS=   2.000 is off-channel
*
COMPUTE FLOWRATE    ID=2 NHD= 170 AREA=   0.4530 Sq km  L=   507 m  W=   338 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     2.0  18.4  5.3   7.0 17.3  14.6  0.0  21.8 13.6
                   RATING CURVES: IDMC=1 IDOC=5 QRMC= 0.50 QROC= 0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 4.0 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
*
* Northern Tributary Swamp
*
ROUTE RESERVOIR     ID=3 HYD NO= 570 INFLOW=2 PCODE=0 OPTION=1
                    ILEVEL=  -1.000  HDIFF=    6.0
                    CONSTANT OUTFLOW  QO=   0.0000
                    ZG= 332.000 CG=   1.000 EG=   0.500 Gate
                    ZS= 333.000 CS=  10.000 ES=   1.000 Spillway
                    ZO= 332.000 AS=   8.290 AN=   0.000 N= 2.000
*
* SECTION H-H                                                          10
*
COMPUTE RATING CURVE ID=3  VS= 20346.900   NSEGS=3
                      MIN EL= 328.32    MAX EL= 329.66
                      CHNSLP= 0.0026    FLNSLP= 0.0026
                      N= 0.120  DIST=   17.87
                      N=-0.070  DIST=   28.69
                      N= 0.120  DIST=   36.31
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  329.66     0.53  329.63     5.12  328.72
                       10.17  328.60    17.86  328.40    20.65  328.32
                       21.16  328.32    28.34  328.44    28.69  328.45
                       36.31  328.75
                     RFN=0.0000 PCODE=1
*
* Route  570 through reach   75
* Using Valley Section  20346.900 As channel Rating Curve
*
```



```
ROUTE CHANNEL       ID=2 HYD NO=  75 INFLOW=3 LENGTH=   607 m  SLOPE=0.0062
                    RCID=3 NS=1 PCODE=1 INDEX=1 PIPE=0 CANOPY=  0.0%
*
* Compute runoff hydrograph from area  175
* VS=   1.000 is main channel & VS=   2.000 is off-channel
*
COMPUTE FLOWRATE    ID=3 NHD= 175 AREA=   0.2570 Sq km  L=   340 m  W=   250 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     9.0   0.0  0.0   0.0 43.1   3.3  0.0  38.6  5.9
                   RATING CURVES: IDMC=1 IDOC=5 QRMC= 0.50 QROC= 0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
*
* Sum hydr.   75 &  175 call result  275
*
ADD HYD             ID=4 HYD NO= 275 IDA=2 IDB=3 ICODE=0                  AREA=
0.710
*
* Main Stem Flows d/s of Northern Tributary
*
ADD HYD             ID=2 HYD NO= 277 IDA=5 IDB=4 ICODE=0                  AREA=
0.710
*
* Remove some flow from groundwater
*
DIVERT FLOWS        INFLO/THRU=1 DIVERT ID=5 HYD= 477 PCODE=1 OPTION=5
                    PERCENT INFLOW=100.00 IDFLAG=2 IDSTOR=0
*
* Sum hydr.  477 &  277 call result 1277
*
ADD HYD             ID=3 HYD NO=1277 IDA=5 IDB=2 ICODE=0                  AREA=
0.710
*
* Divert flow into low flow channel (79)
*
DIVERT FLOWS        INFLO/THRU=3 DIVERT ID=5 HYD=3277 PCODE=1 OPTION=1
                    INLET CAPACITY=   0.3000 CMS  IDFLAG=2 IDSTOR=0
*
* SECTION D-D                                                          19
*
COMPUTE RATING CURVE ID=3  VS=   328.300   NSEGS=3
                      MIN EL= 318.22    MAX EL= 321.02
                      CHNSLP= 0.0061    FLNSLP= 0.0061
                      N= 0.250  DIST=   23.45
                      N=-0.120  DIST=   28.26
                      N= 0.250  DIST=   40.00
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  319.31     4.29  318.27     4.35  318.26
                        4.49  318.26    15.16  318.46    17.72  318.46
                       20.00  318.46    23.45  318.47    23.65  318.38
                       24.04  318.22    25.00  318.22    25.33  318.22
                       28.26  319.17    28.87  319.37    30.65  320.37
                       30.98  320.55    38.17  320.54    38.25  320.54
                       40.00  321.02
                     RFN=0.0000 PCODE=1
*
* High flow channel
*
ROUTE CHANNEL       ID=2 HYD NO=  78 INFLOW=3 K= -37.000 TL= 0.000
                     X= 0.400 NS=1 PCODE=1 IDX=1 PIPE=0 CANOPY=  0.0%
*
```

```
* SECTION D-D                                                          19
*
COMPUTE RATING CURVE ID=3  VS= 30328.301   NSEGS=3
                      MIN EL= 318.22    MAX EL= 321.02
                      CHNSLP= 0.0121    FLNSLP= 0.0121
                      N= 0.250  DIST=   23.45
                      N=-0.070  DIST=   28.26
                      N= 0.250  DIST=   40.00
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  319.31     4.29  318.27     4.35  318.26
                        4.49  318.26    15.16  318.46    17.72  318.46
                       20.00  318.46    23.45  318.47    23.65  318.38
                       24.04  318.22    25.00  318.22    25.33  318.22
                       28.26  319.17    28.87  319.37    30.65  320.37
                       30.98  320.55    38.17  320.54    38.25  320.54
                       40.00  321.02
                     RFN=0.0000 PCODE=1
*
* Low flow channel
* Using Valley Section  30328.301 As channel Rating Curve
*
ROUTE CHANNEL       ID=3 HYD NO=  79 INFLOW=5 LENGTH=  1200 m  SLOPE=0.0120
                    RCID=3 NS=1 PCODE=1 INDEX=1 PIPE=0 CANOPY=  0.0%
*
* Sum flows for channel 78*
*
ADD HYD             ID=4 HYD NO= 279 IDA=3 IDB=2 ICODE=0                 AREA=
0.000
*
* Compute runoff hydrograph from area  180
* VS=   1.000 is main channel & VS=   2.000 is off-channel
*
COMPUTE FLOWRATE    ID=2 NHD= 180 AREA=   0.4700 Sq km  L=   800 m  W=   300 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                    14.0   3.8  0.0   3.3 18.6   8.2 18.4  12.6 21.0
                    RATING CURVES: IDMC=1 IDOC=5 QRMC= 0.50 QROC= 0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=2 RBPCODE=0 FACTOR= 0.400
                    ILEVEL= 250.000      HDIFF=    8.0 QO=   0.0000
                    ZG= 250.000 CG=   0.000 EG=   1.000 Gate
                    ZS= 256.000 CS= 100.000 ES=   1.500 Spillway
                    ZO= 250.000  K=  22.000 DZ=     4.0 Recharge
                    AS=  22.300 AN=   0.000  N=   0.000 Storage
                    FSS=0.000 FGW=0.000 GLEVEL=  0.000 QGWI=  0.0000
                    IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0 GWFACT=0.00 GWON=0
*
* Inflow to Mill Pond (Number 1)
*
ADD HYD             ID=3 HYD NO= 278 IDA=4 IDB=2 ICODE=0                 AREA=
0.470
*
* Torrance Creek flows out of Mill Pond
*
ROUTE RESERVOIR     ID=2 HYD NO= 580 INFLOW=3 PCODE=0 OPTION=1
                    ILEVEL=  -1.000  HDIFF=    8.0
                    CONSTANT OUTFLOW  QO=   0.0000
                    ZG= 320.220 CG=   0.000 EG=   0.500 Gate
                    ZS= 320.220 CS=   1.360 ES=   1.500 Spillway
                    ZO= 319.220 AS=   0.000 AN=   0.078 N= 2.100
*
* Go to event file: Torrance Creek flows out of Mill Pond
*
```



```
CHANGE INPUT FILE
*
* Divert flow from 580 into ground
*
DIVERT FLOWS        INFLO/THRU=2 DIVERT ID=5 HYD=3580 PCODE=1 OPTION=1
                    INLET CAPACITY=   0.0250 CMS  IDFLAG=2 IDSTOR=0
*
* SECTION D-D                                                          19
*
COMPUTE RATING CURVE ID=3  VS=   328.300   NSEGS=3
                      MIN EL= 318.22    MAX EL= 321.02
                      CHNSLP= 0.0061    FLNSLP= 0.0061
                      N= 0.250  DIST=   23.45
                      N=-0.120  DIST=   28.26
                      N= 0.250  DIST=   40.00
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  319.31     4.29  318.27     4.35  318.26
                        4.49  318.26    15.16  318.46    17.72  318.46
                       20.00  318.46    23.45  318.47    23.65  318.38
                       24.04  318.22    25.00  318.22    25.33  318.22
                       28.26  319.17    28.87  319.37    30.65  320.37
                       30.98  320.55    38.17  320.54    38.25  320.54
                       40.00  321.02
                     RFN=0.0000 PCODE=1
*
* Torrance Creek Flows at Eramosa River (outlet)
* Using Valley Section    328.300 As channel Rating Curve
*
ROUTE CHANNEL       ID=2 HYD NO=  80 INFLOW=5 LENGTH=   578 m  SLOPE=0.0120
                    RCID=3 NS=1 PCODE=1 INDEX=1 PIPE=0 CANOPY=  0.0%
*
* Go to event file: Torrance Creek Flows at Eramosa River (outlet)
*
CHANGE INPUT FILE
*
FINISH
```

1	130	0.5030	12.54	0.1066	0.	RCFLAGS	0	0	return1.dat
			scene1.wat						
1	3130	0.5030	0.00	0.0000	0.	RCFLAGS	0	0	
1	30	0.5030	0.00	0.0000	0.	RCFLAGS	0	0	
1	132	0.1730	12.01	0.0656	0.	RCFLAGS	0	0	
1	232	0.6760	3.07	0.0656	0.	RCFLAGS	0	0	
1	135	2.2800	7.10	0.2192	15.	RCFLAGS	0	10	
1	3135	2.2800	0.00	0.0000	0.	RCFLAGS	0	0	
1	4135	2.7830	8.08	0.3216	0.	RCFLAGS	0	0	
1	35	2.2800	0.00	0.0000	0.	RCFLAGS	0	0	
1	140	0.5890	15.10	0.1630	0.	RCFLAGS	0	0	
1	235	2.8690	3.10	0.1630	0.	RCFLAGS	0	0	
1	240	3.5450	3.10	0.2235	0.	RCFLAGS	0	0	
1	40	3.5450	3.06	0.2172	0.	RCFLAGS	0	0	
1	145	0.5540	12.60	0.1042	0.	RCFLAGS	0	0	
1	3145	0.5540	0.00	0.0000	0.	RCFLAGS	0	0	
1	4145	3.3370	8.83	0.4253	0.	RCFLAGS	0	0	
1	50	0.5540	0.00	0.0000	0.	RCFLAGS	0	0	
1	150	0.3990	16.51	0.1859	0.	RCFLAGS	0	0	
1	245	0.9530	6.91	0.1859	0.	RCFLAGS	0	0	
1	250	4.4980	3.88	0.3764	0.	RCFLAGS	0	0	
1	3250	4.4980	3.49	0.3388	0.	RCFLAGS	0	0	
1	4250	7.8350	3.98	0.4615	0.	RCFLAGS	0	0	
1	101	1.4200	7.56	0.1387	12.	RCFLAGS	0	0	
1	3101	1.4200	0.00	0.0000	0.	RCFLAGS	0	0	
1	4101	9.2550	4.53	0.5936	0.	RCFLAGS	0	0	
1	102	0.1400	65.45	0.7214	0.	RCFLAGS	0	0	
1	202	1.5600	5.87	0.7214	0.	RCFLAGS	0	0	
1	103	0.4620	56.41	2.1189	0.	RCFLAGS	0	0	
1	203	2.0220	17.42	2.8403	0.	RCFLAGS	0	0	
1	3203	2.0220	17.31	2.8395	0.	RCFLAGS	0	0	
1	4203	11.2770	3.74	0.5944	0.	RCFLAGS	0	0	
1	105	0.6830	3.06	0.0153	0.	RCFLAGS	0	0	
1	205	2.7050	13.71	2.8501	0.	RCFLAGS	0	0	
1	106	0.1870	23.43	0.0779	0.	RCFLAGS	0	0	
1	206	2.8920	14.34	2.8737	0.	RCFLAGS	0	0	
1	107	0.1880	33.20	0.1138	0.	RCFLAGS	0	0	
1	207	3.0800	15.49	2.9073	0.	RCFLAGS	0	0	
1	505	3.0800	5.94	0.1564	70000.	RCFLAGS	0	0	
1	110	0.3330	20.87	0.1231	0.	RCFLAGS	0	0	
1	210	3.4130	7.40	0.2771	0.	RCFLAGS	0	0	
1	510	3.4130	7.37	0.2766	165.	RCFLAGS	0	0	
1	10	3.4130	7.22	0.2746	0.	RCFLAGS	0	0	
1	115	0.1250	37.54	0.1167	0.	RCFLAGS	0	0	
1	215	3.5380	8.30	0.3710	0.	RCFLAGS	0	0	
1	415	11.2770	1.87	0.2972	0.	RCFLAGS	0	0	
1	1215	3.5380	14.26	0.6652	0.	RCFLAGS	0	0	
1	20	3.5380	13.69	0.6434	0.	RCFLAGS	0	0	return1.dat
			scene1.wat						
1	120	0.4210	14.51	0.0970	0.	RCFLAGS	0	0	
1	220	3.9590	13.78	0.7262	0.	RCFLAGS	0	0	
1	420	11.2770	1.87	0.2972	0.	RCFLAGS	0	0	
1	1220	3.9590	19.10	1.0108	0.	RCFLAGS	0	0	
1	520	3.9590	19.08	1.0097	378.	RCFLAGS	0	0	
1	24	3.9590	18.95	1.0086	0.	RCFLAGS	0	0	
1	524	3.9590	18.93	1.0086	145.	RCFLAGS	0	0	
1	124	0.1820	23.36	0.1208	0.	RCFLAGS	0	0	
1	224	4.1410	19.12	1.0819	0.	RCFLAGS	0	0	
1	126	0.0990	6.15	0.0321	0.	RCFLAGS	0	0	
1	226	4.2400	18.82	1.0911	0.	RCFLAGS	0	0	
1	26	4.2400	17.82	0.9756	0.	RCFLAGS	0	0	
1	251	8.7380	10.44	1.1815	0.	RCFLAGS	0	0	
1	160	0.3150	26.08	0.1229	0.	RCFLAGS	0	0	

1	3160	0.3150	0.00	0.0000	0.	RCFLAGS	0	0	
1	4160	11.5920	0.71	0.1229	0.	RCFLAGS	0	0	
1	60	0.3150	0.00	0.0000	0.	RCFLAGS	0	0	
1	162	0.3930	16.90	0.2278	0.	RCFLAGS	0	0	
1	260	0.7080	9.38	0.2278	0.	RCFLAGS	0	0	
1	262	9.4460	10.36	1.2655	0.	RCFLAGS	0	0	
1	65	9.4460	10.06	1.2592	0.	RCFLAGS	0	0	
1	165	0.2390	5.54	0.0320	0.	RCFLAGS	0	0	
1	265	9.6850	9.95	1.2747	0.	RCFLAGS	0	0	
1	3265	9.6850	7.46	0.9560	0.	RCFLAGS	0	0	
1	4265	21.2770	1.52	0.4181	0.	RCFLAGS	0	0	
1	170	0.4530	13.52	0.0986	0.	RCFLAGS	0	0	
1	570	0.4530	12.02	0.0565	1440.	RCFLAGS	0	0	
1	75	0.4530	11.61	0.0565	0.	RCFLAGS	0	0	
1	175	0.2570	20.64	0.1725	0.	RCFLAGS	0	0	
1	275	0.7100	14.88	0.1972	0.	RCFLAGS	0	0	
1	277	10.3950	7.97	1.0631	0.	RCFLAGS	0	0	
1	477	21.2770	1.52	0.4181	0.	RCFLAGS	0	0	
1	1277	10.3950	11.08	1.4811	0.	RCFLAGS	0	0	
1	3277	10.3950	7.52	1.1811	0.	RCFLAGS	0	0	
1	78	10.3950	1.50	0.2174	0.	RCFLAGS	0	0	
1	79	10.3950	7.40	1.1801	0.	RCFLAGS	0	0	
1	279	10.3950	8.90	1.2847	0.	RCFLAGS	0	0	
1	180	0.4700	17.90	0.1398	12.	RCFLAGS	0	0	
1	278	10.8650	9.29	1.3668	0.	RCFLAGS	0	0	
1	580	10.8650	9.17	1.3634	3350.	RCFLAGS	0	0	
1	3580	10.8650	8.63	1.3384	0.	RCFLAGS	0	0	
1	80	10.8650	8.51	1.3380	0.	RCFLAGS	0	0	
2	130	0.5030	23.12	0.1944	0.	RCFLAGS	0	0	return1.dat
			scene1.wat						
2	3130	0.5030	0.00	0.0000	0.	RCFLAGS	0	0	
2	30	0.5030	0.00	0.0000	0.	RCFLAGS	0	0	
2	132	0.1730	23.13	0.1214	0.	RCFLAGS	0	0	
2	232	0.6760	5.92	0.1214	0.	RCFLAGS	0	0	
2	135	2.2800	12.20	0.3793	27.	RCFLAGS	0	10	
2	3135	2.2800	0.00	0.0000	0.	RCFLAGS	0	0	
2	4135	2.7830	14.17	0.5696	0.	RCFLAGS	0	0	
2	35	2.2800	0.00	0.0000	0.	RCFLAGS	0	0	
2	140	0.5890	26.31	0.2834	0.	RCFLAGS	0	0	
2	235	2.8690	5.40	0.2834	0.	RCFLAGS	0	0	
2	240	3.5450	5.50	0.4003	0.	RCFLAGS	0	0	
2	40	3.5450	5.44	0.3927	0.	RCFLAGS	0	0	
2	145	0.5540	22.15	0.1825	0.	RCFLAGS	0	0	
2	3145	0.5540	0.00	0.0000	0.	RCFLAGS	0	0	
2	4145	3.3370	15.50	0.7520	0.	RCFLAGS	0	0	
2	50	0.5540	0.00	0.0000	0.	RCFLAGS	0	0	
2	150	0.3990	30.97	0.3234	0.	RCFLAGS	0	0	
2	245	0.9530	12.97	0.3234	0.	RCFLAGS	0	0	
2	250	4.4980	7.04	0.6775	0.	RCFLAGS	0	0	
2	3250	4.4980	6.33	0.6097	0.	RCFLAGS	0	0	
2	4250	7.8350	7.00	0.8179	0.	RCFLAGS	0	0	
2	101	1.4200	12.19	0.2241	20.	RCFLAGS	0	0	
2	3101	1.4200	0.00	0.0000	0.	RCFLAGS	0	0	
2	4101	9.2550	7.80	1.0342	0.	RCFLAGS	0	0	
2	102	0.1400	86.01	0.8904	0.	RCFLAGS	0	0	
2	202	1.5600	7.72	0.8904	0.	RCFLAGS	0	0	
2	103	0.4620	74.82	2.6353	0.	RCFLAGS	0	0	
2	203	2.0220	23.05	3.5257	0.	RCFLAGS	0	0	
2	3203	2.0220	22.94	3.5249	0.	RCFLAGS	0	0	
2	4203	11.2770	6.42	1.0350	0.	RCFLAGS	0	0	
2	105	0.6830	3.30	0.0176	0.	RCFLAGS	0	0	
2	205	2.7050	17.98	3.5369	0.	RCFLAGS	0	0	
2	106	0.1870	36.50	0.1200	0.	RCFLAGS	0	0	

2	206	2.8920	19.18	3.5730	0.	RCFLAGS	0	0	
2	107	0.1880	48.44	0.1627	0.	RCFLAGS	0	0	
2	207	3.0800	20.97	3.6356	0.	RCFLAGS	0	0	
2	505	3.0800	7.94	0.2102	81800.	RCFLAGS	0	0	
2	110	0.3330	32.61	0.1915	0.	RCFLAGS	0	0	
2	210	3.4130	10.35	0.3972	0.	RCFLAGS	0	0	
2	510	3.4130	10.31	0.3814	557.	RCFLAGS	0	0	
2	10	3.4130	10.13	0.3811	0.	RCFLAGS	0	0	
2	115	0.1250	53.25	0.1607	0.	RCFLAGS	0	0	
2	215	3.5380	11.66	0.4955	0.	RCFLAGS	0	0	
2	415	11.2770	3.21	0.5175	0.	RCFLAGS	0	0	
2	1215	3.5380	21.89	1.0130	0.	RCFLAGS	0	0	
2	20	3.5380	21.14	0.9962	0.	RCFLAGS	0	0	return1.dat
			scene1.wat						
2	120	0.4210	23.12	0.1554	0.	RCFLAGS	0	0	
2	220	3.9590	21.35	1.1289	0.	RCFLAGS	0	0	
2	420	11.2770	3.21	0.5175	0.	RCFLAGS	0	0	
2	1220	3.9590	30.49	1.6251	0.	RCFLAGS	0	0	
2	520	3.9590	30.45	1.6216	950.	RCFLAGS	0	0	
2	24	3.9590	30.23	1.6200	0.	RCFLAGS	0	0	
2	524	3.9590	30.20	1.6200	199.	RCFLAGS	0	0	
2	124	0.1820	35.46	0.1782	0.	RCFLAGS	0	0	
2	224	4.1410	30.43	1.7275	0.	RCFLAGS	0	0	
2	126	0.0990	10.94	0.0562	0.	RCFLAGS	0	0	
2	226	4.2400	29.97	1.7442	0.	RCFLAGS	0	0	
2	26	4.2400	28.56	1.5939	0.	RCFLAGS	0	0	
2	251	8.7380	17.12	1.9813	0.	RCFLAGS	0	0	
2	160	0.3150	38.16	0.1779	0.	RCFLAGS	0	0	
2	3160	0.3150	0.00	0.0000	0.	RCFLAGS	0	0	
2	4160	11.5920	1.04	0.1779	0.	RCFLAGS	0	0	
2	60	0.3150	0.00	0.0000	0.	RCFLAGS	0	0	
2	162	0.3930	27.61	0.3619	0.	RCFLAGS	0	0	
2	260	0.7080	15.32	0.3619	0.	RCFLAGS	0	0	
2	262	9.4460	16.98	2.1267	0.	RCFLAGS	0	0	
2	65	9.4460	16.55	2.1163	0.	RCFLAGS	0	0	
2	165	0.2390	9.54	0.0550	0.	RCFLAGS	0	0	
2	265	9.6850	16.38	2.1451	0.	RCFLAGS	0	0	
2	3265	9.6850	12.28	1.6088	0.	RCFLAGS	0	0	
2	4265	21.2770	2.43	0.6828	0.	RCFLAGS	0	0	
2	170	0.4530	20.02	0.1471	0.	RCFLAGS	0	0	
2	570	0.4530	16.77	0.0808	2490.	RCFLAGS	0	0	
2	75	0.4530	16.17	0.0808	0.	RCFLAGS	0	0	
2	175	0.2570	33.31	0.2530	0.	RCFLAGS	0	0	
2	275	0.7100	22.37	0.2812	0.	RCFLAGS	0	0	
2	277	10.3950	12.97	1.7662	0.	RCFLAGS	0	0	
2	477	21.2770	2.43	0.6828	0.	RCFLAGS	0	0	
2	1277	10.3950	17.94	2.4489	0.	RCFLAGS	0	0	
2	3277	10.3950	14.09	2.1489	0.	RCFLAGS	0	0	
2	78	10.3950	1.62	0.2228	0.	RCFLAGS	0	0	
2	79	10.3950	13.90	2.1481	0.	RCFLAGS	0	0	
2	279	10.3950	15.52	2.2595	0.	RCFLAGS	0	0	
2	180	0.4700	24.57	0.1932	17.	RCFLAGS	0	0	
2	278	10.8650	15.91	2.3798	0.	RCFLAGS	0	0	
2	580	10.8650	15.73	2.3732	5120.	RCFLAGS	0	0	
2	3580	10.8650	15.18	2.3482	0.	RCFLAGS	0	0	
2	80	10.8650	15.01	2.3478	0.	RCFLAGS	0	0	
3	130	0.5030	33.79	0.2832	0.	RCFLAGS	0	0	return1.dat
			scene1.wat						
3	3130	0.5030	0.00	0.0000	0.	RCFLAGS	0	0	
3	30	0.5030	0.00	0.0000	0.	RCFLAGS	0	0	
3	132	0.1730	34.74	0.1806	0.	RCFLAGS	0	0	
3	232	0.6760	8.89	0.1806	0.	RCFLAGS	0	0	
3	135	2.2800	17.46	0.5439	37.	RCFLAGS	0	0	

3	3135	2.2800	0.00	0.0000	0.	RCFLAGS	0	0	
3	4135	2.7830	20.41	0.8214	0.	RCFLAGS	0	0	
3	35	2.2800	0.00	0.0000	0.	RCFLAGS	0	0	
3	140	0.5890	39.95	0.4104	0.	RCFLAGS	0	0	
3	235	2.8690	8.20	0.4104	0.	RCFLAGS	0	0	
3	240	3.5450	8.33	0.5841	0.	RCFLAGS	0	0	
3	40	3.5450	8.25	0.5742	0.	RCFLAGS	0	0	
3	145	0.5540	31.58	0.2596	0.	RCFLAGS	0	0	
3	3145	0.5540	0.00	0.0000	0.	RCFLAGS	0	0	
3	4145	3.3370	22.26	1.0809	0.	RCFLAGS	0	0	
3	50	0.5540	0.00	0.0000	0.	RCFLAGS	0	0	
3	150	0.3990	43.88	0.4634	0.	RCFLAGS	0	0	
3	245	0.9530	18.37	0.4634	0.	RCFLAGS	0	0	
3	250	4.4980	10.40	0.9856	0.	RCFLAGS	0	0	
3	3250	4.4980	9.36	0.8871	0.	RCFLAGS	0	0	
3	4250	7.8350	10.08	1.1767	0.	RCFLAGS	0	0	
3	101	1.4200	16.58	0.3044	27.	RCFLAGS	0	0	
3	3101	1.4200	0.00	0.0000	0.	RCFLAGS	0	0	
3	4101	9.2550	11.08	1.4699	0.	RCFLAGS	0	0	
3	102	0.1400	103.05	1.0298	0.	RCFLAGS	0	0	
3	202	1.5600	9.25	1.0298	0.	RCFLAGS	0	0	
3	103	0.4620	90.65	3.0796	0.	RCFLAGS	0	0	
3	203	2.0220	27.85	4.1094	0.	RCFLAGS	0	0	
3	3203	2.0220	27.74	4.1086	0.	RCFLAGS	0	0	
3	4203	11.2770	9.11	1.4707	0.	RCFLAGS	0	0	
3	105	0.6830	3.51	0.0196	0.	RCFLAGS	0	0	
3	205	2.7050	21.62	4.1217	0.	RCFLAGS	0	0	
3	106	0.1870	48.56	0.1595	0.	RCFLAGS	0	0	
3	206	2.8920	23.36	4.1716	0.	RCFLAGS	0	0	
3	107	0.1880	61.20	0.2031	0.	RCFLAGS	0	0	
3	207	3.0800	25.67	4.2582	0.	RCFLAGS	0	0	
3	505	3.0800	9.66	0.2564	92000.	RCFLAGS	0	0	
3	110	0.3330	43.75	0.2568	0.	RCFLAGS	0	0	
3	210	3.4130	12.99	0.5063	0.	RCFLAGS	0	0	
3	510	3.4130	12.94	0.4989	873.	RCFLAGS	0	0	
3	10	3.4130	12.72	0.4961	0.	RCFLAGS	0	0	
3	115	0.1250	67.95	0.2043	0.	RCFLAGS	0	0	
3	215	3.5380	14.67	0.6502	0.	RCFLAGS	0	0	
3	415	11.2770	4.55	0.7354	0.	RCFLAGS	0	0	
3	1215	3.5380	29.19	1.3855	0.	RCFLAGS	0	0	
3	20	3.5380	28.30	1.3613	0.	RCFLAGS	0	0	return1.dat
			scene1.wat						
3	120	0.4210	32.02	0.2151	0.	RCFLAGS	0	0	
3	220	3.9590	28.69	1.5475	0.	RCFLAGS	0	0	
3	420	11.2770	4.55	0.7354	0.	RCFLAGS	0	0	
3	1220	3.9590	41.67	2.2576	0.	RCFLAGS	0	0	
3	520	3.9590	41.58	2.2458	1800.	RCFLAGS	0	0	
3	24	3.9590	41.28	2.2428	0.	RCFLAGS	0	0	
3	524	3.9590	41.24	2.2421	261.	RCFLAGS	0	10	
3	124	0.1820	46.63	0.2317	0.	RCFLAGS	0	0	
3	224	4.1410	41.48	2.3827	0.	RCFLAGS	0	0	
3	126	0.0990	16.02	0.0819	0.	RCFLAGS	0	0	
3	226	4.2400	40.89	2.4066	0.	RCFLAGS	0	0	
3	26	4.2400	39.23	2.2292	0.	RCFLAGS	0	0	
3	251	8.7380	23.85	2.8152	0.	RCFLAGS	0	0	
3	160	0.3150	48.79	0.2259	0.	RCFLAGS	0	0	
3	3160	0.3150	0.00	0.0000	0.	RCFLAGS	0	0	
3	4160	11.5920	1.33	0.2259	0.	RCFLAGS	0	0	
3	60	0.3150	0.00	0.0000	0.	RCFLAGS	0	0	
3	162	0.3930	37.85	0.4916	0.	RCFLAGS	0	0	
3	260	0.7080	21.01	0.4916	0.	RCFLAGS	0	0	
3	262	9.4460	23.64	3.0248	0.	RCFLAGS	0	0	
3	65	9.4460	23.18	3.0134	0.	RCFLAGS	0	0	

3	165	0.2390	13.56	0.0786	0.	RCFLAGS	0	0	
3	265	9.6850	22.94	3.0572	0.	RCFLAGS	0	0	
3	3265	9.6850	17.21	2.2929	0.	RCFLAGS	0	0	
3	4265	21.2770	3.33	0.9550	0.	RCFLAGS	0	0	
3	170	0.4530	26.72	0.1974	0.	RCFLAGS	0	0	
3	570	0.4530	21.67	0.1063	3600.	RCFLAGS	0	0	
3	75	0.4530	20.87	0.1063	0.	RCFLAGS	0	0	
3	175	0.2570	44.36	0.3406	0.	RCFLAGS	0	0	
3	275	0.7100	29.38	0.3720	0.	RCFLAGS	0	0	
3	277	10.3950	18.04	2.5094	0.	RCFLAGS	0	0	
3	477	21.2770	3.33	0.9550	0.	RCFLAGS	0	0	
3	1277	10.3950	24.86	3.4641	0.	RCFLAGS	0	0	
3	3277	10.3950	20.76	3.1641	0.	RCFLAGS	0	0	
3	78	10.3950	1.72	0.2270	0.	RCFLAGS	0	0	
3	79	10.3950	20.49	3.1629	0.	RCFLAGS	0	0	
3	279	10.3950	22.20	3.2798	0.	RCFLAGS	0	0	
3	180	0.4700	30.69	0.2425	21.	RCFLAGS	0	0	
3	278	10.8650	22.57	3.4379	0.	RCFLAGS	0	0	
3	580	10.8650	22.33	3.4263	7040.	RCFLAGS	0	0	
3	3580	10.8650	21.78	3.4013	0.	RCFLAGS	0	0	
3	80	10.8650	21.59	3.4006	0.	RCFLAGS	0	0	
4	130	0.5030	40.13	0.3345	0.	RCFLAGS	0	0	return1.dat
			scene1.wat						
4	3130	0.5030	0.00	0.0000	0.	RCFLAGS	0	0	
4	30	0.5030	0.00	0.0000	0.	RCFLAGS	0	0	
4	132	0.1730	41.57	0.2136	0.	RCFLAGS	0	0	
4	232	0.6760	10.64	0.2136	0.	RCFLAGS	0	0	
4	135	2.2800	20.55	0.6390	44.	RCFLAGS	0	0	
4	3135	2.2800	0.00	0.0000	0.	RCFLAGS	0	0	
4	4135	2.7830	24.09	0.9667	0.	RCFLAGS	0	0	
4	35	2.2800	0.00	0.0000	0.	RCFLAGS	0	0	
4	140	0.5890	46.83	0.4810	0.	RCFLAGS	0	0	
4	235	2.8690	9.61	0.4810	0.	RCFLAGS	0	0	
4	240	3.5450	9.81	0.6863	0.	RCFLAGS	0	0	
4	40	3.5450	9.74	0.6806	0.	RCFLAGS	0	0	
4	145	0.5540	37.17	0.3042	0.	RCFLAGS	0	0	
4	3145	0.5540	0.00	0.0000	0.	RCFLAGS	0	0	
4	4145	3.3370	26.26	1.2708	0.	RCFLAGS	0	0	
4	50	0.5540	0.00	0.0000	0.	RCFLAGS	0	0	
4	150	0.3990	51.50	0.5418	0.	RCFLAGS	0	0	
4	245	0.9530	21.56	0.5418	0.	RCFLAGS	0	0	
4	250	4.4980	12.25	1.1829	0.	RCFLAGS	0	0	
4	3250	4.4980	11.02	1.0646	0.	RCFLAGS	0	0	
4	4250	7.8350	11.89	1.3829	0.	RCFLAGS	0	0	
4	101	1.4200	19.14	0.3505	31.	RCFLAGS	0	0	
4	3101	1.4200	0.00	0.0000	0.	RCFLAGS	0	0	
4	4101	9.2550	13.00	1.7198	0.	RCFLAGS	0	0	
4	102	0.1400	112.75	1.1085	0.	RCFLAGS	0	0	
4	202	1.5600	10.12	1.1085	0.	RCFLAGS	0	0	
4	103	0.4620	99.62	3.3790	0.	RCFLAGS	0	0	
4	203	2.0220	30.57	4.4875	0.	RCFLAGS	0	0	
4	3203	2.0220	30.46	4.4867	0.	RCFLAGS	0	0	
4	4203	11.2770	10.69	1.7206	0.	RCFLAGS	0	0	
4	105	0.6830	3.62	0.0206	0.	RCFLAGS	0	0	
4	205	2.7050	23.68	4.5004	0.	RCFLAGS	0	0	
4	106	0.1870	55.60	0.1820	0.	RCFLAGS	0	0	
4	206	2.8920	25.75	4.5616	0.	RCFLAGS	0	0	
4	107	0.1880	68.49	0.2259	0.	RCFLAGS	0	0	
4	207	3.0800	28.36	4.6621	0.	RCFLAGS	0	0	
4	505	3.0800	10.65	0.2828	97800.	RCFLAGS	0	0	
4	110	0.3330	50.26	0.2940	0.	RCFLAGS	0	0	
4	210	3.4130	14.51	0.5685	0.	RCFLAGS	0	0	
4	510	3.4130	14.44	0.5636	961.	RCFLAGS	0	0	

4	10	3.4130	14.21	0.5613	0.	RCFLAGS	0	0	
4	115	0.1250	76.41	0.2287	0.	RCFLAGS	0	0	
4	215	3.5380	16.41	0.7415	0.	RCFLAGS	0	0	
4	415	11.2770	5.34	0.8603	0.	RCFLAGS	0	0	
4	1215	3.5380	33.45	1.6011	0.	RCFLAGS	0	0	
4	20	3.5380	32.42	1.5706	0.	RCFLAGS	0	0	return1.dat
			scene1.wat						
4	120	0.4210	37.11	0.2487	0.	RCFLAGS	0	0	
4	220	3.9590	32.92	1.7875	0.	RCFLAGS	0	0	
4	420	11.2770	5.34	0.8603	0.	RCFLAGS	0	0	
4	1220	3.9590	48.14	2.6220	0.	RCFLAGS	0	0	
4	520	3.9590	48.03	2.5996	2420.	RCFLAGS	0	0	
4	24	3.9590	47.68	2.5964	0.	RCFLAGS	0	0	
4	524	3.9590	47.64	2.5956	289.	RCFLAGS	0	10	
4	124	0.1820	53.07	0.2615	0.	RCFLAGS	0	0	
4	224	4.1410	47.88	2.7542	0.	RCFLAGS	0	0	
4	126	0.0990	18.98	0.0956	0.	RCFLAGS	0	0	
4	226	4.2400	47.21	2.7821	0.	RCFLAGS	0	0	
4	26	4.2400	45.39	2.5940	0.	RCFLAGS	0	0	
4	251	8.7380	27.70	3.2767	0.	RCFLAGS	0	0	
4	160	0.3150	55.16	0.2540	0.	RCFLAGS	0	0	
4	3160	0.3150	0.00	0.0000	0.	RCFLAGS	0	0	
4	4160	11.5920	1.50	0.2540	0.	RCFLAGS	0	0	
4	60	0.3150	0.00	0.0000	0.	RCFLAGS	0	0	
4	162	0.3930	43.85	0.5637	0.	RCFLAGS	0	0	
4	260	0.7080	24.34	0.5637	0.	RCFLAGS	0	0	
4	262	9.4460	27.45	3.5199	0.	RCFLAGS	0	0	
4	65	9.4460	26.93	3.5066	0.	RCFLAGS	0	0	
4	165	0.2390	15.93	0.0919	0.	RCFLAGS	0	0	
4	265	9.6850	26.66	3.5583	0.	RCFLAGS	0	0	
4	3265	9.6850	19.99	2.6688	0.	RCFLAGS	0	0	
4	4265	21.2770	3.85	1.1049	0.	RCFLAGS	0	0	
4	170	0.4530	30.56	0.2258	0.	RCFLAGS	0	0	
4	570	0.4530	24.50	0.1209	4240.	RCFLAGS	0	0	
4	75	0.4530	23.91	0.1209	0.	RCFLAGS	0	0	
4	175	0.2570	50.62	0.3886	0.	RCFLAGS	0	0	
4	275	0.7100	33.57	0.4266	0.	RCFLAGS	0	0	
4	277	10.3950	20.92	2.9196	0.	RCFLAGS	0	0	
4	477	21.2770	3.85	1.1049	0.	RCFLAGS	0	0	
4	1277	10.3950	28.80	4.0243	0.	RCFLAGS	0	0	
4	3277	10.3950	24.63	3.7243	0.	RCFLAGS	0	0	
4	78	10.3950	1.74	0.2282	0.	RCFLAGS	0	0	
4	79	10.3950	24.36	3.7235	0.	RCFLAGS	0	0	
4	279	10.3950	26.11	3.8414	0.	RCFLAGS	0	0	
4	180	0.4700	34.15	0.2702	23.	RCFLAGS	0	0	
4	278	10.8650	26.46	4.0209	0.	RCFLAGS	0	0	
4	580	10.8650	26.18	4.0069	8140.	RCFLAGS	0	0	
4	3580	10.8650	25.64	3.9819	0.	RCFLAGS	0	0	
4	80	10.8650	25.42	3.9810	0.	RCFLAGS	0	0	
5	130	0.5030	51.02	0.4192	0.	RCFLAGS	0	0	return1.dat
			scene1.wat						
5	3130	0.5030	0.00	0.0000	0.	RCFLAGS	0	0	
5	30	0.5030	0.00	0.0000	0.	RCFLAGS	0	0	
5	132	0.1730	54.04	0.2707	0.	RCFLAGS	0	0	
5	232	0.6760	13.83	0.2707	0.	RCFLAGS	0	0	
5	135	2.2800	26.04	0.8038	55.	RCFLAGS	0	0	
5	3135	2.2800	0.00	0.0000	0.	RCFLAGS	0	0	
5	4135	2.7830	30.56	1.2145	0.	RCFLAGS	0	0	
5	35	2.2800	0.00	0.0000	0.	RCFLAGS	0	0	
5	140	0.5890	58.74	0.5987	0.	RCFLAGS	0	0	
5	235	2.8690	12.06	0.5987	0.	RCFLAGS	0	0	
5	240	3.5450	12.40	0.8587	0.	RCFLAGS	0	0	
5	40	3.5450	12.31	0.8524	0.	RCFLAGS	0	0	

5	145	0.5540	46.76	0.3785	0.	RCFLAGS	0	0	
5	3145	0.5540	0.00	0.0000	0.	RCFLAGS	0	0	
5	4145	3.3370	33.25	1.5930	0.	RCFLAGS	0	0	
5	50	0.5540	0.00	0.0000	0.	RCFLAGS	0	0	
5	150	0.3990	64.83	0.6712	0.	RCFLAGS	0	0	
5	245	0.9530	27.14	0.6712	0.	RCFLAGS	0	0	
5	250	4.4980	15.46	1.4760	0.	RCFLAGS	0	0	
5	3250	4.4980	13.91	1.3284	0.	RCFLAGS	0	0	
5	4250	7.8350	15.05	1.7325	0.	RCFLAGS	0	0	
5	101	1.4200	23.72	0.4320	38.	RCFLAGS	0	0	
5	3101	1.4200	0.00	0.0000	0.	RCFLAGS	0	0	
5	4101	9.2550	16.38	2.1480	0.	RCFLAGS	0	0	
5	102	0.1400	129.02	1.2400	0.	RCFLAGS	0	0	
5	202	1.5600	11.58	1.2400	0.	RCFLAGS	0	0	
5	103	0.4620	114.87	3.8659	0.	RCFLAGS	0	0	
5	203	2.0220	35.18	5.1059	0.	RCFLAGS	0	0	
5	3203	2.0220	35.07	5.1051	0.	RCFLAGS	0	0	
5	4203	11.2770	13.46	2.1488	0.	RCFLAGS	0	0	
5	105	0.6830	3.82	0.0225	0.	RCFLAGS	0	0	
5	205	2.7050	27.18	5.1199	0.	RCFLAGS	0	0	
5	106	0.1870	67.63	0.2192	0.	RCFLAGS	0	0	
5	206	2.8920	29.80	5.2037	0.	RCFLAGS	0	0	
5	107	0.1880	80.75	0.2639	0.	RCFLAGS	0	0	
5	207	3.0800	32.91	5.3274	0.	RCFLAGS	0	0	
5	505	3.0800	12.32	0.3278	108000.	RCFLAGS	0	0	
5	110	0.3330	61.72	0.3578	0.	RCFLAGS	0	0	
5	210	3.4130	17.14	0.6750	0.	RCFLAGS	0	0	
5	510	3.4130	16.99	0.6708	1110.	RCFLAGS	0	0	
5	10	3.4130	16.74	0.6689	0.	RCFLAGS	0	0	
5	115	0.1250	91.15	0.2702	0.	RCFLAGS	0	0	
5	215	3.5380	19.37	0.8877	0.	RCFLAGS	0	0	
5	415	11.2770	6.73	1.0744	0.	RCFLAGS	0	0	
5	1215	3.5380	40.82	1.9586	0.	RCFLAGS	0	0	
5	20	3.5380	39.69	1.9288	0.	RCFLAGS	0	0	return1.dat

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5	120	0.4210	46.07	0.3067	0.	RCFLAGS	0	0	
5	220	3.9590	40.36	2.1995	0.	RCFLAGS	0	0	
5	420	11.2770	6.73	1.0744	0.	RCFLAGS	0	0	
5	1220	3.9590	59.54	3.2496	0.	RCFLAGS	0	0	
5	520	3.9590	59.36	3.2074	3670.	RCFLAGS	0	0	
5	24	3.9590	58.96	3.2040	0.	RCFLAGS	0	0	
5	524	3.9590	58.92	3.2039	313.	RCFLAGS	0	0	
5	124	0.1820	65.37	0.3186	0.	RCFLAGS	0	0	
5	224	4.1410	59.20	3.3982	0.	RCFLAGS	0	0	
5	126	0.0990	27.98	0.1428	0.	RCFLAGS	0	0	
5	226	4.2400	58.47	3.4401	0.	RCFLAGS	0	0	
5	26	4.2400	56.67	3.2708	0.	RCFLAGS	0	0	
5	251	8.7380	34.66	4.1628	0.	RCFLAGS	0	0	
5	160	0.3150	65.64	0.2999	0.	RCFLAGS	0	0	
5	3160	0.3150	0.00	0.0000	0.	RCFLAGS	0	0	
5	4160	11.5920	1.78	0.2999	0.	RCFLAGS	0	0	
5	60	0.3150	0.00	0.0000	0.	RCFLAGS	0	0	
5	162	0.3930	55.73	0.7054	0.	RCFLAGS	0	0	
5	260	0.7080	30.94	0.7054	0.	RCFLAGS	0	0	
5	262	9.4460	34.38	4.4906	0.	RCFLAGS	0	0	
5	65	9.4460	33.81	4.4736	0.	RCFLAGS	0	0	
5	165	0.2390	24.08	0.1419	0.	RCFLAGS	0	0	
5	265	9.6850	33.57	4.5569	0.	RCFLAGS	0	0	
5	3265	9.6850	25.18	3.4177	0.	RCFLAGS	0	0	
5	4265	21.2770	4.79	1.3994	0.	RCFLAGS	0	0	
5	170	0.4530	38.29	0.2833	0.	RCFLAGS	0	0	
5	570	0.4530	30.16	0.1503	5520.	RCFLAGS	0	0	
5	75	0.4530	29.42	0.1503	0.	RCFLAGS	0	0	

5	175	0.2570	62.64	0.4825	0.	RCFLAGS	0	0	
5	275	0.7100	41.45	0.5268	0.	RCFLAGS	0	0	
5	277	10.3950	26.29	3.7418	0.	RCFLAGS	0	0	
5	477	21.2770	4.79	1.3994	0.	RCFLAGS	0	0	
5	1277	10.3950	36.10	5.1412	0.	RCFLAGS	0	0	
5	3277	10.3950	31.80	4.8412	0.	RCFLAGS	0	0	
5	78	10.3950	1.79	0.2302	0.	RCFLAGS	0	0	
5	79	10.3950	31.46	4.8399	0.	RCFLAGS	0	0	
5	279	10.3950	33.26	4.9581	0.	RCFLAGS	0	0	
5	180	0.4700	40.90	0.3258	28.	RCFLAGS	0	0	
5	278	10.8650	33.59	5.1836	0.	RCFLAGS	0	0	
5	580	10.8650	33.26	5.1626	10400.	RCFLAGS	0	0	
5	3580	10.8650	32.71	5.1376	0.	RCFLAGS	0	0	
5	80	10.8650	32.48	5.1367	0.	RCFLAGS	0	0	
6	130	0.5030	56.06	0.4579	0.	RCFLAGS	0	0	return1.dat

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6	3130	0.5030	0.00	0.0000	0.	RCFLAGS	0	0	
6	30	0.5030	0.00	0.0000	0.	RCFLAGS	0	0	
6	132	0.1730	59.85	0.2966	0.	RCFLAGS	0	0	
6	232	0.6760	15.32	0.2966	0.	RCFLAGS	0	0	
6	135	2.2800	28.60	0.8800	60.	RCFLAGS	0	0	
6	3135	2.2800	0.00	0.0000	0.	RCFLAGS	0	0	
6	4135	2.7830	33.56	1.3285	0.	RCFLAGS	0	0	
6	35	2.2800	0.00	0.0000	0.	RCFLAGS	0	0	
6	140	0.5890	64.26	0.6524	0.	RCFLAGS	0	0	
6	235	2.8690	13.19	0.6524	0.	RCFLAGS	0	0	
6	240	3.5450	13.60	0.9374	0.	RCFLAGS	0	0	
6	40	3.5450	13.51	0.9307	0.	RCFLAGS	0	0	
6	145	0.5540	51.22	0.4126	0.	RCFLAGS	0	0	
6	3145	0.5540	0.00	0.0000	0.	RCFLAGS	0	0	
6	4145	3.3370	36.49	1.7411	0.	RCFLAGS	0	0	
6	50	0.5540	0.00	0.0000	0.	RCFLAGS	0	0	
6	150	0.3990	71.00	0.7296	0.	RCFLAGS	0	0	
6	245	0.9530	29.73	0.7296	0.	RCFLAGS	0	0	
6	250	4.4980	16.94	1.6092	0.	RCFLAGS	0	0	
6	3250	4.4980	15.25	1.4483	0.	RCFLAGS	0	0	
6	4250	7.8350	16.52	1.8931	0.	RCFLAGS	0	0	
6	101	1.4200	25.84	0.4694	44.	RCFLAGS	0	10	
6	3101	1.4200	0.00	0.0000	0.	RCFLAGS	0	0	
6	4101	9.2550	17.95	2.3448	0.	RCFLAGS	0	0	
6	102	0.1400	136.49	1.2999	0.	RCFLAGS	0	0	
6	202	1.5600	12.25	1.2999	0.	RCFLAGS	0	0	
6	103	0.4620	121.84	4.0972	0.	RCFLAGS	0	0	
6	203	2.0220	37.29	5.3971	0.	RCFLAGS	0	0	
6	3203	2.0220	37.18	5.3963	0.	RCFLAGS	0	0	
6	4203	11.2770	14.75	2.3456	0.	RCFLAGS	0	0	
6	105	0.6830	3.91	0.0233	0.	RCFLAGS	0	0	
6	205	2.7050	28.78	5.4115	0.	RCFLAGS	0	0	
6	106	0.1870	73.16	0.2362	0.	RCFLAGS	0	0	
6	206	2.8920	31.65	5.5059	0.	RCFLAGS	0	0	
6	107	0.1880	86.37	0.2812	0.	RCFLAGS	0	0	
6	207	3.0800	34.99	5.6402	0.	RCFLAGS	0	0	
6	505	3.0800	13.09	0.3483	112000.	RCFLAGS	0	0	
6	110	0.3330	67.02	0.3870	0.	RCFLAGS	0	0	
6	210	3.4130	18.35	0.7237	0.	RCFLAGS	0	0	
6	510	3.4130	18.17	0.7212	1170.	RCFLAGS	0	0	
6	10	3.4130	17.89	0.7188	0.	RCFLAGS	0	0	
6	115	0.1250	97.96	0.2891	0.	RCFLAGS	0	0	
6	215	3.5380	20.72	0.9562	0.	RCFLAGS	0	0	
6	415	11.2770	7.37	1.1728	0.	RCFLAGS	0	0	
6	1215	3.5380	44.23	2.1238	0.	RCFLAGS	0	0	
6	20	3.5380	43.01	2.0905	0.	RCFLAGS	0	0	return1.dat

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6	120	0.4210	50.24	0.3334	0.	RCFLAGS	0	0	
6	220	3.9590	43.77	2.3857	0.	RCFLAGS	0	0	
6	420	11.2770	7.37	1.1728	0.	RCFLAGS	0	0	
6	1220	3.9590	64.78	3.5333	0.	RCFLAGS	0	0	
6	520	3.9590	64.58	3.4837	4320.	RCFLAGS	0	0	
6	24	3.9590	64.14	3.4796	0.	RCFLAGS	0	0	
6	524	3.9590	64.10	3.4796	331.	RCFLAGS	0	0	
6	124	0.1820	71.09	0.3446	0.	RCFLAGS	0	0	
6	224	4.1410	64.40	3.6896	0.	RCFLAGS	0	0	
6	126	0.0990	32.26	0.1641	0.	RCFLAGS	0	0	
6	226	4.2400	63.65	3.7376	0.	RCFLAGS	0	0	
6	26	4.2400	61.70	3.5531	0.	RCFLAGS	0	0	
6	251	8.7380	37.79	4.5262	0.	RCFLAGS	0	0	
6	160	0.3150	70.47	0.3209	0.	RCFLAGS	0	0	
6	3160	0.3150	0.00	0.0000	0.	RCFLAGS	0	0	
6	4160	11.5920	1.91	0.3209	0.	RCFLAGS	0	0	
6	60	0.3150	0.00	0.0000	0.	RCFLAGS	0	0	
6	162	0.3930	61.27	0.7697	0.	RCFLAGS	0	0	
6	260	0.7080	34.01	0.7697	0.	RCFLAGS	0	0	
6	262	9.4460	37.51	4.8845	0.	RCFLAGS	0	0	
6	65	9.4460	36.94	4.8688	0.	RCFLAGS	0	0	
6	165	0.2390	27.97	0.1651	0.	RCFLAGS	0	0	
6	265	9.6850	36.72	4.9663	0.	RCFLAGS	0	0	
6	3265	9.6850	27.54	3.7248	0.	RCFLAGS	0	0	
6	4265	21.2770	5.22	1.5211	0.	RCFLAGS	0	0	
6	170	0.4530	41.92	0.3101	0.	RCFLAGS	0	0	
6	570	0.4530	32.83	0.1642	6120.	RCFLAGS	0	0	
6	75	0.4530	32.02	0.1642	0.	RCFLAGS	0	0	
6	175	0.2570	68.27	0.5259	0.	RCFLAGS	0	0	
6	275	0.7100	45.14	0.5732	0.	RCFLAGS	0	0	
6	277	10.3950	28.74	4.0808	0.	RCFLAGS	0	0	
6	477	21.2770	5.22	1.5211	0.	RCFLAGS	0	0	
6	1277	10.3950	39.43	5.6017	0.	RCFLAGS	0	0	
6	3277	10.3950	35.07	5.3017	0.	RCFLAGS	0	0	
6	78	10.3950	1.81	0.2310	0.	RCFLAGS	0	0	
6	79	10.3950	34.71	5.3004	0.	RCFLAGS	0	0	
6	279	10.3950	36.52	5.4200	0.	RCFLAGS	0	0	
6	180	0.4700	44.04	0.3515	30.	RCFLAGS	0	0	
6	278	10.8650	36.85	5.6651	0.	RCFLAGS	0	0	
6	580	10.8650	36.49	5.6415	11400.	RCFLAGS	0	0	
6	3580	10.8650	35.95	5.6165	0.	RCFLAGS	0	0	
6	80	10.8650	35.70	5.6155	0.	RCFLAGS	0	0	
7	130	0.5030	116.18	0.9108	0.	RCFLAGS	0	0	return1.dat
			scene1.wat						
7	3130	0.5030	25.31	0.4508	0.	RCFLAGS	0	0	
7	30	0.5030	25.50	0.4473	0.	RCFLAGS	0	0	
7	132	0.1730	130.27	0.6018	0.	RCFLAGS	0	0	
7	232	0.6760	52.31	0.9451	0.	RCFLAGS	0	0	
7	135	2.2800	60.61	1.8019	123.	RCFLAGS	0	0	
7	3135	2.2800	17.01	0.9019	0.	RCFLAGS	0	0	
7	4135	2.7830	52.14	1.3600	0.	RCFLAGS	0	0	
7	35	2.2800	17.04	0.8997	0.	RCFLAGS	0	0	
7	140	0.5890	129.97	1.2812	0.	RCFLAGS	0	0	
7	235	2.8690	40.22	2.0728	0.	RCFLAGS	0	0	
7	240	3.5450	42.53	2.9916	0.	RCFLAGS	0	0	
7	40	3.5450	42.41	2.9877	0.	RCFLAGS	0	0	
7	145	0.5540	104.47	0.8126	0.	RCFLAGS	0	0	
7	3145	0.5540	24.28	0.3926	0.	RCFLAGS	0	0	
7	4145	3.3370	56.80	1.7800	0.	RCFLAGS	0	0	
7	50	0.5540	24.74	0.3733	0.	RCFLAGS	0	0	
7	150	0.3990	144.64	1.4098	0.	RCFLAGS	0	0	
7	245	0.9530	74.94	1.4519	0.	RCFLAGS	0	0	
7	250	4.4980	49.30	4.4138	0.	RCFLAGS	0	0	

7	3250	4.4980	44.37	3.9724	0.	RCFLAGS	0	0	
7	4250	7.8350	27.02	2.2214	0.	RCFLAGS	0	0	
7	101	1.4200	51.79	0.9215	82.	RCFLAGS	0	0	
7	3101	1.4200	15.02	0.4415	0.	RCFLAGS	0	0	
7	4101	9.2550	28.52	2.7014	0.	RCFLAGS	0	0	
7	102	0.1400	226.57	2.0055	0.	RCFLAGS	0	0	
7	202	1.5600	34.01	2.0055	0.	RCFLAGS	0	0	
7	103	0.4620	205.52	6.4698	0.	RCFLAGS	0	0	
7	203	2.0220	73.20	8.4753	0.	RCFLAGS	0	0	
7	3203	2.0220	73.09	8.4745	0.	RCFLAGS	0	0	
7	4203	11.2770	23.42	2.7022	0.	RCFLAGS	0	0	
7	105	0.6830	57.59	0.6046	0.	RCFLAGS	0	0	
7	205	2.7050	69.18	8.5085	0.	RCFLAGS	0	0	
7	106	0.1870	140.30	0.4361	0.	RCFLAGS	0	0	
7	206	2.8920	73.78	8.7278	0.	RCFLAGS	0	0	
7	107	0.1880	154.74	0.4868	0.	RCFLAGS	0	0	
7	207	3.0800	78.72	8.9894	0.	RCFLAGS	0	0	
7	505	3.0800	19.25	0.5048	220000.	RCFLAGS	0	0	
7	110	0.3330	135.18	0.7376	0.	RCFLAGS	0	0	
7	210	3.4130	30.56	1.1678	0.	RCFLAGS	0	0	
7	510	3.4130	30.25	1.1657	1600.	RCFLAGS	0	0	
7	10	3.4130	29.85	1.1643	0.	RCFLAGS	0	0	
7	115	0.1250	180.44	0.5133	0.	RCFLAGS	0	0	
7	215	3.5380	35.17	1.6062	0.	RCFLAGS	0	0	
7	415	11.2770	11.71	1.3511	0.	RCFLAGS	0	0	
7	1215	3.5380	72.50	2.9429	0.	RCFLAGS	0	0	
7	20	3.5380	70.49	2.9267	0.	RCFLAGS	0	0	return1.dat
			scene1.wat						
7	120	0.4210	110.46	0.7182	0.	RCFLAGS	0	0	
7	220	3.9590	74.74	3.5881	0.	RCFLAGS	0	0	
7	420	11.2770	11.71	1.3511	0.	RCFLAGS	0	0	
7	1220	3.9590	108.10	4.9392	0.	RCFLAGS	0	0	
7	520	3.9590	107.38	4.8625	8400.	RCFLAGS	0	0	
7	24	3.9590	106.56	4.8589	0.	RCFLAGS	0	0	
7	524	3.9590	106.49	4.8582	454.	RCFLAGS	0	10	
7	124	0.1820	142.92	0.6597	0.	RCFLAGS	0	0	
7	224	4.1410	108.09	5.2831	0.	RCFLAGS	0	0	
7	126	0.0990	90.01	0.4373	0.	RCFLAGS	0	0	
7	226	4.2400	107.67	5.4374	0.	RCFLAGS	0	0	
7	26	4.2400	104.63	5.3049	0.	RCFLAGS	0	0	
7	251	8.7380	73.61	9.0289	0.	RCFLAGS	0	0	
7	160	0.3150	129.58	0.5717	0.	RCFLAGS	0	0	
7	3160	0.3150	21.67	0.2417	0.	RCFLAGS	0	0	
7	4160	11.5920	2.93	0.3300	0.	RCFLAGS	0	0	
7	60	0.3150	22.07	0.2281	0.	RCFLAGS	0	0	
7	162	0.3930	130.24	1.5455	0.	RCFLAGS	0	0	
7	260	0.7080	82.11	1.5455	0.	RCFLAGS	0	0	
7	262	9.4460	74.25	10.2229	0.	RCFLAGS	0	0	
7	65	9.4460	73.41	10.1683	0.	RCFLAGS	0	0	
7	165	0.2390	81.11	0.4745	0.	RCFLAGS	0	0	
7	265	9.6850	73.60	10.5094	0.	RCFLAGS	0	0	
7	3265	9.6850	55.20	7.8821	0.	RCFLAGS	0	0	
7	4265	21.2770	9.97	2.9574	0.	RCFLAGS	0	0	
7	170	0.4530	102.65	0.7436	0.	RCFLAGS	0	0	
7	570	0.4530	77.89	0.3884	15900.	RCFLAGS	0	0	
7	75	0.4530	76.27	0.3884	0.	RCFLAGS	0	0	
7	175	0.2570	140.00	1.0564	0.	RCFLAGS	0	0	
7	275	0.7100	99.34	1.1576	0.	RCFLAGS	0	0	
7	277	10.3950	58.22	8.7581	0.	RCFLAGS	0	0	
7	477	21.2770	9.97	2.9574	0.	RCFLAGS	0	0	
7	1277	10.3950	78.63	11.7134	0.	RCFLAGS	0	0	
7	3277	10.3950	73.45	11.4134	0.	RCFLAGS	0	0	
7	78	10.3950	2.04	0.2395	0.	RCFLAGS	0	0	

7	79	10.3950	72.99	11.4100	0.	RCFLAGS	0	0
7	279	10.3950	75.03	11.5367	0.	RCFLAGS	0	0
7	180	0.4700	85.32	0.6873	59.	RCFLAGS	0	0
7	278	10.8650	75.48	12.0968	0.	RCFLAGS	0	0
7	580	10.8650	74.80	11.9749	25500.	RCFLAGS	0	0
7	3580	10.8650	74.26	11.9499	0.	RCFLAGS	0	0
7	80	10.8650	73.93	11.9473	0.	RCFLAGS	0	0

1614-13338 220 Arkell Road
MIDUSS Parameters

Existing Conditions

Area Description	Catchment Number	Area	Pervious Length	Gradient	% Impervious	Impervious Length	Overland Manning's 'n'	Max Infiltration (1)	Min Infiltration (2)	Lag Constant (3)	Depression Storage (4)
		(ha)	(m)	(%)		(m)		(mm/hr)	(mm/hr)	(hrs)	(mm)
Wetland/wooded area to Torrance Creek (part of Torrance Creek Swamp)	105	0.83	50	0.5	0	10	0.25	75	13	0.5	15.0
Agricultural land, some forested and lawnd coverage, and a residential property including a driveway and several buildings draining west to Torrance Creek	106	3.87	120	4	10	10	0.25	75	13	0.5	5.0
Mostly agricultural and lawn area with a portion of the residential building draining northeast, eventually to Torrance Creek	110	2.47	150	2	5	10	0.25	75	13	0.5	5.0
Adjacent Rooftops, rear yards and portion of SWMF banks of Existing Arkell Meadows Subdivision draining west to Torrance Creek	107	0.66	200	2	40	10	0.25	75	13	0.5	5.0

Total Site Area **7.2**
Total Area 7.83

Proposed Conditions

Area Description	Catchment Number	Area	Pervious Length	Gradient	% Impervious	Impervious Length	Overland Manning's 'n'	Max Infiltration (1)	Min Infiltration (2)	Lag Constant (3)	Depression Storage (4)
		(ha)	(m)	(%)		(m)		(mm/hr)	(mm/hr)	(hrs)	(mm)
Residential area consisting of approximately half single family and half townhomes	200	2.44	20	2	65	41	0.25	75	13	0.5	5.0
Ecological Linkage at north end of site and rear lots of multiblock on east side draining east offsite	201A + 201B	1.12	150	2	0	10	0.25	75	13	0.5	5.0
Park	202	0.29	50	3	10	4	0.25	75	13	0.5	5.0
SWM Block	203	0.37	50	1	15	4	0.25	75	13	0.5	5.0
Wetland/wooded area to Torrance Creek (part of Torrance Creek Swamp) along with some existing pasture/grass	204	1.65	50	0.5	0	10	0.25	75	13	0.5	10.0
Mostly naturalized/landscaped area (former driveway) draining uncontrolled to Torrance Creek	205	0.24	10	0.5	15	10	0.25	75	13	0.5	5.0
Rear lots and portion or rooftops units as well as portion of park/trail draining uncontrolled to Torrance Creek	206	0.38	90	2	25	10	0.25	75	13	0.5	5.0
Ecological Linkage draining west (around SWM)	207A + 207B	0.35	110	2	0	10	0.25	75	13	0.5	5.0
Adjacent Rooftops, rear yards and portion of SWMF banks of Existing Arkell Meadows Subdivision draining west to Torrance Creek	208	0.66	200	2	40	10	0.25	75	13	0.5	5.0
Rear lots from townhome units and trail connection draining to reverse sloped culvert and subsequently west to Torrance Creek	209	0.33	200	2	15	10	0.25	75	13	0.5	5.0

Total Site **7.2**
Developed to Pond (incl pond block) **2.8** 58% impervious
Total Area **7.83**

Notes:
1. Maximum infiltration rate based on neighbouring Victoria Park Village as well as Geotechnical Investigation for 220 Arkell Road (Stantec, 2018)
2. Minimum infiltration rate based on neighbouring Victoria Park Village as well as Geotechnical Investigation for 220 Arkell Road (Stantec, 2018)
3. Typical value for lag constant from MTO Design Chart 1.13 from the MTO Drainage Management Manual (1997)
4. Depression storage based on typical values for a pasture, grass and wetland from the Technical Guidelines for Flood Hazard Mapping (MNRF, 2017)

1614-13338 220 Arkell Road

Stormwater Quality Volumetric Requirements

Drainage Area (ha)[2]	Total % Imp.	Level	Facility Type	Water Quality Unit Volume Requirements [1]			Water Quality Volume Requirements			Drawdown for Water Quality Volume (hrs)	Drawdown during 25mm, 4hr Event
				Total Unit Volume (m^3/ha)	Permanent Pool (m^3/ha)	Extended Detention (m^3/ha)	Permanent Pool (m^3)	Extended Detention (m^3)	Total MOE Volume		
2.81	58%	Basic	Drypond	161	N/A	N/A	N/A	N/A	454	34	29

[1] Water quality unit volume requirements based on Table 3.2, Stormwater Management Planning & Design Manual (MOE 2003)

[2] Drainage Area for Quality control represents total storm sewer drainage area to SWM Facility and includes the area of the SWM block itself and external area draining onto site

1614-13338 220 Arkell Road

Sediment Forebay Sizing Calculations

Using MOE - SWMPD Manual Criteria (2003)

STORMWATER MANAGEMENT FACILITY

Settling

Dist = sqrt(r*Q_p/v_s)

= **7.7** **m**

r : 1 = l to w ratio — r = 3.00

Q_p = peak SWM outflow for water quality portion of E.D. zone — Q_p = 0.006

v_s = settling velocity for 0.15 mm particles (m/s) — v_s = 0.0003

Dispersion Length

Dist = 8Q/dv

= **1.8** **m**

Q = 5 yr max inlet flow (m^3/s) — Q = 0.114

d = depth of perm pool in forebay (m) — d = 1

v_f = desired vel in forebay (m/s) — v_f = 0.5

Velocity

v = Q/A

= **0.05** **m/s**

y = total depth of forebay from perm. pool (m) — y = 1 — Note 1.

b = bottom width (avg) of forebay (m) — b = 2

Q = 5 yr inlet flow (m^3/s) — Q = 0.114

A = cross-sectional area (m^2) — A = 2.3 — Note 1.

Target velocity = 0.15 — V_{targ} = 0.15

Therefore, **Velocity Target Satisfied**

Cleanout Frequency

Table 6.3 MOE SWMPD Guidelines

cleanout = Vol/(load*A_{sew}*effic)

= **27.2** **years**

Therefore, **Cleanout Time OK**

A_{sew} = Contributing Sewer Area (ha) — A_{sew} = 2.81

Imp = Percent Impervious (%) — Imp = 58%

load = Sediment Loading (m^3/ha) — load = 2.1 — Note 2.

effic = Removal Efficiency (%) — effic = 60%

Targ = Cleanout Frequency Target (years) — Targ = 7

Vol = Sediment volume (m^3) (0.5m depth) — Vol = 97 — Note 3.

Notes

1. Total depth and cross-sectional area are 'worst-case' values, representative of conditions just prior to sediment clean-out
2. Interpolated based on percent impervious
3. Volume of bottom 0.5 m depth, the maximum sediment accumulation depth

1614-13338 220 Arkell Road
SWM Facility: Stage-Storage-Discharge Calculations

	Rating Curve for MIDUSS				
				Drawdown (hrs) - including infiltration	
	Elevation (m)	Total Outflow (m^3/s)	Active Storage (m^3)	Increment	Total
Bottom of Forebay	334.00				
	334.10				
	334.20				
	334.30				
	334.40				
	334.50				
	334.60				
	334.70				
	334.80				
	334.90				
Drypond bottom	335.00				
	335.10	0.003	82	15.6	15.6
	335.20	0.005	171	6.4	22.0
	335.30	0.006	266	4.9	26.9
	335.40	0.007	367	4.3	31.2
	335.50	0.008	475	4.0	35.2
	335.60	0.009	591	3.8	39.0
	335.70	0.010	713	3.7	42.7
	335.80	0.010	843	3.6	46.4
	335.90	0.011	981	3.6	50.0
	336.00	0.012	1,126	3.6	53.6
	336.10	0.012	1,280	3.6	57.2
	336.20	0.013	1,442	3.6	60.8
	336.30	0.013	1,612	3.7	64.5
	336.40	0.014	1,791	3.7	68.2
	336.50	0.014	1,979	3.7	71.9
	336.60	0.015	2,176	3.8	75.7
Emergency Weir	336.70	0.015	2,384	3.9	79.6
	336.80	0.286	2,604	0.4	80.0
	336.90	0.783	2,836	0.1	80.1
Top of Pond	337.00	1.433	3,049	0.1	80.2

	Volume Estimation					
		Forebay		Total		Total
	Elevation (m)	Area (m^2)	Perm Vol (m^3)	Area (m^2)	Vol (m^3)	Act Vol (m^3)
Bottom of Forebay	334.00	19		19		
	334.10	32	3	32	3	
	334.20	48	7	48	7	
	334.30	66	12	66	12	
	334.40	87	20	87	20	
	334.50	111	30	111	30	
	334.60	137	42	137	42	
	334.70	165	57	165	57	
	334.80	196	75	196	75	
	334.90	230	97	230	97	
Drypond bottom	335.00	792	148	792	148	
	335.10			853	230	82
	335.20			916	318	171
	335.30			981	413	266
	335.40			1049	515	367
	335.50			1118	623	475
	335.60			1189	738	591
	335.70			1263	861	713
	335.80			1338	991	843
	335.90			1415	1129	981
	336.00			1495	1274	1,126
	336.10			1576	1428	1,280
	336.20			1660	1590	1,442
	336.30			1745	1760	1,612
	336.40			1833	1939	1,791
	336.50			1923	2127	1,979
	336.60			2024	2324	2,176
Emergency Weir	336.70			2139	2532	2,384
	336.80			2257	2752	2,604
	336.90			2377	2,984	2,836
Top of Pond	337.00			2495	3,197	3,049

	Outlet Controls			
			Overflow	
	Elevation (m)	Orifice 1 (m^3/s)	Weir (m^3/s)	Total Flow (m^3/s)
Bottom of Forebay	334.00			
	334.10			
	334.20			
	334.30			
	334.40			
	334.50			
	334.60			
	334.70			
	334.80			
	334.90			
Drypond bottom	335.00			
	335.10	0.003		0.003
	335.20	0.005		0.005
	335.30	0.006		0.006
	335.40	0.007		0.007
	335.50	0.008		0.008
	335.60	0.009		0.009
	335.70	0.010		0.010
	335.80	0.010		0.010
	335.90	0.011		0.011
	336.00	0.012		0.012
	336.10	0.012		0.012
	336.20	0.013		0.013
	336.30	0.013		0.013
	336.40	0.014		0.014
	336.50	0.014		0.014
	336.60	0.015		0.015
Emergency Weir	336.70	0.015	0.000	0.015
	336.80	0.016	0.270	0.286
	336.90	0.016	0.767	0.783
Top of Pond	337.00	0.016	1.416	1.433

Parameters	
Orifice 1	
Orifice Invert Elev. (m)	Orifice Coeff.
335.00	0.60
Orifice Mid-point Elev. (m)	Perimeter (m)
335.04	0.24
Orifice Diam.(mm)	Area (m^2)
75	0.004
Weir Coeff. (semi-circular)	Orientation
1.62	Vertical
Overflow Spillway	
Spillway Invert (m)	Top of Berm (m)
336.70	337.00
Spillway Length @ Invert (m)	Max. Flow Depth (m)
5	0.30
Left Side Slope	Right Side Slope
10	10
Weir Coefficient (Rectangle)	Topwidth
1.7	11.0
Weir Coefficient (Triangle)	
1.3	

Weir Equation Used: $Q = C_{wb}*L*H^{1.5} + C_{wt}*S*H^{2.5}$

where
- L = bottom width of spillway
- H = head above weir invert
- S = side slopes (ratio of H:V)
- C_{wt} = weir coefficient (triangular)
- C_{wb} = weir coefficient (broad-crested)

Orifice Flow Calculations: Orifice flow equation

$Q = C.A.(2.g.H)^{0.5}$

where
- C = orifice coefficient
- A = area of orifice
- g = acceleration due to gravity
- H = head above centre line of orifice
- Note: used when water elevation is above 3/4 of the orifice diameter

Sharp crested semi-circular weir equation

$Q=C*D^{2.5}*(H/D)^{1.88}$

where
- C = sharp crested semi-circular weir coefficient
- D = diameter of orifice
- H = head above orifice invert
- Note: used when water elevation is below 3/4 of the orifice diameter

```
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      Licensee: Paragon Engineering Limited
35    COMMENT
     7     line(s) of comment
      **********************
      1614-13338 220 Arkell
      Stormwater Management Modelling
      Existing Conditions
      25mm, 4 hour event
      Modeller: B.Weersink (Mar 2022)
      **********************
23    FILE RAINFALL
     1     1=READ: 2=WRITE
    10     25mm.STM             is Filename
 3    IMPERVIOUS
         2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .013     Manning "n"
      .000     Max.Infiltn. mm/hr
      .000     Min.Infiltn. mm/hr
      .050     Lag const (hours)
     1.500     Dep.Storage mm
35    COMMENT
     3     line(s) of comment
      **********************
      Catchment 110 - Existing Catchment draining east
      **********************
 4    CATCHMENT
   110.000     ID No.ó 99999
     2.470     Area in hectares
   150.000     Length (PERV) metres
     2.000     Gradient (%)
     5.000     Per cent Impervious
    10.000     Length (IMPERV)
      .000     %Imp. with Zero Dpth
         2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250     Manning "n"
    75.000     Max.Infiltn. mm/hr
    13.000     Min.Infiltn. mm/hr
      .500     Lag const (hours)
     5.000     Dep.Storage mm
         1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .022       .000       .000       .000 c.m/s
            .000       .918       .046     C perv/imperv/total
14    START
     1     1=Zero; 2=Define
35    COMMENT
     3     line(s) of comment
      **********************
      Catchment 106 - Existing Site draining west to Torrance Cree
      **********************
 4    CATCHMENT
   106.000     ID No.ó 99999
     3.870     Area in hectares
   120.000     Length (PERV) metres
     4.000     Gradient (%)
    10.000     Per cent Impervious
    10.000     Length (IMPERV)
      .000     %Imp. with Zero Dpth
         2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250     Manning "n"
    75.000     Max.Infiltn. mm/hr
    13.000     Min.Infiltn. mm/hr
      .500     Lag const (hours)
     5.000     Dep.Storage mm
         1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .069       .000       .000       .000 c.m/s
            .000       .907       .091     C perv/imperv/total
15    ADD RUNOFF
            .069       .069       .000       .000 c.m/s
35    COMMENT
     3     line(s) of comment
      **********************
      Catchment 105 - Wetland area (Torrance Creek Swamp)
      **********************
 4    CATCHMENT
   105.000     ID No.ó 99999
      .830     Area in hectares
    50.000     Length (PERV) metres
      .500     Gradient (%)
      .000     Per cent Impervious
    10.000     Length (IMPERV)
      .000     %Imp. with Zero Dpth
         2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250     Manning "n"
    75.000     Max.Infiltn. mm/hr
    13.000     Min.Infiltn. mm/hr
      .500     Lag const (hours)
    15.000     Dep.Storage mm
         1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
      ****************************************** c.m/s
            .000       .000       .000     C perv/imperv/total
15    ADD RUNOFF
            .000       .069       .000       .000 c.m/s
20    MANUAL
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         192   533    15.000        are MAXDT MAXHYD & DTMIN values
      Licensee: Paragon Engineering Limited
35    COMMENT
      7     line(s) of comment
      **********************
      1614-13338 220 Arkell
      Stormwater Management Modelling
      Existing Conditions
      2-yr, 48-hour adjusted storm (TCSS)
      Modeller: B.Weersink (Mar 2022)
      **********************
23    FILE RAINFALL
      1     1=READ: 2=WRITE
      10    2yr48hr.ST           is Filename
 3    IMPERVIOUS
          2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .013     Manning "n"
       .000     Max.Infiltn. mm/hr
       .000     Min.Infiltn. mm/hr
       .050     Lag const (hours)
      1.500     Dep.Storage mm
35    COMMENT
      3     line(s) of comment
      **********************
      Catchment 110 - Existing Catchment draining east
      **********************
 4    CATCHMENT
     110.000    ID No.ó 99999
      2.470     Area in hectares
     150.000    Length (PERV) metres
      2.000     Gradient (%)
      5.000     Per cent Impervious
     10.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
          2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     75.000     Max.Infiltn. mm/hr
     13.000     Min.Infiltn. mm/hr
       .500     Lag const (hours)
      5.000     Dep.Storage mm
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .005       .000       .000       .000 c.m/s
             .002       .925       .048     C perv/imperv/total
14    START
      1     1=Zero; 2=Define
35    COMMENT
      3     line(s) of comment
      **********************
      Catchment 106 - Existing Site draining west to Torrance Cree
      **********************
 4    CATCHMENT
     106.000    ID No.ó 99999
      3.870     Area in hectares
     120.000    Length (PERV) metres
      4.000     Gradient (%)
     10.000     Per cent Impervious
     10.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
          2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     75.000     Max.Infiltn. mm/hr
     13.000     Min.Infiltn. mm/hr
       .500     Lag const (hours)
      5.000     Dep.Storage mm
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .017       .000       .000       .000 c.m/s
             .002       .903       .092     C perv/imperv/total
15    ADD RUNOFF
             .017       .017       .000       .000 c.m/s
35    COMMENT
      3     line(s) of comment
      **********************
      Catchment 105 - Wetland area (Torrance Creek Swamp)
      **********************
 4    CATCHMENT
     105.000    ID No.ó 99999
       .830     Area in hectares
     50.000     Length (PERV) metres
       .500     Gradient (%)
       .000     Per cent Impervious
     10.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
          2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     75.000     Max.Infiltn. mm/hr
     13.000     Min.Infiltn. mm/hr
       .500     Lag const (hours)
     15.000     Dep.Storage mm
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
      ****************************************** c.m/s
             .000       .000       .000     C perv/imperv/total
15    ADD RUNOFF
             .000       .017       .000       .000 c.m/s
20    MANUAL
```

```
      Output File (4.7) ARK5EX.OUT   opened 2022-03-29   8:43
      Units used are defined by G =    9.810
         192   533    15.000        are MAXDT MAXHYD & DTMIN values
      Licensee: Paragon Engineering Limited
35    COMMENT
      7     line(s) of comment
      **********************
      1614-13338 220 Arkell
      Stormwater Management Modelling
      Existing Conditions
      5-yr, 48-hour adjusted storm (TCSS)
      Modeller: B.Weersink (Mar 2022)
      **********************
23    FILE RAINFALL
      1     1=READ: 2=WRITE
      10    5yr48hr.ST           is Filename
 3    IMPERVIOUS
          2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .013     Manning "n"
       .000     Max.Infiltn. mm/hr
       .000     Min.Infiltn. mm/hr
       .050     Lag const (hours)
      1.500     Dep.Storage mm
35    COMMENT
      3     line(s) of comment
      **********************
      Catchment 110 - Existing Catchment draining east
      **********************
 4    CATCHMENT
     110.000    ID No.ó 99999
      2.470     Area in hectares
     150.000    Length (PERV) metres
      2.000     Gradient (%)
      5.000     Per cent Impervious
     10.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
          2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     75.000     Max.Infiltn. mm/hr
     13.000     Min.Infiltn. mm/hr
       .500     Lag const (hours)
      5.000     Dep.Storage mm
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .028       .000       .000       .000 c.m/s
             .063       .919       .106     C perv/imperv/total
14    START
      1     1=Zero; 2=Define
35    COMMENT
      3     line(s) of comment
      **********************
      Catchment 106 - Existing Site draining west to Torrance Cree
      **********************
 4    CATCHMENT
     106.000    ID No.ó 99999
      3.870     Area in hectares
     120.000    Length (PERV) metres
      4.000     Gradient (%)
     10.000     Per cent Impervious
     10.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
          2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     75.000     Max.Infiltn. mm/hr
     13.000     Min.Infiltn. mm/hr
       .500     Lag const (hours)
      5.000     Dep.Storage mm
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .058       .000       .000       .000 c.m/s
             .063       .896       .146     C perv/imperv/total
15    ADD RUNOFF
             .058       .058       .000       .000 c.m/s
35    COMMENT
      3     line(s) of comment
      **********************
      Catchment 105 - Wetland area (Torrance Creek Swamp)
      **********************
 4    CATCHMENT
     105.000    ID No.ó 99999
       .830     Area in hectares
     50.000     Length (PERV) metres
       .500     Gradient (%)
       .000     Per cent Impervious
     10.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
          2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     75.000     Max.Infiltn. mm/hr
     13.000     Min.Infiltn. mm/hr
       .500     Lag const (hours)
     15.000     Dep.Storage mm
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
      ****************************************** c.m/s
             .000       .000       .000     C perv/imperv/total
15    ADD RUNOFF
             .000       .058       .000       .000 c.m/s
20    MANUAL
```

```
         Output File (4.7) ARK25EX.OUT  opened 2022-03-29   8:44
         Units used are defined by G =    9.810
            192   533    15.000        are MAXDT MAXHYD & DTMIN values
         Licensee: Paragon Engineering Limited
35       COMMENT
       7     line(s) of comment
         **********************
         1614-13338 220 Arkell
         Stormwater Management Modelling
         Existing Conditions
         25-yr, 48-hour adjusted storm (TCSS)
         Modeller: B.Weersink (Mar 2022)
         **********************
23       FILE RAINFALL
       1     1=READ: 2=WRITE
      10     25y48h.STM           is Filename
 3     IMPERVIOUS
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .013     Manning "n"
        .000     Max.Infiltn. mm/hr
        .000     Min.Infiltn. mm/hr
        .050     Lag const (hours)
       1.500     Dep.Storage mm
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 110 - Existing Catchment draining east
         **********************
 4     CATCHMENT
     110.000     ID No.ó 99999
       2.470     Area in hectares
     150.000     Length (PERV) metres
       2.000     Gradient (%)
       5.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
               .062       .000       .000       .000 c.m/s
               .112       .913       .152     C perv/imperv/total
14       START
       1     1=Zero; 2=Define
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 106 - Existing Site draining west to Torrance Cree
         **********************
 4     CATCHMENT
     106.000     ID No.ó 99999
       3.870     Area in hectares
     120.000     Length (PERV) metres
       4.000     Gradient (%)
      10.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
               .120       .000       .000       .000 c.m/s
               .112       .891       .189     C perv/imperv/total
15       ADD RUNOFF
               .120       .120       .000       .000 c.m/s
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 105 - Wetland area (Torrance Creek Swamp)
         **********************
 4     CATCHMENT
     105.000     ID No.ó 99999
        .830     Area in hectares
      50.000     Length (PERV) metres
        .500     Gradient (%)
        .000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
      15.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
               .011       .120       .000       .000 c.m/s
               .045       .000       .045     C perv/imperv/total
15       ADD RUNOFF
               .011       .122       .000       .000 c.m/s
20       MANUAL
```

```
      Output File (4.7) ARK100EX.OUT opened 2022-03-29   8:45
      Units used are defined by G =    9.810
         192   533    15.000        are MAXDT MAXHYD & DTMIN values
      Licensee: Paragon Engineering Limited
35    COMMENT
      7     line(s) of comment
      **********************
      1614-13338 220 Arkell
      Stormwater Management Modelling
      Existing Conditions
      100-yr, 48-hour adjusted storm (TCSS)
      Modeller: B.Weersink (Mar 2022)
      **********************
23    FILE RAINFALL
      1     1=READ: 2=WRITE
      10    10048h.STM           is Filename
 3    IMPERVIOUS
          2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .013     Manning "n"
       .000     Max.Infiltn. mm/hr
       .000     Min.Infiltn. mm/hr
       .050     Lag const (hours)
      1.500     Dep.Storage mm
35    COMMENT
      3     line(s) of comment
      **********************
      Catchment 110 - Existing Catchment draining east
      **********************
 4    CATCHMENT
     110.000    ID No.ó 99999
      2.470     Area in hectares
     150.000    Length (PERV) metres
      2.000     Gradient (%)
      5.000     Per cent Impervious
     10.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
          2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     75.000     Max.Infiltn. mm/hr
     13.000     Min.Infiltn. mm/hr
       .500     Lag const (hours)
      5.000     Dep.Storage mm
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .103       .000       .000       .000 c.m/s
             .153       .906       .191     C perv/imperv/total
14    START
      1     1=Zero; 2=Define
35    COMMENT
      3     line(s) of comment
      **********************
      Catchment 106 - Existing Site draining west to Torrance Cree
      **********************
 4    CATCHMENT
     106.000    ID No.ó 99999
      3.870     Area in hectares
     120.000    Length (PERV) metres
      4.000     Gradient (%)
     10.000     Per cent Impervious
     10.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
          2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     75.000     Max.Infiltn. mm/hr
     13.000     Min.Infiltn. mm/hr
       .500     Lag const (hours)
      5.000     Dep.Storage mm
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .186       .000       .000       .000 c.m/s
             .154       .886       .227     C perv/imperv/total
15    ADD RUNOFF
             .186       .186       .000       .000 c.m/s
35    COMMENT
      3     line(s) of comment
      **********************
      Catchment 105 - Wetland area (Torrance Creek Swamp)
      **********************
 4    CATCHMENT
     105.000    ID No.ó 99999
       .830     Area in hectares
     50.000     Length (PERV) metres
       .500     Gradient (%)
       .000     Per cent Impervious
     10.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
          2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     75.000     Max.Infiltn. mm/hr
     13.000     Min.Infiltn. mm/hr
       .500     Lag const (hours)
     15.000     Dep.Storage mm
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .024       .186       .000       .000 c.m/s
             .098       .000       .098     C perv/imperv/total
15    ADD RUNOFF
             .024       .202       .000       .000 c.m/s
20    MANUAL
```

```
          Output File (4.7) ARK25M.OUT   opened 2023-02-23  15:13
          Units used are defined by G =    9.810
              48   120     5.000        are MAXDT MAXHYD & DTMIN values
          Licensee: Paragon Engineering Limited
 35       COMMENT
        7     line(s) of comment
          **********************
          1614-13338 220 Arkell
          Stormwater Management Modelling
          Proposed Conditions
          25mm, 4 hour event
          Modeller: B.Weersink (Mar 2022)
          **********************
 23       FILE RAINFALL
        1     1=READ: 2=WRITE
       10     25mm.STM             is Filename
  3       IMPERVIOUS
              2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
           .013     Manning "n"
           .000     Max.Infiltn. mm/hr
           .000     Min.Infiltn. mm/hr
           .050     Lag const (hours)
          1.500     Dep.Storage mm
 35       COMMENT
        3     line(s) of comment
          **********************
          Catchment 201 - Ecological Linkage and rear yards east
          **********************
  4       CATCHMENT
       201.000     ID No.ó 99999
         1.120     Area in hectares
       150.000     Length (PERV) metres
         2.000     Gradient (%)
         5.000     Per cent Impervious
        10.000     Length (IMPERV)
          .000     %Imp. with Zero Dpth
             2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .250     Manning "n"
        75.000     Max.Infiltn. mm/hr
        13.000     Min.Infiltn. mm/hr
          .500     Lag const (hours)
         5.000     Dep.Storage mm
             1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .010       .000       .000       .000 c.m/s
                .000       .918       .046     C perv/imperv/total
 14       START
        1     1=Zero; 2=Define
 35       COMMENT
        3     line(s) of comment
          **********************
          Catchment 200 - Developed Area to SWM
          **********************
  4       CATCHMENT
       200.000     ID No.ó 99999
         2.440     Area in hectares
        20.000     Length (PERV) metres
         2.000     Gradient (%)
        65.000     Per cent Impervious
        41.000     Length (IMPERV)
          .000     %Imp. with Zero Dpth
             2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .250     Manning "n"
        75.000     Max.Infiltn. mm/hr
        13.000     Min.Infiltn. mm/hr
          .500     Lag const (hours)
         5.000     Dep.Storage mm
             1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .245       .000       .000       .000 c.m/s
                .000       .925       .602     C perv/imperv/total
 15       ADD RUNOFF
                .245       .245       .000       .000 c.m/s
 35       COMMENT
        3     line(s) of comment
          **********************
          Catchment 203 - dry SWMF
          **********************
  4       CATCHMENT
       203.000     ID No.ó 99999
          .370     Area in hectares
        50.000     Length (PERV) metres
         2.000     Gradient (%)
        15.000     Per cent Impervious
         4.000     Length (IMPERV)
          .000     %Imp. with Zero Dpth
             2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .250     Manning "n"
        75.000     Max.Infiltn. mm/hr
        13.000     Min.Infiltn. mm/hr
          .500     Lag const (hours)
         5.000     Dep.Storage mm
             1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .010       .245       .000       .000 c.m/s
                .000       .885       .133     C perv/imperv/total
 15       ADD RUNOFF
                .010       .255       .000       .000 c.m/s
 35       COMMENT
        3     line(s) of comment
          **********************
          Dry SWM Stage-storage
          **********************
 10       POND
        6 Depth - Discharge - Volume sets
          335.000        .000          .0
          335.300      .00600       266.0
          336.000       .0120      1126.0
          336.200       .0130      1442.0
          336.700       .0150      2384.0
          337.000      1.433       3049.0
          Peak Outflow    =      .006 c.m/s
          Maximum Depth   =   335.344 metres
          Maximum Storage =      321. c.m
                .010       .255       .006       .000 c.m/s
 16       NEXT LINK
                .010       .006       .006       .000 c.m/s
 35       COMMENT
        3     line(s) of comment
          **********************
          Catchment 206 - Rear yards draining uncontrolled to wetland
          **********************
  4       CATCHMENT
       206.000     ID No.ó 99999
          .380     Area in hectares
        90.000     Length (PERV) metres
         2.000     Gradient (%)
        25.000     Per cent Impervious
        10.000     Length (IMPERV)
          .000     %Imp. with Zero Dpth
             2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .250     Manning "n"
        75.000     Max.Infiltn. mm/hr
        13.000     Min.Infiltn. mm/hr
          .500     Lag const (hours)
         5.000     Dep.Storage mm
             1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .017       .006       .006       .000 c.m/s
                .000       .918       .229     C perv/imperv/total
 15       ADD RUNOFF
                .017       .019       .006       .000 c.m/s
```

```
 35     COMMENT
       3     line(s) of comment
        **********************
        Catchment 202 - Park Area
        **********************
  4     CATCHMENT
      202.000     ID No.ó 99999
        .290      Area in hectares
       50.000     Length (PERV) metres
        2.000     Gradient (%)
       10.000     Per cent Impervious
       10.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
           2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       75.000     Max.Infiltn. mm/hr
       13.000     Min.Infiltn. mm/hr
         .500     Lag const (hours)
        5.000     Dep.Storage mm
           1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .005       .019       .006       .000 c.m/s
              .000       .918       .092     C perv/imperv/total
 15     ADD RUNOFF
              .005       .024       .006       .000 c.m/s
 35     COMMENT
       3     line(s) of comment
        **********************
        Catchment 207 - Ecological Linkage draining around pond to w
        **********************
  4     CATCHMENT
      207.000     ID No.ó 99999
        .350      Area in hectares
      110.000     Length (PERV) metres
        2.000     Gradient (%)
         .000     Per cent Impervious
       10.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
           2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       75.000     Max.Infiltn. mm/hr
       13.000     Min.Infiltn. mm/hr
         .500     Lag const (hours)
        5.000     Dep.Storage mm
           1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
        ****************************************** c.m/s
              .000       .000       .000     C perv/imperv/total
 15     ADD RUNOFF
              .000       .024       .006       .000 c.m/s
 35     COMMENT
       3     line(s) of comment
        **********************
        Catchment 204 - Wetland
        **********************
  4     CATCHMENT
      204.000     ID No.ó 99999
        1.650     Area in hectares
       50.000     Length (PERV) metres
         .500     Gradient (%)
         .000     Per cent Impervious
       10.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
           2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       75.000     Max.Infiltn. mm/hr
       13.000     Min.Infiltn. mm/hr
         .500     Lag const (hours)
       10.300     Dep.Storage mm
           1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
        ****************************************** c.m/s
              .000       .000       .000     C perv/imperv/total
 15     ADD RUNOFF
              .000       .024       .006       .000 c.m/s
 35     COMMENT
       3     line(s) of comment
        **********************
        Catchment 205 - Former Driveway
        **********************
  4     CATCHMENT
      205.000     ID No.ó 99999
        .240      Area in hectares
       10.000     Length (PERV) metres
         .500     Gradient (%)
       15.000     Per cent Impervious
       10.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
           2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       75.000     Max.Infiltn. mm/hr
       13.000     Min.Infiltn. mm/hr
         .500     Lag const (hours)
        5.000     Dep.Storage mm
           1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .006       .024       .006       .000 c.m/s
              .000       .927       .139     C perv/imperv/total
 15     ADD RUNOFF
              .006       .030       .006       .000 c.m/s
 35     COMMENT
       3     line(s) of comment
        **********************
        Catchment 209 - Rear lots of townhomes and trail connection
        **********************
  4     CATCHMENT
      209.000     ID No.ó 99999
        .330      Area in hectares
      200.000     Length (PERV) metres
        2.000     Gradient (%)
       15.000     Per cent Impervious
       10.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
           2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       75.000     Max.Infiltn. mm/hr
       13.000     Min.Infiltn. mm/hr
         .500     Lag const (hours)
        5.000     Dep.Storage mm
           1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .009       .030       .006       .000 c.m/s
              .000       .918       .138     C perv/imperv/total
 35     COMMENT
       3     line(s) of comment
        **********************
        Total Flow to Wetland
        **********************
 15     ADD RUNOFF
              .009       .039       .006       .000 c.m/s
 20     MANUAL
```

```
         Output File (4.7) ARK2.OUT     opened 2023-02-23  15:47
         Units used are defined by G =    9.810
            192   533    15.000        are MAXDT MAXHYD & DTMIN values
         Licensee: Paragon Engineering Limited
35       COMMENT
       7     line(s) of comment
         **********************
         1614-13338 220 Arkell
         Stormwater Management Modelling
         Proposed Conditions
         2-yr, 48-hour adjusted storm (TCSS)
         Modeller: B.Weersink (Mar 2022)
         **********************
23       FILE RAINFALL
       1     1=READ: 2=WRITE
      10     2yr48hr.ST           is Filename
 3       IMPERVIOUS
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .013     Manning "n"
        .000     Max.Infiltn. mm/hr
        .000     Min.Infiltn. mm/hr
        .050     Lag const (hours)
       1.500     Dep.Storage mm
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 201 - Ecological Linkage and rear yards east
         **********************
 4       CATCHMENT
     201.000     ID No.ó 99999
       1.120     Area in hectares
     150.000     Length (PERV) metres
       2.000     Gradient (%)
       5.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .002       .000       .000       .000 c.m/s
              .002       .925       .048     C perv/imperv/total
14       START
       1     1=Zero; 2=Define
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 200 - Developed Area to SWM
         **********************
 4       CATCHMENT
     200.000     ID No.ó 99999
       2.440     Area in hectares
      20.000     Length (PERV) metres
       2.000     Gradient (%)
      65.000     Per cent Impervious
      41.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .080       .000       .000       .000 c.m/s
              .002       .973       .633     C perv/imperv/total
15       ADD RUNOFF
              .080       .080       .000       .000 c.m/s
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 203 - dry SWMF
         **********************
 4       CATCHMENT
     203.000     ID No.ó 99999
        .370     Area in hectares
      50.000     Length (PERV) metres
       2.000     Gradient (%)
      15.000     Per cent Impervious
       4.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .002       .080       .000       .000 c.m/s
              .002       .873       .132     C perv/imperv/total
15       ADD RUNOFF
              .002       .082       .000       .000 c.m/s
35       COMMENT
       3     line(s) of comment
         **********************
         Dry SWM Stage-storage
         **********************
10       POND
       6 Depth - Discharge - Volume sets
        335.000        .000          .0
        335.300      .00600       266.0
        336.000       .0120      1126.0
        336.200       .0130      1442.0
        336.700       .0150      2384.0
        337.000      1.433      3049.0
        Peak Outflow    =      .011 c.m/s
        Maximum Depth   =   335.914 metres
        Maximum Storage =     1021. c.m
              .002       .082       .011       .000 c.m/s
16       NEXT LINK
              .002       .011       .011       .000 c.m/s
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 206 - Rear yards draining uncontrolled to wetland
         **********************
 4       CATCHMENT
     206.000     ID No.ó 99999
        .380     Area in hectares
      90.000     Length (PERV) metres
       2.000     Gradient (%)
      25.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .004       .011       .011       .000 c.m/s
              .002       .925       .232     C perv/imperv/total
15       ADD RUNOFF
              .004       .014       .011       .000 c.m/s
```

```
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 202 - Park Area
       **********************
  4    CATCHMENT
     202.000     ID No.ó 99999
       .290      Area in hectares
      50.000     Length (PERV) metres
       2.000     Gradient (%)
      10.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .001       .014       .011       .000 c.m/s
             .002       .925       .094     C perv/imperv/total
 15     ADD RUNOFF
             .001       .015       .011       .000 c.m/s
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 207 - Ecological Linkage draining around pond to w
       **********************
  4    CATCHMENT
     207.000     ID No.ó 99999
       .350      Area in hectares
     110.000     Length (PERV) metres
       2.000     Gradient (%)
        .000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .000       .015       .011       .000 c.m/s
             .002       .000       .002     C perv/imperv/total
 15     ADD RUNOFF
             .000       .015       .011       .000 c.m/s
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 204 - Wetland
       **********************
  4    CATCHMENT
     204.000     ID No.ó 99999
       1.650     Area in hectares
      50.000     Length (PERV) metres
        .500     Gradient (%)
        .000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
      10.300     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
       ****************************************** c.m/s
             .000       .000       .000     C perv/imperv/total
 15     ADD RUNOFF
             .000       .015       .011       .000 c.m/s
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 205 - Former Driveway
       **********************
  4    CATCHMENT
     205.000     ID No.ó 99999
       .240      Area in hectares
      10.000     Length (PERV) metres
        .500     Gradient (%)
      15.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .002       .015       .011       .000 c.m/s
             .002       .954       .144     C perv/imperv/total
 15     ADD RUNOFF
             .002       .017       .011       .000 c.m/s
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 209 - Rear lots of townhomes and trail connection
       **********************
  4    CATCHMENT
     209.000     ID No.ó 99999
       .330      Area in hectares
     200.000     Length (PERV) metres
       2.000     Gradient (%)
      15.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .002       .017       .011       .000 c.m/s
             .002       .925       .140     C perv/imperv/total
 35     COMMENT
      3     line(s) of comment
       **********************
       Total Flow to Wetland
       **********************
 15     ADD RUNOFF
             .002       .019       .011       .000 c.m/s
 20     MANUAL
```

```
         Output File (4.7) ARK5.OUT     opened 2023-02-23  15:49
         Units used are defined by G =    9.810
            192   533    15.000        are MAXDT MAXHYD & DTMIN values
         Licensee: Paragon Engineering Limited
35       COMMENT
       7     line(s) of comment
         **********************
         1614-13338 220 Arkell
         Stormwater Management Modelling
         Proposed Conditions
         5-yr, 48-hour adjusted storm (TCSS)
         Modeller: B.Weersink (Mar 2022)
         **********************
23       FILE RAINFALL
       1     1=READ: 2=WRITE
      10     5yr48hr.ST           is Filename
 3       IMPERVIOUS
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .013     Manning "n"
        .000     Max.Infiltn. mm/hr
        .000     Min.Infiltn. mm/hr
        .050     Lag const (hours)
       1.500     Dep.Storage mm
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 201 - Ecological Linkage and rear yards east
         **********************
 4       CATCHMENT
     201.000     ID No.ó 99999
       1.120     Area in hectares
     150.000     Length (PERV) metres
       2.000     Gradient (%)
       5.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .013       .000       .000       .000 c.m/s
              .063       .919       .106     C perv/imperv/total
14       START
       1     1=Zero; 2=Define
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 200 - Developed Area to SWM
         **********************
 4       CATCHMENT
     200.000     ID No.ó 99999
       2.440     Area in hectares
      20.000     Length (PERV) metres
       2.000     Gradient (%)
      65.000     Per cent Impervious
      41.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .109       .000       .000       .000 c.m/s
              .063       .978       .658     C perv/imperv/total
15       ADD RUNOFF
              .109       .109       .000       .000 c.m/s
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 203 - dry SWMF
         **********************
 4       CATCHMENT
     203.000     ID No.ó 99999
        .370     Area in hectares
      50.000     Length (PERV) metres
       2.000     Gradient (%)
      15.000     Per cent Impervious
       4.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .007       .109       .000       .000 c.m/s
              .063       .869       .184     C perv/imperv/total
15       ADD RUNOFF
              .007       .114       .000       .000 c.m/s
35       COMMENT
       3     line(s) of comment
         **********************
         Dry SWM Stage-storage
         **********************
10       POND
       6 Depth - Discharge - Volume sets
        335.000        .000          .0
        335.300      .00600       266.0
        336.000       .0120      1126.0
        336.200       .0130      1442.0
        336.700       .0150      2384.0
        337.000       1.433      3049.0
         Peak Outflow    =      .013 c.m/s
         Maximum Depth   =   336.155 metres
         Maximum Storage =     1370. c.m
              .007       .114       .013       .000 c.m/s
16       NEXT LINK
              .007       .013       .013       .000 c.m/s
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 206 - Rear yards draining uncontrolled to wetland
         **********************
 4       CATCHMENT
     206.000     ID No.ó 99999
        .380     Area in hectares
      90.000     Length (PERV) metres
       2.000     Gradient (%)
      25.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .007       .013       .013       .000 c.m/s
              .063       .919       .277     C perv/imperv/total
15       ADD RUNOFF
              .007       .019       .013       .000 c.m/s
```

```
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 202 - Park Area
       **********************
  4    CATCHMENT
     202.000     ID No.ó 99999
       .290      Area in hectares
      50.000     Length (PERV) metres
       2.000     Gradient (%)
      10.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .005       .019       .013       .000 c.m/s
             .063       .919       .149     C perv/imperv/total
 15     ADD RUNOFF
             .005       .024       .013       .000 c.m/s
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 207 - Ecological Linkage draining around pond to w
       **********************
  4    CATCHMENT
     207.000     ID No.ó 99999
       .350      Area in hectares
     110.000     Length (PERV) metres
       2.000     Gradient (%)
        .000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .004       .024       .013       .000 c.m/s
             .063       .000       .063     C perv/imperv/total
 15     ADD RUNOFF
             .004       .028       .013       .000 c.m/s
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 204 - Wetland
       **********************
  4    CATCHMENT
     204.000     ID No.ó 99999
       1.650     Area in hectares
      50.000     Length (PERV) metres
        .500     Gradient (%)
        .000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
      10.300     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .006       .028       .013       .000 c.m/s
             .019       .000       .019     C perv/imperv/total
 15     ADD RUNOFF
             .006       .029       .013       .000 c.m/s
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 205 - Former Driveway
       **********************
  4    CATCHMENT
     205.000     ID No.ó 99999
       .240      Area in hectares
      10.000     Length (PERV) metres
        .500     Gradient (%)
      15.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .006       .029       .013       .000 c.m/s
             .063       .947       .196     C perv/imperv/total
 15     ADD RUNOFF
             .006       .032       .013       .000 c.m/s
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 209 - Rear lots of townhomes and trail connection
       **********************
  4    CATCHMENT
     209.000     ID No.ó 99999
       .330      Area in hectares
     200.000     Length (PERV) metres
       2.000     Gradient (%)
      15.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .005       .032       .013       .000 c.m/s
             .063       .919       .192     C perv/imperv/total
 35     COMMENT
      3     line(s) of comment
       **********************
       Total Flow to Wetland
       **********************
 15     ADD RUNOFF
             .005       .036       .013       .000 c.m/s
 20     MANUAL
```

```
         Output File (4.7) ARK25.OUT    opened 2023-02-23  15:50
         Units used are defined by G =    9.810
            192   533    15.000        are MAXDT MAXHYD & DTMIN values
         Licensee: Paragon Engineering Limited
35       COMMENT
       7     line(s) of comment
         **********************
         1614-13338 220 Arkell
         Stormwater Management Modelling
         Proposed Conditions
         25-yr, 48-hour adjusted storm (TCSS)
         Modeller: B.Weersink (Mar 2022)
         **********************
23       FILE RAINFALL
       1     1=READ: 2=WRITE
      10     25y48h.STM           is Filename
 3       IMPERVIOUS
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .013     Manning "n"
        .000     Max.Infiltn. mm/hr
        .000     Min.Infiltn. mm/hr
        .050     Lag const (hours)
       1.500     Dep.Storage mm
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 201 - Ecological Linkage and rear yards east
         **********************
 4       CATCHMENT
     201.000     ID No.ó 99999
       1.120     Area in hectares
     150.000     Length (PERV) metres
       2.000     Gradient (%)
       5.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .028       .000       .000       .000 c.m/s
              .112       .913       .152     C perv/imperv/total
14       START
       1     1=Zero; 2=Define
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 200 - Developed Area to SWM
         **********************
 4       CATCHMENT
     200.000     ID No.ó 99999
       2.440     Area in hectares
      20.000     Length (PERV) metres
       2.000     Gradient (%)
      65.000     Per cent Impervious
      41.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .151       .000       .000       .000 c.m/s
              .110       .980       .675     C perv/imperv/total
15       ADD RUNOFF
              .151       .151       .000       .000 c.m/s
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 203 - dry SWMF
         **********************
 4       CATCHMENT
     203.000     ID No.ó 99999
        .370     Area in hectares
      50.000     Length (PERV) metres
       2.000     Gradient (%)
      15.000     Per cent Impervious
       4.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .013       .151       .000       .000 c.m/s
              .112       .866       .225     C perv/imperv/total
15       ADD RUNOFF
              .013       .163       .000       .000 c.m/s
35       COMMENT
       3     line(s) of comment
         **********************
         Dry SWM Stage-storage
         **********************
10       POND
       6 Depth - Discharge - Volume sets
        335.000       .000         .0
        335.300     .00600       266.0
        336.000      .0120      1126.0
        336.200      .0130      1442.0
        336.700      .0150      2384.0
        337.000      1.433      3049.0
         Peak Outflow    =      .014 c.m/s
         Maximum Depth   =   336.396 metres
         Maximum Storage =     1810. c.m
              .013       .163       .014       .000 c.m/s
16       NEXT LINK
              .013       .014       .014       .000 c.m/s
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 206 - Rear yards draining uncontrolled to wetland
         **********************
 4       CATCHMENT
     206.000     ID No.ó 99999
        .380     Area in hectares
      90.000     Length (PERV) metres
       2.000     Gradient (%)
      25.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .013       .014       .014       .000 c.m/s
              .112       .913       .312     C perv/imperv/total
15       ADD RUNOFF
              .013       .026       .014       .000 c.m/s
```

```
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 202 - Park Area
       **********************
  4    CATCHMENT
     202.000     ID No.ó 99999
       .290      Area in hectares
      50.000     Length (PERV) metres
       2.000     Gradient (%)
      10.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .010       .026       .014       .000 c.m/s
             .112       .913       .192     C perv/imperv/total
 15     ADD RUNOFF
             .010       .035       .014       .000 c.m/s
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 207 - Ecological Linkage draining around pond to w
       **********************
  4    CATCHMENT
     207.000     ID No.ó 99999
       .350      Area in hectares
     110.000     Length (PERV) metres
       2.000     Gradient (%)
        .000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .009       .035       .014       .000 c.m/s
             .112       .000       .112     C perv/imperv/total
 15     ADD RUNOFF
             .009       .044       .014       .000 c.m/s
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 204 - Wetland
       **********************
  4    CATCHMENT
     204.000     ID No.ó 99999
       1.650     Area in hectares
      50.000     Length (PERV) metres
        .500     Gradient (%)
        .000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
      10.300     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .029       .044       .014       .000 c.m/s
             .077       .000       .077     C perv/imperv/total
 15     ADD RUNOFF
             .029       .068       .014       .000 c.m/s
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 205 - Former Driveway
       **********************
  4    CATCHMENT
     205.000     ID No.ó 99999
       .240      Area in hectares
      10.000     Length (PERV) metres
        .500     Gradient (%)
      15.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .010       .068       .014       .000 c.m/s
             .110       .946       .236     C perv/imperv/total
 15     ADD RUNOFF
             .010       .074       .014       .000 c.m/s
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 209 - Rear lots of townhomes and trail connection
       **********************
  4    CATCHMENT
     209.000     ID No.ó 99999
       .330      Area in hectares
     200.000     Length (PERV) metres
       2.000     Gradient (%)
      15.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .008       .074       .014       .000 c.m/s
             .112       .913       .232     C perv/imperv/total
 35     COMMENT
      3     line(s) of comment
       **********************
       Total Flow to Wetland
       **********************
 15     ADD RUNOFF
             .008       .082       .014       .000 c.m/s
 20     MANUAL
```

```
          Output File (4.7) ARK100.OUT   opened 2023-02-23  15:51
          Units used are defined by G =    9.810
             192   533    15.000        are MAXDT MAXHYD & DTMIN values
          Licensee: Paragon Engineering Limited
 35       COMMENT
        7     line(s) of comment
          **********************
          1614-13338 220 Arkell
          Stormwater Management Modelling
          Proposed Conditions
          100-yr, 48-hour adjusted storm (TCSS)
          Modeller: B.Weersink (Mar 2022)
          **********************
 23       FILE RAINFALL
        1     1=READ: 2=WRITE
       10     10048h.STM           is Filename
  3       IMPERVIOUS
            2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .013     Manning "n"
         .000     Max.Infiltn. mm/hr
         .000     Min.Infiltn. mm/hr
         .050     Lag const (hours)
        1.500     Dep.Storage mm
 35       COMMENT
        3     line(s) of comment
          **********************
          Catchment 201 - Ecological Linkage and rear yards east
          **********************
  4       CATCHMENT
      201.000     ID No.ó 99999
        1.120     Area in hectares
      150.000     Length (PERV) metres
        2.000     Gradient (%)
        5.000     Per cent Impervious
       10.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       75.000     Max.Infiltn. mm/hr
       13.000     Min.Infiltn. mm/hr
         .500     Lag const (hours)
        5.000     Dep.Storage mm
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .047       .000       .000       .000 c.m/s
                .153       .906       .191     C perv/imperv/total
 14       START
        1     1=Zero; 2=Define
 35       COMMENT
        3     line(s) of comment
          **********************
          Catchment 200 - Developed Area to SWM
          **********************
  4       CATCHMENT
      200.000     ID No.ó 99999
        2.440     Area in hectares
       20.000     Length (PERV) metres
        2.000     Gradient (%)
       65.000     Per cent Impervious
       41.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       75.000     Max.Infiltn. mm/hr
       13.000     Min.Infiltn. mm/hr
         .500     Lag const (hours)
        5.000     Dep.Storage mm
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .191       .000       .000       .000 c.m/s
                .153       .978       .689     C perv/imperv/total
 15       ADD RUNOFF
                .191       .191       .000       .000 c.m/s
 35       COMMENT
        3     line(s) of comment
          **********************
          Catchment 203 - dry SWMF
          **********************
  4       CATCHMENT
      203.000     ID No.ó 99999
         .370     Area in hectares
       50.000     Length (PERV) metres
        2.000     Gradient (%)
       15.000     Per cent Impervious
        4.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       75.000     Max.Infiltn. mm/hr
       13.000     Min.Infiltn. mm/hr
         .500     Lag const (hours)
        5.000     Dep.Storage mm
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .020       .191       .000       .000 c.m/s
                .152       .864       .259     C perv/imperv/total
 15       ADD RUNOFF
                .020       .211       .000       .000 c.m/s
 35       COMMENT
        3     line(s) of comment
          **********************
          Dry SWM Stage-storage
          **********************
 10       POND
        6 Depth - Discharge - Volume sets
        335.000        .000          .0
        335.300      .00600       266.0
        336.000       .0120      1126.0
        336.200       .0130      1442.0
        336.700       .0150      2384.0
        337.000      1.433      3049.0
          Peak Outflow    =      .015 c.m/s
          Maximum Depth   =   336.645 metres
          Maximum Storage =     2280. c.m
                .020       .211       .015       .000 c.m/s
 16       NEXT LINK
                .020       .015       .015       .000 c.m/s
 35       COMMENT
        3     line(s) of comment
          **********************
          Catchment 206 - Rear yards draining uncontrolled to wetland
          **********************
  4       CATCHMENT
      206.000     ID No.ó 99999
         .380     Area in hectares
       90.000     Length (PERV) metres
        2.000     Gradient (%)
       25.000     Per cent Impervious
       10.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       75.000     Max.Infiltn. mm/hr
       13.000     Min.Infiltn. mm/hr
         .500     Lag const (hours)
        5.000     Dep.Storage mm
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .018       .015       .015       .000 c.m/s
                .153       .906       .342     C perv/imperv/total
 15       ADD RUNOFF
                .018       .032       .015       .000 c.m/s
```

```
 35     COMMENT
  3     line(s) of comment
        **********
        Catchment 202 - Park Area
        **********
  4     CATCHMENT
202.000     ID No.ó 99999
  .290      Area in hectares
 50.000     Length (PERV) metres
  2.000     Gradient (%)
 10.000     Per cent Impervious
 10.000     Length (IMPERV)
   .000     %Imp. with Zero Dpth
     2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
   .250     Manning "n"
 75.000     Max.Infiltn. mm/hr
 13.000     Min.Infiltn. mm/hr
   .500     Lag const (hours)
  5.000     Dep.Storage mm
     1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          .015       .032       .015       .000 c.m/s
          .152       .906       .228     C perv/imperv/total
 15     ADD RUNOFF
          .015       .047       .015       .000 c.m/s
 35     COMMENT
  3     line(s) of comment
        **********
        Catchment 207 - Ecological Linkage draining around pond to w
        **********
  4     CATCHMENT
207.000     ID No.ó 99999
  .350      Area in hectares
110.000     Length (PERV) metres
  2.000     Gradient (%)
   .000     Per cent Impervious
 10.000     Length (IMPERV)
   .000     %Imp. with Zero Dpth
     2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
   .250     Manning "n"
 75.000     Max.Infiltn. mm/hr
 13.000     Min.Infiltn. mm/hr
   .500     Lag const (hours)
  5.000     Dep.Storage mm
     1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          .016       .047       .015       .000 c.m/s
          .153       .000       .153     C perv/imperv/total
 15     ADD RUNOFF
          .016       .062       .015       .000 c.m/s
 35     COMMENT
  3     line(s) of comment
        **********
        Catchment 204 - Wetland
        **********
  4     CATCHMENT
204.000     ID No.ó 99999
 1.650      Area in hectares
 50.000     Length (PERV) metres
   .500     Gradient (%)
   .000     Per cent Impervious
 10.000     Length (IMPERV)
   .000     %Imp. with Zero Dpth
     2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
   .250     Manning "n"
 75.000     Max.Infiltn. mm/hr
 13.000     Min.Infiltn. mm/hr
   .500     Lag const (hours)
 10.300     Dep.Storage mm
     1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          .062       .062       .015       .000 c.m/s
          .124       .000       .124     C perv/imperv/total
 15     ADD RUNOFF
          .062       .122       .015       .000 c.m/s
 35     COMMENT
  3     line(s) of comment
        **********
        Catchment 205 - Former Driveway
        **********
  4     CATCHMENT
205.000     ID No.ó 99999
  .240      Area in hectares
 10.000     Length (PERV) metres
   .500     Gradient (%)
 15.000     Per cent Impervious
 10.000     Length (IMPERV)
   .000     %Imp. with Zero Dpth
     2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
   .250     Manning "n"
 75.000     Max.Infiltn. mm/hr
 13.000     Min.Infiltn. mm/hr
   .500     Lag const (hours)
  5.000     Dep.Storage mm
     1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          .015       .122       .015       .000 c.m/s
          .153       .945       .271     C perv/imperv/total
 15     ADD RUNOFF
          .015       .131       .015       .000 c.m/s
 35     COMMENT
  3     line(s) of comment
        **********
        Catchment 209 - Rear lots of townhomes and trail connection
        **********
  4     CATCHMENT
209.000     ID No.ó 99999
  .330      Area in hectares
200.000     Length (PERV) metres
  2.000     Gradient (%)
 15.000     Per cent Impervious
 10.000     Length (IMPERV)
   .000     %Imp. with Zero Dpth
     2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
   .250     Manning "n"
 75.000     Max.Infiltn. mm/hr
 13.000     Min.Infiltn. mm/hr
   .500     Lag const (hours)
  5.000     Dep.Storage mm
     1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          .013       .131       .015       .000 c.m/s
          .154       .906       .267     C perv/imperv/total
 35     COMMENT
  3     line(s) of comment
        **********
        Total Flow to Wetland
        **********
 15     ADD RUNOFF
          .013       .144       .015       .000 c.m/s
 20     MANUAL
```

220 Arkell - Single Family Soakaway Pits
Infiltration Gallery Sizing Calculations

Estimated Infiltration Rate - Glacial Till
Clear Stone

Typical Single Detached Lot (30')		**Units**
Total Roof Area to be Infiltrated	120	m^2
Runoff depth	25	mm
Total Volume of Runoff	3.0	m^3
Total Volume of Runoff + 20%	3.6	m^3
Gallery Length	8	m
Gallery Height	0.5	m
Gallery Width	2.00	m
Void Ratio of Infiltration Gallery Stone	0.4	
Total Gallery Storage Volume Provided	3.20	m^3
Surface Area	16	m^2
Assumed Infiltration rate[1]	4.8	mm/hr
Drawdown Rate	0.000021	m^3/s
Drawdown Time (using volume with 20%)	47	hrs

Total Number of lots	31	
Total Rooftop Area	3720	m^2

Note:

(1) Infiltration rate assumed based on soil conditions (glacial till to sand); however, in-situ testing required at detail design stage to confirm

220 Arkell - Multiblock Gallery (lumped as one)
Infiltration Gallery Sizing Calculations

Estimated Infiltration Rate - Glacial Till
Clear Stone

		Units
Individual Building Roof Area to be Infiltrated	180	m^2
Number of Buildings	19	
Total Rooftop Area to be Infiltrated	3420	m^2
Runoff depth	25	mm
Total Volume of Runoff	85.5	m^3
Total Volume of Runoff + 20%	102.6	m^3
Gallery Footprint	500.0	m^2
Gallery Height	0.5	m
Void Ratio of Infiltration Gallery Stone	0.4	
Total Gallery Storage Volume Provided	100.0	m^3
Assumed Infiltration rate[1]	4.8	mm/hr
Drawdown Rate	0.000667	m^3/s
Drawdown Time (using volume with 20%)	43	hrs

Note:

(1) Infiltration rate assumed based on soil conditions (glacial till to sand); however, in-situ testing required at detail design stage to confirm

220 Arkell - EOP Infiltration
Infiltration Gallery Sizing Calculations

Estimated Infiltration Rate - Sandy Soil
Stormtech SC-160LP System

		Units
Runoff depth	25	mm
Total Volume of Runoff to infiltrate	214.0	m^3
Total Gallery Storage Volume Provided	230.00	m^3
Surface Area	878	m^2
Assumed Infiltration rate[1]	12	mm/hr
Drawdown Rate	0.002927	m^3/s
Drawdown Time	20	hrs

Note:

(1) Infiltration rate assumed based on soil conditions (glacial till to sand); however, in-situ testing required at detail design stage to confirm

220 Arkell - Multiblock Infiltration Targets

Parameter	Value
Total Multi-block Area (ha)	1.71
Assumed impervious %	75
Assumed Rooftop Area (ha)	0.34
Rooftop Infiltration Volume Required per Water Balance (m^3/yr)	**2,526**
Pervious Infiltration in Sub-Area D per Water Balance (m^3/yr)	1,598
Pervious area in Sub-Area D (ha)	0.82
Pervious infiltration per hectare (m^3/yr/ha)	1,949
Assumed Pervious Area in Multiblock (ha)	0.43
Pervious Infiltration required in Multiblock (m^3/yr)	**833**
Total Infiltration required in Multiblock through rooftop galleries and pervious surface (m^3/yr)	**3,359**

Note:

Water Balance Calculations are presented in the *Revised Water Balance Calculations in Response to First Submission Comments, Draft Plan Application – 220 Arkell Road, City of Guelph* (Stantec, 2022)

PROJECT INFORMATION	
ENGINEERED PRODUCT MANAGER	
ADS SALES REP	
PROJECT NO.	

Advanced Drainage Systems, Inc.

SiteAssist™
FOR STORMTECH
INSTALLATION INSTRUCTIONS
VISIT OUR APP

220 ARKELL ROAD
GUELPH, ON

SC-160LP STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH SC-160LP.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL BE CERTIFIED TO CSA B184, "POLYMERIC SUB-SURFACE STORMWATER MANAGEMENT STRUCTURES", AND MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE CSA S6 CL-625 TRUCK AND THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 40 mm (1.5").
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 400 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 23° C / 73° F), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF THE SC-160LP SYSTEM

1. STORMTECH SC-160LP CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH SC-160LP CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH SC-160LP CONSTRUCTION GUIDE".
3. FOUNDATION STONE AND EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE WELL GRADED BETWEEN ¾" AND 2" (20-50 mm).
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. THE DEPTH OF FOUNDATION STONE SHALL BE DETERMINED BASED ON THE SUBGRADE BEARING CAPACITY PROVIDED BY THE SITE DESIGN ENGINEER.
6. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES CONCERNING CHAMBER FOUNDATION DESIGN AND SUBGRADE BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
7. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
8. CHAMBERS SHALL BE INSTALLED "TOE TO TOE". NO ADDITIONAL SPACING BETWEEN ROWS IS REQUIRED.
9. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
10. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

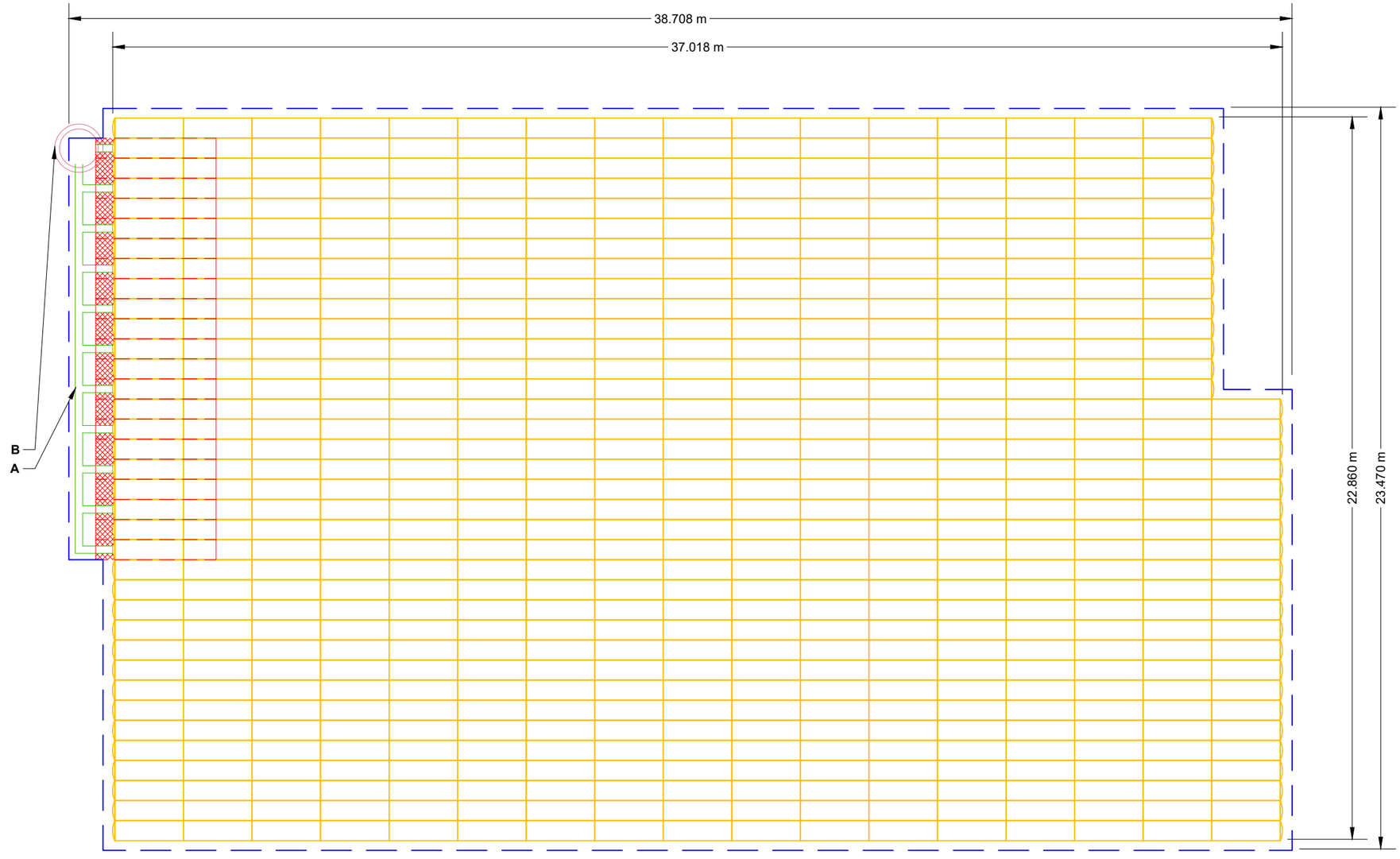
1. THE USE OF CONSTRUCTION EQUIPMENT OVER SC-160LP CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADERS, DUMP TRUCKS, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH SC-160LP CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH SC-106LP CONSTRUCTION GUIDE".
2. FULL 900 mm (36") OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

PROPOSED LAYOUT		PROPOSED ELEVATIONS	
598	STORMTECH SC-160LP CHAMBERS	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	337.695
72	STORMTECH SC-160LP END CAPS	MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	335.155
152	STONE ABOVE (mm)	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	335.003
152	STONE BELOW (mm)	MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	335.003
40	STONE VOID	MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	335.003
283.8	INSTALLED SYSTEM VOLUME (m^3) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)	TOP OF STONE:	334.800
		TOP OF SC-160LP CHAMBER:	334.647
		200 mm ISOLATOR ROW PLUS INVERT:	334.367
		200 mm x 200 mm BOTTOM MANIFOLD INVERT:	334.359
878.2	SYSTEM AREA (m^2)	BOTTOM OF SC-160LP CHAMBER:	334.342
124.4	SYSTEM PERIMETER (m)	BOTTOM OF STONE:	334.190

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
MANIFOLD	A	200 mm x 200 mm BOTTOM MANIFOLD, MOLDED FITTINGS	17 mm	
CONCRETE STRUCTURE	B	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		62 L/s IN



NO ISOLATOR ROW PLUS

PLACE MINIMUM 3.810 m OF ADSPLUS125 WOVEN GEOTEXTILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS

BED LIMITS

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH NOTE #6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION:** THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.

220 ARKELL ROAD
GUELPH, ON

DRAWN: CN
CHECKED: N/A
DATE:
PROJECT #:

DESCRIPTION	CHK	DRW	DATE

4640 TRUEMAN BLVD
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SCALE = 1 : 150

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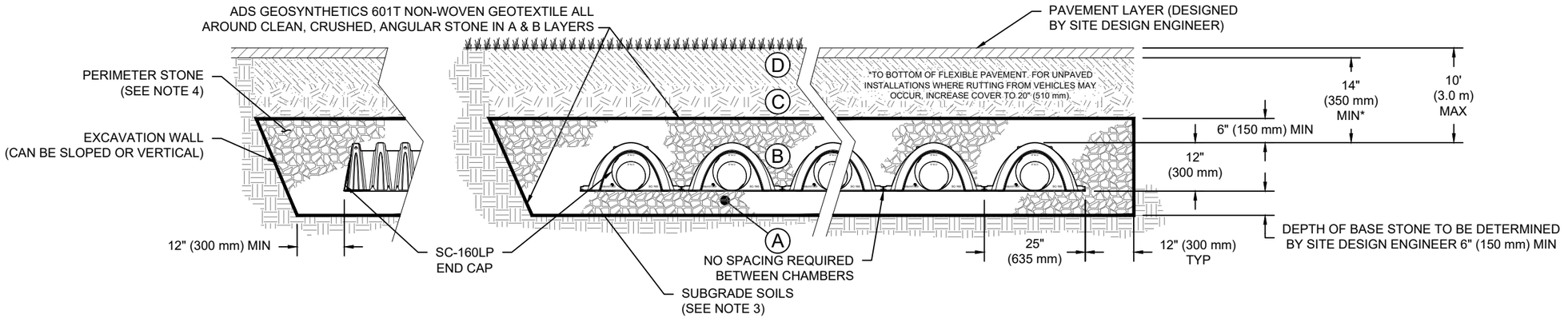
ACCEPTABLE FILL MATERIALS: STORMTECH SC-160LP CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 14" (355 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 12" (300 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 6" (150 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS. ROLLER GROSS VEHICLE WEIGHT NOT TO EXCEED 12,000 lbs (53 kN). DYNAMIC FORCE NOT TO EXCEED 20,000 lbs (89 kN).
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 6" (150 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.



NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
2. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 1.5”
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 400 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

220 ARKELL ROAD
GUELPH, ON
DRAWN: CN
CHECKED: N/A
DATE:
PROJECT #:

DATE	DRW	CHK	DESCRIPTION

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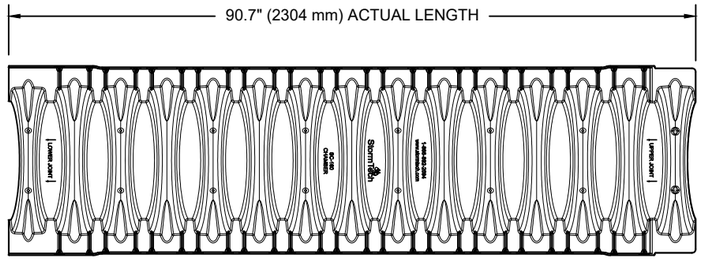
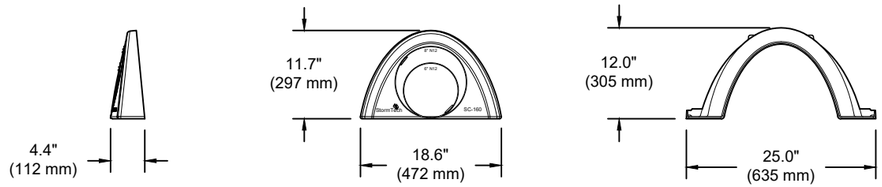
SHEET
3 OF 4

SC-160LP TECHNICAL SPECIFICATION

NTS



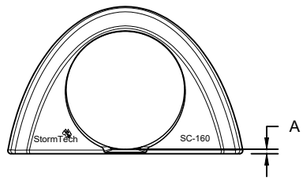


NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	25.0" X 12.0" X 85.4"	(635 mm X 305 mm X 2169 mm)
CHAMBER STORAGE	6.85 CUBIC FEET	(0.19 m³)
MINIMUM INSTALLED STORAGE*	16.0 CUBIC FEET	(0.45 m³)
WEIGHT	24.0 lbs.	(10.9 kg)

*ASSUMES 6" (152 mm) ABOVE, 6" (152 mm) BELOW, AND STONE BETWEEN CHAMBERS WITH 40% STONE POROSITY.

PART #	STUB	A
SC160EPP	6" (150 mm)	0.66" (16 mm)
	8" (200 mm)	0.80" (20 mm)
SC160EPP08	8" (200 mm)	0.96" (24 mm)



ALL STUBS ARE PLACED AT BOTTOM OF END CAP SUCH THAT THE OUTSIDE DIAMETER OF THE STUB IS FLUSH WITH THE BOTTOM OF THE END CAP. FOR ADDITIONAL INFORMATION CONTACT STORMTECH AT 1-888-892-2694.

NOTE: ALL DIMENSIONS ARE NOMINAL

220 ARKELL ROAD
GUELPH, ON

DATE:
DRAWN: CN
PROJECT #:
CHECKED: N/A

DATE	DRW	CHK	DESCRIPTION

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1800mmø CSP RISER FULLY PERFORATED (50mmø) C/W GALVANIZED HALF OPENING HINGED TOP WELDED TO CSP FIRST ROW OF HOLES AT PERMANENT POOL ELEV.=335.00m T/G=336.80 INV=335.00

INFILTRATION TRENCH (SC-160LP ADS CHAMBER SYSTEM) 35m (L) x 24m (W) CHAMBER INV=334.35 CHAMBER OBV=334.65 (0.35m MIN. COVER REQUIRED) TOP OF STONE=334.80

=336.85
34.80
34.85
334.60

7.6m-200mmø STM @ 1.32%

200mmø SHUT-OFF VALVE

9.9m-200mmø STM @ 1.32%

337.00

337.00

337.00

336.55

17.5m-300mmø STM @ 0.86%

89°

335.00 (EX)

MATCH EXISTING LIMIT

INFILTRATION TRENCH

DRY SWM FACILITY

3:1

3:1

335.00

335.50

339.20

336.70

336.55

337.00

336.55

335.70

4.9%

Δ = 1°

L=334.25

L=335.25

ADS OGS Sizing Summary

Project Name: 220 Arkell Road

Consulting Engineer: Stantec

Location: Guelph, ON

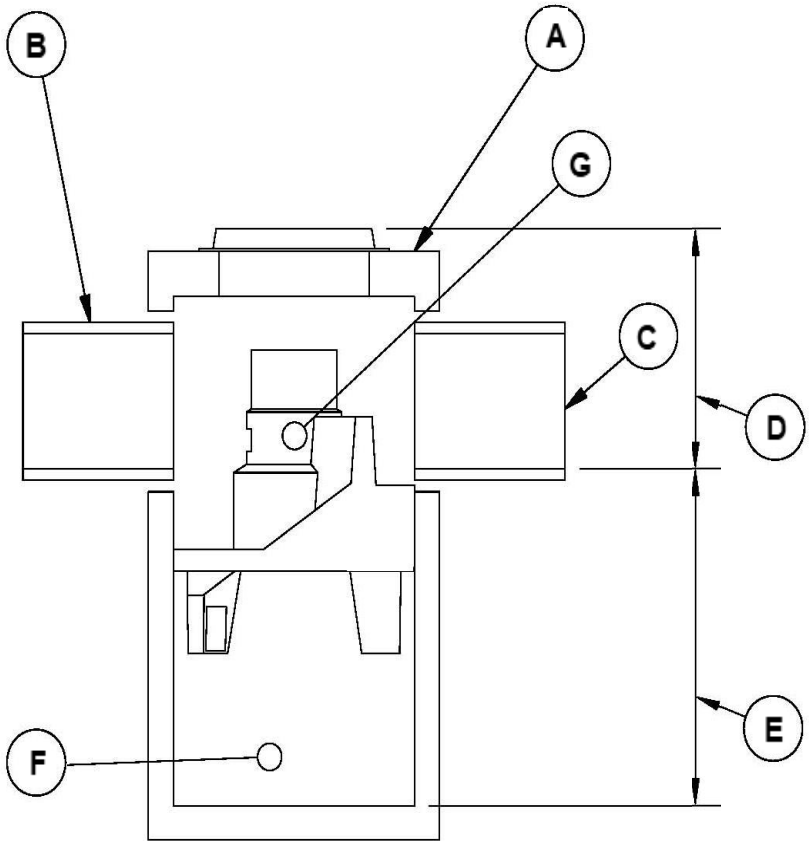
Sizing Completed By: C. Neath **Email:** cody.neath@ads-pipe.com

Treatment Requirements		
Treatment Goal:	Normal (MOE)	
Selected Parameters:	70% TSS	90% Volume
Selected Unit:	**FD-8HC**	

Site Details	
Site Area:	2.55 ha
% Impervious:	65%
Rational C:	0.69
Rainfall Station:	Waterloo_Wellington
Particle Size Distribution:	NJDEP / ETV
Peak Flowrate:	---

Summary of Results		
Model	**TSS Removal**	**Volume Treated**
FD-4HC	56.0%	97.2%
FD-5HC	61.0%	99.1%
FD-6HC	65.0%	99.6%
FD-8HC	72.0%	99.9%

FD-8HC Specification	
Unit Diameter (A):	2,400 mm
Inlet Pipe Diameter (B):	675 mm
Outlet Pipe Diameter (C):	675 mm
Height, T/G to Outlet Invert (D):	1940 mm
Height, Outlet Invert to Sump (E):	2260 mm
Sediment Storage Capacity (F):	3.47 m^3
Oil Storage Capacity (G):	4,239 L
Recommended Sediment Depth for Maintenance:	465 mm
Max. Pipe Diameter:	1,200 mm
Peak Flow Capacity:	1,415 L/s



Site Elevations:	
Rim Elevation:	337.00
Inlet Pipe Elevation:	335.13
Outlet Pipe Elevation:	335.06

Notes:

Removal efficiencies are based on NJDEP Test Protocols and independently verified.

All units supplied by ADS have numerous local, provincial, and international certifications (copies of which can be provided upon request). The design engineer is responsible for ensuring compliance with applicable regulations.

Project Name: 220 Arkell Road
Consulting Engineer: Stantec
Location: Guelph, ON

Net Annual Removal Efficiency Summary: FD-8HC

Rainfall Intensity[1]	Fraction of Rainfall[1]	FD-8HC Removal Efficiency[2]	Weighted Net-Annual Removal Efficiency
mm/hr	%	%	%
0.50	0.3%	92.5%	0.3%
1.00	27.0%	85.0%	22.9%
1.50	3.2%	80.6%	2.6%
2.00	13.6%	77.5%	10.6%
2.50	7.2%	75.1%	5.4%
3.00	1.8%	73.2%	1.3%
3.50	6.7%	71.5%	4.8%
4.00	3.7%	70.1%	2.6%
4.50	1.5%	68.8%	1.0%
5.00	4.8%	67.6%	3.2%
6.00	3.3%	65.7%	2.2%
7.00	4.7%	64.0%	3.0%
8.00	2.8%	62.6%	1.7%
9.00	2.0%	61.3%	1.2%
10.00	2.5%	60.2%	1.5%
20.00	9.0%	52.7%	4.8%
30.00	3.1%	48.3%	1.5%
40.00	1.0%	45.2%	0.5%
50.00	0.8%	42.8%	0.3%
100.00	0.9%	35.3%	0.3%
150.00	0.1%	0.0%	0.0%
200.00	0.0%	0.0%	0.0%
		Total Net Annual Removal Efficiency:	72.0%
		Total Runoff Volume Treated:	99.9%

Notes:

(1) Rainfall Data: 1981:2007,HLY03 6149387, Waterloo/Wellingotn Airport, ON

(2) Based in NJDEP / ETV PSD, NJDEP Test Protocols 2013.

(3) Rainfall adjusted to 5 min peak intensity based on hourly average.

Stantec Consulting Ltd.
100-300 Hagey Boulevard, Waterloo ON N2L 0A4

November 5, 2018
File: 161413338/11

Attention: Mr. Jim Hall, P. Eng., Development Infrastructure Engineer
City of Guelph
Engineering and Capital Infrastructure
Services Department
1 Carden Street
Guelph ON N1H 3A1

Dear Mr. Hall,

Reference: 220 Arkell Road – Response to Stormwater Management City Comments Dated July 19, 2018

The purpose of this letter is to respond to City comments dated July 19, 2018, specifically related to the proposed interim stormwater management (SWM) for the development (hereafter referred to as the 'site'). Stantec Consulting Ltd. (Stantec) met with City of Guelph (City) staff on September 10, 2018 to review the comments and to establish a general approach to the response. This letter addresses the analysis that was completed to ensure no negative impacts occur to the SWM design for the neighbouring Subdivision to the south, Arkell Meadows, following construction of the proposed interim access road to the 220 Arkell site.

1.0 BACKGROUND

Following the meeting on September 10, 2018, City staff requested that Stantec analyze the existing infiltration/SWM strategy for Arkell Meadows as the proposed alignment for the interim emergency access road passes over an Open Space Block (Block 20). A copy of the *Arkell Meadows Final Stormwater Management (FSWM) and Servicing Report* (KJ Behm and Associates, 2013) was obtained from the City to determine pre-development and current conditions and should be read in conjunction with this letter.

2.0 PRE-DEVELOPMENT AND CURRENT CONDITIONS

Under pre-development conditions, Block 20 is identified as a 'dead-end drainage' feature and provides additional recharge for the site (consistent with the Torrance Creek Subwatershed Study). The current Arkell Meadows design is illustrated on the attached Drawing H-1. An infiltration gallery receiving runoff from Lots 1-12 and Block 20 stretches along the rearyards of these lots and extends into Block 20. Under current conditions, Block 20 is 'Open Space' with no impervious coverage. According to the Arkell Meadows FSWM design and grading, the majority of Block 20 drains to a catchbasin located in the northwest corner of the Block which is connected to the rearyard infiltration gallery. Block 20 is part of Catchment 13 (from the hydrologic model MIDUSS) from the post-development drainage conditions which also includes parts of Lots 6-12. The hydrologic model presents Catchment 13 as 0.35 ha of residential area with an assumed 70% impervious coverage. The current Drainage Plan is attached and please refer to the original FSWM Report for the MIDUSS model output. Catchment 13 from the MIDUSS model seems to be a combination of Catchments 11, 12, 13, and 14 illustrated on the Drainage Plan. Please note the current MIDUSS parameters and catchment areas do not match the current Drainage Plan; however, the Plan has been included to give a general illustration of current drainage ditch.

The current Arkell Meadows SWM strategy uses a treatment train approach to provide water quality and water quantity control and maintains existing recharge volumes through several design infiltration components:

- Lot Level Controls: infiltration galleries in the rearyards of Lots 1-12
- Conveyance Controls: roadside catchbasins with sumps, oil/grit separator (OGS) units, sand filters, and vegetation at outlet points from the site
- End-of-Pipe Controls: a SWM facility providing polishing of runoff through interaction with vegetation as well as an infiltration system with a sand filter bottom to provide recharge and separate contaminants from runoff

3.0 PROPOSED CONDITIONS

A proposed emergency access road alignment extends from Dawes Avenue through Block 20 to the north, ultimately connecting to the site as illustrated on Drawing C-400. This connection is for emergency access only and regular vehicular traffic is not anticipated to occur.

The interim emergency access road is a 10 m wide asphalt road and extends from Dawes Avenue into the site through Block 20 of the Arkell Meadows Subdivision. Ultimately, the width of the road/trail will be reduced to a 4 m asphalt trail for pedestrian use and maintenance access further north in the park area; however, for the purposes of this assessment it is assumed the 10 m road is the ultimate condition.

As a result of this proposal, the following tasks were completed to ensure the continued functioning of the Arkell Meadows hydrology and SWM system:

- Review the current Arkell Meadows Subdivision infiltration/SWM design for proposed conditions
- Ensure the water quantity control for the site is maintained under proposed conditions
- Ensure water quality treatment is provided for the proposed development

3.1 WATER BALANCE, INFILTRATION AND WATER QUANTITY CONTROL

The Arkell Meadows Subdivision maintains a groundwater recharge water balance by directing rooftop runoff to a rearyard infiltration gallery and all other post-development runoff to a SWM facility for filtration and ultimately infiltration. The drainage strategy also promotes evapotranspiration (ET) in the pond to enhance the post-development ET volumes.

Given the location of the proposed access road, the removal of the existing RYCB 32 receiving drainage from Block 20 (northwest corner of the Block) and connecting into the infiltration gallery is expected. To maintain drainage to the infiltration gallery, the proposed access road is super-elevated on the west side to direct drainage to the east to the grassed swale on the property line between Lot 12 and Block 20. Runoff drains north along this grassed area to a future catchbasin (CB) which will connect to the infiltration gallery. The proposed access road increases the impervious coverage on Block 20; however, as shown on the attached water balance calculation, the change to the ET and recharge components of the balance is negligible.

The table below illustrates the results of the post-development water balance analysis for Arkell Meadows. The full analysis is attached.

Table 1: Summary of 2013 Water Balance for Arkell Meadows Subdivision

Water Balance Component	Pre-Development	Current Conditions	Proposed Access Road
Evapotranspiration (mm/year)	600	419	416
Recharge (mm/year)	300	474	476
Runoff (mm/year)	17	24	25
Total Precipitation (mm/year)	917	917	917

Following construction of the access road, additional drainage is directed to the infiltration system for groundwater recharge; however, the increase in impervious coverage reduces the ET and increases the runoff (as expected). Under these proposed conditions and compared to the current conditions, the design has an ET reduction of 3 mm/year (0.7%), a recharge increase of 2 mm/year (0.4%), and a runoff increase of 1 mm/year (4%). Given

these relatively small changes, no negative impact to the local water balance is anticipated following construction of the proposed access road.

The SWM facility and rearyard infiltration system provide water quantity control for the site. The hydrologic model MIDUSS was used in the FSWM Report and has been recreated for the catchment in which the proposed access road is located (Catchment 13) to illustrate the impact on the gallery capacity. The additional impervious area from the proposed access road increases the impervious area to the infiltration gallery; however, the current design volume of the gallery has sufficient capacity to infiltrate all runoff up to and including the 1:100-year return period design storm. The supporting MIDUSS output is attached for reference.

The future site development at 220 Arkell Road, located north of the Arkell Meadows Subdivision, will also maintain surface water flows to the wetland to the west by installing a culvert under the proposed access road. A low area exists near the property line between 220 Arkell and Arkell Meadows, immediately north of Block 20 and Lot 12. Surface flow from this low area will be directed west under the proposed access road as illustrated on Drawing C-400. The culvert conveys surface water runoff from the future 220 Arkell Road development; however, in the event of overflows from the Arkell Meadows Subdivision, the culvert conveys water away from the existing subdivision and towards the wetland. The specific discharge and volume details flowing to the culvert will be provided at the detailed design stage.

3.2 WATER QUALITY CONTROL

A treatment train approach consisting of lot level controls, conveyance controls, and end-of-pipe controls provides water quality for the site. These controls include vegetation, infiltration, and groundwater recharge. A similar approach is recommended for the proposed access road in the form of conveyance controls and end-of-pipe controls. The proposed access road is super-elevated and drains east to a grassed swale. The swale provides conveyance control as runoff drains north along the property line between Block 20 and Lot 12. Water quality benefits of the proposed grassed swale are also achieved as a result of the runoff / vegetation interaction which slows the velocity of runoff, as compared to a piped system, thereby promoting the sedimentation of particulate matter in the swale. The vegetation also provides nutrient uptake benefits to help reduce biological pollutants such as nitrogen and phosphorous. According to the *Low Impact Development SWM Planning and Design Manual (*CVC/TRCA, 2010), grassed swales provide a median sediment removal rate of 76%. In addition to conveyance control, it is recommended a CB insert (CB Shield or equivalent) is installed in the proposed CB as an end-of-pipe treatment prior to infiltrating in the rearyard gallery. Sediment removal rates for CB Shields range between 25.2 - 64% depending on inflow rates from the Environmental Technology Verification (ETV) testing specifications (please refer to CB Shield Website for details of the ETV Report). The combined minimum sediment removal rate is therefore 82% (76% plus an additional 25.2% of the remaining sediment). In addition, given the proposed access road is for emergency use only and its future use is a Public trail only, limited vehicular traffic is expected. Any water quality treatment strategies are expected to be more than sufficient for the limited sediment and oil/grit build-up on the road itself and in the runoff.

Drawing C-400 illustrates the proposed grading and drainage patterns in Block 20.

Reference: 220 Arkell Road – Response to Stormwater Management City Comments Dated July 19, 2018

4.0 SUMMARY

The following SWM strategies are proposed to maintain the Arkell Meadows hydrologic regime:

- Super-elevate access road to direct all runoff towards a grassed swale conveying runoff north between Block 20 and Lot 12 to a proposed catchbasin at the north property limits of Arkell Meadows
- Maintain water balance for the site by directing access road runoff to the proposed catchbasin which is connected to the existing infiltration gallery
- Install a culvert under the proposed access road near the property line between the future 220 Arkell Road Development and the existing Arkell Meadows Subdivision to maintain surface water flows to the wetland to the west
- Provide water quality treatment through the combination of a grassed swale (conveyance control) and a catchbasin insert (end-of-pipe) prior to infiltration to the existing gallery. Vehicular traffic is expected during emergency situations, only, so the runoff water quality should have limited sediment and oil/grit which is typical of heavily-used roads

No negative impacts to the stormwater management system for Arkell Meadows Subdivision are anticipated from the implementation of the proposed emergency access road.

If you have any questions or would like to clarify anything within this proposal, please do not hesitate to contact the undersigned.

Regards,

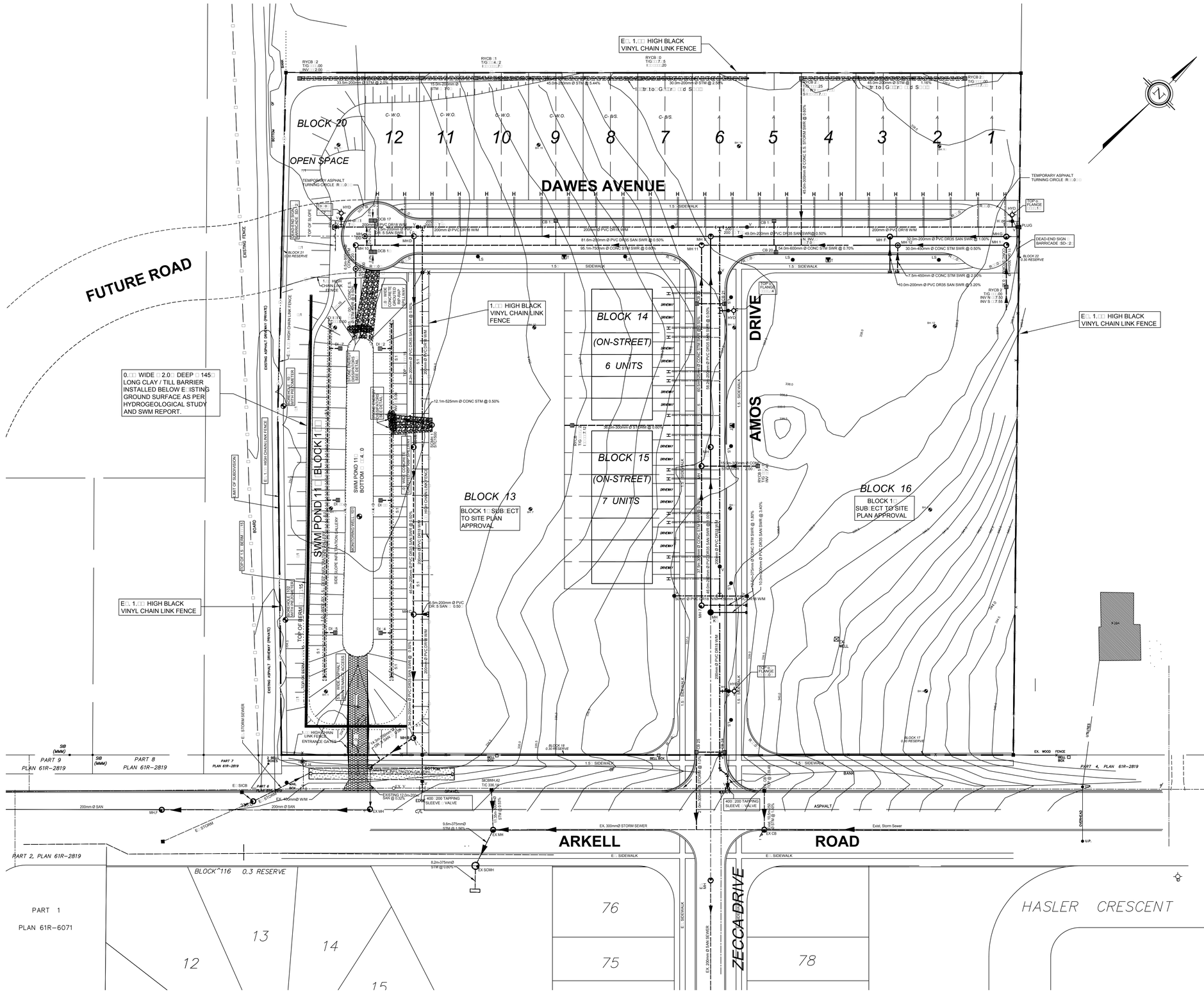
Stantec Consulting Ltd.

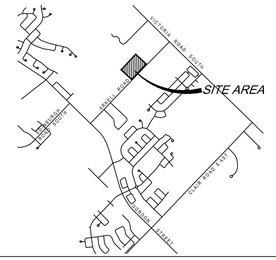
Trevor Fraser P.Eng.
Surface Water Resources Engineer
Phone: (519) 575-4120
trevor.fraser@stantec.com

Attachment: Arkell Meadows Drawing H-1
Arkell Meadows Current Drainage Plan
Arkell Meadows Current MIDUSS Model
Proposed Drawing C-400
Water Balance – Pre-Development, Current, Proposed
Proposed MIDUSS Model

c. Mr. Carson Reid, Rockpoint Properties Inc.
Mr. Kevin Brousseau / Ms. Melissa Straus, Stantec Consulting Ltd.

tf v:\01614\active\161413338\design\correspondence\(11) water resources\let_20181024_161413338_letter_to_city_taf_v1.docx





KEY PLAN Scale : NOT TO SCALE

LEGEND

- CB 1□ — CATCH BASIN
- V — WATERMAIN
- SA — SANITARY SEWER
- ST — STORM SEWER
- V — VALVE
- LS — LIGHT STANDARD
- T — TRANSFORMER

THE POSITION OF POLES: LINES: CONDUITS: WATERMAINS: SEWERS AND OTHER UNDERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS: AND WHERE SHOWN: THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK: THE CONTRACTOR SHALL INFORM HIMSELF OF THE E□ACT LOCATION OF SUCH UTILITIES AND STRUCTURES: AND SHALL ASSUME ALL LIABILITY FROM DAMAGE TO THEM.

GENERAL NOTES:

FIELD NOTES: PLAN REFERENCES:

BENCH MARK: No. □□2 ELEVATION: □□□.245

PLAN REFERENCES: TRAFFIC CONTROL BO□ PAD SW CORNER OF ARKELL AND VICTORIA RD.

No.	DATE	DESCRIPTION	INTL
□	2□/04/14	GENERAL REVISIONS	K.B
5	15/11/1□	MHS C□E□2□7□K RELOCATED	K.B
4	15/07/1□	ISSUED FOR TENDER	K.B
□	0□/0□/1□	GENERAL REVISIONS	K.B
2	2□/04/1□	GENERAL REVISIONS	K.B
1	12/02/1□	GENERAL REVISIONS	K.B

SCHEDULE OF REVISIONS

CITY OF Guelph
Making a Difference
ENGINEERING SERVICES

ARKELL MEADOWS SUBDIVISION GUELPH, ONTARIO

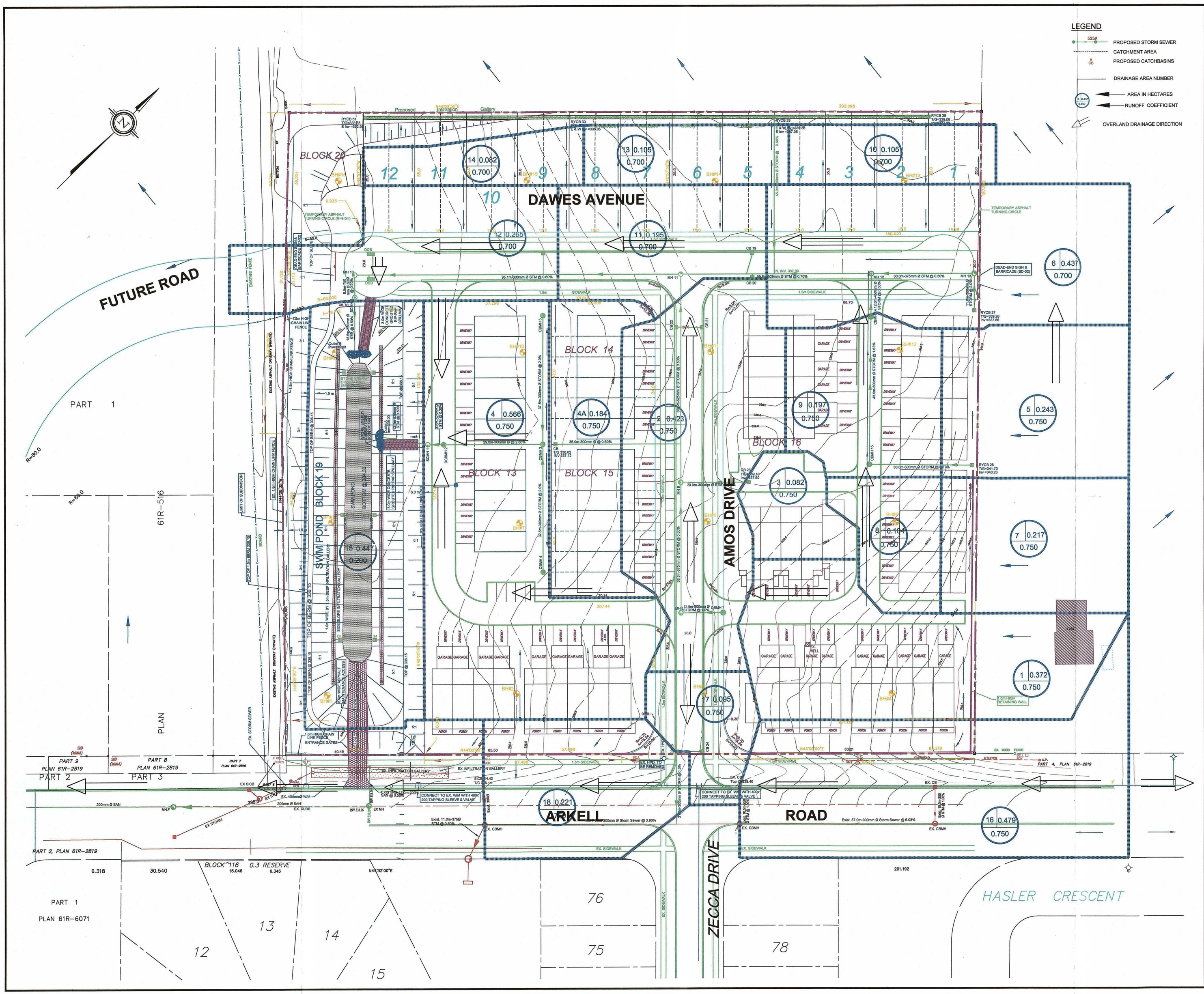
GENERAL SERVICING PLAN

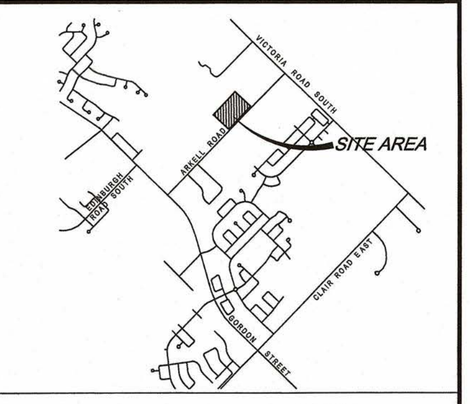
REGISTERED PROFESSIONAL ENGINEER PROVINCE OF ONTARIO
K. J. BEHM
01/05/14

CHECKED: APPROVED:

K. □ BEHM AND ASSOCIATES INC.
CONSULTING ENGINEERS
55 ERB STREET EAST: SUITE □20
WATERLOO: ONTARIO N2□ 4K□
PHONE :51□.742.510 FA□:51□.742.4□2

DESIGNED BY: K□B	SCALES Hor.□1:500 V□rt.□1:50	DRAWING. NO.
DRAWN BY: SMS	DATE DRAWN: SEPT 200□	H-1
CHECKED BY: K□B	CONTRACT NO.: 2-1□11	





KEY PLAN Scale : NOT TO SCALE

NOTES:

GENERAL NOTES

1. All work to be done in accordance with the standards and specifications of the City of Guelph and the Ontario Provincial standards except where noted.
2. The Contractor shall notify the City of Guelph and the Engineer at least 48 hours prior to commencing construction.
3. All concrete to be 30 MPa in 28 days with 6 +/-1% air entrainment unless otherwise stated.
4. All sewer pipe & watermains to be as per standard Class 'B' bedding (OPSD 802.01 & 802.030).
5. All structures shall allow for an adjustment of between 150-300mm with moduloc.
6. All manholes shall be as per OPSD 701.010 backfilled with Granular 'B' (100% SPD minimum).
7. All service connections shall be as per City if Guelph SD-65.

SANITARY SEWER SYSTEMS

1. Sanitary sewers shall be 200mm dia. PVC SDR-35 meeting the current ASTM D3034 specifications and CSA 182.2 .
2. Sanitary services shall be 100mm dia. PVC SDR-28 meeting current CSA B182.2 specifications. Service connections shall be to a minimum grade of 2.0%. All connections to new mains shall have manufactured tees. All new connections to existing mains shall use stainless steel straps & saddles.
3. All sanitary stubs including services shall have a wooden 2" x 4" marker painted green.

STORM SEWER SYSTEMS

1. Storm sewers 450mm dia. and less shall be either concrete E.S.(CSA A.257.2) or PVC Ultra-Rib (CSA B.182.4) or PVC SDR-35 (CSA B.182.2. Storm sewers larger than 450mm dia. shall be reinforced concrete. All Rear Yard Catch Basin leads shall be E.S. concrete..
2. Storm Services shall be 125mm dia. PVC SDR-28 meeting the current CSA B.182.2 specifications. Service connections shall be to a minimum grade of 2.0%. All connections to new mains shall be prefabricated manufactured tees or Kor-N-Tees.
3. All catch basin leads shall be PVC SDR-35 (250mm dia.-singles & 300mm dia.-paired & doubles)

WATERMAIN SYSTEMS

1. Watermains shall be 150mm dia. C900 PVC Class 1500 as per OPSD 802.010.
2. Water services shall be 25mm dia. Type "K" Soft Copper Tubing meeting ASTM B88 specifications.
3. Watermains shall have a minimum cover of 2.0 vertical metres and vertical separation with other services of 0.50 metres and horizontal separation of 2.5 metres.
4. Water valves shall be located on property line as per City of Guelph SD-54B.
5. All water stubs including services shall have a wooden 2" x 4" marker painted blue.

ROADWORKS & SWM POND/EMERGENCY ACCESS

1. Road cross sections shall be as per drawing D-1.
2. Concrete curb and gutter shall be OPSD 600.040.
3. Curb radii at intersections shall be 9.0m to face of curb (minimum).
4. Driveway access shall be as per SD-47.
5. Boulevard Landscaping shall be with 125mm of Topsoil and No.1 Nursery Sod.
6. Pavement Design for all roads shall be:
   - 350mm Granular 'B' Road Base
   - 175mm Granular 'A' Road Base
   - 50mm HL-8 Binder Asphalt
   - 40mm HL-3 Surface Asphalt
7. Driveways shall be:
   - 150mm Granular 'B' Road Base
   - 150mm Granular 'A' Road Base
   - 50mm HL-3C Binder Asphalt

LEGEND: FOR BORE HOLES

BH#13 GROUND=338.60
- 0.0 TOPSOIL to 0.20m 338.50 to 338.30
- 0.2 SILT to 0.60m 338.30 to 337.90
- 0.6 SAND to 6.5m 337.90 to 333.00
- 6.5

THE POSITION OF POLES, LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR SHALL INFORM HIMSELF OF THE EXACT LOCATION OF SUCH UTILITIES AND STRUCTURES, AND SHALL ASSUME ALL LIABILITY FROM DAMAGE TO THEM.

GENERAL NOTES:

FIELD NOTES:

PLAN REFERENCES:

BENCH MARK: No. 392 ELEVATION: 336.245

PLAN REFERENCES: TRAFFIC CONTROL BOX PAD SW CORNER OF ARKELL AND VICTORIA RD.

No.	DATE	DESCRIPTION	INTL
3	12/02/13	GENERAL REVISIONS	KJB
2	15/12/12	GENERAL REVISIONS	KJB
1	03/01/12	GENERAL REVISIONS	KJB

SCHEDULE OF REVISIONS

CITY OF Guelph
Making a Difference
ENGINEERING SERVICES

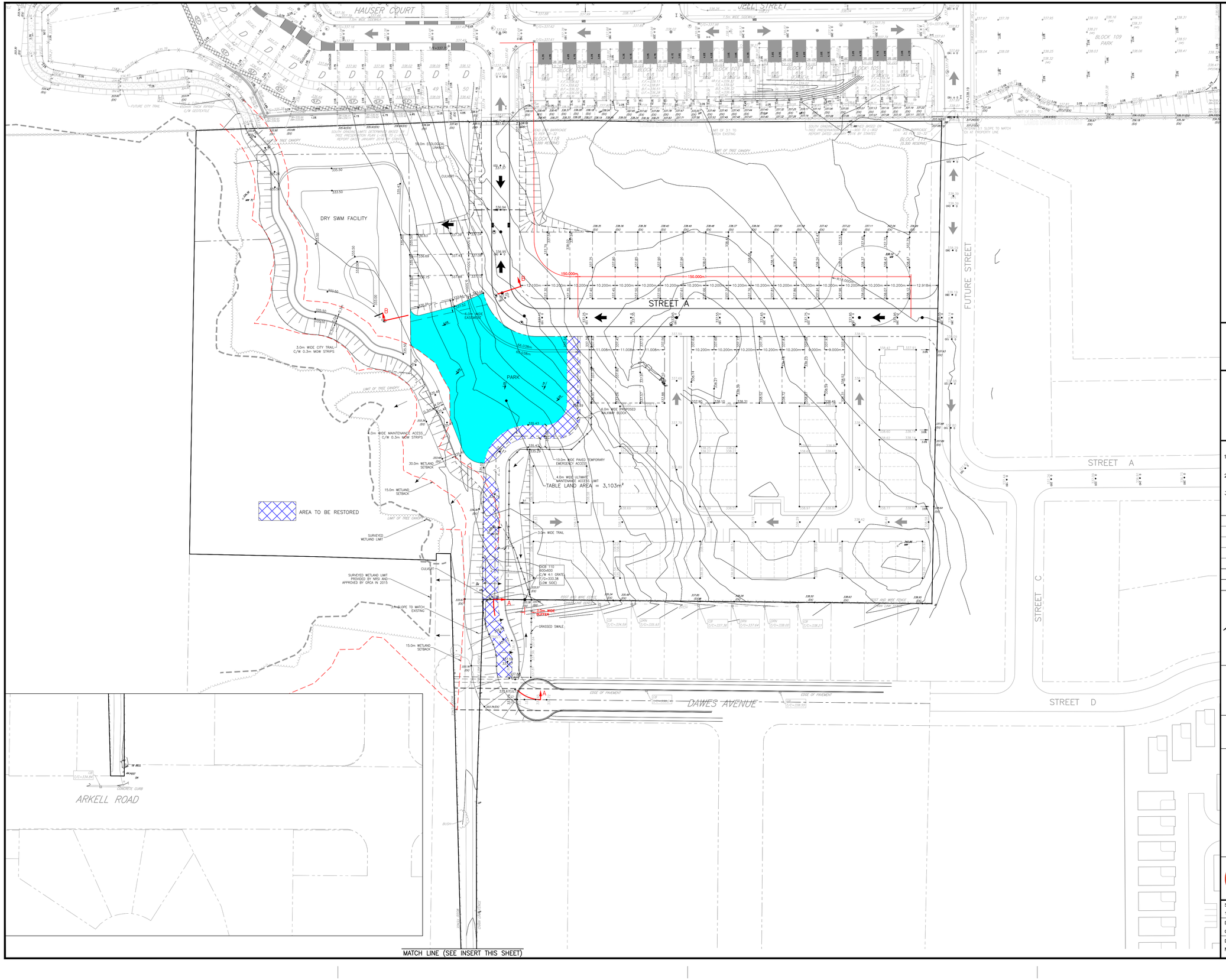
ARKELL MEADOWS SUBDIVISION GUELPH, ONTARIO

POST DEVELOPMENT PLAN

CHECKED: APPROVED:

K. J. BEHM AND ASSOCIATES INC.
CONSULTING ENGINEERS
55 ERB STREET EAST, SUITE 320
WATERLOO, ONTARIO N2J 4K8
PHONE (519) 742 3510 FAX (519) 742 3462

DESIGNED BY: KJB	SCALES Hor.=1:500 Vert.=1:50	DRAWING. NO.
DRAWN BY: SMS	DATE DRAWN: SEPT 2009	PD-1
CHECKED BY: KJB	CONTRACT NO.:	



North:

LEGEND:

- PHASE LIMIT
- 352.92 ORIGINAL GROUND ELEVATION
- 352.92 PROPOSED ELEVATION
- 351.91 EXISTING ELEVATIONS
- 352.92 FUTURE PROPOSED ELEVATION
- 2.0% 2.0% FLOW DIRECTION
- 349.00 ORIGINAL GROUND CONTOUR
- PROPOSED STORM MANHOLE
- PROPOSED STORM CATCHBASIN MANHOLE
- PROPOSED CATCHBASIN
- PROPOSED DOUBLE CATCHBASIN
- PROPOSED SANITARY MANHOLE
- PROPOSED VALVE & BOX
- PROPOSED HYDRANT
- EXISTING INTERIM SLOPE (3:1 UNLESS NOTED OTHERWISE)
- PROPOSED SLOPE (3:1 UNLESS NOTED OTHERWISE)
- OVERLAND FLOW DIRECTION
- FUTURE OVERLAND FLOW DIRECTION
- SURFACE FLOW DIRECTION
- BH GWE BORE HOLE GROUND WATER LEVEL

ALL DIMENSIONS AND ELEVATIONS ARE IN METRES UNLESS OTHERWISE NOTED.

PIPE SIZES ARE IN MILLIMETRES.

The position of existing above ground and underground utilities and facilities are not necessarily shown on the drawings, and where shown, the accuracy of the position of such utilities and facilities is not guaranteed. Before starting work, the contractor shall confirm the exact location of all existing utilities and facilities, and shall assume all liability for damage to them. Drawings shall not be used for construction unless sealed. All work to be performed in accordance with the Occupational Health & Safety Act 1990.

GENERAL NOTES:

1. BENCHMARK: GUELPH BENCHMARK #91. #493 VICTORIA ROAD NORTH ELEVATION=351.060m
2. LEGAL INFORMATION TAKEN FROM BLACK, SHOEMAKER, ROBINSON & DONALDSON INC. PROJECT #02-4541-3 DATED FEBRUARY 11, 2003.
3. TOPOGRAPHICAL SURVEY BY STANTEC CONSULTING LTD. DATED MAY 2000. ADDITIONAL TOPOGRAPHICAL SURVEY BY STANTEC CONSULTING LTD. DATED JUNE 2002

SCHEDULE OF REVISIONS

CITY OF Guelph
Making a Difference

ENGINEERING SERVICES

CONCEPTUAL GRADING PLAN

220 ARKELL SUBDIVISION

DESIGNED BY:	APPROVED BY:

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

SCALES:	CHECKED BY:
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DATE DRAWN:	CONTRACT No.
OCTOBER 20 / 17	X-XXXX
DRAWN BY:	DRAWING No.
MHH	C-400

- 000

Monthly Water Balance Analysis
161413338 - 220 Arkell Road - Interim Access Road Analysis
Pre-Development Conditions - KJ Behm, 2010 Analysis

Land Cover Descriptions
Pasture and grasses | Silt/Sand loam | Hilly

Main Site Area (ha) 4.3
Impervious

Land Description Factors			**Impervious**	**Perm. Pool**
Topography	0.10		-	-
Soils	0.30		-	-
Cover	0.15		-	-
Sum (Infiltration Factor)	0.55		-	-
Soil Moisture Capacity (mm)	250		-	-
Site Area	4.30		0.00	0
Percentage of Total Site Area	100%		0%	0%

100% **OK**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Comment
Climate Data (Data from Waterloo-Wellington Station - Climate Normals from 1966-1990)														
Average Daily Temperature (°C)	-7.3	-6.8	-1.5	5.8	12.5	17.0	19.9	18.7	14.3	8.0	2.5	-4.0		Daily average temperature in each month
Precipitation (mm)	54.3	55.6	72.7	72.6	76.3	79.5	90.4	93.3	89.6	70.4	83.1	79.2	**917.0**	
Evapotranspiration Analysis														
PET (Thornthwaite, 1948) (mm/month)	0.0	0.0	0.0	30.2	75.1	104.7	124.1	107.7	70.8	35.6	9.1	0.0	**557.3**	Expected ET for 917 mm of annual rainfall per unit area of pervious area (zero impervious coverage)
Precipitation - PET (mm)	54.3	55.6	72.7	42.4	1.2	-25.2	-33.7	-14.4	18.8	34.8	74.0	79.2		
Accumulated Water Loss (mm)						-25.20	-58.90	-73.30						
Moisture Retention (mm)	250.0	250.0	250.0	250.0	250.0	226.0	196.0	186.0	204.8	239.6	250.0	250.0		From Table 30 of Thornthwaite and Mather, Instructions and Tables for Computing PET and the Water Balance (1957)
Change in Soil Moisture (mm)	0.0	0.0	0.0	0.0	0.0	-24.0	-30.0	-10.0	18.8	34.8	10.4	0.0		
Actual Evapotranspiration (mm)	**0.0**	**0.0**	**0.0**	**30.2**	**75.1**	**103.5**	**120.4**	**103.3**	**70.8**	**35.6**	**9.1**	**0.0**	**548.0**	

Volume-Based Balance (m^3)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Precipitation	2,335	2,391	3,126	3,122	3,281	3,419	3,887	4,012	3,853	3,027	3,573	3,406	**39,431**	**917 mm/year**
Evapotranspiration[1]	0	0	0	1,299	3,229	4,451	5,177	4,442	3,044	1,531	391	0	**23,564**	**548 mm/year**
Pervious Runoff	0	0	0	5,886	23	-464	-581	-194	364	673	1,432	0	7,140	166 mm/year
Impervious Runoff	0	0	0	0	0	0	0	0	0	0	0	0	0	0 mm/year
Total Runoff	0	0	0	5,886	23	-464	-581	-194	364	673	1,432	0	**7,140**	**166 mm/year**
Groundwater Recharge	0	0	0	7,194	28	-568	-710	-237	445	823	1,750	0	**8,727**	**203 mm/year**
Recharge/Runoff Analysis														
Surplus/Deficit	54.3	55.6	72.7	42.4	1.2	-24.0	-30.0	-10.0	18.8	34.8	74.0	79.2	**369.0**	
Weighted Infiltration Factor	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55		Based on MOE SWM Manual (2003)
Runoff (mm)	**0.0**	**0.0**	**0.0**	**136.9**	**0.5**	**-10.8**	**-13.5**	**-4.5**	**8.5**	**15.7**	**33.3**	**0.0**	**166.1**	Assume no runoff in sub-zero months
Recharge (mm)	**0.0**	**0.0**	**0.0**	**167.3**	**0.7**	**-13.2**	**-16.5**	**-5.5**	**10.3**	**19.1**	**40.7**	**0.0**	**203.0**	
Recharge (mm)	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	
Dead-End Drainage Area[2]	***Split total runoff from site into ET, recharge, runoff due to 'dead-end drainage' feature***													
Adjusted Runoff (10% of runoff)	0	0	0	589	2	-46	-58	-19	36	67	143	0	**714**	**17 mm/year**
Adjusted Recharge (60% of runoff)	0	0	0	10,638	42	-839	-1,049	-350	657	1,217	2,588	0	**12,904**	**300 mm/year**
Adjusted ET (30% of runoff)	0	0	0	3,153	3,237	4,304	4,994	4,381	3,159	1,743	842	0	**25,813**	**600 mm/year**

Monthly Water Balance Analysis
161413338 - 220 Arkell Road - Interim Access Road Analysis
Current Conditions - KJ Behm, 2010 Analysis

Land Cover Descriptions
Pasture and grasses | Silt/Sand loam | Hilly

Main Site Area (ha)	3.5	See notes		
Impervious Cover	50%	See notes		

Land Description Factors			**Impervious**	**Perm. Pool**
Topography	0.10		-	-
Soils	0.30		-	-
Cover	0.15		-	-
Sum (Infiltration Factor)	0.55		-	-
Soil Moisture Capacity (mm)	50		-	-
Site Area	1.75		1.75	0.00
Percentage of Total Site Area[2]	50%		50%	0%

100% **OK**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Comment
Climate Data (Data from Waterloo-Wellington Station - Climate Normals from 1966-1990)														
Average Daily Temperature (°C)	-7.3	-6.8	-1.5	5.8	12.5	17.0	19.9	18.7	14.3	8.0	2.5	-4.0		Daily average temperature in each month
Precipitation (mm)	54.3	55.6	72.7	72.6	76.3	79.5	90.4	93.3	89.6	70.4	83.1	79.2	**917.0**	
Evapotranspiration Analysis														
PET (Thornthwaite, 1948) (mm/month)	0.00	0.00	0.00	30.20	75.10	104.70	124.10	107.70	70.80	35.60	9.10	0.00	**557.3**	Expected ET for 917 mm of annual rainfall per unit area of pervious area (zero impervious coverage)
Precipitation - PET (mm)	54.3	55.6	72.7	42.4	1.2	-25.2	-33.7	-14.4	18.8	34.8	74.0	79.2		
Accumulated Water Loss (mm)						-25.2	-58.9	-73.3						
Moisture Retention (mm)	250.0	250.0	250.0	250.0	250.0	226.0	196.0	186.0	204.8	239.6	250.0	250.0		From Table 30 of Thornthwaite and Mather, Instructions and Tables for Computing PET and the Water Balance (1957)
Change in Soil Moisture (mm)	0.0	0.0	0.0	0.0	0.0	-24.0	-30.0	-10.0	18.8	34.8	10.4	0.0		
Actual Evapotranspiration (mm)	**0.0**	**0.0**	**0.0**	**30.2**	**75.1**	**103.5**	**120.4**	**103.3**	**70.8**	**35.6**	**9.1**	**0.0**	**548.0**	

Volume-Based Balance (m^3)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Precipitation	1,901	1,946	2,545	2,541	2,671	2,783	3,164	3,266	3,136	2,464	2,909	2,772	**32,095**	**917 mm/year**
Pervious Evapotranspiration	0	0	0	529	1,314	1,811	2,107	1,808	1,239	623	159	0	9,590	548 mm/year
Pervious Runoff	0	0	0	2,396	9	-189	-236	-79	148	274	583	0	2,906	166 mm/year
Impervious Runoff	0	0	0	5,852	1,335	1,391	1,582	1,633	1,568	1,232	1,454	0	16,048	917 mm/year
Pervious Groundwater Recharge	0	0	0	2,928	12	-231	-289	-96	181	335	712	0	**3,552**	**203 mm/year**
Pervious Runoff to Pond	***Split total runoff from pervious areas into ET, recharge, runoff due to pond retention***													
Adjusted Runoff (5% of runoff)	0	0	0	120	0	-9	-12	-4	7	14	29	0	**145**	**8 mm/year**
Adjusted Recharge (75% of runoff)	0	0	0	1,797	7	-142	-177	-59	111	206	437	0	**2,179**	**125 mm/year**
Adjusted ET (20% of runoff)	0	0	0	479	2	-38	-47	-16	30	55	117	0	**581**	**33 mm/year**
Impervious Runoff to Pond	***Split total runoff from pervious areas into ET, recharge, runoff due to pond retention***													
Adjusted Runoff (90% of runoff)	0	0	0	5,267	1,202	1,252	1,424	1,469	1,411	1,109	1,309	0	**14,443**	**825 mm/year**
Adjusted ET (10% of runoff)	0	0	0	585	134	139	158	163	157	123	145	0	**1,605**	**92 mm/year**
Recharge/Runoff Analysis														
Surplus/Deficit	54.3	55.6	72.7	42.4	1.2	-24.0	-30.0	-10.0	18.8	34.8	74.0	79.2	**369.0**	
Weighted Infiltration Factor	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55		Based on MOE SWM Manual (2003)
Runoff (mm)	**0.0**	**0.0**	**0.0**	**136.9**	**0.5**	**-10.8**	**-13.5**	**-4.5**	**8.5**	**15.7**	**33.3**	**0.0**	**166.1**	Assume no runoff in sub-zero months
Recharge (mm)	**0.0**	**0.0**	**0.0**	**167.3**	**0.7**	**-13.2**	**-16.5**	**-5.5**	**10.3**	**19.1**	**40.7**	**0.0**	**203.0**	

Infiltration Augmentation														
Pond Recharge (75% of runoff)	0	0	0	3,950	901	939	1,068	1,102	1,058	832	982	0	10,832	619 mm/year
Pond ET (20% of runoff)	0	0	0	1,053	240	250	285	294	282	222	262	0	2,889	165 mm/year
Pond Runoff (5% of runoff)	0	0	0	263	60	63	71	73	71	55	65	0	722	41 mm/year
Final Recharge	**0**	**0**	**0**	**8,675**	**920**	**566**	**602**	**947**	**1,350**	**1,372**	**2,131**	**0**	**16,563**	**473 mm/year**
Final Runoff	**0**	**0**	**0**	**383**	**61**	**53**	**59**	**70**	**78**	**69**	**95**	**0**	**867**	**25 mm/year**
Final ET	**0**	**0**	**0**	**2,646**	**1,690**	**2,163**	**2,503**	**2,249**	**1,708**	**1,023**	**683**	**0**	**14,664**	**419 mm/year**

Notes:
Site area is 3.5 ha in KJ Behm post-development analysis as it does not include the SWM facility area
Impervious coverage assumed to be 50% based on KJ Behm analysis
Existing and current conditions water balances recreated using water balance spreadsheet from Arkell Meadows Final Stormwater Management and Servicing Report (KJ Behm, 2010)
Moisture retention from Table 30 of Thornthwaite and Mather: Instructions and Tables for Computing PET and the Water Balance (1957)

Monthly Water Balance Analysis
161413338 - 220 Arkell Road Interim
Proposed Conditions

Land Cover Descriptions
Pasture and grasses | Silt/Sand loam | Hilly

Main Site Area (ha)	3.5	See notes		
Impervious Cover	51%	See notes		

Land Description Factors			**Impervious**	**Perm. Pool**
Topography	0.10		-	-
Soils	0.30		-	-
Cover	0.15		-	-
Sum (Infiltration Factor)	0.55		-	-
Soil Moisture Capacity (mm)	50		-	-
Site Area	1.72		1.79	0.00
Percentage of Total Site Area	49%		51%	0%

100% **OK**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Comment
Climate Data (Data from Waterloo-Wellington Station - Climate Normals from 1966-1990)														
Average Daily Temperature (°C)	-7.3	-6.8	-1.5	5.8	12.5	17.0	19.9	18.7	14.3	8.0	2.5	-4.0		Daily average temperature in each month
Precipitation (mm)	54.3	55.6	72.7	72.6	76.3	79.5	90.4	93.3	89.6	70.4	83.1	79.2	**917.0**	
Evapotranspiration Analysis														
PET (Thornthwaite, 1948) (mm/month)	0.0	0.0	0.0	30.2	75.1	104.7	124.1	107.7	70.8	35.6	9.1	0.0	**557.3**	Expected ET for 917 mm of annual rainfall per unit area of pervious area (zero impervious coverage)
Precipitation - PET (mm)	54.3	55.6	72.7	42.4	1.2	-25.2	-33.7	-14.4	18.8	34.8	74.0	79.2		
Accumulated Water Loss (mm)						-25.2	-58.9	-73.3						
Moisture Retention (mm)	250.0	250.0	250.0	250.0	250.0	226.0	196.0	186.0	204.8	239.6	250.0	250.0		From Table 30 of Thornthwaite and Mather, Instructions and Tables for Computing PET and the Water Balance (1957)
Change in Soil Moisture (mm)	0.0	0.0	0.0	0.0	0.0	-24.0	-30.0	-10.0	18.8	34.8	10.4	0.0		
Actual Evapotranspiration (mm)	**0.0**	**0.0**	**0.0**	**30.2**	**75.1**	**103.5**	**120.4**	**103.3**	**70.8**	**35.6**	**9.1**	**0.0**	**548.0**	

Volume-Based Balance (m^3)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Precipitation	1,901	1,946	2,545	2,541	2,671	2,783	3,164	3,266	3,136	2,464	2,909	2,772	**32,095**	**917 mm/year**
Pervious Evapotranspiration	0	0	0	518	1,288	1,775	2,065	1,772	1,214	611	156	0	9,398	548 mm/year
Pervious Runoff	0	0	0	2,348	9	-185	-232	-77	145	269	571	0	2,848	166 mm/year
Impervious Runoff	0	0	0	5,969	1,362	1,419	1,614	1,665	1,599	1,257	1,483	0	16,368	917 mm/year
Pervious Groundwater Recharge	0	0	0	2,869	11	-226	-283	-94	177	328	698	0	**3,481**	**203 mm/year**
Pervious Runoff to Pond	***Split total runoff from pervious areas into ET, recharge, runoff due to pond retention***													
Adjusted Runoff (5% of runoff)	0	0	0	117	0	-9	-12	-4	7	13	29	0	**142**	**8 mm/year**
Adjusted Recharge (75% of runoff)	0	0	0	1,761	7	-139	-174	-58	109	201	428	0	**2,136**	**125 mm/year**
Adjusted ET (20% of runoff)	0	0	0	470	2	-37	-46	-15	29	54	114	0	**570**	**33 mm/year**
Impervious Runoff to Pond	***Split total runoff from pervious areas into ET, recharge, runoff due to pond retention***													
Adjusted Runoff (90% of runoff)	0	0	0	5,372	1,226	1,277	1,452	1,499	1,439	1,131	1,335	0	**14,732**	**825 mm/year**
Adjusted ET (10% of runoff)	0	0	0	597	136	142	161	167	160	126	148	0	**1,637**	**92 mm/year**
Recharge/Runoff Analysis														
Surplus/Deficit	54.3	55.6	72.7	42.4	1.2	-24.0	-30.0	-10.0	18.8	34.8	74.0	79.2	**369.0**	
Weighted Infiltration Factor	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55		Based on MOE SWM Manual (2003)
Runoff (mm)	**0.0**	**0.0**	**0.0**	**136.9**	**0.5**	**-10.8**	**-13.5**	**-4.5**	**8.5**	**15.7**	**33.3**	**0.0**	**166.1**	Assume no runoff in sub-zero months
Recharge (mm)	**0.0**	**0.0**	**0.0**	**167.3**	**0.7**	**-13.2**	**-16.5**	**-5.5**	**10.3**	**19.1**	**40.7**	**0.0**	**203.0**	

Infiltration Augmentation														
Pond Recharge (75% of runoff)	0	0	0	4,029	919	958	1,089	1,124	1,080	848	1,001	0	11,049	619 mm/year
Pond ET (20% of runoff)	0	0	0	1,074	245	255	290	300	288	226	267	0	2,946	165 mm/year
Pond Runoff (5% of runoff)	0	0	0	269	61	64	73	75	72	57	67	0	737	41 mm/year
Final Recharge	**0**	**0**	**0**	**8,659**	**938**	**593**	**633**	**972**	**1,366**	**1,378**	**2,128**	**0**	**16,665**	**476 mm/year**
Final Runoff	**0**	**0**	**0**	**386**	**62**	**55**	**61**	**71**	**79**	**70**	**95**	**0**	**879**	**25 mm/year**
Final ET	**0**	**0**	**0**	**2,659**	**1,671**	**2,135**	**2,470**	**2,222**	**1,691**	**1,016**	**686**	**0**	**14,551**	**416 mm/year**

Notes:
Impervious coverage based on 400 sq. m of ermgency access road or approximately 50% of Block 20
Current water balance assumes 3.5 ha drainage area and ignores SWM facility area
Overall impervious coverage increases to 51% due to additional 400 sq. m of access road

```
00001>          Output File (4.7) ARK100.OUT   opened 2018-10-26  13:07
00002>          Units used are defined by G =    9.810
00003>              36   300     5.000        are MAXDT MAXHYD & DTMIN values
00004>          Licensee: Paragon Engineering Limited
00005>    35    COMMENT
00006>         6     line(s) of comment
00007>          **********************
00008>          161413338 - 220 Arkell
00009>          Proposed Conditions - SWM Modelling
00010>          100-yr, 3 hour storm event
00011>          Interim access road - T.Fraser (Oct 2018)
00012>          **********************
00013>     2    STORM
00014>              1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
00015>       4688.000     Coefficient  a
00016>         17.000     Constant  b    (min)
00017>           .962     Exponent  c
00018>           .400     Fraction to peak  r
00019>        180.000     Duration ó  180 min
00020>                   87.263 mm     Total depth
00021>     3    IMPERVIOUS
00022>              2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
00023>           .013     Manning "n"
00024>           .000     Max.Infiltn. mm/hr
00025>           .000     Min.Infiltn. mm/hr
00026>           .050     Lag const (hours)
00027>          1.500     Dep.Storage mm
00028>    35    COMMENT
00029>         3     line(s) of comment
00030>          ****************************************
00031>          CURRENT CONDITIONS (KJ Behm parameters)
00032>          ****************************************
00033>    35    COMMENT
00034>         4     line(s) of comment
00035>          ****************************************
00036>          Catchment 101 - check to match Behm results
00037>          Entire Site pre-development
00038>          ****************************************
00039>     4    CATCHMENT
00040>        101.000     ID No.ó 99999
00041>          4.309     Area in hectares
00042>        100.000     Length (PERV) metres
00043>          2.000     Gradient (%)
00044>           .000     Per cent Impervious
00045>        100.000     Length (IMPERV)
00046>           .000     %Imp. with Zero Dpth
00047>              2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
00048>           .250     Manning "n"
00049>        100.000     Max.Infiltn. mm/hr
00050>        100.000     Min.Infiltn. mm/hr
00051>           .250     Lag const (hours)
00052>          5.000     Dep.Storage mm
00053>              1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
00054>                  .297       .000       .000       .000 c.m/s
00055>                  .133       .000       .133     C perv/imperv/total
00056>    15    ADD RUNOFF
00057>                  .297       .297       .000       .000 c.m/s
00058>    14    START
00059>         1     1=Zero; 2=Define
00060>    35    COMMENT
00061>         3     line(s) of comment
00062>          ****************************************
00063>          Catchment 13 - Current Conditions (duplicate)
00064>          ****************************************
00065>     4    CATCHMENT
00066>        201.000     ID No.ó 99999
00067>           .350     Area in hectares
00068>         23.000     Length (PERV) metres
00069>          2.000     Gradient (%)
00070>         70.000     Per cent Impervious
00071>         23.000     Length (IMPERV)
00072>           .000     %Imp. with Zero Dpth
00073>              2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
00074>           .250     Manning "n"
00075>         75.000     Max.Infiltn. mm/hr
00076>         12.500     Min.Infiltn. mm/hr
00077>           .250     Lag const (hours)
00078>          5.000     Dep.Storage mm
00079>              1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
00080>                  .157       .000       .000       .000 c.m/s
00081>                  .514       .963       .828     C perv/imperv/total
00082>    15    ADD RUNOFF
00083>                  .157       .157       .000       .000 c.m/s
00084>    35    COMMENT
00085>         3     line(s) of comment
00086>          ****************************************
00087>          Infiltration Gallery - from Behm Design
00088>          ****************************************
00089>    10    POND
00090>         7 Depth - Discharge - Volume sets
00091>             .000       .000          .0
00092>             .001      .00300         .4
00093>             .200       .0400        8.6
00094>             .400       .0770       16.8
00095>             .600        .114       25.1
00096>             .800        .151       33.3
00097>            1.000        .188       43.4
00098>          Peak Outflow    =      .139 c.m/s
00099>          Maximum Depth   =      .735 metres
00100>          Maximum Storage =       31. c.m
00101>                  .157       .157       .139       .000 c.m/s
00102>    16    NEXT LINK
00103>                  .157       .139       .139       .000 c.m/s
00104>    14    START
00105>         1     1=Zero; 2=Define
00106>    35    COMMENT
00107>         4     line(s) of comment
00108>          ****************************************
00109>          Catchment 13 - Proposed Conditions
00110>          Block 20 with access road; 70% imp.
00111>          ****************************************
00112>     4    CATCHMENT
00113>        301.000     ID No.ó 99999
00114>           .350     Area in hectares
00115>         23.000     Length (PERV) metres
00116>          2.000     Gradient (%)
00117>         81.000     Per cent Impervious
00118>         23.000     Length (IMPERV)
00119>           .000     %Imp. with Zero Dpth
00120>              2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
00121>           .250     Manning "n"
00122>         75.000     Max.Infiltn. mm/hr
00123>         12.500     Min.Infiltn. mm/hr
00124>           .250     Lag const (hours)
00125>          5.000     Dep.Storage mm
00126>              1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
00127>                  .175       .000       .139       .000 c.m/s
00128>                  .514       .963       .877     C perv/imperv/total
00129>    15    ADD RUNOFF
00130>                  .175       .175       .139       .000 c.m/s
00131>    35    COMMENT
00132>         3     line(s) of comment
00133>          ****************************************
00134>          Infiltration Gallery - from Behm Design
00135>          ****************************************
00136>    10    POND
00137>         7 Depth - Discharge - Volume sets
00138>             .000       .000          .0
00139>             .001      .00300         .4
00140>             .200       .0400        8.6
00141>             .400       .0770       16.8
00142>             .600        .114       25.1
00143>             .800        .151       33.3
00144>            1.000        .188       43.4
00145>          Peak Outflow    =      .148 c.m/s
00146>          Maximum Depth   =      .784 metres
00147>          Maximum Storage =       33. c.m
00148>                  .175       .175       .148       .000 c.m/s
00149>    16    NEXT LINK
00150>                  .175       .148       .148       .000 c.m/s
00151>    20    MANUAL
00152>
```