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

February 12, 2024
File: 1614-13338/29

Attention: Mr. Ethan Barrand
City of Guelph
1 Carden Street,
Guelph ON N1H 3A1

Dear Mr. Barrand

Reference: 220 Arkell Road, Guelph
Draft Plan of Subdivision – Third Submission
Revised Preliminary Servicing, Grading and Stormwater Management Report
Addendum No. 1 – Revised Section 5.0 Stormwater Management

Further to the Revised Preliminary Servicing, Grading and Stormwater Report dated April 4, 2023, we provide Addendum No. 1 as it relates to Section 5.0 Stormwater Management complete with updated Drawings, Figures and Appendix Materials in response to the City Second Submission comments dated September 11, 2023 as follows:

- Figure 2.0 Emergency Access Profile Interim & Ultimate
- Updated Section 5.0 from the Revised Preliminary Servicing, Grading and Stormwater Management Report
    - Figure 7.0 Existing Catchments
    - Figure 8.0 Proposed Catchments
    - Figure 9.0 Emergency Access Culvert Cross Section
    - Drawing No. C-100 Conceptual Servicing Plan, Rev. 2 (Appendix A)
    - Drawing No. C-410 Conceptual Stormwater Management Plan, Rev. 1 (Appendix A)
    - Appendix D: Stormwater Management, Stormwater Management Hydrologic Model, and Design Calculations

This Addenda serves to update the Stormwater Management section of the revised FSR (Section 5.0) in support of Draft Plan Approval and should be read in conjunction with the Infiltration Testing Results completed in 2023 (Stantec, February 7, 2024), the Revised Water Balance Memo (Stantec, February 7, 2024), and the comment response matrixes included with our Third Submission (dated February 12, 2024).

Reference: **220 Arkell Road, Guelph**
Draft Plan of Subdivision – Third Submission
Revised Preliminary Servicing, Grading and Stormwater Management Report
Addendum No. 1 – Revised Section 5.0 Stormwater Management

Should you have any questions related to the presented information, please contact the undersigned.

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Attachments: Noted above

c. Mr. Carson Reid / Mr. Spencer Reid, Rockpoint Properties Inc.
Ms. Nancy Shoemaker, J.D. Barnes Limited
Ms. Jessica Conroy, GRCA
Ms. Jackie Bellemare, Stantec Consulting

TEMPORARY ACCESS CULVERT TO BE REVIEWED AT DETAILED DESIGN TO VERIFY 100-YEAR PONDING LIMITS DO NOT EXTEND ONTO EXISTING LOTS AND MAJOR FLOWS ARE CONVEYED.

ASSUMED EXISTING HOME LOCATION

INFILTRATION GALLERY TO BE RELOCATED MIN. 5.0m FROM EXISTING HOME

EXISTING HYDRANT TO BE RELOCATED

3.0m BUFFER

1.2m

3.0m BUFFER

5.5m

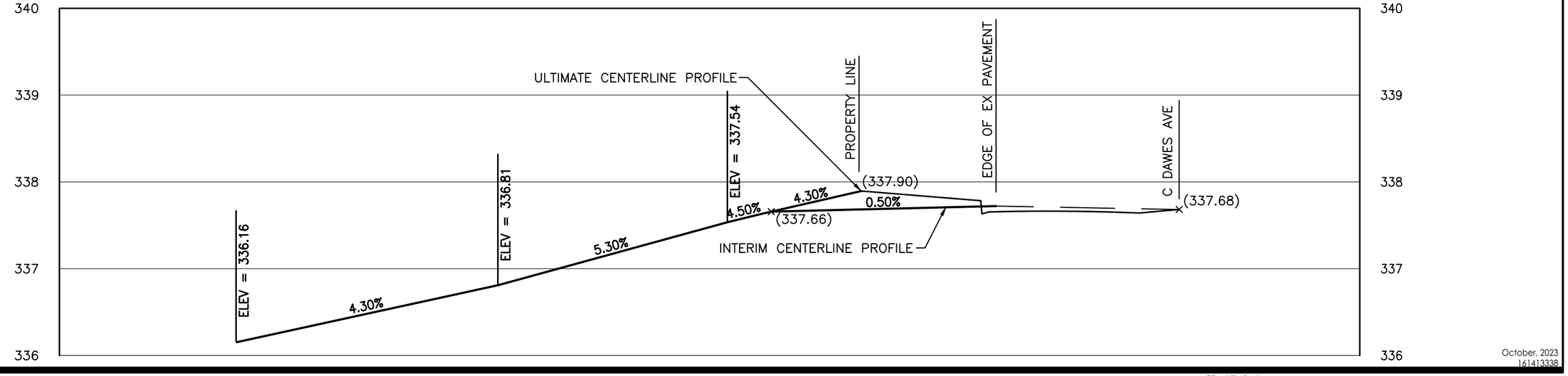
24.8m-300mmø CULVERT @ 1.25%

10.0M WIDE PAVED TEMPORARY EMERGENCY ACCESS

CHAIN LINK FENCE

BLOCK 12

MAX. 5.0%



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Legend

Scale

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

Client/Project
ROCKPOINT PROPERTIES INC.
220 ARKELL ROAD, GUELPH

Figure No.
2.0

Title
EMERGENCY ACCESS PROFILE
INTERIM & ULTIMATE

ORIGINAL SHEET - ANSI B

October, 2023
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5.0 STORMWATER MANAGEMENT

5.1 OVERVIEW

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

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

5.2 BACKGROUND

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

- *City of Guelph Development Engineering Manual*, City of Guelph, October 2023
- *City of Guelph Stormwater Management Master Plan: Municipal Class Environmental Assesssment – Final Report,* Aquafor Beech Ltd., March 2023
- *Letter Re: 220 Arkell Road – Response to Stormwater Management City Comments Dated July 19, 2018,* Stantec Consulting Ltd., November 5, 2018
- *Low Impact Development Stormwater Management Planning and Design Guide*, Credit Valley Conservation Authority and Toronto and Region Conservation Authority, 2010
- *Stormwater Management Planning and Design Manual (SWMPD Manual),* Ontario Ministry of the Environment, March 2003
- *Torrance Creek Subwatershed Study (TCSS), Management Strategy Addendum*, Totten Sims Hubucki et al, January 1999
- *Eramosa River Watershed Hydrology Study*, H.O. Schroeter and D.K. Boyd, 1998

5.3 DESIGN CRITERIA

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

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

5.4 EXISTING CONDITIONS

5.4.1 Geotechnical Information

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

Groundwater was measured in four (4) onsite boreholes with measurements during spring conditions in April 2017 ranging from 333.19 mASL in the north-west corner of the site to 337.10 mASL in the south-east corner of the site. Groundwater levels were also monitored from April 2017 to May 2018 as part of the *Hydrogeological Assessment* (Stantec, 2019) with the above reported levels representing the seasonally high levels for the site. Groundwater generally flows from east to west towards the Torrance Creek Swamp PSW. Additional groundwater levels were collected at potential infiltration facility locations through six new boreholes drilled in March 2022. The new borehole depths range from 6.1 to 9.4 m below ground surface (BGS) and each was equipped with a single monitoring well (i.e., MW101-22 to MW106-22). Data recorded by Leveloggers installed in MW101-22 to MW106-22 from March to November 2022 is presented in the *Revised Water Balance Calculations in Response to First and Second Submission Comments, Draft Plan Application – 220 Arkell Road, City of Guelph* (Stantec, 2024).

Infiltration rates were determined based on in-situ testing within 14 test pits located across the site in locations of proposed infiltration measures. Unfactored infiltration rates ranged from 33 mm/hr to 87 mm/hr. Applying the appropriate safety factor based on Table C2 of the *Low Impact Stormwater Management Planning and Design Guideline* (CVC, 2010), the design infiltration rates ranged from 10 mm/hr to 28 mm/hr. The minimum design infiltration rate in the footprint of the proposed infiltration measure was subsequently used in the corresponding LID design. For further details and results of the infiltration testing methods and results, refer to the *Infiltration Testing Results in Response to Second Submission Comments and in Support of the Third Draft Plan Submission – 220 Arkell Road, City of Guelph, Ontario* (Stantec, 2024).

5.5 STORMWATER MANAGEMENT DESIGN

5.5.1 Hydrologic Modeling

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

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

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

Return Period	Adjustment Factor (Table 4.6.3 in TCSS)	Last 24-hour Volume (mm)
2-year	0.345	81.8
5-year	0.425	100.7
10-year	0.495	117.3
25-year	0.525	124.4
50-year	0.597	141.5
100-year	0.627	148.6
Regional	1	237.0

Additionally, the 25 mm, 4-hour Chicago rainfall event was run to aid in the design of infiltration and erosion control measures for the site and the 100-year, 3-hr Chicago rainfall event was run as a check to ensure the SWM design functions under varying rainfall distributions.

5.5.1.1 Existing Conditions

The existing drainage conditions for the site were originally delineated in the TCSS and have been updated based on new topographic information. The original subcatchments are illustrated on Figure 4.6.1 from the TCSS (provided in Appendix D). The site is within three (3) of the TCSS subcatchments. A detailed topographic survey of the site was completed to improve the accuracy of the existing drainage patterns. An additional external area was defined for flows from the adjacent subdivision flowing across the site to Torrance Creek.

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

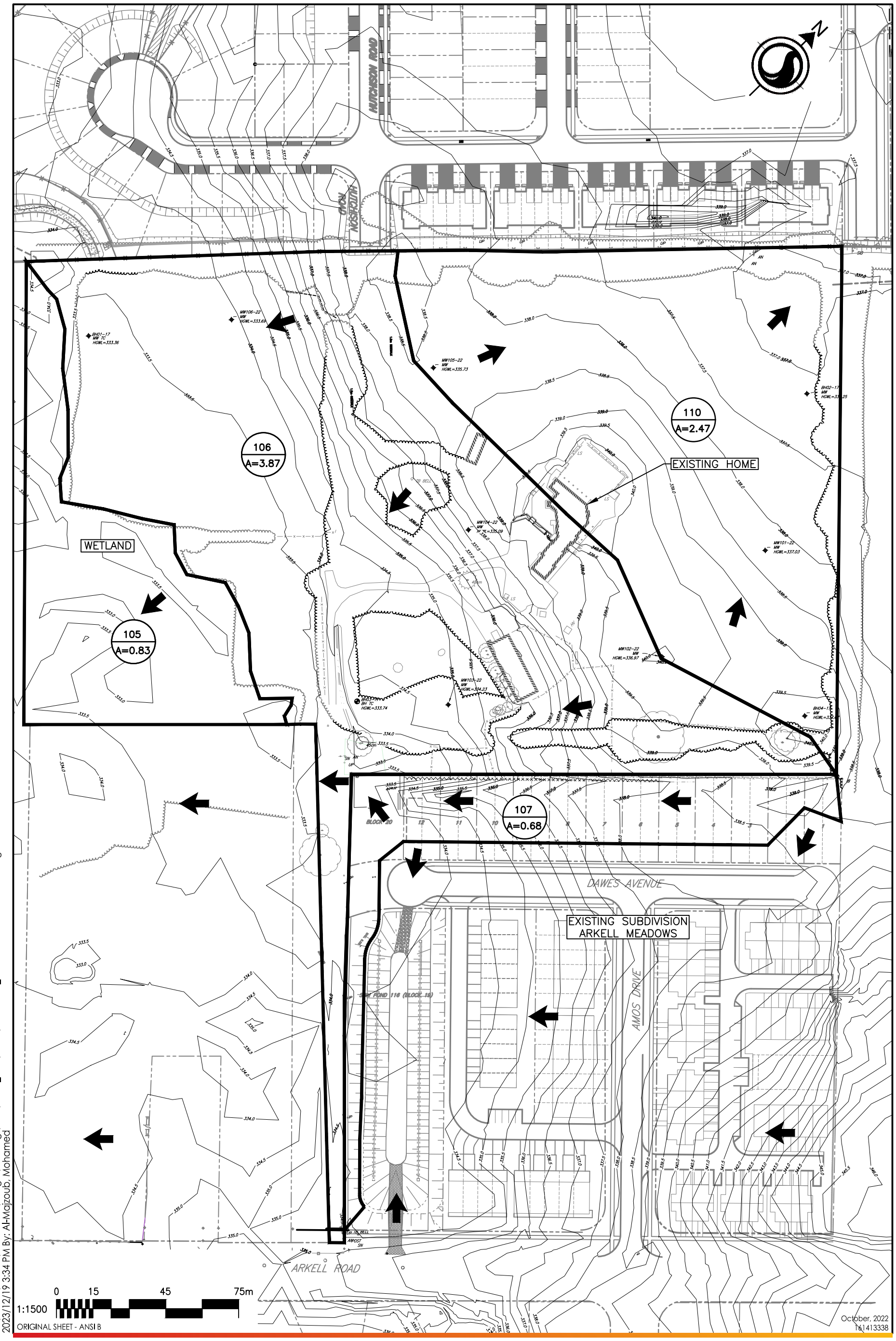
- Catchment 105: 0.83 ha of wooded/wetland area at the west end of the site draining to Torrance Creek
- Catchment 106: 3.87 ha of agricultural land, some forested and lawn coverage, and a residential property including a driveway and several buildings draining west to Torrance Creek
- Catchment 107: 0.68 ha of rooftops, rear yards, and Stormwater Management Facility (SWMF) embankment from the adjacent Arkell Meadows Subdivision draining across the existing driveway west to Torrance Creek
- Catchment 110: 2.47 ha of mostly agricultural and lawn area with a portion of the residential building draining east to the existing woodlot, eventually to Torrance Creek

5.5.1.2 Proposed Conditions

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

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

- Catchment 200: 2.42 ha of internal drainage from single family homes, Multi-Family Block, and roadway draining to the onsite SWMF
- Catchment 201A: 1.02 ha of naturalized area (ecological linkage) and rear lots draining uncontrolled, offsite to the neighbouring site
- Catchment 201B: 0.13 ha of naturalized area behind the buildings in the Multi-Block on eastern side of site that will remain untouched and drain uncontrolled, offsite to the neighbouring site



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Legend

- 100 / A=1.57 — CATCHMENT ID (FROM TCSS FIG 4.6.1) / CONTRIBUTING AREA (ha)
- MAJOR OVERLAND FLOOD ROUTE
- DRAINAGE BOUNDARY
- REGULATION LIMIT

Client/Project
ROCKPOINT PROPERTIES INC.
220 ARKELL ROAD, GUELPH

Figure No.
7.0

Title
EXISTING CATCHMENTS

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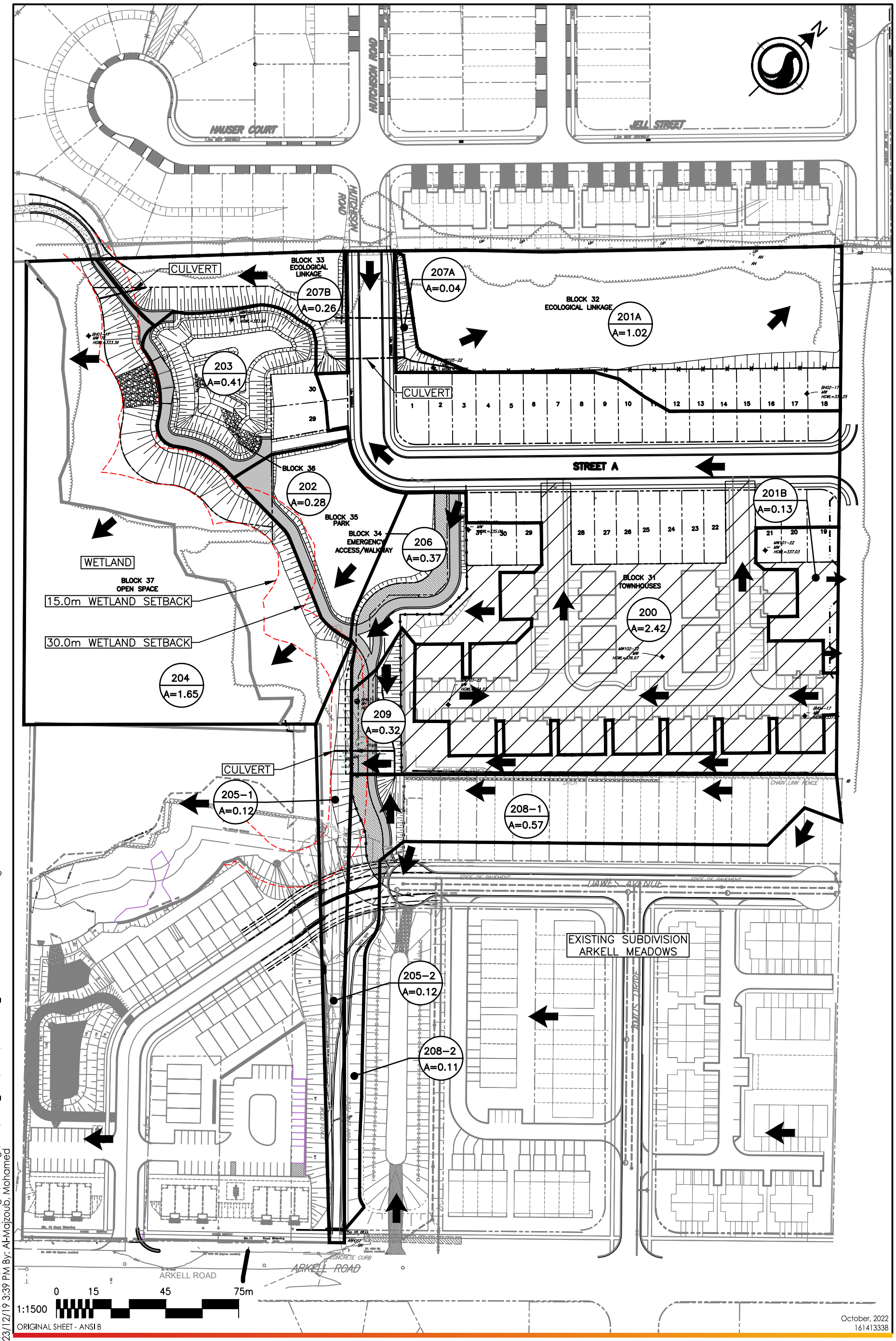

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Legend

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

Client/Project
ROCKPOINT PROPERTIES INC.
220 ARKELL ROAD, GUELPH

Figure No.
8.0

Title
PROPOSED CATCHMENTS

- Catchment 202: 0.28 ha of park area draining uncontrolled to Torrance Creek
- Catchment 203: 0.41 ha representing the onsite SWMF Block
- Catchment 204: 1.65 ha forested/wetland coverage including the required buffer distance remaining undeveloped and draining to Torrance Creek
- Catchment 205-1: 0.12 ha of the mostly naturalized/landscaped area (former driveway) draining uncontrolled west to Torrance Creek
- Catchment 205-2: 0.12 ha of the mostly naturalized/landscaped area (former driveway) draining uncontrolled west to Torrance Creek
- Catchment 206: 0.37 ha of asphalt pathway, park, and rear yards draining uncontrolled to Torrance Creek
- Catchment 207A: 0.04 ha of naturalized area (ecological linkage) draining uncontrolled, west through the proposed crossing culvert and subsequently to Torrance Creek (around proposed SWMF)
- Catchment 207B: 0.26 ha of naturalized area (ecological linkage) draining uncontrolled, west to Torrance Creek (around proposed SWMF)
- Catchment 208-1: 0.57 ha of rooftops and rear yards from the adjacent Arkell Meadows Subdivision draining across the existing driveway west to Torrance Creek
- Catchment 208-2: 0.11 ha of the SWMF embankment and trail from the adjacent Arkell Meadows Subdivision draining across the existing driveway west to Torrance Creek
- Catchment 209: 0.32 ha of rear lots from townhome units and trail connection draining to a low-lying area before spilling to Torrance Creek via a proposed culvert. Ponding occurs in the low-lying area, similar to existing conditions, promoting infiltration and delaying flows to the wetland to mimic the current flow regime.

5.6 STORMWATER MANAGEMENT STRATEGY

The proposed stormwater management strategy adheres to the Guidelines as presented in the *SWMPD Manual* (2003) and *City of Guelph Development Engineering Manual* (October 2023).

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

and design of the SWM components are described in the following sections. All design calculations are provided in Appendix D.

5.6.1 Water Quality Control

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

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

The proposed OGS unit (First Defense (FD-8HC) or approved equivalent – must meet the Canadian Environmental Technology Verification Program per City of Guelph requirements) has been sized to provide 70% TSS removal for the contributing area (refer to OGS Sizing Calculations in Appendix D); however, it is understood that the City of Guelph assumes OGS units only provide a long-term TSS removal of 50% due to long-term maintenance concerns. Therefore, following treatment by the OGS, runoff flows to a forebay at the inlet of the SWMF to provide further treatment (as well as to isolate sediment to facilitate future cleanouts as stated earlier). Following the forebay, the infiltration cell of the SWMF will provide the remaining required water quality treatment. Per Table 3.2 in the *Stormwater Management Planning and Design Manual* (MECP, 2003) the required water quality storage volume for an infiltration basin is 88 m³ for 58% impervious coverage of a 2.83 ha area. The basin design includes 256 m³ of infiltration storage, so the facility will provide 80% TSS removal while the OGS and forebay are more provided to to isolate sediment deposition and prevent clogging of the infiltration cell.

During the non-winter months, the infiltration cell of the SWMF will provide infiltration of the 25 mm event (discussed in subsequent sections), which accounts for over 80% of annual precipitation volume, and will provide over 80% removal of TSS to the downstream system. During the winter months, the SWMF will likely still provide this infiltration and meet the required TSS removal through infiltration/volume reduction, but in the instances where the ground is still frozen but runoff is occurring, surface discharge downstream may occur in events smaller than the 25 mm event. The ponding depth prior to surface discharge will be around 0.3 m in the infiltration cell and the SWMF will therefore function more as a constructed wetland as vegetation should be established throughout the infiltration cell. As per MECP guidance, the total unitary volume requirement for

enhanced water quality treatment in a wetland is 108 m³/ha for 58% impervious coverage. Based on the drainage area of 2.83 ha and subtracting the 40 m³/ha extended detention volume leads to a total permanent pool requirement of 192 m³. The infiltration cell has 256 m³ of storage capacity and therefore would exceed this requirement in the case that the infiltration cell were full. Therefore, the SWMF will provide 80% TSS removal to the downstream system in winter months as well as the remainder of the year with the OGS and forebay providing pre-treatment to reduce sedimentation build up in the infiltration cell.

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

5.6.2 Water Quantity Control

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

The proposed EOP SWMF is located at the northwest corner of the site, adjacent to the Torrance Creek Swamp PSW and provides attenuation for runoff from the majority of the developed site including roadways, driveways, rooftops and landscaped coverage. The design uses an infiltration basin SWMF configuration complete with a forebay and upstream OGS unit to provide an enhanced level of water quality control (as discussed above) with a maximum ponding elevation of approximately 336.69 m during the 100-year return-period rainfall event.

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

Table 2: Existing Conditions Flow Rates from TCSS GAWSER Model

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

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

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

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

Using the flow rates from GAWSER and the above equation, the following targets were utilized to assist in design of the SWMF. Although the drainage area to the SWMF is 2.83 ha, 1.55 ha was used in establishing the targets as this is the proposed drainage area that exists within the existing Catchment 106. The other portion of the proposed area to the SWMF is within Catchment 110 and has not been accounted for in the targets. Table 3 below outlines the target release rates from the SWMF, with proposed flow rates documented in subsequent sections and summarized in Table 5.

Table 3: Target Release Rates for SWMF Design

Developed Area with Existing TCSS Catchment 106 to proposed SWMF	Transposed Flow Rates for Existing Catchment 106 within Developed Area draining to Pond			
	2-year	5-year	25-year	100-year
1.55	0.012	0.019	0.028	0.036

The preliminary outlet structure for the SWMF consists of a low flow orifice to meet the peak flow targets established above. An overflow emergency weir is provided in the event the orifice gets clogged or for rainfall events larger than the 100-year event. The low flow orifice is elevated 0.3 m above the infiltration cell of the SWMF to allow for infiltration of the 25 mm runoff event prior to surface discharge downstream. Details of the outlet structure are provided in Table 4 and shown on the SWMF Drawing C-410, with further details and calculations provided in Appendix D.

Table 4: SWMF Design Characteristics

Parameter	Basin Characteristics
Total Contributing Area (Including Major Flow Drainage)	2.83 ha
Total Contributing Area req. Quality Control	2.83 ha
Total Percent Impervious	58%
Bottom Elevation of forebay	334.00 m
Bottom Elevation of Infiltration Cell	335.00 m
Infiltration Depth (m)	0.30 m
Infiltration Volume provided / required*	256 m^3 / 184 m^3
Facility Top Elevation	337.00 m
High Water Level (100-Year Storm Event)	336.69 m
Freeboard Provided Above High Water Level	0.31 m
Orifice Control Outlet	
Orifice 1 Diameter	75 mm
Orifice 1 Invert Elevation	335.30 m
Emergency Weir	
Spillway Width	5 m
Spillway Invert	336.70 m
Side slopes	10:1
* Provided volume is the volume provided in the bottom 0.30 m of the SWMF infiltration cell Required volume calculated per “End-of-Pipe Infiltration” section discussion, below	

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

Table 5: SWMF Operating Characteristics

	Rainfall Event							
	25 mm	**2-year**	**5-year**	**10-year**	**25-year**	**50-year**	**100-year**	**Regional**
Existing Peak Flow Rate to Torrance Creek (m^3/s)	**0.069**	**0.017**	**0.058**	**0.100**	**0.121**	**0.176**	**0.202**	**N/A**
Proposed Peak Flow to SWMF (m^3/s)	0.256	0.082	0.113	0.148	0.162	0.197	0.211	0.356
SWMF Target Release Rate (m^3/s)	N/A	0.012	0.019	0.025	0.028	N/A	0.036	N/A
Proposed Peak Flow from SWMF (m^3/s)	0.006	0.010	0.011	0.012	0.013	0.014	0.014	0.351
Proposed Peak Flow from Total Site to Torrance Creek (m^3/s)	**0.038**	**0.018**	**0.034**	**0.065**	**0.079**	**0.121**	**0.139**	**0.675**
Maximum Active Storage Volume (m^3)	324	1,036	1,390	1,702	1,836	2,169	2,313	2,523
Maximum Active Ponding Depth (m) (above infiltration elevation)	0.28	0.76	0.95	1.11	1.17	1.33	1.39	1.47
Maximum Active Ponding Elevation (m)	335.58	336.06	336.25	336.41	336.47	336.63	336.69	336.77
Active Storage Drawdown Time (hours) (excluding infiltration)	23.6	48.5	57.8	65.2	68.2	75.4	78.3	79.2

As shown in Table 5, the peak flow rates from the proposed SWMF are lower than the target release rates established from the TCSS and peak flow rates from the overall site are equal to or less than pre-development levels for all storm events, with the exception of the 2-year event. Due to the low target flow rates, even with a 75 mm orifice plate there is a negligible increase of 0.001 m^3/s during the 2-year event. As lot-level and EOP infiltration has not been included in the MIDUSS modelling, this estimate is conservative and is anticipated to be lower than modelled; therefore, the proposed SWMF design onsite meets the water quantity requirements for Torrance Creek.

In addition to the TCSS 48-hour storm events that were run for the design of the SWMF, the 100-year, 3-hour Chicago storm event was also run to ensure the design functions as intended under a different storm distribution. The MIDUSS modelling is included for this run, and it shows that the post-development peak flow rates for the 100-year, 3-hour event are reduced from pre-development values and that the volume in the SWMF is significantly less than that used during the 100-year 48-hour storm documented in the table above. Therefore, the TCSS storm events are assumed to be more conservative in the SWMF design and the site will still function as designed under other storm distributions.

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

Table 6: Peak Flow Rates East to the Existing Woodlot

	Rainfall Event						
	25 mm	**2-year**	**5-year**	**10-year**	**25-year**	**50-year**	**100-year**
Existing Peak Flow Rate to the Existing Woodlot (m^3/s)	0.022	0.005	0.028	0.052	0.062	0.089	0.103
Proposed Peak Flow to the Existing Woodlot (m^3/s)	0.010	0.003	0.013	0.024	0.029	0.041	0.048

5.6.3 Thermal Mitigation

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

5.7 INFILTRATION ASSESSMENT & WATER BALANCE

5.7.1 Lot Level and Centralized Infiltration

Based on the results of the *Geotechnical Investigation* (Stantec 2019), site soils generally consist of a mix of glacial till to sand which are both generally conducive to infiltration practices. As discussed in previous sections, the resulting design infiltration rates for these soils based on in-situ testing ranged from 10 – 28 mm/hr.

Rear yard soakaway pits infiltrating roof water are proposed for all single-family homes within the subdivision. Similarly, centralized infiltration trenches are proposed for the Multi-Family Block to direct shared roof areas to recharge locations. Rooftop runoff is considered ‘clean’ and does not require water quality treatment prior to infiltrating. As such, roof leaders from all homes are to be connected to the soakaway pits or centralized trenches via direct connection or via surface flow with an overflow provided

at grade for single family lots or an overflow connection to the storm sewer for the centralized trenches. Specific connection details will be provided at detailed design. These galleries have been designed to infiltrate the 25 mm runoff volume in under 48 hours and to ensure 1 m separation from the high groundwater level. Soakaway pits have been sized assuming 40% of the lot is building coverage, which leads to an estimated rooftop area of 120 m² for the single-family lots. This value was taken from *Section 5 – Residential Zones* of the City of Guelph Zoning Bylaw. For the Multi-Family Block, the centralized galleries have been sized based on rooftop areas from the latest preliminary Site Plan layout.

All Single-Family galleries were sized assuming an infiltration rate of 10 mm/hr, which corresponds to the lowest design infiltration rate from the in-situ testing at the single-family gallery locations. All multi-block galleries were sized assuming an infiltration rate of 16 mm/hr, which corresponds to the lowest design infiltration rate from the in-situ testing at the test pits in the approximate locations of the proposed multi-block galleries. The EOP infiltration system was sized assuming an infiltration rate of 16 mm/hr, based on results of the in-situ testing at the test pit locations in the proposed SWMF area. Gallery locations, along with separation to high ground water levels, are shown on Drawing C-400, while gallery sizing for the single family lots are found in Appendix D.

5.7.2 End-of-Pipe Infiltration

End-of-pipe infiltration will occur in the infiltration cell of the SWMF. The infiltration cell is sized to infiltrate the 25 mm runoff volume from the site, after accounting for rooftop infiltration, prior to surface discharge downstream. The total runoff volume during the 25 mm event from the MIDUSS modelling to the SWMF is approximately 377 m³ (2.42 ha x 25mm runoff volume x 0.601 (MIDUSS runoff coefficient for catchment 200) + 0.41 ha x 25 mm runoff volume x 0.133 (MIDUSS runoff coefficient for catchment 203)). Upstream rooftop infiltration will account for infiltration of 194 m³ of this runoff volume (0.836 ha of rooftop x 25mm runoff x 0.926 (MIDUSS runoff coefficient for impervious surface in catchment 200)), leaving 184 m³ to infiltrate in the EOP system during the 25 mm event. As stated earlier, the outlet orifice will be placed 0.30 m above the bottom elevation of the infiltration cell, thereby providing 256 m^3 of storage for infiltration. This exceeds the required 184 m³ to infiltrate the remaining 25 mm of runoff from the site, while providing some additional storage if some upstream galleries do not function as intended. Per the City of Guelph Development Engineering Manual (October 2023), surface infiltration features should have a ponding depth of no more than 0.6 m. The 0.3 m ponding depth for the infiltration portion of the pond is below this required depth. Deeper ponding depths will occur in the infiltration cell during larger storm events; however, as there is a surface outlet for these storm events which will drawdown the volumes/depths quickly and these events occur infrequently, compaction due to excessive ponding depths is not considered to be a concern.

The elevation of the infiltration cell of the SWMF will be 335.00 m, which based on the latest spring high groundwater level data from MW 106-22 of 333.69 m, achieves a separation of 1.31 m. Based on the groundwater contours as shown in the latest *Revised Water Balance Calculations in Response to First and Second Submission Comments, Draft Plan Application – 220 Arkell Road, City of Guelph* (Stantec, 2024) and on the profile of the SWMF on Drawing C-410, water levels increase moving west to east away

from the wetland. At the far east corner of the SWMF, there is a small portion of the SWMF that has slightly less than 1 m of separation to the high groundwater level of approximately 0.9 m. As the majority of the SWMF achieves > 1 m separation to the high groundwater level, this small area on the eastern side is not a concern. This area of <1 m of separation will also only occur during the spring high groundwater levels. Details on the infiltration system are included on Drawing C-410 as well as in Appendix D.

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

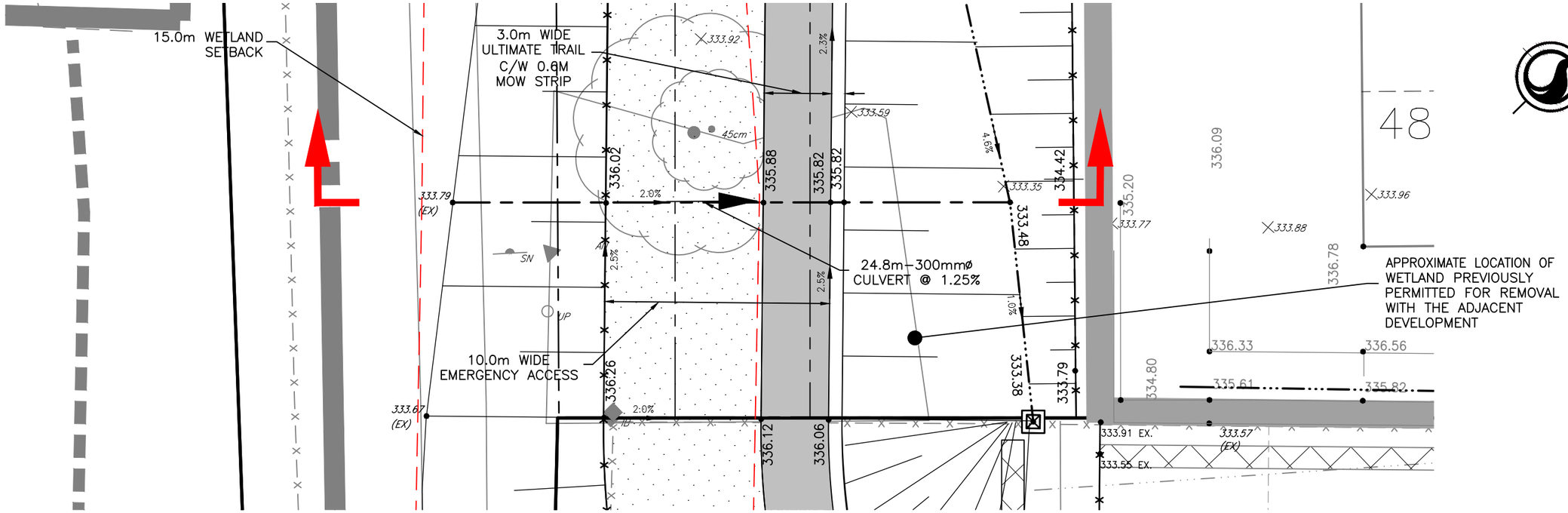
The proposed infiltration cell does not incorporate a winter by-pass and will therefore provide infiltration year-round. The subject property is located within WHPA 8 as identified on Figures 3.1 and 5.2 in the *Stormwater Management Masterplan: Appendix E – Infiltration Policy Recommendations* (Aquafor Beech, 2022) and does not contain any high-risk activities. Therefore, as per Sections 5 and 6 in the *Infiltration Policy Recommendations*, year-round infiltration is permitted on the subject lands. This was also confirmed through discussions with City of Guelph staff as per the email correspondence dated November 13, 2023 (included in Appendix D).

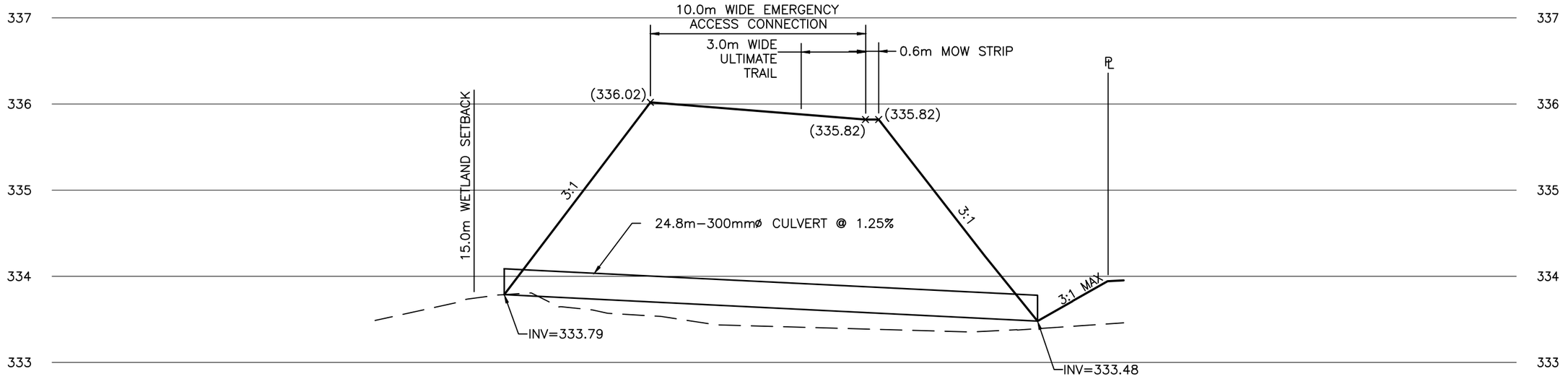
5.7.3 Water Balance Analysis

The preliminary infiltration target for this area per Section 6.2.2 of the TCSS is 150 mm/yr; however, a more detailed site water balance was performed to determine a more accurate site-specific value as well as determine the site runoff to the nearby wetland. Water balance calculations were completed as part of the *Hydrogeological Assessment* (Stantec 2019) and updated per the latest *Revised Water Balance Calculations in Response to First and Second Submission Comments, Draft Plan Application – 220 Arkell Road, City of Guelph* (Stantec, 2024) for pre- and post-development conditions to quantify infiltration volumes at the Site and confirm the recharge function.

Under pre-development conditions, the average annual volume of infiltration is estimated at 15,433 m^3/yr and while the average annual volume of runoff is split between water flowing to south-west towards Torrance Creek Swamp and north-east towards the woodlot. Pre-development condition runoff towards Torrance Creek is estimated at 8,706 m^3/yr, while runoff towards the woodlot is estimated at 4,035 m^3/yr. Under post-development conditions without additional infiltration measures, the increase in impervious surfaces results in a projected infiltration volume deficit of 3,860 m^3/year with a runoff surplus to the Torrance Creek Swamp of 16,404 m^3/yr. Runoff to the woodlot decreases by 2,445 m^3/yr due to site grading changes. Details of the calculations and results can be found in the *Revised Water Balance Calculations in Response to First and Second Submission Comments, Draft Plan Application – 220 Arkell Road, City of Guelph* (Stantec, 2024).

To reduce the infiltration deficit and establish a recharge balance, rear yard soakaway pits, centralized infiltration trenches, and the infiltration basin as discussed above will be implemented.





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2023/03/03 2:27 PM By: Al-Majzoub, Mohamed

ORIGINAL SHEET - ANSI B

October, 2022
161413338

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Legend

Scale

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

Client/Project
ROCKPOINT PROPERTIES INC.
220 ARKELL ROAD, GUELPH

Figure No.
9.0

Title
EMERGENCY ACCESS CULVERT CROSS SECTION

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

Table 7 - Results of Site Water Balance

Site Condition	Annual Volumes (m^3/yr)		
	Runoff to Torrance Creek Swamp	Runoff to Woodlot	Infiltration across the Site
Pre-Development	8,706	4,035	15,540
Post-Development (unmitigated)	25,111	1,590	11,680
Post-Development (with Infiltration)	11,346	1,590	25,445

By implementing the recharge augmentation practices discussed above, there is a recharge surplus across the site of 9,905 m^3/yr with a runoff surplus to Torrance Creek of 2,640 m^3/yr and a runoff deficit of 2,445 m^3/s to the woodlot. The infiltration target from the TCSS of 150 mm/yr is exceeded as the proposed infiltration with mitigation measures is 363 mm/yr.

5.7.4 Consideration of Multi-Block

At this stage in the design, the Site Plan for the Multi-Family Block is unknown. It is assumed that all rooftop areas within the Block can and will be directed to centralized infiltration trenches to achieve the intended recharge target. At a minimum, the Multi-Family Block must infiltrate all rainfall events up to and including the 25 mm storm from all rooftops (assumed rooftop coverage is 4,400 m^2) for a total average annual rooftop infiltration volume of 3,250 m^3/yr. This is the target annual recharge volume for the Multi-Block and should be met at the Site Plan Approval Stage.

This target does not include the pervious infiltration in the Multi-Block achieved through passive infiltration at an assumed impervious percentage of 75%. If the impervious percentage is higher at the Site Plan design stage, further infiltration measures will be required to offset any increase in impervious coverage. In the current water balance, the pervious infiltration in the Multi-Block accounts for approximately 770 m^3/year of recharge (based on approximately 0.40 ha of pervious coverage in 1.58 ha Multi-Block), for a total site target of 4,020 m^3/yr when combined with rooftop infiltration. Refer to Appendix D for calculations as well as the detailed Water Balance Calculations presented in the *Revised Water Balance Calculations in Response to First and Second Submission Comments, Draft Plan Application – 220 Arkell Road, City of Guelph* (Stantec, 2024).

5.7.5 Major Overland Flow

Major overland flow through the proposed subdivision will occur along the ROWs with storm sewers providing conveyance of the minor events. A check was completed to ensure that major flows can

adequately be conveyed to the SWMF. The flow route to the SWMF was noted to be the most downstream point prior to the pond and likely pinch point for flows, so this was the only location checked.

Although the 100-year, 3-hour Chicago storm wasn't used to design the SWMF, it produced the highest peak flow rates into the pond and was therefore used to check the capacity of the overflow route. Any flow through storm sewers was conservatively ignored at this stage, when in reality the storm system will convey a significant portion of flow. FlowMaster was used to model the inlet swale to the pond with the following characteristics of the overland flow path and results. FlowMaster output files can be found in Appendix D.

Table 8: Overland Flow into SWMF

Bottom Width (m)	Side Slopes (H:V)	Top Width (m)	Longitudinal Slope (m/m)	Flow Rate (m^3/s)	Flow Depth (m)
4	3	6	0.009	1.01	0.19

5.7.6 Surface Flow to PSW through Emergency Access Road

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

Under current conditions along the existing driveway, there is a low-lying area east of the existing driveway, at the location of the proposed culvert under the Emergency Access Road. At this location, surface water ponds allowing for infiltration and evaporation prior to spilling west to the wetland (contour 333.5 m). Given the location of the proposed Emergency Access Road and ultimate trail alignment illustrated on Figure 9.0, surface water runoff from Catchment 206 flows west through a culvert and under the road/trail to the PSW. As outlined in *Re: 220 Arkell Road – Response to Stormwater Management City comments dated July 19, 2018* (Stantec, 2018), a culvert is proposed to convey surface flows under the Emergency Access Road to maintain this flow west under proposed conditions; however, to attenuate surface flows to address City of Guelph concerns (i.e., reduce surface flow to the wetland and increase evapotranspiration and infiltration), the proposed culvert is reverse sloped to encourage ponding and infiltration, similar to the existing hydrologic regime, and to match existing grades on the site (natural depression within the site). The specific details of this ponding area will be finalized at detailed design.

APPENDIX A

Conceptual Servicing Plan (Drawing No. C-100)

Conceptual Stormwater Management Plan (Drawing No. C-410)

KEY PLAN Scale : NOT TO SCALE

HAUSER COURT

JELL STREET

HUTCHISON ROAD

BLOCK 109 PARK

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

VICTORIA PARK VILLAGE SUBDIVISION

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

	ELEV.	COVER
ROAD	337.62	
SANITARY	333.50	4.12

1800mmø CSP RISER FULLY PERFORATED (50mmø) C/W GALVANIZED HALF OPENING HINGED TOP WELDED TO CSP. FIRST ROW OF HOLES AT ELEV.=335.00m T/G=334.80 INV=333.30

MATCH EXISTING

MATCH EXISTING LIMIT

BLOCK 33 ECOLOGICAL LINKAGE

BLOCK 118 (0.300 RESERVE)

BLOCK 32 ECOLOGICAL LINKAGE

BLOCK 117 (0.300 RESERVE)

50.0m ECOLOGICAL LINKAGE

APPROXIMATE LOCATION OF WILDLIFE CULVERT

	ELEV.	COVER
ROAD	336.90	
SANITARY	333.79	3.11

	ELEV.	COVER
ROAD	338.02	

FUT. CULVERT

INFILTRATION SWM FACILITY

DRAINAGE CULVERT

	ELEV.	COVER
ROAD	337.03	
STORM	335.38	1.65
SANITARY	333.98	3.05

	ELEV.	COVER
STORM	335.00	0.5

30

29

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

	ELEV.	COVER
ROAD	337.99	
STORM	336.13	1.86
SANITARY	334.93	3.06

	ELEV.	COVER
ROAD	339.81	
SANITARY	336.81	3.00
STORM	337.91	1.85

4.0m WIDE ACCESS C/W 0.6m MOW STRIPS

STREET A

FUTURE STREET

BLOCK 36

	ELEV.	COVER
ROAD	337.20	
STORM	335.52	1.68
SANITARY	334.13	3.07

BLOCK 35 PARK

BLOCK 34 EMERGENCY ACCESS/WALKWAY

TORRANCE CREEK SWAMP (PSW)

BLOCK 37 OPEN SPACE

31 30 29

28 27 26 25 24 23 22

	ELEV.	COVER
ROAD	339.44	
STORM	337.57	1.87
SANITARY	336.45	3.00

21 20 19

TREE PROTECTION SILT FENCE

	ELEV.	COVER
HP		
ROAD	340.47	

8.0m WIDE PROPOSED WALKWAY BLOCK

BLOCK 31 TOWNHOUSES

	ELEV.	COVER
ROAD	338.09	
STORM	336.40	1.69
SANITARY	335.37	2.72

	ELEV.	COVER
ROAD	339.64	
STORM	338.16	1.48
SANITARY	336.92	2.72

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

30.0m WETLAND SETBACK

15.0m WETLAND SETBACK

10.0m WIDE PAVED TEMPORARY EMERGENCY ACCESS

4.0m WIDE ULTIMATE MAINTENANCE ACCESS LIMIT

	ELEV.	COVER
ROAD	338.41	
SANITARY	335.61	2.80

SURVEYED WETLAND LIMIT

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

CULVERT

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

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

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

3:1 SLOPE TO MATCH EXISTING

15.0m WETLAND SETBACK

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

INFILTRATION GALLERY TO BE RELOCATED MIN. 5.0M FROM EXISTING HOME

ARKELL MEADOWS SUBDIVISION

	ELEV.	COVER
ROAD	339.79	
SANITARY	337.09	2.70

STREET C

STREET D

DAWES AVENUE

EDGE OF PAVEMENT

SWM POND 116 (BLOCK 19)

ALMOS DRIVE

ARKELL ROAD

CONCRETE CURB

INSERT

MATCH LINE (SEE INSERT THIS SHEET)

Stantec

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Notes

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

Legend

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

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

	ELEV.	COVER
LP		
ROAD	300.82	ROAD ELEVATION
STORM	297.88	2.8 COVER OVER SEWER
SANITARY	297.11	3.4 SEWER OBVERT ELEVATION

BHF HGWL BORE HOLE, GROUND WATER LEVEL

INFILTRATION GALLERY

2.	RESPONSE TO 2ND SUBMISSION COMMENTS	MALM	KRB	23.12.20
1.	SECOND SUBMISSION	MALM	KRB	23.03.03
0.	FIRST SUBMISSION	MHH	KRB	19.05.30
Revision		By	Appd.	YY.MM.DD
File Name: 161413338_C-UC-Concept.dwg		Dwn.	Chkd.	Dsgn. 23.12.19 YY.MM.DD

Permit-Seal

Professional Engineers Ontario

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

PRELIMINARY NOT FOR CONSTRUCTION

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

Client/Project

ROCKPOINT PROPERTIES INC.

220 ARKELL ROAD

Guelph, ON

Title

CONCEPTUAL SERVICING PLAN

Project No.	Scale	Drawing No.	Sheet	Revision
161413338	1:750 (0 7.5 22.5 37.5m)	C-100	2	

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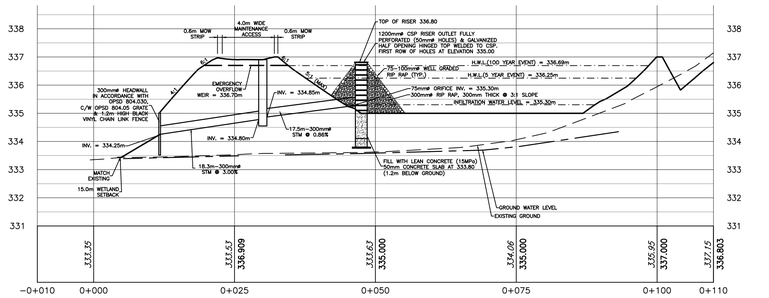
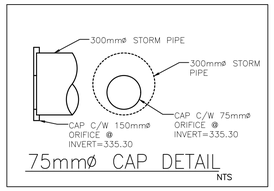


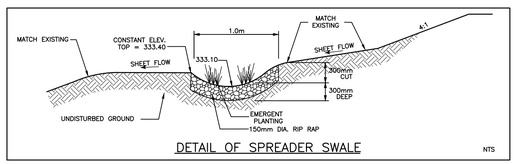


75mmø CAP DETAIL
NTS

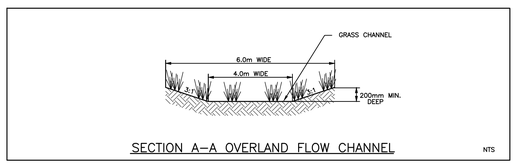
RIP-RAP GRADATION TABLE
100mm RIP-RAP 175mm THICK (MTO)
100% SMALLER THAN 150mm
AT LEAST 20% LARGER THAN 120mm
AT LEAST 50% LARGER THAN 100mm
AT LEAST 80% LARGER THAN 60mm

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

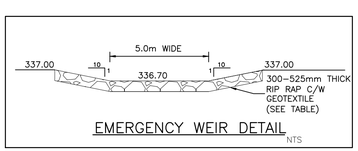
RIP-RAP DETAIL
NTS



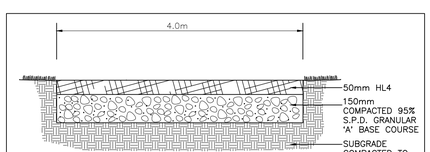
DETAIL OF SPREADER SWALE
NTS



SECTION A-A OVERLAND FLOW CHANNEL
NTS

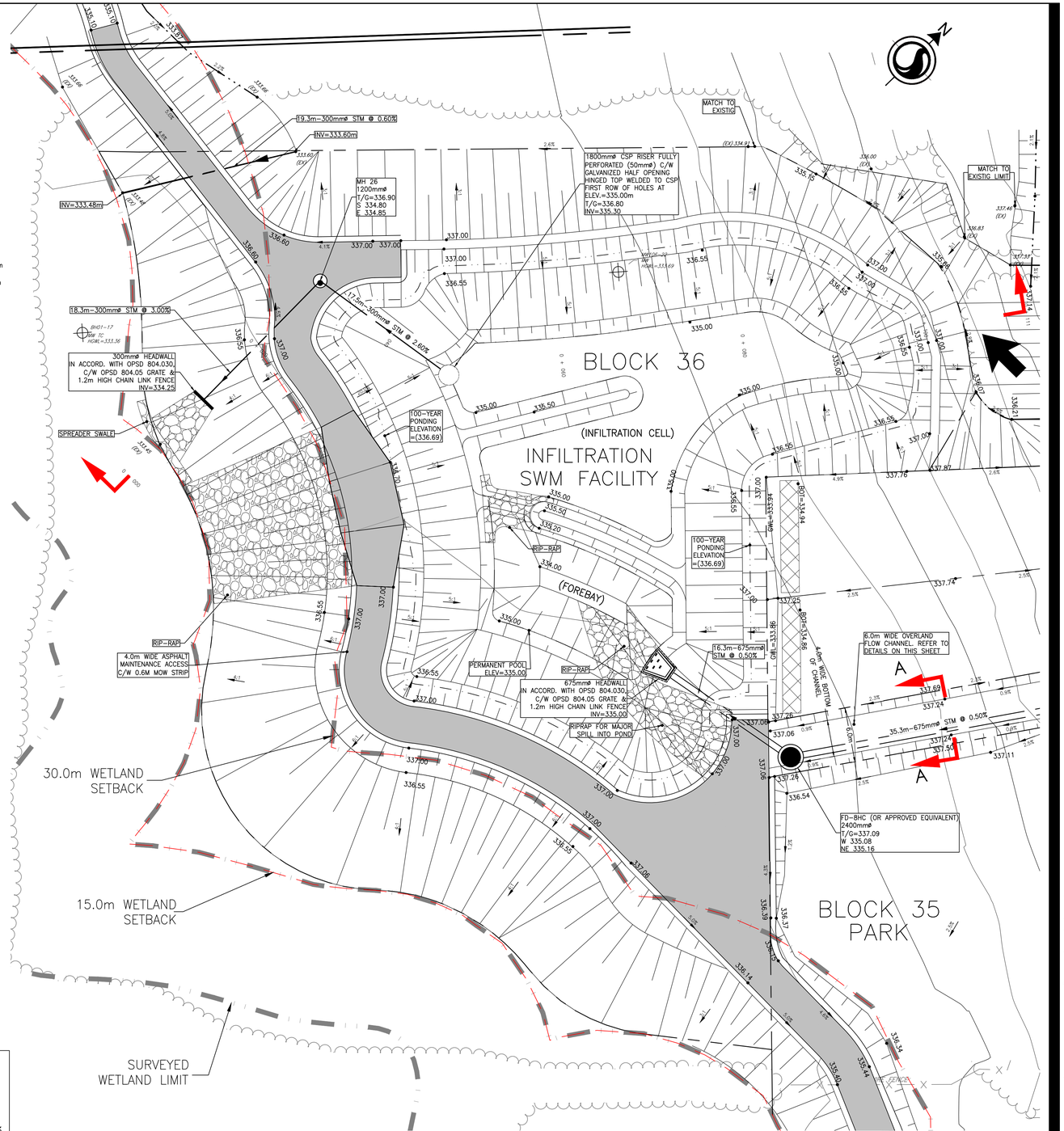


EMERGENCY WEIR DETAIL
NTS



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

ASPHALT MAINTENANCE ACCESS/WALKWAY DETAIL
NTS



NOTE:
POND SLOPES AND BOTTOM, FROM POND BOTTOM (334.00) TO 0.5m ABOVE PERMANENT POOL (335.00) TO ELEVATION 335.50 WITHIN THE FOREBAY LINED WITH 0.45m THICK ANTI SEEPAGE LINER. FINAL THICKNESS CONFIRMED FOLLOWING SOURCING AND TESTING OF MATERIAL BY GEOTECHNICAL CONSULTANT. ANY LOCALIZED SAND LAYERS CONTACTED ABOVE THE PERMANENT POOL WERE ALSO TO BE LINED.

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Notes
1. BENCHMARK:
   NID-27 RWW376.3
   GUELPH BENCHMARK #392. BENCHMARK PLATE ON TRAFFIC CONTROL BOX LOCATED ON SOUTH WEST CORNER OF THE INTERSECTION OF ARKELL ROAD AND VICTORIA ROAD. ELEVATION: 336.245m
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Legend

1.	RESPONSE TO 2ND SUBMISSION COMMENTS	MA/LM	KRB	23.12.20
0.	SECOND SUBMISSION	MA/LM	KRB	23.03.03
Revision		By	Appd.	YY.MM.DD
File Name: 161413338_C-SWM.dwg		Dwn.	Chkd.	23.12.19
			Dsgn.	YY.MM.DD

Permit-Seal

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

PRELIMINARY NOT FOR CONSTRUCTION
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Client/Project
ROCKPOINT PROPERTIES INC.

220 ARKELL ROAD

Guelph, ON

Title
CONCEPTUAL STORMWATER MANAGEMENT PLAN

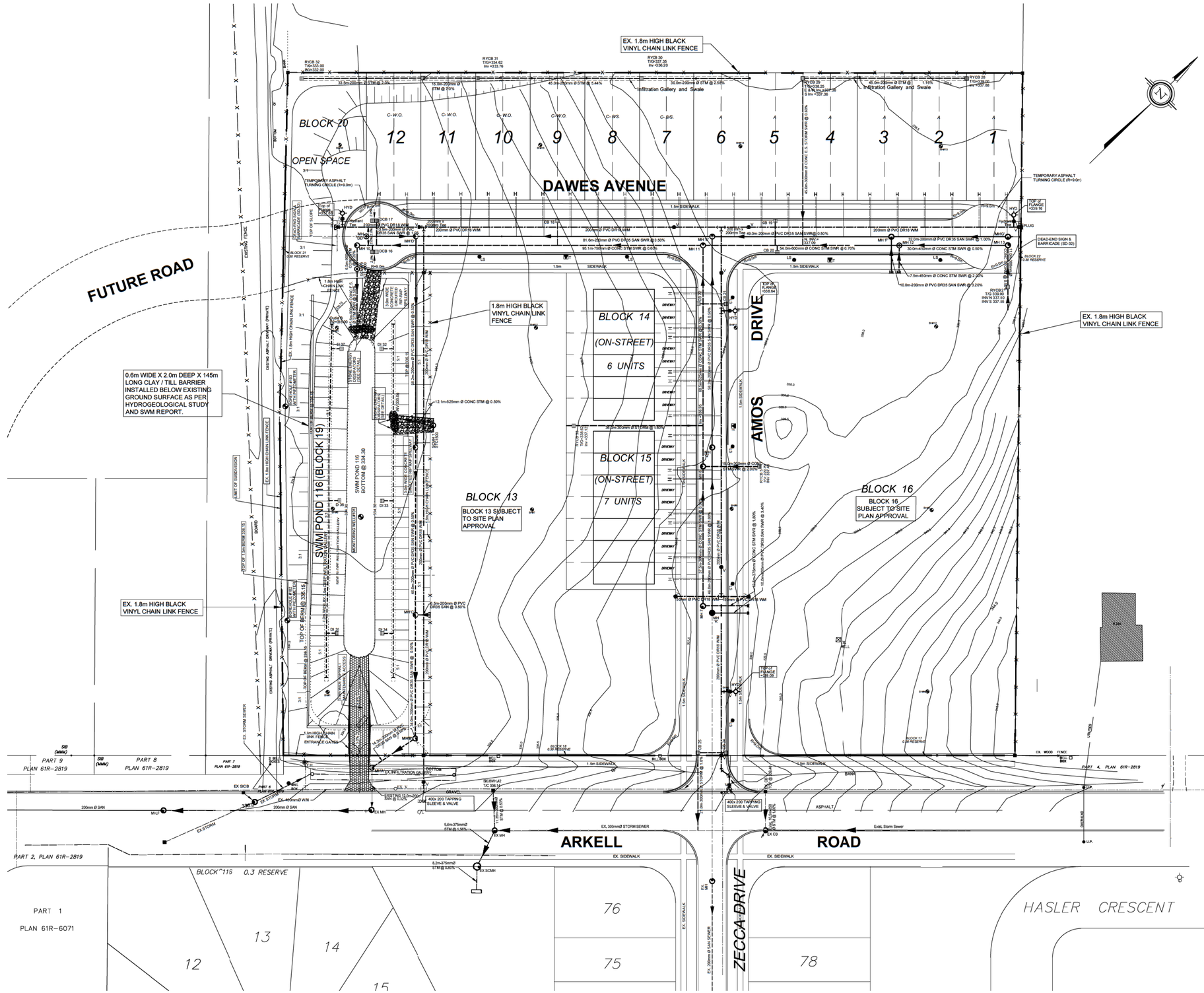
Project No.	Scale	Sheet	Revision
161413338	1:250 (0 2.5 7.5 12.5m)		
Drawing No.			
C-410			1

V:\161414\active\161413338\design\drowing\Civil\sheet_files\161413338_C-SWM.dwg
2023/12/19 3:51 PM By: AHAbjpod, Mohamed

ORIGINAL SHEET - ARCH D

APPENDIX D

Stormwater Management Hydrologic Model
Design Calculations



LEGEND

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

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

GENERAL NOTES:

FIELD NOTES: PLAN REFERENCES:

BENCH MARK: No. 392 ELEVATION: 336.245

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

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

SCHEDULE OF REVISIONS

CITY OF Guelph — Making a Difference

ENGINEERING SERVICES

ARKELL MEADOWS SUBDIVISION GUELPH, ONTARIO

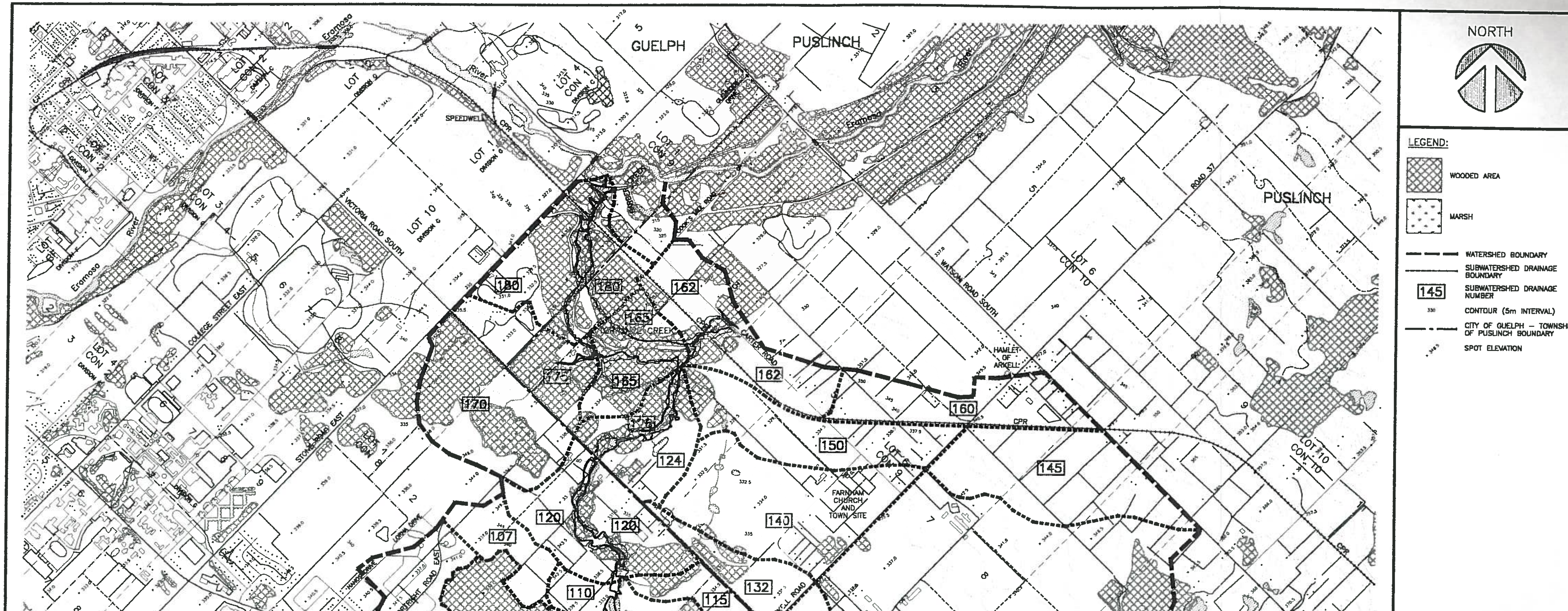
GENERAL SERVICING PLAN

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

CHECKED: APPROVED:

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

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



ALL DIMENSIONS AND INFORMATION SHALL BE CHECKED AND VERIFIED ON THE JOB AND ANY DISCREPANCIES MUST BE REPORTED TO THE CONSULTANT BEFORE COMMENCING THE WORK.

IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO INFORM HIMSELF OF THE EXACT LOCATION OF, AND ASSUME ALL LIABILITY FOR DAMAGE TO ALL UTILITIES, SERVICES AND STRUCTURES WHETHER ABOVE GROUND OR BELOW GRADE BEFORE COMMENCING THE WORK. SUCH INFORMATION IS NOT NECESSARILY SHOWN ON THE DRAWINGS, AND WHERE SHOWN, THE ACCURACY CANNOT BE GUARANTEED.

ALL DRAWINGS REMAIN THE PROPERTY OF THE CONSULTANT AND MAY NOT BE REPRODUCED OR REVISED WITHOUT THE CONSULTANTS WRITTEN PERMISSION.

WITH THE SOLE EXCEPTION OF THE BENCHMARK(S) SPECIFICALLY DESCRIBED FOR THIS PROJECT, NO ELEVATION INDICATED OR ASSUMED HEREON IS TO BE USED AS A REFERENCE ELEVATION FOR ANY PURPOSE.

Study Team:

Totten Sims Hubicki Associates
Ecological Services Group
Mark L. Dorfman, Planner Inc.
Stanley Consulting
Donald G. Weatherbe Associates
Schroeter & Associates

THE CITY OF Guelph

TORRANCE CREEK SUBWATERSHED
GUELPH ONTARIO

Grand River Conservation Authority

SUBWATERSHED DRAINAGE BOUNDARIES

DRAWN BY	DESIGNED BY –	DATE SEPT.1998
CHECKED BY	APPROVED BY –	PROJECT No.
SCALE Horiz. N.T.S. Vert. –	DRAWING No. FIGURE 4.6.1	

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



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

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



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

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



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

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



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

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



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

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



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

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



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

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



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

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

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

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

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

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

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

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

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

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

scene1.wat

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

scene1.wat

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

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

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

1614-13338 220 Arkell Road
MIDUSS Parameters

Existing Conditions

Area Description	Catchment Number	Area	Pervious Length	Gradient	% Impervious	Impervious Length	Overland Manning's 'n'	Max Infiltration (1)	Min Infiltration (2)	Lag Constant (3)	Depression Storage (4)
		(ha)	(m)	(%)		(m)		(mm/hr)	(mm/hr)	(hrs)	(mm)
Wetland/wooded area to Torrance Creek (part of Torrance Creek Swamp)	105	0.83	50	0.5	0	10	0.25	75	13	0.5	15.0
Agricultural land, some forested and lawnd coverage, and a residential property including a driveway and several buildings draining west to Torrance Creek	106	3.87	120	4	10	10	0.25	75	13	0.5	5.0
Mostly agricultural and lawn area with a portion of the residential building draining northeast, eventually to Torrance Creek	110	2.47	150	2	5	10	0.25	75	13	0.5	5.0
Adjacent Rooftops, rear yards and portion of SWMF banks of Existing Arkell Meadows Subdivision draining west to Torrance Creek	107	0.68	200	2	40	10	0.25	75	13	0.5	5.0

Proposed Conditions

Area Description	Catchment Number	Area	Pervious Length	Gradient	% Impervious	Impervious Length	Overland Manning's 'n'	Max Infiltration (1)	Min Infiltration (2)	Lag Constant (3)	Depression Storage (4)
		(ha)	(m)	(%)		(m)		(mm/hr)	(mm/hr)	(hrs)	(mm)
Residential area consisting of approximately half single family and half townhomes	200	2.42	20	2	65	40	0.25	75	13	0.5	5.0
Ecological Linkage at north end of site and rear lots of multiblock on east side draining east offsite	201A + 201B	1.15	150	2	0	10	0.25	75	13	0.5	5.0
Park	202	0.28	50	3	10	4	0.25	75	13	0.5	5.0
SWM Block	203	0.41	50	1	15	4	0.25	75	13	0.5	5.0
Wetland/wooded area to Torrance Creek (part of Torrance Creek Swamp) along with some existing pasture/grass	204	1.65	50	0.5	0	10	0.25	75	13	0.5	10.0
Mostly naturalized/landscaped area (former driveway) draining uncontrolled to Torrance Creek	205	0.24	10	0.5	15	10	0.25	75	13	0.5	5.0
Rear lots and portion or rooftops units as well as portion of park/trail draining uncontrolled to Torrance Creek	206	0.37	90	2	25	10	0.25	75	13	0.5	5.0
Ecological Linkage draining west (around SWM)	207A + 207B	0.30	110	2	0	10	0.25	75	13	0.5	5.0
Adjacent Rooftops, rear yards and portion of SWMF banks of Existing Arkell Meadows Subdivision draining west to Torrance Creek	208	0.68	200	2	40	10	0.25	75	13	0.5	5.0
Rear lots from townhome units and trail connection draining to reverse sloped culvert and subsequently west to Torrance Creek	209	0.32	200	2	15	10	0.25	75	13	0.5	5.0

Total Site	**7.14**	
Developed to Pond (incl pond block)	**2.83**	58% impervious

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

1614-13338 220 Arkell Road

Stormwater Quality Volumetric Requirements

Drainage Area (ha)[2]	Total % Imp.	Level	Facility Type	Water Quality Unit Volume Requirements [1]			Water Quality Volume Requirements			Drawdown for Water Quality Volume (hrs)	Drawdown during 25mm, 4hr Event
				Total Unit Volume (m^3/ha)	Permanent Pool (m^3/ha)	Extended Detention (m^3/ha)	Permanent Pool (m^3)	Extended Detention (m^3)	Total MOE Volume		
2.83	58%	Enhanced	Infiltration Basin	31	N/A	N/A	N/A	N/A	88		
2.83	58%	Enhanced	Wetland (during frozen conditions)	108	68	40	192	113	305	23	24

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

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

1614-13338 220 Arkell Road

Sediment Forebay Sizing Calculations

Using MOE - SWMPD Manual Criteria (2003)

STORMWATER MANAGEMENT FACILITY

Settling

Dist = sqrt(r*Q_p/v_s)

= **7.7** **m**

r : 1 = l to w ratio — r = 3.00

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

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

Dispersion Length

Dist = 8Q/dv

= **1.8** **m**

Q = 5 yr max inlet flow (m^3/s) — Q = 0.113

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

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

Velocity

v = Q/A

= **0.02** **m/s**

Therefore, **Velocity Target Satisfied**

y = total depth of forebay from perm. pool to sediment (m) — y = 0.5 — Note 1.

b = bottom width (avg) of forebay (m) — b = 7

Q = 5 yr inlet flow (m^3/s) — Q = 0.113

A = cross-sectional area (m^2) — A = 4.8 — Note 1.

Target velocity = 0.15 — V_{targ} = 0.15

Cleanout Frequency

Table 6.3 MOE SWMPD Guidelines

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

= **7.8** **years**

Therefore, **Cleanout Time OK**

A_{sew} = Contributing Sewer Area (ha) — A_{sew} = 2.83

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

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

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

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

Vol = Sediment volume (m^3) (0.5m depth) — Vol = 27 — Note 3.

Notes

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

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

SSD used in MIDUSS modelling

	Rating Curve for MIDUSS									
							Drawdown (hrs) - including infiltration		Drawdown (hrs) - Active Storage	
	Elevation (m)	Infiltration (m³/s)	Discharge to PSW (m³/s)	Total Outflow (m³/s)	Active Storage (m³)	Storage without Infiltration Portion (m³)	Increment	Total	Increment	Total
Bottom of Forebay	334.00									
	334.10									
	334.20									
	334.30									
	334.40									
	334.50									
	334.60									
	334.70									
	334.80									
	334.90									
Bottom of Infiltration cell	335.00	0.002		0.002						
	335.10	0.002		0.002	76		9.5	9.5		
	335.20	0.002		0.002	161		10.6	20.2		
	335.25	0.002		0.002	208		5.8	26.0		
Outflow starts	335.30	0.002		0.002	256		6.1	32.1		
	335.40	0.002	0.003	0.005	361	105	7.9	39.9	9.9	9.9
	335.50	0.002	0.005	0.007	476	219	5.3	45.2	8.3	18.2
	335.60	0.002	0.006	0.008	603	347	4.7	49.8	6.6	24.8
	335.70	0.002	0.007	0.009	739	482	4.3	54.1	5.8	30.5
	335.80	0.002	0.008	0.010	883	626	4.1	58.2	5.3	35.9
	335.90	0.002	0.009	0.011	1,036	779	4.0	62.2	5.1	40.9
	336.00	0.002	0.010	0.012	1,197	941	3.9	66.2	4.9	45.8
	336.10	0.002	0.010	0.012	1,368	1,112	3.9	70.1	4.8	50.6
	336.20	0.002	0.011	0.013	1,548	1,292	3.9	74.0	4.7	55.3
	336.30	0.002	0.012	0.014	1,738	1,481	3.9	77.9	4.7	60.0
	336.40	0.002	0.012	0.014	1,937	1,681	3.9	81.9	4.7	64.7
	336.50	0.002	0.013	0.015	2,146	1,890	4.0	85.9	4.7	69.4
	336.60	0.002	0.013	0.015	2,366	2,109	4.0	89.9	4.7	74.1
	336.70	0.002	0.014	0.016	2,597	2,341	4.1	94.0	4.8	78.9
	336.80	0.002	0.284	0.286	2,841	2,584	0.4	94.4	0.5	79.4
	336.90	0.002	0.782	0.784	3,097	2,840	0.1	94.6	0.1	79.5
Top of Pond	337.00	0.002	1.432	1.434	3,364	3,107	0.1	94.6	0.1	79.6

	Volume Estimation			
	Forebay	Infiltration Portion	Total	Total
Elevation (m)	Perm Vol (m³)	Vol (m³)	Vol (m³)	Act Vol (m³)
334.00				
334.10	3		3	
334.20	7		7	
334.30	12		12	
334.40	19		19	
334.50	27		27	
334.60	38		38	
334.70	50		50	
334.80	65		65	
334.90	82		82	
335.00	102		102	
335.10		76	178	76
335.20		161	263	161
335.25		208	310	208
335.30		256	358	256
335.40			463	361
335.50			577	476
335.60			705	603
335.70			841	739
335.80			985	883
335.90			1137	1,036
336.00			1299	1,197
336.10			1470	1,368
336.20			1650	1,548
336.30			1840	1,738
336.40			2039	1,937
336.50			2248	2,146
336.60			2468	2,366
336.70			2699	2,597
336.80			2943	2,841
336.90			3199	3,097
337.00			3466	3,364

	Outlet Controls				
			Overflow		
Elevation (m)	Orifice 1 (m³/s)	Weir (m³/s)	Total Flow (m³/s)	Infiltration (m³/s)	Parameters
334.00					Orifice 1
334.10					Orifice Invert Elev. (m) / Orifice Coeff.
334.20					335.30 / 0.60
334.30					Orifice Mid-point Elev. (m) / Perimeter (m)
334.40					335.34 / 0.24
334.50					Orifice Diam.(mm) / Area (m^2)
334.60					75 / 0.004
334.70					Weir Coeff. (semi-circular) / Orientation
334.80					1.62 / Vertical
334.90					Infiltration out of bottom
335.00				0.002	Infiltration Area (m2) / Infiltration invert (m)
335.10				0.002	500 / 335.00
335.20				0.002	Infiltration Rate (mm/hr) / Safety Factor
335.25				0.002	56 / 3.5
335.30				0.002	Factored Infiltration Rate (mm/hr) / Infiltration Rate (m3/s)
335.40	0.003		0.003	0.002	16 / 0.002
335.50	0.005		0.005	0.002	
335.60	0.006		0.006	0.002	
335.70	0.007		0.007	0.002	Overflow Spillway
335.80	0.008		0.008	0.002	Spillway Invert (m) / Top of Berm (m)
335.90	0.009		0.009	0.002	336.70 / 337.00
336.00	0.010		0.010	0.002	Spillway Length @ Invert (m) / Max. Flow Depth (m)
336.10	0.010		0.010	0.002	5 / 0.30
336.20	0.011		0.011	0.002	Left Side Slope / Right Side Slope
336.30	0.012		0.012	0.002	10 / 10
336.40	0.012		0.012	0.002	Weir Coefficient (Rectangle) / Topwidth
336.50	0.013		0.013	0.002	1.7 / 11.0
336.60	0.013		0.013	0.002	Weir Coefficient (Triangle)
336.70	0.014		0.014	0.002	1.3
336.80	0.014	0.270	0.284	0.002	
336.90	0.015	0.767	0.782	0.002	
337.00	0.015	1.416	1.432	0.002	

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

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

Active Storage Drawdown Time Calculations:

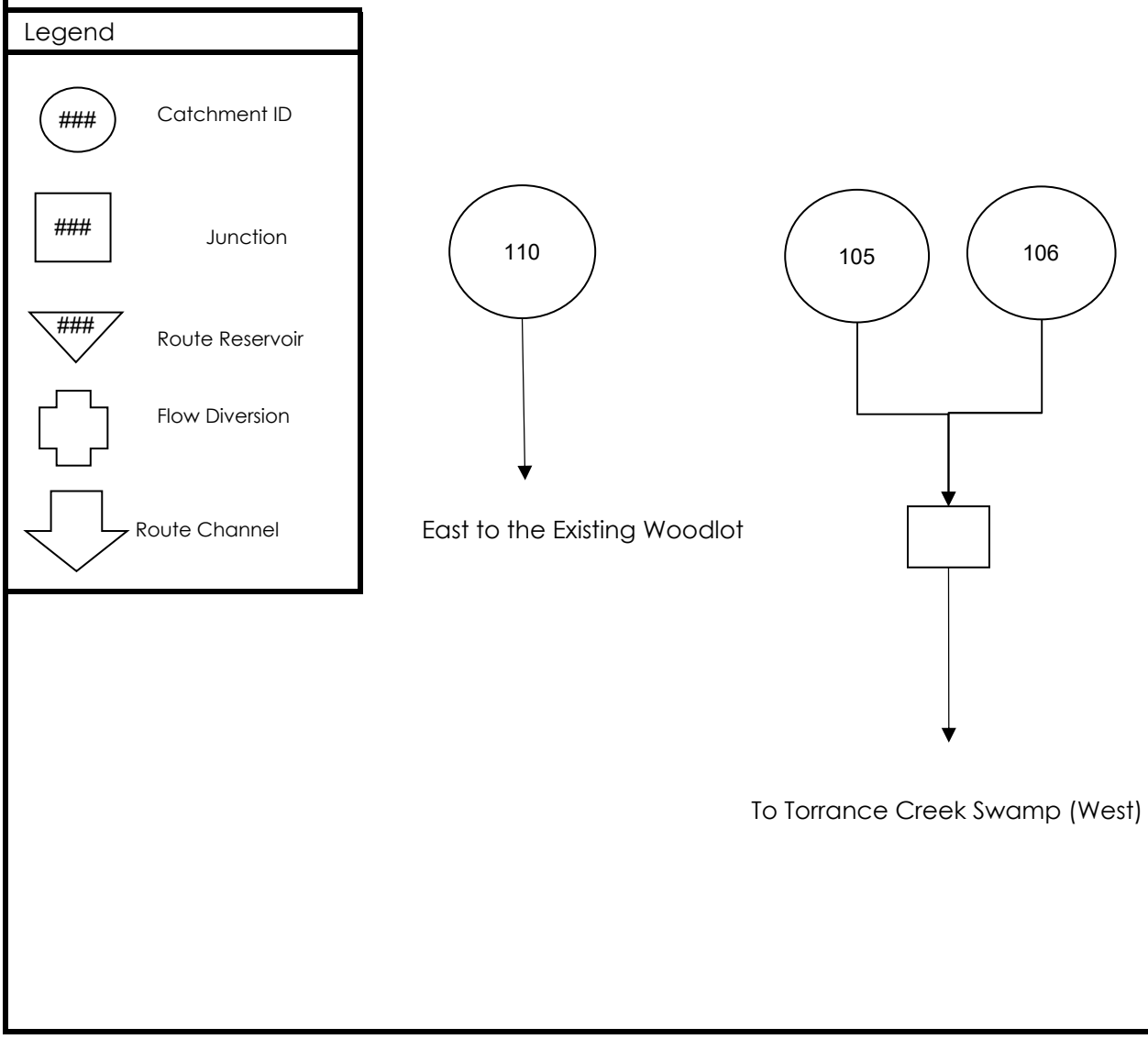
Greater than 0.1 m above the low flow orifice invert
$T=[v_2-v_1]/[(Q_2+Q_1)/2]/3600$
where
T=drawdown time in hours
v_2=starting pond volume
v_2=ending pond volume
Q_2=starting flow
Q_1=ending flow

From 0.0 to 0.1 m above the low flow orifice invert
$T=[v_2-v_1]/[(Q_2)]/3600$
where
T=drawdown time in hours
v_2=starting pond volume
v_2=ending pond volume
Q_2=starting flow

Orifice flow equation
$Q = C \cdot A \cdot (2 \cdot g \cdot H)^{0.5}$
where
C = orifice coefficient
A = area of orifice
g = acceleration due to gravity
H = head above centre line of orifice
Note: used when water elevation is above 3/4 of the orifice diameter

Sharp crested semi-circular weir equation
$Q=C*D^{2.5}*(H/D)^{1.88}$
where
C = sharp crested semi-circular weir coefficient
D = diameter of orifice
H = head above orifice invert
Note: used when water elevation is below 3/4 of the orifice diameter

1614-13338 220 Arkell Road
MIDUSS Schematic
Existing Conditions



```
      Output File (4.7) ARK25MEX.OUT opened 2022-03-29   8:57
      Units used are defined by G =    9.810
          48   120     5.000        are MAXDT MAXHYD & DTMIN values
      Licensee: Paragon Engineering Limited
35    COMMENT
     7     line(s) of comment
      **********************
      1614-13338 220 Arkell
      Stormwater Management Modelling
      Existing Conditions
      25mm, 4 hour event
      Modeller: B.Weersink (Mar 2022)
      **********************
23    FILE RAINFALL
     1     1=READ: 2=WRITE
    10     25mm.STM             is Filename
 3    IMPERVIOUS
         2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .013     Manning "n"
      .000     Max.Infiltn. mm/hr
      .000     Min.Infiltn. mm/hr
      .050     Lag const (hours)
     1.500     Dep.Storage mm
35    COMMENT
     3     line(s) of comment
      **********************
      Catchment 110 - Existing Catchment draining east
      **********************
 4    CATCHMENT
   110.000     ID No.ó 99999
     2.470     Area in hectares
   150.000     Length (PERV) metres
     2.000     Gradient (%)
     5.000     Per cent Impervious
    10.000     Length (IMPERV)
      .000     %Imp. with Zero Dpth
         2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250     Manning "n"
    75.000     Max.Infiltn. mm/hr
    13.000     Min.Infiltn. mm/hr
      .500     Lag const (hours)
     5.000     Dep.Storage mm
         1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .022       .000       .000       .000 c.m/s
            .000       .918       .046     C perv/imperv/total
14    START
     1     1=Zero; 2=Define
35    COMMENT
     3     line(s) of comment
      **********************
      Catchment 106 - Existing Site draining west to Torrance Cree
      **********************
 4    CATCHMENT
   106.000     ID No.ó 99999
     3.870     Area in hectares
   120.000     Length (PERV) metres
     4.000     Gradient (%)
    10.000     Per cent Impervious
    10.000     Length (IMPERV)
      .000     %Imp. with Zero Dpth
         2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250     Manning "n"
    75.000     Max.Infiltn. mm/hr
    13.000     Min.Infiltn. mm/hr
      .500     Lag const (hours)
     5.000     Dep.Storage mm
         1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .069       .000       .000       .000 c.m/s
            .000       .907       .091     C perv/imperv/total
15    ADD RUNOFF
            .069       .069       .000       .000 c.m/s
35    COMMENT
     3     line(s) of comment
      **********************
      Catchment 105 - Wetland area (Torrance Creek Swamp)
      **********************
 4    CATCHMENT
   105.000     ID No.ó 99999
      .830     Area in hectares
    50.000     Length (PERV) metres
      .500     Gradient (%)
      .000     Per cent Impervious
    10.000     Length (IMPERV)
      .000     %Imp. with Zero Dpth
         2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
      .250     Manning "n"
    75.000     Max.Infiltn. mm/hr
    13.000     Min.Infiltn. mm/hr
      .500     Lag const (hours)
    15.000     Dep.Storage mm
         1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
      ****************************************** c.m/s
            .000       .000       .000     C perv/imperv/total
15    ADD RUNOFF
            .000       .069       .000       .000 c.m/s
20    MANUAL
```

```
      Output File (4.7) ARK2EX.OUT   opened 2022-03-29   8:42
      Units used are defined by G =    9.810
         192   533    15.000        are MAXDT MAXHYD & DTMIN values
      Licensee: Paragon Engineering Limited
35    COMMENT
      7     line(s) of comment
      **********************
      1614-13338 220 Arkell
      Stormwater Management Modelling
      Existing Conditions
      2-yr, 48-hour adjusted storm (TCSS)
      Modeller: B.Weersink (Mar 2022)
      **********************
23    FILE RAINFALL
      1     1=READ: 2=WRITE
      10    2yr48hr.ST           is Filename
 3    IMPERVIOUS
          2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .013     Manning "n"
       .000     Max.Infiltn. mm/hr
       .000     Min.Infiltn. mm/hr
       .050     Lag const (hours)
      1.500     Dep.Storage mm
35    COMMENT
      3     line(s) of comment
      **********************
      Catchment 110 - Existing Catchment draining east
      **********************
 4    CATCHMENT
     110.000    ID No.ó 99999
      2.470     Area in hectares
     150.000    Length (PERV) metres
      2.000     Gradient (%)
      5.000     Per cent Impervious
     10.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
          2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     75.000     Max.Infiltn. mm/hr
     13.000     Min.Infiltn. mm/hr
       .500     Lag const (hours)
      5.000     Dep.Storage mm
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .005       .000       .000       .000 c.m/s
             .002       .925       .048     C perv/imperv/total
14    START
      1     1=Zero; 2=Define
35    COMMENT
      3     line(s) of comment
      **********************
      Catchment 106 - Existing Site draining west to Torrance Cree
      **********************
 4    CATCHMENT
     106.000    ID No.ó 99999
      3.870     Area in hectares
     120.000    Length (PERV) metres
      4.000     Gradient (%)
     10.000     Per cent Impervious
     10.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
          2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     75.000     Max.Infiltn. mm/hr
     13.000     Min.Infiltn. mm/hr
       .500     Lag const (hours)
      5.000     Dep.Storage mm
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .017       .000       .000       .000 c.m/s
             .002       .903       .092     C perv/imperv/total
15    ADD RUNOFF
             .017       .017       .000       .000 c.m/s
35    COMMENT
      3     line(s) of comment
      **********************
      Catchment 105 - Wetland area (Torrance Creek Swamp)
      **********************
 4    CATCHMENT
     105.000    ID No.ó 99999
       .830     Area in hectares
     50.000     Length (PERV) metres
       .500     Gradient (%)
       .000     Per cent Impervious
     10.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
          2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     75.000     Max.Infiltn. mm/hr
     13.000     Min.Infiltn. mm/hr
       .500     Lag const (hours)
     15.000     Dep.Storage mm
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
      ****************************************** c.m/s
             .000       .000       .000     C perv/imperv/total
15    ADD RUNOFF
             .000       .017       .000       .000 c.m/s
20    MANUAL
```

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

```
         Output File (4.7) ARK10EX.OUT  opened 2023-12-13  14:25
         Units used are defined by G =    9.810
            192   533    15.000        are MAXDT MAXHYD & DTMIN values
         Licensee: Paragon Engineering Limited
35       COMMENT
          7     line(s) of comment
          **********************
          1614-13338 220 Arkell
          Stormwater Management Modelling
          Existing Conditions
          10-yr, 48-hour adjusted storm (TCSS)
          Modeller: B.Weersink (Mar 2022)
          **********************
23       FILE RAINFALL
          1     1=READ: 2=WRITE
         10     10y48h.STM           is Filename
 3       IMPERVIOUS
             2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .013     Manning "n"
          .000     Max.Infiltn. mm/hr
          .000     Min.Infiltn. mm/hr
          .050     Lag const (hours)
         1.500     Dep.Storage mm
35       COMMENT
          3     line(s) of comment
          **********************
          Catchment 110 - Existing Catchment draining east
          **********************
 4       CATCHMENT
       110.000     ID No.ó 99999
         2.470     Area in hectares
       150.000     Length (PERV) metres
         2.000     Gradient (%)
         5.000     Per cent Impervious
        10.000     Length (IMPERV)
          .000     %Imp. with Zero Dpth
             2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .250     Manning "n"
        75.000     Max.Infiltn. mm/hr
        13.000     Min.Infiltn. mm/hr
          .500     Lag const (hours)
         5.000     Dep.Storage mm
             1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .052       .000       .000       .000 c.m/s
                .099       .915       .140     C perv/imperv/total
14       START
          1     1=Zero; 2=Define
35       COMMENT
          3     line(s) of comment
          **********************
          Catchment 106 - Existing Site draining west to Torrance Cree
          **********************
 4       CATCHMENT
       106.000     ID No.ó 99999
         3.870     Area in hectares
       120.000     Length (PERV) metres
         4.000     Gradient (%)
        10.000     Per cent Impervious
        10.000     Length (IMPERV)
          .000     %Imp. with Zero Dpth
             2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .250     Manning "n"
        75.000     Max.Infiltn. mm/hr
        13.000     Min.Infiltn. mm/hr
          .500     Lag const (hours)
         5.000     Dep.Storage mm
             1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .100       .000       .000       .000 c.m/s
                .099       .892       .179     C perv/imperv/total
15       ADD RUNOFF
                .100       .100       .000       .000 c.m/s
35       COMMENT
          3     line(s) of comment
          **********************
          Catchment 105 - Wetland area (Torrance Creek Swamp)
          **********************
 4       CATCHMENT
       105.000     ID No.ó 99999
          .830     Area in hectares
        50.000     Length (PERV) metres
          .500     Gradient (%)
          .000     Per cent Impervious
        10.000     Length (IMPERV)
          .000     %Imp. with Zero Dpth
             2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .250     Manning "n"
        75.000     Max.Infiltn. mm/hr
        13.000     Min.Infiltn. mm/hr
          .500     Lag const (hours)
        15.000     Dep.Storage mm
             1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .007       .100       .000       .000 c.m/s
                .029       .000       .029     C perv/imperv/total
15       ADD RUNOFF
                .007       .100       .000       .000 c.m/s
20       MANUAL
```

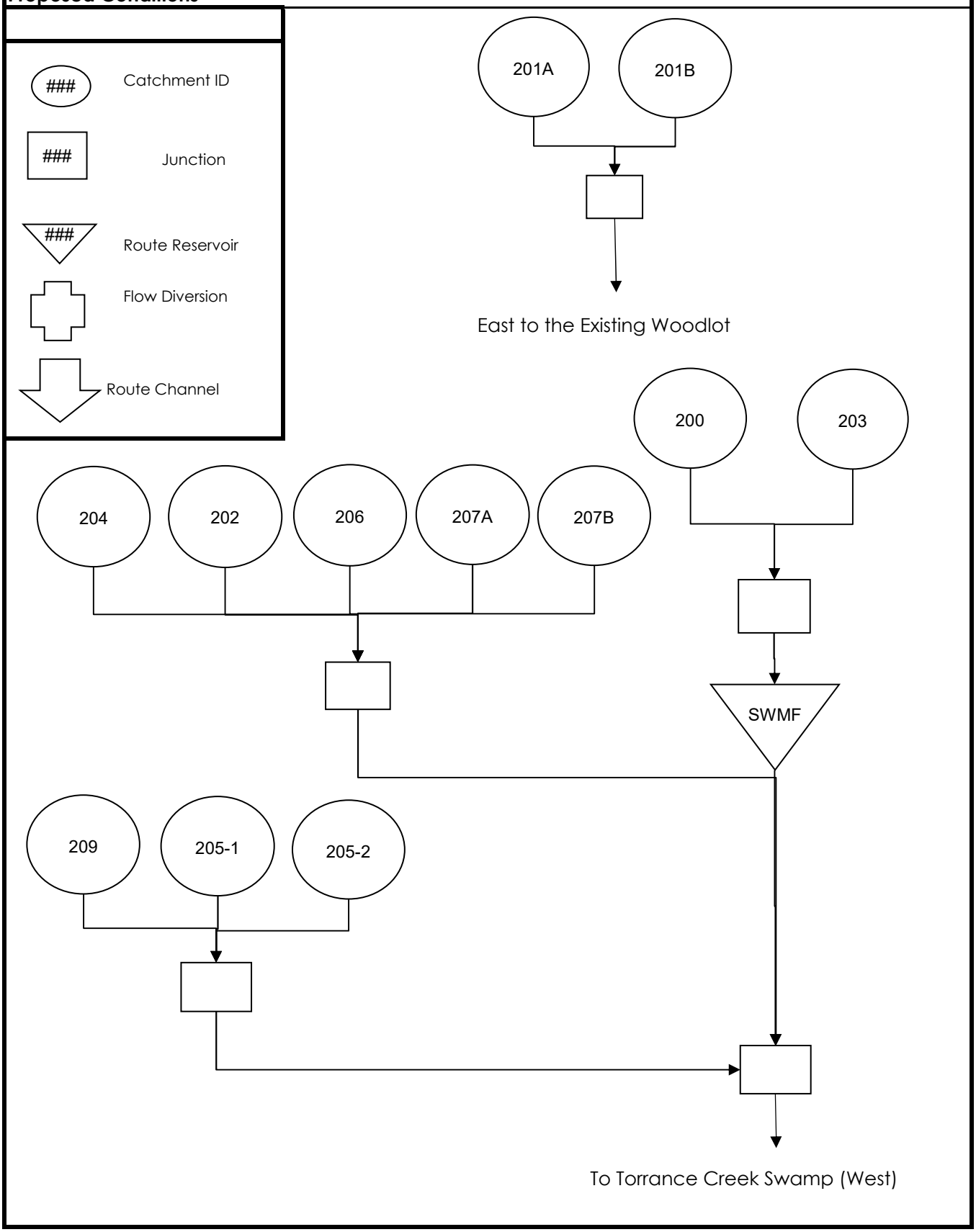
```
         Output File (4.7) ARK25EX.OUT  opened 2022-03-29   8:44
         Units used are defined by G =    9.810
            192   533    15.000        are MAXDT MAXHYD & DTMIN values
         Licensee: Paragon Engineering Limited
35       COMMENT
       7     line(s) of comment
         **********************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

```
         Output File (4.7) ARK50EX.OUT  opened 2023-12-13  14:28
         Units used are defined by G =    9.810
            192   533    15.000        are MAXDT MAXHYD & DTMIN values
         Licensee: Paragon Engineering Limited
35       COMMENT
       7     line(s) of comment
         **********************
         1614-13338 220 Arkell
         Stormwater Management Modelling
         Existing Conditions
         50-yr, 48-hour adjusted storm (TCSS)
         Modeller: B.Weersink (Mar 2022)
         **********************
23       FILE RAINFALL
       1     1=READ: 2=WRITE
      10     50y48h.STM           is Filename
 3     IMPERVIOUS
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .013     Manning "n"
        .000     Max.Infiltn. mm/hr
        .000     Min.Infiltn. mm/hr
        .050     Lag const (hours)
       1.500     Dep.Storage mm
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 110 - Existing Catchment draining east
         **********************
 4     CATCHMENT
     110.000     ID No.ó 99999
       2.470     Area in hectares
     150.000     Length (PERV) metres
       2.000     Gradient (%)
       5.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
        .089       .000       .000       .000 c.m/s
        .141       .908       .180     C perv/imperv/total
14       START
       1     1=Zero; 2=Define
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 106 - Existing Site draining west to Torrance Cree
         **********************
 4     CATCHMENT
     106.000     ID No.ó 99999
       3.870     Area in hectares
     120.000     Length (PERV) metres
       4.000     Gradient (%)
      10.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
        .161       .000       .000       .000 c.m/s
        .141       .887       .216     C perv/imperv/total
15       ADD RUNOFF
           .161       .161       .000       .000 c.m/s
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 105 - Wetland area (Torrance Creek Swamp)
         **********************
 4     CATCHMENT
     105.000     ID No.ó 99999
        .830     Area in hectares
      50.000     Length (PERV) metres
        .500     Gradient (%)
        .000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
      15.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
        .020       .161       .000       .000 c.m/s
        .082       .000       .082     C perv/imperv/total
15       ADD RUNOFF
           .020       .176       .000       .000 c.m/s
20       MANUAL
```

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

```
         Output File (4.7) 100EX3H.OUT  opened 2023-12-13  14:38
         Units used are defined by G =    9.810
             36   200     5.000        are MAXDT MAXHYD & DTMIN values
         Licensee: Paragon Engineering Limited
 35      COMMENT
        7     line(s) of comment
         **********************
         1614-13338 220 Arkell
         Stormwater Management Modelling
         Existing Conditions
         100yr, 3 hour event
         Modeller: B.Weersink (Mar 2022)
         **********************
 23      FILE RAINFALL
        1     1=READ: 2=WRITE
       10     3h100yr.ST           is Filename
  3      IMPERVIOUS
            2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .013     Manning "n"
         .000     Max.Infiltn. mm/hr
         .000     Min.Infiltn. mm/hr
         .050     Lag const (hours)
        1.500     Dep.Storage mm
 35      COMMENT
        3     line(s) of comment
         **********************
         Catchment 110 - Existing Catchment draining east
         **********************
  4      CATCHMENT
      110.000     ID No.ó 99999
        2.470     Area in hectares
      150.000     Length (PERV) metres
        2.000     Gradient (%)
        5.000     Per cent Impervious
       10.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       75.000     Max.Infiltn. mm/hr
       13.000     Min.Infiltn. mm/hr
         .500     Lag const (hours)
        5.000     Dep.Storage mm
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
         .386       .000       .000       .000 c.m/s
         .385       .925       .412     C perv/imperv/total
 14      START
        1     1=Zero; 2=Define
 35      COMMENT
        3     line(s) of comment
         **********************
         Catchment 106 - Existing Site draining west to Torrance Cree
         **********************
  4      CATCHMENT
      106.000     ID No.ó 99999
        3.870     Area in hectares
      120.000     Length (PERV) metres
        4.000     Gradient (%)
       10.000     Per cent Impervious
       10.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       75.000     Max.Infiltn. mm/hr
       13.000     Min.Infiltn. mm/hr
         .500     Lag const (hours)
        5.000     Dep.Storage mm
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
         .733       .000       .000       .000 c.m/s
         .385       .902       .436     C perv/imperv/total
 15      ADD RUNOFF
         .733       .733       .000       .000 c.m/s
 35      COMMENT
        3     line(s) of comment
         **********************
         Catchment 105 - Wetland area (Torrance Creek Swamp)
         **********************
  4      CATCHMENT
      105.000     ID No.ó 99999
         .830     Area in hectares
       50.000     Length (PERV) metres
         .500     Gradient (%)
         .000     Per cent Impervious
       10.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       75.000     Max.Infiltn. mm/hr
       13.000     Min.Infiltn. mm/hr
         .500     Lag const (hours)
       15.000     Dep.Storage mm
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
         .102       .733       .000       .000 c.m/s
         .270       .000       .270     C perv/imperv/total
 15      ADD RUNOFF
         .102       .816       .000       .000 c.m/s
 20      MANUAL
```

1614-13338 220 Arkell Road
MIDUSS Schematic
Proposed Conditions



```
         Output File (4.7) ARK25M.OUT   opened 2023-12-19  20:27
         Units used are defined by G =    9.810
             48   200     5.000        are MAXDT MAXHYD & DTMIN values
         Licensee: Paragon Engineering Limited
35       COMMENT
       7     line(s) of comment
         **********************
         1614-13338 220 Arkell
         Stormwater Management Modelling
         Proposed Conditions
         25mm, 4 hour event
         Modeller: B.Weersink (Mar 2022)
         **********************
23       FILE RAINFALL
       1     1=READ: 2=WRITE
      10     25mm.STM             is Filename
 3     IMPERVIOUS
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .013     Manning "n"
        .000     Max.Infiltn. mm/hr
        .000     Min.Infiltn. mm/hr
        .050     Lag const (hours)
       1.500     Dep.Storage mm
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 201 - Ecological Linkage and rear yards east
         **********************
 4     CATCHMENT
     201.000     ID No.ó 99999
       1.150     Area in hectares
     150.000     Length (PERV) metres
       2.000     Gradient (%)
       5.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .010       .000       .000       .000 c.m/s
              .000       .918       .046     C perv/imperv/total
14       START
       1     1=Zero; 2=Define
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 200 - Developed Area to SWM
         **********************
 4     CATCHMENT
     200.000     ID No.ó 99999
       2.420     Area in hectares
      20.000     Length (PERV) metres
       2.000     Gradient (%)
      65.000     Per cent Impervious
      40.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .245       .000       .000       .000 c.m/s
              .000       .925       .601     C perv/imperv/total
15       ADD RUNOFF
              .245       .245       .000       .000 c.m/s
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 203 - dry SWMF
         **********************
 4     CATCHMENT
     203.000     ID No.ó 99999
        .410     Area in hectares
      50.000     Length (PERV) metres
       2.000     Gradient (%)
      15.000     Per cent Impervious
       4.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .011       .245       .000       .000 c.m/s
              .000       .885       .133     C perv/imperv/total
15       ADD RUNOFF
              .011       .256       .000       .000 c.m/s
35       COMMENT
       3     line(s) of comment
         **********************
         Dry SWM Stage-storage
         **********************
10       POND
       6 Depth - Discharge - Volume sets
        335.300        .000          .0
        335.500      .00500       219.0
        335.800      .00800       626.0
        336.200       .0110      1292.0
        336.700       .0140      2341.0
        337.000       1.432      3107.0
         Peak Outflow    =      .006 c.m/s
         Maximum Depth   =   335.577 metres
         Maximum Storage =      324. c.m
              .011       .256       .006       .000 c.m/s
16       NEXT LINK
              .011       .006       .006       .000 c.m/s
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 206 - Rear yards draining uncontrolled to wetland
         **********************
 4     CATCHMENT
     206.000     ID No.ó 99999
        .370     Area in hectares
      90.000     Length (PERV) metres
       2.000     Gradient (%)
      25.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .016       .006       .006       .000 c.m/s
              .000       .918       .229     C perv/imperv/total
15       ADD RUNOFF
              .016       .019       .006       .000 c.m/s
```

```
 35     COMMENT
       3     line(s) of comment
        **********************
        Catchment 202 - Park Area
        **********************
  4     CATCHMENT
      202.000     ID No.ó 99999
        .280     Area in hectares
       50.000     Length (PERV) metres
        2.000     Gradient (%)
       10.000     Per cent Impervious
       10.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       75.000     Max.Infiltn. mm/hr
       13.000     Min.Infiltn. mm/hr
         .500     Lag const (hours)
        5.000     Dep.Storage mm
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .005       .019       .006       .000 c.m/s
              .000       .918       .092     C perv/imperv/total
 15     ADD RUNOFF
              .005       .024       .006       .000 c.m/s
 35     COMMENT
       3     line(s) of comment
        **********************
        Catchment 207 - Ecological Linkage draining around pond to w
        **********************
  4     CATCHMENT
      207.000     ID No.ó 99999
        .300     Area in hectares
      110.000     Length (PERV) metres
        2.000     Gradient (%)
         .000     Per cent Impervious
       10.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       75.000     Max.Infiltn. mm/hr
       13.000     Min.Infiltn. mm/hr
         .500     Lag const (hours)
        5.000     Dep.Storage mm
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
        ****************************************** c.m/s
              .000       .000       .000     C perv/imperv/total
 15     ADD RUNOFF
              .000       .024       .006       .000 c.m/s
 35     COMMENT
       3     line(s) of comment
        **********************
        Catchment 204 - Wetland
        **********************
  4     CATCHMENT
      204.000     ID No.ó 99999
        1.650     Area in hectares
       50.000     Length (PERV) metres
         .500     Gradient (%)
         .000     Per cent Impervious
       10.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       75.000     Max.Infiltn. mm/hr
       13.000     Min.Infiltn. mm/hr
         .500     Lag const (hours)
       10.300     Dep.Storage mm
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
        ****************************************** c.m/s
              .000       .000       .000     C perv/imperv/total
 15     ADD RUNOFF
              .000       .024       .006       .000 c.m/s
 35     COMMENT
       3     line(s) of comment
        **********************
        Catchment 205 - Former Driveway
        **********************
  4     CATCHMENT
      205.000     ID No.ó 99999
        .240     Area in hectares
       10.000     Length (PERV) metres
         .500     Gradient (%)
       15.000     Per cent Impervious
       10.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       75.000     Max.Infiltn. mm/hr
       13.000     Min.Infiltn. mm/hr
         .500     Lag const (hours)
        5.000     Dep.Storage mm
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .006       .024       .006       .000 c.m/s
              .000       .927       .139     C perv/imperv/total
 15     ADD RUNOFF
              .006       .030       .006       .000 c.m/s
 35     COMMENT
       3     line(s) of comment
        **********************
        Catchment 209 - Rear lots of townhomes and trail connection
        **********************
  4     CATCHMENT
      209.000     ID No.ó 99999
        .320     Area in hectares
      200.000     Length (PERV) metres
        2.000     Gradient (%)
       15.000     Per cent Impervious
       10.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       75.000     Max.Infiltn. mm/hr
       13.000     Min.Infiltn. mm/hr
         .500     Lag const (hours)
        5.000     Dep.Storage mm
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .009       .030       .006       .000 c.m/s
              .000       .918       .138     C perv/imperv/total
 35     COMMENT
       3     line(s) of comment
        **********************
        Total Flow to Wetland
        **********************
 15     ADD RUNOFF
              .009       .038       .006       .000 c.m/s
 20     MANUAL
```

```
          Output File (4.7) ARK2.OUT     opened 2023-12-19  20:28
          Units used are defined by G =    9.810
             192   533    15.000        are MAXDT MAXHYD & DTMIN values
          Licensee: Paragon Engineering Limited
 35       COMMENT
        7     line(s) of comment
          **********************
          1614-13338 220 Arkell
          Stormwater Management Modelling
          Proposed Conditions
          2-yr, 48-hour adjusted storm (TCSS)
          Modeller: B.Weersink (Dec 2023)
          **********************
 23       FILE RAINFALL
        1     1=READ: 2=WRITE
       10     2yr48hr.ST           is Filename
  3       IMPERVIOUS
            2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .013     Manning "n"
         .000     Max.Infiltn. mm/hr
         .000     Min.Infiltn. mm/hr
         .050     Lag const (hours)
        1.500     Dep.Storage mm
 35       COMMENT
        3     line(s) of comment
          **********************
          Catchment 201 - Ecological Linkage and rear yards east
          **********************
  4       CATCHMENT
      201.000     ID No.ó 99999
        1.150     Area in hectares
      150.000     Length (PERV) metres
        2.000     Gradient (%)
        5.000     Per cent Impervious
       10.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       75.000     Max.Infiltn. mm/hr
       13.000     Min.Infiltn. mm/hr
         .500     Lag const (hours)
        5.000     Dep.Storage mm
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .003       .000       .000       .000 c.m/s
              .002       .925       .048     C perv/imperv/total
 14       START
        1     1=Zero; 2=Define
 35       COMMENT
        3     line(s) of comment
          **********************
          Catchment 200 - Developed Area to SWM
          **********************
  4       CATCHMENT
      200.000     ID No.ó 99999
        2.420     Area in hectares
       20.000     Length (PERV) metres
        2.000     Gradient (%)
       65.000     Per cent Impervious
       40.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       75.000     Max.Infiltn. mm/hr
       13.000     Min.Infiltn. mm/hr
         .500     Lag const (hours)
        5.000     Dep.Storage mm
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .079       .000       .000       .000 c.m/s
              .002       .974       .634     C perv/imperv/total
 15       ADD RUNOFF
              .079       .079       .000       .000 c.m/s
 35       COMMENT
        3     line(s) of comment
          **********************
          Catchment 203 - dry SWMF
          **********************
  4       CATCHMENT
      203.000     ID No.ó 99999
         .410     Area in hectares
       50.000     Length (PERV) metres
        2.000     Gradient (%)
       15.000     Per cent Impervious
        4.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       75.000     Max.Infiltn. mm/hr
       13.000     Min.Infiltn. mm/hr
         .500     Lag const (hours)
        5.000     Dep.Storage mm
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .003       .079       .000       .000 c.m/s
              .002       .873       .132     C perv/imperv/total
 15       ADD RUNOFF
              .003       .082       .000       .000 c.m/s
 35       COMMENT
        3     line(s) of comment
          **********************
          Dry SWM Stage-storage
          **********************
 10       POND
        6 Depth - Discharge - Volume sets
          335.300        .000          .0
          335.500      .00500       219.0
          335.800      .00800       626.0
          336.200       .0110      1292.0
          336.700       .0140      2341.0
          337.000       1.432      3107.0
          Peak Outflow    =      .010 c.m/s
          Maximum Depth   =   336.046 metres
          Maximum Storage =     1036. c.m
              .003       .082       .010       .000 c.m/s
 16       NEXT LINK
              .003       .010       .010       .000 c.m/s
 35       COMMENT
        3     line(s) of comment
          **********************
          Catchment 206 - Rear yards draining uncontrolled to wetland
          **********************
  4       CATCHMENT
      206.000     ID No.ó 99999
         .370     Area in hectares
       90.000     Length (PERV) metres
        2.000     Gradient (%)
       25.000     Per cent Impervious
       10.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       75.000     Max.Infiltn. mm/hr
       13.000     Min.Infiltn. mm/hr
         .500     Lag const (hours)
        5.000     Dep.Storage mm
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .004       .010       .010       .000 c.m/s
              .002       .925       .232     C perv/imperv/total
 15       ADD RUNOFF
              .004       .013       .010       .000 c.m/s
```

```
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 202 - Park Area
       **********************
  4    CATCHMENT
     202.000     ID No.ó 99999
       .280     Area in hectares
      50.000     Length (PERV) metres
       2.000     Gradient (%)
      10.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .001       .013       .010       .000 c.m/s
             .002       .925       .094     C perv/imperv/total
 15     ADD RUNOFF
             .001       .014       .010       .000 c.m/s
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 207 - Ecological Linkage draining around pond to w
       **********************
  4    CATCHMENT
     207.000     ID No.ó 99999
       .300     Area in hectares
     110.000     Length (PERV) metres
       2.000     Gradient (%)
        .000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .000       .014       .010       .000 c.m/s
             .002       .000       .002     C perv/imperv/total
 15     ADD RUNOFF
             .000       .014       .010       .000 c.m/s
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 204 - Wetland
       **********************
  4    CATCHMENT
     204.000     ID No.ó 99999
       1.650     Area in hectares
      50.000     Length (PERV) metres
        .500     Gradient (%)
        .000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
      10.300     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
       ****************************************** c.m/s
             .000       .000       .000     C perv/imperv/total
 15     ADD RUNOFF
             .000       .014       .010       .000 c.m/s
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 205 - Former Driveway
       **********************
  4    CATCHMENT
     205.000     ID No.ó 99999
       .240     Area in hectares
      10.000     Length (PERV) metres
        .500     Gradient (%)
      15.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .002       .014       .010       .000 c.m/s
             .002       .954       .144     C perv/imperv/total
 15     ADD RUNOFF
             .002       .016       .010       .000 c.m/s
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 209 - Rear lots of townhomes and trail connection
       **********************
  4    CATCHMENT
     209.000     ID No.ó 99999
       .320     Area in hectares
     200.000     Length (PERV) metres
       2.000     Gradient (%)
      15.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .002       .016       .010       .000 c.m/s
             .002       .925       .140     C perv/imperv/total
 35     COMMENT
      3     line(s) of comment
       **********************
       Total Flow to Wetland
       **********************
 15     ADD RUNOFF
             .002       .018       .010       .000 c.m/s
 20     MANUAL
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         Output File (4.7) ARK5.OUT     opened 2023-12-19  20:29
         Units used are defined by G =    9.810
            192   533    15.000        are MAXDT MAXHYD & DTMIN values
         Licensee: Paragon Engineering Limited
35       COMMENT
       7     line(s) of comment
         **********************
         1614-13338 220 Arkell
         Stormwater Management Modelling
         Proposed Conditions
         5-yr, 48-hour adjusted storm (TCSS)
         Modeller: B.Weersink (Dec 2023)
         **********************
23       FILE RAINFALL
       1     1=READ: 2=WRITE
      10     5yr48hr.ST           is Filename
 3       IMPERVIOUS
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .013     Manning "n"
        .000     Max.Infiltn. mm/hr
        .000     Min.Infiltn. mm/hr
        .050     Lag const (hours)
       1.500     Dep.Storage mm
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 201 - Ecological Linkage and rear yards east
         **********************
 4       CATCHMENT
     201.000     ID No.ó 99999
       1.150     Area in hectares
     150.000     Length (PERV) metres
       2.000     Gradient (%)
       5.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          .013       .000       .000       .000 c.m/s
          .063       .919       .106     C perv/imperv/total
14       START
       1     1=Zero; 2=Define
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 200 - Developed Area to SWM
         **********************
 4       CATCHMENT
     200.000     ID No.ó 99999
       2.420     Area in hectares
      20.000     Length (PERV) metres
       2.000     Gradient (%)
      65.000     Per cent Impervious
      40.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          .108       .000       .000       .000 c.m/s
          .063       .978       .658     C perv/imperv/total
15       ADD RUNOFF
          .108       .108       .000       .000 c.m/s
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 203 - dry SWMF
         **********************
 4       CATCHMENT
     203.000     ID No.ó 99999
        .410     Area in hectares
      50.000     Length (PERV) metres
       2.000     Gradient (%)
      15.000     Per cent Impervious
       4.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          .008       .108       .000       .000 c.m/s
          .063       .869       .184     C perv/imperv/total
15       ADD RUNOFF
          .008       .113       .000       .000 c.m/s
35       COMMENT
       3     line(s) of comment
         **********************
         Dry SWM Stage-storage
         **********************
10       POND
       6 Depth - Discharge - Volume sets
        335.300        .000          .0
        335.500      .00500       219.0
        335.800      .00800       626.0
        336.200       .0110      1292.0
        336.700       .0140      2341.0
        337.000       1.432      3107.0
         Peak Outflow    =      .011 c.m/s
         Maximum Depth   =   336.247 metres
         Maximum Storage =     1390. c.m
          .008       .113       .011       .000 c.m/s
16       NEXT LINK
          .008       .011       .011       .000 c.m/s
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 206 - Rear yards draining uncontrolled to wetland
         **********************
 4       CATCHMENT
     206.000     ID No.ó 99999
        .370     Area in hectares
      90.000     Length (PERV) metres
       2.000     Gradient (%)
      25.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          .007       .011       .011       .000 c.m/s
          .063       .919       .277     C perv/imperv/total
15       ADD RUNOFF
          .007       .018       .011       .000 c.m/s
```

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 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 202 - Park Area
       **********************
  4    CATCHMENT
     202.000     ID No.ó 99999
       .280     Area in hectares
      50.000     Length (PERV) metres
       2.000     Gradient (%)
      10.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .005       .018       .011       .000 c.m/s
             .063       .919       .149     C perv/imperv/total
 15     ADD RUNOFF
             .005       .022       .011       .000 c.m/s
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 207 - Ecological Linkage draining around pond to w
       **********************
  4    CATCHMENT
     207.000     ID No.ó 99999
       .300     Area in hectares
     110.000     Length (PERV) metres
       2.000     Gradient (%)
        .000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .003       .022       .011       .000 c.m/s
             .063       .000       .063     C perv/imperv/total
 15     ADD RUNOFF
             .003       .025       .011       .000 c.m/s
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 204 - Wetland
       **********************
  4    CATCHMENT
     204.000     ID No.ó 99999
       1.650     Area in hectares
      50.000     Length (PERV) metres
        .500     Gradient (%)
        .000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
      10.300     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .006       .025       .011       .000 c.m/s
             .019       .000       .019     C perv/imperv/total
 15     ADD RUNOFF
             .006       .026       .011       .000 c.m/s
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 205 - Former Driveway
       **********************
  4    CATCHMENT
     205.000     ID No.ó 99999
       .240     Area in hectares
      10.000     Length (PERV) metres
        .500     Gradient (%)
      15.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .006       .026       .011       .000 c.m/s
             .063       .947       .196     C perv/imperv/total
 15     ADD RUNOFF
             .006       .030       .011       .000 c.m/s
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 209 - Rear lots of townhomes and trail connection
       **********************
  4    CATCHMENT
     209.000     ID No.ó 99999
       .320     Area in hectares
     200.000     Length (PERV) metres
       2.000     Gradient (%)
      15.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .004       .030       .011       .000 c.m/s
             .063       .919       .192     C perv/imperv/total
 35     COMMENT
      3     line(s) of comment
       **********************
       Total Flow to Wetland
       **********************
 15     ADD RUNOFF
             .004       .034       .011       .000 c.m/s
 20     MANUAL
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         Output File (4.7) ARK10.OUT    opened 2023-12-19  20:30
         Units used are defined by G =    9.810
            192   533    15.000        are MAXDT MAXHYD & DTMIN values
         Licensee: Paragon Engineering Limited
35       COMMENT
       7     line(s) of comment
         **********************
         1614-13338 220 Arkell
         Stormwater Management Modelling
         Proposed Conditions
         10-yr, 48-hour adjusted storm (TCSS)
         Modeller: B.Weersink (Dec 2023)
         **********************
23       FILE RAINFALL
       1     1=READ: 2=WRITE
      10     10y48h.STM           is Filename
 3       IMPERVIOUS
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .013     Manning "n"
        .000     Max.Infiltn. mm/hr
        .000     Min.Infiltn. mm/hr
        .050     Lag const (hours)
       1.500     Dep.Storage mm
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 201 - Ecological Linkage and rear yards east
         **********************
 4       CATCHMENT
     201.000     ID No.ó 99999
       1.150     Area in hectares
     150.000     Length (PERV) metres
       2.000     Gradient (%)
       5.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .024       .000       .000       .000 c.m/s
              .099       .915       .140     C perv/imperv/total
14       START
       1     1=Zero; 2=Define
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 200 - Developed Area to SWM
         **********************
 4       CATCHMENT
     200.000     ID No.ó 99999
       2.420     Area in hectares
      20.000     Length (PERV) metres
       2.000     Gradient (%)
      65.000     Per cent Impervious
      40.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .138       .000       .000       .000 c.m/s
              .098       .979       .671     C perv/imperv/total
15       ADD RUNOFF
              .138       .138       .000       .000 c.m/s
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 203 - dry SWMF
         **********************
 4       CATCHMENT
     203.000     ID No.ó 99999
        .410     Area in hectares
      50.000     Length (PERV) metres
       2.000     Gradient (%)
      15.000     Per cent Impervious
       4.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .012       .138       .000       .000 c.m/s
              .099       .867       .214     C perv/imperv/total
15       ADD RUNOFF
              .012       .148       .000       .000 c.m/s
35       COMMENT
       3     line(s) of comment
         **********************
         Dry SWM Stage-storage
         **********************
10       POND
       6 Depth - Discharge - Volume sets
        335.300        .000          .0
        335.500      .00500       219.0
        335.800      .00800       626.0
        336.200       .0110      1292.0
        336.700       .0140      2341.0
        337.000       1.432      3107.0
         Peak Outflow    =      .012 c.m/s
         Maximum Depth   =   336.395 metres
         Maximum Storage =     1702. c.m
              .012       .148       .012       .000 c.m/s
16       NEXT LINK
              .012       .012       .012       .000 c.m/s
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 206 - Rear yards draining uncontrolled to wetland
         **********************
 4       CATCHMENT
     206.000     ID No.ó 99999
        .370     Area in hectares
      90.000     Length (PERV) metres
       2.000     Gradient (%)
      25.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .011       .012       .012       .000 c.m/s
              .099       .915       .303     C perv/imperv/total
15       ADD RUNOFF
              .011       .022       .012       .000 c.m/s
```

```
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 202 - Park Area
       **********************
  4    CATCHMENT
     202.000     ID No.ó 99999
       .280     Area in hectares
      50.000     Length (PERV) metres
       2.000     Gradient (%)
      10.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .008       .022       .012       .000 c.m/s
             .099       .915       .181     C perv/imperv/total
 15     ADD RUNOFF
             .008       .030       .012       .000 c.m/s
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 207 - Ecological Linkage draining around pond to w
       **********************
  4    CATCHMENT
     207.000     ID No.ó 99999
       .300     Area in hectares
     110.000     Length (PERV) metres
       2.000     Gradient (%)
        .000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .006       .030       .012       .000 c.m/s
             .099       .000       .099     C perv/imperv/total
 15     ADD RUNOFF
             .006       .036       .012       .000 c.m/s
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 204 - Wetland
       **********************
  4    CATCHMENT
     204.000     ID No.ó 99999
       1.650     Area in hectares
      50.000     Length (PERV) metres
        .500     Gradient (%)
        .000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
      10.300     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .022       .036       .012       .000 c.m/s
             .062       .000       .062     C perv/imperv/total
 15     ADD RUNOFF
             .022       .054       .012       .000 c.m/s
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 205 - Former Driveway
       **********************
  4    CATCHMENT
     205.000     ID No.ó 99999
       .240     Area in hectares
      10.000     Length (PERV) metres
        .500     Gradient (%)
      15.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .009       .054       .012       .000 c.m/s
             .098       .947       .225     C perv/imperv/total
 15     ADD RUNOFF
             .009       .059       .012       .000 c.m/s
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 209 - Rear lots of townhomes and trail connection
       **********************
  4    CATCHMENT
     209.000     ID No.ó 99999
       .320     Area in hectares
     200.000     Length (PERV) metres
       2.000     Gradient (%)
      15.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .007       .059       .012       .000 c.m/s
             .099       .915       .222     C perv/imperv/total
 35     COMMENT
      3     line(s) of comment
       **********************
       Total Flow to Wetland
       **********************
 15     ADD RUNOFF
             .007       .065       .012       .000 c.m/s
 20     MANUAL
```

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          Output File (4.7) ARK25.OUT    opened 2023-12-19  20:31
          Units used are defined by G =    9.810
             192   533    15.000        are MAXDT MAXHYD & DTMIN values
          Licensee: Paragon Engineering Limited
 35       COMMENT
        7     line(s) of comment
          **********************
          1614-13338 220 Arkell
          Stormwater Management Modelling
          Proposed Conditions
          25-yr, 48-hour adjusted storm (TCSS)
          Modeller: B.Weersink (Dec 2023)
          **********************
 23       FILE RAINFALL
        1     1=READ: 2=WRITE
       10     25y48h.STM           is Filename
  3       IMPERVIOUS
              2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
           .013     Manning "n"
           .000     Max.Infiltn. mm/hr
           .000     Min.Infiltn. mm/hr
           .050     Lag const (hours)
          1.500     Dep.Storage mm
 35       COMMENT
        3     line(s) of comment
          **********************
          Catchment 201 - Ecological Linkage and rear yards east
          **********************
  4       CATCHMENT
       201.000     ID No.ó 99999
         1.150     Area in hectares
       150.000     Length (PERV) metres
         2.000     Gradient (%)
         5.000     Per cent Impervious
        10.000     Length (IMPERV)
          .000     %Imp. with Zero Dpth
             2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .250     Manning "n"
        75.000     Max.Infiltn. mm/hr
        13.000     Min.Infiltn. mm/hr
          .500     Lag const (hours)
         5.000     Dep.Storage mm
             1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .029       .000       .000       .000 c.m/s
                .112       .913       .152     C perv/imperv/total
 14       START
        1     1=Zero; 2=Define
 35       COMMENT
        3     line(s) of comment
          **********************
          Catchment 200 - Developed Area to SWM
          **********************
  4       CATCHMENT
       200.000     ID No.ó 99999
         2.420     Area in hectares
        20.000     Length (PERV) metres
         2.000     Gradient (%)
        65.000     Per cent Impervious
        40.000     Length (IMPERV)
          .000     %Imp. with Zero Dpth
             2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .250     Manning "n"
        75.000     Max.Infiltn. mm/hr
        13.000     Min.Infiltn. mm/hr
          .500     Lag const (hours)
         5.000     Dep.Storage mm
             1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .149       .000       .000       .000 c.m/s
                .110       .979       .675     C perv/imperv/total
 15       ADD RUNOFF
                .149       .149       .000       .000 c.m/s
 35       COMMENT
        3     line(s) of comment
          **********************
          Catchment 203 - dry SWMF
          **********************
  4       CATCHMENT
       203.000     ID No.ó 99999
          .410     Area in hectares
        50.000     Length (PERV) metres
         2.000     Gradient (%)
        15.000     Per cent Impervious
         4.000     Length (IMPERV)
          .000     %Imp. with Zero Dpth
             2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .250     Manning "n"
        75.000     Max.Infiltn. mm/hr
        13.000     Min.Infiltn. mm/hr
          .500     Lag const (hours)
         5.000     Dep.Storage mm
             1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .014       .149       .000       .000 c.m/s
                .112       .866       .225     C perv/imperv/total
 15       ADD RUNOFF
                .014       .162       .000       .000 c.m/s
 35       COMMENT
        3     line(s) of comment
          **********************
          Dry SWM Stage-storage
          **********************
 10       POND
        6 Depth - Discharge - Volume sets
          335.300        .000          .0
          335.500      .00500       219.0
          335.800      .00800       626.0
          336.200       .0110      1292.0
          336.700       .0140      2341.0
          337.000       1.432      3107.0
          Peak Outflow    =      .013 c.m/s
          Maximum Depth   =   336.460 metres
          Maximum Storage =     1836. c.m
                .014       .162       .013       .000 c.m/s
 16       NEXT LINK
                .014       .013       .013       .000 c.m/s
 35       COMMENT
        3     line(s) of comment
          **********************
          Catchment 206 - Rear yards draining uncontrolled to wetland
          **********************
  4       CATCHMENT
       206.000     ID No.ó 99999
          .370     Area in hectares
        90.000     Length (PERV) metres
         2.000     Gradient (%)
        25.000     Per cent Impervious
        10.000     Length (IMPERV)
          .000     %Imp. with Zero Dpth
             2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .250     Manning "n"
        75.000     Max.Infiltn. mm/hr
        13.000     Min.Infiltn. mm/hr
          .500     Lag const (hours)
         5.000     Dep.Storage mm
             1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .013       .013       .013       .000 c.m/s
                .112       .913       .312     C perv/imperv/total
 15       ADD RUNOFF
                .013       .024       .013       .000 c.m/s
```

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 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 202 - Park Area
       **********************
  4    CATCHMENT
     202.000     ID No.ó 99999
       .280     Area in hectares
      50.000     Length (PERV) metres
       2.000     Gradient (%)
      10.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .010       .024       .013       .000 c.m/s
             .112       .913       .192     C perv/imperv/total
 15     ADD RUNOFF
             .010       .033       .013       .000 c.m/s
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 207 - Ecological Linkage draining around pond to w
       **********************
  4    CATCHMENT
     207.000     ID No.ó 99999
       .300     Area in hectares
     110.000     Length (PERV) metres
       2.000     Gradient (%)
        .000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .008       .033       .013       .000 c.m/s
             .112       .000       .112     C perv/imperv/total
 15     ADD RUNOFF
             .008       .041       .013       .000 c.m/s
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 204 - Wetland
       **********************
  4    CATCHMENT
     204.000     ID No.ó 99999
       1.650     Area in hectares
      50.000     Length (PERV) metres
        .500     Gradient (%)
        .000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
      10.300     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .029       .041       .013       .000 c.m/s
             .077       .000       .077     C perv/imperv/total
 15     ADD RUNOFF
             .029       .065       .013       .000 c.m/s
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 205 - Former Driveway
       **********************
  4    CATCHMENT
     205.000     ID No.ó 99999
       .240     Area in hectares
      10.000     Length (PERV) metres
        .500     Gradient (%)
      15.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .010       .065       .013       .000 c.m/s
             .110       .946       .236     C perv/imperv/total
 15     ADD RUNOFF
             .010       .071       .013       .000 c.m/s
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 209 - Rear lots of townhomes and trail connection
       **********************
  4    CATCHMENT
     209.000     ID No.ó 99999
       .320     Area in hectares
     200.000     Length (PERV) metres
       2.000     Gradient (%)
      15.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .008       .071       .013       .000 c.m/s
             .112       .913       .232     C perv/imperv/total
 35     COMMENT
      3     line(s) of comment
       **********************
       Total Flow to Wetland
       **********************
 15     ADD RUNOFF
             .008       .079       .013       .000 c.m/s
 20     MANUAL
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         Output File (4.7) ARK50.OUT    opened 2023-12-19  20:32
         Units used are defined by G =    9.810
            192   533    15.000        are MAXDT MAXHYD & DTMIN values
         Licensee: Paragon Engineering Limited
35       COMMENT
       7     line(s) of comment
         **********************
         1614-13338 220 Arkell
         Stormwater Management Modelling
         Proposed Conditions
         50-yr, 48-hour adjusted storm (TCSS)
         Modeller: B.Weersink (Dec 2023)
         **********************
23       FILE RAINFALL
       1     1=READ: 2=WRITE
      10     50y48h.STM           is Filename
 3       IMPERVIOUS
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .013     Manning "n"
        .000     Max.Infiltn. mm/hr
        .000     Min.Infiltn. mm/hr
        .050     Lag const (hours)
       1.500     Dep.Storage mm
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 201 - Ecological Linkage and rear yards east
         **********************
 4       CATCHMENT
     201.000     ID No.ó 99999
       1.150     Area in hectares
     150.000     Length (PERV) metres
       2.000     Gradient (%)
       5.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .041       .000       .000       .000 c.m/s
              .141       .908       .180     C perv/imperv/total
14       START
       1     1=Zero; 2=Define
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 200 - Developed Area to SWM
         **********************
 4       CATCHMENT
     200.000     ID No.ó 99999
       2.420     Area in hectares
      20.000     Length (PERV) metres
       2.000     Gradient (%)
      65.000     Per cent Impervious
      40.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .177       .000       .000       .000 c.m/s
              .140       .978       .685     C perv/imperv/total
15       ADD RUNOFF
              .177       .177       .000       .000 c.m/s
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 203 - dry SWMF
         **********************
 4       CATCHMENT
     203.000     ID No.ó 99999
        .410     Area in hectares
      50.000     Length (PERV) metres
       2.000     Gradient (%)
      15.000     Per cent Impervious
       4.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .019       .177       .000       .000 c.m/s
              .141       .864       .249     C perv/imperv/total
15       ADD RUNOFF
              .019       .197       .000       .000 c.m/s
35       COMMENT
       3     line(s) of comment
         **********************
         Dry SWM Stage-storage
         **********************
10       POND
       6 Depth - Discharge - Volume sets
        335.300        .000          .0
        335.500      .00500       219.0
        335.800      .00800       626.0
        336.200       .0110      1292.0
        336.700       .0140      2341.0
        337.000       1.432      3107.0
         Peak Outflow    =      .014 c.m/s
         Maximum Depth   =   336.618 metres
         Maximum Storage =     2169. c.m
              .019       .197       .014       .000 c.m/s
16       NEXT LINK
              .019       .014       .014       .000 c.m/s
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 206 - Rear yards draining uncontrolled to wetland
         **********************
 4       CATCHMENT
     206.000     ID No.ó 99999
        .370     Area in hectares
      90.000     Length (PERV) metres
       2.000     Gradient (%)
      25.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .016       .014       .014       .000 c.m/s
              .141       .908       .333     C perv/imperv/total
15       ADD RUNOFF
              .016       .029       .014       .000 c.m/s
```

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 35     COMMENT
  3       line(s) of comment
          **********
          Catchment 202 - Park Area
          **********
  4     CATCHMENT
202.000     ID No.ó 99999
  .280      Area in hectares
 50.000     Length (PERV) metres
  2.000     Gradient (%)
 10.000     Per cent Impervious
 10.000     Length (IMPERV)
   .000     %Imp. with Zero Dpth
     2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
   .250     Manning "n"
 75.000     Max.Infiltn. mm/hr
 13.000     Min.Infiltn. mm/hr
   .500     Lag const (hours)
  5.000     Dep.Storage mm
     1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          .013       .029       .014       .000 c.m/s
          .141       .908       .217     C perv/imperv/total
 15     ADD RUNOFF
          .013       .041       .014       .000 c.m/s
 35     COMMENT
  3       line(s) of comment
          **********
          Catchment 207 - Ecological Linkage draining around pond to w
          **********
  4     CATCHMENT
207.000     ID No.ó 99999
  .300      Area in hectares
110.000     Length (PERV) metres
  2.000     Gradient (%)
   .000     Per cent Impervious
 10.000     Length (IMPERV)
   .000     %Imp. with Zero Dpth
     2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
   .250     Manning "n"
 75.000     Max.Infiltn. mm/hr
 13.000     Min.Infiltn. mm/hr
   .500     Lag const (hours)
  5.000     Dep.Storage mm
     1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          .012       .041       .014       .000 c.m/s
          .141       .000       .141     C perv/imperv/total
 15     ADD RUNOFF
          .012       .052       .014       .000 c.m/s
 35     COMMENT
  3       line(s) of comment
          **********
          Catchment 204 - Wetland
          **********
  4     CATCHMENT
204.000     ID No.ó 99999
 1.650      Area in hectares
 50.000     Length (PERV) metres
   .500     Gradient (%)
   .000     Per cent Impervious
 10.000     Length (IMPERV)
   .000     %Imp. with Zero Dpth
     2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
   .250     Manning "n"
 75.000     Max.Infiltn. mm/hr
 13.000     Min.Infiltn. mm/hr
   .500     Lag const (hours)
 10.300     Dep.Storage mm
     1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          .052       .052       .014       .000 c.m/s
          .110       .000       .110     C perv/imperv/total
 15     ADD RUNOFF
          .052       .102       .014       .000 c.m/s
 35     COMMENT
  3       line(s) of comment
          **********
          Catchment 205 - Former Driveway
          **********
  4     CATCHMENT
205.000     ID No.ó 99999
  .240      Area in hectares
 10.000     Length (PERV) metres
   .500     Gradient (%)
 15.000     Per cent Impervious
 10.000     Length (IMPERV)
   .000     %Imp. with Zero Dpth
     2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
   .250     Manning "n"
 75.000     Max.Infiltn. mm/hr
 13.000     Min.Infiltn. mm/hr
   .500     Lag const (hours)
  5.000     Dep.Storage mm
     1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          .013       .102       .014       .000 c.m/s
          .140       .945       .261     C perv/imperv/total
 15     ADD RUNOFF
          .013       .110       .014       .000 c.m/s
 35     COMMENT
  3       line(s) of comment
          **********
          Catchment 209 - Rear lots of townhomes and trail connection
          **********
  4     CATCHMENT
209.000     ID No.ó 99999
  .320      Area in hectares
200.000     Length (PERV) metres
  2.000     Gradient (%)
 15.000     Per cent Impervious
 10.000     Length (IMPERV)
   .000     %Imp. with Zero Dpth
     2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
   .250     Manning "n"
 75.000     Max.Infiltn. mm/hr
 13.000     Min.Infiltn. mm/hr
   .500     Lag const (hours)
  5.000     Dep.Storage mm
     1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          .011       .110       .014       .000 c.m/s
          .141       .908       .256     C perv/imperv/total
 35     COMMENT
  3       line(s) of comment
          **********
          Total Flow to Wetland
          **********
 15     ADD RUNOFF
          .011       .121       .014       .000 c.m/s
 20     MANUAL
```

```
         Output File (4.7) ARK100I.OUT  opened 2023-12-19  20:33
         Units used are defined by G =    9.810
            192   533    15.000        are MAXDT MAXHYD & DTMIN values
         Licensee: Paragon Engineering Limited
35       COMMENT
       7     line(s) of comment
         **********************
         1614-13338 220 Arkell
         Stormwater Management Modelling
         Proposed Conditions
         100-yr, 48-hour adjusted storm (TCSS)
         Modeller: B.Weersink (Dec 2023)
         **********************
23       FILE RAINFALL
       1     1=READ: 2=WRITE
      10     10048h.STM           is Filename
 3       IMPERVIOUS
            2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .013     Manning "n"
         .000     Max.Infiltn. mm/hr
         .000     Min.Infiltn. mm/hr
         .050     Lag const (hours)
        1.500     Dep.Storage mm
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 201 - Ecological Linkage and rear yards east
         **********************
 4       CATCHMENT
     201.000     ID No.ó 99999
       1.150     Area in hectares
     150.000     Length (PERV) metres
       2.000     Gradient (%)
       5.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .048       .000       .000       .000 c.m/s
              .153       .906       .191     C perv/imperv/total
14       START
       1     1=Zero; 2=Define
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 200 - Developed Area to SWM
         **********************
 4       CATCHMENT
     200.000     ID No.ó 99999
       2.420     Area in hectares
      20.000     Length (PERV) metres
       2.000     Gradient (%)
      65.000     Per cent Impervious
      40.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .189       .000       .000       .000 c.m/s
              .153       .977       .689     C perv/imperv/total
15       ADD RUNOFF
              .189       .189       .000       .000 c.m/s
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 203 - dry SWMF
         **********************
 4       CATCHMENT
     203.000     ID No.ó 99999
        .410     Area in hectares
      50.000     Length (PERV) metres
       2.000     Gradient (%)
      15.000     Per cent Impervious
       4.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .022       .189       .000       .000 c.m/s
              .152       .864       .259     C perv/imperv/total
15       ADD RUNOFF
              .022       .211       .000       .000 c.m/s
35       COMMENT
       3     line(s) of comment
         **********************
         Dry SWM Stage-storage
         **********************
10       POND
       6 Depth - Discharge - Volume sets
       335.300        .000          .0
       335.500      .00500       219.0
       335.800      .00800       626.0
       336.200       .0110      1292.0
       336.700       .0140      2341.0
       337.000       1.432      3107.0
         Peak Outflow    =      .014 c.m/s
         Maximum Depth   =   336.687 metres
         Maximum Storage =     2313. c.m
              .022       .211       .014       .000 c.m/s
16       NEXT LINK
              .022       .014       .014       .000 c.m/s
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 206 - Rear yards draining uncontrolled to wetland
         **********************
 4       CATCHMENT
     206.000     ID No.ó 99999
        .370     Area in hectares
      90.000     Length (PERV) metres
       2.000     Gradient (%)
      25.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .018       .014       .014       .000 c.m/s
              .153       .906       .342     C perv/imperv/total
15       ADD RUNOFF
              .018       .031       .014       .000 c.m/s
```

```
35     COMMENT
       3     line(s) of comment
       **********************
       Catchment 202 - Park Area
       **********************
 4     CATCHMENT
     202.000     ID No.ó 99999
       .280     Area in hectares
      50.000     Length (PERV) metres
       2.000     Gradient (%)
      10.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .015       .031       .014       .000 c.m/s
              .152       .906       .228     C perv/imperv/total
15     ADD RUNOFF
              .015       .045       .014       .000 c.m/s
35     COMMENT
       3     line(s) of comment
       **********************
       Catchment 207 - Ecological Linkage draining around pond to w
       **********************
 4     CATCHMENT
     207.000     ID No.ó 99999
       .300     Area in hectares
     110.000     Length (PERV) metres
       2.000     Gradient (%)
        .000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .014       .045       .014       .000 c.m/s
              .153       .000       .153     C perv/imperv/total
15     ADD RUNOFF
              .014       .058       .014       .000 c.m/s
35     COMMENT
       3     line(s) of comment
       **********************
       Catchment 204 - Wetland
       **********************
 4     CATCHMENT
     204.000     ID No.ó 99999
       1.650     Area in hectares
      50.000     Length (PERV) metres
        .500     Gradient (%)
        .000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
      10.300     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .062       .058       .014       .000 c.m/s
              .124       .000       .124     C perv/imperv/total
15     ADD RUNOFF
              .062       .118       .014       .000 c.m/s
35     COMMENT
       3     line(s) of comment
       **********************
       Catchment 205 - Former Driveway
       **********************
 4     CATCHMENT
     205.000     ID No.ó 99999
       .240     Area in hectares
      10.000     Length (PERV) metres
        .500     Gradient (%)
      15.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .015       .118       .014       .000 c.m/s
              .153       .945       .271     C perv/imperv/total
15     ADD RUNOFF
              .015       .127       .014       .000 c.m/s
35     COMMENT
       3     line(s) of comment
       **********************
       Catchment 209 - Rear lots of townhomes and trail connection
       **********************
 4     CATCHMENT
     209.000     ID No.ó 99999
       .320     Area in hectares
     200.000     Length (PERV) metres
       2.000     Gradient (%)
      15.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .013       .127       .014       .000 c.m/s
              .154       .906       .267     C perv/imperv/total
35     COMMENT
       3     line(s) of comment
       **********************
       Total Flow to Wetland
       **********************
15     ADD RUNOFF
              .013       .139       .014       .000 c.m/s
20     MANUAL
```

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          Output File (4.7) ARKREG.OUT   opened 2023-12-19  20:34
          Units used are defined by G =    9.810
             192   533    15.000        are MAXDT MAXHYD & DTMIN values
          Licensee: Paragon Engineering Limited
35        COMMENT
        7     line(s) of comment
          **********************
          1614-13338 220 Arkell
          Stormwater Management Modelling
          Proposed Conditions
          Regional Storm
          Modeller: B.Weersink (Dec 2023)
          **********************
23        FILE RAINFALL
        1     1=READ: 2=WRITE
       10     Regional.S           is Filename
 3      IMPERVIOUS
            2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .013     Manning "n"
         .000     Max.Infiltn. mm/hr
         .000     Min.Infiltn. mm/hr
         .050     Lag const (hours)
        1.500     Dep.Storage mm
35      COMMENT
        3     line(s) of comment
          **********************
          Catchment 201 - Ecological Linkage and rear yards east
          **********************
 4      CATCHMENT
      201.000     ID No.ó 99999
        1.150     Area in hectares
      150.000     Length (PERV) metres
        2.000     Gradient (%)
        5.000     Per cent Impervious
       10.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
       75.000     Max.Infiltn. mm/hr
       13.000     Min.Infiltn. mm/hr
         .500     Lag const (hours)
        5.000     Dep.Storage mm
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .115       .000       .000       .000 c.m/s
              .259       .891       .291     C perv/imperv/total
14      START
        1     1=Zero; 2=Define
35      COMMENT
        3     line(s) of comment
          **********************
          Catchment 200 - Developed Area to SWM
          **********************
 4      CATCHMENT
      200.000     ID No.ó 99999
        2.420     Area in hectares
       20.000     Length (PERV) metres
        2.000     Gradient (%)
       65.000     Per cent Impervious
       40.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
       75.000     Max.Infiltn. mm/hr
       13.000     Min.Infiltn. mm/hr
         .500     Lag const (hours)
        5.000     Dep.Storage mm
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .310       .000       .000       .000 c.m/s
              .258       .962       .716     C perv/imperv/total
15      ADD RUNOFF
              .310       .310       .000       .000 c.m/s
35      COMMENT
        3     line(s) of comment
          **********************
          Catchment 203 - dry SWMF
          **********************
 4      CATCHMENT
      203.000     ID No.ó 99999
         .410     Area in hectares
       50.000     Length (PERV) metres
        2.000     Gradient (%)
       15.000     Per cent Impervious
        4.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
       75.000     Max.Infiltn. mm/hr
       13.000     Min.Infiltn. mm/hr
         .500     Lag const (hours)
        5.000     Dep.Storage mm
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .046       .310       .000       .000 c.m/s
              .258       .862       .349     C perv/imperv/total
15      ADD RUNOFF
              .046       .356       .000       .000 c.m/s
35      COMMENT
        3     line(s) of comment
          **********************
          Dry SWM Stage-storage
          **********************
10      POND
        6 Depth - Discharge - Volume sets
         335.300        .000          .0
         335.500      .00500       219.0
         335.800      .00800       626.0
         336.200       .0110      1292.0
         336.700       .0140      2341.0
         337.000       1.432      3107.0
         Peak Outflow    =      .351 c.m/s
         Maximum Depth   =   336.771 metres
         Maximum Storage =     2523. c.m
              .046       .356       .351       .000 c.m/s
16      NEXT LINK
              .046       .351       .351       .000 c.m/s
35      COMMENT
        3     line(s) of comment
          **********************
          Catchment 206 - Rear yards draining uncontrolled to wetland
          **********************
 4      CATCHMENT
      206.000     ID No.ó 99999
         .370     Area in hectares
       90.000     Length (PERV) metres
        2.000     Gradient (%)
       25.000     Per cent Impervious
       10.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
       75.000     Max.Infiltn. mm/hr
       13.000     Min.Infiltn. mm/hr
         .500     Lag const (hours)
        5.000     Dep.Storage mm
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .040       .351       .351       .000 c.m/s
              .259       .891       .417     C perv/imperv/total
15      ADD RUNOFF
              .040       .391       .351       .000 c.m/s
```

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 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 202 - Park Area
       **********************
  4    CATCHMENT
     202.000     ID No.ó 99999
       .280     Area in hectares
      50.000     Length (PERV) metres
       2.000     Gradient (%)
      10.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .031       .391       .351       .000 c.m/s
             .258       .891       .321     C perv/imperv/total
 15     ADD RUNOFF
             .031       .423       .351       .000 c.m/s
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 207 - Ecological Linkage draining around pond to w
       **********************
  4    CATCHMENT
     207.000     ID No.ó 99999
       .300     Area in hectares
     110.000     Length (PERV) metres
       2.000     Gradient (%)
        .000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .031       .423       .351       .000 c.m/s
             .258       .000       .258     C perv/imperv/total
 15     ADD RUNOFF
             .031       .452       .351       .000 c.m/s
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 204 - Wetland
       **********************
  4    CATCHMENT
     204.000     ID No.ó 99999
       1.650     Area in hectares
      50.000     Length (PERV) metres
        .500     Gradient (%)
        .000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
      10.300     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .173       .452       .351       .000 c.m/s
             .241       .000       .241     C perv/imperv/total
 15     ADD RUNOFF
             .173       .621       .351       .000 c.m/s
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 205 - Former Driveway
       **********************
  4    CATCHMENT
     205.000     ID No.ó 99999
       .240     Area in hectares
      10.000     Length (PERV) metres
        .500     Gradient (%)
      15.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .027       .621       .351       .000 c.m/s
             .258       .934       .359     C perv/imperv/total
 15     ADD RUNOFF
             .027       .648       .351       .000 c.m/s
 35     COMMENT
      3     line(s) of comment
       **********************
       Catchment 209 - Rear lots of townhomes and trail connection
       **********************
  4    CATCHMENT
     209.000     ID No.ó 99999
       .320     Area in hectares
     200.000     Length (PERV) metres
       2.000     Gradient (%)
      15.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .030       .648       .351       .000 c.m/s
             .259       .891       .354     C perv/imperv/total
 35     COMMENT
      3     line(s) of comment
       **********************
       Total Flow to Wetland
       **********************
 15     ADD RUNOFF
             .030       .675       .351       .000 c.m/s
 20     MANUAL
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         Output File (4.7) 100PR3H.OUT  opened 2023-12-19  20:25
         Units used are defined by G =    9.810
             36   200     5.000        are MAXDT MAXHYD & DTMIN values
         Licensee: Paragon Engineering Limited
35       COMMENT
       7     line(s) of comment
         **********************
         1614-13338 220 Arkell
         Stormwater Management Modelling
         Proposed Conditions
         100yr, 3 hour event
         Modeller: B.Weersink (Mar 2022)
         **********************
23       FILE RAINFALL
       1     1=READ: 2=WRITE
      10     3h100yr.ST           is Filename
 3     IMPERVIOUS
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .013     Manning "n"
        .000     Max.Infiltn. mm/hr
        .000     Min.Infiltn. mm/hr
        .050     Lag const (hours)
       1.500     Dep.Storage mm
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 201 - Ecological Linkage and rear yards east
         **********************
 4     CATCHMENT
     201.000     ID No.ó 99999
       1.150     Area in hectares
     150.000     Length (PERV) metres
       2.000     Gradient (%)
       5.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
        .180       .000       .000       .000 c.m/s
        .385       .925       .412     C perv/imperv/total
14       START
       1     1=Zero; 2=Define
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 200 - Developed Area to SWM
         **********************
 4     CATCHMENT
     200.000     ID No.ó 99999
       2.420     Area in hectares
      20.000     Length (PERV) metres
       2.000     Gradient (%)
      65.000     Per cent Impervious
      40.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
       1.005       .000       .000       .000 c.m/s
        .381       .970       .764     C perv/imperv/total
15       ADD RUNOFF
       1.005     1.005       .000       .000 c.m/s
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 203 - dry SWMF
         **********************
 4     CATCHMENT
     203.000     ID No.ó 99999
        .410     Area in hectares
      50.000     Length (PERV) metres
       2.000     Gradient (%)
      15.000     Per cent Impervious
       4.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
        .093     1.005       .000       .000 c.m/s
        .383       .866       .456     C perv/imperv/total
15       ADD RUNOFF
        .093     1.087       .000       .000 c.m/s
35       COMMENT
       3     line(s) of comment
         **********************
         Dry SWM Stage-storage
         **********************
10       POND
       6 Depth - Discharge - Volume sets
       335.300        .000          .0
       335.500      .00500       219.0
       335.800      .00800       626.0
       336.200       .0110      1292.0
       336.700       .0140      2341.0
       337.000      1.432       3107.0
       Peak Outflow    =      .012 c.m/s
       Maximum Depth   =   336.387 metres
       Maximum Storage =     1685. c.m
        .093     1.087       .012       .000 c.m/s
16       NEXT LINK
        .093       .012       .012       .000 c.m/s
35       COMMENT
       3     line(s) of comment
         **********************
         Catchment 206 - Rear yards draining uncontrolled to wetland
         **********************
 4     CATCHMENT
     206.000     ID No.ó 99999
        .370     Area in hectares
      90.000     Length (PERV) metres
       2.000     Gradient (%)
      25.000     Per cent Impervious
      10.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           2     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      75.000     Max.Infiltn. mm/hr
      13.000     Min.Infiltn. mm/hr
        .500     Lag const (hours)
       5.000     Dep.Storage mm
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
        .071       .012       .012       .000 c.m/s
        .385       .925       .520     C perv/imperv/total
15       ADD RUNOFF
        .071       .081       .012       .000 c.m/s
```

```
 35     COMMENT
  3     line(s) of comment
        **********
        Catchment 202 - Park Area
        **********
  4     CATCHMENT
202.000     ID No.ó 99999
  .280      Area in hectares
 50.000     Length (PERV) metres
  2.000     Gradient (%)
 10.000     Per cent Impervious
 10.000     Length (IMPERV)
   .000     %Imp. with Zero Dpth
     2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
   .250     Manning "n"
 75.000     Max.Infiltn. mm/hr
 13.000     Min.Infiltn. mm/hr
   .500     Lag const (hours)
  5.000     Dep.Storage mm
     1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          .066       .081       .012       .000 c.m/s
          .383       .925       .438     C perv/imperv/total
 15     ADD RUNOFF
          .066       .146       .012       .000 c.m/s
 35     COMMENT
  3     line(s) of comment
        **********
        Catchment 207 - Ecological Linkage draining around pond to w
        **********
  4     CATCHMENT
207.000     ID No.ó 99999
  .300      Area in hectares
110.000     Length (PERV) metres
  2.000     Gradient (%)
   .000     Per cent Impervious
 10.000     Length (IMPERV)
   .000     %Imp. with Zero Dpth
     2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
   .250     Manning "n"
 75.000     Max.Infiltn. mm/hr
 13.000     Min.Infiltn. mm/hr
   .500     Lag const (hours)
  5.000     Dep.Storage mm
     1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          .053       .146       .012       .000 c.m/s
          .385       .000       .385     C perv/imperv/total
 15     ADD RUNOFF
          .053       .192       .012       .000 c.m/s
 35     COMMENT
  3     line(s) of comment
        **********
        Catchment 204 - Wetland
        **********
  4     CATCHMENT
204.000     ID No.ó 99999
 1.650      Area in hectares
 50.000     Length (PERV) metres
   .500     Gradient (%)
   .000     Per cent Impervious
 10.000     Length (IMPERV)
   .000     %Imp. with Zero Dpth
     2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
   .250     Manning "n"
 75.000     Max.Infiltn. mm/hr
 13.000     Min.Infiltn. mm/hr
   .500     Lag const (hours)
 10.300     Dep.Storage mm
     1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          .247       .192       .012       .000 c.m/s
          .324       .000       .324     C perv/imperv/total
 15     ADD RUNOFF
          .247       .431       .012       .000 c.m/s
 35     COMMENT
  3     line(s) of comment
        **********
        Catchment 205 - Former Driveway
        **********
  4     CATCHMENT
205.000     ID No.ó 99999
  .240      Area in hectares
 10.000     Length (PERV) metres
   .500     Gradient (%)
 15.000     Per cent Impervious
 10.000     Length (IMPERV)
   .000     %Imp. with Zero Dpth
     2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
   .250     Manning "n"
 75.000     Max.Infiltn. mm/hr
 13.000     Min.Infiltn. mm/hr
   .500     Lag const (hours)
  5.000     Dep.Storage mm
     1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          .084       .431       .012       .000 c.m/s
          .381       .958       .467     C perv/imperv/total
 15     ADD RUNOFF
          .084       .469       .012       .000 c.m/s
 35     COMMENT
  3     line(s) of comment
        **********
        Catchment 209 - Rear lots of townhomes and trail connection
        **********
  4     CATCHMENT
209.000     ID No.ó 99999
  .320      Area in hectares
200.000     Length (PERV) metres
  2.000     Gradient (%)
 15.000     Per cent Impervious
 10.000     Length (IMPERV)
   .000     %Imp. with Zero Dpth
     2      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
   .250     Manning "n"
 75.000     Max.Infiltn. mm/hr
 13.000     Min.Infiltn. mm/hr
   .500     Lag const (hours)
  5.000     Dep.Storage mm
     1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          .042       .469       .012       .000 c.m/s
          .385       .925       .466     C perv/imperv/total
 35     COMMENT
  3     line(s) of comment
        **********
        Total Flow to Wetland
        **********
 15     ADD RUNOFF
          .042       .509       .012       .000 c.m/s
 20     MANUAL
```

220 Arkell - Single Family Soakaway Pits
Infiltration Gallery Sizing Calculations

Typical Single Detached Lot (30')		**Units**
Total Roof Area to be Infiltrated	120	m^2
Runoff depth	25	mm
Total Volume of Runoff	3.0	m^3
Total Volume of Runoff + 20%	3.6	m^3
Gallery Length	8	m
Gallery Height	0.5	m
Gallery Width	2.00	m
Void Ratio of Infiltration Gallery Stone	0.4	
Total Gallery Storage Volume Provided	3.20	m^3
Surface Area	16	m^2
Assumed Infiltration rate[1]	10.0	mm/hr
Drawdown Rate	0.000044	m^3/s
Drawdown Time (using volume with 20%)	23	hrs

Total Number of lots	33	
Total Rooftop Area	3960	m^2

Note:

(1) Infiltration rate based on in-situ testing completed by Stantec. This is the minimum design infiltration rate (safety factors applied) of the testing done in the locations of the infiltration locations.

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

		Units
Individual Building Roof Area to be Infiltrated	275	m^2
Number of Buildings	16	
Total Rooftop Area to be Infiltrated	4400	m^2
Runoff depth	25	mm
Total Volume of Runoff	110.0	m^3
Total Volume of Runoff + 20%	132.0	m^3
Gallery Footprint	660.0	m^2
Gallery Height	0.50	m
Void Ratio of Infiltration Gallery Stone	0.4	
Total Gallery Storage Volume Provided	132.0	m^3
Assumed Infiltration rate[(1)]	17.0	mm/hr
Drawdown Rate	0.003117	m^3/s
Drawdown Time (using volume with 20%)	12	hrs

Note:

(1) Infiltration rate based on in-situ testing completed by Stantec. This is the minimum design infiltration rate (safety factors applied) of the testing done in the locations of the infiltration locations.

220 Arkell - Multiblock Infiltration Targets

Parameter	Value
Total Multi-block Area (ha)	1.58
Assumed impervious %	75
Assumed Rooftop Area (ha)	0.44
Rooftop Infiltration Volume Required per Water Balance (m^3/yr)	**3,250**
Pervious Infiltration in Sub-Area D per Water Balance (m^3/yr)	1,598
Pervious area in Sub-Area D (ha)	0.82
Pervious infiltration per hectare (m^3/yr/ha)	1,949
Assumed Pervious Area in Multiblock (ha)	0.40
Pervious Infiltration required in Multiblock (m^3/yr)	**770**
Total Infiltration required in Multiblock through rooftop galleries and pervious surface (m^3/yr)	**4,020**

Note:

Water Balance Calculations are presented in the *Revised Water Balance Calculations in Response to First Submission Comments, Draft Plan Application – 220 Arkell Road, City of Guelph* (Stantec, 2023)

Worksheet for SWM Inlet - Chicago100yr

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.024
Channel Slope	0.009 m/m
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	4.00 m
Discharge	1,010.00 L/s

Results	
Normal Depth	186.8 mm
Flow Area	0.9 m²
Wetted Perimeter	5.2 m
Hydraulic Radius	164.4 mm
Top Width	5.12 m
Critical Depth	178.1 mm
Critical Slope	0.011 m/m
Velocity	1.19 m/s
Velocity Head	0.07 m
Specific Energy	0.26 m
Froude Number	0.928
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 mm
Length	0.0 m
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 mm
Profile Description	N/A
Profile Headloss	0.00 m
Downstream Velocity	0.00 m/s
Upstream Velocity	0.00 m/s
Normal Depth	186.8 mm
Critical Depth	178.1 mm
Channel Slope	0.009 m/m
Critical Slope	0.011 m/m

ADS OGS Sizing Summary

Project Name: 220 Arkell Road

Consulting Engineer: Stantec

Location: Guelph, ON

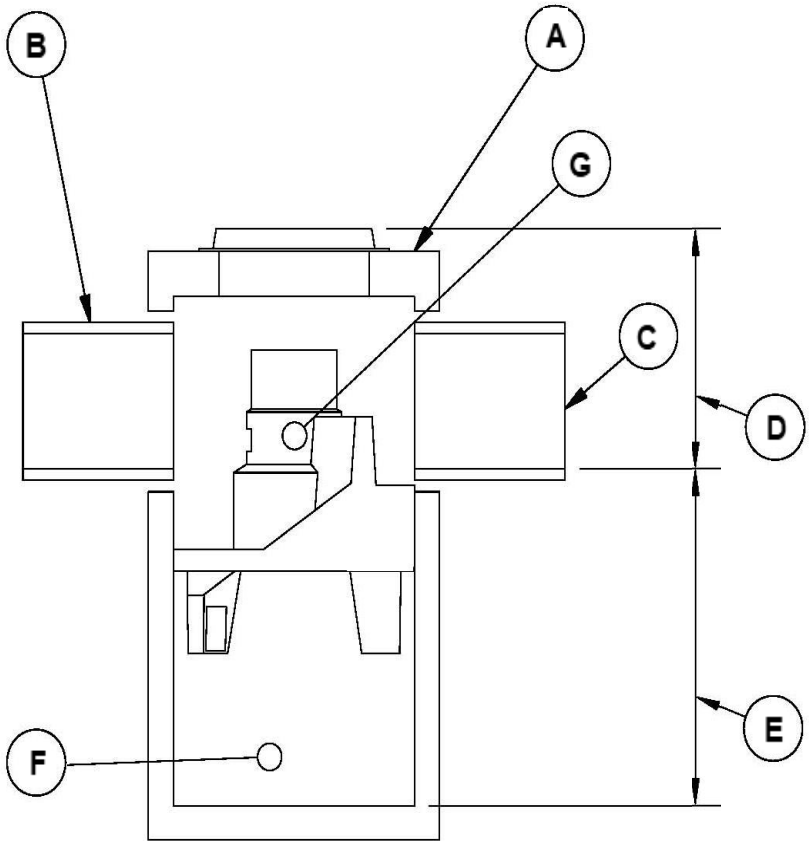
Sizing Completed By: C. Neath **Email:** cody.neath@ads-pipe.com

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

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

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

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



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

Notes:

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

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

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

Net Annual Removal Efficiency Summary: FD-8HC

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

Notes:

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

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

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

Weersink, Bryan

From: Ethan Barrand <Ethan.Barrand@guelph.ca>
Sent: Monday, November 13, 2023 11:52 AM
To: Brousseau, Kevin
Cc: Jim Hall; Bellemare, Jackie; Weersink, Bryan
Subject: RE: 220 Arkell - Nov 8 response to comments

Winter controls as in the Forebay and OGS will still providing treatment throughout the winter months. As discussed in the meeting, City staff have had discussions surrounding the 2023 DEM being published soon and can confirm that no winter by-pass is required for this development.

Ethan Barrand, P.Eng.
Development Engineer
Engineering and Transportation Services
City of Guelph
519-822-1260 extension 2250
Mobile 226-820-6386
Ethan.Barrand@guelph.ca

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Facebook.com/cityofguelph
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From: Brousseau, Kevin <kevin.brousseau@stantec.com>
Sent: Monday, November 13, 2023 11:46 AM
To: Ethan Barrand <Ethan.Barrand@guelph.ca>
Cc: Jim Hall <Jim.Hall@guelph.ca>; Michael Witmer <Michael.Witmer@guelph.ca>; Bellemare, Jackie <Jackie.Bellemare@stantec.com>; Weersink, Bryan <Bryan.Weersink@stantec.com>
Subject: RE: 220 Arkell - Nov 8 response to comments

Thank you for the additional input Ethan and acknowledgement to a few of our responses.

That said, with respect to comment #24 and your additional response. Can you clarify what “winter controls” are required for a an infiltration facility?

98	24	C	If an infiltration gallery is to be used following the stormwater pond, please be sure infiltration calculations c (winter) months are not accounted for within the monthly and annual infiltration calculations. Please indicat would be responsible for controlling the by-pass to the gallery. Is there a less intrusive design that can be i allow for the bypass to be fully independent? Additional discussions may be required with City staff.
99		R	SWM Design has been revised to provide an infiltration facility with no controls for winter periods.
100		City	To clarrify - winter controls are still required, however, a by-pass is no longer needed.

Please advise.

Thank you.

Vacation Alert:
Please note I will be away on vacation starting November 20th returning on Monday November 27th.
I will be checking and responding to emails upon my return.

Kevin Brousseau, L.E.T., C.E.T.
Principal, Practice Leader - Community Development

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

November 5, 2018
File: 161413338/11

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

Dear Mr. Hall,

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

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

1.0 BACKGROUND

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

2.0 PRE-DEVELOPMENT AND CURRENT CONDITIONS

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

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

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

3.0 PROPOSED CONDITIONS

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

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

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

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

3.1 WATER BALANCE, INFILTRATION AND WATER QUANTITY CONTROL

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

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

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

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

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

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

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

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

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

3.2 WATER QUALITY CONTROL

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

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

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

4.0 SUMMARY

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

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

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

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

Regards,

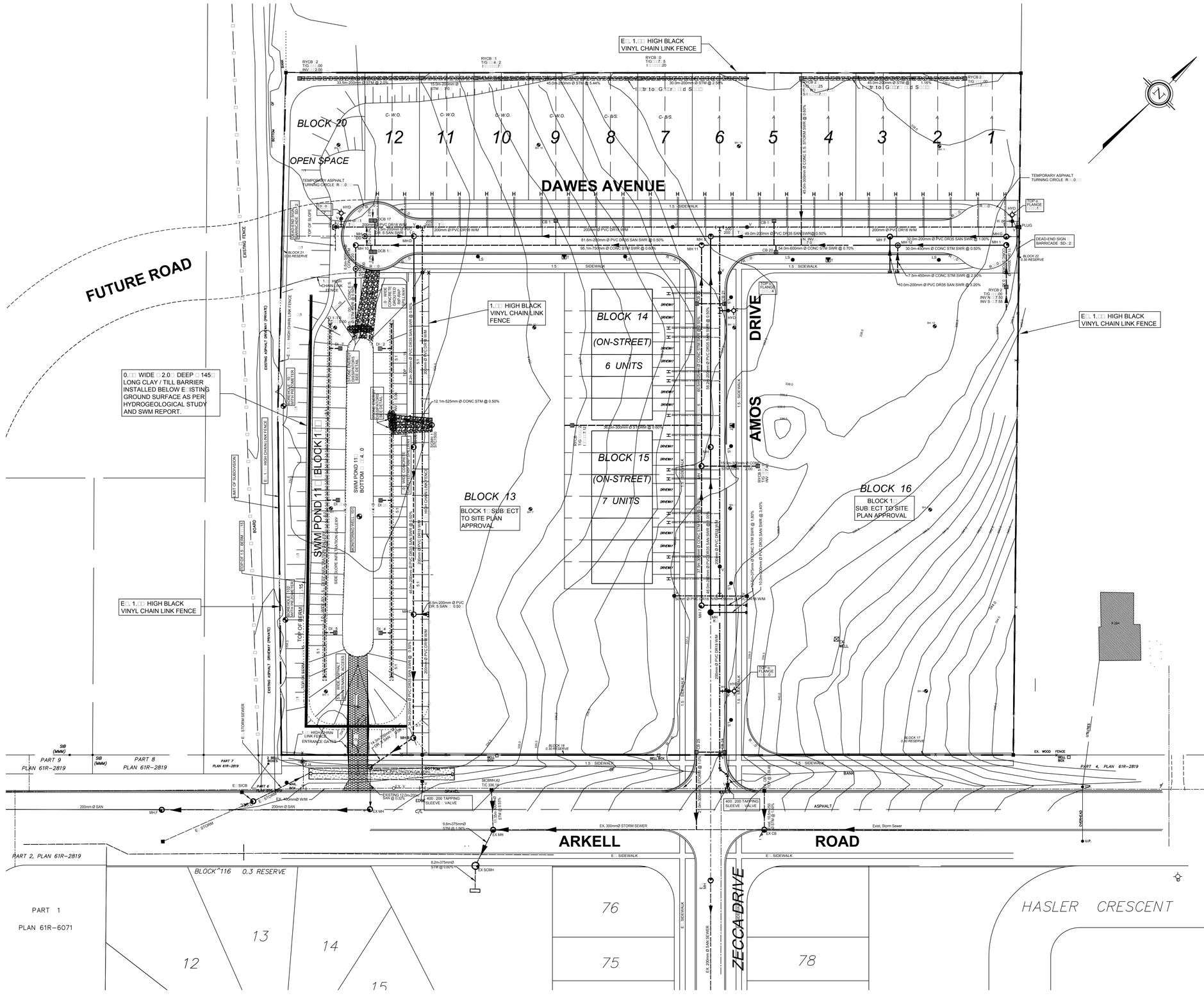
Stantec Consulting Ltd.

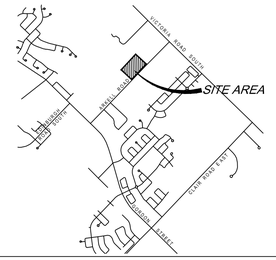
Trevor Fraser P.Eng.
Surface Water Resources Engineer
Phone: (519) 575-4120
trevor.fraser@stantec.com

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

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

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





KEY PLAN Scale : NOT TO SCALE

LEGEND

- CB 1□ — CATCH BASIN
- WATERMAIN
- SANITARY SEWER
- STORM SEWER
- VALVE
- LIGHT STANDARD
- TRANSFORMER

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

GENERAL NOTES:

FIELD NOTES: PLAN REFERENCES:

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

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

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

SCHEDULE OF REVISIONS

CITY OF Guelph
Making a Difference
ENGINEERING SERVICES

ARKELL MEADOWS SUBDIVISION GUELPH, ONTARIO

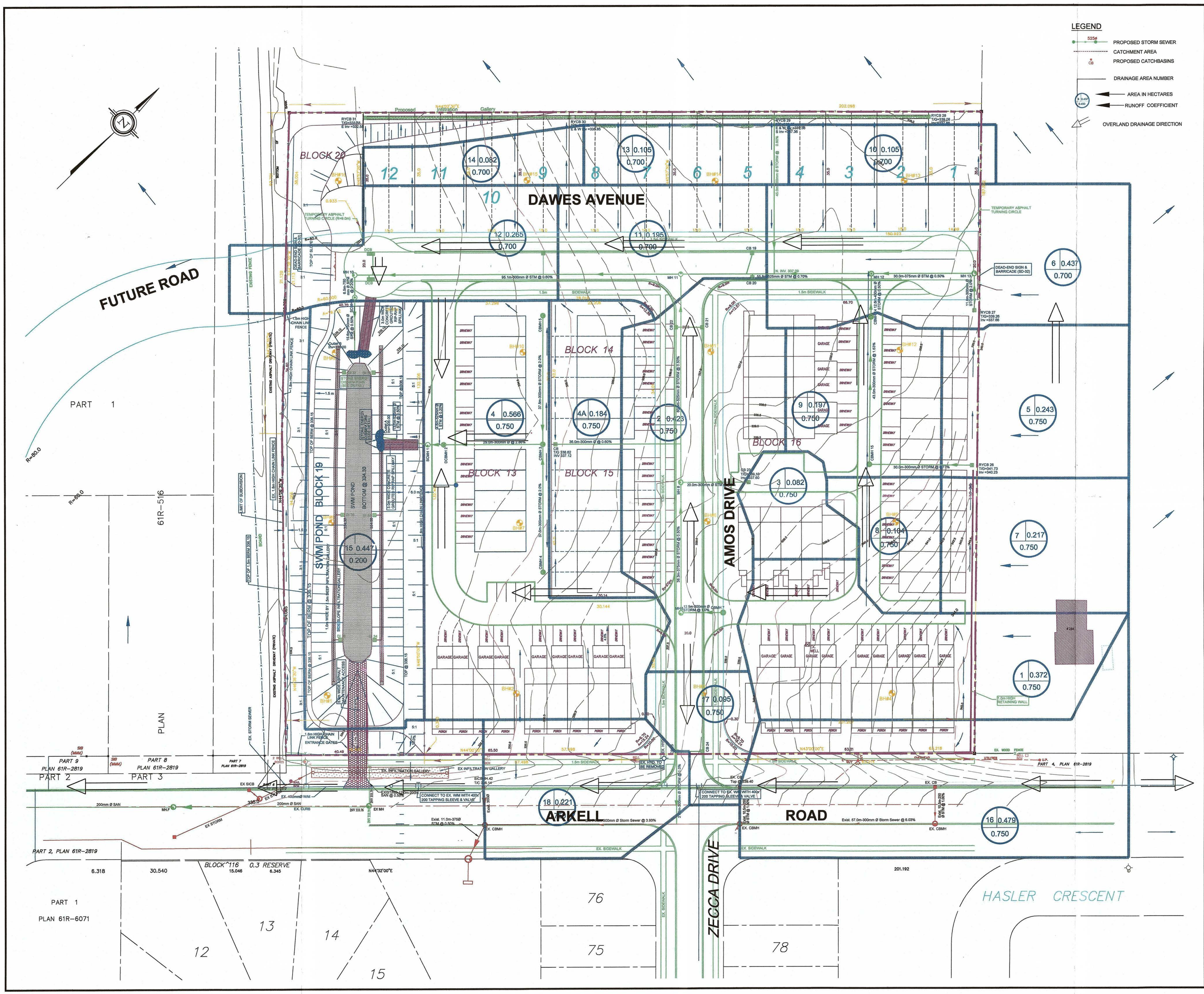
GENERAL SERVICING PLAN

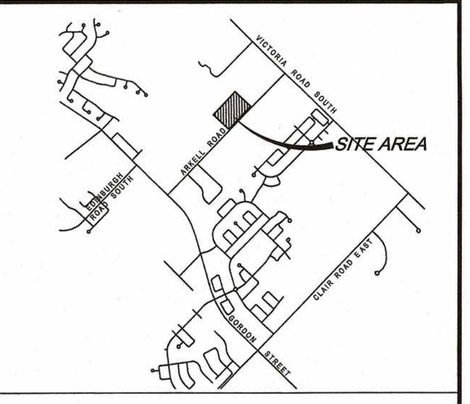
REGISTERED PROFESSIONAL ENGINEER PROVINCE OF ONTARIO
K. J. BEHM
01/05/14

CHECKED: APPROVED:

K. □ BEHM AND ASSOCIATES INC.
CONSULTING ENGINEERS
55 ERB STREET EAST: SUITE □20
WATERLOO: ONTARIO N2□ 4K□
PHONE :51□ 742□510 FA□ :51□ 742□4□2

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





KEY PLAN Scale : NOT TO SCALE

NOTES:

GENERAL NOTES

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

SANITARY SEWER SYSTEMS

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

STORM SEWER SYSTEMS

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

WATERMAIN SYSTEMS

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

ROADWORKS & SWM POND/EMERGENCY ACCESS

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

LEGEND: FOR BORE HOLES

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

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

GENERAL NOTES:

FIELD NOTES:

PLAN REFERENCES:

BENCH MARK: No. 392 ELEVATION: 336.245

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

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

SCHEDULE OF REVISIONS

CITY OF Guelph
Making a Difference
ENGINEERING SERVICES

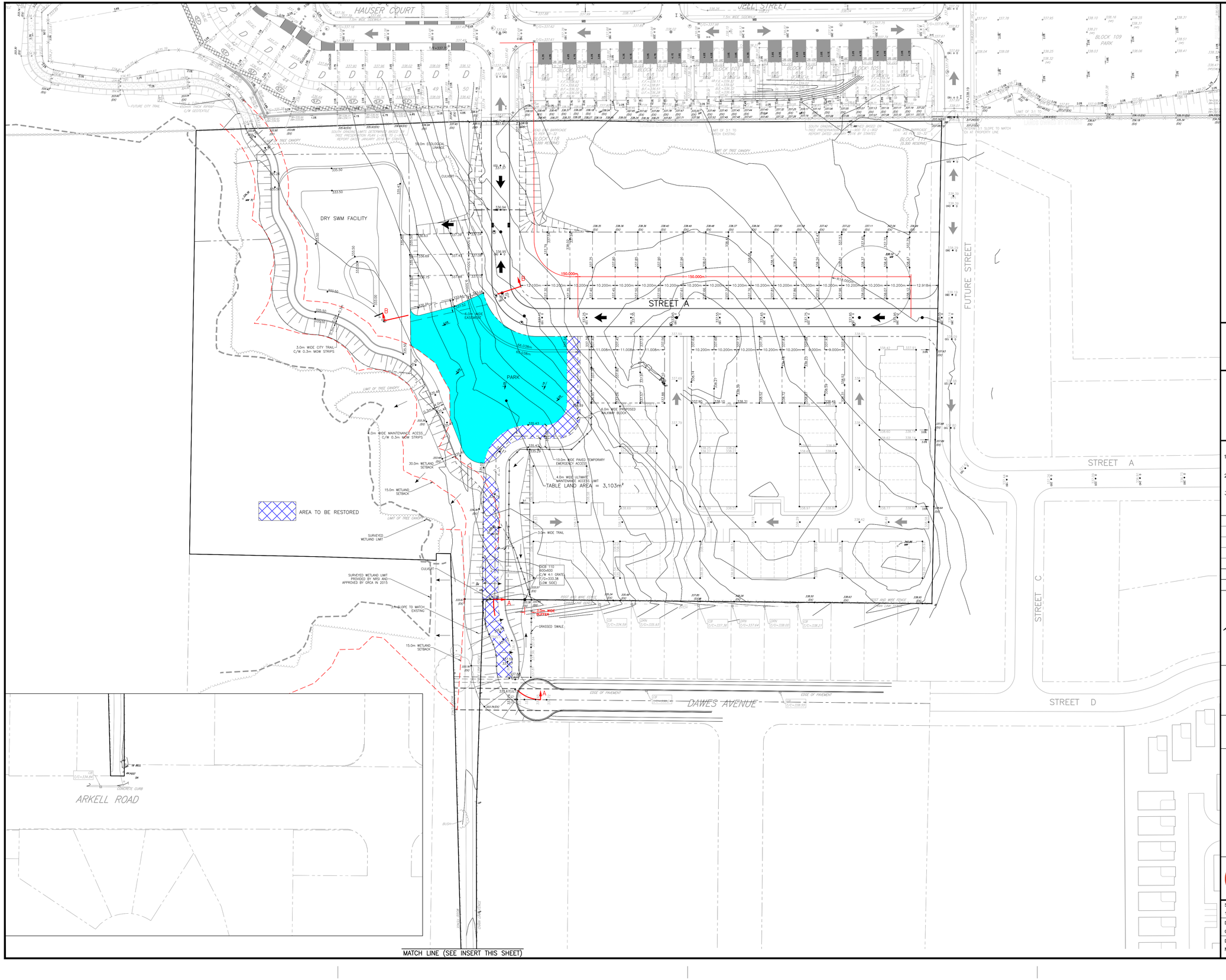
ARKELL MEADOWS SUBDIVISION GUELPH, ONTARIO

POST DEVELOPMENT PLAN

CHECKED: APPROVED:

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

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



North:

LEGEND:

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

ALL DIMENSIONS AND ELEVATIONS ARE IN METRES UNLESS OTHERWISE NOTED.

PIPE SIZES ARE IN MILLIMETRES.

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

GENERAL NOTES:

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

SCHEDULE OF REVISIONS

CITY OF Guelph
Making a Difference

ENGINEERING SERVICES

CONCEPTUAL GRADING PLAN

220 ARKELL SUBDIVISION

DESIGNED BY:	APPROVED BY:

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

SCALES:	CHECKED BY:
1:750	KRB
DATE DRAWN:	CONTRACT No.
OCTOBER 20 / 17	X-XXXX
DRAWN BY:	DRAWING No.
MHH	C-400

- 000

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

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

Main Site Area (ha) 4.3
Impervious

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

100% **OK**

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

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

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

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

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

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

100% **OK**

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

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

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

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

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

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

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

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

100% **OK**

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

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

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

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

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