190 – 216 ARKELL ROAD
GUELPH, ONTARIO

Stormwater Management Report

Project Location:
190 - 216 Arkell Road
Guelph, Ontario

Prepared for:
Crescent Homes
3-180 Frobisher Drive
Waterloo, ON N2V 2A2

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October 10, 2018

MTE File No.: 42063-104

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1.0 INTRODUCTION

1.1 Overview

MTE Consultants Inc. has been retained by Crescent Homes to complete a preliminary Stormwater Management (SWM) Report in support of a Draft Plan of Subdivision Application for lands known as 190, 202, 210 and 216 Arkell Road, located in the City of Guelph, as provided on Figure 1.

The subject site is generally bound by an existing wetland to the north, existing residential to the east, Arkell Road right-of-way to the south and an existing single family residential house to the west. The proposed subdivision lands are approximately 2.58ha in area; however, the northern third of the site cannot be developed due to the existing wetland and its setbacks. The site is legally described as Part of Lot 6, Puslinch Concession 8 in the City of Guelph, Regional Municipality of Waterloo. The site is currently comprised of four residential properties. Municipal addresses for the individual lots are 190, 202, 210, & 216 Arkell Road. The existing homes will be vacated and demolished prior to development.

The Draft Plan of Subdivision for the proposed development includes 34 townhome units fronting onto a municipal right-of-way and two 3-storey apartment buildings with a combined total of 32 apartment units located on a private condominium block in the southeast corner of the site. The proposed right-of-way will connect the existing Dawes Avenue to Arkell Road at the existing Summerfield Drive and Arkell Road intersection.

This report presents the proposed plan detailing the stormwater quality, quantity and infiltration measures that will be provided for the development.

1.2 Purpose of Study

The purpose of this study is to develop a comprehensive stormwater management strategy for the current development proposal that is acceptable to the City of Guelph, the Grand River Conservation Authority and the Ministry of the Environment, Conservation and Parks.

1.3 Objectives

The primary objectives of this study are as follows:

- Establish criteria for the management of stormwater runoff from this site;
- Recommend a plan for controlling the quantity and quality of stormwater runoff from the study area;
- Recommend a strategy for controlling the volume of infiltration to groundwater; and
- Address environmental concerns related to development adjacent to the wetlands, high groundwater levels and nearby municipal wells.

FIGURE 1.0 Date: AUG.29/18 Scale: N.T.S.

SITE LOCATION PLAN

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2.0 EXISTING CONDITIONS AND BACKGROUND INFORMATION

2.1 Topographical Information

MTE completed a detailed topographical survey of the site in the fall of 2016. There is approximately 2m of topographical relief across the site from the south to the north. Elevations across the site range from approximately 335.30masl along the Arkell Road property limit to 333.30masl near the wetland. The adjacent residential subdivision east of the subject property is approximately 4m higher in elevation than the subject property. The existing conditions of the subject property are provided on the enclosed Existing Conditions Plan.

2.2 Pre-Development Conditions

The site is located within the Torrance Creek Subwatershed. The rear portion of the property is comprised of the Torrance Creek Wetland which lies at the headwaters of a tributary to Torrance Creek. Approximately one third of the northerly portion of the site either lies within the wetland complex or within the required 30m wetland buffer.

Under pre-development conditions, surface runoff from the site flows northerly towards the wetland complex.

Based on existing conditions, the site was modeled as one (1) catchment using the MIDUSS hydrologic modeling program. Table 2.1 provides a brief description of the catchment as well as the design parameters used in the hydrologic modeling.

Figure 2 provides an illustration of the pre-development catchment area.

Hydrologic modelling details and results are further discussed in Section 5.

TABLE 2.1 - PRE-DEVELOPMENT CATCHMENT PARAMETERS

Catchment	Description	Area (ha.)	% Impervious	Flow Length (m)	Slope
100	Existing Residential	2.58	11	150	1

2.3 Geotechnical Information

In 2017, Peto MacCallum Ltd. carried out a geotechnical investigation for the proposed Arkell Hills Subdivision. The fieldwork for this investigation included six boreholes on the subject property (BH1-BH6).

Based on the results of Peto MacCallum's geotechnical investigation, the subsurface stratigraphy at the site generally consists of topsoil and some localized fill overlying native deposits of sand and gravel. A thick (~3.6m) layer of silt was encountered 2.2m below existing grades on the easterly portion of the site. For further geotechnical information refer to Peto MacCallum's Geotechnical Investigation.

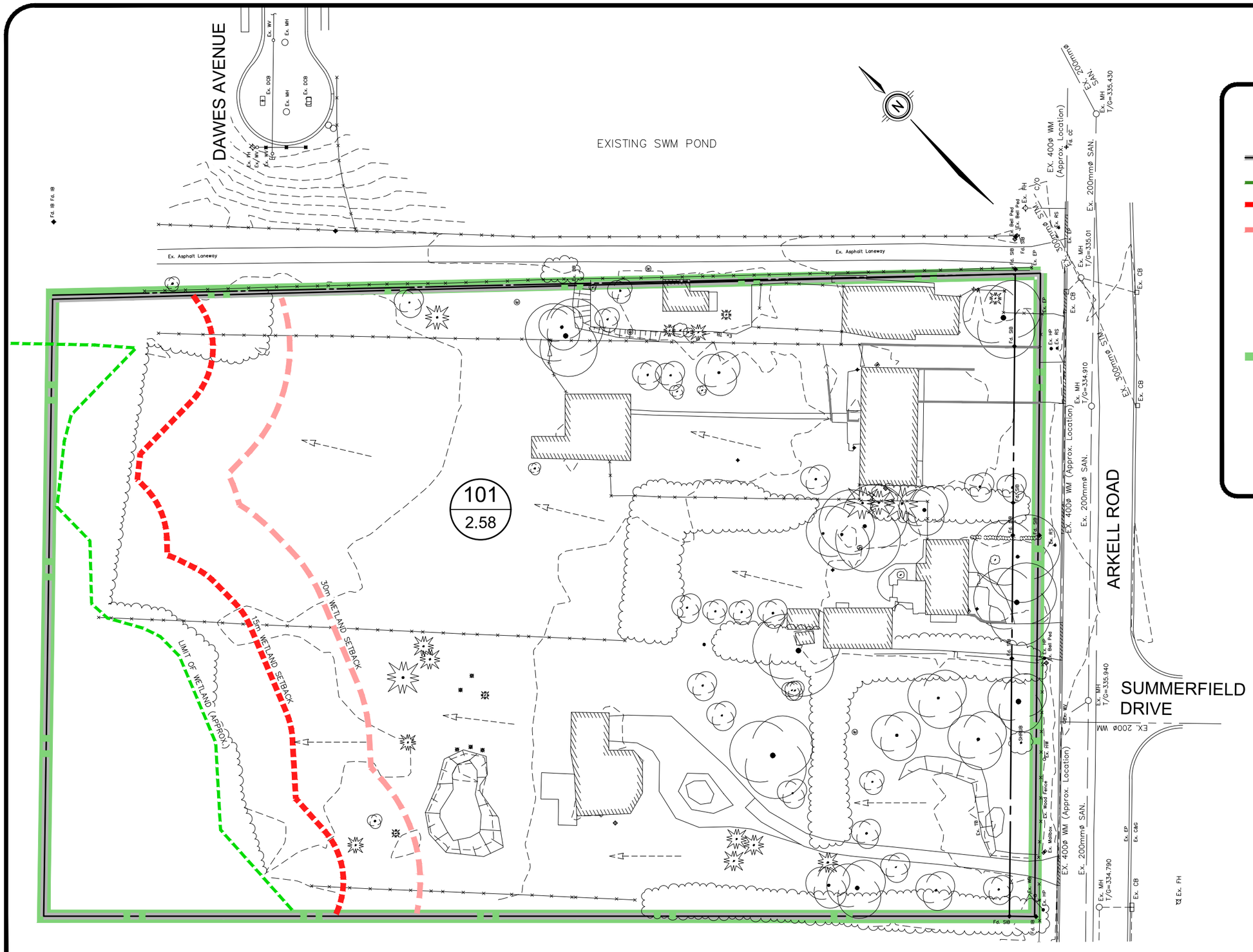
2.4 Hydrogeological Information

A hydrogeological investigation was conducted by MTE. Monitoring wells were installed in four (4) of the boreholes which had been advanced by Peto MacCallum.

MTE has conducted continuous groundwater monitoring since March of 2017. The highest groundwater elevations were observed in April of 2017 and ranged from elevation 333.99masl in the northerly portion of the site to 333.24masl in the southerly portion of the site. These elevations represent depths of 1.05m below existing grade (southerly portion of the site) to above the existing grade (northerly portion of the site). The measured groundwater elevations indicate that the shallow groundwater flows from the north to the south (i.e. away from the wetland). For further hydrogeological information refer to MTE's Hydrogeological Report under separate cover.

2.5 Drainage Outlets

Currently, runoff from the site travels overland in a northerly direction and contributes to the Torrance Creek Wetland Complex.



LEGEND

- SITE BOUNDARY
- LIMIT OF WETLAND
- 15m WETLAND SETBACK
- 30m WETLAND SETBACK
- 334.5 — EXISTING CONTOUR
- EXISTING DIRECTION OF DRAINAGE
- CATCHMENT 104
- 101 / 2.58 — SUB-CATCHMENT NUMBER / AREA (ha.)

FIGURE 2.0

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PRE-DEVELOPMENT CATCHMENT AREAS

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3.0 STORMWATER MANAGEMENT

3.1 Stormwater Management Criteria

New developments are required to provide stormwater management in accordance with provincial and municipal policies including but not limited to:

- MOE/MNR Stormwater Quality Guidelines for New Development (May 1991);
- Stormwater Management Practices, Planning and Design Manual (MOE, March 2003);
- GRCA Policies and Guidelines regarding urban development and floodplain management;
- The Torrance Creek Subwatershed Study Management Strategy (1999); and
- The City of Guelph's Development Engineering Manual.

The stormwater management criteria discussed below have been established based on the above policies, background reports, agency requirements, and site specific considerations.

3.1.1 Quantity Control

The subject property is located within the Torrance Creek Subwatershed. As stated in the Torrance Creek Subwatershed Study (TCSS) completed in 1999, the primary objective of quantity control is to maintain hydrologic functions for existing conditions with both surface and subsurface flows. Water quantity targets to be met include:

- Infiltration for areas between Arkell Road and Torrence Creek shall maintain 150mm/year;
- Peak flow control for all design storm events (post- to pre-development for the 2 to 100-year design storm events); and
- 24 – 48 hour extended detention time for 25mm rainfall event, if necessary (given infiltration levels and water quality requirements).

3.1.2 Quality Control

The City of Guelph's Engineering Design Guidelines state that all developments shall provide Level 1 (Enhanced) treatment and that thermal impacts to the receiving stream shall be minimized using preventative methods which mimic the natural water balance (preferred) or mitigation techniques such as cooling trenches, plantings, etc.

The TCSS established quality targets for development within the subwatershed as follows:

- Quality - Torrance Creek is considered a cold water watercourse and thus requires Level 1 (Enhanced) protection;
- Nutrients - Total Phosphorus should be less than 30ug/L, use of grassed swales and buffer strips for direct drainage will reduce suspended solids and nutrients;
- Dissolved Oxygen – Dissolved oxygen concentration should not be less than 4 mg/L during summer months. Reduction of temperature and nutrient concentrations will

assist DO levels. Aeration of direct runoff may also be helpful; and

- Temperature – Temperatures within Torrance Creek should be below 25 degrees Celsius. New developments can mitigate temperature increases by maximizing infiltration, minimizing the use of surface ponds, and using underground drainage elements before discharging to surface.

The City of Guelph requires that any OGS units intended to provide quality control for a site be verified by the Canadian Environmental Technology Verification Program. OGS products are permitted only as a pre-treatment device. For small sites (i.e. < 2ha) OGS units are permitted as part of a treatment train approach and are considered capable of achieving 50% TSS removal.

3.1.3 Proposed SWM Strategy

The proposed SWM facility will collect stormwater runoff from the right-of way and the front half of the on-street townhome roofs. The stormwater runoff from the right-of-way will be collected via storm sewers and drain through an oil/grit separator (OGS) unit for pre-treatment before discharging to a wet pond for quantity control prior to discharging to an infiltration gallery.

Stormwater runoff from the apartment block will also discharge to the wet pond and will also be pre-treated with an on-site OGS unit. The OGS unit for the Apartment Block will be designed as part of the Site Plan process for this Block. Stormwater runoff from the apartment building rooftops will discharge directly to a private infiltration gallery located on the apartment block.

Stormwater runoff from the rear yards of the townhomes located west of the proposed right-of-way will discharge un-attenuated directly to the wetland. These rear yards located are at a lower elevation than the storm sewers and due to the high groundwater, infiltration cannot be achieved without the required separation distance to the high groundwater.

3.2 Monitoring

As per the TCSS, both the performance of the proposed SWM facility and its effect on the shallow groundwater table must be monitored.

Facility monitoring

Upon completion of construction, the SWM facility is to be inspected by Municipal Staff to ensure conformance to the design. Upon confirmation from Municipal staff that the facility is acceptable, the facility will be monitored for a period of 2 years under the ownership of the developer to confirm the performance of the facility meets the quantity and quality targets. Upon completion of the monitoring program, a monitoring report shall be submitted to the Municipality for approval prior to the assumption of the facility.

The SWM facility will be monitored for peak flow rates and flow durations, water levels and drawdown times, pollutant removal efficiency, and the quality/toxicity of the water discharging to the infiltration cell. The facility shall also be monitored to determine how quickly sediment accumulates within the proposed OGS unit and wet pond.

The facility performance should be compared to the theoretical (design) performance and any aberrations should be noted. Remedial action will be required if facility performance does not meet minimum requirements.

Groundwater Monitoring

Ground water levels and quality shall be monitored. MTE has completed over 1 year of continuous monitoring of the groundwater levels which will form the basis against which post-construction levels will be compared. It is recommended that groundwater samples be collected and tested for quality to provide a basis against which post-construction quality results may be compared. Post-construction quality samples should be taken from the shallow groundwater downstream of the SWM facility.

3.3 Water Balance

The City of Guelph requires that Low Impact Design (LID) best management practices be used to mimic pre-development recharge rates. Site specific monthly and yearly water balances shall be completed.

The TCSS divided the subwatershed into three stormwater management 'zones' and laid out specific infiltration targets for each. The proposed site falls within zone 2 of the TCSS. Baseflow enhancement is encouraged on lands within this zone especially if they are close to the creek. An infiltration target of 150-200mm/year is suggested.

The TCSS provides a water balance summary for the south tributary to Torrance Creek in two locations, at the outflow south tributary and at the main confluence with Torrance Creek. The proposed site is located roughly halfway between the two locations and was assumed to have a greater correlation with the downstream location (i.e. the main confluence), thus the information for that location was utilized for the existing water budget.

Under proposed conditions, all runoff collected by the storm sewers will be pre-treated via OGS unit and the proposed wet pond prior to being infiltrated.

3.4 Wellhead Protection

The subject property is located near the Burke Well. Due to the proximity of the Burke well, the westerly portion of the subject property falls within the 100m zone around the well and has been assigned a vulnerability score of 10. The remainder of the site either falls within a vulnerability score of 6 or 8.

4.0 PROPOSED DEVELOPMENT AND SWM STRATEGY

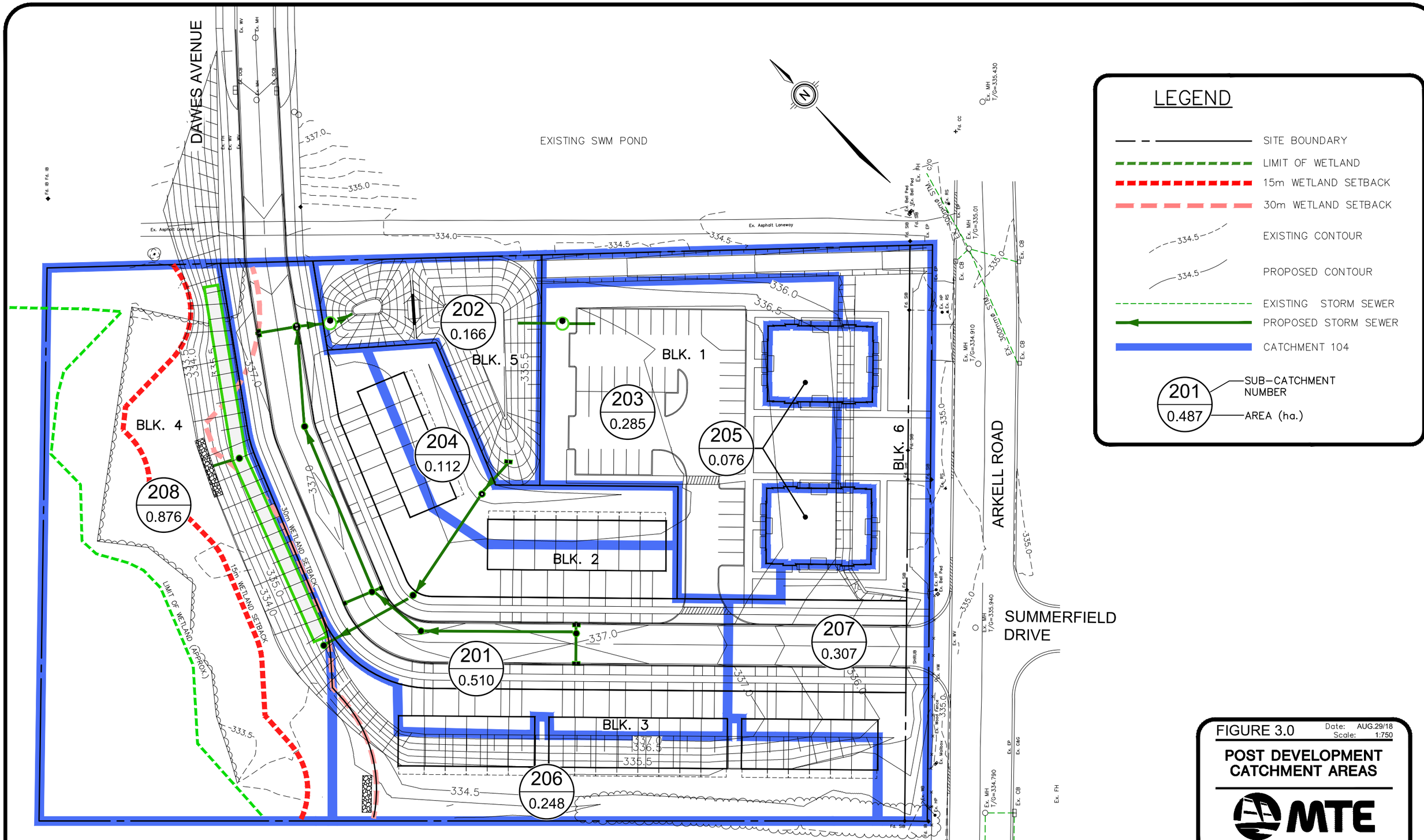
4.1 Post-Development Conditions

Under post-development conditions, the catchment area was delineated into eight catchments. Table 4.1 provides a brief description of each catchment area as well as the design parameters used in the hydrologic modeling.

Figure 3 provides an illustration of the catchment areas.

TABLE 4.1 - POST-DEVELOPMENT CATCHMENT PARAMETERS

Catchment	Description	Area (ha.)	% Impervious	Flow Length (m)	Slope
201	Runoff discharging to SWM Facility	0.510	65	5	2
202	SWM Facility	0.166	50	5	2
203	Apartment Block	0.285	70	30	2
204	Townhouse Rear yards discharging to Infiltration Gallery	0.112	50	5	2
205	Apartment Rooftops	0.076	100	5	1
206	Runoff discharging un-attenuated to Wetland	0.248	25	13	2
207	Runoff discharging un-attenuated to Arkell Road	0.307	25	30	2
208	Wetland	0.876	5	35	5
	Total	2.58	36	n/a	n/a



LEGEND

- SITE BOUNDARY
- LIMIT OF WETLAND
- 15m WETLAND SETBACK
- 30m WETLAND SETBACK
- EXISTING CONTOUR (334.5)
- PROPOSED CONTOUR (334.5)
- EXISTING STORM SEWER
- PROPOSED STORM SEWER
- CATCHMENT 104

201 / 0.487 — SUB-CATCHMENT NUMBER / AREA (ha.)

FIGURE 3.0

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POST DEVELOPMENT CATCHMENT AREAS

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5.0 STORMWATER MANAGEMENT DESIGN

5.1 Hydrologic Modelling

As noted in previous sections, a hydrologic model was developed for the subject area to provide a quantitative estimate of peak flows from the site under existing and proposed development conditions. The rainfall event simulation model MIDUSS was used to simulate responses to the 25mm, 5 and 100-year design storm events. The City of Guelph does not specify parameters for a 25mm event, thus the City of Guelph's 1-year design storm event parameters were used. Additionally, the 25mm event was modelled as a 4 hour Chicago distribution as required by the City of Guelph.

The City of Guelph Horton Infiltration Parameters were used for impervious and pervious surfaces.

Peak flow rates for the above noted storm events under pre- and post-development conditions are shown in Table 5.3. The MIDUSS modelling output and hydrologic modelling schematics for pre- and post-development conditions are provided in Appendix 'A'.

5.2 Stormwater Quality Control

The proposed SWM facility has been designed using a 'treatment train' methodology. An OGS unit will be utilized to provide pre-treatment to runoff prior to discharging flows to the wet pond. The wet pond will then provide quality control to the runoff before discharging flows to the proposed infiltration gallery.

The OGS unit is designed to treat runoff from minor events (i.e. events ≤ 25mm) before releasing flows to the wet pond. Flows from events greater than the 25mm event may by-pass the OGS unit but since the majority of annual rainfall occurs in storms less than or equal to a 25mm event, the majority of water borne sediment is also transported to the OGS unit in these less intense events. Therefore, the OGS unit is designed to target the smaller flows. Per City of Guelph standards, proposed OGS unit has been verified by the Canadian Environmental Technology Verification Program and has been sized to provide 50% TSS removal. A detailed sizing report for the OGS unit is included in Appendix 'C'.

The wet pond will have a depth of 1.0m. As per the City of Guelph's requirements, an Enhanced Level (formerly Level 1) of water quality protection is required. Quality control measures proposed will take the form of a wet pond, servicing a total drainage area imperviousness of 64%. Using a treatment train approach with an OGS discharging a wet pond prior to infiltration an Enhanced Level of water quality control will be achieved. Considering the total post-development drainage area discharging to the SWM facility is 0.961ha, this equates to a required volume of 203m^3. The volume provided in the wet pond totals 655m^3 which exceeds the required volume. Table 5.1 outlines the design of the proposed SWM facility.

TABLE 5.1 - WATER QUALITY CONTROL DETAILS

General	Pond Characteristics
Wet Pond Stormwater Management Facility	Level 1 Quality Control
Total Contributing Area	0.961 ha
Imperviousness (of whole drainage area)	64%
Bottom Elevation	334.00m
Storage	
Unit Area Storage Volume Requirements as per SWMMP (MOE 2003)	211m^3/ha
Required Total Volume	203m^3
Permanent Pool	
Required Permanent Pool Volume	164m^3
Permanent Pool Volume Provided	655m^3
Permanent Pool Elevation	335.00m
Extended Detention	
Minimum Required Volume (based on 40m^3/ha)	39m^3
Extended Detention Volume Provided	1075m^3
Approximate Drawdown Time (based on 25 mm event)	23hr
Extended Detention Elevation	335.00m
Peak Release Rate for Extended Detention (Quality)	0.009m^3/s
Forebay	
Required Forebay Length	8m
Actual Forebay Length	8m
Permanent Pool Elevation	335.00m
Bottom Elevation	334.40m
Outlet Controls	
Orifice (Extended Detention)	300mm
Ditch Inlet Catch Basin	600mm x 600mm
Elevation (low side)	335.65m
7.5 m wide Rip Rap Overflow Weir - Elevation	336.35m

5.3 Stormwater Quantity Control

Flows for all storm events will be conveyed to the SWM facility by a combination of storm sewers and overland flow routes. The stage-storage-discharge relationship of the proposed SWM facility is shown below in **Table 5.2**. A detailed stage-storage-discharge relationship for the SWM facility is provided in Appendix 'A'.

TABLE 5.2 - STAGE-STORAGE-DISCHARGE INFORMATION

Elevation (m)	Discharge (m^3/s)	Volume (m^3)
335.00	0.000	0
335.10	0.006	88.6
335.20	0.022	181.4
335.30	0.044	278.4
335.40	0.088	379.6
335.50	0.108	485.0
335.60	0.125	594.6
335.70	0.140	708.4
335.80	0.153	826.4
335.90	0.165	948.6
336.00	0.176	1075.0

A summary of the peak flows for the pre- and post-development conditions is summarized in Table 5.3. Enough volume has been provided to store the 100-year storm event to maximum elevation of 355.44m. The MIDUSS output for the quantity control can be found in Appendix 'A'.

TABLE 5.3 - SUMMARY OF PEAK FLOWS

Drainage Area	25mm Storm Event (m^3/s)	5-year Storm Event (m^3/s)	100-year Storm Event (m^3/s)
Pre-Development			
Total from site	0.045	0.090	0.396
Post-Development			
Area 201	0.058	0.114	0.230
Area 202	0.015	0.030	0.073
Area 203	0.031	0.063	0.131
Area 204	0.010	0.020	0.049
Area 205	0.013	0.025	0.039
Area 206	0.011	0.025	0.093
Area 207	0.013	0.027	0.097
Area 208	0.008	0.072	0.311
Total to wetland	0.018	0.094	0.398
Total from site	0.032	0.118	0.495

A summary of the maximum ponding elevations for the SWM facility is provided in Table 5.4.

TABLE 5.4 - MAXIMUM WET POND PONDING ELEVATIONS

Storm Event	Maximum Ponding Elevation (m)
25mm Storm Event	335.12
5-Year Storm Event	335.23
100-Year Storm Event	335.44

5.4 Stormwater Management Facility

The following list of SWM facility design characteristics outlines all significant design aspects and rationales.

- As previously described in Section 5.2 , the SWM facility has been designed as a wet pond facility with sufficient storage volumes to achieve an Enhanced (formerly Level 1) degree of protection.

- The design of the SWM facility has incorporated internal side slopes of 3:1 throughout the facility. Fencing will be provided around the entire SWM facility.

- Operation and maintenance of the SWM facility will be the responsibility of the City of Guelph. Maintenance responsibilities include regular inspection of the basin. It should be noted that the estimated sediment clean-out frequencies outlined in the forebay calculation sheet might be reduced during the interval prior to complete stabilization of the upstream contributing drainage areas.

5.5 Overland Flow Control

For storms greater than the 100-year design storm, all excess runoff will be directed overland towards Arkell Road.

5.6 Water Budget Analysis

Under existing conditions the site provides surface inputs to the Torrance Creek Wetland Complex (TCWC). Infiltrated water contributes to the shallow groundwater table which flows southward. A water balance has been conducted to determine what impacts the proposed development may have on the existing wetlands. Furthermore, the site lies within the capture zone of the Burke well located on the north side of Arkell Road, roughly a hundred meters west of the site.

Annual precipitation was estimated to be 923.3mm/yr based on data gathered at the Guelph Arboretum weather station from 1971-2000. Infiltration, evapotranspiration, and runoff rates for pre- and post-development conditions were estimated using the Thornthwaite and Mather method (1957). Pre- and Post-development catchment areas are depicted in Figures 2 and 3 respectively.

Under pre-development conditions, the majority of the site drains north towards the wetland

complex while a small portion drains toward Arkell road. Both major and minor flows directed to Arkell road are directed west and then discharged into the wetland. The surface runoff balance seeks to keep post-development runoff rates to as near pre-development rates as possible. Due to site layout constraints, the majority of infiltration measures on the site will be concentrated along the north edge of the development. An end-of-pipe (EOP) gallery is proposed to allow runoff from the site to infiltrate into the ground and recharge the shallow groundwater table. A small amount of infiltration is proposed below the parking area of the proposed condo block for the roofs of the apartment buildings.

The main portion of the site, including the majority of the municipal road, SWM block, and condo block, drains to a wet pond SWM facility where flows will be released gradually to allow for settling of fines out of the effluent. Once released from the pond, flows will be directed to the proposed EOP gallery where the water will be allowed to infiltrate. As flows from road surfaces will be directed to the infiltration gallery, it is proposed that a winter by-pass be installed to allow salt laden flows to be discharged directly to the surface during the winter months.

Portions of the site which cannot be directed to the proposed SWM pond will be directed to areas of amended topsoil or enhanced grass swales where possible. Runoff from the roofs of the proposed apartment buildings will be directed to an infiltration gallery below the proposed condo block parking area which is sized to capture and infiltrate runoff from all events up to the 100-year storm.

The proposed strategy results in annual increases in infiltration and runoff from the site by 12% and 42% respectively. For more information please refer to the water balance calculations contained in Appendix ‘B’.

6.0 EROSION AND SEDIMENT CONTROL MEASURES

Precautions will be taken during construction to limit erosion and sedimentation. Erosion and Sediment Control Plans will be prepared and will accompany the detailed design submission for the subject lands. The plans will illustrate the erosion and sediment control measures to be implemented during construction, which will limit impacts associated with site development.

Typically, the recommended construction sequence for erosion and sediment control measures will be as follows:

- Placement of all sediment control fencing where required;
- Construction of permanent and temporary stormwater management ponds which will serve as sedimentation basins for the site during construction;
- Construction of temporary swales to direct runoff to sedimentation basins, with rock check dams as required to control velocities;
- Stripping and strategic placement of topsoil stockpiles. Placement of sediment control fencing around all stockpile areas; and
- Re-vegetation of completed areas as soon as possible after construction, including those areas not slated for construction within 60 days.

Where rock check dams are proposed to promote sedimentation and reduce velocities, clean aggregate is to be placed perpendicular to the direction of flow in the swale, with a small volume of excavation on the upstream side to provide storage for accumulated sediment.

Sediment control fencing shall consist of filter fabric attached to paige wire fencing and sealed at ground level. It will be installed at the perimeter of the work areas and intermittently on sloped areas where required. Sediment control fencing will be placed around all topsoil stockpiles.

Storage consistent with the GRCA's requirement of 125m^3/ha of live and dead storage respectively (total 250m^3/ha), will be provided. This storage will be provided to ensure that suspended material will have ample time to settle out. In addition, the sediment basin will be sized with sufficient capacity to allow flows to pass without breaching. Once the active construction and grading activities have been completed, the sedimentation basins can be cleaned out.

Access to topsoil or fill storage areas will be located on the upstream side of storage piles. This practice will ensure continuity of the sediment control fencing in the downslope direction which is most vulnerable to erosion and sediment deposition. Further, topsoil and hydroseed will be placed on all exposed areas following the completion of grading activities.

A mud mat will be placed at the entrance to the site and streets will be required to be swept on a weekly basis or as required.

As per requirements of the GRCA and the City of Guelph, monthly reports will be submitted to the GRCA and City of Guelph to keep them informed of the performance of the erosion and sedimentation control measures.

7.0 OPERATION AND MAINTENANCE

It is recommended that during construction of the SWM facility monitoring and inspection of the erosion and sediment controls be conducted to ensure the satisfactory performance of these measures.

Reporting of the inspection and monitoring results should be distributed to the Grand River Conservation Authority and the City of Guelph. If it is found that the erosion and sediment control measures are not working adequately, they shall be augmented to the satisfaction of the Grand River Conservation Authority and the City of Guelph, based on field decisions.

Furthermore, it is recommended that the owner initiate a post-construction monitoring program to ensure the long term effectiveness of the SWM facility. The post-construction monitoring program should include:

- Periodic inspection of the SWM control facility and other erosion control works;
- Inspection of the SWM facility and its outlet after significant rainfall events (generally in excess of 10mm of rainfall);
- Removal of debris that may accumulate and hinder functioning of the SWM facility;

- Implementation of remedial measures including erosion stabilization, repair of damaged vegetation and sediment removal, as required.

Frequency of the post-construction monitoring will be at the discretion of the Grand River Conservation Authority and the City of Guelph. It is recommended that a minimum of four (seasonal) inspections be made, annually. An Operation, Maintenance and Monitoring Report will be submitted to the City of Guelph under a separate cover.

All of which is respectfully submitted,

MTE CONSULTANTS INC.

Jeff Lerch, P.Eng
Design Engineer

APPENDIX A

HYDROLOGIC MODELLING OUTPUT

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"     150.000   Pervious length"
"       1.000   Pervious slope"
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"       0.000   Impervious Max.infiltration"
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"       0.001   Impervious Lag constant (hours)"
"       1.500   Impervious Depression storage"
"                 0.045     0.000     0.000     0.000 c.m/sec"
"            Catchment 101          Pervious   Impervious Total Area "
"            Surface Area           2.296      0.284      2.580      hectare"
"            Time of concentration      ---    2.130      2.130      minutes"
"            Time to Centroid       0.000      62.617     62.617     minutes"
"            Rainfall depth         24.995     24.995     24.995     mm"
"            Rainfall volume        573.94     70.94      644.88     c.m"
"            Rainfall losses        24.995     1.869      22.451     mm"
"            Runoff depth           0.000      23.126     2.544      mm"
"            Runoff volume          0.00       65.63      65.63      c.m"
"            Runoff coefficient     0.000      0.925      0.102      "
"            Maximum flow           0.000      0.045      0.045      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
```



```
"                 0.045     0.045     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                 0.045     0.045     0.045     0.000"
" 40          HYDROGRAPH   Combine    100"
"           6   Combine "
"         100   Node #"
"               Flow From Site"
"            Maximum flow                  0.045    c.m/sec"
"            Hydrograph volume            65.632    c.m"
"                 0.045     0.045     0.045     0.045"
" 38          START/RE-START TOTALS 101"
"           3   Runoff Totals on EXIT"
"            Total Catchment area                      2.580    hectare"
"            Total Impervious area                     0.284    hectare"
"            Total % impervious                       11.000"
" 19          EXIT"
```

```
"                MIDUSS Output ---------------------------------------------->"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                           Sunday, February 07, 2010"
"           10   Units used:                                              ie METRIC"
"                Job folder:                          Q:\42063\104\SWM\FINAL"
"                Output filename:                      42063-104 5YR PRE-D.out"
"                Licensee name:                                           ADMIN"
"                Company                                              Microsoft"
"                Date & Time last used:                9/28/2018 at 11:06:47 AM"
" 31          TIME PARAMETERS"
"       5.000   Time Step"
"     170.000   Max. Storm length"
"    3600.000   Max. Hydrograph"
" 32         STORM Chicago storm"
"           1   Chicago storm"
"    1593.000   Coefficient A"
"      11.000   Constant B"
"       0.879   Exponent C"
"       0.400   Fraction R"
"     170.000   Duration"
"       1.000   Time step multiplier"
"            Maximum intensity          134.894    mm/hr"
"            Total depth                 46.775    mm"
"           4   Shyd   Hydrograph extension used in this file"
" 33         CATCHMENT 101"
"           1   Triangular SCS"
"           2   Proportional to %"
"           2   Horton equation"
"         101   Entire site "
"      11.000   % Impervious"
"       2.580   Total Area"
"     150.000   Flow length"
"       1.000   Overland Slope"
"       2.296   Pervious Area"
"     150.000   Pervious length"
"       1.000   Pervious slope"
"       0.284   Impervious Area"
"      18.539   Impervious length"
"       1.000   Impervious slope"
"       0.300   Pervious Manning 'n'"
"      75.000   Pervious Max.infiltration"
"      12.500   Pervious Min.infiltration"
"       0.250   Pervious Lag constant (hours)"
"       5.000   Pervious Depression storage"
"       0.013   Impervious Manning 'n'"
"       0.000   Impervious Max.infiltration"
"       0.000   Impervious Min.infiltration"
"       0.001   Impervious Lag constant (hours)"
"       1.500   Impervious Depression storage"
"                  0.090     0.000     0.000     0.000 c.m/sec"
"            Catchment 101          Pervious   Impervious Total Area "
"            Surface Area           2.296      0.284      2.580      hectare"
"            Time of concentration  55.410     1.666      37.338     minutes"
"            Time to Centroid       123.913    81.884     109.780    minutes"
"            Rainfall depth         46.775     46.775     46.775     mm"
"            Rainfall volume        1074.05    132.75     1206.80    c.m"
"            Rainfall losses        35.881     2.117      32.167     mm"
"            Runoff depth           10.894     44.658     14.608     mm"
"            Runoff volume          250.16     126.74     376.90     c.m"
"            Runoff coefficient     0.233      0.955      0.312      "
"            Maximum flow           0.070      0.087      0.090      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
```



```
"                  0.090     0.090     0.000     0.000"
" 40         HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                  0.090     0.090     0.090     0.000"
" 40         HYDROGRAPH   Combine    100"
"           6   Combine "
"         100   Node #"
"               Flow From Site"
"            Maximum flow                    0.090    c.m/sec"
"            Hydrograph volume             376.897    c.m"
"                  0.090     0.090     0.090     0.090"
" 38         START/RE-START TOTALS 101"
"           3   Runoff Totals on EXIT"
"            Total Catchment area                    2.580    hectare"
"            Total Impervious area                   0.284    hectare"
"            Total % impervious                     11.000"
" 19         EXIT"
```

```
"                MIDUSS Output ---------------------------------------------->"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                       Sunday, February 07, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:                          Q:\42063\104\SWM\FINAL"
"                Output filename:                     42063-104 100YR PRE-D.out"
"                Licensee name:                                         ADMIN"
"                Company                                            Microsoft"
"                Date & Time last used:                9/28/2018 at 11:07:57 AM"
" 31          TIME PARAMETERS"
"       5.000   Time Step"
"     210.000   Max. Storm length"
"    3600.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"           1   Chicago storm"
"    4688.000   Coefficient A"
"      17.000   Constant B"
"       0.962   Exponent C"
"       0.400   Fraction R"
"     210.000   Duration"
"       1.000   Time step multiplier"
"            Maximum intensity          213.574    mm/hr"
"            Total depth                 88.830    mm"
"           6   100hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"           1   Triangular SCS"
"           2   Proportional to %"
"           2   Horton equation"
"         101   Entire site "
"      11.000   % Impervious"
"       2.580   Total Area"
"     150.000   Flow length"
"       1.000   Overland Slope"
"       2.296   Pervious Area"
"     150.000   Pervious length"
"       1.000   Pervious slope"
"       0.284   Impervious Area"
"      18.539   Impervious length"
"       1.000   Impervious slope"
"       0.300   Pervious Manning 'n'"
"      75.000   Pervious Max.infiltration"
"      12.500   Pervious Min.infiltration"
"       0.250   Pervious Lag constant (hours)"
"       5.000   Pervious Depression storage"
"       0.013   Impervious Manning 'n'"
"       0.000   Impervious Max.infiltration"
"       0.000   Impervious Min.infiltration"
"       0.001   Impervious Lag constant (hours)"
"       1.500   Impervious Depression storage"
"                  0.396     0.000     0.000     0.000 c.m/sec"
"            Catchment 101          Pervious   Impervious Total Area "
"            Surface Area           2.296      0.284      2.580      hectare"
"            Time of concentration  33.570     1.386      27.496     minutes"
"            Time to Centroid       127.191    97.104     121.513    minutes"
"            Rainfall depth         88.830     88.830     88.830     mm"
"            Rainfall volume        2039.71    252.10     2291.81    c.m"
"            Rainfall losses        43.209     2.967      38.782     mm"
"            Runoff depth           45.621     85.863     50.048     mm"
"            Runoff volume          1047.55    243.68     1291.23    c.m"
"            Runoff coefficient     0.514      0.967      0.563      "
"            Maximum flow           0.368      0.144      0.396      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
```



```
"                  0.396     0.396     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                  0.396     0.396     0.396     0.000"
" 40          HYDROGRAPH   Combine    100"
"            6   Combine "
"          100   Node #"
"                Flow From Site"
"            Maximum flow                  0.396    c.m/sec"
"            Hydrograph volume          1291.227    c.m"
"                  0.396     0.396     0.396     0.396"
" 38          START/RE-START TOTALS 101"
"           3   Runoff Totals on EXIT"
"            Total Catchment area                      2.580    hectare"
"            Total Impervious area                     0.284    hectare"
"            Total % impervious                       11.000"
" 19          EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                           Sunday, February 07, 2010"
"           10   Units used:                                              ie METRIC"
"                Job folder:                                 Q:\42063\104\SWM\FINAL"
"                Output filename:                         42063-104 25MM POST-D.out"
"                Licensee name:                                             ADMIN"
"                Company                                                 Microsoft"
"                Date & Time last used:                    10/10/2018 at 1:25:42 PM"
" 31           TIME PARAMETERS"
"        5.000   Time Step"
"      120.000   Max. Storm length"
"     3600.000   Max. Hydrograph"
" 32           STORM Chicago storm"
"            1   Chicago storm"
"      367.000   Coefficient A"
"        5.000   Constant B"
"        0.700   Exponent C"
"        0.394   Fraction R"
"      120.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity            72.993    mm/hr"
"             Total depth                  24.995    mm"
"            7   2500hyd   Hydrograph extension used in this file"
" 33           CATCHMENT 206"
"            1   Triangular SCS"
"            2   Proportional to %"
"            2   Horton equation"
"          206   Easterly Rear Yards"
"       25.000   % Impervious"
"        0.248   Total Area"
"       13.000   Flow length"
"        2.000   Overland Slope"
"        0.186   Pervious Area"
"       13.000   Pervious length"
"        2.000   Pervious slope"
"        0.062   Impervious Area"
"        4.333   Impervious length"
"        2.000   Impervious slope"
"        0.300   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.013   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.001   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                  0.011     0.000     0.000     0.000 c.m/sec"
"             Catchment 206           Pervious   Impervious Total Area "
"             Surface Area            0.186      0.062      0.248      hectare"
"             Time of concentration       ---    0.723      0.723      minutes"
"             Time to Centroid        0.000      61.131     61.131     minutes"
"             Rainfall depth          24.995     24.995     24.995     mm"
"             Rainfall volume         46.49      15.50      61.99      c.m"
"             Rainfall losses         24.995     2.773      19.440     mm"
"             Runoff depth            0.000      22.222     5.556      mm"
"             Runoff volume           0.00       13.78      13.78      c.m"
"             Runoff coefficient      0.000      0.889      0.222      "
"             Maximum flow            0.000      0.011      0.011      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"            4   Add Runoff "
```



```
"                  0.011     0.011     0.000     0.000"
" 40           HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                  0.011     0.011     0.011     0.000"
" 40           HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Flow to Wetland"
"             Maximum flow                    0.011    c.m/sec"
"             Hydrograph volume              13.778    c.m"
"                  0.011     0.011     0.011     0.011"
" 40           HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                  0.011     0.000     0.011     0.011"
" 33           CATCHMENT 207"
"            1   Triangular SCS"
"            2   Proportional to %"
"            2   Horton equation"
"          207   Unattenuated to Arkell"
"       25.000   % Impervious"
"        0.307   Total Area"
"       30.000   Flow length"
"        2.000   Overland Slope"
"        0.230   Pervious Area"
"       30.000   Pervious length"
"        2.000   Pervious slope"
"        0.077   Impervious Area"
"       10.000   Impervious length"
"        2.000   Impervious slope"
"        0.300   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.013   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.001   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                  0.013     0.000     0.011     0.011 c.m/sec"
"             Catchment 207           Pervious   Impervious Total Area "
"             Surface Area            0.230      0.077      0.307      hectare"
"             Time of concentration       ---    1.194      1.194      minutes"
"             Time to Centroid        0.000      61.185     61.185     minutes"
"             Rainfall depth          24.995     24.995     24.995     mm"
"             Rainfall volume         57.55      19.18      76.74      c.m"
"             Rainfall losses         24.995     2.046      19.258     mm"
"             Runoff depth            0.000      22.949     5.737      mm"
"             Runoff volume           0.00       17.61      17.61      c.m"
"             Runoff coefficient      0.000      0.918      0.230      "
"             Maximum flow            0.000      0.013      0.013      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.013     0.013     0.011     0.011"
" 40           HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                  0.013     0.013     0.013     0.011"
" 40           HYDROGRAPH   Combine    2"
"            6   Combine "
"            2   Node #"
"                Flow to Arkell Road "
"             Maximum flow                    0.013    c.m/sec"
"             Hydrograph volume              17.613    c.m"
```

```
"                0.013     0.013     0.013     0.013"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                0.013     0.000     0.013     0.013"
" 33          CATCHMENT 208"
"            1   Triangular SCS"
"            2   Proportional to %"
"            2   Horton equation"
"          208   Wetland"
"        5.000   % Impervious"
"        0.876   Total Area"
"       35.000   Flow length"
"        5.000   Overland Slope"
"        0.832   Pervious Area"
"       35.000   Pervious length"
"        5.000   Pervious slope"
"        0.044   Impervious Area"
"        1.842   Impervious length"
"        5.000   Impervious slope"
"        0.300   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.013   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.001   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                0.008     0.000     0.013     0.013 c.m/sec"
"             Catchment 208          Pervious   Impervious Total Area "
"             Surface Area           0.832      0.044      0.876      hectare"
"             Time of concentration     ---     0.329      0.329      minutes"
"             Time to Centroid       0.000      60.159     60.159     minutes"
"             Rainfall depth         24.995     24.995     24.995     mm"
"             Rainfall volume        208.01     10.95      218.96     c.m"
"             Rainfall losses        24.995     4.722      23.982     mm"
"             Runoff depth           0.000      20.274     1.014      mm"
"             Runoff volume          0.00       8.88       8.88       c.m"
"             Runoff coefficient     0.000      0.811      0.041      "
"             Maximum flow           0.000      0.008      0.008      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                0.008     0.008     0.013     0.013"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                0.008     0.008     0.008     0.013"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Flow to Wetland"
"             Maximum flow                  0.018    c.m/sec"
"             Hydrograph volume            22.658    c.m"
"                0.008     0.008     0.008     0.018"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                0.008     0.000     0.008     0.018"
" 33          CATCHMENT 201"
"            1   Triangular SCS"
"            2   Proportional to %"
"            2   Horton equation"
"          201   ROW"
"       65.000   % Impervious"
```



```
"        0.510   Total Area"
"        5.000   Flow length"
"        2.000   Overland Slope"
"        0.178   Pervious Area"
"        5.000   Pervious length"
"        2.000   Pervious slope"
"        0.331   Impervious Area"
"        9.286   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.013   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.001   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                0.058     0.000     0.008     0.018 c.m/sec"
"             Catchment 201          Pervious   Impervious Total Area "
"             Surface Area           0.178      0.331      0.510      hectare"
"             Time of concentration     ---     1.142      1.142      minutes"
"             Time to Centroid       0.000      61.180     61.180     minutes"
"             Rainfall depth         24.995     24.995     24.995     mm"
"             Rainfall volume        44.62      82.86      127.48     c.m"
"             Rainfall losses        24.995     2.055      10.084     mm"
"             Runoff depth           0.000      22.940     14.911     mm"
"             Runoff volume          0.00       76.05      76.05      c.m"
"             Runoff coefficient     0.000      0.918      0.597      "
"             Maximum flow           0.000      0.058      0.058      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                0.058     0.058     0.008     0.018"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                0.058     0.058     0.058     0.018"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                0.058     0.058     0.058     0.018"
" 33          CATCHMENT 202"
"            1   Triangular SCS"
"            2   Proportional to %"
"            2   Horton equation"
"          202   SWM Pond"
"       50.000   % Impervious"
"        0.166   Total Area"
"        5.000   Flow length"
"        2.000   Overland Slope"
"        0.083   Pervious Area"
"        5.000   Pervious length"
"        2.000   Pervious slope"
"        0.083   Impervious Area"
"        5.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.013   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
```

```
"       0.001   Impervious Lag constant (hours)"
"       1.500   Impervious Depression storage"
"                 0.015     0.058     0.058     0.018 c.m/sec"
"            Catchment 202          Pervious   Impervious Total Area "
"            Surface Area           0.083      0.083      0.166      hectare"
"            Time of concentration      ---    0.788      0.788      minutes"
"            Time to Centroid       0.000      61.170     61.170     minutes"
"            Rainfall depth         24.995     24.995     24.995     mm"
"            Rainfall volume        20.75      20.75      41.49      c.m"
"            Rainfall losses        24.995     2.563      13.779     mm"
"            Runoff depth           0.000      22.433     11.216     mm"
"            Runoff volume          0.00       18.62      18.62      c.m"
"            Runoff coefficient     0.000      0.897      0.449      "
"            Maximum flow           0.000      0.015      0.015      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"          4   Add Runoff "
"                 0.015     0.072     0.058     0.018"
" 40         HYDROGRAPH Copy to Outflow"
"          8   Copy to Outflow"
"                 0.015     0.072     0.072     0.018"
" 40         HYDROGRAPH Next link "
"          5   Next link "
"                 0.015     0.072     0.072     0.018"
" 33         CATCHMENT 203"
"          1   Triangular SCS"
"          2   Proportional to %"
"          2   Horton equation"
"        203   Apartment Block"
"     70.000   % Impervious"
"      0.285   Total Area"
"     30.000   Flow length"
"      2.000   Overland Slope"
"      0.086   Pervious Area"
"     30.000   Pervious length"
"      2.000   Pervious slope"
"      0.199   Impervious Area"
"     70.000   Impervious length"
"      1.000   Impervious slope"
"      0.250   Pervious Manning 'n'"
"     75.000   Pervious Max.infiltration"
"     12.500   Pervious Min.infiltration"
"      0.250   Pervious Lag constant (hours)"
"      5.000   Pervious Depression storage"
"      0.013   Impervious Manning 'n'"
"      0.000   Impervious Max.infiltration"
"      0.000   Impervious Min.infiltration"
"      0.001   Impervious Lag constant (hours)"
"      1.500   Impervious Depression storage"
"                 0.031     0.072     0.072     0.018 c.m/sec"
"            Catchment 203          Pervious   Impervious Total Area "
"            Surface Area           0.086      0.199      0.285      hectare"
"            Time of concentration      ---    4.726      4.726      minutes"
"            Time to Centroid       0.000      66.178     66.178     minutes"
"            Rainfall depth         24.995     24.995     24.995     mm"
"            Rainfall volume        21.37      49.87      71.24      c.m"
"            Rainfall losses        24.995     1.693      8.683      mm"
"            Runoff depth           0.000      23.303     16.312     mm"
"            Runoff volume          0.00       46.49      46.49      c.m"
"            Runoff coefficient     0.000      0.932      0.653      "
"            Maximum flow           0.000      0.031      0.031      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"          4   Add Runoff "
"                 0.031     0.097     0.072     0.018"
```



```
" 40         HYDROGRAPH Copy to Outflow"
"          8   Copy to Outflow"
"                 0.031     0.097     0.097     0.018"
" 40         HYDROGRAPH   Combine    3"
"          6   Combine "
"          3   Node #"
"              Flow to SWM Pond"
"           Maximum flow                    0.097    c.m/sec"
"           Hydrograph volume             141.156    c.m"
"                 0.031     0.097     0.097     0.097"
" 40         HYDROGRAPH   Confluence    3"
"          7   Confluence "
"          3   Node #"
"              Flow to SWM Pond"
"           Maximum flow                    0.097    c.m/sec"
"           Hydrograph volume             141.156    c.m"
"                 0.031     0.097     0.097     0.000"
" 54         POND DESIGN"
"      0.097   Current peak flow    c.m/sec"
"      0.048   Target outflow    c.m/sec"
"      141.2   Hydrograph volume    c.m"
"        11.   Number of stages"
"    335.000   Minimum water level    metre"
"    336.000   Maximum water level    metre"
"    335.000   Starting water level    metre"
"          0   Keep Design Data: 1 = True; 0 = False"
"                Level Discharge    Volume"
"              335.000     0.000     0.000"
"              335.100   0.00632    88.600"
"              335.200   0.02225   181.400"
"              335.300   0.04416   278.400"
"              335.400   0.08821   379.600"
"              335.500    0.1080   485.000"
"              335.600    0.1248   594.600"
"              335.700    0.1395   708.400"
"              335.800    0.1528   826.400"
"              335.900    0.1650   948.600"
"              336.000    0.1764  1075.000"
"          1.   ORIFICES"
"               Orifice   Orifice   Orifice Number of"
"                invert coefficie  diameter  orifices"
"              335.000     0.630    0.3000     1.000"
"           Peak outflow                    0.009    c.m/sec"
"           Maximum level                 335.117    metre"
"           Maximum storage               104.525    c.m"
"           Centroidal lag                  4.769    hours"
"                0.031     0.097     0.009     0.000 c.m/sec"
" 40         HYDROGRAPH Next link "
"          5   Next link "
"                 0.031     0.009     0.009     0.000"
" 33         CATCHMENT 204"
"          1   Triangular SCS"
"          2   Proportional to %"
"          2   Horton equation"
"        204   Rear Yards"
"     50.000   % Impervious"
"      0.112   Total Area"
"      5.000   Flow length"
"      2.000   Overland Slope"
"      0.056   Pervious Area"
"      5.000   Pervious length"
"      2.000   Pervious slope"
"      0.056   Impervious Area"
```

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"       5.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      75.000   Pervious Max.infiltration"
"      12.500   Pervious Min.infiltration"
"       0.250   Pervious Lag constant (hours)"
"       5.000   Pervious Depression storage"
"       0.013   Impervious Manning 'n'"
"       0.000   Impervious Max.infiltration"
"       0.000   Impervious Min.infiltration"
"       0.001   Impervious Lag constant (hours)"
"       1.500   Impervious Depression storage"
                0.010     0.009     0.009     0.000 c.m/sec"
            Catchment 204          Pervious   Impervious Total Area "
            Surface Area           0.056      0.056      0.112      hectare"
            Time of concentration    ---      0.788      0.788      minutes"
            Time to Centroid       0.000      61.170     61.170     minutes"
            Rainfall depth         24.995     24.995     24.995     mm"
            Rainfall volume        14.00      14.00      27.99      c.m"
            Rainfall losses        24.995     2.563      13.779     mm"
            Runoff depth           0.000      22.433     11.216     mm"
            Runoff volume          0.00       12.56      12.56      c.m"
            Runoff coefficient     0.000      0.897      0.449      "
            Maximum flow           0.000      0.010      0.010      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"          4   Add Runoff "
                0.010     0.013     0.009     0.000"
" 40         HYDROGRAPH Copy to Outflow"
"          8   Copy to Outflow"
                0.010     0.013     0.013     0.000"
" 40         HYDROGRAPH   Combine    4"
"          6   Combine "
"          4   Node #"
               Flow to Infiltration Gallery"
            Maximum flow                 0.013    c.m/sec"
            Hydrograph volume          153.709    c.m"
                0.010     0.013     0.013     0.013"
" 40         HYDROGRAPH   Confluence    4"
"          7   Confluence "
"          4   Node #"
               Flow to Infiltration Gallery"
            Maximum flow                 0.013    c.m/sec"
            Hydrograph volume          153.709    c.m"
                0.010     0.013     0.013     0.000"
" 57         TRENCH Design d/s of 4"
"      0.013   Peak inflow"
"    153.709   Hydrograph volume"
"    336.500   Ground elevation"
"    334.500   Downstream trench invert"
"      1.000   Trench height"
"    333.000   Water table elevation"
"      2.000   Trench top width"
"      2.000   Trench bottom width"
"    100.000   Voids ratio (%)"
"     15.000   Hydraulic conductivity"
"      0.000   Trench gradient (%)"
"     80.000   Trench length"
"      1.000   Include base width"
"        21.   Number of stages"
                 Level Discharge    Volume"
               334.500     0.000       0.0"
               334.600     0.000      16.0"
               334.700     0.000      32.0"
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               334.800     0.000      48.0"
               334.900     0.000      64.0"
               335.000     0.000      80.0"
               335.100     0.000      96.0"
               335.200     0.000     112.0"
               335.300     0.000     128.0"
               335.400     0.000     144.0"
               335.500     0.000     160.0"
               335.600     0.005     160.1"
               335.700     0.018     160.2"
               335.800     0.035     160.3"
               335.900     0.055     160.5"
               336.000     0.073     160.6"
               336.100     0.088     160.7"
               336.200     0.102     160.8"
               336.300     0.114     160.9"
               336.400     0.125     161.0"
               336.500     0.135     161.1"
         1.    TRENCH PIPES"
           Downstream      Pipe      Pipe      Pipe Perf'ted?    Offset"
               Invert    length     diam.    grade%     0=Yes  distance"
              335.500    10.000     0.000     9.000     1.000     0.000"
         1.    MANHOLE"
                Access"
              diameter"
                1.200"
         1.    OUTFLOW PIPE"
         0.    Inflow at upstream end of trench: 1=True; 0=False"
            Upstream Downstr'm      Pipe      Pipe   Manning     Entry"
              invert    invert    Length  Diameter       'n'   loss Ke"
              335.500   334.600   10.000     0.300     0.013     0.500"
           Peak outflow                    0.000    c.m/sec"
           Outflow volume                  0.015    c.m"
           Peak exfiltration               0.001    c.m/sec"
           Exfiltration volume           153.393    c.m"
           Maximum level                 335.140    metre"
           Maximum storage               102.328    c.m"
           Centroidal lag                 22.021    hours"
           Infiltration area 2 sides     102.329    sq.metre"
           Infiltration Base area        160.000    sq.metre"
                0.010     0.013     0.000     0.001 c.m/sec"
" 40         HYDROGRAPH   Combine    1"
"          6   Combine "
"          1   Node #"
               Flow to Wetland"
            Maximum flow                 0.018    c.m/sec"
            Hydrograph volume           22.672    c.m"
                0.010     0.013     0.000     0.018"
" 40         HYDROGRAPH Start - New Tributary"
"          2   Start - New Tributary"
                0.010     0.000     0.000     0.018"
" 33         CATCHMENT 205"
"          1   Triangular SCS"
"          1   Equal length"
"          2   Horton equation"
"        205   Apartment Rooftops"
"    100.000   % Impervious"
"      0.076   Total Area"
"      5.000   Flow length"
"      1.000   Overland Slope"
"      0.000   Pervious Area"
"      5.000   Pervious length"
"      1.000   Pervious slope"
```

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"       0.076   Impervious Area"
"       5.000   Impervious length"
"       1.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      75.000   Pervious Max.infiltration"
"      12.500   Pervious Min.infiltration"
"       0.250   Pervious Lag constant (hours)"
"       5.000   Pervious Depression storage"
"       0.013   Impervious Manning 'n'"
"       0.000   Impervious Max.infiltration"
"       0.000   Impervious Min.infiltration"
"       0.001   Impervious Lag constant (hours)"
"       1.500   Impervious Depression storage"
"               0.013     0.000     0.000     0.018 c.m/sec"
"            Catchment 205          Pervious   Impervious Total Area "
"            Surface Area           0.000      0.076      0.076      hectare"
"            Time of concentration      ---    0.970      0.970      minutes"
"            Time to Centroid       0.000      61.205     61.205     minutes"
"            Rainfall depth         24.995     24.995     24.995     mm"
"            Rainfall volume        0.00       19.00      19.00      c.m"
"            Rainfall losses        24.995     2.182      2.182      mm"
"            Runoff depth           0.000      22.813     22.813     mm"
"            Runoff volume          0.00       17.34      17.34      c.m"
"            Runoff coefficient     0.000      0.913      0.913      "
"            Maximum flow           0.000      0.013      0.013      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"               0.013     0.013     0.000     0.018"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"               0.013     0.013     0.013     0.018"
" 40          HYDROGRAPH   Combine    9"
"           6   Combine "
"           9   Node #"
"               Flow to Private Infiltration Gallery"
"            Maximum flow                  0.013    c.m/sec"
"            Hydrograph volume            17.338    c.m"
"               0.013     0.013     0.013     0.013"
" 40          HYDROGRAPH   Confluence    1"
"           7   Confluence "
"           1   Node #"
"               Flow to Wetland"
"            Maximum flow                  0.018    c.m/sec"
"            Hydrograph volume            22.672    c.m"
"               0.013     0.018     0.013     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"               0.013     0.018     0.018     0.000"
" 40          HYDROGRAPH   Combine    99"
"           6   Combine "
"          99   Node #"
"               Flow from the Site "
"            Maximum flow                  0.018    c.m/sec"
"            Hydrograph volume            22.672    c.m"
"               0.013     0.018     0.018     0.018"
" 40          HYDROGRAPH   Confluence    2"
"           7   Confluence "
"           2   Node #"
"               Flow to Arkell Road "
"            Maximum flow                  0.013    c.m/sec"
"            Hydrograph volume            17.613    c.m"
"               0.013     0.013     0.018     0.000"
" 40          HYDROGRAPH Copy to Outflow"
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```
"           8   Copy to Outflow"
"               0.013     0.013     0.013     0.000"
" 40          HYDROGRAPH   Combine    99"
"           6   Combine "
"          99   Node #"
"               Flow from the Site "
"            Maximum flow                  0.032    c.m/sec"
"            Hydrograph volume            40.286    c.m"
"               0.013     0.013     0.013     0.032"
" 38          START/RE-START TOTALS 2"
"           3   Runoff Totals on EXIT"
"            Total Catchment area                    2.580    hectare"
"            Total Impervious area                   0.929    hectare"
"            Total % impervious                     35.990"
" 19          EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                           Sunday, February 07, 2010"
"           10   Units used:                                              ie METRIC"
"                Job folder:                                 Q:\42063\104\SWM\FINAL"
"                Output filename:                           42063-104 5YR POST-D.out"
"                Licensee name:                                              ADMIN"
"                Company                                                  Microsoft"
"                Date & Time last used:                   10/10/2018 at 3:02:43 PM"
" 31           TIME PARAMETERS"
"       5.000   Time Step"
"     170.000   Max. Storm length"
"    3600.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"           1   Chicago storm"
"    1593.000   Coefficient A"
"      11.000   Constant B"
"       0.879   Exponent C"
"       0.400   Fraction R"
"     170.000   Duration"
"       1.000   Time step multiplier"
"            Maximum intensity           134.894    mm/hr"
"            Total depth                  46.775    mm"
"           4   Shyd   Hydrograph extension used in this file"
" 33          CATCHMENT 206"
"           1   Triangular SCS"
"           2   Proportional to %"
"           2   Horton equation"
"         206   Easterly Rear Yards"
"      25.000   % Impervious"
"       0.248   Total Area"
"      13.000   Flow length"
"       2.000   Overland Slope"
"       0.186   Pervious Area"
"      13.000   Pervious length"
"       2.000   Pervious slope"
"       0.062   Impervious Area"
"       4.333   Impervious length"
"       2.000   Impervious slope"
"       0.300   Pervious Manning 'n'"
"      75.000   Pervious Max.infiltration"
"      12.500   Pervious Min.infiltration"
"       0.250   Pervious Lag constant (hours)"
"       5.000   Pervious Depression storage"
"       0.013   Impervious Manning 'n'"
"       0.000   Impervious Max.infiltration"
"       0.000   Impervious Min.infiltration"
"       0.001   Impervious Lag constant (hours)"
"       1.500   Impervious Depression storage"
"                   0.025     0.000     0.000     0.000 c.m/sec"
"            Catchment 206          Pervious   Impervious Total Area "
"            Surface Area           0.186      0.062      0.248      hectare"
"            Time of concentration  10.375     0.566      4.886      minutes"
"            Time to Centroid       84.265     80.760     82.304     minutes"
"            Rainfall depth         46.775     46.775     46.775     mm"
"            Rainfall volume        87.00      29.00      116.00     c.m"
"            Rainfall losses        35.938     5.479      28.324     mm"
"            Runoff depth           10.837     41.296     18.451     mm"
"            Runoff volume          20.16      25.60      45.76      c.m"
"            Runoff coefficient     0.232      0.883      0.394      "
"            Maximum flow           0.019      0.020      0.025      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
```



```
"                   0.025     0.025     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                   0.025     0.025     0.025     0.000"
" 40          HYDROGRAPH   Combine    1"
"           6   Combine "
"           1   Node #"
"               Flow to Wetland"
"            Maximum flow                    0.025    c.m/sec"
"            Hydrograph volume              45.760    c.m"
"                   0.025     0.025     0.025     0.025"
" 40          HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                   0.025     0.000     0.025     0.025"
" 33          CATCHMENT 207"
"           1   Triangular SCS"
"           2   Proportional to %"
"           2   Horton equation"
"         207   Unattenuated to Arkell"
"      25.000   % Impervious"
"       0.307   Total Area"
"      30.000   Flow length"
"       2.000   Overland Slope"
"       0.230   Pervious Area"
"      30.000   Pervious length"
"       2.000   Pervious slope"
"       0.077   Impervious Area"
"      10.000   Impervious length"
"       2.000   Impervious slope"
"       0.300   Pervious Manning 'n'"
"      75.000   Pervious Max.infiltration"
"      12.500   Pervious Min.infiltration"
"       0.250   Pervious Lag constant (hours)"
"       5.000   Pervious Depression storage"
"       0.013   Impervious Manning 'n'"
"       0.000   Impervious Max.infiltration"
"       0.000   Impervious Min.infiltration"
"       0.001   Impervious Lag constant (hours)"
"       1.500   Impervious Depression storage"
"                   0.027     0.000     0.025     0.025 c.m/sec"
"            Catchment 207          Pervious   Impervious Total Area "
"            Surface Area           0.230      0.077      0.307      hectare"
"            Time of concentration  17.136     0.934      7.877      minutes"
"            Time to Centroid       90.234     80.890     84.894     minutes"
"            Rainfall depth         46.775     46.775     46.775     mm"
"            Rainfall volume        107.70     35.90      143.60     c.m"
"            Rainfall losses        35.892     3.239      27.729     mm"
"            Runoff depth           10.883     43.536     19.046     mm"
"            Runoff volume          25.06      33.41      58.47      c.m"
"            Runoff coefficient     0.233      0.931      0.407      "
"            Maximum flow           0.017      0.025      0.027      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                   0.027     0.027     0.025     0.025"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                   0.027     0.027     0.027     0.025"
" 40          HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               Flow to Arkell Road "
"            Maximum flow                    0.027    c.m/sec"
"            Hydrograph volume              58.471    c.m"
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```
"                0.027     0.027     0.027     0.027"
" 40          HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                0.027     0.000     0.027     0.027"
" 33          CATCHMENT 208"
"           1   Triangular SCS"
"           2   Proportional to %"
"           2   Horton equation"
"         208   Wetland"
"       5.000   % Impervious"
"       0.876   Total Area"
"      35.000   Flow length"
"       5.000   Overland Slope"
"       0.832   Pervious Area"
"      35.000   Pervious length"
"       5.000   Pervious slope"
"       0.044   Impervious Area"
"       1.842   Impervious length"
"       5.000   Impervious slope"
"       0.300   Pervious Manning 'n'"
"      75.000   Pervious Max.infiltration"
"      12.500   Pervious Min.infiltration"
"       0.250   Pervious Lag constant (hours)"
"       5.000   Pervious Depression storage"
"       0.013   Impervious Manning 'n'"
"       0.000   Impervious Max.infiltration"
"       0.000   Impervious Min.infiltration"
"       0.001   Impervious Lag constant (hours)"
"       1.500   Impervious Depression storage"
"                0.072     0.000     0.027     0.027 c.m/sec"
"            Catchment 208          Pervious   Impervious Total Area "
"            Surface Area           0.832      0.044      0.876      hectare"
"            Time of concentration  14.279     0.257      12.055     minutes"
"            Time to Centroid       87.776     79.816     86.514     minutes"
"            Rainfall depth         46.775     46.775     46.775     mm"
"            Rainfall volume        389.26     20.49      409.75     c.m"
"            Rainfall losses        35.887     7.789      34.483     mm"
"            Runoff depth           10.888     38.986     12.292     mm"
"            Runoff volume          90.61      17.08      107.68     c.m"
"            Runoff coefficient     0.233      0.833      0.263      "
"            Maximum flow           0.070      0.014      0.072      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                0.072     0.072     0.027     0.027"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                0.072     0.072     0.072     0.027"
" 40          HYDROGRAPH   Combine    1"
"           6   Combine "
"           1   Node #"
"               Flow to Wetland"
"            Maximum flow                 0.094    c.m/sec"
"            Hydrograph volume          153.442    c.m"
"                0.072     0.072     0.072     0.094"
" 40          HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                0.072     0.000     0.072     0.094"
" 33          CATCHMENT 201"
"           1   Triangular SCS"
"           2   Proportional to %"
"           2   Horton equation"
"         201   ROW"
"       65.000  % Impervious"
```



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"       0.510   Total Area"
"       5.000   Flow length"
"       2.000   Overland Slope"
"       0.178   Pervious Area"
"       5.000   Pervious length"
"       2.000   Pervious slope"
"       0.331   Impervious Area"
"       9.286   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      75.000   Pervious Max.infiltration"
"      12.500   Pervious Min.infiltration"
"       0.250   Pervious Lag constant (hours)"
"       5.000   Pervious Depression storage"
"       0.013   Impervious Manning 'n'"
"       0.000   Impervious Max.infiltration"
"       0.000   Impervious Min.infiltration"
"       0.001   Impervious Lag constant (hours)"
"       1.500   Impervious Depression storage"
"                0.114     0.000     0.072     0.094 c.m/sec"
"            Catchment 201          Pervious   Impervious Total Area "
"            Surface Area           0.178      0.331      0.510      hectare"
"            Time of concentration  5.242      0.894      1.411      minutes"
"            Time to Centroid       79.908     80.832     80.722     minutes"
"            Rainfall depth         46.775     46.775     46.775     mm"
"            Rainfall volume        83.49      155.06     238.55     c.m"
"            Rainfall losses        35.889     3.387      14.763     mm"
"            Runoff depth           10.886     43.388     32.012     mm"
"            Runoff volume          19.43      143.83     163.26     c.m"
"            Runoff coefficient     0.233      0.928      0.684      "
"            Maximum flow           0.020      0.108      0.114      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                0.114     0.114     0.072     0.094"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                0.114     0.114     0.114     0.094"
" 40          HYDROGRAPH Next link "
"           5   Next link "
"                0.114     0.114     0.114     0.094"
" 33          CATCHMENT 202"
"           1   Triangular SCS"
"           2   Proportional to %"
"           2   Horton equation"
"         202   SWM Pond"
"      50.000   % Impervious"
"       0.166   Total Area"
"       5.000   Flow length"
"       2.000   Overland Slope"
"       0.083   Pervious Area"
"       5.000   Pervious length"
"       2.000   Pervious slope"
"       0.083   Impervious Area"
"       5.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      75.000   Pervious Max.infiltration"
"      12.500   Pervious Min.infiltration"
"       0.250   Pervious Lag constant (hours)"
"       5.000   Pervious Depression storage"
"       0.013   Impervious Manning 'n'"
"       0.000   Impervious Max.infiltration"
"       0.000   Impervious Min.infiltration"
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"       0.001   Impervious Lag constant (hours)"
"       1.500   Impervious Depression storage"
"                 0.030     0.114     0.114     0.094 c.m/sec"
"            Catchment 202          Pervious   Impervious Total Area "
"            Surface Area           0.083      0.083      0.166      hectare"
"            Time of concentration  5.242      0.616      1.572      minutes"
"            Time to Centroid       79.908     80.779     80.599     minutes"
"            Rainfall depth         46.775     46.775     46.775     mm"
"            Rainfall volume        38.82      38.82      77.65      c.m"
"            Rainfall losses        35.889     4.995      20.442     mm"
"            Runoff depth           10.886     41.780     26.333     mm"
"            Runoff volume          9.04       34.68      43.71      c.m"
"            Runoff coefficient     0.233      0.893      0.563      "
"            Maximum flow           0.009      0.027      0.030      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"          4   Add Runoff "
"                 0.030     0.144     0.114     0.094"
" 40         HYDROGRAPH Copy to Outflow"
"          8   Copy to Outflow"
"                 0.030     0.144     0.144     0.094"
" 40         HYDROGRAPH Next link "
"          5   Next link "
"                 0.030     0.144     0.144     0.094"
" 33         CATCHMENT 203"
"          1   Triangular SCS"
"          2   Proportional to %"
"          2   Horton equation"
"        203   Apartment Block"
"       70.000   % Impervious"
"        0.285   Total Area"
"       30.000   Flow length"
"        2.000   Overland Slope"
"        0.086   Pervious Area"
"       30.000   Pervious length"
"        2.000   Pervious slope"
"        0.199   Impervious Area"
"       70.000   Impervious length"
"        1.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.013   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.001   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                 0.063     0.144     0.144     0.094 c.m/sec"
"            Catchment 203          Pervious   Impervious Total Area "
"            Surface Area           0.086      0.199      0.285      hectare"
"            Time of concentration  15.360     3.697      4.804      minutes"
"            Time to Centroid       88.710     84.905     85.266     minutes"
"            Rainfall depth         46.775     46.775     46.775     mm"
"            Rainfall volume        39.99      93.32      133.31     c.m"
"            Rainfall losses        35.929     2.431      12.481     mm"
"            Runoff depth           10.846     44.344     34.294     mm"
"            Runoff volume          9.27       88.47      97.74      c.m"
"            Runoff coefficient     0.232      0.948      0.733      "
"            Maximum flow           0.007      0.060      0.063      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"          4   Add Runoff "
"                 0.063     0.196     0.144     0.094"
```



```
" 40         HYDROGRAPH Copy to Outflow"
"          8   Copy to Outflow"
"                 0.063     0.196     0.196     0.094"
" 40         HYDROGRAPH   Combine    3"
"          6   Combine "
"          3   Node #"
"              Flow to SWM Pond"
"           Maximum flow                    0.196    c.m/sec"
"           Hydrograph volume             304.713    c.m"
"                 0.063     0.196     0.196     0.196"
" 40         HYDROGRAPH   Confluence    3"
"          7   Confluence "
"          3   Node #"
"              Flow to SWM Pond"
"           Maximum flow                    0.196    c.m/sec"
"           Hydrograph volume             304.713    c.m"
"                 0.063     0.196     0.196     0.000"
" 54         POND DESIGN"
"         0.196   Current peak flow    c.m/sec"
"         0.048   Target outflow    c.m/sec"
"         304.7   Hydrograph volume    c.m"
"           11.   Number of stages"
"       335.000   Minimum water level    metre"
"       336.000   Maximum water level    metre"
"       335.000   Starting water level    metre"
"             0   Keep Design Data: 1 = True; 0 = False"
"                   Level Discharge    Volume"
"                 335.000     0.000     0.000"
"                 335.100   0.00632    88.600"
"                 335.200   0.02225   181.400"
"                 335.300   0.04416   278.400"
"                 335.400   0.08821   379.600"
"                 335.500    0.1080   485.000"
"                 335.600    0.1248   594.600"
"                 335.700    0.1395   708.400"
"                 335.800    0.1528   826.400"
"                 335.900    0.1650   948.600"
"                 336.000    0.1764  1075.000"
"           1.   ORIFICES"
"                Orifice   Orifice   Orifice Number of"
"                 invert coefficie  diameter  orifices"
"                335.000     0.630    0.3000     1.000"
"              Peak outflow                  0.029    c.m/sec"
"              Maximum level               335.233    metre"
"              Maximum storage             213.190    c.m"
"              Centroidal lag                4.235    hours"
"                   0.063     0.196     0.029     0.000 c.m/sec"
" 40         HYDROGRAPH Next link "
"          5   Next link "
"                 0.063     0.029     0.029     0.000"
" 33         CATCHMENT 204"
"          1   Triangular SCS"
"          2   Proportional to %"
"          2   Horton equation"
"        204   Rear Yards"
"       50.000   % Impervious"
"        0.112   Total Area"
"        5.000   Flow length"
"        2.000   Overland Slope"
"        0.056   Pervious Area"
"        5.000   Pervious length"
"        2.000   Pervious slope"
"        0.056   Impervious Area"
```

```
"       5.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      75.000   Pervious Max.infiltration"
"      12.500   Pervious Min.infiltration"
"       0.250   Pervious Lag constant (hours)"
"       5.000   Pervious Depression storage"
"       0.013   Impervious Manning 'n'"
"       0.000   Impervious Max.infiltration"
"       0.000   Impervious Min.infiltration"
"       0.001   Impervious Lag constant (hours)"
"       1.500   Impervious Depression storage"
                  0.020     0.029     0.029     0.000 c.m/sec"
             Catchment 204          Pervious   Impervious Total Area "
             Surface Area           0.056      0.056      0.112      hectare"
             Time of concentration  5.242      0.616      1.572      minutes"
             Time to Centroid       79.908     80.779     80.599     minutes"
             Rainfall depth         46.775     46.775     46.775     mm"
             Rainfall volume        26.19      26.19      52.39      c.m"
             Rainfall losses        35.889     4.995      20.442     mm"
             Runoff depth           10.886     41.780     26.333     mm"
             Runoff volume          6.10       23.40      29.49      c.m"
             Runoff coefficient     0.233      0.893      0.563      "
             Maximum flow           0.006      0.018      0.020      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"          4   Add Runoff "
                  0.020     0.034     0.029     0.000"
" 40         HYDROGRAPH Copy to Outflow"
"          8   Copy to Outflow"
                  0.020     0.034     0.034     0.000"
" 40         HYDROGRAPH   Combine    4"
"          6   Combine "
"          4   Node #"
              Flow to Infiltration Gallery"
             Maximum flow                0.034    c.m/sec"
             Hydrograph volume         334.153    c.m"
                  0.020     0.034     0.034     0.034"
" 40         HYDROGRAPH   Confluence    4"
"          7   Confluence "
"          4   Node #"
              Flow to Infiltration Gallery"
             Maximum flow                0.034    c.m/sec"
             Hydrograph volume         334.153    c.m"
                  0.020     0.034     0.034     0.000"
" 57         TRENCH Design d/s of 4"
"       0.034   Peak inflow"
"     334.153   Hydrograph volume"
"     336.500   Ground elevation"
"     334.500   Downstream trench invert"
"       1.000   Trench height"
"     333.000   Water table elevation"
"       2.000   Trench top width"
"       2.000   Trench bottom width"
"     100.000   Voids ratio (%)"
"      15.000   Hydraulic conductivity"
"       0.000   Trench gradient (%)"
"      80.000   Trench length"
"       1.000   Include base width"
"         21.   Number of stages"
                  Level Discharge    Volume"
                334.500     0.000       0.0"
                334.600     0.000      16.0"
                334.700     0.000      32.0"
```



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                334.800     0.000      48.0"
                334.900     0.000      64.0"
                335.000     0.000      80.0"
                335.100     0.000      96.0"
                335.200     0.000     112.0"
                335.300     0.000     128.0"
                335.400     0.000     144.0"
                335.500     0.000     160.0"
                335.600     0.005     160.1"
                335.700     0.018     160.2"
                335.800     0.035     160.3"
                335.900     0.055     160.5"
                336.000     0.073     160.6"
                336.100     0.088     160.7"
                336.200     0.102     160.8"
                336.300     0.114     160.9"
                336.400     0.125     161.0"
                336.500     0.135     161.1"
         1.   TRENCH PIPES"
           Downstream      Pipe      Pipe      Pipe Perf'ted?    Offset"
               Invert    length     diam.    grade%     0=Yes  distance"
              335.500    10.000     0.000     9.000     1.000     0.000"
         1.   MANHOLE"
               Access"
            diameter"
              1.200"
         1.   OUTFLOW PIPE"
         0.   Inflow at upstream end of trench: 1=True; 0=False"
            Upstream Downstr'm      Pipe      Pipe   Manning     Entry"
              invert    invert    Length  Diameter       'n'   loss Ke"
              335.500   334.600   10.000     0.300     0.013     0.500"
           Peak outflow                  0.017    c.m/sec"
           Outflow volume               98.390    c.m"
           Peak exfiltration             0.002    c.m/sec"
           Exfiltration volume         234.567    c.m"
           Maximum level               335.699    metre"
           Maximum storage             160.224    c.m"
           Centroidal lag                4.302    hours"
           Infiltration area 2 sides   160.000    sq.metre"
           Infiltration Base area      160.000    sq.metre"
                0.020     0.034     0.017     0.002 c.m/sec"
 40         HYDROGRAPH   Combine    1"
          6   Combine "
          1   Node #"
              Flow to Wetland"
             Maximum flow                0.094    c.m/sec"
             Hydrograph volume         251.836    c.m"
                  0.020     0.034     0.017     0.094"
 40         HYDROGRAPH Start - New Tributary"
          2   Start - New Tributary"
                0.020     0.000     0.017     0.094"
 33         CATCHMENT 205"
          1   Triangular SCS"
          1   Equal length"
          2   Horton equation"
        205   Apartment Rooftops"
    100.000   % Impervious"
      0.076   Total Area"
      5.000   Flow length"
      1.000   Overland Slope"
      0.000   Pervious Area"
      5.000   Pervious length"
      1.000   Pervious slope"
```

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"       0.076   Impervious Area"
"       5.000   Impervious length"
"       1.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      75.000   Pervious Max.infiltration"
"      12.500   Pervious Min.infiltration"
"       0.250   Pervious Lag constant (hours)"
"       5.000   Pervious Depression storage"
"       0.013   Impervious Manning 'n'"
"       0.000   Impervious Max.infiltration"
"       0.000   Impervious Min.infiltration"
"       0.001   Impervious Lag constant (hours)"
"       1.500   Impervious Depression storage"
"             0.025     0.000     0.017     0.094 c.m/sec"
"          Catchment 205          Pervious   Impervious Total Area "
"          Surface Area           0.000      0.076      0.076      hectare"
"          Time of concentration  6.454      0.759      0.759      minutes"
"          Time to Centroid       80.838     80.773     80.773     minutes"
"          Rainfall depth         46.775     46.775     46.775     mm"
"          Rainfall volume        0.00       35.55      35.55      c.m"
"          Rainfall losses        36.132     3.996      3.996      mm"
"          Runoff depth           10.643     42.779     42.779     mm"
"          Runoff volume          0.00       32.51      32.51      c.m"
"          Runoff coefficient     0.000      0.915      0.915      "
"          Maximum flow           0.000      0.025      0.025      c.m/sec"
" 40       HYDROGRAPH Add Runoff "
"        4   Add Runoff "
"             0.025     0.025     0.017     0.094"
" 40       HYDROGRAPH Copy to Outflow"
"        8   Copy to Outflow"
"             0.025     0.025     0.025     0.094"
" 40       HYDROGRAPH   Combine    9"
"        6   Combine "
"        9   Node #"
"            Flow to Private Infiltration Gallery"
"          Maximum flow                  0.025    c.m/sec"
"          Hydrograph volume            32.512    c.m"
"             0.025     0.025     0.025     0.025"
" 40       HYDROGRAPH   Confluence    1"
"        7   Confluence "
"        1   Node #"
"            Flow to Wetland"
"          Maximum flow                  0.094    c.m/sec"
"          Hydrograph volume           251.836    c.m"
"             0.025     0.094     0.025     0.000"
" 40       HYDROGRAPH Copy to Outflow"
"        8   Copy to Outflow"
"             0.025     0.094     0.094     0.000"
" 40       HYDROGRAPH   Combine    99"
"        6   Combine "
"       99   Node #"
"            Flow from the Site "
"          Maximum flow                  0.094    c.m/sec"
"          Hydrograph volume           251.836    c.m"
"             0.025     0.094     0.094     0.094"
" 40       HYDROGRAPH   Confluence    2"
"        7   Confluence "
"        2   Node #"
"            Flow to Arkell Road "
"          Maximum flow                  0.027    c.m/sec"
"          Hydrograph volume            58.471    c.m"
"             0.025     0.027     0.094     0.000"
" 40       HYDROGRAPH Copy to Outflow"
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```
"        8   Copy to Outflow"
"             0.025     0.027     0.027     0.000"
" 40       HYDROGRAPH   Combine    99"
"        6   Combine "
"       99   Node #"
"            Flow from the Site "
"          Maximum flow                  0.118    c.m/sec"
"          Hydrograph volume           310.306    c.m"
"             0.025     0.027     0.027     0.118"
" 38       START/RE-START TOTALS 2"
"        3   Runoff Totals on EXIT"
"          Total Catchment area                      2.580    hectare"
"          Total Impervious area                     0.929    hectare"
"          Total % impervious                       35.990"
" 19       EXIT"
```

```
"              MIDUSS Output ------------------------------------------------>"
"              MIDUSS version                              Version 2.25  rev. 473"
"              MIDUSS created                           Sunday, February 07, 2010"
"          10  Units used:                                              ie METRIC"
"              Job folder:                                 Q:\42063\104\SWM\FINAL"
"              Output filename:                        42063-104 100YR POST-D.out"
"              Licensee name:                                              ADMIN"
"              Company                                                  Microsoft"
"              Date & Time last used:                    10/10/2018 at 3:12:06 PM"
" 31         TIME PARAMETERS"
"       5.000  Time Step"
"     210.000  Max. Storm length"
"    3600.000  Max. Hydrograph"
" 32       STORM Chicago storm"
"           1  Chicago storm"
"    4688.000  Coefficient A"
"      17.000  Constant B"
"       0.962  Exponent C"
"       0.400  Fraction R"
"     210.000  Duration"
"       1.000  Time step multiplier"
"            Maximum intensity          213.574    mm/hr"
"            Total depth                 88.830    mm"
"           6  100hyd   Hydrograph extension used in this file"
" 33        CATCHMENT 206"
"           1  Triangular SCS"
"           2  Proportional to %"
"           2  Horton equation"
"         206  Easterly Rear Yards"
"       25.000  % Impervious"
"        0.248  Total Area"
"       13.000  Flow length"
"        2.000  Overland Slope"
"        0.186  Pervious Area"
"       13.000  Pervious length"
"        2.000  Pervious slope"
"        0.062  Impervious Area"
"        4.333  Impervious length"
"        2.000  Impervious slope"
"        0.300  Pervious Manning 'n'"
"       75.000  Pervious Max.infiltration"
"       12.500  Pervious Min.infiltration"
"        0.250  Pervious Lag constant (hours)"
"        5.000  Pervious Depression storage"
"        0.013  Impervious Manning 'n'"
"        0.000  Impervious Max.infiltration"
"        0.000  Impervious Min.infiltration"
"        0.001  Impervious Lag constant (hours)"
"        1.500  Impervious Depression storage"
"                  0.093     0.000     0.000     0.000 c.m/sec"
"            Catchment 206          Pervious   Impervious Total Area "
"            Surface Area           0.186      0.062      0.248      hectare"
"            Time of concentration  6.286      0.471      4.164      minutes"
"            Time to Centroid       99.156     96.173     98.067     minutes"
"            Rainfall depth         88.830     88.830     88.830     mm"
"            Rainfall volume        165.22     55.07      220.30     c.m"
"            Rainfall losses        43.925     11.424     35.800     mm"
"            Runoff depth           44.904     77.406     53.030     mm"
"            Runoff volume          83.52      47.99      131.51     c.m"
"            Runoff coefficient     0.506      0.871      0.597      "
"            Maximum flow           0.074      0.031      0.093      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4  Add Runoff "
```



```
"                  0.093     0.093     0.000     0.000"
" 40         HYDROGRAPH Copy to Outflow"
"           8  Copy to Outflow"
"                  0.093     0.093     0.093     0.000"
" 40         HYDROGRAPH   Combine    1"
"           6  Combine "
"           1  Node #"
"              Flow to Wetland"
"            Maximum flow                        0.093    c.m/sec"
"            Hydrograph volume                 131.514    c.m"
"                  0.093     0.093     0.093     0.093"
" 40         HYDROGRAPH Start - New Tributary"
"           2  Start - New Tributary"
"                  0.093     0.000     0.093     0.093"
" 33         CATCHMENT 207"
"           1  Triangular SCS"
"           2  Proportional to %"
"           2  Horton equation"
"         207  Unattenuated to Arkell"
"       25.000  % Impervious"
"        0.307  Total Area"
"       30.000  Flow length"
"        2.000  Overland Slope"
"        0.230  Pervious Area"
"       30.000  Pervious length"
"        2.000  Pervious slope"
"        0.077  Impervious Area"
"       10.000  Impervious length"
"        2.000  Impervious slope"
"        0.300  Pervious Manning 'n'"
"       75.000  Pervious Max.infiltration"
"       12.500  Pervious Min.infiltration"
"        0.250  Pervious Lag constant (hours)"
"        5.000  Pervious Depression storage"
"        0.013  Impervious Manning 'n'"
"        0.000  Impervious Max.infiltration"
"        0.000  Impervious Min.infiltration"
"        0.001  Impervious Lag constant (hours)"
"        1.500  Impervious Depression storage"
"                  0.097     0.000     0.093     0.093 c.m/sec"
"            Catchment 207          Pervious   Impervious Total Area "
"            Surface Area           0.230      0.077      0.307      hectare"
"            Time of concentration  10.381     0.777      6.769      minutes"
"            Time to Centroid       103.328    96.385     100.717    minutes"
"            Rainfall depth         88.830     88.830     88.830     mm"
"            Rainfall volume        204.53     68.18      272.71     c.m"
"            Rainfall losses        43.360     6.595      34.169     mm"
"            Runoff depth           45.470     82.235     54.661     mm"
"            Runoff volume          104.69     63.12      167.81     c.m"
"            Runoff coefficient     0.512      0.926      0.615      "
"            Maximum flow           0.076      0.040      0.097      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4  Add Runoff "
"                  0.097     0.097     0.093     0.093"
" 40         HYDROGRAPH Copy to Outflow"
"           8  Copy to Outflow"
"                  0.097     0.097     0.097     0.093"
" 40         HYDROGRAPH   Combine    2"
"           6  Combine "
"           2  Node #"
"              Flow to Arkell Road "
"            Maximum flow                        0.097    c.m/sec"
"            Hydrograph volume                 167.809    c.m"
```

```
"                0.097     0.097     0.097     0.097"
" 40          HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                0.097     0.000     0.097     0.097"
" 33          CATCHMENT 208"
"             1   Triangular SCS"
"             2   Proportional to %"
"             2   Horton equation"
"           208   Wetland"
"         5.000   % Impervious"
"         0.876   Total Area"
"        35.000   Flow length"
"         5.000   Overland Slope"
"         0.832   Pervious Area"
"        35.000   Pervious length"
"         5.000   Pervious slope"
"         0.044   Impervious Area"
"         1.842   Impervious length"
"         5.000   Impervious slope"
"         0.300   Pervious Manning 'n'"
"        75.000   Pervious Max.infiltration"
"        12.500   Pervious Min.infiltration"
"         0.250   Pervious Lag constant (hours)"
"         5.000   Pervious Depression storage"
"         0.013   Impervious Manning 'n'"
"         0.000   Impervious Max.infiltration"
"         0.000   Impervious Min.infiltration"
"         0.001   Impervious Lag constant (hours)"
"         1.500   Impervious Depression storage"
"                 0.311     0.000     0.097     0.097 c.m/sec"
"              Catchment 208          Pervious   Impervious Total Area "
"              Surface Area           0.832      0.044      0.876      hectare"
"              Time of concentration  8.651      0.214      7.975      minutes"
"              Time to Centroid       101.516    95.204     101.011    minutes"
"              Rainfall depth         88.830     88.830     88.830     mm"
"              Rainfall volume        739.24     38.91      778.15     c.m"
"              Rainfall losses        43.359     13.638     41.873     mm"
"              Runoff depth           45.471     75.192     46.957     mm"
"              Runoff volume          378.41     32.93      411.34     c.m"
"              Runoff coefficient     0.512      0.846      0.529      "
"              Maximum flow           0.301      0.023      0.311      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                 0.311     0.311     0.097     0.097"
" 40          HYDROGRAPH Copy to Outflow"
"             8   Copy to Outflow"
"                 0.311     0.311     0.311     0.097"
" 40          HYDROGRAPH   Combine    1"
"             6   Combine "
"             1   Node #"
"                 Flow to Wetland"
"              Maximum flow                  0.398    c.m/sec"
"              Hydrograph volume           542.854    c.m"
"                 0.311     0.311     0.311     0.398"
" 40          HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                 0.311     0.000     0.311     0.398"
" 33          CATCHMENT 201"
"             1   Triangular SCS"
"             2   Proportional to %"
"             2   Horton equation"
"           201   ROW"
"         65.000   % Impervious"
```



```
"         0.510   Total Area"
"         5.000   Flow length"
"         2.000   Overland Slope"
"         0.178   Pervious Area"
"         5.000   Pervious length"
"         2.000   Pervious slope"
"         0.331   Impervious Area"
"         9.286   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        75.000   Pervious Max.infiltration"
"        12.500   Pervious Min.infiltration"
"         0.250   Pervious Lag constant (hours)"
"         5.000   Pervious Depression storage"
"         0.013   Impervious Manning 'n'"
"         0.000   Impervious Max.infiltration"
"         0.000   Impervious Min.infiltration"
"         0.001   Impervious Lag constant (hours)"
"         1.500   Impervious Depression storage"
"                 0.230     0.000     0.311     0.398 c.m/sec"
"              Catchment 201          Pervious   Impervious Total Area "
"              Surface Area           0.178      0.331      0.510      hectare"
"              Time of concentration  3.176      0.744      1.292      minutes"
"              Time to Centroid       95.810     96.342     96.222     minutes"
"              Rainfall depth         88.830     88.830     88.830     mm"
"              Rainfall volume        158.56     294.47     453.03     c.m"
"              Rainfall losses        44.572     7.000      20.150     mm"
"              Runoff depth           44.258     81.830     68.680     mm"
"              Runoff volume          79.00      271.27     350.27     c.m"
"              Runoff coefficient     0.498      0.921      0.773      "
"              Maximum flow           0.083      0.171      0.230      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                 0.230     0.230     0.311     0.398"
" 40          HYDROGRAPH Copy to Outflow"
"             8   Copy to Outflow"
"                 0.230     0.230     0.230     0.398"
" 40          HYDROGRAPH Next link "
"             5   Next link "
"                 0.230     0.230     0.230     0.398"
" 33          CATCHMENT 202"
"             1   Triangular SCS"
"             2   Proportional to %"
"             2   Horton equation"
"           202   SWM Pond"
"        50.000   % Impervious"
"         0.166   Total Area"
"         5.000   Flow length"
"         2.000   Overland Slope"
"         0.083   Pervious Area"
"         5.000   Pervious length"
"         2.000   Pervious slope"
"         0.083   Impervious Area"
"         5.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        75.000   Pervious Max.infiltration"
"        12.500   Pervious Min.infiltration"
"         0.250   Pervious Lag constant (hours)"
"         5.000   Pervious Depression storage"
"         0.013   Impervious Manning 'n'"
"         0.000   Impervious Max.infiltration"
"         0.000   Impervious Min.infiltration"
```

```
"       0.001   Impervious Lag constant (hours)"
"       1.500   Impervious Depression storage"
"                  0.073     0.230     0.230     0.398 c.m/sec"
"            Catchment 202           Pervious   Impervious Total Area "
"            Surface Area            0.083      0.083      0.166      hectare"
"            Time of concentration   3.176      0.513      1.477      minutes"
"            Time to Centroid        95.810     96.238     96.083     minutes"
"            Rainfall depth          88.830     88.830     88.830     mm"
"            Rainfall volume         73.73      73.73      147.46     c.m"
"            Rainfall losses         44.572     10.857     27.714     mm"
"            Runoff depth            44.258     77.973     61.115     mm"
"            Runoff volume           36.73      64.72      101.45     c.m"
"            Runoff coefficient      0.498      0.878      0.688      "
"            Maximum flow            0.039      0.042      0.073      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"          4   Add Runoff "
"                  0.073     0.303     0.230     0.398"
" 40         HYDROGRAPH Copy to Outflow"
"          8   Copy to Outflow"
"                  0.073     0.303     0.303     0.398"
" 40         HYDROGRAPH Next link "
"          5   Next link "
"                  0.073     0.303     0.303     0.398"
" 33         CATCHMENT 203"
"          1   Triangular SCS"
"          2   Proportional to %"
"          2   Horton equation"
"        203   Apartment Block"
"       70.000   % Impervious"
"        0.285   Total Area"
"       30.000   Flow length"
"        2.000   Overland Slope"
"        0.086   Pervious Area"
"       30.000   Pervious length"
"        2.000   Pervious slope"
"        0.199   Impervious Area"
"       70.000   Impervious length"
"        1.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.013   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.001   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                  0.131     0.303     0.303     0.398 c.m/sec"
"            Catchment 203           Pervious   Impervious Total Area "
"            Surface Area            0.086      0.199      0.285      hectare"
"            Time of concentration   9.306      3.076      4.226      minutes"
"            Time to Centroid        102.153    99.503     99.992     minutes"
"            Rainfall depth          88.830     88.830     88.830     mm"
"            Rainfall volume         75.95      177.22     253.16     c.m"
"            Rainfall losses         43.655     3.273      15.387     mm"
"            Runoff depth            45.175     85.557     73.443     mm"
"            Runoff volume           38.62      170.69     209.31     c.m"
"            Runoff coefficient      0.509      0.963      0.827      "
"            Maximum flow            0.030      0.108      0.131      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"          4   Add Runoff "
"                  0.131     0.434     0.303     0.398"
```



```
" 40         HYDROGRAPH Copy to Outflow"
"          8   Copy to Outflow"
"                  0.131     0.434     0.434     0.398"
" 40         HYDROGRAPH   Combine    3"
"          6   Combine "
"          3   Node #"
"              Flow to SWM Pond"
"            Maximum flow                    0.434    c.m/sec"
"            Hydrograph volume               661.029    c.m"
"                  0.131     0.434     0.434     0.434"
" 40         HYDROGRAPH   Confluence    3"
"          7   Confluence "
"          3   Node #"
"              Flow to SWM Pond"
"            Maximum flow                    0.434    c.m/sec"
"            Hydrograph volume               661.029    c.m"
"                  0.131     0.434     0.434     0.000"
" 54         POND DESIGN"
"        0.434   Current peak flow    c.m/sec"
"        0.048   Target outflow    c.m/sec"
"        661.0   Hydrograph volume    c.m"
"          11.   Number of stages"
"      335.000   Minimum water level    metre"
"      336.000   Maximum water level    metre"
"      335.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                  335.000    0.000     0.000"
"                  335.100    0.00632    88.600"
"                  335.200    0.02225   181.400"
"                  335.300    0.04416   278.400"
"                  335.400    0.08821   379.600"
"                  335.500    0.1080    485.000"
"                  335.600    0.1248    594.600"
"                  335.700    0.1395    708.400"
"                  335.800    0.1528    826.400"
"                  335.900    0.1650    948.600"
"                  336.000    0.1764   1075.000"
"            1.   ORIFICES"
"                 Orifice   Orifice   Orifice Number of"
"                  invert coefficie  diameter  orifices"
"                 335.000     0.630    0.3000     1.000"
"               Peak outflow                    0.096    c.m/sec"
"               Maximum level                 335.438    metre"
"               Maximum storage               419.508    c.m"
"               Centroidal lag                  3.631    hours"
"                    0.131     0.434     0.096     0.000 c.m/sec"
" 40         HYDROGRAPH Next link "
"          5   Next link "
"                  0.131     0.096     0.096     0.000"
" 33         CATCHMENT 204"
"          1   Triangular SCS"
"          2   Proportional to %"
"          2   Horton equation"
"        204   Rear Yards"
"       50.000   % Impervious"
"        0.112   Total Area"
"        5.000   Flow length"
"        2.000   Overland Slope"
"        0.056   Pervious Area"
"        5.000   Pervious length"
"        2.000   Pervious slope"
"        0.056   Impervious Area"
```

```
"       5.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      75.000   Pervious Max.infiltration"
"      12.500   Pervious Min.infiltration"
"       0.250   Pervious Lag constant (hours)"
"       5.000   Pervious Depression storage"
"       0.013   Impervious Manning 'n'"
"       0.000   Impervious Max.infiltration"
"       0.000   Impervious Min.infiltration"
"       0.001   Impervious Lag constant (hours)"
"       1.500   Impervious Depression storage"
                  0.049     0.096     0.096     0.000 c.m/sec"
            Catchment 204          Pervious   Impervious Total Area "
            Surface Area           0.056      0.056      0.112      hectare"
            Time of concentration  3.176      0.513      1.477      minutes"
            Time to Centroid       95.810     96.238     96.083     minutes"
            Rainfall depth         88.830     88.830     88.830     mm"
            Rainfall volume        49.74      49.74      99.49      c.m"
            Rainfall losses        44.572     10.857     27.714     mm"
            Runoff depth           44.258     77.973     61.115     mm"
            Runoff volume          24.78      43.66      68.45      c.m"
            Runoff coefficient     0.498      0.878      0.688      "
            Maximum flow           0.026      0.029      0.049      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"          4   Add Runoff "
                  0.049     0.109     0.096     0.000"
" 40         HYDROGRAPH Copy to Outflow"
"          8   Copy to Outflow"
                  0.049     0.109     0.109     0.000"
" 40         HYDROGRAPH   Combine    4"
"          6   Combine "
"          4   Node #"
              Flow to Infiltration Gallery"
            Maximum flow                 0.109    c.m/sec"
            Hydrograph volume          728.924    c.m"
                  0.049     0.109     0.109     0.109"
" 40         HYDROGRAPH   Confluence    4"
"          7   Confluence "
"          4   Node #"
              Flow to Infiltration Gallery"
            Maximum flow                 0.109    c.m/sec"
            Hydrograph volume          728.924    c.m"
                  0.049     0.109     0.109     0.000"
" 57         TRENCH Design d/s of 4"
"       0.109   Peak inflow"
"     728.924   Hydrograph volume"
"     336.500   Ground elevation"
"     334.500   Downstream trench invert"
"       1.000   Trench height"
"     333.000   Water table elevation"
"       2.000   Trench top width"
"       2.000   Trench bottom width"
"     100.000   Voids ratio (%)"
"      15.000   Hydraulic conductivity"
"       0.000   Trench gradient (%)"
"      80.000   Trench length"
"       1.000   Include base width"
"         21.   Number of stages"
                  Level Discharge    Volume"
                334.500     0.000       0.0"
                334.600     0.000      16.0"
                334.700     0.000      32.0"
```



```
                334.800     0.000      48.0"
                334.900     0.000      64.0"
                335.000     0.000      80.0"
                335.100     0.000      96.0"
                335.200     0.000     112.0"
                335.300     0.000     128.0"
                335.400     0.000     144.0"
                335.500     0.000     160.0"
                335.600     0.005     160.1"
                335.700     0.018     160.2"
                335.800     0.035     160.3"
                335.900     0.055     160.5"
                336.000     0.073     160.6"
                336.100     0.088     160.7"
                336.200     0.102     160.8"
                336.300     0.114     160.9"
                336.400     0.125     161.0"
                336.500     0.135     161.1"
          1.    TRENCH PIPES"
            Downstream      Pipe      Pipe      Pipe Perf'ted?    Offset"
                Invert    length     diam.    grade%     0=Yes  distance"
               335.500    10.000     0.000     9.000     1.000     0.000"
          1.    MANHOLE"
                Access"
              diameter"
                1.200"
          1.    OUTFLOW PIPE"
          0.    Inflow at upstream end of trench: 1=True; 0=False"
              Upstream Downstr'm      Pipe      Pipe   Manning     Entry"
                invert    invert    Length  Diameter       'n'   loss Ke"
               335.500   334.600    10.000     0.300     0.013     0.500"
            Peak outflow                  0.103    c.m/sec"
            Outflow volume              485.846    c.m"
            Peak exfiltration             0.002    c.m/sec"
            Exfiltration volume         244.152    c.m"
            Maximum level               336.210    metre"
            Maximum storage             160.803    c.m"
            Centroidal lag                3.151    hours"
            Infiltration area 2 sides   160.000    sq.metre"
            Infiltration Base area      160.000    sq.metre"
                  0.049     0.109     0.103     0.002 c.m/sec"
" 40         HYDROGRAPH   Combine    1"
"          6   Combine "
"          1   Node #"
              Flow to Wetland"
            Maximum flow                  0.398    c.m/sec"
            Hydrograph volume          1028.682    c.m"
                  0.049     0.109     0.103     0.398"
" 40         HYDROGRAPH Start - New Tributary"
"          2   Start - New Tributary"
                  0.049     0.000     0.103     0.398"
" 33         CATCHMENT 205"
"          1   Triangular SCS"
"          1   Equal length"
"          2   Horton equation"
"        205   Apartment Rooftops"
"    100.000   % Impervious"
"      0.076   Total Area"
"      5.000   Flow length"
"      1.000   Overland Slope"
"      0.000   Pervious Area"
"      5.000   Pervious length"
"      1.000   Pervious slope"
```

```
"       0.076   Impervious Area"
"       5.000   Impervious length"
"       1.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      75.000   Pervious Max.infiltration"
"      12.500   Pervious Min.infiltration"
"       0.250   Pervious Lag constant (hours)"
"       5.000   Pervious Depression storage"
"       0.013   Impervious Manning 'n'"
"       0.000   Impervious Max.infiltration"
"       0.000   Impervious Min.infiltration"
"       0.001   Impervious Lag constant (hours)"
"       1.500   Impervious Depression storage"
                0.039     0.000     0.103     0.398 c.m/sec"
            Catchment 205          Pervious   Impervious Total Area "
            Surface Area           0.000      0.076      0.076      hectare"
            Time of concentration  3.910      0.631      0.631      minutes"
            Time to Centroid       96.661     96.278     96.278     minutes"
            Rainfall depth         88.830     88.830     88.830     mm"
            Rainfall volume        0.00       67.51      67.51      c.m"
            Rainfall losses        44.299     8.603      8.603      mm"
            Runoff depth           44.531     80.227     80.227     mm"
            Runoff volume          0.00       60.97      60.97      c.m"
            Runoff coefficient     0.000      0.903      0.903      "
            Maximum flow           0.000      0.039      0.039      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"          4   Add Runoff "
                0.039     0.039     0.103     0.398"
" 40         HYDROGRAPH Copy to Outflow"
"          8   Copy to Outflow"
                0.039     0.039     0.039     0.398"
" 40         HYDROGRAPH   Combine    9"
"          6   Combine "
"          9   Node #"
               Flow to Private Infiltration Gallery"
            Maximum flow                  0.039    c.m/sec"
            Hydrograph volume            60.973    c.m"
                0.039     0.039     0.039     0.039"
" 40         HYDROGRAPH   Confluence    1"
"          7   Confluence "
"          1   Node #"
               Flow to Wetland"
            Maximum flow                  0.398    c.m/sec"
            Hydrograph volume          1028.682    c.m"
                0.039     0.398     0.039     0.000"
" 40         HYDROGRAPH Copy to Outflow"
"          8   Copy to Outflow"
                0.039     0.398     0.398     0.000"
" 40         HYDROGRAPH   Combine    99"
"          6   Combine "
"         99   Node #"
               Flow from the Site "
            Maximum flow                  0.398    c.m/sec"
            Hydrograph volume          1028.682    c.m"
                0.039     0.398     0.398     0.398"
" 40         HYDROGRAPH   Confluence    2"
"          7   Confluence "
"          2   Node #"
               Flow to Arkell Road "
            Maximum flow                  0.097    c.m/sec"
            Hydrograph volume           167.809    c.m"
                0.039     0.097     0.398     0.000"
" 40         HYDROGRAPH Copy to Outflow"
```



```
"          8   Copy to Outflow"
                0.039     0.097     0.097     0.000"
" 40         HYDROGRAPH   Combine    99"
"          6   Combine "
"         99   Node #"
               Flow from the Site "
            Maximum flow                  0.495    c.m/sec"
            Hydrograph volume          1196.491    c.m"
                0.039     0.097     0.097     0.495"
" 38         START/RE-START TOTALS 2"
"          3   Runoff Totals on EXIT"
            Total Catchment area                      2.580    hectare"
            Total Impervious area                     0.929    hectare"
            Total % impervious                       35.990"
" 19         EXIT"
```

APPENDIX B

WATER BUDGET CALCULATIONS

ARKELL NORTH (CONDO DEVELOPMENT)
SITE WATER BUDGET (INFILTRATION) ANALYSIS
Guelph, Ontario

Project Number: 42063-104
Date: October 10, 2018
Design By: JJM
File: Q:\42063\104\Water Balance\Copy of Water Balance Sep 2018-JJM.xls

	Value	Units	Source
Site Information			
Annual Precipitation	923.2	mm/yr	Canadian Climate Centre 1971-2000 Normals
Mean Annual Temperature	6.5	deg.C	Canadian Climate Centre 1971-2000 Normals
Latitude	43	deg N	Site Plan
Elevation	~335	m	Site Plan
Soil Information			
Surficial Soil	Sand and Gravel		Peto MacCallum Limited
Hydrologic Soil Group	B		MOE SWM Planning & Design Manual, 2003

		Precipitation	ET	Runoff	Infiltration	
Lawn, Flat	B	923.2	563	126	234	
Pstr/Shrb, Flat	B	923.2	578	86	259	
Mat. Frst., Flat	B	923.2	587	67	269	
Lawn, Flat	B	923.2	574	**122**	**227**	Amended Soil
Vegetated, Flat	B	923.2	574	87	262	Amended Soil
Roof/Drive		923.2	179	744	0	
Roof Infilt (25mm)				51.8	692	

Assume Dry Swale(DS) Runoff Reduction 45-85%
Ammended Topsoil (ATS) Runoff Reduction 10-15%

ANNUAL SITE INFILTRATION

Location	Pre-development			Post-development						Comments
				Pervious - Passive			Active Infiltration			
	Site Area	Infiltration Rate	Infiltration Volume	Site Area	Infiltration Rate	Infiltration Volume	Area Draining to Location	Infiltration Rate	Infiltration Volume	
(Landuse - Slope)	*ha*	*mm/yr/m²*	*m³/yr*	*ha*	*mm/yr/m²*	*m³/yr*	*ha*	*mm/yr/m²*	*m³/yr*	
101A Developed/Urban Area (Pervious)	1.37	234	3206							
101A Developed/Urban Area (Imperv)	0.27	0	0							
101B - Woodlot	0.33	269	892							
101C - Agrl./Pastr. Land	0.37	259	946							
Wetland Area	0.24	0	0							
				201 - Lawns/Boulevards	0.184	234	431				Municipal ROW and Street
				201 - Mun. R.O.W./Roofs/Dvwys	0.326	0	0				Fronting Townhomes
				202 - Lawn	0.083	234	194				SWM Block
				202 - Impervious	0.083	0	0				
				203 - Lawn	0.085	234	199				Condon Block to Pond
				203 - Impervious	0.200	0	0				
				204 - Lawn	0.057	234	133				Rear Yards of Townhomes
				204 - Impervious	0.055	0	0				Backing onto SWM Block
											Roof Area of Condo Block
				205 - Impervious	0.076	0	0	0.076	744	566	Apartments to Infiltration Gallery
				206 - Lawn	0.180	234	421				Uncontroled to TCWC
				206 - Impervious	0.068	0	0			51	0.10 Enhd. Swale RO Reduction =10%
				207 - Lawn	0.239	234	559				Uncontroled to Arkell Road
				207 - Impervious	0.068	0	0			51	0.10 Runoff Directed to ATS
				208 - Natural Area/Wetland Buffer	0.420	269	1130				Wetland/Woodlot Area
				208 - Wetland	0.456	0	0				
				Pervious Area Directed to EOP	0.409			0.409	40	165	Area to EOP Infiltration Gallery
				Impervious Area Directed to EOP	0.664			0.664	261	1732	Infiltrate x% of annual rainfall volume
											EOP Gallery: Sized for 30mm of Imp. Runoff
											Perv. Infil. %: 4%
					2.580		3067	1.149	1045	2563	Imp. Infil. %: 28%
Total Pervious	2.07	244	5044								
Total Impervious	0.51	0	0								
Total	**2.58**	**196**	**5044**					**2.58**	**466**	**5630**	
Torrance Creek SWS Target	2.58	150	**3864**								

Net Gain of Infilt'n over Pre-Dev	**587**	***m³/yr***
Net Surplus of Infilt'n over target	**1766**	***m³/yr***
	112%	

ANNUAL SURFACE RUNOFF TO WETLAND

Location	Pre-development			Post-development						Comments
				Local Runoff			LID Measure			
	Site Area	Runoff Rate	Runoff Volume	Site Area	Runoff Rate	Runoff Volume	Area Draining to Location	Runoff Rate	Runoff Volume	
	ha	*mm/yr/m²*	*m³/yr*	*ha*	*mm/yr/m²*	*m³/yr*	*ha*	*mm/yr/m²*	*m³/yr*	**Runoff Reduction**
101A Developed/Urban Area (Pervious)	1.37	126	1726							
101A Developed/Urban Area (Imperv)	0.27	744	2009							
101B - Woodlot	0.33	67	222							
101C - Agrl./Pastr. Land	0.37	86	314							
Wetland Area	0.24	744	1781							
				201 - Lawns/Boulevards	0.184	126	232				
				201 - Mun. R.O.W./Roofs/Dvwys	0.326	744	2426				
				202 - Lawn	0.083	126	105				
				202 - Impervious	0.083	744	618				
				203 - Lawn	0.085	126	107				
				203 - Impervious	0.200	744	1488				
				204 - Lawn	0.057	126	72				
				204 - Impervious	0.055	744	409				
											Runoff directed to
				205 - Impervious	0.076	744	566	0.076		-566	0.00 Private Infil. Gallery
				206 - Lawn	0.180	87	157				
				206 - Impervious	0.068	744	506			-51	0.10 Enhd. Swale RO Reduction =10%
				207 - Lawn	0.239	126	301				Runoff Directed to ATS
				207 - Impervious	0.068	744	506			-51	0.10 ATS RO Reduction = 10%
				208 - Natural Area/Wetland Buffer	0.420	67	281				
				208 - Wetland	0.456	744	3393				
				Site Area to Wetland (uncontrolled)	1.431		5145				
				End of pipe Infiltration Gallery			-1896				
				ntroled Site RO (From EOP Infil. Galle	1.07	332	3560				
				Uncontrolled Site RO	1.51	379	5711				
				Total Site RO	2.58	359	9271	1.507	-44	-667	211 Avg Imp. runoff rate to inf gall
					2.58		9271	**1.507**		**-667**	
								2.580		**8604**	Post-Dev Total
Total Pervious Total	2.07	109	2262								
Total Impervious	0.51	744	3791								
Total to Wetland	**2.58**	235	**6053**								

Net Gain of Runoff over Pre-Dev	**2551**	***m³/yr***
	142%	

Site Averaged Pre-Development Parameters

Average Annual Precipitation (mm)	923
Average Annual Evapotrans. (mm)	492
Average Annual Water Surplus (mm)	431
Average Annual Runoff (mm)	235
Average Annual Infiltration (mm)	196

Urban Lawn

Average Annual Water Surplus (mm)	349
Average Annual Infiltration (mm)	223

MONTHLY DISTRIBUTIONS

Post-Development Parameters			Urban Lawn (Per)			Impervious (Roofs/Road)		
Month	Mean Air Temp (deg. C)	Avg. Precip (mm)	ET (mm) [1]	Total Runoff (mm) [2]	INF	ET (mm) [3]	Total Surplus/Runoff (mm) [4]	Imperv. Infiltration (mm)
Jan	-7.6	56.4	2	5	50	9	48	48
Feb	-6.9	50.8	2	9	40	8	43	42
Mar	-1.3	72.1	8	20	45	10	62	62
Apr	5.9	78.3	31	12	35	19	59	59
May	12.3	79.9	71	9	0	21	59	59
Jun	16.9	76	108	10	-43	18	58	56
Jul	19.7	88.5	124	11	-46	19	70	66
Aug	18.6	95.9	103	11	-18	21	75	68
Sep	14.1	92.1	69	10	13	19	73	71
Oct	7.9	69.2	40	9	20	15	54	54
Nov	2.4	86.3	13	11	62	13	74	73
Dec	-4	77.7	3	8	67	8	69	69
		923.2	**574**	**126**	**223**	**179**	**744**	**727**

[1] Typical monthly Pervious Area ET Distribution (various calibrated continuous hydrologic model distributions)
[2] Typical monthly Rural Pervious Area Runoff Distribution (various calibrated continuous hydrologic model distributions)
[3] Typical monthly Impervious Area ET distribution for 2mm depression storage (calibrated continuous hydrologic model distribution)
[4] Remainder of Precip - ET

Month	Total Monthly Precipitation	Pre-development (Pervious)			Pre-development (Impervious)			Total Runoff Volume
		Area Draining to Location	Runoff Rate	Runoff Volume	Area Draining to Location	Runoff Rate	Runoff Volume	
	mm/mth/m²	*ha*	*mm/mth/m²*	*m³/mth*	*ha*	*mm/mth/m²*	*m³/mth*	
January	56.4	2.07	4	92	0.51	48	243	334
February	50.8	2.07	8	160	0.51	43	220	380
March	72.1	2.07	17	355	0.51	62	318	673
April	78.3	2.07	11	223	0.51	59	303	526
May	79.9	2.07	8	160	0.51	59	299	460
June	76	2.07	9	183	0.51	58	296	479
July	88.5	2.07	9	195	0.51	70	355	550
August	95.9	2.07	9	195	0.51	75	382	577
September	92.1	2.07	9	183	0.51	73	372	555
October	69.2	2.07	8	160	0.51	54	275	436
November	86.3	2.07	10	206	0.51	74	376	582
December	77.7	2.07	7	149	0.51	69	353	502
	923.2		**109**	**2262**		**744**	**3791**	**6053**

[1] Typical monthly Pervious Area RO Distbn. (various calibrated continuous hydrologic model distbns)

Post Develoment		Net Gain/Loss of Surface Runoff	Net Gain/Loss of Surface Runoff
Month	Total Monthly Runoff		
	m³/mnth	*m³/mnth*	%
January	635	301	90%
February	629	249	65%
March	996	323	48%
April	868	342	65%
May	528	69	15%
June	541	62	13%
July	637	87	16%
August	684	107	19%
September	651	96	17%
October	491	55	13%
November	1028	446	77%
December	936	433	86%
	8623	**2570**	**42%**
Net Gain of Runoff above Pre-Dev		**2570**	**42%**

Month	Post-development (Controlled RO)							
	Pervious			Impervious - Roof/Road			Total Runoff Volume TO EOP	Total Runoff Volume
	Area Draining to Location	Runoff Rate [2]	Runoff Volume TO EOP	Area Draining to Location	Runoff Rate	Runoff Volume TO EOP		
	ha	*mm/mth/m²*	*m³/mth*	*ha*	*mm/mth/m²*	*m³/mth*	*m³/mth*	*m³/mth*
January	0.41	5	21	0.66	48	316	337	337
February	0.41	9	37	0.66	43	286	323	323
March	0.41	20	81	0.66	62	414	495	495
April	0.41	12	51	0.66	59	395	445	445
May	0.41	9	37	0.66	59	390	427	139
June	0.41	10	42	0.66	58	385	427	144
July	0.41	11	44	0.66	70	463	507	172
August	0.41	11	44	0.66	75	498	542	191
September	0.41	10	42	0.66	73	485	526	175
October	0.41	9	37	0.66	54	359	395	126
November	0.41	11	47	0.66	74	490	537	537
December	0.41	8	34	0.66	69	460	494	494
	0.41	126	**515**	**0.66**	**744**	**4941**	**5457**	**3579**
			23%			130%		66%

Month	Post-development (Uncontrolled RO)						
	Pervious			Impervious - Roof/Road			Total Runoff Volume
	Area Draining to Location	Runoff Rate [2]	Runoff Volume	Area Draining to Location	Runoff Rate	Runoff Volume from Site	
	ha	*mm/mth/m²*	*m³/mth*	*ha*	*mm/mth/m²*	*m³/mth*	*m³/mth*
January	0.84	5	43	0.59	43	255	298
February	0.84	9	75	0.59	39	231	306
March	0.84	20	166	0.59	56	334	500
April	0.84	12	104	0.59	54	318	423
May	0.84	9	75	0.59	53	315	390
June	0.84	10	86	0.59	53	311	397
July	0.84	11	91	0.59	63	374	465
August	0.84	11	91	0.59	68	402	493
September	0.84	10	86	0.59	66	391	477
October	0.84	9	75	0.59	49	290	364
November	0.84	11	96	0.59	67	395	491
December	0.84	8	70	0.59	63	372	441
		126	**1057**	**0.59**	**673**	**3987**	**5044**
			47%			105%	
*Impervious and total runoff volumes exclude the runoff volume from the apartment roofs which is all being infiltrated.							**8623**
							142%

APPENDIX C

OGS SUMMARY

Stormceptor®

FORTERRA

Brief Stormceptor Sizing Report - Arkell Hills

Project Information & Location			
Project Name	Arkell Hills	Project Number	8243
City	Guelph	State/ Province	Ontario
Country	Canada	Date	7/26/2018
Designer Information		**EOR Information (optional)**	
Name	Jeff Lerch	Name	
Company	MTE	Company	
Phone #	519-743-6500	Phone #	
Email	jlerch@mte85.com	Email	

Stormwater Treatment Recommendation
The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	
Target TSS Removal (%)	80
TSS Removal (%) Provided	82
Recommended Stormceptor Model	STC 750

The recommended Stormceptor Model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary		
Stormceptor Model	**% TSS Removal Provided**	**% Runoff Volume Captured Provided**
STC 300	72	88
STC 750	82	95
STC 1000	83	95
STC 1500	83	95
STC 2000	86	98
STC 3000	87	98
STC 4000	90	99
STC 5000	90	99
STC 6000	92	100
STC 9000	94	100
STC 10000	94	100
STC 14000	96	100
StormceptorMAX	Custom	Custom

Stormceptor®

FORTERRA™

Sizing Details

Drainage Area	
Total Area (ha)	0.537
Imperviousness %	64.0

Rainfall	
Station Name	WATERLOO WELLINGTON A
State/Province	Ontario
Station ID #	9387
Years of Records	34
Latitude	43°27'N
Longitude	80°23'W

Water Quality Objective	
TSS Removal (%)	80.0
Runoff Volume Capture (%)	90.00
Oil Spill Capture Volume (L)	
Peak Conveyed Flow Rate (L/s)	
Water Quality Flow Rate (L/s)	

Up Stream Storage	
Storage (ha-m)	Discharge (cms)
0.000	0.000

Up Stream Flow Diversion	
Max. Flow to Stormceptor (cms)	

Particle Size Distribution (PSD)
The selected PSD defines TSS removal

Fine Distribution		
Particle Diameter (microns)	Distribution %	Specific Gravity
20.0	20.0	1.30
60.0	20.0	1.80
150.0	20.0	2.20
400.0	20.0	2.65
2000.0	20.0	2.65

Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules.
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed.
- For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

For Stormceptor Specifications and Drawings Please Visit:
http://www.imbriumsystems.com/technical-specifications