Preliminary Servicing & Stormwater Management Report for:

Ainley Farm Subdivision
Township of Centre Wellington (Elora)

GMBP File: 411009
October 2017

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PRELIMINARY SERVICING & STORMWATER MANAGEMENT REPORT AINLEY FARM SUBDIVISION TOWNSHIP OF CENTRE WELLINGTON (ELORA)

October 30, 2017
Our File: 411009

1.0 INTRODUCTION

In support of the Draft Plan of Subdivision Application for Part of Lots 17 and 18, Concession 12 in the Township of Centre Wellington (Geographic Township of Nichol) herein after referred to as the Ainley Farm Subdivision, GM BluePlan Engineering Limited have prepared this report to address the preliminary servicing and stormwater management requirements for the site.

The servicing and stormwater management techniques were derived from the recommendations presented in the following reports:

- Stormwater Management Plan for The North Valley Subdivision (Cambridge Engineering and Planning Consultants Limited, January 1994),
- Design Report, Ville Lora Downs North Subdivision, Phase III (Gamsby and Mannerow Limited, July 2004),
- Design Report, Ville Lora Downs Subdivision, Stage VI (Gamsby and Mannerow Limited, April 1998),
- Preliminary Geotechnical Investigation completed CMT Engineering Inc. (March 29, 2006), and
- Environmental Impact Study completed by North-South Environmental Inc. (June 2006).

Together, these reports form the overview for the development of these lands while maintaining the adjacent natural features.

2.0 LOCATION

Figure 1 shows the location of the Ainley Farm Subdivision and the surrounding area. The 21.46-hectare site is bound by existing agricultural and future development lands to the north, Gerrie Road to the east, existing residential lands to the south (Ville Lora Downs Subdivision, Phase V and Phase VI) and existing wetland and residential lands to the west (Ville Lora Downs North Subdivision, Phase III).

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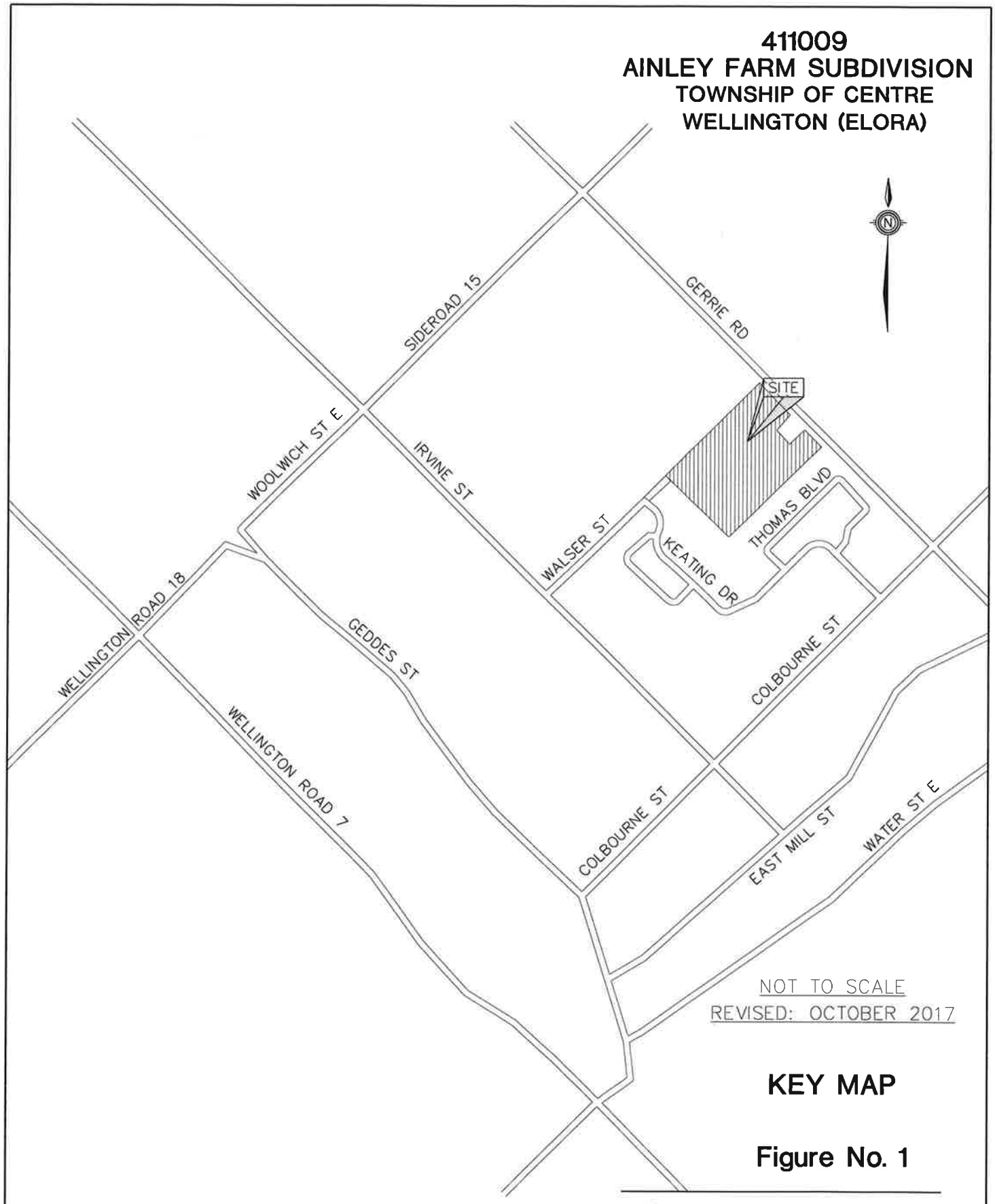
AINLEY FARM SUBDIVISION
TOWNSHIP OF CENTRE
WELLINGTON (ELORA)



NOT TO SCALE

REVISED: OCTOBER 2017

KEY MAP

Figure No. 1

BluePlan ENGINEERING

Plotted On: October 24, 2017 411009-FIG1-KEYMAP.dwg

3.0 EXISTING CONDITIONS

3.1 LAND USE

The site is currently comprised of agricultural fields and a natural heritage feature consisting of a woodlot and wetland. The existing site features are shown on the General Plans (GM BluePlan Engineering Limited Drawing No. 1 and No. 2).

3.2 TOPOGRAPHY

The topography throughout the Ainley Farm Subdivision is undulating and consists of rolling slopes with gradients ranging from 0.5% to 20%. Original ground elevations on site range from approximately 410.0m to approximately 416.0m. The northeastern portion of the site generally drains in a northeast direction towards Gerrie Road. The remainder of the site generally drains in a southwest direction towards the existing wetland, ultimately discharging to the existing channel located immediately south of the wetland. The northwestern portion of the site, adjacent to the existing Walser Street right-of-way, drains in a southerly direction towards Walser Street.

3.3 SOILS

The predominant surface soil type on the site is Harriston Loam (Soil Survey of Wellington County Report No. 35). Harriston Loam has a hydrologic soil classification of BC and generally has good drainage characteristics.

The Preliminary Geotechnical Investigation by CMT Engineering Inc. (March 2006) established the characteristics of the underlying soils. The boreholes identified the underlying soils as topsoil overlying organic silt, silt or sandy silt, silt till or sandy silt till, sand or silty sand and clayey silt. The results of the geotechnical investigation are included in Appendix ‘A’.

3.4 GROUNDWATER

As part of the Preliminary Geotechnical Investigation (CMT Engineering Inc., March 2006), groundwater observation wells were installed. Groundwater elevation measurements have been collected on a monthly basis from March 2006 to the present, to establish seasonally high groundwater elevations. To date, the monitoring has established that groundwater levels vary seasonally. Lower groundwater elevations have been observed in the late summer and fall. The highest groundwater elevations have been observed during the spring snow melt.

From the groundwater elevation measurements and the Preliminary Geotechnical Investigation, the seasonally high groundwater level is estimated to range from approximately 0.10m to 1.10m below the original ground surface.

Based on the underlying native soils and the high groundwater elevations across the site, the use of infiltration structures for recharge is not recommended for this site. The results of the groundwater elevation measurements have been included in Appendix ‘B’.

4.0 PROPOSED DEVELOPMENT

The Draft Plan of Subdivision, prepared by Black, Shoemaker, Robinson & Donaldson Limited (January 23, 2017) (Figure 2), illustrates the proposed lot fabric, internal roads, park block, and open space areas and stormwater management blocks.

Access to the 21.46-hectare development will be provided via Gerrie Road and the extension of Walser Street.

Within the development, there are 122 single family lots, one (1) multi-family/on-street townhouses block, one (1) apartment block, one (1) open space block, one (1) park block and three (3) stormwater management blocks.

In addition, four (4) future single detached lots will be created on the north side of Walser Avenue through the extension of Walser Avenue into the Ainsley Farm property.

4.1 SITE GRADING

The site layout and internal road network for the Ainley Farm Subdivision are shown on the General Plans (GM BluePlan Engineering Limited Drawing No. 1 and No. 2). The grade and elevation of the internal streets are controlled by the existing centre line elevations of Walser Street and Gerrie Road, the major overland flow route to the stormwater management facilities and the elevation of the existing sanitary sewers on Walser Street and Keating Drive.

The site has been graded to match the existing elevations along the property boundary of the adjacent lands. Minor grading on the adjacent lands located along the north boundary of the site is required. The adjacent lands along the north boundary of the site are owned by the Developer (James Keating Construction (2004) Limited).

4.2 STREETS

All streets will be constructed with a minimum grade of 0.5% and a maximum grade of 8.0% as per Township of Centre Wellington standards. An urban road cross-section (20 m right-of-way width), with concrete curb and gutter will be provided for Street No.1, 2, 3, 4 and the extension of Walser Street, as per Township of Centre Wellington Standard Drawing STD R1.

Concrete sidewalks (1.5 metre wide) will be constructed along both sides of the Walser Street extension and Street No. 1, 2, 3 and 4.

4.3 WATER SUPPLY

As part of the Ville Lora Downs North Subdivision Phase III, a 200mm diameter watermain was terminated at the easterly limit of Walser Street. There is currently no watermain on Gerrie Road across the frontage of the Ainley Farm Subdivision.

Water supply for the Ainley Farm Subdivision will be provided via the extension of a 200mm diameter watermain, along the Walser Street extension, Street No. 2 and a portion of Street No. 1. A 150mm diameter watermain will also be extended along the remainder of Street No. 1, Street No. 3, and Street No. 4.

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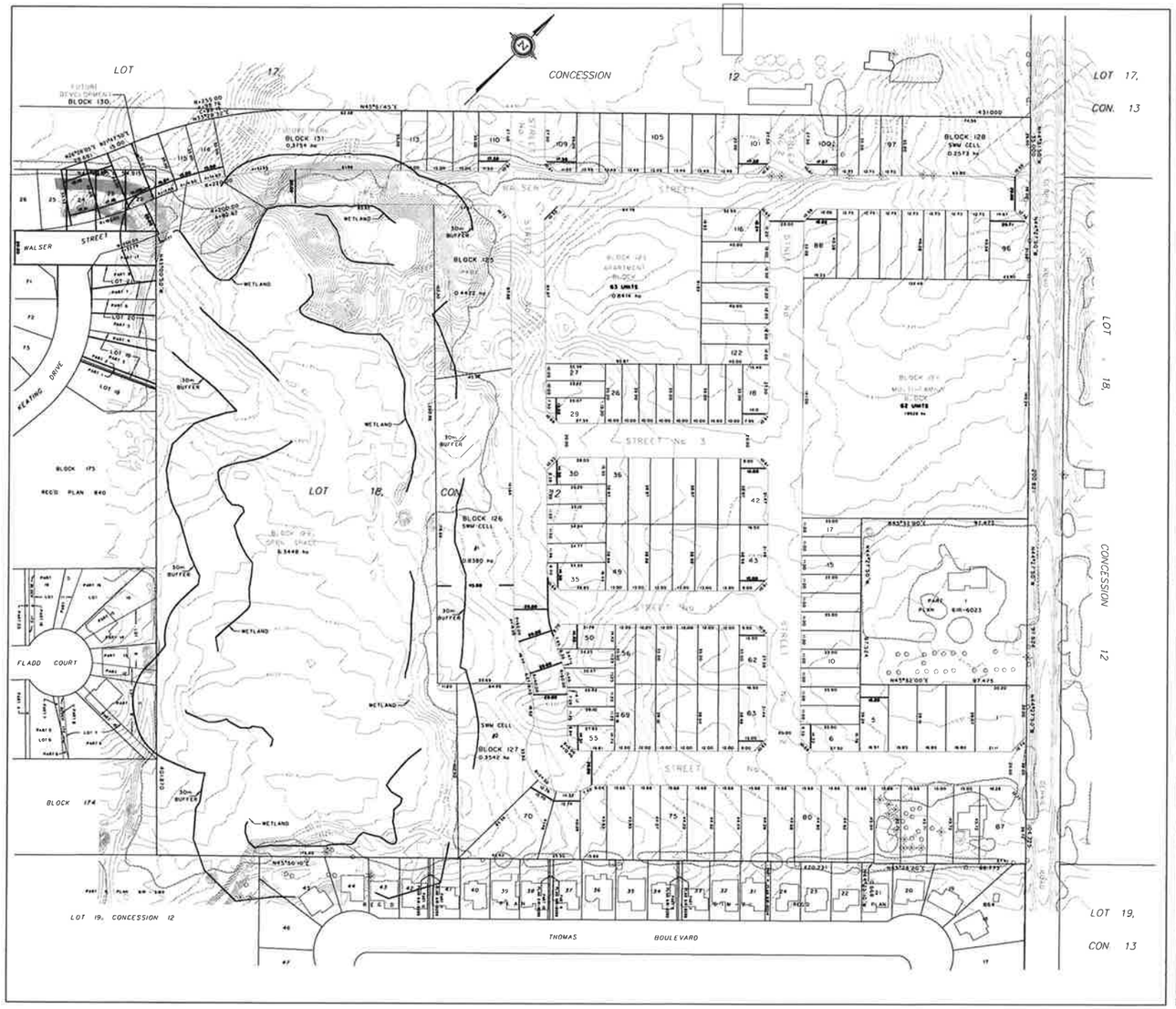
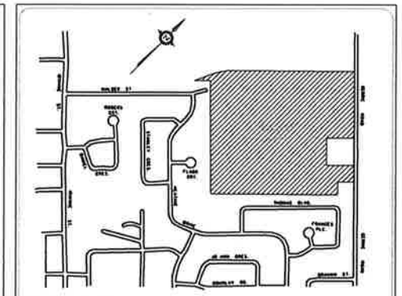
AINLEY FARM SUBDIVISION
TOWNSHIP OF CENTRE
WELLINGTON (ELORA)





KEY PLAN N.T.S.

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

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

OWNERS CERTIFICATE

WE HEREBY AUTHORIZE BLACK, SHOEMAKER, ROBINSON, AND DONALDSON LIMITED, ONTARIO LAND SURVEYORS, URBAN AND RURAL PLANNERS TO SUBMIT THIS DRAFT PLAN OF PROPOSED SUBDIVISION

DATE — JAMES KEATING CONSTRUCTION (2004) LTD.

SURVEYOR'S CERTIFICATE

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

DATE — IAN D. ROBINSON ONTARIO LAND SURVEYOR

METRIC

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

RELEVANT INFORMATION

LOTS/BLOCKS	LAND USE	UNITS	AREAS (ha)
LOTS 1 TO 102	SINGLE-DETACHED RESIDENTIAL	102	6.9338
BLOCK 103	APARTMENT BLK	63	0.8416
BLOCK 104	ON-STREET TOWNHOUSES	60	1.8628
BLOCK 125	PARK		0.4422
BLOCKS 126, 127 & 129	STORMWATER MANAGEMENT		1.6935
BLOCK 128	OPEN SPACE		0.3498
STREETS	ROADS		2.6258
BLOCK 130	FUTURE DEVELOPMENT	4	0.0696
BLOCK 131	FUTURE PARK		0.3734
TOTAL		231	24.4803 ha

NOTES:
ELEVATIONS AND RELEVANT INFORMATION TAKEN FROM

DRAFT PLAN OF SUBDIVISION
OF PART OF
LOTS 17 & 18, CONCESSION 12
TOWNSHIP OF CENTRE WELLINGTON
(GEOGRAPHIC TOWNSHIP OF NICHOL)
COUNTY OF WELLINGTON
SCALE 1:1000 0 10 20 30 40 50 METRES

BLACK, SHOEMAKER, ROBINSON & DONALDSON LIMITED
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351 Speedvale Avenue West, Guelph, Ontario N1H 1C5
TEL: (519) 822-4031 FAX (519) 822-1220 www.BSRD.COM

DATE: JANUARY 23, 2017
DRAWN BY: MS
PROJECT: 04-5865-16

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REVISED: OCTOBER 2017

DRAFT PLAN OF SUBDIVISION

Figure No. 2

BluePlan ENGINEERING

Plotted On: October 24, 2017 411009-FIG2-DRAFT PLAN.dwg

4.4 SANITARY SEWER

During the municipal servicing of the Ville Lora Downs North Subdivision Phase III, a 200mm diameter sanitary sewer was designed, approved and constructed on Walser Street. The existing 200mm diameter sanitary sewer is currently terminated at the easterly limit of Walser Street. As part of the Ville Lora Downs Subdivision, Phase VI, a 200mm diameter sanitary sewer was also designed, approved and constructed on Keating Drive. There are currently no sanitary sewers on Gerrie Road across the frontage of the Ainley Farm.

Sanitary service for the Ainley Farm Subdivision will be provided via connections to both the existing 200mm diameter sanitary sewer on Walser Street and the existing 200mm diameter sanitary sewer on Keating Drive.

The extension of a 200mm diameter sanitary sewer along the Walser Street extension will service the lots fronting on to Walser Street, as well as a portion of the lots fronting onto Street No. 2. The extension of a 200mm diameter sanitary sewer on easement through Drimmie Part to Street No. 1, from the existing 200mm diameter sanitary sewer on Keating Drive, will service the remainder of the subdivision (Street No. 2, Street No. 3 and Street No. 4).

4.5 STORM SEWER

The storm sewer system for the Ainley Farm Subdivision will be sized to convey the 5-year design storm event and the storm sewer system will discharge to the two (2) proposed stormwater management facilities or to the existing storm sewer on Walser Street.

The storm sewers on Street No. 1, Street No. 3, Street No. 4, a portion of Street No. 2 and a portion of the Walser Street extension will discharge to the proposed Stormwater Management Facility No. 1 located to the east of the existing wetland.

The storm sewers on the remainder of Street No. 2, along with a portion of the Walser Street extension, will discharge to the proposed Stormwater Management Facility No. 2 located to the west of Gerrie Road.

The storm sewers on the remainder of the Walser Street extension will discharge directly to the existing storm sewer system on Walser Street, ultimately discharging to the existing storm sewers on Keating Drive.

4.6 DEWATERING

Dewatering may be required during the installation of sanitary sewer, storm sewer and watermain. A Permit to Take Water (PTTW) or an Environmental Activity and Sector Registry (EASR) from the Ministry of Environment and Climate Change (MOECC) will be required if dewatering activities will involve the removal of more than 400,000 litres of groundwater per day from the site.

If dewatering activities are required during the installation of sewers and watermain, all discharge will be directed to the interim sediment control pond prior to discharge from the site.

As part of the area grading of the site, the interim stormwater management facility will be constructed and will act as an interim sedimentation control pond for the remainder of the municipal servicing and home building construction. This will prevent sediment from being discharged to the wetland. Upon build-out, accumulated sediment will be collected and removed from the interim sediment control pond.

4.7 FOUNDATION DRAINAGE

As per the Township of Centre Wellington municipal standards, foundation drainage will be provided via sump pits and sump pumps in each residential unit, ultimately discharging via individual storm sewer lateral connections to the storm sewer system located within the municipal right-of-way.

4.8 STORMWATER MANAGEMENT

Details of the stormwater management system for the Ainley Farm Subdivision are discussed in detail in Section 5.0.

4.9 WATER BUDGET

Based on average water budget values for this area, the average annual precipitation is estimated to be 925 mm. The potential for evapotranspiration for this area is estimated to be 555 mm for the silt till and 495 mm for sand and gravel. Therefore, 370 mm and 430 mm remain available for infiltration and runoff from the silt till and sand and gravel, respectively.

From the Preliminary Geotechnical Investigation (CMT Engineering Inc., March 26, 2006), the surficial deposits across the majority of the site are described as native silt tills, with some sandy silt tills. As there are no areas of consistent sandy soils across the site, the characteristics of the silt tills will be used to develop the water budget analysis across the site.

The recharge rate for the native silt tills is estimated to be 125 mm and therefore, the runoff is estimated to be 245 mm.

Based on the annual infiltration rates, the existing annual average groundwater recharge occurring within the 21.46-hectare site, and 1.24 hectares of external areas discharging to the site, is estimated to be 28,273 m^3. Under post-development conditions, the annual average groundwater recharge occurring on-site and within the external areas is estimated to be 17,951 m^3. The groundwater recharge has been identified in Table No.1.

Under existing conditions the annual average runoff from the site and external areas is estimated to be 56,009 m^3. As a result of the proposed development the impervious area (rooftop and paved surfaces) of the site increases, the annual potential evapotranspiration for impervious surfaces decreases to 200 mm and the runoff from the site increases. The runoff from the site and external areas under post-development conditions is estimated to be 95,065 m^3 per year.

The estimated existing and post-development recharge and runoff volumes for the Ainley Farm Subdivision are detailed in Table 1. The estimations take into account the surficial geology, which is comprised mainly of glacial tills. The net recharge values are for the uppermost overburden aquifer.

In summary, the estimated recharge and runoff volume for the Ainley Farm Subdivision are as follows:

Table No. 2: Summary of Recharge and Runoff Volume

	Existing Condition	Post-Development Condition	Percent Change
Total Estimated Recharge	28,273 m^3	17,951 m^3	-37%
Total Estimated Runoff	56,009 m^3	95,065 m^3	70%

Table 1: Water Budget - Existing and Post Development Conditions

Ainley Farm Subdivision

	Existing Conditions											
	10-11		40		Total To Wetland	20-21		Total To Gerrie Road and Grand River	30-31		Total To Walser Street	Existing
	Impervious	Pervious	Impervious	Pervious		Impervious	Pervious		Impervious	Pervious		Total
Annual Precipitation (mm)	925	925	925	925		925	925		925	925		
Annual Evapotranspiration (mm) - S&G	200	495	200	495		200	495		200	495		
Available for Recharge & Runoff (mm) - S&G	725	430	725	430		725	430		725	430		
Annual Evapotranspiration (mm) - Till	200	555	200	555		200	555		200	555		
Available for Recharge & Runoff (mm) - Till	725	370	725	370		725	370		725	370		
Annual Precipitation <= 5 year storm	680	680	680	680		680	680		680	680		
Total Area (ha)	**7.89**		**6.34**			**7.47**			**1.00**			
Area (ha)	0.00	7.89	0.00	6.34	14.23	0.08	7.39	7.47	0.00	1.00	1.00	**22.70**
Area (m^2)	0	78,900	0	63,400	142,300	820	73,880	74,700	0	10,000	10,000	**227,000**
Geology:												
S&G area (ha)	0.00	0.00	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	-
Till area (ha)	0.00	7.89	0.00	6.34	14.23	0.08	7.39	7.47	0.00	1.00	1.00	**22.70**
Annual Infiltration:												
Pervious: S&G areas (@ 380 mm/year)	-	0	-	0	-	-	0	-	-	0	-	-
Till areas (@ 125 mm/year)	-	9,863	-	7,925	17,788	-	9,235	9,235	-	1,250	1,250	**28,273**
Impervious: S&G areas (@ 0 mm/year)	0	-	0	-	-	0	-	-	0	-	-	-
Till areas (@ 0 mm/year)	0	-	0	-	-	0	-	-	0	-	-	-
Total Annual Infiltration (m^3/year)	0	9,863	0	7,925	17,788	0	9,235	9,235	0	1,250	1,250	**28,273**
Annual Runoff:												
Pervious: S&G areas (@ 50 mm/year)	-	0	-	0	-	-	0	-	-	0	-	-
Till areas (@ 245 mm/year)	-	19,331	-	15,533	34,864	-	18,101	18,101	-	2,450	2,450	**55,414**
Impervious: S&G areas (@ 725 mm/year)	0	-	0	-	-	0	-	-	0	-	-	-
Till areas (@ 725 mm/year)	0	-	0	-	-	595	-	**595**	0	-	-	**595**
Total Annual Runoff (m^3/year)	0	19,331	0	15,533	34,864	595	18,101	18,695	0	2,450	2,450	**56,009**
Summary:												
Runoff (m^3/year)	0	19,331	0	15,533	34,864	595	18,101	18,695	0	2,450	2,450	**56,009**
Natural recharge (m^3/year)	0	9,863	0	7,925	17,788	0	9,235	9,235	0	1,250	1,250	**28,273**
Total recharge (m^3/year)	-	9,863	-	7,925	17,788	-	9,235	9,235	-	1,250	1,250	**28,273**
Net Runoff from Site (m^3/year)	0	19,331	0	15,533	34,864	595	18,101	18,695	0	2,450	2,450	**56,009**
Total Recharge (m^3/year)	9,863		7,925		17,788	9,235		9,235	1,250		1,250	**28,273**
Discharge from Site (m^3/year)	19,331		15,533		34,864	18,695		18,695	2,450		2,450	**56,009**

Table 1: Water Budget - Existing and Post Development Conditions

Ainley Farm Subdivision

	Post Development Conditions																						
	1000		1100		4000		Total To Wetland	2100		2200		2300		Total To Gerrie Road and Grand River	3100		3200		3300		Total To Walser Street	Post-Dev Total
	Impervious	Pervious	Impervious	Pervious	Impervious	Pervious		Impervious	Pervious	Impervious	Pervious	Impervious	Pervious		Impervious	Pervious	Impervious	Pervious	Impervious	Pervious		
Annual Precipitation (mm)	925	925	925	925	925	925		925	925	925	925	925	925		925	925	925	925	925	925		
Annual Evapotranspiration (mm) - S&G	200	495	200	495	200	495		200	495	200	495	200	495		200	495	200	495	200	495		
Available for Recharge & Runoff (mm) - S&G	725	430	725	430	725	430		725	430	725	430	725	430		725	430	725	430	725	430		
Annual Evapotranspiration (mm) - Till	200	555	200	555	200	555		200	555	200	555	200	555		200	555	200	555	200	555		
Available for Recharge & Runoff (mm) - Till	725	370	725	370	725	370		725	370	725	370	725	370		725	370	725	370	725	370		
Annual Precipitation <= 5 year storm	680	680	680	680	680	680		680	680	680	680	680	680		680	680	680	680	680	680		
Total Area (ha)	**11.28**		**0.47**		**6.34**			**2.18**		**0.91**		**0.47**			**0.40**		**0.35**		**0.22**			
Area (ha)	5.64	5.64	0.00	0.47	0.00	6.34	18.09	1.31	0.87	0.68	0.23	0.05	0.42	3.56	0.24	0.16	0.21	0.14	0.13	0.09	0.97	**22.62**
Area (m^2)	56,400	56,400	0	4,700	0	63,400	180,900	13,080	8,720	6,825	2,275	470	4,230	35,600	2,400	1,600	2,100	1,400	1,320	880	9,700	**226,200**
Geology:																						
S&G area (ha)	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	-	-
Till area (ha)	5.64	5.64	0.00	0.47	0.00	6.34	18.09	1.31	0.87	0.68	0.23	0.05	0.42	3.56	0.24	0.16	0.21	0.14	0.13	0.09	0.97	**22.62**
Annual Infiltration:																						
Pervious: S&G areas (@ 380 mm/year)	-	0	-	0	-	0	-	-	0	-	0	-	0	-	-	0	-	0	-	0	-	-
Till areas (@ 125 mm/year)	-	7,050	-	588	-	7,925	15,563	-	1,090	-	284	-	529	1,903	-	200	-	175	-	110	485	**17,951**
Impervious: S&G areas (@ 0 mm/year)	0	-	0	-	0	-	-	0	-	0	-	0	-	-	0	-	0	-	0	-	-	-
Till areas (@ 0 mm/year)	0	-	0	-	0	-	-	0	-	0	-	0	-	-	0	-	0	-	0	-	-	-
Total Annual Infiltration (m^3/year)	0	7,050	0	588	0	7,925	15,563	0	1,090	0	284	0	529	1,903	0	200	0	175	0	110	485	**17,951**
Annual Runoff:																						
Pervious: S&G areas (@ 50 mm/year)	-	0	-	0	-	0	-	-	0	-	0	-	0	-	-	0	-	0	-	0	-	-
Till areas (@ 245 mm/year)	-	13,818	-	1,152	-	15,533	30,503	-	2,136	-	557	-	1,036	3,730	-	392	-	343	-	216	951	**35,183**
Impervious: S&G areas (@ 725 mm/year)	0	-	0	-	0	-	-	0	-	0	-	0	-	-	0	-	0	-	0	-	-	-
Till areas (@ 725 mm/year)	40,890	-	0	-	0	-	**40,890**	9,483	-	4,948	-	341	-	**14,772**	1,740	-	1,523	-	957	-	**4,220**	**59,881**
Total Annual Runoff (m^3/year)	40,890	13,818	0	1,152	0	15,533	71,393	9,483	2,136	4,948	557	341	1,036	18,502	1,740	392	1,523	343	957	216	5,170	**95,065**
Summary:																						
Runoff (m^3/year)	40,890	13,818	0	1,152	0	15,533	71,393	9,483	2,136	4,948	557	341	1,036	18,502	1,740	392	1,523	343	957	216	5,170	**95,065**
Natural recharge (m^3/year)	0	7,050	0	588	0	7,925	15,563	0	1,090	0	284	0	529	1,903	0	200	0	175	0	110	485	**17,951**
Total recharge (m^3/year)	0	7,050	0	588	-	7,925	15,563	0	1,090	0	284	0	529	1,903	0	200	0	175	0	110	485	**17,951**
Net Runoff from Site (m^3/year)	40,890	13,818	0	1,152	0	15,533	71,393	9,483	2,136	4,948	557	341	1,036	18,502	1,740	392	1,523	343	957	216	5,170	**95,065**
Total Recharge (m^3/year)	7,050		588		7,925		15,563	1,090		284		529		1,903	200		175		110		485	**17,951**
Discharge from Site (m^3/year)	54,708		1,152		15,533		71,393	11,619		5,506		1,377		18,502	2,132		1,866		1,173		5,170	**95,065**

Table 1: Water Budget - Existing and Post Development Conditions

Ainley Farm Subdivision

	Totals (Entire Site)			Totals (Wetland)			Totals (To Gerrie Road and Grand River)			Totals (To Walser Street)		
	Existing Total	Post-Dev Total	% Difference	Existing Total	Post-Dev Total	% Difference	Existing Total	Post-Dev Total	% Difference	Existing Total	Post-Dev Total	% Difference
Annual Precipitation (mm)												
Annual Evapotranspiration (mm) - S&G												
Available for Recharge & Runoff (mm) - S&G												
Annual Evapotranspiration (mm) - Till												
Available for Recharge & Runoff (mm) - Till												
Annual Precipitation <= 5 year storm												
Total Area (ha)												
Area (ha)	**22.70**	**22.62**	0%	**14.23**	**18.09**	27%	**7.47**	**3.56**	-52%	**1.00**	**0.97**	-3%
Area (m^2)	**227,000**			**0**			**63,400**			**10,000**		
Geology:												
S&G area (ha)	-	-		-	-		-	-		-	-	
Till area (ha)	**22.70**	**22.62**	0%	**14.23**	**18.09**	27%	**7.47**	**3.56**	-52%	**1.00**	**0.97**	-3%
Annual Infiltration:												
Pervious: S&G areas (@ 380 mm/year)	-	-		-	-		**0**	-		-	-	
Till areas (@ 125 mm/year)	**28,273**	**17,951**	-37%	**17,788**	**15,563**	-13%	**9,235**	**1,903**	-79%	**1,250**	**485**	-61%
Impervious: S&G areas (@ 0 mm/year)	-	-		-	-		-	-		-	-	
Till areas (@ 0 mm/year)	-	-		-	-		-	-		-	-	
Total Annual Infiltration (m^3/year)	**28,273**	**17,951**	-37%	**17,788**	**15,563**	-13%	**9,235**	**1,903**	-79%	**1,250**	**485**	-61%
Annual Runoff:												
Pervious: S&G areas (@ 50 mm/year)	-	-		-	-		-	-		-	-	
Till areas (@ 245 mm/year)	**55,414**	**35,183**	-37%	**34,864**	**30,503**	-13%	**18,101**	**3,730**	-79%	**2,450**	**951**	-61%
Impervious: S&G areas (@ 725 mm/year)	-	-		-	-		-	-		-	-	
Till areas (@ 725 mm/year)	**595**	**59,881**		-	**0**		**595**	**14,772**		-	**4,220**	
Total Annual Runoff (m^3/year)	**56,009**	**95,065**	70%	**34,864**	**71,393**	105%	**18,695**	**18,502**	-1%	**2,450**	**5,170**	111%
Summary:												
Runoff (m^3/year)	**56,009**	**95,065**	70%	**34,864**	**71,393**	105%	**18,695**	**18,502**	-1%	**2,450**	**5,170**	111%
Natural recharge (m^3/year)	**28,273**	**17,951**	-37%	**17,788**	**15,563**	-13%	**9,235**	**1,903**	-79%	**1,250**	**485**	-61%
Total recharge (m^3/year)	**28,273**	**17,951**	-37%	**17,788**	**15,563**	-13%	**9,235**	**1,903**	-79%	**1,250**	**485**	-61%
Net Runoff from Site (m^3/year)	**56,009**	**95,065**	70%	**34,864**	**71,393**	105%	**18,695**	**18,502**	-1%	**2,450**	**5,170**	111%
Total Recharge (m^3/year)	**28,273**	**17,951**	-37%	**17,788**	**15,563**	-13%	**9,235**	**1,903**	-79%	**1,250**	**485**	-61%
Discharge from Site (m^3/year)	**56,009**	**95,065**	70%	**34,864**	**71,393**	105%	**18,695**	**18,502**	-1%	**2,450**	**5,170**	111%

5.0 STORMWATER MANAGEMENT SYSTEM

The objectives of the stormwater management plan are as follows:

a) Provide Enhanced (80% Total Suspended Solids) water quality control prior to discharge to the existing wetland and to an existing tributary of the Grand River.
b) Provide quantity control for the full range of design storms to attenuate post-development runoff to the existing condition level.
c) Route the Regional Storm to minimize flood damage.

5.1 STORMWATER MANAGEMENT CRITERIA

The studies, policies and guidelines used to develop the stormwater management plan for this development were as follows:

1) Stormwater Management Planning and Design Manual, 2003
2) Design Principles for Stormwater Management Facilities, 1996
3) The Interim Stormwater Quality Control Guidelines, 1991
4) The Stormwater Quality Best Management Practices Manual, 1991
5) The MTO Drainage Management Technical Guidelines, 1989
6) The Ontario Urban Design Guidelines, 1987

The method used to evaluate and design the stormwater management plan was as follows:

A three-hour duration rainfall event was used to generate the mass rainfall data required for the 2, 5, 10, 25, 50 and 100-year design storms. The Fergus Shand Dam Chicago parameters and the total depth of rainfall for each storm are as follows:

Table No. 3: Chicago Rainfall Distribution Parameters

	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
a =	695.047	1459.072	2327.596	3701.648	5089.418	6933.019
b =	6.387	13.690	19.500	25.500	30.000	34.699
c =	0.793	0.850	0.894	0.937	0.967	0.998
r =	0.38	0.38	0.38	0.38	0.38	0.38
Duration = (minutes)	180	180	180	180	180	180
Rainfall Depth = (mm)	33.014	49.792	61.359	75.581	86.737	97.921

The SCS infiltration method was used in the runoff calculations. The CN parameters used in the MIDUSS modelling are as follows:

Table No. 4: SCS Curve Number Parameters

	IMPERVIOUS AREAS	PERVIOUS AREAS
Residential	98	78
Agricultural	98	74
Wetland/Forest	98	50

The hydrologic model MIDUSS was used to create the runoff hydrographs and to route the flows through the storage structures.

5.2 STORMWATER MANAGEMENT APPROACH

In line with current practices and guidelines, the stormwater management plan for the Ainley Farm Subdivision is a "treatment train" to attenuate post-development flows and to provide Enhanced (80% total suspended solids removal) water quality control treatment prior to discharge from the site. The "treatment train" will include a combination of lot level, conveyance and end-of-pipe best management practices.

Lot level controls will simply consist of directing roof leaders to grassed areas and grassed swales.

Conveyance controls will include the use of storm sewers, grassed swales, four (4) oil/grit separator structures for Stormwater Management Facility No.1 and Stormwater Management Facility No.2.

End-of-pipe controls will be provided by two (2) extended detention stormwater management facilities designed to attenuate post-development runoff prior to discharge from the site. Runoff generated from Stormwater Management Facility No.1 will discharge to the existing wetland, ultimately discharging to the existing swale in Drimmie Park and the existing storm sewers on Keating Drive. Stormwater Management Facility No.2 will discharge to the roadside ditch along Gerrie Road, ultimately discharging to a tributary of the Grand River.

A small portion of runoff from the westerly portion of Walser Street will discharge uncontrolled to the existing storm sewer system on Walser Street.

Major storm flows from the development will sheetflow overland via the municipal right-of-ways to either Stormwater Management Facility No.1 or Stormwater Management Facility No.2.

This combination of lot-level, conveyance and end-of-pipe controls will control the release of the runoff from the site.

5.3 STORMWATER MANAGEMENT PLAN

The best management practices (BMP's) in the Stormwater Management Planning and Design Manual (2003) were screened. Those found to be applicable to this development are discussed in the following sections.

5.3.1 LOT LEVEL CONTROLS

Stormwater management practices recommended to provide lot level control on this site are as follows:

a) Roof Drainage to Ground Surface

The driveways and front yards will drain to the street. The roof and rear yard will generally drain to the rear of the lot with exception for lots with back to front drainage.

The roof runoff will be filtered across the grassed surface and some will infiltrate. The runoff for any event large enough to generate flow to the swale system will be adequately filtered by the grass enroute.

b) Rear Yard Swales

The lots will be graded to current Township of Centre Wellington Standards. Where practical, the length of the rear lot swales between catch basins will be increased to extend the contact time with the grassed surfaces.

To promote infiltration on the lots and in the swales, it is recommended that the average depth of graded topsoil be 300 mm.

c) Lot Level Infiltration Systems

The Stormwater Management Practices and Planning Manual (2003), recommends that infiltration structures be installed in soils having a hydraulic conductivity greater than or equal to 15 mm/hour (4.2×10^{-4} cm/s) and where a 1 metre minimum separation from the seasonally high groundwater level can be provided.

The soils on the site have high silt content and thus a low hydraulic conductivity, estimated to be in the order of 1×10^{-4} cm/s. Seasonally high groundwater levels on the site range from 0.10 metres to 1.10 metres below the ground surface, therefore making the 1 metre separation from high groundwater level difficult to achieve.

To demonstrate the infeasibility of including lot-level infiltration within the stormwater management design, we have considered Lot 65. The rear yard and rooftop catchment area of Lot 65 is approximately 0.03 hectares in size and will have an average imperviousness of 50%. Under a "first flush" (2-year) design storm, this lot would generate approximately 5.16 m^3 of runoff.

An infiltration trench, 6 metres long by 3 metre wide by 1 metre deep, constructed in this lot would have an effective contact area of 18 m^2. Based a hydraulic conductivity of 1.0×10^{-4} cm/s, the estimated rate of recharge is 1.8×10^{-5} m^3/s.

Therefore, the estimated "drain down" time for a rear lot infiltration structure would be approximately 80 hours. The Stormwater Management Planning and Design Manual (2003) recommend that infiltration structures drain within 24 hours.

Based on the estimated "drain down" time of 80 hours and the high groundwater levels, it is our opinion that infiltration systems are **not** feasible and should **not** be incorporated as part of the development.

5.3.2 CONVEYANCE CONTROLS

The storm conveyance system for the development will consist of grassed swales, storm sewers, major overland channel and four (4) oil/grit separator structures. Conveyance controls will be achieved through the regular maintenance of the grassed swales, storm sewers, major overland channel, forebay and oil/grit separator structures as part of the Township's annual maintenance program. Maintenance requirements will include the annual removal of accumulated sediments and debris from manholes, catch basins, and oil/grit separator structures.

5.3.3 END-OF-PIPE CONTROLS

a) Existing Conditions

Under existing conditions, the majority of the site is utilized for agricultural purposes. For hydrologic modelling purposes, the 21.46-hectare site and 1.24 hectares of external areas was modelled as seven (7) catchments. These catchments are shown on the Existing Conditions Storm Drainage Area Plan (Figure 3).

Catchment 10 (7.76 hectares, 0% impervious) consists primarily of agricultural lands and an existing residential lot.

Catchment 11 (0.13 hectares, 0% impervious) represents the external lands, which consists primarily of agricultural lands of an existing residential lot.

Runoff generated from Catchment 10 and 11 currently sheetflows overland in an east to west direction, ultimately discharging to the existing wetland.

Catchment 20 (6.65 hectares, 0% impervious) consists primarily of agricultural lands and an existing residential lot.

Catchment 21 (0.82 hectares, 0% impervious) represents external lands consisting of an undeveloped residential lot.

Runoff generated from Catchment 20 and 21 currently sheetflows overland to the existing roadside ditch along Gerrie Road and ultimately to a tributary of the Grand River.

Catchment 30 (0.78 hectares, 0% impervious) represents the external lands, which consists primarily of an existing wetland.

Catchment 31 (0.22 hectares, 0% impervious) represents the external lands, which consists primarily of an existing wetland and agricultural lands.

Runoff generated from Catchment 30 and 31 currently sheetflows overland, ultimately discharging to the existing wetland.

Catchment 40 (6.34 hectares, 0% impervious) represents the south-westerly portion of the site, consisting of a natural heritage feature (wetland and woodlot).

Runoff generated from Catchment 40 currently sheetflows overland in an east to west direction, discharging to an existing swale in Drimmie Park and ultimately the existing storm sewer system on Keating Drive.

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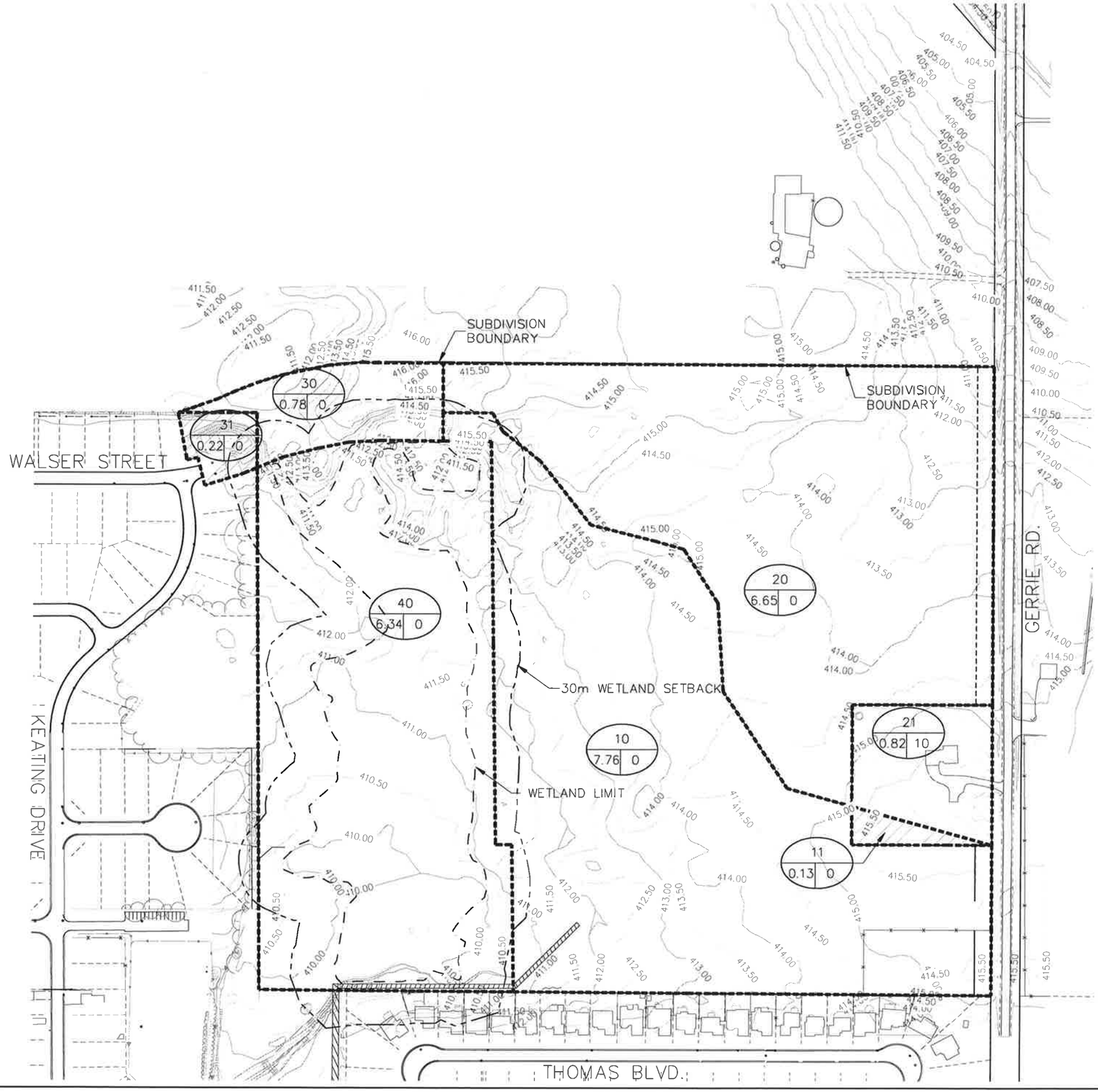

LEGEND

DRAINAGE AREA BOUNDARY

200 — CATCHMENT NUMBER
0.30 80 — % IMPERVIOUS
AREA IN HECTARES

EXTERNAL LANDS

SCALE = 1:3000
REVISED: OCTOBER 2017

EXISTING CONDITIONS STORM DRAINAGE AREA PLAN

Figure No. 3

BluePlan ENGINEERING

Plotted On: October 24, 2017 411009-FIG3-STM-EX.dwg

Table No. 5 gives the results of the ponding in the existing wetland.

Table No. 5: Wetland (Existing Condition Flow Rates and Runoff Volumes)

	Available Capacity			Actual Capacity Used			Drawdown Time (hr)**
	Peak Flow m^3/s	Storage Volume m^3	Storage Elevation m	Peak Flow m^3/s	Storage Volume m^3	Storage Elevation m	
Wetland Bottom	0.000	0.0	409.63	---	---	---	---
2-Year	---	---	---	0.091	39	409.65	7.4
5-Year	---	---	---	0.315	135	409.70	6.9
10-Year	---	---	---	0.536	231	409.75	6.9
25-Year	---	---	---	0.736	556	409.80	6.7
50-Year	---	---	---	0.935	881	409.84	6.5
100-Year	---	---	---	1.157	1242	409.89	6.0
Weir	1.345	9,472.3	410.50	---	---	---	---
Regional Storm	---	---	---	1.422	1675	409.95	52.1
Overflow	1.885	15,057.7	410.75	---	---	---	---

**Drawdown time obtained from the hydrologic modeling software MIDUSS

Table No. 6 gives the results of the existing condition drainage channel routing downstream of the existing wetland.

Table No. 6: Wetland (Existing Condition Drainage Channel Downstream of Wetland – Section 1 of 2)

	Channel Design Capacity			Actual Channel Capacity Used		
	Peak Flow m^3/s	Average Channel Depth m	Velocity m/s	Peak Flow m^3/s	Average Channel Depth m	Velocity m/s
2-Year	---	---	---	0.091	0.159	0.535
5-Year	---	---	---	0.315	0.254	0.730
10-Year	---	---	---	0.536	0.310	0.834
25-Year	---	---	---	0.736	0.349	0.903
50-Year	---	---	---	0.935	0.381	0.958
100-Year	---	---	---	1.157	0.413	1.011
Regional Storm	---	---	---	1.422	0.446	1.064
Top of Bank	10.655	0.95	1.602	---	---	---

Table No. 7 gives the results of the existing condition drainage channel routing downstream of the existing wetland.

Table No. 7: Wetland (Existing Condition Drainage Channel Downstream of Wetland – Section 2 of 2)

	Channel Design Capacity			Actual Channel Capacity Used		
	Peak Flow m^3/s	**Average Channel Depth m**	**Velocity m/s**	**Peak Flow m^3/s**	**Average Channel Depth m**	**Velocity m/s**
2-Year	---	---	---	0.091	0.081	0.504
5-Year	---	---	---	0.313	0.164	0.766
10-Year	---	---	---	0.534	0.221	0.907
25-Year	---	---	---	0.735	0.264	1.000
50-Year	---	---	---	0.934	0.301	1.074
100-Year	---	---	---	1.153	0.336	1.142
Regional Storm	---	---	---	1.415	0.375	1.212
Top of Bank	9.246	0.95	1.966	---	---	---

Table No. 8 summarizes the existing condition flow rates and runoff volumes from the site for the full range of design storm events.

Table No. 8: Existing Condition Flow Rates and Runoff Volumes

	CATCHMENTS										
	30	**31**	**Total to Walser**	**10**	**11**	**40**	**Total to Ex. Wetland**	**20**	**21**	**Total to Tributary of Grand River**	**Total from Site**
2 year											
Flow Rate (m^3/s)	0.006	0.002	0.008	0.044	0.001	0.054	0.093	0.038	0.016	0.043	**0.144**
Runoff Volume (m^3)	39.9	11.3	51.2	397.3	6.7	324.5	728.5	340.5	60.4	400.8	**1180.5**
5 year											
Flow Rate (m^3/s)	0.021	0.007	0.028	0.157	0.004	0.186	0.331	0.135	0.030	0.152	**0.511**
Runoff Volume (m^3)	100.1	28.2	128.3	995.9	16.7	813.0	1825.6	853.4	130.5	983.9	**2937.8**
10 year											
Flow Rate (m^3/s)	0.036	0.013	0.048	0.273	0.008	0.320	0.517	0.234	0.049	0.263	**0.828**
Runoff Volume (m^3)	151.3	42.7	193.9	1505.1	25.2	1229.4	2759.8	1289.8	188.3	1478.1	**4431.8**
25 year											
Flow Rate (m^3/s)	0.059	0.020	0.078	0.454	0.012	0.520	0.940	0.389	0.078	0.435	**1.453**
Runoff Volume (m^3)	222.18	62.6	284.8	2210.7	37.0	1805.2	4052.8	1894.4	266.6	2161.0	**6498.6**
50 year											
Flow Rate (m^3/s)	0.080	0.027	0.105	0.618	0.016	0.703	1.261	0.530	0.103	0.592	**1.958**
Runoff Volume (m^3)	282.5	79.6	362.1	2811.2	47.1	2295.0	5153	2409.1	332.7	2741.8	**8256.9**
100 year											
Flow Rate (m^3/s)	0.102	0.034	0.134	0.801	0.020	0.877	1.614	0.687	0.134	0.763	**2.511**
Runoff Volume (m^3)	346.3	97.5	443.8	3447.0	57.6	2814.3	6318.9	2953.9	401.7	3355.6	**10118.3**
Regional											
Flow Rate (m^3/s)	0.087	0.023	0.110	0.881	0.014	0.688	1.582	0.755	0.087	0.840	**2.532**
Runoff Volume (m^3)	1598.8	453.3	2052.2	15780.0	267.9	12943.0	28991.5	13523.0	1719.5	15243.0	**46286.7**

b) Allowable Release Rates

In order to maintain the existing condition drainage pattern, the allowable release rates have been determined by the existing conditions release rates. Under post-development conditions, runoff generated from the site will be attenuated to the existing condition level. Therefore, the allowable release rates from the site under post-development conditions are outlined in Table No. 9.

Table No. 9: Allowable Release Rates

Allowable Release Rate	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	Regional
To Ex. Wetland	0.093 m^3/s	0.331 m^3/s	0.517 m^3/s	0.940 m^3/s	1.261 m^3/s	1.614 m^3/s	1.582 m^3/s
To Tributary of Grand River	0.043 m^3/s	0.152 m^3/s	0.263 m^3/s	0.435 m^3/s	0.592 m^3/s	0.763 m^3/s	0.840 m^3/s
To Walser	0.008 m^3/s	0.028 m^3/s	0.048 m^3/s	0.078 m^3/s	0.105 m^3/s	0.134 m^3/s	0.110 m^3/s
Total	**0.144 m^3/s**	**0.511 m^3/s**	**0.828 m^3/s**	**1.453 m^3/s**	**1.958 m^3/s**	**2.511 m^3/s**	**2.532 m^3/s**

c) Post-Development Conditions

Under post-development conditions, the existing drainage patterns of the site will be maintained. Post-development flows from the site will be attenuated to existing condition levels through the use of two (2) stormwater management facilities. Stormwater Management Facility No. 1 will outlet to the existing wetland. Stormwater Management Facility No. 2 will outlet to the existing roadside ditch along Gerrie Road and ultimately a tributary of the Grand River.

For the post-development condition analysis, the 21.46-hectare site and 1.24 hectares of external areas was modelled as nine (9) drainage catchments. These catchments are shown on the Post-Development Storm Drainage Area Plan (Figure No. 4).

Catchment 1000 (11.28-hectares, 50% Impervious) represents the southwest portion of development, including Street No. 1, a portion of Street 2, Street 3, Street 4 and Stormwater Management Facility No. 1. Major and minor storm runoff generated from Catchment 1000 will be directed to Stormwater Management Facility No. 1.

Catchment 1100 (0.47-hectares, 0% Impervious) represents a portion of external lands including existing residential lot. Major and minor storm runoff generated from Catchment 1100 will be directed to Stormwater Management Facility No. 1.

Quantity control for minor and major stormwater runoff generated from Catchment 1000 and 1100 will be provided by Stormwater Management Facility No. 1. A multi-staged outlet structure consisting of a 130 mm diameter knockout, two ditch inlet catch basin structures, complete with 300 mm diameter orifice plate and 200 mm diameter orifice plate and a 20.0 metre wide overflow weir will attenuate runoff generated from Catchment 1000 and 1100 prior to discharge to the existing wetland.

Quality control treatment (80% TSS removal) for runoff generated from Catchment 1000 and 1100 will be provided by three (3) oil/grit separator structures. The first oil/grit separator structure (Stormceptor STC 9000 or approved equivalent) will be located at the northerly inlet to Stormwater Management Facility No. 1 (Street 3). The second oil/grit separator structure (Stormceptor STC 6000 or approved equivalent) will be located at the central inlet to Stormwater Management Facility

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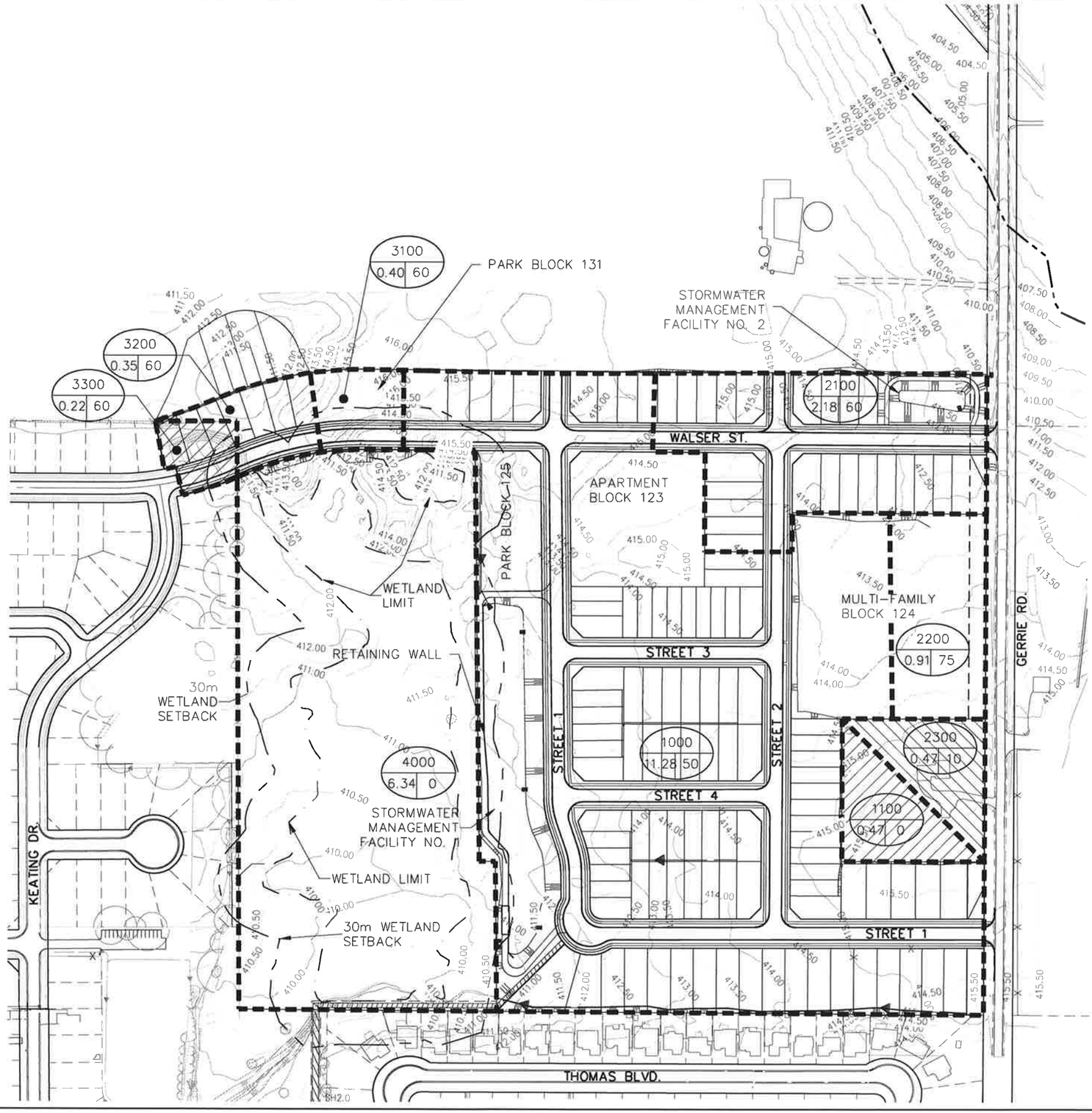


LEGEND

DRAINAGE AREA BOUNDARY

200 — CATCHMENT NUMBER
0.30 80 — % IMPERVIOUS
AREA IN HECTARES

EXTERNAL LANDS

SCALE = 1:3000

REVISED: OCTOBER 2017

POST-DEVELOPMENT STORM DRAINAGE AREA PLAN

Figure No. 4

BluePlan ENGINEERING

Plotted On: October 24, 2017 411009-FIG4-STM-POST.dwg

No. 1 (Street 4). The third oil/grit separator structure (Stormceptor STC 4000 or approved equivalent) will be located at the southerly inlet to Stormwater Management Facility No. 1 (Street 1). ***Catchment 2100 (2.18-hectares, 60% Impervious)*** represents the north portion of development, including the remainder of Street 2, and a portion of Walser Street. Major and minor storm runoff generated from Catchment 2100 will be directed to Stormwater Management Facility No. 2.

Quantity and quality control for minor and major stormwater runoff generated from Catchment 2100 will be provided by Stormwater Management Facility No. 2. A multi-staged outlet structure consisting of a 150 mm diameter knockout, a 450 mm diameter outlet pipe and a 10.0 metre long overflow weir will attenuate runoff generated from Catchment 2100 prior to discharge to the existing roadside ditch along Gerrie Road and ultimately a tributary of the Grand River.

Quality control treatment (80% TSS removal) for runoff generated from Catchment 2100 will be provided by one (1) oil/grit separator structure. The oil/grit separator structure (Stormceptor STC 4000 or approved equivalent) will be located at the inlet to Stormwater Management Facility No. 2.

Catchment 2200 (0.91-hectares, 75% Impervious) represents the multi-family residential block. Runoff generated from Catchment 2200 will discharge to the roadside ditch along Gerrie Road, and ultimately a tributary of the Grand River. At such time as development of Catchment 2200 proceeds, a privately owned and operated on-site quality and quantity control stormwater management facility will be required to attenuate stormwater runoff to the existing condition level, prior to discharge to the existing roadside ditch along Gerrie Road.

The privately owned and operated on-site stormwater management facility will be designed, reviewed and approved as part of the site plan approval process for the development block. The on-site stormwater management controls which may be utilized include, but are not limited to, a stormwater management facility (i.e. SWM pond), rooftop storage, parking lot ponding (to a maximum depth of 0.3m), below grade storage (i.e. clear stone storage, superpipe storage, etc.) and oil/grit separators.

Catchment 2300 (0.47-hectares, 10% Impervious) represents the remainder of the existing residential lot on Gerrie Road. Major and minor storm runoff generated from Catchment 2300 will be directed to the existing roadside ditch on Gerrie Road, ultimately discharging to a tributary of the Grand River.

Catchment 3100 (0.40-hectares, 60% Impervious) represents a portion of Walser Street and future Park Block 123. Minor storm runoff generated from Catchment 3100 will be directed to Stormwater Management Facility No. 2. Major storm runoff generated from Catchment 3100 will sheetflow overland to the existing Walser Street right-of-way.

Catchment 3200 (0.35-hectares, 60% Impervious) represents four (4) new single family lots and a portion of Walser Street that form part of the Ville Lora Downs North Phase III development. Minor storm runoff generated from Catchment 3200 will be directed to the existing storm sewers on Walser Street. Major storm runoff generated from Catchment 3200 will sheetflow overland to the existing Walser Street right-of-way.

Catchment 3300 (0.22-hectares, 60% Impervious) represents three (3) new single family lots and a portion of Walser Street that form part of the Ville Lora Downs North Phase III development. Minor storm runoff generated from Catchment 3300 will be directed to the existing storm sewers on Walser Street. Major storm runoff generated from Catchment 3300 will discharge overland to the existing Walser Street right-of-way.

Quality and quantity control for stormwater runoff generated from Catchments 3200 and 3300 will be provided by the existing stormwater management facilities approved and constructed as part of the Villa Lora Downs North Phase II development.

Catchment 4000 (6.34 hectares, 0% impervious) represents the remainder of the site, which is a natural heritage feature consisting of a woodlot and wetland area. Runoff generated from Catchment 4000 will continue to sheetflow overland, ultimately discharging to the existing swale in Drimmie Park and the existing storm sewers on Keating Drive.

Table No. 10 lists the uncontrolled flow rate and runoff volumes generated from each catchment area shown on Figure No. 4, for the 2, 5, 10, 25, 50 and 100-year design storm events and the Regional storm.

Table No. 10: Post-Development Uncontrolled Flow Rate and Runoff Volume

	CATCHMENTS													
	1000	**1100**	**4000**	**To Ex. Wetland**	**2100**	**2200**	**2300**	**3100 (minor)**	**To Roadside Ditch**	**3100 (major)**	**3200**	**3300**	**To Walser Street**	**Total**
2 year														
Flow Rate (m^3/s)	1.014	0.009	0.054	**1.064**	0.437	0.129	0.010	0.043	**0.576**	0.00	0.038	0.024	**0.061**	**1.700**
Runoff Volume (m^3)	1945.6	32.2	324.5	**2379.6**	420.1	203.6	41.9	77.31	**987.3**	0.00	67.7	42.5	**110.2**	**3477.1**
5 year														
Flow Rate (m^3/s)	1.493	0.027	0.186	**1.592**	0.597	0.174	0.023	0.062	**0.788**	0.00	0.054	0.034	**0.088**	**2.468**
Runoff Volume (m^3)	3375.6	74.59	813.0	**4394.2**	1254.8	334.6	87.8	131.0	**1677.1**	0.00	114.6	72.0	**186.6**	**6257.9**
10 year														
Flow Rate (m^3/s)	1.840	0.042	0.320	**1.979**	0.706	0.204	0.036	0.075	**0.933**	0.013	0.066	0.041	**0.120**	**3.031**
Runoff Volume (m^3)	4431.7	109.3	1229.4	**5933.93**	1630.5	428.7	124.5	170.0	**2183.7**	6.5	148.7	93.5	**248.7**	**8366.4**
25 year														
Flow Rate (m^3/s)	2.321	0.064	0.520	**2.537**	0.854	0.243	0.055	0.092	**1.130**	0.030	0.081	0.051	**0.162**	**3.829**
Runoff Volume (m^3)	5580.3	156.6	1805.2	**7946.0**	2107.7	546.8	173.6	219.5	**2828.1**	20.8	192.1	120.7	**333.7**	**11107.8**
50 Year														
Flow Rate (m^3/s)	2.726	0.081	0.703	**3.024**	0.964	0.272	0.073	0.107	**1.277**	0.045	0.093	0.059	**0.197**	**4.498**
Runoff Volume (m^3)	6876.2	196.2	2295.1	**9590.3**	2490.3	640.8	214.2	259.2	**3345.3**	36.4	226.8	142.6	**405.7**	**11341.3**
100 Year														
Flow Rate (m^3/s)	3.124	0.099	0.877	**3.571**	1.088	0.302	0.090	0.121	**1.445**	0.059	0.106	0.066	**0.230**	**5.198**
Runoff Volume (m^3)	7984.7	237.1	2814.3	**11282.1**	2881.0	736.1	256.9	299.4	**3874.0**	53.3	262.0	164.7	**480.0**	**15636.1**
Regional Storm														
Flow Rate (m^3/s)	1.367	0.054	0.688	**2.083**	0.465	0.110	0.051	0.049	**0.051**	0.000	0.043	0.027	**0.070**	**2.770**
Runoff Volume (m^3)	25716.0	1010.2	12943.0	**40591.6**	8956.6	2150.2	1036.4	922.4	**1036.4**	0.0	807.1	507.3	**1314.4**	**54049.4**

Table No. 11 compares the routing results through the proposed Stormwater Management Facility No. 1.

Table No. 11: Catchment 1000 & 1100 – Stormwater Management Facility No. 1 Available Stage/Storage/Discharge

CONTROL	Available Capacity			Actual Capacity Used		
	Peak Flow m^3/s	Storage Volume m^3	Storage Elevation m	Peak Flow m^3/s	Storage Volume m^3	Storage Elevation m
Pond Bottom / 130mm Knockout	0.00	0.0	411.00	---	---	---
2 year	---	---	---	0.017	1,908.2	411.31
CB Lip 1 Elevation	0.026	3,804.5	411.60	---	---	---
5 year	---	---	---	0.024	3,379.6	411.54
10 year	---	---	---	0.092	4,142.3	411.65
CB Lip 2 Elevation	0.163	4,806.0	411.75	---	---	---
25 year	---	---	---	0.220	5,041.1	411.79
Weir	0.252	5,485.0	411.85	---	---	---
50 year	---	---	---	0.464	5,588.4	411.87
100 year	---	---	---	0.917	5,809.4	411.91
Regional Storm	---	---	---	1.322	6,057.8	411.96
Top of Bank	1.912	6,295.5	412.00	---	---	---

Table No. 12 compares the routing results through the proposed Stormwater Management Facility No. 2.

Table No. 12: Catchment 2100 – Stormwater Management Facility No. 2 Available Stage/Storage/Discharge

CONTROL	Available Capacity			Actual Capacity Used		
	Peak Flow m^3/s	Storage Volume m^3	Storage Elevation m	Peak Flow m^3/s	Storage Volume m^3	Storage Elevation m
Permanent Pool /150mm Knockout	0.00	0.0	410.65	---	---	---
2 year	---	---	---	0.028	252.82	411.06
CB Lip Elevation	0.291	446.3	411.30	---	---	---
5 year	---	---	---	0.103	382.70	411.23
10 year	---	---	---	0.195	413.67	411.26
Weir	0.384	806.9	411.65	---	---	---
25 year	---	---	---	0.294	456.53	411.31
50 year	---	---	---	0.316	523.93	411.38
100 year	---	---	---	0.338	609.58	411.58
Regional Storm	---	---	---	0.240	432.77	411.29
Top of bank	2.818	1,195.4	411.95	---	---	---

Table No. 13 gives the results of the post-development ponding occurring in the wetland, which discharges to the existing channel located immediately south of the existing wetland.

Table No. 13: Wetland (Post-Development Condition Flow Rates and Runoff Volumes)

	Available Capacity			Actual Capacity Used			Drawdown Time (hr)**
	Peak Flow m^3/s	Storage Volume m^3	Storage Elevation m	Peak Flow m^3/s	Storage Volume m^3	Storage Elevation m	
Wetland Bottom	0.000	0.0	409.63	---	---	---	---
2-Year	---	---	---	0.067	29	409.65	86.3
5-Year	---	---	---	0.195	84	409.67	106.2
10-Year	---	---	---	0.319	137	409.70	112.5
25-Year	---	---	---	0.555	257	409.75	113.6
50-Year	---	---	---	0.706	503	409.79	114.3
100-Year	---	---	---	1.104	1159	409.88	114.3
Weir	1.345	9,472.3	410.50	---	---	---	---
Regional Storm	---	---	---	1.869	2369	410.03	160.2
Overflow	1.885	15,057.7	410.75	---	---	---	---

**Drawdown time obtained from the hydrologic modeling software MIDUSS

Table No. 14 gives the results of the post-development condition drainage channel routing downstream of the existing wetland.

Table No. 14: Wetland (Post-Development Condition Drainage Channel Downstream of Wetland – Section 1 of 2)

	Channel Design Capacity			Actual Channel Capacity Used		
	Peak Flow m^3/s	Average Channel Depth m	Velocity m/s	Peak Flow m^3/s	Average Channel Depth m	Velocity m/s
2-Year	---	---	---	0.067	0.142	0.496
5-Year	---	---	---	0.195	0.212	0.648
10-Year	---	---	---	0.319	0.255	0.732
25-Year	---	---	---	0.555	0.314	0.841
50-Year	---	---	---	0.706	0.343	0.893
100-Year	---	---	---	1.104	0.406	0.999
Regional Storm	---	---	---	1.869	0.495	1.139
Top of Bank	10.655	0.95	1.602	---	---	---

Table No. 15 gives the results of the post-development condition drainage channel routing downstream of the existing wetland.

Table No. 15: Wetland (Post-Development Condition Drainage Channel Downstream of Wetland – Section 2 of 2)

	Channel Design Capacity			Actual Channel Capacity Used		
	Peak Flow m^3/s	Average Channel Depth m	Velocity m/s	Peak Flow m^3/s	Average Channel Depth m	Velocity m/s
2-Year	---	---	---	0.067	0.067	0.452
5-Year	---	---	---	0.194	0.125	0.654
10-Year	---	---	---	0.316	0.165	0.768
25-Year	---	---	---	0.554	0.226	0.917
50-Year	---	---	---	0.705	0.258	0.987
100-Year	---	---	---	1.103	0.329	1.128
Regional Storm	---	---	---	1.862	0.432	1.310
Top of Bank	9.246	0.95	1.966	---	---	---

Table No. 16 summarizes the post-development flow rates from the site.

Table No. 16: Summary of Post-Development Flow Rates from the Site

CATCHMENT	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	Regional Storm
Catchments 1000 & 1100 & 3100 (minor) (controlled)	0.017 m^3/s	0.024 m^3/s	0.108 m^3/s	0.220 m^3/s	0.464 m^3/s	0.917 m^3/s	1.322 m^3/s
Catchment 4000 (uncontrolled)	0.054 m^3/s	0.186 m^3/s	0.320 m^3/s	0.520 m^3/s	0.703 m^3/s	0.877 m^3/s	0.688 m^3/s
Total to Ex. Wetland	**0.069 m^3/s**	**0.206 m^3/s**	**0.343 m^3/s**	**0.615 m^3/s**	**0.864 m^3/s**	**1.561 m^3/s**	**1.936 m^3/s**
Catchments 2100 (controlled)	0.028 m^3/s	0.103 m^3/s	0.195 m^3/s	0.294 m^3/s	0.316 m^3/s	0.338 m^3/s	0.240 m^3/s
Catchment 2200 (uncontrolled)	0.014 m^3/s	0.042 m^3/s	0.067 m^3/s	0.105 m^3/s	0.138 m^3/s	0.172 m^3/s	0.098 m^3/s
Catchment 2300 (uncontrolled)	0.010 m^3/s	0.023 m^3/s	0.036 m^3/s	0.055 m^3/s	0.073 m^3/s	0.090 m^3/s	0.051 m^3/s
Total to Tributary of Grand River	**0.048 m^3/s**	**0.162 m^3/s**	**0.298 m^3/s**	**0.452 m^3/s**	**0.523 m^3/s**	**0.598 m^3/s**	**0.389 m^3/s**
Catchment 3100 (major) & 3200 & 3300 (uncontrolled)	0.061 m^3/s	0.088 m^3/s	0.120 m^3/s	0.162 m^3/s	0.197 m^3/s	0.230 m^3/s	0.070 m^3/s
Total to Walser Street	**0.061 m^3/s**	**0.088 m^3/s**	**0.120 m^3/s**	**0.162 m^3/s**	**0.197 m^3/s**	**0.230 m^3/s**	**0.070 m^3/s**
Total from Site	**0.116 m^3/s**	**0.349 m^3/s**	**0.566 m^3/s**	**0.897 m^3/s**	**1.128 m^3/s**	**1.488 m^3/s**	**2.277 m^3/s**

The following table compares the allowable release rates to the post-development flow rates for the site.

Table No. 17: Comparison of Allowable Release Rates and Post-Development Conditions Flow Rates

DESIGN STORM	To Ex. Wetland		To Tributary of Grand River		To Walser Street		Total from Site	
	Allowable Release Rate (m^3/s)	Post Flow Rate (m^3/s)	Allowable Release Rate (m^3/s)	Post Flow Rate (m^3/s)	Allowable Release Rate (m^3/s)	Post Flow Rate (m^3/s)	Allowable Release Rate (m^3/s)	Post Flow Rate (m^3/s)
2 year	0.093	0.069	0.043	0.048	0.008	0.061	0.144	0.116
5 year	0.331	0.206	0.152	0.162	0.028	0.088	0.511	0.349
10 year	0.517	0.343	0.263	0.298	0.048	0.120	0.828	0.566
25 year	0.940	0.615	0.435	0.452	0.078	0.162	1.453	0.897
50 Year	1.261	0.864	0.592	0.523	0.105	0.197	1.958	1.128
100 Year	1.614	1.561	0.763	0.593	0.134	0.230	2.511	1.488
Regional	1.582	1.936	0.840	0.389	0.110	0.070	2.532	2.277

Therefore, the post-development runoff generated from the site will be attenuated to the less than the allowable release rates for the full range of design storm events.

5.3.4 MINOR / MAJOR DRAINAGE SYSTEM

Minor storm drainage will be conveyed to the proposed stormwater management facilities and the existing storm sewers on Walser Street via storm sewers with the capacity to convey the 5-year design storm event.

The major storm runoff generated from Street 1, and a portion of Street 2, Street 3 and Street 4 will discharge to the proposed stormwater management facility located east of the existing wetland (Stormwater Management Facility No. 1), which outlets to the existing wetland, ultimately discharging to the existing storm sewers on Keating Drive.

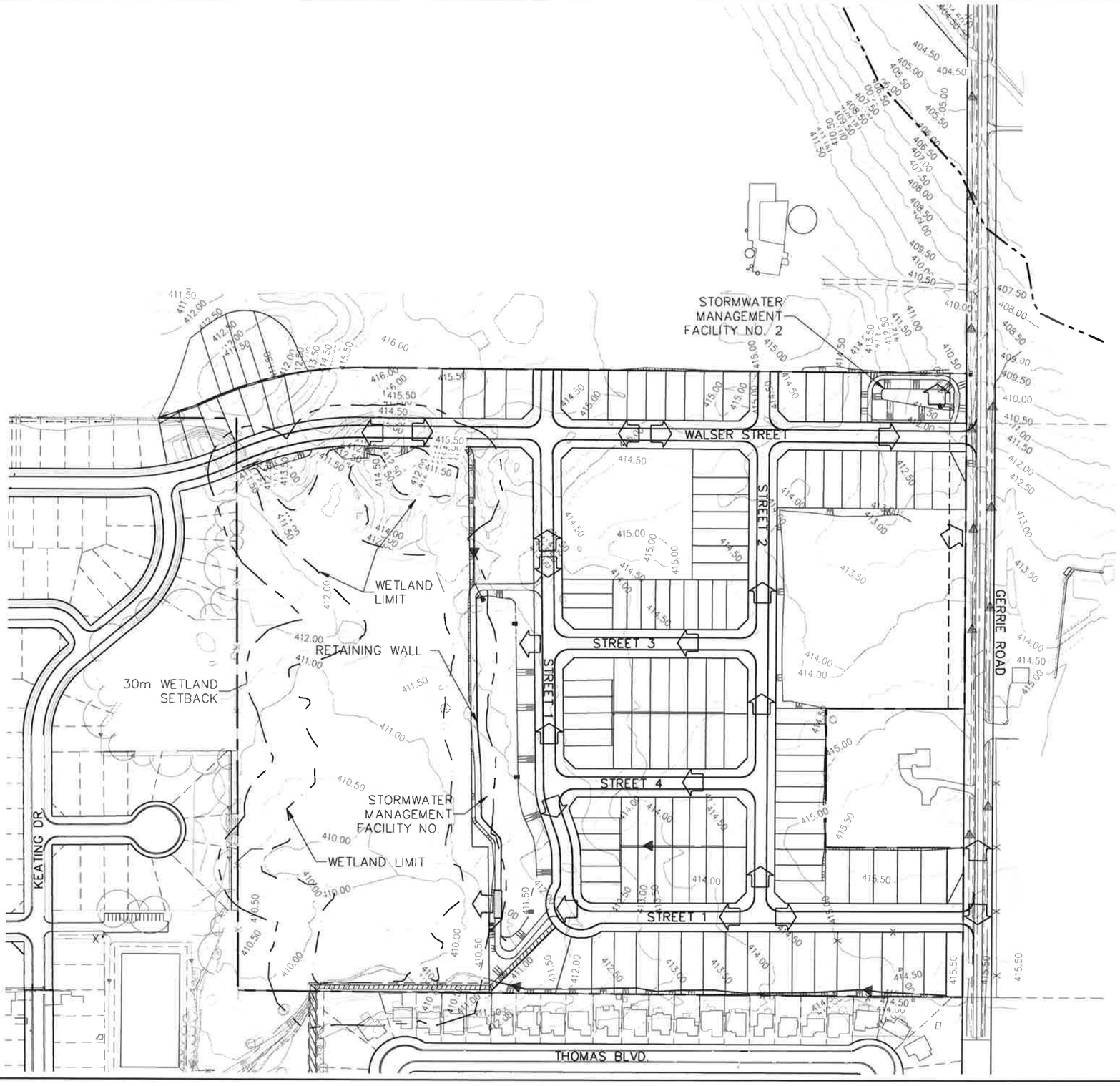
The major storm runoff generated from the remainder of Street 2 and a portion of the Walser Street extension will discharge to the proposed stormwater management facility (Stormwater Management Facility No. 2), ultimately discharging to a tributary of the Grand River.

The major storm runoff generated from the remainder of the Walser Street extension will discharge directly to the existing Walser Street Right-of-Way, ultimately discharging to the Keating Drive Right-of-Way.

Preliminary analysis indicates that the municipal right-of-way has the capacity to convey the runoff from a major design storm event.

The major design storm drainage patterns expected for the Ainley Farm Subdivision are shown on Figure 5.

411009
AINLEY FARM SUBDIVISION
TOWNSHIP OF CENTRE
WELLINGTON (ELORA)



LEGEND

MAJOR OVERLAND FLOW

SCALE = 1:3000

REVISED: OCTOBER 2017

MAJOR STORM DRAINAGE PATTERN PLAN

Figure No. 5

BluePlan ENGINEERING

Plotted On: October 24, 2017 411009-FIG5-MAJ_STM_DRAINAGE.d

6.0 SEDIMENT AND EROSION CONTROL PLAN

A silt fence will be installed along the property boundary. The silt fence will serve to minimize the opportunity for water borne sediments to be transported from the site to the adjacent properties.

Temporary straw bale check dams will be installed in rear yard swales after the initial grading has been completed to slow the flow rates and promote the settlement of water borne sediments before they reach the silt fences and stormwater management facilities.

Upon completion of the grading, any area not subject to active construction within 30 days will be top soiled and seeded as per OPSS 572.

Once catch basins have been installed, the grates will be wrapped in filter cloth. This feature will be maintained until all building and landscaping has been completed.

Inspection and maintenance of all silt fencing and sediment and erosion controls will start after installation is complete. These features will be inspected on a weekly basis or after a rainfall event of 13 mm or greater. Maintenance will be carried out, within 48 hours, on any part of the controls found to need repair.

Once construction and landscaping within the limits of the subdivision has been substantially completed (75% house building construction is complete), the silt fence will be removed, any accumulated sediment will be collected and the area will be restored.

After construction of the subdivision, erosion and sediment transport will be minimal.

7.0 MAINTENANCE PLAN

A two-phase maintenance plan is recommended. Phase I will address the short-term more intensive maintenance necessary during and immediately after construction. Once all landscaping has been completed, maintenance will shift to Phase II.

As outlined in the section on Sediment and Erosion Control, Phase I will include weekly inspection of all sediment and erosion control devices plus “as needed” inspection after significant rainfall, with the repair of any damaged works and collection of captured sediment.

Phase II will be the maintenance carried out by the Township of Centre Wellington after all construction has been completed. This work will involve a yearly visual inspection of the stormwater management facilities and catch basins to determine the amount of sediment accumulation. Sediment should be removed as required and the recommended vegetation replanted.

8.0 CONCLUSIONS

From the foregoing analysis, the following conclusions are drawn:

- Water supply for the Ainley Farm Subdivision will be provided via the extension of a 200 mm diameter watermain along the Walser Street extension, Street No. 2 and a portion of Street No. 1. A 150 mm diameter watermain will be extended along the remainder of Street No. 1, Street No. 3, and Street No. 4.
- Sanitary service for the proposed lots along the Walser Street extension and a portion of Street No. 2 will be provided by the extension of a 200 mm diameter sanitary sewer from the existing 200 mm diameter sanitary sewer on Walser Street. Sanitary service for the remainder of the site will be provided by the extension of a 200 mm diameter sanitary sewer on easement from the existing 200 mm diameter sanitary sewer on Keating Drive.
- Storm sewers will be designed to convey the 5-year design storm event and will discharge to the two (2) stormwater management facilities and the existing storm sewer on Walser Street.
- Major storm runoff will be conveyed within the limits of the street right-of-ways to the two (2) stormwater management facilities and the existing Walser Street right-of-way.
- As per the Township of Centre Wellington municipal standards, foundation drainage will be collected in sump pits in each residential unit and pumped to the storm sewer system located within the municipal right-of-way.
- Quantity control for runoff generated from the development will be provided by two (2) stormwater management facilities,
- Quality control for runoff generated from the development will be provided by four (4) oil/grit separators (Stormceptor or approved equivalent).
- Installation of infiltration systems in the rear yard areas is not feasible due to the low hydraulic conductivity of the native underlying silty tills and the presence of high groundwater levels.
- During the construction phase, the erosion control measures will minimize the transport of sediment off-site during the construction period.

All of which is respectfully submitted.

GM BLUEPLAN ENGINEERING LIMITED
Per:

Sarah Primmer, P.Eng.

SP/

Encl.

W:\Kitchener\411-2011\411009\Documents\Reports, Manuals, Contracts\411009 Prelim Servicing and SWM Report_2017-10-27.docx

APPENDIX A

PRELIMINARY GEOTECHNICAL INVESTIGATION

CMT ENGINEERING INC.

MARCH 29, 2006

PRELIMINARY GEOTECHNICAL INVESTIGATION

AINLEY SUBDIVISION
TOWNSHIP OF CENTRE WELLINGTON
VILLAGE OF ELORA, ONTARIO

CMT Project 06-004

Prepared For:

Gamsby and Mannerow Limited

March 29, 2006

CMT ENGINEERING INC.

CMT Engineering Inc.
1011 Industrial Crescent, Unit 1
P.O. Box 159
St. Clements, Ontario N0B 2M0
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March 29, 2006 06-004.R01

Gamsby and Mannerow Limited
255 Woodlawn Road West, Suite 210
Guelph, Ontario
N1H 8J1

Attention: Mr. Glenn Anderson, C.E.T.

Dear Sir:

Re: Preliminary Geotechnical Investigation
Ainley Subdivision
Township of Centre Wellington
Village of Elora, Ontario

As requested, CMT Engineering Inc. conducted a subsoil investigation at the above-referenced site, and we are pleased to present the enclosed report.

We trust that this information meets your present requirements and we thank you for this opportunity to have been of service. Should you have any questions, please do not hesitate to contact our office.

Yours very truly,

Robert Koopmans, P.Eng.

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TABLE OF CONTENTS

1.0 INTRODUCTION

The services of CMT Engineering Inc. were retained by Mr. Glenn Anderson of Gamsby and Mannerow Limited to carry out a subsurface investigation for the proposed Ainley Subdivision in the Township of Centre Wellington (Village of Elora).

It is our understanding that single-family and multi-family residences are proposed to be built on the eastern two-thirds of the property. The western one-third of the property is proposed for open space and may contain a storm water management pond.

The purpose of the investigation was to determine the subsurface soil profile, the water levels in the boreholes and provide recommendations with respect to site grading, bearing capacity for house foundations, trench excavations, bedding and backfilling for service pipes, site dewatering, road construction, pavement design recommendations and soil hydraulic conductivity for storm water management design.

2.0 SITE CONDITIONS

The geotechnical investigation was conducted on Part Lot 18, Concession 12 of the Township of Centre Wellington. In general, the eastern two-thirds of the property is currently farm land, while the western one-third is treed. The site topography undulates slightly and the ground surface elevation drops towards the southwest corner of the property.

3.0 FIELD AND LABORATORY PROCEDURES

On January 25, 2006, a track-mount CME 55 drillrig operated by Aardvark Drilling Inc. was used to drill eight (8) boreholes (referenced as Boreholes 101 to 108) to depths of between 3.5 m (11.5 ft) and 5.0 m (16.4 ft) below the existing ground surface elevation. Standard penetration tests were conducted at 0.76 m (2.5 ft) intervals to depths of 3.0 m (10.0 ft) and at 1.5 m (5.0 ft) intervals below 3.0 m (10.0 ft) in all boreholes. Monitoring wells were installed in all eight boreholes to determine the presence and depth of the groundwater table.

Technical staff from CMT Engineering Inc. observed the drilling operation and collected and logged the recovered soil samples. Soil samples taken from Borehole 102 (3.05 to 3.51 m), Borehole 103 (4.57 to 5.03 m), Borehole 105 (2.29 to 2.74 m) and Borehole 107 (2.29 to 2.74 m) were placed in marked sample bags for grain size analyses (refer to Appendix C for laboratory test results). A bulk sample from Borehole 103 (1.5 to 2.0 m) was submitted for laboratory Proctor testing (refer to Appendix D for the laboratory test results). A small portion of each sample was placed in a sealed marked jar for moisture content determinations.

Gamsby and Mannerow Limited surveyed the ground surface elevations for all boreholes, as well as the tops of the monitoring wells.

Drawing 1 shows the site plan with all of the borehole locations.

4.0 SUBSOIL CONDITIONS

The soil conditions at the borehole locations are summarized briefly below, while a more detailed stratigraphic description is provided in the borehole logs in Appendix A. Cross-section profiles through Boreholes 101-103-102-104 and Boreholes 105-106-107-108 are provided in Appendix B.

4.1 Topsoil

Dark brown silt topsoil was found at the top of all eight boreholes. The topsoil was frozen at the time of the investigation. The thickness of the topsoil ranged from 30 mm to 60 mm (average 42 mm).

4.2 Organic Silt

Organic silt was found underlying the topsoil in Borehole 103. The organic silt was saturated, loose and brown with some sand and occasional topsoil nodules. The moisture content of the organic silt was 83.5% and the N-count was 8 blows per 0.30 m.

4.3 Silt or Sandy Silt

Silt was found underlying the sandy silt in Borehole 105. The silt was very moist, loose and brown with some clay, trace sand and trace gravel. The moisture content of the silt was 18.5% and the N-count was 8 blows per 0.30 m.

Sandy silt was found underlying the topsoil in Borehole 102. In general, the sandy silt was moist, compact and brown with a trace of clay and a trace of gravel. The moisture content was 10.4% and the N-count was 12 blows per 0.30 m.

4.4 Silt Till or Sandy Silt Till

Glacial till comprising silt or sandy silt was found in all boreholes (101 to 108). In general, the silt till was moist, compact to very dense and brown with trace to some sand,

gravel and clay. The moisture content ranged from 6.8% to 20.4% (average 11.7%) and the N-count ranged from 14 to 100 blows per 0.30 m (average 37 blows per 0.30 m). The sandy silt till was generally moist, compact to very dense and brown with trace to some sand, gravel and clay. The moisture content ranged from 7.6% to 26.7% (average 13.4%) and the N-count ranged from 7 to 100 blows per 0.30 m (average 36 blows per 0.30 m).

4.5 Sand or Silty Sand

Sand was found in Boreholes 101, 102, 105 and 107. In general, the sand was very moist to wet, compact and brown with trace silt and/or trace gravel. The moisture content ranged from 14.3% to 20.0% (average 17.2%) and the N-count ranged from 7 to 22 blows per 0.30 m (average 15 blows per 0.30 m).

Silty sand was found in Boreholes 101, 103, 104, 105, 106 and 108. In general, the silty sand was wet to saturated, compact and brown with occasional trace gravel. The moisture content ranged from 10.5% to 27.7% (average 20.8%) and the N-count ranged from 1 to 25 blows per 0.30 m (average 10 blows per 0.30 m).

4.6 Clayey Silt

A localized layer of clayey silt was found in Borehole 107. The clayey silt was moist, compact and brown with trace sand and trace gravel. The moisture content was 13.6% and the N-count was 11 blows per 0.30 m.

4.7 Groundwater Conditions

Monitoring wells were installed in all boreholes. The monitoring wells were constructed utilizing 50 mm Schedule 40 PVC pipe with a 3 m long slot 10 screen surrounded by the sand filter comprising #3 industrial sand. The boreholes were backfilled with 3/8" bentonite holeplug from the top of the sand filter to the existing ground surface. For protection and security purposes, locking steel protective covers were installed on all of the monitoring wells.

A copy of the well record has been included in Appendix E. It is a requirement of Regulation 903 of the Ontario Water Resources Act that the monitoring well installations be abandoned within 180 days after they are no longer in use.

At the time of writing, the static water levels in the monitoring wells had been read on February 8, 2006, February 20, 2006, March 9, 2006, March 25, 2006 and March 29, 2006. A summary showing the ground surface, borehole bottom and water level elevations for Boreholes 101 to 108 are provided below:

Borehole No.	Ground Surface Elevation (m)	Elevation of Borehole Bottom (m)	Elevation of Water Table (m) (F) - Frozen				
			Feb 8, 2006	Feb 20, 2006	Mar 9, 2006	Mar 25, 2006	Mar 29, 2006
101	413.64	408.64	413.07	413.11	412.83	412.96	--
102	414.37	409.37	411.57	411.96	411.91	412.48	--
103	414.89	409.89	412.65	412.98	412.88	412.77	--
104	410.93	407.43	410.36	410.60	410.17	410.66	--
105	414.05	409.28	414.05	414.07 (F)	414.15 (F)	414.15 (F)	414.68
106	410.91	405.94	410.67	410.86 (F)	410.93 (F)	410.75	--
107	409.58	406.08	409.43	409.06 (F)	409.12 (F)	409.41	--
108	410.32	406.82	409.06	409.21	408.82	409.01	--

Due to the close proximity of the groundwater to the ground surface, some of the monitoring wells were frozen at the time of the water level readings.

The groundwater levels will be measured on a monthly basis in an effort to try and establish extreme (high and low) groundwater elevations.

5.0 DISCUSSION

It is our understanding that the property owner is proposing to develop a residential subdivision on the property investigated. The subdivision will be fully serviced with municipal sewers and water supply. A storm water management facility is proposed to be constructed in the western portion of the site.

5.1 Site Grading

Prior to the commencement of any site grading, all topsoil and organic silt soils (Borehole 103) must be removed from the proposed building envelopes (including extended zone of influence areas), road allowance and driveways.

Due to the high water table and isolated wet surface conditions, it may be necessary to utilize an excavator during topsoil stripping to minimize over-excavation as a result of soil disturbance from heavy construction traffic.

At this time, the proposed founding elevations for the residences are not available. However, it would appear that some cut and fill operations will be required to level the building site.

Prior to any placement of structural fill, the subgrade for the building envelope must be prepared large enough to accommodate a 1:1 slope commencing at a distance of 1.0 m beyond the outside edge of the proposed foundation down to approved native founding soils.

Soils approved for use as structural fill must be placed in loose lifts not exceeding 0.3 m (1 ft) in depth for granular soils and 0.2 m (8") in depth for fine grained (silt and clay) soils and compacted using adequate heavy vibratory padfoot compaction equipment to a minimum of 98% standard Proctor maximum dry density (SPMDD). The approved structural fill materials must be free of frozen materials, organics or other deleterious materials and must not contain particles exceeding 150 mm (6") in diameter. The soils must be at moisture contents suitable to achieve the specified compaction.

A laboratory Proctor moisture-density test was performed on a bulk sample of the silt till from Borehole 103 (depth 1.5 to 2.0 m). The results of the laboratory Proctor test indicate that the optimum moisture content of the sample is 8.3%. Since the insitu moisture contents of the split spoon sample of silt till ranged from 6.8% to 20.4% (average 11.7%), it should be anticipated that the majority of the silt till will require air-drying in order to achieve the specified compaction during construction.

The fine grained soils encountered in the geotechnical investigation are highly susceptible to strength losses if subjected to frequent disturbance by construction traffic. Therefore, it is recommended to minimize construction traffic on subgrade soils.

It would be recommended that the site grading and underground service installation be undertaken during drier warm weather conditions in order to minimize dewatering operations, eliminate frost problems and most importantly improve the placement and compaction of structural fill and backfill materials. Proper compaction and backfilling operations are imperative in order to provide adequate support for structures, service pipes, driveway and roadways.

If site grading and site servicing is undertaken during cold or wet weather conditions, projected overall costs would be anticipated to be higher and the project would be expected to take longer to complete.

5.2 Site Dewatering

Based on this geotechnical investigation and similar high water tables encountered during the construction of the neighbouring Ville Lora Downs Subdivision, water concerns should be anticipated for this project. Static water levels measured in the monitoring wells suggest that perched groundwater can be expected at the locations of Boreholes 101, 102, 103, 105 and 106 which were advanced within the proposed residential development area. The water appears to be surface water that has perched on top of the relatively impermeable sandy silt till, sandy silt and silt till soils. Furthermore, artesian conditions can also be expected at the locations of Boreholes 101, 102 and 103. The artesian water appears to be located between the upper sandy silt till and lower silt till in Borehole 101, between the upper and lower silt tills in Borehole 102 and below the silt till layer in Borehole 103.

Provisions for site dewatering should be part of the site development and construction process. Normally, it would be recommended that well points be installed in order to dewater the site so that site services and residential foundations could be installed. However, based on past experience, the installation of a well point dewatering system by qualified contractors can be very expensive and not necessarily guaranteed. It is probably most cost-effective to install a series of inverted drainage pipes in advance of the service (sanitary, storm and water) trench excavations and also at the locations of the manholes. Water pumps should be utilized to pump water from the inverted pipes on a continuous basis in order to keep the water table drawn down below the excavation level. Temporary drainage trenches should be constructed to remove the site water to a storm water retention pond (or reasonable alternative). The removal of considerable amounts of fine soil particles from the pumping operation can be anticipated. As such, the drainage trenches, storm water pond, pumps and hoses will most likely require regular cleanout. It might be cost-effective in regard to road construction and house construction to investigate the possibility of installing a permanent deep drainage system to lower the water table in the immediate area. Caution would be necessary with this option, since it could affect wells and building structures on adjacent properties.

The dewatering conditions may improve if work is conducted during the drier summer months as well as following the installation of the services.

5.3 Excavations

The anticipated sanitary, storm and water pipe invert elevations are all expected to be well below the water table and therefore site dewatering will be required (see Section 5.2 above). Based on observations from the neighbouring Ville Lora Downs Subdivision, the water levels in the summer are generally lower and therefore dewatering requirements

may be less. However, the anticipated effects of the artesian water conditions are still expected to be of concern.

All excavations must be carried out in accordance with Ontario Regulation 213/91 (Reg 213/91) of the Occupational Health and Safety Act and Regulations for Construction Projects.

Type 2 Soils: The native glacial till soils would be classified as Type 2 soils under Reg 213/91 and must be sloped to within 1.2 m of the bottom of the excavation at a minimum gradient of 1 horizontal to 1 vertical. Where excavations expose glacial till soils underlain by wet sand or silt soils, the recommendations for Type 4 soils below must be adhered to.

Type 3 Soils: The native sand and silt soils in an unsaturated condition (above the water table) would be classified as Type 3 soils under Reg 213/91 and must be sloped from the bottom of the excavation at a minimum gradient of 1 horizontal to 1 vertical.

Type 4 Soils: All native sand or silt soils in a saturated condition (below the water table) would be classified as Type 4 soils under Reg 213/91. Excavations that expose the Type 2 and Type 3 soils noted above but are underlain by saturated sand or silt soils must be treated as Type 4 soils as well. Type 4 soils must be sloped at a minimum gradient of 3 horizontal to 1 vertical. The loose wet condition of the Type 4 soils makes them very susceptible to sloughing and slope failure during excavation.

If it is not practical to excavate according to the above requirements, then a trench box system (designed in accordance with the Ontario Health and Safety Act Regulations) may be utilized.

It should be noted that some of the native glacial till soils become very dense with depth (N-values in excess of 100 blows per 0.30 m) and may prove difficult to excavate with conventional excavating equipment. It is also imperative that when the very dense soils are utilized for backfilling of service trenches, the material must be broken down (pulverized) to minimize voids and reduce the potential for settlement.

5.4 Service Pipe Bedding

The native soils are generally considered to be suitable for indirect support of the proposed service pipes. Where water inflow is a concern and the soil conditions are not suitable to support the pipe, then 80 mm to 120 mm (3" to 5") river stone (or equivalent) with a 150 mm (6") layer of 19 mm clear stone should be used to create an adequate supporting base for the pipe.

Pipe embedment and backfill for flexible pipes should be undertaken in accordance with OPSD-802.010. Pipe embedment, cover and backfill for rigid pipes should be undertaken in accordance with OPSD-802.030 or OPSD-802.031. Trenching, backfilling and compaction with respect to storm sewer pipe installations should comply with OPSS 514.

Flexible Pipes: The pipe bedding should be shaped to receive the bottom of the pipe. If necessary, pipe culvert frost treatment should be undertaken in accordance with OPSD-803.030 and OPSD-803.031. The trench excavations should be symmetrical with respect to the centreline of the pipe. The granular material placed under the haunches of the pipe must be compacted to 95% SPMDD prior to the continued placement and compaction of the embedment material. The homogeneous granular material used for embedment should be placed and compacted uniformly around the pipe. Should wet conditions be encountered at the base of the trench, then the pipe should consist of 19 mm clear stone (meeting OPS Specifications). Normally, it would be advisable to wrap the clear stone with geotextile to prevent fine soils from entering the clear stone and thereby creating voids around the pipe. In wet conditions, this is not possible to do and generally not necessary since most of the void spaces are quickly filled with fine soils as water (with suspended fine soils) rapidly enters the excavation. It is imperative that the newly installed pipe be backfilled as soon as possible in order to prevent the potential for pipe uplift. This can occur due to buoyancy, as water enters the excavation. It is also advisable to check the elevation of the installed pipe at regular intervals to ensure that uplift has not occurred. Protection against heavy construction equipment should be undertaken in accordance with OPSD-808.010.

Rigid Pipes: In general, the pipe installation recommendations for rigid pipes are the same as those for flexible pipes except that the minimum depth of bedding below a rigid pipe should be 0.15 *D* (where *D* is the pipe diameter). In no case should this dimension be less than 150 mm or greater than 300 mm.

5.5 Trench Backfill

Native backfill material can be used to fill the trench from 12" (30 cm) above the pipe to the subgrade elevation provided that the material is free of organics, not frozen and is not overly wet (above the optimum moisture).

Based on the existing water table, the moisture contents determined from soil samples that were taken during the geotechnical investigation, and the laboratory Proctor test (see Appendix C), it can be assumed that most soils will be too wet to enable proper compaction. As such, these soils should be allowed to drain and air-dry as long as possible before backfilling.

If wet or frozen soils are used for backfill purposes, proper compaction of the backfill will not be possible and settlement of the trenches can be expected. Site assessments will be required to determine what options can be undertaken to construct a suitable road base. These options may include subexcavating and increasing the thickness of the granular subbase, the possible use of high strength geotextiles, or a combination of both.

5.6 Sensitivity of Subsoils

The silty nature of many of the soils encountered in the boreholes can make them highly susceptible to strength losses and will prove difficult to place and compact if they become overly wet as a result of inclement weather or water seepage. If the soils become overly wet and disturbed, they may become unsuitable for reuse and require subexcavation. As such, the following is recommended:

- provide proper measures for adequate drainage during construction
- use a smooth-lipped bucket while excavating to the subgrade elevation to reduce disturbance
- minimize construction traffic traveling over the subgrade soils

5.7 Road Construction and Pavement Design

In order to achieve a suitable subgrade for the construction of the pavement structure, the following recommendations are provided:

a) If necessary, maintain the site dewatering system during preparation of the road subgrade. Once the road subgrade is completed, the drainage pipes should be removed or cut off at the subgrade elevation and infilled with lean concrete or a bentonite slurry.

b) The design subgrade for the road should be proof-rolled using heavy rubber-tire equipment, such as a grader. Compactive effort should be applied and compaction tests should be undertaken. Areas requiring fill to achieve the subgrade elevation should be treated as indicated above prior to placement of any additional fill. The subgrade should be evaluated to determine if subexcavation and additional Granular 'B' will be required or if the installation of a reinforcing geotextile will be necessary.

c) The road subgrade should be cut to grade using a smooth-lipped bucket. The subgrade should be graded smooth (with no depressions) and sloped at a minimum of 2%. Construction traffic should not be allowed onto the prepared road subgrade. Construction traffic should travel only on the Granular 'B' subbase. It may be necessary to temporarily

increase the thickness of the Granular 'B' during road construction to accommodate the truck traffic.

d) It is recommended that 100 mm diameter perforated subdrains fitted with a filter sock be installed along each curb line to collect and redirect water beneath the pavement surface. It is suggested that the subdrains be installed in a 0.3 m (1 ft) by 0.3 m (1 ft) trench and placed approximately 50 mm (2") from the trench bottom. In drier conditions, the perforated subdrain with a factory-installed filter sock can be installed in Granular 'A' bedding. In wet conditions, 19 mm clear stone wrapped completely in non-woven geotextile (such as Terrafix 270R or equivalent) is recommended. Rapid drainage of the pavement structure is critical to ensure long-term performance of the road.

Based on the anticipated loading and considering that the subsoils contain frost-susceptible soils, the following pavement design is recommended for the proposed roads:

Material	**Recommended Thickness**
Asphaltic Concrete	HL3 - 40 mm (1.5") HL4 or HL8 - 50 mm (2.0")
Granular 'A' Base	150 mm (6.0")
Granular 'B' Subbase	450 mm (18.0")

The granular subbase materials should be compacted to 100% SPMDD. Asphaltic concrete should be supplied, placed and compacted to 97% Marshall bulk relative density in accordance with OPSS 1150 and OPSS 310.

The pavement should be designed to ensure that water will not pond on the pavement surface. If the surface asphalt is not placed in a reasonable time following the placement of the binder asphalt, it is recommended that the catch basin lids be lowered or apertures provided to allow the surface water to drain rather than accumulating around the catch basins.

5.8 Bearing Capacity / Settlement

The proposed residential buildings may be supported on conventional spread and pier footings provided they are founded on undisturbed native soils at or below the elevations listed in the following table or structural fill prepared as detailed in Section 5.1 of this report:

Borehole No.	Existing Ground Surface Elevation (m)	Highest Recommended Footing Elevation (m)	Soil Type
101	413.64	413.01	sandy silt till
102	414.37	412.70	silt till
103	414.89	413.59	silt till
105	414.05	411.65	sandy silt till
106	410.91	408.51	silt till

It is ideally recommended that foundations be constructed above the water table. The native founding soils and structural fill in a drained condition would be considered suitable to support foundations designed with a safe net allowable bearing capacity of 150 kPa. It is anticipated that the water table may be within one footing width below the founding elevation. Therefore, a safe net allowable bearing capacity of 75 kPa should be used for design purposes.

With respect to the bearing capacities as determined above, total and differential settlements are estimated to be within the generally acceptable limits of 25 mm (1") and 19 mm (3/4") respectively.

A minimum of 1.2 m (4 ft) of soil cover above the footing grade must be provided for frost protection.

5.9 Residential Drainage Considerations

If high water conditions continue to exist during the construction of the residential foundations, and the foundations are constructed near or below the water table, then the following will be required:

- a granular drainage layer and sump pump will be required as per Section 9.14.4 of the current Ontario Building Code

- slab-on-grades constructed where groundwater levels may cause hydrostatic pressure must be designed to resist such pressures

- slab-on-grade and exterior walls must be waterproofed

If foundation construction occurs above the high water table, then conventional construction methods can be utilized.

5.10 Potential Storm Water Management Facility

Boreholes 104, 107 and 108 were all drilled in the open space area (west side of property) where a storm water management facility is proposed. In general, Borehole 104 has silt till underlain by silty sand. It would appear that artesian conditions are present in the silty sand layer below the more impermeable silt till layer. Based on the monitoring well readings, the water level fluctuates to just below the ground surface elevation.

In general, Borehole 107 has sand underlain by clayey silt and lower sandy silt till. Artesian conditions may be present in the sandy silt till below the more impermeable clayey silt layer. Based on the monitoring well readings, the water level was just below the ground surface elevation. The upper sand layer has a high moisture content due to the infiltration of surface water, which is in turn impeded by the lower clayey silt layer.

In general, Borehole 108 has silty sand underlain by sandy silt till. Artesian conditions may be present in the lower portion of the sandy silt layer below the more impermeable silty sand layer (higher density, lower moisture). Based on the monitoring well readings, the water level has fluctuated to within approximately 1.0 m of the ground surface elevation.

Based on the results of the geotechnical investigation, it can be concluded that the soil and groundwater conditions in the area of Boreholes 104, 107 and 108 are unsuitable for an inground storm water management facility.

6.0 SITE INSPECTIONS

Site grading, dewatering, trench excavations, backfilling and compaction of the service pipes should be supervised by qualified geotechnical personnel to ensure that a suitable subbase is prepared, proper backfill materials are used and that the specified compaction is achieved.

The construction of the pavement structure should also be supervised by qualified personnel to ensure that suitable materials are used and that the specified compaction is achieved. It is also

recommended that the residential foundation excavations be examined to ensure that the bearing capacity of the soil is suitable to support the structures.

CMT Engineering Inc. would be pleased to provide inspection, testing and consulting services for this project.

7.0 LIMITATIONS OF THE INVESTIGATION

This investigation was conducted to determine the subsurface conditions for this project and the comments are based on the information gathered at the borehole locations only. It is therefore assumed that the borehole information is representative of the subsoil conditions across the site. Should any conditions at the site be encountered which differ from those found at the borehole locations, we request that we be notified immediately.

This report is intended solely for the client named. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties.

We trust that this report meets with your present requirements. Should you have any questions, please do not hesitate to contact our office.

Respectfully submitted,

Robert Koopmans, P.Eng.
Consulting Engineer

Tim Salter, C.E.T.

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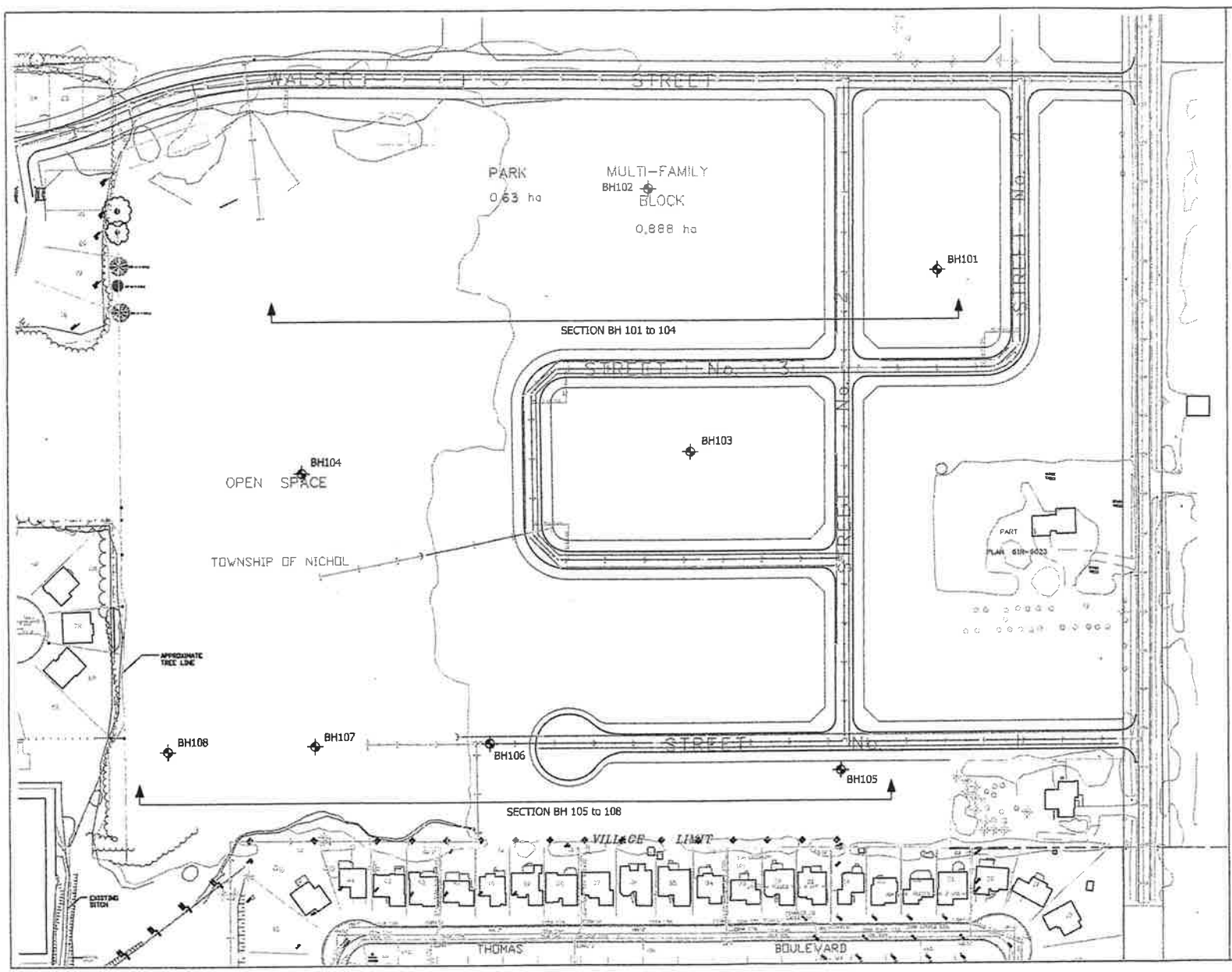

Base plan provided by:

GM

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BOREHOLE LOCATION PLAN

Ainley Subdivision
Township of Centre Wellington
Village of Elora, ON

Project: 06-004	Drawing: 2
Date: Mar. 2006	Sheet: 1
Scale: 1:2000	

APPENDIX A

BOREHOLE LOGS
Boreholes 101 to 108

BOREHOLE 101

Date Drilled: Jan. 25, 2006
Rig: CME 55
Contractor: Aardvark
Drilling Method: HSA

Elevation: 413.64m
Logged by: CD

Project No.: 06-004
Project: Ainley Subdivision
Township of Centre Wellington
Location: Elora

Depth (ft/m)	Sample Type	Recovery (%)	Sample Number	Symbols	SOIL DESCRIPTION	Elevation / Depth	Well Installation	Moisture Content % Wp [----X----] Wl 10 20 30 40	Pocket Penetrometer kPa 100 300 / SPT (N) Blows/0.3 m 10 30 50 70 90
					Ground Surface (m)	413.64			
					Topsoil Dark brown silt, frozen	0.00 413.31			
					Sandy Silt Till Compact brown sandy silt till, some clay, some gravel, moist	0.33			
1	SS		1					9.7	22
								20.7	20
2	SS		2			411.84			
					Sand Compact brown sand, very moist to wet	1.80 411.54			
					Silty Sand Compact brown silty sand, wet	2.10		24.9	14
3	SS		3						
					spoon sank through silty sand under weight of rods			27.7	1
4	SS		4			409.64			
					Sand Dense brown sand, trace silt, wet	4.00 408.94		20.4	40
5	SS		5		*Silt Till* Dense brown silt till, some sand, gravel and clay, moist	4.70 408.64			
					End of Borehole	5.00			

Well Installation: 413.07m (Feb 8/06); Stick up well with protective metal casing; Bentonite Seal; #3 Sand Filter; 50mm schedule 40 PVC pipe with slot 10 screen

Please refer to section 4.7 of this report for additional water levels

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BOREHOLE 102

Date Drilled: Jan. 25, 2006
Rig: CME 55
Contractor: Aardvark
Drilling Method: HSA

Elevation: 414.37m
Logged by: CD

Project No.: 06-004
Project: Ainley Subdivision
Township of Centre Wellington
Location: Elora

Depth (ft/m)	Sample Type	Recovery (%)	Sample Number	Symbols	SOIL DESCRIPTION		Well Installation	Moisture Content % Wp [----X----] Wl 10 20 30 40	Pocket Penetrometer kPa 100 300 / SPT (N) Blows/0.3 m 10 30 50 70 90
					Ground Surface (m)	414.37			
					Topsoil Dark brown silt, frozen	0.00 414.07			
					Sandy Silt Compact mottled brown sandy silt till, trace clay, trace gravel, moist	0.30			
3	SS		1					10.4	12
						413.00			
					Silt Till Compact brown silt till, trace sand, trace gravel, moist	1.37			
6	SS		2					17.6	15
8	SS		3					4.8	30
						411.77			
					Sand Compact brown sand, trace silt, trace gravel, moist to very moist	2.60			
11	SS		4					20.0	22
						410.37			
					Silt Till Dense grey silt till, trace sand gravel and clay, moist	4.00			
16	SS		5					7.7	53
						409.37			
					End of Borehole	5.00			

Bentonite Seal
#3 Sand Filter
411.57m (Feb 8/06)
Stick up well with protective metal casing
50mm schedule 40 PVC pipe with slot 10 screen

Please refer to section 4.7 of this report for additional water levels

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BOREHOLE 103

Date Drilled: Jan. 24, 2006
Rig: CME 55
Contractor: Aardvark
Drilling Method: HSA

Elevation: 414.89m
Logged by: CD

Project No.: 06-004
Project: Ainley Subdivision
Township of Centre Wellington
Location: Elora

Depth (ft/m)	Sample Type	Recovery (%)	Sample Number	Symbols	SOIL DESCRIPTION		Well Installation
					Ground Surface (m)	414.89	
					Topsoil Dark brown silt, frozen	0.00	
						414.34	
					Organic Silt Loose brown organic silt, some sand, occasional topsoil nodule, very moist	0.55	
1	SS		1			413.89	
					Silt Till Compact brown silt till, trace sand, trace gravel, moist, becoming dense with depth	1.00	
2	AS		2				
3	SS		3				
	SS		4			411.54	
					Silty Sand Dense brown silty sand, wet	3.35	
4						410.89	
					Becoming loose, trace clay, saturated	4.00	
5	SS		5			409.89	
					End of Borehole	5.00	

Well Installation: Bentonite Seal; #3 Sand Filter; 412.65m (Feb 8/06); Stick up well with protective metal casing; 50mm schedule 40 PVC pipe with slot 10 screen

Moisture Content %
Wp [----X----] Wl
10 20 30 40

Depth (m)	Moisture Content %
1	>508)
2	13.6
3	9.2
4	13.1
5	23.1

Pocket Penetrometer
kPa
100 300

SPT (N)
Blows/0.3 m
10 30 50 70 90

Depth (m)	SPT (N)
1	5
2	20
3	32
4	37
5	6

Please refer to section 4.7 of this report for additional water levels

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BOREHOLE 104

Date Drilled: Jan. 24, 2006
Rig: CME 55
Contractor: Aardvark
Drilling Method: HSA

Elevation: 410.93m
Logged by: CD

Project No.: 06-004
Project: Ainley Subdivision
Township of Centre Wellington
Location: Elora

Depth (ft/m)	Sample Type	Recovery (%)	Sample Number	Symbols	SOIL DESCRIPTION		Well Installation	Moisture Content % Wp [----X----] Wl 10 20 30 40	Pocket Penetrometer ● kPa ● 100 300 SPT (N) ■ Blows/0.3 m ■ 10 30 50 70 90
					Ground Surface (m)	410.93			
					Topsoil Dark brown silt, frozen	0.00			
						410.63			
					Silt Till Compact dark brown silt till, some clay, trace sand, trace gravel, moist	0.30			
3	SS		1				Bentonite Seal	10.2	14
5	SS		2			409.56	#3 Sand Filter	23.0	14
					Silty Sand Compact brown silty sand, saturated	1.37			
8	SS		3					17.8	8
10	SS		4					25.9	10
						407.43			
					End of Borehole	3.50			

Stick up well with protective metal casing

410.36m (Feb 8/06)

50mm schedule 40 PVC pipe with slot 10 screen

Please refer to section 4.7 of this report for additional water level readings

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BOREHOLE 105

Date Drilled: Jan. 25, 2006
Rig: CME 55
Contractor: Aardvark
Drilling Method: HSA

Elevation: 414.05m
Logged by: CD

Project No.: 06-004
Project: Ainley Subdivision
Township of Centre Wellington
Location: Elora

Depth (ft/m)	Sample Type	Recovery (%)	Sample Number	Symbols	SOIL DESCRIPTION		Well Installation	Moisture Content % Wp [----X----] Wl 10 20 30 40	Pocket Penetrometer kPa 100 300 SPT (N) Blows/0.3 m 10 30 50 70 90
					Ground Surface (m)	414.05	Ø 414.05m (Feb 8/06)		
0					*Topsoil* Dark brown silt, frozen	0.00			
						413.67			
1					*Silty Sand* Loose red-brown silty sand, moist	0.38			
2									
3	SS		1					18.5	4
4						412.68			
5					*Silt* Loose brown silt, some clay, trace sand, trace gravel, very moist	1.37		18.5	8
6	SS		2						
7						412.05			
					Sand wet sand seam at 2.0m depth	2.00			
8	SS		3		*Sandy Silt Till* Very dense brown sandy silt till, some clay, trace gravel, moist			7.7	26
9									
10	SS		4					8.1	100
11									
12									
13									
14									
15	SS		5			409.28		7.6	100
					End of Borehole	4.77			
16									
17									
18									
19									

Bentonite Seal
#3 Sand Filter
50mm schedule 40 PVC pipe with slot 10 screen
Stick up well with protective metal casing

Please refer to section 4.7 of this report for additional water level readings

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BOREHOLE 106

Date Drilled: Jan. 25, 2006
Rig: CME 55
Contractor: Aardvark
Drilling Method: HSA

Elevation: 410.91m
Logged by: CD

Project No.: 06-004
Project: Ainley Subdivision
Township of Centre Wellington
Location: Elora

Depth (ft/m)	Sample Type	Recovery (%)	Sample Number	Symbols	SOIL DESCRIPTION		Well Installation (Feb 8/06)	Moisture Content % Wp [----X----] Wl 10 20 30 40	Pocket Penetrometer kPa 100 300 / SPT (N) Blows/0.3 m 10 30 50 70 90
					Ground Surface (m)	410.91			
					Topsoil	0.00			
					Dark brown silt, frozen	410.59			
					Silty Sand	0.32			
					Loose mottled grey silty sand, trace gravel, moist				
3 / 1	SS		1					24.0	9
5									
6 / 2	SS		2					12.1	9
						408.81			
7					*Sandy Silt Till*	2.10			
8	SS		3		Dense to very dense grey sandy silt till, trace sand, trace gravel, moist			6.8	33
9									
10 / 3								8.3	28
11	SS		4						
12									
13 / 4									
14									
15								9.0	100
16	SS		5			405.94			
17 / 5					End of Borehole	4.97			
18									
19									

Well Installation (Feb 8/06): 410.67m; Stick up well with protective metal casing; Bentonite Seal; #3 Sand Filter; 50mm schedule 40 PVC pipe with slot 10 screen

Please refer to section 4.7 of this report for additional water level readings

CMT ENGINEERING INC.
1011 Industrial Crescent, Unit 1
St. Clements, Ontario N0B 2M0
phone 519-699-5775 fax 519-699-4664
www.cmtinc.net

BOREHOLE 107

Date Drilled: Jan. 24, 2006
Rig: CME 55
Contractor: Aardvark
Drilling Method: HSA

Elevation: 409.58m
Logged by: CD

Project No.: 06-004
Project: Ainley Subdivision
Township of Centre Wellington
Location: Elora

Depth (ft/m)	Sample Type	Recovery (%)	Sample Number	Symbols	SOIL DESCRIPTION		Well Installation	Moisture Content % Wp [----X----] Wl 10 20 30 40	Pocket Penetrometer kPa 100 300 / SPT (N) Blows/0.3 m 10 30 50 70 90
					Ground Surface (m)	409.58			
					Topsoil	0.00			
					Dark brown silt, frozen				
						408.98			
					Sand	0.60			
	SS		1		Loose red-brown sand, some silt, moist to wet			14.3	7
						408.21			
					Clayey Silt	1.37			
	SS		2		Compact brown clayey silt, trace sand, trace gravel, moist			13.6	11
						407.48			
					Sandy Silt Till	2.10			
	AS		3		Compact to loose brown sandy silt till, trace clay, saturated			19.1	25
	SS		4					17.3	7
						406.08			
					End of Borehole	3.50			

Well Installation:
- 409.43m (Feb 8/06)
- Stick up well with protective metal casing
- Bentonite Seal
- #3 Sand Filter
- 50mm schedule 40 PVC pipe with slot 10 screen

Please refer to section 4.7 of this report for additional water level readings

CMT ENGINEERING INC.
1011 Industrial Crescent, Unit 1
St. Clements, Ontario N0B 2M0
phone 519-699-5775 fax 519-699-4664
www.cmtinc.net

BOREHOLE 108

Date Drilled: Jan. 25, 2006
Rig: CME 55
Contractor: Aardvark
Drilling Method: HSA

Elevation: 410.32m
Logged by: CD

Project No.: 06-004
Project: Ainley Subdivision
Township of Centre Wellington
Location: Elora

Depth (ft/m)	Sample Type	Recovery (%)	Sample Number	Symbols	SOIL DESCRIPTION	Elevation / Depth	Well Installation	Moisture Content % Wp [----X----] Wl 10 20 30 40	Pocket Penetrometer kPa 100 300 / SPT (N) Blows/0.3 m 10 30 50 70 90
					Ground Surface (m)	410.32			
0					***Topsoil*** Dark brown silt, frozen	0.00			
						409.74			
1					***Silty Sand*** Compact mottled brown silty sand, trace gravel, moist	0.58			
2	SS		1					10.5	25
3						408.95			
4					***Sandy Silt Till*** Dense to loose brown sandy silt till, wet	1.37			
5	SS		2					16.8	38
6									
7									
8	SS		3					19.9	18
9									
10									
11	SS		4					26.7	7
12						406.82			
13					End of Borehole	3.50			
14									

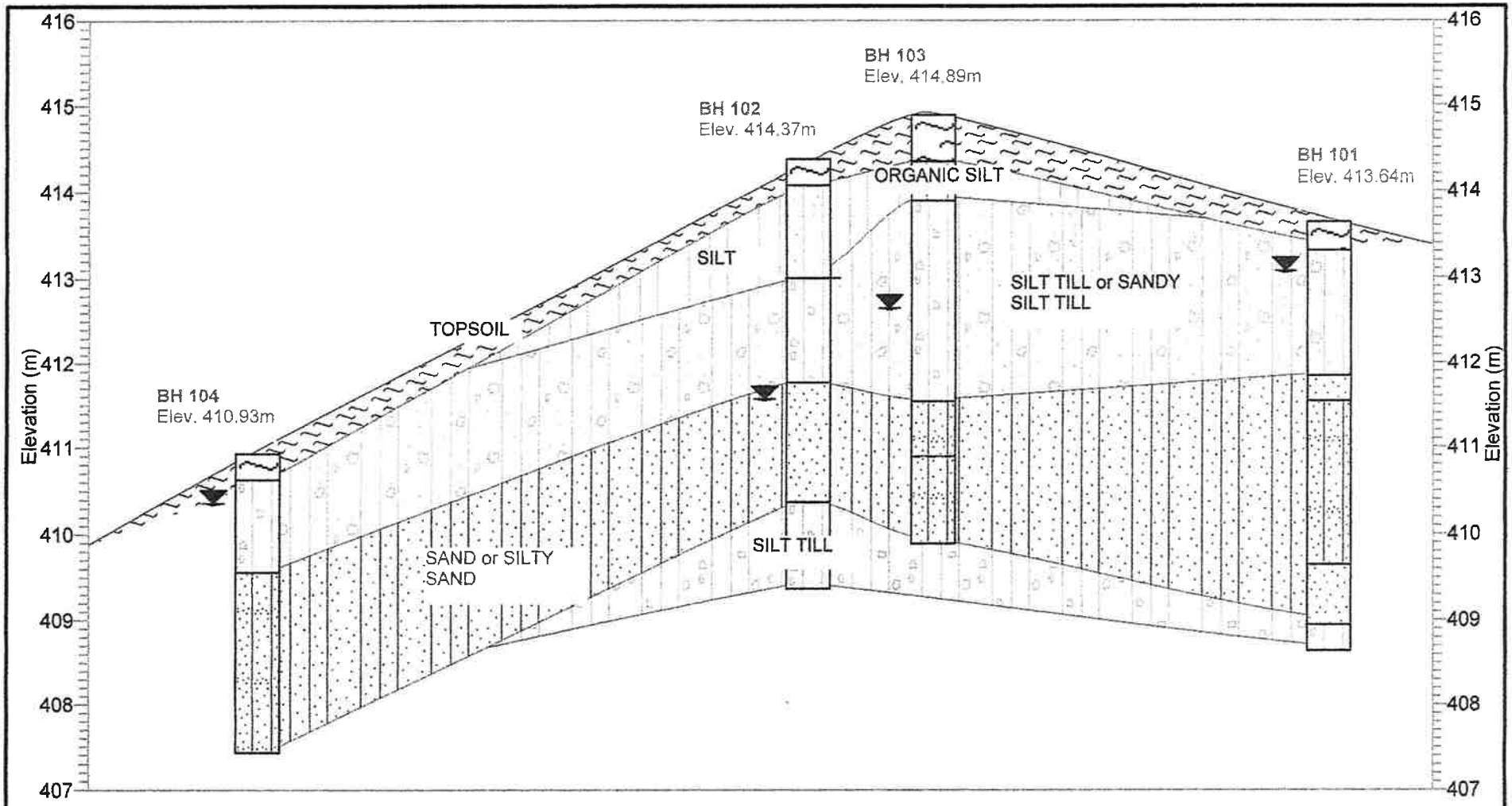
Well Installation: Stick up well with protective metal casing; Bentonite Seal; 409.06m (Feb 8/06); #3 Sand Filter; 50mm schedule 40 PVC pipe with slot 10 screen

Please refer to section 4.7 of this report for additional water level readings

CMT ENGINEERING INC.
1011 Industrial Crescent, Unit 1
St. Clements, Ontario N0B 2M0
phone 519-699-5775 fax 519-699-4664
www.cmtinc.net

APPENDIX B

CROSS-SECTIONS



CMT ENGINEERING INC.

1011 Industrial Cres.,
Unit 1
St. Clements, Ontario

Project: AINLEY SUBDIVISION

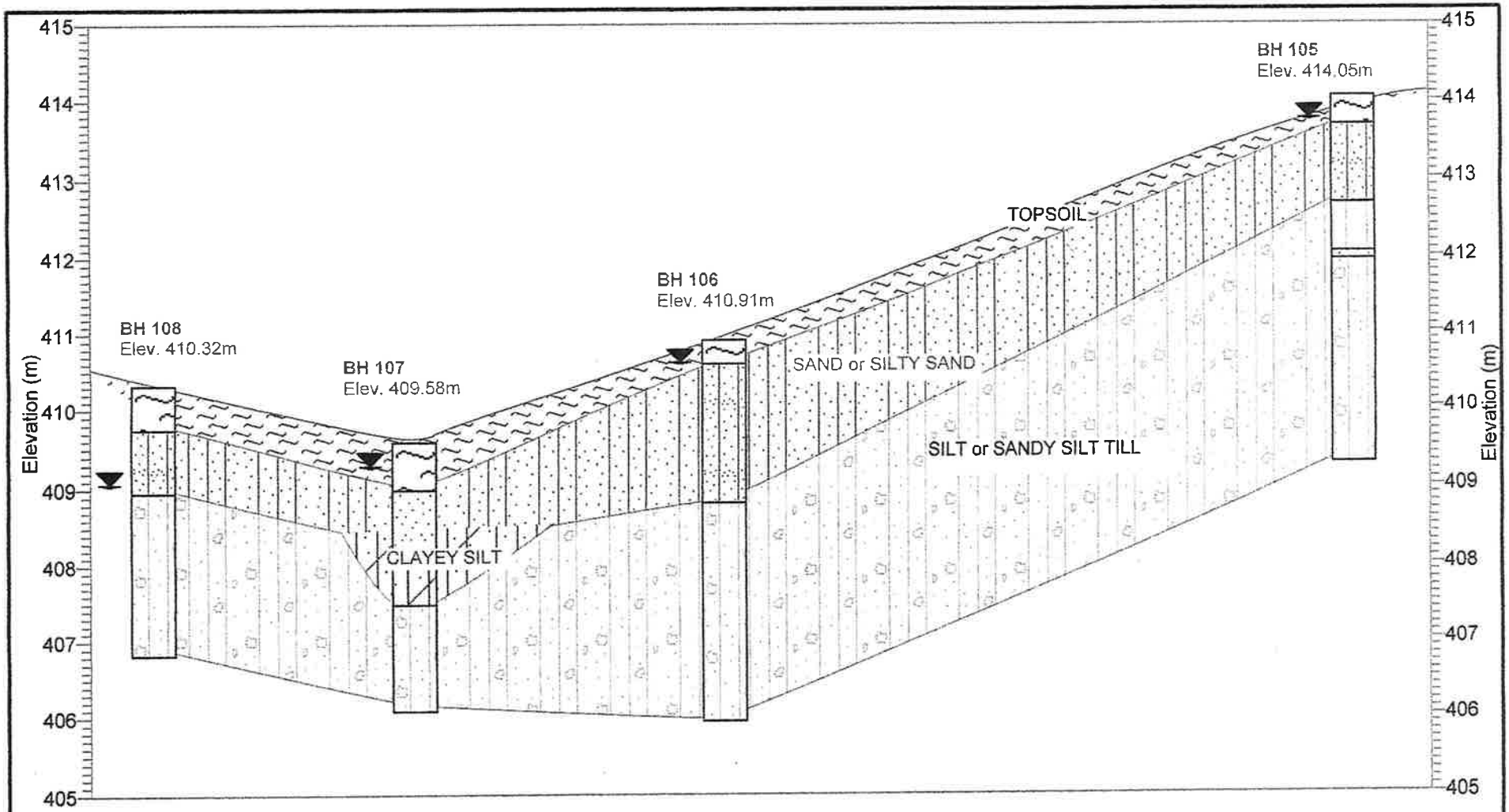
Project Number: 06-004

Location: Elora, Ontario

Drawn By: JS

Date: February, 2006

NOTE: Water levels shown were measured on Feb. 8, 2006. Please refer to Section 4.7 of this report for additional water levels.



CMT ENGINEERING INC.
1011 Industrial Cres.,
Unit 1
St. Clements, Ontario

Project: AINLEY SUBDIVISION

Project Number: 06-004

Location: Elora, Ontario

Drawn By: JS

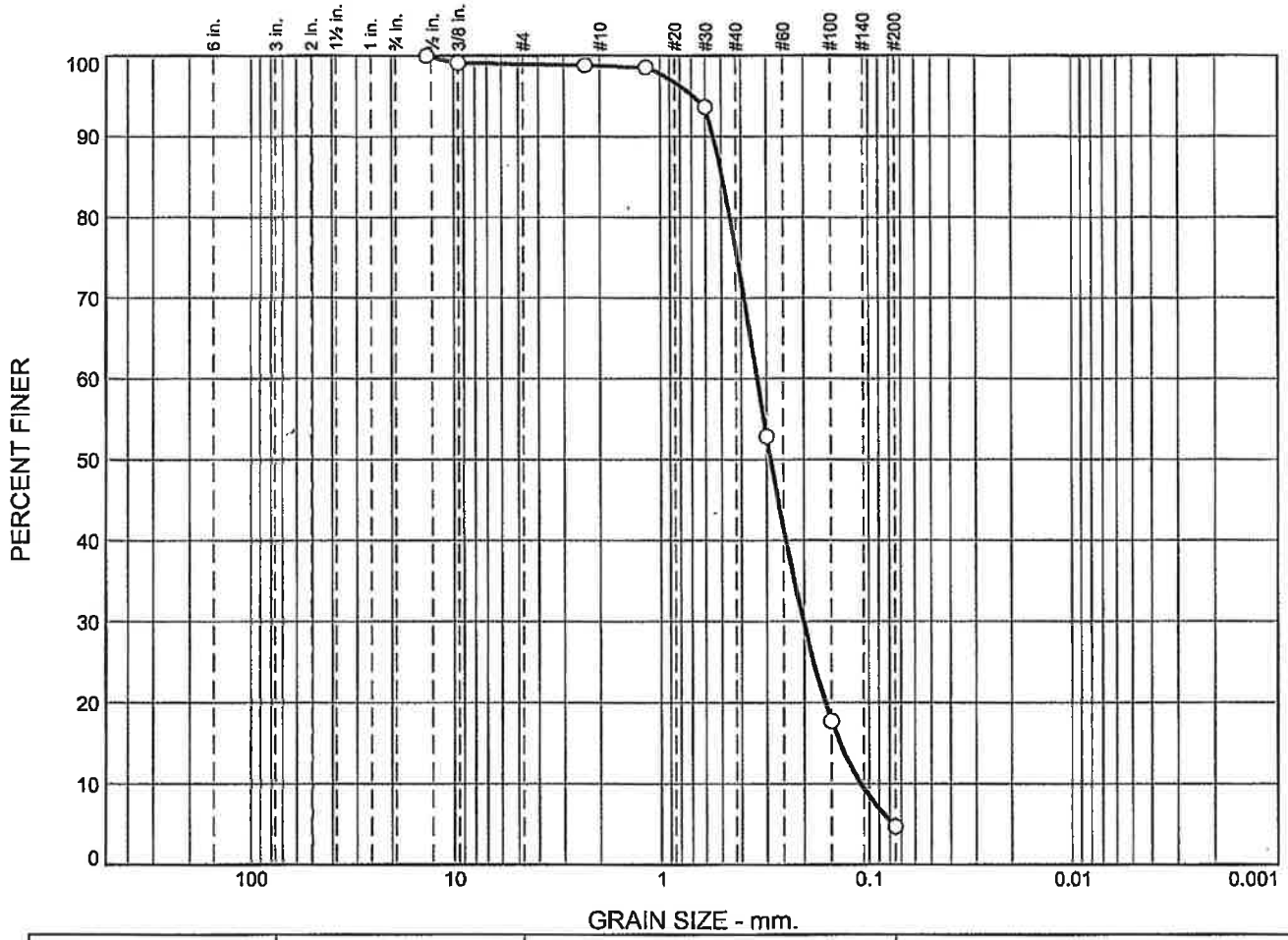
Date: February 2006

NOTE: Water levels shown were measured on Feb. 8, 2006. Please refer to Section 4.7 of this report for additional water levels.

APPENDIX C

GRAIN SIZE ANALYSES

Particle Size Distribution Report



	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	1.0	0.2	22.7	71.4	4.7	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	BH102 - SS4	1	3.05-3.51m	Sand, trace silt, trace gravel	SP
				Tested by CMT - January 27, 2006	

CMT Engineering Inc.

St. Clements, ON

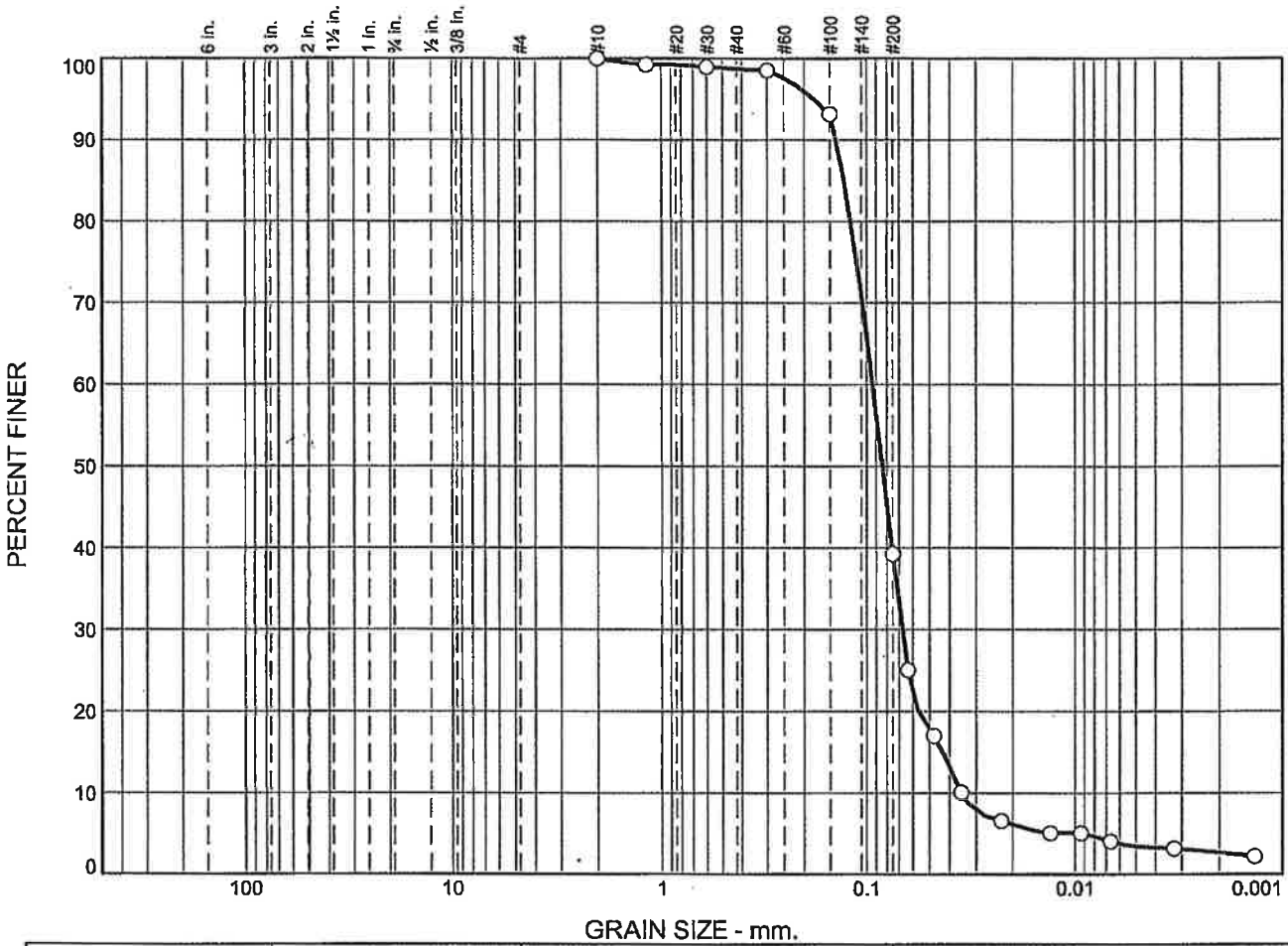
Client: Ainley Subdivision

Project: Township of Centre Wellington
Elora, Ontario

Project No.: 06-004

Figure 1

Particle Size Distribution Report



	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	1.2	59.5	36.6	2.7

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	BH103 - SS5	1	4.57-5.03m	Silty sand, trace clay	SM
				Tested by CMT - January 27, 2006	

CMT Engineering Inc.

St. Clements, ON

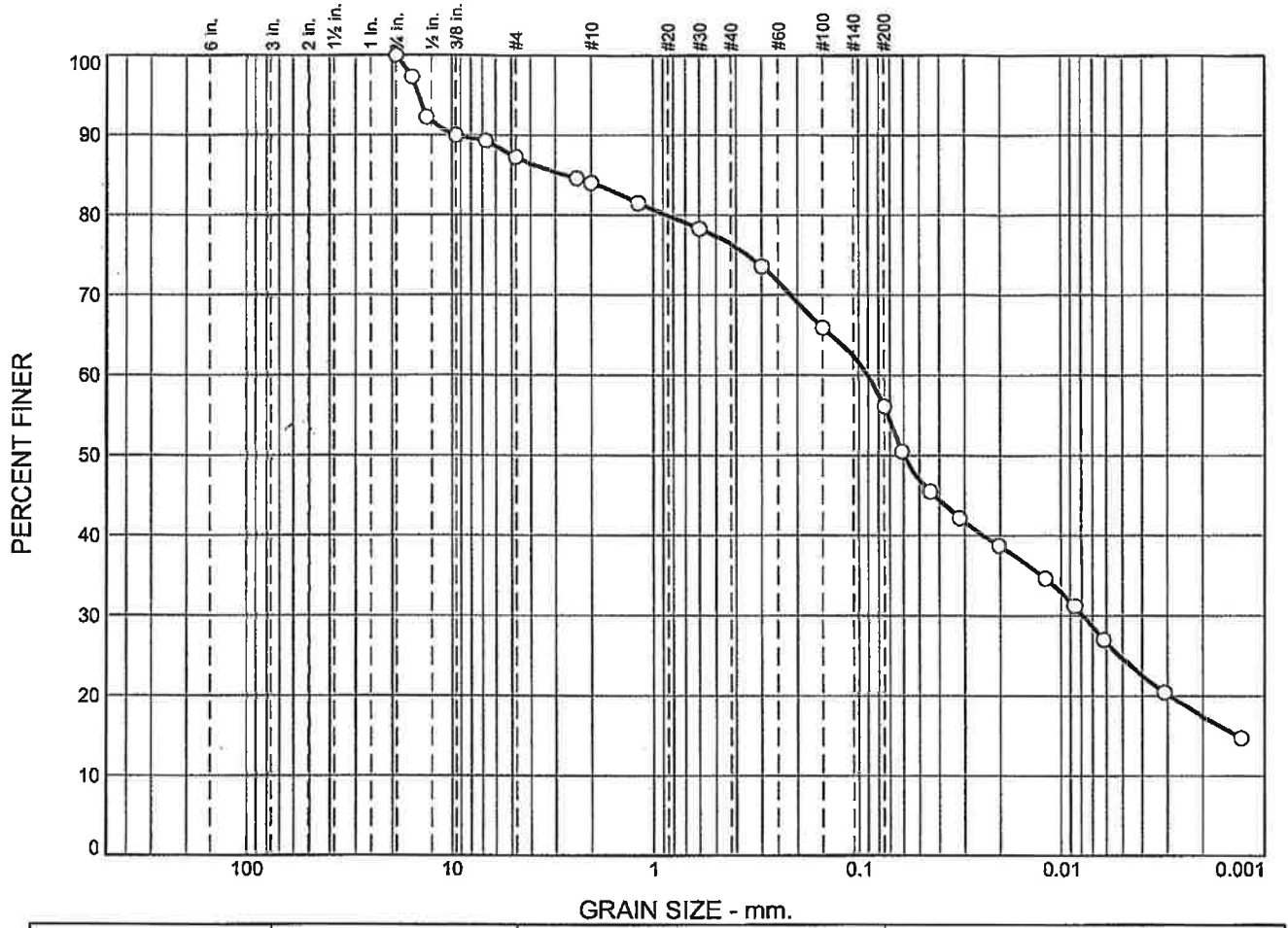
Client: Ainley Subdivision

Project: Township of Centre Wellington
Elora, Ontario

Project No.: 06-004

Figure 2

Particle Size Distribution Report



	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
O	0.0	0.0	12.8	3.2	7.6	20.3	38.7	17.4

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
O	BH105 - SS3	1	2.29-2.74m	Sandy silt, some clay, some gravel	ML
				Tested by CMT - January 27, 2006	

CMT Engineering Inc.

St. Clements, ON

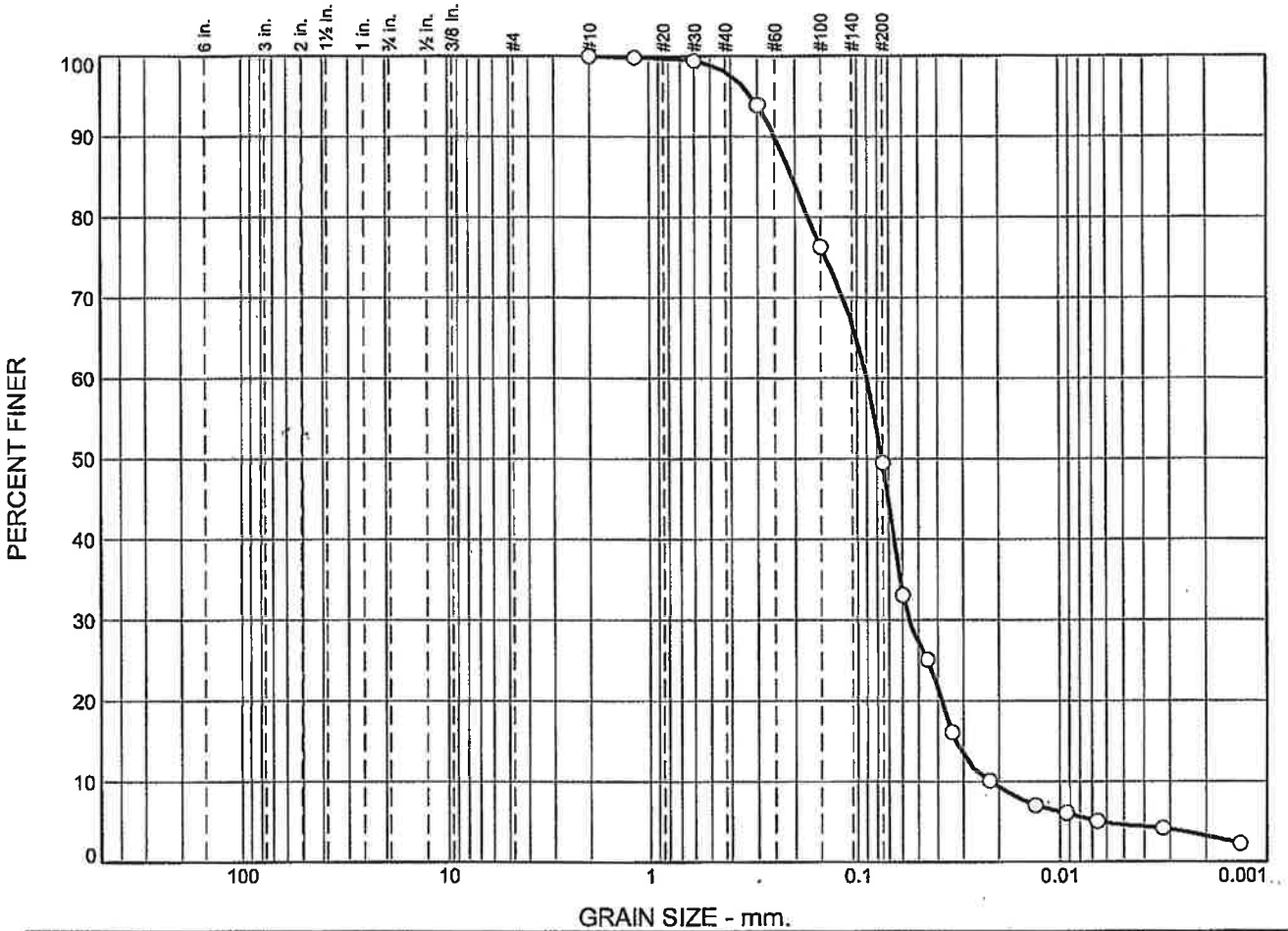
Client: Ainley Subdivision

Project: Township of Centre Wellington
Elora, Ontario

Project No.: 06-004

Figure 3

Particle Size Distribution Report



	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	1.9	48.6	46.3	3.2

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	BH107 - SS3	1	2.29-2.74m	Sand and silt, trace clay	SM
				Tested by CMT - January 27, 2006	

CMT Engineering Inc.

St. Clements, ON

Client: Ainley Subdivision

Project: Township of Centre Wellington
Elora, Ontario

Project No.: 06-004

Figure 4

APPENDIX D

LABORATORY PROCTOR TEST

CMT ENGINEERING INC.

LABORATORY PROCTOR TEST

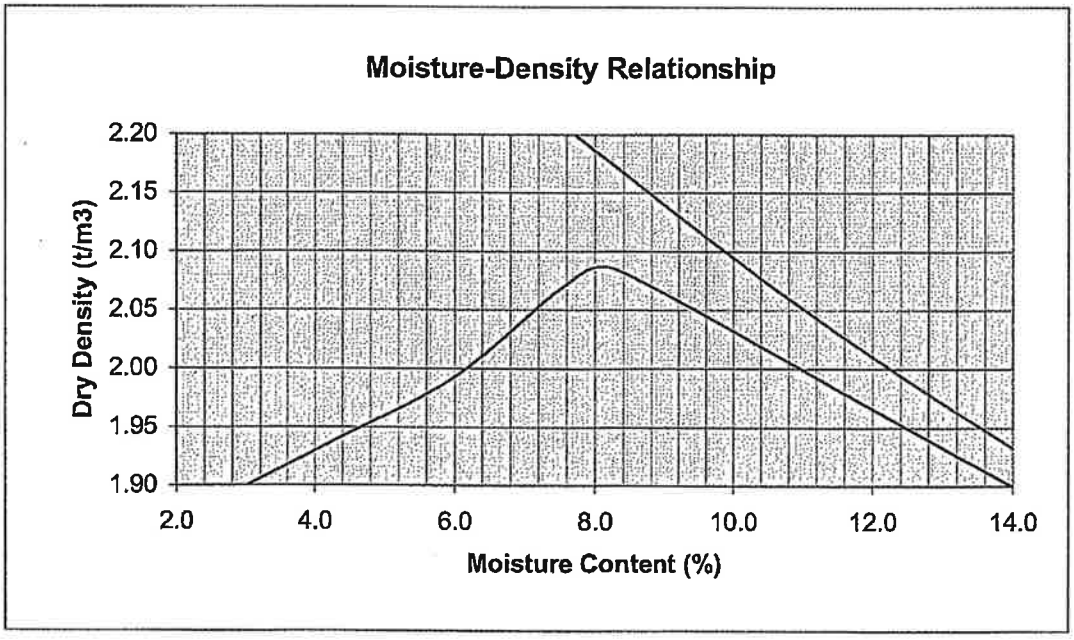
PROJECT NO.: 06-004
PROJECT: Ainley Subdivision
PROJECT LOCATION: Township of Centre Wellington (Elora)

SAMPLED FROM: Borehole 103, BS, depth 1.5 to 2.0 m
DATE SAMPLED/BY: January 25, 2006 by C.D. of CMT Inc.
DATE TESTED/BY: January 26, 2006 by J.S. of CMT Inc.

SOIL TYPE: silt till
REMARKS:

TEST STANDARD:
ASTM D698
PROCEDURE - ☑ A ☐ B ☐ C

ASSUMED SPECIFIC GRAVITY: 2.65
MAXIMUM DRY DENSITY: 2.085 t/m^3
OPTIMUM MOISTURE CONTENT: 8.3%



APPENDIX E

WELL RECORD

Ontario Ministry of the Environment

Well Tag Number (Plate below) A035811 A035811

Well Record

Regulation 903 Ontario Water Resources Act

page ___ of ___

Instructions for Completing Form

- For use in the Province of Ontario only. This document is a permanent legal document. Please retain for future reference.
- All Sections must be completed in full to avoid delays in processing. Further instructions and explanations are available on the back of this form.
- Questions regarding completing this application can be directed to the Water Well Management Coordinator at 416-235-6203.
- All metre measurements shall be reported to 1/10th of a metre.
- Please print clearly in blue or black ink only.

Ministry Use Only

MUN | CON | LOT

Well Owner's Information and Location of Well Information

First Name	Last Name	Mailing Address (Street Number/Name, RR,Lot,Concession)
James	Keetch	Matheson St.

County/District/Municipality	Township/City/Town/Village	Province	Postal Code	Telephone Number (include area code)
	Elora	Ontario		

Address of Well Location (County/District/Municipality)	Township	Lot	Concession
Gerrie Rd.	Centre Wellington	17+18	12

RR#/Street Number/Name	City/Town/Village	Site/Compartment/Block/Tract etc.
	Elora	

GPS Reading	NAD	Zone	Easting	Northing	Unit Make/Model	Mode of Operation
	83		No SIGNAL			☐ Undifferentiated ☐ Averaged ☐ Differentiated, specify

Log of Overburden and Bedrock Materials (see instructions)

General Colour	Most common material	Other Materials	General Description	Depth From	Depth To
Brown	SILT TILL			0	1.5
Brown	SILT SAND			1.5	4.5

Hole Diameter

Depth From	Depth To	Diameter Centimetres
0	4.5	72

Water Record

Water found at Metres / Kind of Water

☐ ___ m ☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other: ___

☐ ___ m ☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other: ___

☐ ___ m ☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other: ___

After test of well yield, water was ☐ Clear and sediment free ☐ Other, specify ___

Chlorinated ☐ Yes ☐ No

Construction Record

Inside diam centimetres	Material	Wall thickness centimetres	Depth From	Depth To
Casing				
4	☐ Steel ☐ Fibreglass ☒ Plastic ☐ Concrete ☐ Galvanized		0	1.5
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			
Screen				
Outside diam 4	☐ Steel ☐ Fibreglass ☒ Plastic ☐ Concrete ☐ Galvanized	Slot No. 10	1.5	4.5
No Casing or Screen				
	☐ Open hole			

Test of Well Yield

Pumping test method	Draw Down Time min	Draw Down Water Level Metres	Recovery Time min	Recovery Water Level Metres
Pump intake set at - (metres)	Static Level			
Pumping rate - (litres/min)	1		1	
Duration of pumping ___ hrs + ___ min	2		2	
Final water level end of pumping ___ metres	3		3	
Recommended pump type. ☐ Shallow ☐ Deep	4		4	
Recommended pump depth. ___ metres	5		5	
Recommended pump rate. (litres/min)	10		10	
	15		15	
If flowing give rate - (litres/min)	20		20	
	25		25	
If pumping discontinued, give reason.	30		30	
	40		40	
	50		50	
	60		60	

Plugging and Sealing Record ☐ Annular space ☐ Abandonment

Depth set at - Metres From	Depth set at - Metres To	Material and type (bentonite slurry, neat cement slurry) etc.	Volume Placed (cubic metres)
0	1	Bentonite Pellets	100 lbs
1	4.5	#3 Well Sand	300 lbs

Method of Construction

☐ Cable Tool ☐ Rotary (air) ☐ Diamond ☐ Digging
☒ Rotary (conventional) ☐ Air percussion ☐ Jetting ☐ Other
☐ Rotary (reverse) ☐ Boring ☐ Driving

Water Use

☐ Domestic ☐ Industrial ☐ Public Supply ☐ Other
☐ Stock ☐ Commercial ☐ Not used
☐ Irrigation ☐ Municipal ☐ Cooling & air conditioning

Final Status of Well

☐ Water Supply ☐ Recharge well ☐ Unfinished ☐ Abandoned, (Other)
☒ Observation well ☐ Abandoned, insufficient supply ☐ Dewatering
☐ Test Hole ☐ Abandoned, poor quality ☐ Replacement well

Well Contractor/Technician Information

Name of Well Contractor	Well Contractor's Licence No.
Aardvark Drilling Inc	7738

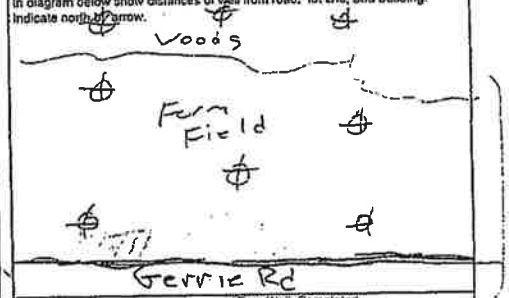
Business Address (street name, number, city etc.)	Well Technician's Licence No.
C-25 Lewis Rd. Guelph On N1H 1E9	T-3305

Name of Well Technician (last name, first name)	Date Submitted YYYY MM DD
Henry, Nathan	2006 10 10

Signature of Technician/Contractor: X

Location of Well

In diagram below show distances of well from road, lot line, and building. Indicate north by arrow.



Audit No. Z 39731

Date Well Completed YYYY MM DD: 2006 01 25

Was the well owner's information package delivered? ☐ Yes ☒ No

Date Delivered YYYY MM DD: 2006 02 01

Ministry Use Only

Data Source	Contractor
Date Received YYYY MM DD	Date of Inspection YYYY MM DD
Remarks	Well Record Number

0506E (09/03)

Contractor's Copy ☒ Ministry's Copy ☐ Well Owner's Copy ☐

Cette formule est disponible en français.

APPENDIX B

GROUNDWATER ELEVATION MONITORING

CMT ENGINEERING INC.

OCTOBER 12, 2012

CMT Engineering Inc.
CONSULTING ENGINEERS
1011 Industrial Crescent, Unit 1
St. Clements, Ontario N0B 2M0
Tel: 519-699-5775
Fax: 519-699-4664
www.cmtinc.net

(411009)

July 4, 2013

06-004.L71

Gamsby and Mannerow Limited
650 Woodlawn Road West
Block C, Unit 1
Guelph, Ontario
N1K 1B8

Dear Sir:

Re: Groundwater Monitoring
Ainley Subdivision
Elora, Ontario

Attached is a current summary of the water level measurements for the above-referenced site. The graphs have been amended to include total monthly precipitation as recorded at the Environment Canada Fergus MOE Weather Station.

I trust this information meets with your present requirements. Should you have any questions, please do not hesitate to contact our office.

Yours very truly,

Tim Salter, C.E.T.

ks

Encl - Water Level Measurements

WATER LEVEL MEASUREMENTS

AINLEY SUBDIVISION
ELORA, ONTARIO

Borehole No.	Ground Surface Elevation (m)	Water Elevation (m) Feb 8/06	Water Elevation (m) Feb 20/06	Water Elevation (m) Mar 9/06	Water Elevation (m) Mar 25/06	Water Elevation (m) Mar 29/06	Water Elevation (m) Apr 28/06	Water Elevation (m) June 6/06	Water Elevation (m) July 8/06	Water Elevation (m) Aug 7/06	Water Elevation (m) Sept 7/06
101	413.64	413.07	413.11	412.83	412.96	--	412.94	412.59	411.70	411.34	411.00
102	414.37	411.57	411.96	411.91	412.48	--	412.43	412.12	411.78	411.43	411.14
103	414.89	412.65	412.98	412.88	412.77	--	412.76	411.55	410.95	410.43	410.31
104	410.93	410.36	410.60	410.17	410.66	--	410.69	410.15	409.15	408.71	408.52
105	414.05	414.05	414.07 (F)	414.15 (F)	414.15 (F)	414.68	413.44	412.86	412.27	412.06	411.59
106	410.91	410.67	410.86 (F)	410.93 (F)	410.75	--	410.54	410.36	409.93	409.89	409.39
107	409.58	409.43	409.06 (F)	409.12 (F)	409.41	--	409.42	409.03	408.11	408.00	407.63
108	410.32	409.06	409.21	408.82	409.01	--	408.99	408.43	407.94	407.76	407.11

*(F) = Frozen

WATER LEVEL MEASUREMENTS

AINLEY SUBDIVISION
ELORA, ONTARIO

Borehole No.	Ground Surface Elevation (m)	Water Elevation (m) Oct 6/06	Water Elevation (m) Nov 11/06	Water Elevation (m) Dec 7/06	Water Elevation (m) Jan 9/07	Water Elevation (m) Feb 12/07	Water Elevation (m) Mar 8/07	Water Elevation (m) Apr 10/07	Water Elevation (m) May 12/07	Water Elevation (m) June 11/07	Water Elevation (m) July 11/07
101	413.64	410.83	412.67	412.97	413.03	412.11	411.61	413.02	412.75	411.87	411.42
102	414.37	411.00	411.25	411.71	411.99	411.69	411.45	412.14	411.96	411.67	411.38
103	414.89	410.36	411.10	411.91	412.27	411.05	410.66	412.50	411.59	410.97	410.54
104	410.93	408.71	409.13	409.45	409.65	409.12	408.96	409.78	409.39	409.24	408.92
105	414.05	411.95	413.94	413.71	413.90	412.95	412.65	413.72	413.29	412.51	412.11
106	410.91	410.13	410.74	410.57	410.59	410.28	410.22	410.55	410.50	410.07	409.59
107	409.58	408.28	408.94	409.11	409.16	408.60	408.43	409.25	409.01	408.24	407.71
108	410.32	407.62	408.21	408.48	408.57	408.07	407.93	408.69	408.36	407.96	407.57

*(F) = Frozen

WATER LEVEL MEASUREMENTS

AINLEY SUBDIVISION
ELORA, ONTARIO

Borehole No.	Ground Surface Elevation (m)	Water Elevation (m) Aug 15/07	Water Elevation (m) Sept 13/07	Water Elevation (m) Oct 12/07	Water Elevation (m) Nov 8/07	Water Elevation (m) Dec 11/07	Water Elevation (m) Jan 15/08	Water Elevation (m) Feb 12/08	Water Elevation (m) Mar 8/08	Water Elevation (m) Apr 13/08	Water Elevation (m) May 8/08
101	413.64	411.01	410.72	410.50	410.35	410.33	412.73	412.92	413.00	413.19	413.05
102	414.37	411.13	410.98	410.87	410.81	410.77	411.26	411.53	411.80	412.92	412.46
103	414.89	410.34	410.36	410.36	410.36	410.36	411.29	411.74	412.03	413.40	412.50
104	410.93	408.73	408.61	408.57	408.58	408.76	409.70	409.66	409.81	410.70	410.35
105	414.05	411.67	411.34	411.22	411.22	411.22	414.00	414.11	414.10 frozen	413.99	413.71
106	410.91	409.22	408.99	408.89	408.89	409.44	410.63	410.61	410.64	410.77	410.69
107	409.58	407.49	407.40	407.43	407.52	407.91	409.20	409.05	409.10	409.52	409.35
108	410.32	407.36	407.37	407.37	407.37	407.52	408.52	408.50	408.57	409.19	408.89

*(F) = Frozen

WATER LEVEL MEASUREMENTS

AINLEY SUBDIVISION
ELORA, ONTARIO

Borehole No.	Ground Surface Elevation (m)	Water Elevation (m) June 10/08	Water Elevation (m) July 8/08	Water Elevation (m) Aug 1/08	Water Elevation (m) Sept 10/08	Water Elevation (m) Oct 8/08	Water Elevation (m) Nov 17/08	Water Elevation (m) Dec 17/08	Water Elevation (m) Jan 23/09	Water Elevation (m) Feb 20/09	Water Elevation (m) Mar 18/09
101	413.64	412.58	412.60	412.55	411.67	410.86	413.08	413.135	412.725	412.960	413.053
102	414.37	412.13	412.06	411.95	411.57	410.30	411.52	411.979	412.147	412.419	412.772
103	414.89	411.53	411.60	411.56	410.86	410.64	412.14	412.746	411.796	412.600	413.046
104	410.93	409.86	409.71	409.76	409.34	408.18	409.98	410.183	409.902	410.238	410.670
105	414.05	412.96	412.87	412.93	412.26	411.60	413.99	413.969	413.221	414.066 (F)	414.070 (F)
106	410.91	410.83	410.24	410.36	410.28	409.04	410.78	410.67	410.567	411.010 (F)	410.963 (F)
107	409.58	409.00	408.72	408.86	408.40	407.36	409.24	409.249	409.009	409.246	409.502
108	410.32	408.33	408.20	408.29	407.95	406.82	408.51	408.662	408.359	408.651	408.948

*(F) = Frozen

WATER LEVEL MEASUREMENTS

AINLEY SUBDIVISION
ELORA, ONTARIO

Borehole No.	Ground Surface Elevation (m)	Water Elevation (m) Apr 21/09	Water Elevation (m) May 21/09	Water Elevation (m) June 26/09	Water Elevation (m) July 22/09	Water Elevation (m) Aug 27/09	Water Elevation (m) Sept 29/09	Water Elevation (m) Oct 30/09	Water Elevation (m) Dec 7/09	Water Elevation (m) Jan 5/10	Water Elevation (m) Feb 9/10
101	413.64	412.95	412.77	411.93	411.54	411.27	411.16	411.72	412.26	412.04	411.55
102	414.37	412.79	412.43	411.93	411.63	411.28	411.11	411.11	411.15	411.19	411.06
103	414.89	412.88	412.03	411.17	410.80	410.44	410.36	410.57	410.91	410.83	410.47
104	410.93	410.45	410.11	409.61	409.35	409.15	409.04	409.23	409.41	409.36	409.19
105	414.05	413.45	412.98	412.21	411.93	412.05	412.12	412.97	413.25	413.05	412.72
106	410.91	410.55	410.43	410.08	409.87	409.90	410.08	410.33	410.54	410.33	410.22
107	409.58	409.35	409.12	408.62	408.13	407.97	407.97	408.47	408.85	408.81	408.60
108	410.32	408.86	408.51	408.08	407.84	407.66	407.52	407.79	408.01	408.05	407.93

*(F) = Frozen

WATER LEVEL MEASUREMENTS

AINLEY SUBDIVISION
ELORA, ONTARIO

Borehole No.	Ground Surface Elevation (m)	Water Elevation (m) Mar 2/10	Water Elevation (m) Apr 17/10	Water Elevation (m) May 11/10	Water Elevation (m) June 1/10	Water Elevation (m) June 29/10	Water Elevation (m) Aug 5/10	Water Elevation (m) Sept 22/10	Water Elevation (m) Oct 22/10	Water Elevation (m) Nov 9/10	Water Elevation (m) Dec 6/10
101	413.64	411.31	412.70	412.87	412.31	412.92	411.66	410.97	410.83	410.84	411.37
102	414.37	411.01	411.60	411.65	411.64	411.73	411.43	411.09	410.58	410.89	410.93
103	414.89	410.37	411.53	411.73	411.21	411.80	410.76	dry	dry	dry	dry
104	410.93	409.14	409.82	410.09	409.51	409.90	409.17	408.85	408.86	408.89	409.20
105	414.05	412.47	413.22	413.36	412.67	413.37	412.16	411.49	411.75	412.25	413.30
106	410.91	410.12	410.49	410.55	410.15	410.53	409.90	409.50	409.60	409.75	410.33
107	409.58	408.38	409.12	409.34	408.69	409.23	408.06	407.69	407.80	407.88	408.72
108	410.32	407.81	408.43	408.70	408.16	408.42	407.78	407.41	407.44	407.51	407.59

*(F) = Frozen

WATER LEVEL MEASUREMENTS

AINLEY SUBDIVISION
ELORA, ONTARIO

Borehole No.	Ground Surface Elevation (m)	Water Elevation (m) Jan 11/11	Water Elevation (m) Feb 19/11	Water Elevation (m) Mar 31/11	Water Elevation (m) July 19/11	Water Elevation (m) Sept 30/11	Water Elevation (m) Dec 7/11	Water Elevation (m) Feb 10/12	Water Elevation (m) Apr 4/12	Water Elevation (m) June 27/12	Water Elevation (m) Aug 1/12
101	413.64	412.24	412.62	413.09	412.33	411.51	413.21	412.91	412.67	411.22	410.84
102	414.37	411.10	411.09	dry	412.09	411.22	412.23	412.16	412.07	411.28	411.05
103	414.89	410.76	411.02	dry	411.42	410.49	413.25	412.28	411.73	410.45	dry
104	410.93	409.27	409.20	410.05	409.54	409.24	410.45	409.95	409.86	409.06	408.73
105	414.05	413.52	413.93	413.86	412.53	412.83	413.93	413.53	412.99	411.75	411.30
106	410.91	410.37	410.61	410.66	410.09	410.23	410.73	410.52	410.46	409.64	409.17
107	409.58	408.85	408.70	409.29	408.21	408.18	409.44	409.14	409.10	407.93	407.52
108	410.32	408.02	407.89	408.66	407.92	407.73	408.92	408.53	408.38	407.69	dry

*(F) = Frozen

WATER LEVEL MEASUREMENTS

AINLEY SUBDIVISION
ELORA, ONTARIO

Borehole No.	Ground Surface Elevation (m)	Water Elevation (m) Oct 11/12	Water Elevation (m) Dec 11/12	Water Elevation (m) Mar 9/13	Water Elevation (m) May 3/13	Water Elevation (m) July 3/13	Water Elevation (m)	Water Elevation (m)	Water Elevation (m)	Water Elevation (m)	Water Elevation (m)
101	413.64	410.48	412.25	412.19	412.94	412.74					
102	414.37	410.81	411.18	411.42	412.52	412.08					
103	414.89	dry	410.87	411.00	412.71	411.74					
104	410.93	408.69	409.36	408.32	410.21	409.94					
105	414.05	dry	413.48	413.12	413.38	412.89					
106	410.91	409.26	410.53	410.40	410.55	410.44					
107	409.58	407.61	408.91	408.84	409.32	409.21					
108	410.32	dry	418.10	408.09	408.74	408.50					

*(F) = Frozen

APPENDIX C

STORMWATER MANAGEMENT ANALYSIS

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                                  Version 2.25  rev. 473"
"                MIDUSS created                                Sunday, February 07, 2010"
"           10   Units used:                                                  ie METRIC"
"                Job folder:          W:\Kitchener\411-2011\411009\Design Data\"
"                                   Modelling Files\2017-01-02\Existing\2017-03-07"
"                Output filename:                    411009_2YR EX_MARCH 2017.out"
"                Licensee name:                                                gmbp"
"                Company                                     Hewlett-Packard Company"
"                Date & Time last used:                       3/8/2017 at 8:17:24 AM"
" 31          TIME PARAMETERS"
"       5.000   Time Step"
"     180.000   Max. Storm length"
"    3600.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"           1   Chicago storm"
"     695.050   Coefficient A"
"       6.387   Constant B"
"       0.793   Exponent C"
"       0.380   Fraction R"
"     180.000   Duration"
"       1.000   Time step multiplier"
"            Maximum intensity            93.293    mm/hr"
"            Total depth                  33.014    mm"
"           6   002hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 30"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"          30   Catchment 30"
"       0.000   % Impervious"
"       0.780   Total Area"
"      75.000   Flow length"
"       2.000   Overland Slope"
"       0.780   Pervious Area"
"      75.000   Pervious length"
"       2.000   Pervious slope"
"       0.000   Impervious Area"
"      75.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      74.000   Pervious SCS Curve No."
"       0.155   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"       8.924   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.000   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                    0.006     0.000     0.000     0.000 c.m/sec"
"            Catchment 30           Pervious   Impervious Total Area "
"            Surface Area           0.780      0.000      0.780      hectare"
"            Time of concentration  51.506     4.129      51.506     minutes"
"            Time to Centroid       164.128    92.147     164.128    minutes"
"            Rainfall depth         33.014     33.014     33.014     mm"
"            Rainfall volume        257.51     0.00       257.51     c.m"
"            Rainfall losses        27.894     5.340      27.894     mm"
"            Runoff depth           5.120      27.674     5.120      mm"
"            Runoff volume          39.93      0.00       39.93      c.m"
"            Runoff coefficient     0.155      0.000      0.155      "
"            Maximum flow           0.006      0.000      0.006      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
```

```
"            4   Add Runoff "
"                    0.006     0.006     0.000     0.000"
" 33          CATCHMENT 31"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           31   Catchment 31"
"        0.000   % Impervious"
"        0.220   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.220   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.155   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.002     0.006     0.000     0.000 c.m/sec"
"             Catchment 31           Pervious   Impervious Total Area "
"             Surface Area           0.220      0.000      0.220      hectare"
"             Time of concentration  35.323     2.832      35.323     minutes"
"             Time to Centroid       144.986    90.217     144.986    minutes"
"             Rainfall depth         33.014     33.014     33.014     mm"
"             Rainfall volume        72.63      0.00       72.63      c.m"
"             Rainfall losses        27.897     5.467      27.897     mm"
"             Runoff depth           5.117      27.547     5.117      mm"
"             Runoff volume          11.26      0.00       11.26      c.m"
"             Runoff coefficient     0.155      0.000      0.155      "
"             Maximum flow           0.002      0.000      0.002      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.002     0.008     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.002     0.008     0.008     0.000"
" 40          HYDROGRAPH   Combine    2"
"            6   Combine "
"            2   Node #"
"                To Walser Street"
"             Maximum flow                  0.008    c.m/sec"
"             Hydrograph volume            51.192    c.m"
"                    0.002     0.008     0.008     0.008"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.002     0.000     0.008     0.008"
" 33          CATCHMENT 10"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           10   Catchment 10"
"        0.000   % Impervious"
"        7.760   Total Area"
"      150.000   Flow length"
```

```
"        2.000   Overland Slope"
"        7.760   Pervious Area"
"      150.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"      150.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.155   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.044     0.000     0.008     0.008 c.m/sec"
"             Catchment 10           Pervious   Impervious Total Area "
"             Surface Area           7.760      0.000      7.760      hectare"
"             Time of concentration  78.068     6.258      78.068     minutes"
"             Time to Centroid       195.540    95.197     195.540    minutes"
"             Rainfall depth         33.014     33.014     33.014     mm"
"             Rainfall volume        2561.88    0.00       2561.88    c.m"
"             Rainfall losses        27.894     5.228      27.894     mm"
"             Runoff depth           5.120      27.786     5.120      mm"
"             Runoff volume          397.31     0.00       397.31     c.m"
"             Runoff coefficient     0.155      0.000      0.155      "
"             Maximum flow           0.044      0.000      0.044      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                  0.044     0.044     0.008     0.008"
" 33          CATCHMENT 11"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"          11   Catchment 11"
"        0.000   % Impervious"
"        0.130   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.130   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.155   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.001     0.044     0.008     0.008 c.m/sec"
"             Catchment 11           Pervious   Impervious Total Area "
"             Surface Area           0.130      0.000      0.130      hectare"
"             Time of concentration  35.323     2.832      35.323     minutes"
"             Time to Centroid       144.986    90.217     144.986    minutes"
"             Rainfall depth         33.014     33.014     33.014     mm"
```

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"            Rainfall volume        42.92       0.00       42.92      c.m"
"            Rainfall losses        27.897      5.467      27.897     mm"
"            Runoff depth           5.117       27.547     5.117      mm"
"            Runoff volume          6.65        0.00       6.65       c.m"
"            Runoff coefficient     0.155       0.000      0.155      "
"            Maximum flow           0.001       0.000      0.001      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"          4   Add Runoff "
"                 0.001     0.045     0.008     0.008"
" 33         CATCHMENT 40"
"          1   Triangular SCS"
"          1   Equal length"
"          1   SCS method"
"         40   Catchment 40"
"      0.000   % Impervious"
"      6.340   Total Area"
"     60.000   Flow length"
"      2.000   Overland Slope"
"      6.340   Pervious Area"
"     60.000   Pervious length"
"      2.000   Pervious slope"
"      0.000   Impervious Area"
"     60.000   Impervious length"
"      2.000   Impervious slope"
"      0.250   Pervious Manning 'n'"
"     74.000   Pervious SCS Curve No."
"      0.155   Pervious Runoff coefficient"
"      0.100   Pervious Ia/S coefficient"
"      8.924   Pervious Initial abstraction"
"      0.015   Impervious Manning 'n'"
"     98.000   Impervious SCS Curve No."
"      0.000   Impervious Runoff coefficient"
"      0.100   Impervious Ia/S coefficient"
"      0.518   Impervious Initial abstraction"
"                0.054     0.045     0.008     0.008 c.m/sec"
"           Catchment 40            Pervious   Impervious Total Area "
"           Surface Area            6.340      0.000      6.340      hectare"
"           Time of concentration   45.052     3.611      45.051     minutes"
"           Time to Centroid        156.495    91.497     156.495    minutes"
"           Rainfall depth          33.014     33.014     33.014     mm"
"           Rainfall volume         2093.08    0.00       2093.09    c.m"
"           Rainfall losses         27.895     5.642      27.895     mm"
"           Runoff depth            5.119      27.372     5.119      mm"
"           Runoff volume           324.53     0.00       324.53     c.m"
"           Runoff coefficient      0.155      0.000      0.155      "
"           Maximum flow            0.054      0.000      0.054      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"          4   Add Runoff "
"                 0.054     0.093     0.008     0.008"
" 54         POND DESIGN"
"      0.093   Current peak flow    c.m/sec"
"      0.050   Target outflow    c.m/sec"
"      728.5   Hydrograph volume    c.m"
"         6.   Number of stages"
"    409.630   Minimum water level    metre"
"    410.750   Maximum water level    metre"
"    409.630   Starting water level    metre"
"          0   Keep Design Data: 1 = True; 0 = False"
"                Level Discharge    Volume"
"              409.630     0.000     0.000"
"              409.750    0.5400   232.250"
"              410.000     1.632  2017.880"
"              410.250     3.737  5148.940"
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```
"              410.500     1.345  9472.330"
"              410.750     1.885  15057.74"
"           Peak outflow                  0.091    c.m/sec"
"           Maximum level               409.650    metre"
"           Maximum storage              39.152    c.m"
"           Centroidal lag                3.081   hours"
"                0.054     0.093     0.091     0.008 c.m/sec"
" 40        HYDROGRAPH Next link "
"         5   Next link "
"                0.054     0.091     0.091     0.008"
" 52        CHANNEL DESIGN"
"       0.091   Current peak flow    c.m/sec"
"       0.035   Manning 'n'"
"          0.   Cross-section type: 0=trapezoidal; 1=general"
"       0.000   Basewidth    metre"
"       7.410   Left bank slope"
"       6.000   Right bank slope"
"       0.950   Channel depth    metre"
"       1.040   Gradient   %"
"            Depth of flow                 0.159    metre"
"            Velocity                      0.535    m/sec"
"            Channel capacity             10.655    c.m/sec"
"            Critical depth                0.130    metre"
" 53        ROUTE    Channel Route 72"
"      72.40      Channel Route 72 Reach length   ( metre)"
"       0.460   X-factor <= 0.5"
"     101.445   K-lag   ( seconds)"
"       0.000   Default(0) or user spec.(1) values used"
"       0.500   X-factor <= 0.5"
"      30.000   K-lag   ( seconds)"
"       0.500   Beta weighting factor"
"     100.000   Routing time step   ( seconds)"
"           1   No. of sub-reaches"
"            Peak outflow                  0.091    c.m/sec"
"                    0.054     0.091     0.091     0.008 c.m/sec"
" 40        HYDROGRAPH Next link "
"         5   Next link "
"                    0.054     0.091     0.091     0.008"
" 52        CHANNEL DESIGN"
"       0.091   Current peak flow    c.m/sec"
"       0.035   Manning 'n'"
"          0.   Cross-section type: 0=trapezoidal; 1=general"
"       2.000   Basewidth    metre"
"       2.950   Left bank slope"
"       3.000   Right bank slope"
"       0.950   Channel depth    metre"
"       1.040   Gradient   %"
"            Depth of flow                 0.081    metre"
"            Velocity                      0.504    m/sec"
"            Channel capacity              9.246    c.m/sec"
"            Critical depth                0.058    metre"
" 53        ROUTE    Channel Route 40"
"      39.80      Channel Route 40 Reach length   ( metre)"
"       0.443   X-factor <= 0.5"
"      59.188   K-lag   ( seconds)"
"       0.000   Default(0) or user spec.(1) values used"
"       0.500   X-factor <= 0.5"
"      30.000   K-lag   ( seconds)"
"       0.500   Beta weighting factor"
"      60.000   Routing time step   ( seconds)"
"           1   No. of sub-reaches"
"            Peak outflow                  0.091    c.m/sec"
"                    0.054     0.091     0.091     0.008 c.m/sec"
```

```
" 40          HYDROGRAPH Next link "
"            5   Next link "
                      0.054     0.091     0.091     0.008"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
                      0.054     0.091     0.091     0.008"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
                 Total"
"             Maximum flow                  0.091    c.m/sec"
"             Hydrograph volume           728.490    c.m"
                      0.054     0.091     0.091     0.091"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
                      0.054     0.000     0.091     0.091"
" 33          CATCHMENT 20"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           20   Catchment 20"
"         0.000   % Impervious"
"         6.650   Total Area"
"       150.000   Flow length"
"         2.000   Overland Slope"
"         6.650   Pervious Area"
"       150.000   Pervious length"
"         2.000   Pervious slope"
"         0.000   Impervious Area"
"       150.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        74.000   Pervious SCS Curve No."
"         0.155   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         8.924   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.000   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
                      0.038     0.000     0.091     0.091 c.m/sec"
              Catchment 20           Pervious   Impervious Total Area "
              Surface Area           6.650      0.000      6.650      hectare"
              Time of concentration  78.068     6.258      78.068     minutes"
              Time to Centroid       195.540    95.197     195.539    minutes"
              Rainfall depth         33.014     33.014     33.014     mm"
              Rainfall volume        2195.43    0.00       2195.43    c.m"
              Rainfall losses        27.894     5.228      27.894     mm"
              Runoff depth           5.120      27.786     5.120      mm"
              Runoff volume          340.48     0.00       340.48     c.m"
              Runoff coefficient     0.155      0.000      0.155      "
              Maximum flow           0.038      0.000      0.038      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
                      0.038     0.038     0.091     0.091"
" 33          CATCHMENT 21"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           21   Catchment 20"
"        10.000   % Impervious"
"         0.820   Total Area"
```

```
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.738   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.082   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.155   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.834   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.016     0.038     0.091     0.091 c.m/sec"
"             Catchment 21           Pervious   Impervious Total Area "
"             Surface Area           0.738      0.082      0.820      hectare"
"             Time of concentration  35.323     2.832      23.162     minutes"
"             Time to Centroid       144.986    90.217     124.487    minutes"
"             Rainfall depth         33.014     33.014     33.014     mm"
"             Rainfall volume        243.64     27.07      270.71     c.m"
"             Rainfall losses        27.897     5.467      25.654     mm"
"             Runoff depth           5.117      27.547     7.360      mm"
"             Runoff volume          37.76      22.59      60.35      c.m"
"             Runoff coefficient     0.155      0.834      0.223      "
"             Maximum flow           0.007      0.015      0.016      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.016     0.043     0.091     0.091"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                  0.016     0.043     0.043     0.091"
" 64          SHOW TABLE"
"            2   Flow hydrograph"
"            4   Inflow Hydrograph"
"             Maximum flow                0.043    c.m/sec"
"             Hydrograph volume         400.831    c.m"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total"
"             Maximum flow                0.134    c.m/sec"
"             Hydrograph volume        1129.320    c.m"
"                  0.016     0.043     0.043     0.134"
" 38          START/RE-START TOTALS 21"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                    22.700    hectare"
"             Total Impervious area                    0.082    hectare"
"             Total % impervious                       0.361"
" 19          EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                            Sunday, February 07, 2010"
"           10   Units used:                                                ie METRIC"
"                Job folder:          W:\Kitchener\411-2011\411009\Design Data\"
"                                  Modelling Files\2017-01-02\Existing\2017-03-07"
"                Output filename:                    411009_5YR EX_MARCH 2017.out"
"                Licensee name:                                                gmbp"
"                Company                                    Hewlett-Packard Company"
"                Date & Time last used:                      3/8/2017 at 8:22:34 AM"
" 31          TIME PARAMETERS"
"       5.000   Time Step"
"     180.000   Max. Storm length"
"    3600.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"           1   Chicago storm"
"    1459.072   Coefficient A"
"      13.690   Constant B"
"       0.850   Exponent C"
"       0.380   Fraction R"
"     180.000   Duration"
"       1.000   Time step multiplier"
"            Maximum intensity          113.586    mm/hr"
"            Total depth                 49.792    mm"
"           6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 30"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"          30   Catchment 30"
"       0.000   % Impervious"
"       0.780   Total Area"
"      75.000   Flow length"
"       2.000   Overland Slope"
"       0.780   Pervious Area"
"      75.000   Pervious length"
"       2.000   Pervious slope"
"       0.000   Impervious Area"
"      75.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      74.000   Pervious SCS Curve No."
"       0.258   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"       8.924   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.000   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                   0.021     0.000     0.000     0.000 c.m/sec"
"            Catchment 30           Pervious   Impervious Total Area "
"            Surface Area           0.780      0.000      0.780      hectare"
"            Time of concentration  36.283     3.738      36.283     minutes"
"            Time to Centroid       141.285    90.242     141.285    minutes"
"            Rainfall depth         49.792     49.792     49.792     mm"
"            Rainfall volume        388.37     0.00       388.38     c.m"
"            Rainfall losses        36.959     6.081      36.959     mm"
"            Runoff depth           12.833     43.710     12.833     mm"
"            Runoff volume          100.10     0.00       100.10     c.m"
"            Runoff coefficient     0.258      0.000      0.258      "
"            Maximum flow           0.021      0.000      0.021      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
```

```
"            4   Add Runoff "
"                    0.021     0.021     0.000     0.000"
" 33          CATCHMENT 31"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           31   Catchment 31"
"        0.000   % Impervious"
"        0.220   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.220   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.258   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.007     0.021     0.000     0.000 c.m/sec"
"             Catchment 31           Pervious   Impervious Total Area "
"             Surface Area           0.220      0.000      0.220      hectare"
"             Time of concentration  24.883     2.563      24.883     minutes"
"             Time to Centroid       128.082    88.517     128.082    minutes"
"             Rainfall depth         49.792     49.792     49.792     mm"
"             Rainfall volume        109.54     0.00       109.54     c.m"
"             Rainfall losses        36.970     6.066      36.969     mm"
"             Runoff depth           12.822     43.726     12.822     mm"
"             Runoff volume          28.21      0.00       28.21      c.m"
"             Runoff coefficient     0.258      0.000      0.258      "
"             Maximum flow           0.007      0.000      0.007      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.007     0.028     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.007     0.028     0.028     0.000"
" 40          HYDROGRAPH   Combine    2"
"            6   Combine "
"            2   Node #"
"                To Walser Street"
"             Maximum flow                  0.028    c.m/sec"
"             Hydrograph volume           128.306    c.m"
"                    0.007     0.028     0.028     0.028"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.007     0.000     0.028     0.028"
" 33          CATCHMENT 10"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           10   Catchment 10"
"        0.000   % Impervious"
"        7.760   Total Area"
"      150.000   Flow length"
```

```
"        2.000   Overland Slope"
"        7.760   Pervious Area"
"      150.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"      150.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.258   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.157     0.000     0.028     0.028 c.m/sec"
"             Catchment 10           Pervious   Impervious Total Area "
"             Surface Area           7.760      0.000      7.760      hectare"
"             Time of concentration  54.995     5.665      54.994     minutes"
"             Time to Centroid       162.955    92.780     162.955    minutes"
"             Rainfall depth         49.792     49.792     49.792     mm"
"             Rainfall volume        3863.83    0.00       3863.84    c.m"
"             Rainfall losses        36.958     5.466      36.958     mm"
"             Runoff depth           12.834     44.325     12.834     mm"
"             Runoff volume          995.89     0.00       995.90     c.m"
"             Runoff coefficient     0.258      0.000      0.258      "
"             Maximum flow           0.157      0.000      0.157      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.157     0.157     0.028     0.028"
" 33          CATCHMENT 11"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           11   Catchment 11"
"        0.000   % Impervious"
"        0.130   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.130   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.258   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.004     0.157     0.028     0.028 c.m/sec"
"             Catchment 11           Pervious   Impervious Total Area "
"             Surface Area           0.130      0.000      0.130      hectare"
"             Time of concentration  24.883     2.563      24.883     minutes"
"             Time to Centroid       128.082    88.517     128.082    minutes"
"             Rainfall depth         49.792     49.792     49.792     mm"
```

```
"             Rainfall volume          64.73       0.00        64.73       c.m"
"             Rainfall losses          36.970      6.066       36.969      mm"
"             Runoff depth             12.822      43.726      12.822      mm"
"             Runoff volume            16.67       0.00        16.67       c.m"
"             Runoff coefficient       0.258       0.000       0.258       "
"             Maximum flow             0.004       0.000       0.004       c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                   0.004     0.159     0.028     0.028"
" 33          CATCHMENT 40"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           40   Catchment 40"
"        0.000   % Impervious"
"        6.340   Total Area"
"       60.000   Flow length"
"        2.000   Overland Slope"
"        6.340   Pervious Area"
"       60.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       60.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.258   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                   0.186     0.159     0.028     0.028 c.m/sec"
"             Catchment 40             Pervious    Impervious Total Area "
"             Surface Area             6.340       0.000       6.340       hectare"
"             Time of concentration    31.736      3.269       31.736      minutes"
"             Time to Centroid         136.024     89.581      136.024     minutes"
"             Rainfall depth           49.792      49.792      49.792      mm"
"             Rainfall volume          3156.79     0.00        3156.79     c.m"
"             Rainfall losses          36.968      6.236       36.968      mm"
"             Runoff depth             12.824      43.556      12.824      mm"
"             Runoff volume            813.01      0.00        813.02      c.m"
"             Runoff coefficient       0.258       0.000       0.258       "
"             Maximum flow             0.186       0.000       0.186       c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                   0.186     0.331     0.028     0.028"
" 54          POND DESIGN"
"        0.331   Current peak flow    c.m/sec"
"        0.050   Target outflow    c.m/sec"
"       1825.6   Hydrograph volume    c.m"
"           6.   Number of stages"
"      409.630   Minimum water level    metre"
"      410.750   Maximum water level    metre"
"      409.630   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                409.630     0.000     0.000"
"                409.750    0.5400   232.250"
"                410.000     1.632  2017.880"
"                410.250     3.737  5148.940"
```

```
"              410.500     1.345  9472.330"
"              410.750     1.885  15057.74"
"           Peak outflow                    0.315    c.m/sec"
"           Maximum level                 409.700    metre"
"           Maximum storage               135.453    c.m"
"           Centroidal lag                  2.630   hours"
"                0.186     0.331     0.315     0.028 c.m/sec"
" 40        HYDROGRAPH Next link "
"          5   Next link "
"                0.186     0.315     0.315     0.028"
" 52        CHANNEL DESIGN"
"       0.315   Current peak flow    c.m/sec"
"       0.035   Manning 'n'"
"          0.   Cross-section type: 0=trapezoidal; 1=general"
"       0.000   Basewidth    metre"
"       7.410   Left bank slope"
"       6.000   Right bank slope"
"       0.950   Channel depth    metre"
"       1.040   Gradient   %"
"            Depth of flow                 0.254    metre"
"            Velocity                      0.730    m/sec"
"            Channel capacity             10.655    c.m/sec"
"            Critical depth                0.214    metre"
" 53        ROUTE    Channel Route 72"
"       72.40      Channel Route 72 Reach length   ( metre)"
"       0.437   X-factor <= 0.5"
"      74.373   K-lag   ( seconds)"
"       0.000   Default(0) or user spec.(1) values used"
"       0.500   X-factor <= 0.5"
"      30.000   K-lag   ( seconds)"
"       0.500   Beta weighting factor"
"      75.000   Routing time step   ( seconds)"
"           1   No. of sub-reaches"
"            Peak outflow                  0.313    c.m/sec"
"                0.186     0.315     0.313     0.028 c.m/sec"
" 40        HYDROGRAPH Next link "
"          5   Next link "
"                0.186     0.313     0.313     0.028"
" 52        CHANNEL DESIGN"
"       0.313   Current peak flow    c.m/sec"
"       0.035   Manning 'n'"
"          0.   Cross-section type: 0=trapezoidal; 1=general"
"       2.000   Basewidth    metre"
"       2.950   Left bank slope"
"       3.000   Right bank slope"
"       0.950   Channel depth    metre"
"       1.040   Gradient   %"
"            Depth of flow                 0.164    metre"
"            Velocity                      0.766    m/sec"
"            Channel capacity              9.246    c.m/sec"
"            Critical depth                0.127    metre"
" 53        ROUTE    Channel Route 40"
"       39.80      Channel Route 40 Reach length   ( metre)"
"       0.388   X-factor <= 0.5"
"      38.965   K-lag   ( seconds)"
"       0.000   Default(0) or user spec.(1) values used"
"       0.500   X-factor <= 0.5"
"      30.000   K-lag   ( seconds)"
"       0.500   Beta weighting factor"
"      42.857   Routing time step   ( seconds)"
"           1   No. of sub-reaches"
"            Peak outflow                  0.313    c.m/sec"
"                0.186     0.313     0.313     0.028 c.m/sec"
```

```
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    0.186     0.313     0.313     0.028"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.186     0.313     0.313     0.028"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total"
"             Maximum flow                  0.313    c.m/sec"
"             Hydrograph volume          1825.586    c.m"
"                    0.186     0.313     0.313     0.313"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.186     0.000     0.313     0.313"
" 33          CATCHMENT 20"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           20   Catchment 20"
"         0.000   % Impervious"
"         6.650   Total Area"
"       150.000   Flow length"
"         2.000   Overland Slope"
"         6.650   Pervious Area"
"       150.000   Pervious length"
"         2.000   Pervious slope"
"         0.000   Impervious Area"
"       150.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        74.000   Pervious SCS Curve No."
"         0.258   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         8.924   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.000   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                    0.135     0.000     0.313     0.313 c.m/sec"
"              Catchment 20           Pervious   Impervious Total Area "
"              Surface Area           6.650      0.000      6.650      hectare"
"              Time of concentration  54.995     5.665      54.994     minutes"
"              Time to Centroid       162.956    92.780     162.955    minutes"
"              Rainfall depth         49.792     49.792     49.792     mm"
"              Rainfall volume        3311.14    0.00       3311.15    c.m"
"              Rainfall losses        36.958     5.466      36.958     mm"
"              Runoff depth           12.834     44.325     12.834     mm"
"              Runoff volume          853.44     0.00       853.44     c.m"
"              Runoff coefficient     0.258      0.000      0.258      "
"              Maximum flow           0.135      0.000      0.135      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.135     0.135     0.313     0.313"
" 33          CATCHMENT 21"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           21   Catchment 20"
"        10.000   % Impervious"
"         0.820   Total Area"
```

```
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.738   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.082   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.258   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.878   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.030     0.135     0.313     0.313 c.m/sec"
"             Catchment 21           Pervious   Impervious Total Area "
"             Surface Area           0.738      0.082      0.820      hectare"
"             Time of concentration  24.883     2.563      18.750     minutes"
"             Time to Centroid       128.082    88.517     117.210    minutes"
"             Rainfall depth         49.792     49.792     49.792     mm"
"             Rainfall volume        367.46     40.83      408.29     c.m"
"             Rainfall losses        36.970     6.066      33.879     mm"
"             Runoff depth           12.822     43.726     15.913     mm"
"             Runoff volume          94.63      35.86      130.48     c.m"
"             Runoff coefficient     0.258      0.878      0.320      "
"             Maximum flow           0.025      0.021      0.030      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.030     0.152     0.313     0.313"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                  0.030     0.152     0.152     0.313"
" 64          SHOW TABLE"
"            2   Flow hydrograph"
"            4   Inflow Hydrograph"
"             Maximum flow                0.152    c.m/sec"
"             Hydrograph volume         983.926    c.m"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total"
"             Maximum flow                0.463    c.m/sec"
"             Hydrograph volume        2809.509    c.m"
"                  0.030     0.152     0.152     0.463"
" 38          START/RE-START TOTALS 21"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                    22.700    hectare"
"             Total Impervious area                    0.082    hectare"
"             Total % impervious                       0.361"
" 19          EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                                Version 2.25  rev. 473"
"                MIDUSS created                              Sunday, February 07, 2010"
"           10   Units used:                                                ie METRIC"
"                Job folder:          W:\Kitchener\411-2011\411009\Design Data\"
"                                  Modelling Files\2017-01-02\Existing\2017-03-07"
"                Output filename:                  411009_10YR EX_MARCH 2017.out"
"                Licensee name:                                              gmbp"
"                Company                                  Hewlett-Packard Company"
"                Date & Time last used:                    3/8/2017 at 8:25:44 AM"
" 31          TIME PARAMETERS"
"       5.000   Time Step"
"     180.000   Max. Storm length"
"    3600.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"           1   Chicago storm"
"    2327.596   Coefficient A"
"      19.500   Constant B"
"       0.894   Exponent C"
"       0.380   Fraction R"
"     180.000   Duration"
"       1.000   Time step multiplier"
"            Maximum intensity          126.171    mm/hr"
"            Total depth                 61.359    mm"
"           6   010hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 30"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"          30   Catchment 30"
"       0.000   % Impervious"
"       0.780   Total Area"
"      75.000   Flow length"
"       2.000   Overland Slope"
"       0.780   Pervious Area"
"      75.000   Pervious length"
"       2.000   Pervious slope"
"       0.000   Impervious Area"
"      75.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      74.000   Pervious SCS Curve No."
"       0.316   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"       8.924   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.000   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                   0.036     0.000     0.000     0.000 c.m/sec"
"            Catchment 30           Pervious   Impervious Total Area "
"            Surface Area           0.780      0.000      0.780      hectare"
"            Time of concentration  31.343     3.560      31.343     minutes"
"            Time to Centroid       133.488    89.347     133.488    minutes"
"            Rainfall depth         61.359     61.359     61.359     mm"
"            Rainfall volume        478.60     0.00       478.60     c.m"
"            Rainfall losses        41.966     6.521      41.966     mm"
"            Runoff depth           19.393     54.839     19.393     mm"
"            Runoff volume          151.27     0.00       151.27     c.m"
"            Runoff coefficient     0.316      0.000      0.316      "
"            Maximum flow           0.036      0.000      0.036      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
```

```
"            4   Add Runoff "
"                    0.036     0.036     0.000     0.000"
" 33          CATCHMENT 31"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           31   Catchment 31"
"        0.000   % Impervious"
"        0.220   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.220   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.316   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.013     0.036     0.000     0.000 c.m/sec"
"             Catchment 31           Pervious   Impervious Total Area "
"             Surface Area           0.220      0.000      0.220      hectare"
"             Time of concentration  21.495     2.441      21.495     minutes"
"             Time to Centroid       122.241    87.742     122.241    minutes"
"             Rainfall depth         61.359     61.359     61.359     mm"
"             Rainfall volume        134.99     0.00       134.99     c.m"
"             Rainfall losses        41.967     6.310      41.967     mm"
"             Runoff depth           19.392     55.050     19.393     mm"
"             Runoff volume          42.66      0.00       42.66      c.m"
"             Runoff coefficient     0.316      0.000      0.316      "
"             Maximum flow           0.013      0.000      0.013      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.013     0.048     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.013     0.048     0.048     0.000"
" 40          HYDROGRAPH   Combine    2"
"            6   Combine "
"            2   Node #"
"                To Walser Street"
"             Maximum flow                 0.048    c.m/sec"
"             Hydrograph volume          193.932    c.m"
"                    0.013     0.048     0.048     0.048"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.013     0.000     0.048     0.048"
" 33          CATCHMENT 10"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           10   Catchment 10"
"        0.000   % Impervious"
"        7.760   Total Area"
"      150.000   Flow length"
```

```
"        2.000   Overland Slope"
"        7.760   Pervious Area"
"      150.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"      150.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.316   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.273     0.000     0.048     0.048 c.m/sec"
"             Catchment 10           Pervious   Impervious Total Area "
"             Surface Area           7.760      0.000      7.760      hectare"
"             Time of concentration  47.507     5.395      47.507     minutes"
"             Time to Centroid       151.963    91.698     151.963    minutes"
"             Rainfall depth         61.359     61.359     61.359     mm"
"             Rainfall volume        4761.47    0.00       4761.48    c.m"
"             Rainfall losses        41.963     5.633      41.963     mm"
"             Runoff depth           19.396     55.726     19.396     mm"
"             Runoff volume          1505.11    0.00       1505.12    c.m"
"             Runoff coefficient     0.316      0.000      0.316      "
"             Maximum flow           0.273      0.000      0.273      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                 0.273     0.273     0.048     0.048"
" 33          CATCHMENT 11"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"          11   Catchment 11"
"        0.000   % Impervious"
"        0.130   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.130   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.316   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.008     0.273     0.048     0.048 c.m/sec"
"             Catchment 11           Pervious   Impervious Total Area "
"             Surface Area           0.130      0.000      0.130      hectare"
"             Time of concentration  21.495     2.441      21.495     minutes"
"             Time to Centroid       122.241    87.742     122.240    minutes"
"             Rainfall depth         61.359     61.359     61.359     mm"
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"              Rainfall volume          79.77       0.00        79.77       c.m"
"              Rainfall losses          41.967      6.310       41.967      mm"
"              Runoff depth             19.392      55.050      19.393      mm"
"              Runoff volume            25.21       0.00        25.21       c.m"
"              Runoff coefficient       0.316       0.000       0.316       "
"              Maximum flow             0.008       0.000       0.008       c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                    0.008     0.277     0.048     0.048"
" 33           CATCHMENT 40"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"            40   Catchment 40"
"         0.000   % Impervious"
"         6.340   Total Area"
"        60.000   Flow length"
"         2.000   Overland Slope"
"         6.340   Pervious Area"
"        60.000   Pervious length"
"         2.000   Pervious slope"
"         0.000   Impervious Area"
"        60.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        74.000   Pervious SCS Curve No."
"         0.316   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         8.924   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.000   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                    0.320     0.277     0.048     0.048 c.m/sec"
"              Catchment 40             Pervious    Impervious Total Area "
"              Surface Area             6.340       0.000       6.340       hectare"
"              Time of concentration    27.416      3.114       27.416      minutes"
"              Time to Centroid         128.990     88.727      128.990     minutes"
"              Rainfall depth           61.359      61.359      61.359      mm"
"              Rainfall volume          3890.17     0.00        3890.18     c.m"
"              Rainfall losses          41.968      6.469       41.968      mm"
"              Runoff depth             19.392      54.890      19.392      mm"
"              Runoff volume            1229.42     0.00        1229.42     c.m"
"              Runoff coefficient       0.316       0.000       0.316       "
"              Maximum flow             0.320       0.000       0.320       c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                    0.320     0.571     0.048     0.048"
" 54           POND DESIGN"
"         0.571   Current peak flow    c.m/sec"
"         0.050   Target outflow    c.m/sec"
"        2759.8   Hydrograph volume    c.m"
"            6.   Number of stages"
"       409.630   Minimum water level    metre"
"       410.750   Maximum water level    metre"
"       409.630   Starting water level    metre"
"             0   Keep Design Data: 1 = True; 0 = False"
"                   Level Discharge    Volume"
"                   409.630     0.000     0.000"
"                   409.750    0.5400   232.250"
"                   410.000     1.632  2017.880"
"                   410.250     3.737  5148.940"
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"              410.500     1.345  9472.330"
"              410.750     1.885  15057.74"
"           Peak outflow                    0.536    c.m/sec"
"           Maximum level                 409.749    metre"
"           Maximum storage               231.241    c.m"
"           Centroidal lag                  2.477   hours"
"                0.320     0.571     0.536     0.048 c.m/sec"
" 40        HYDROGRAPH Next link "
"          5   Next link "
"                0.320     0.536     0.536     0.048"
" 52        CHANNEL DESIGN"
"       0.536   Current peak flow    c.m/sec"
"       0.035   Manning 'n'"
"          0.   Cross-section type: 0=trapezoidal; 1=general"
"       0.000   Basewidth    metre"
"       7.410   Left bank slope"
"       6.000   Right bank slope"
"       0.950   Channel depth    metre"
"       1.040   Gradient   %"
"            Depth of flow                  0.310    metre"
"            Velocity                       0.834    m/sec"
"            Channel capacity              10.655    c.m/sec"
"            Critical depth                 0.265    metre"
" 53        ROUTE    Channel Route 72"
"       72.40      Channel Route 72 Reach length   ( metre)"
"       0.423   X-factor <= 0.5"
"      65.118   K-lag   ( seconds)"
"       0.000   Default(0) or user spec.(1) values used"
"       0.500   X-factor <= 0.5"
"      30.000   K-lag   ( seconds)"
"       0.500   Beta weighting factor"
"      75.000   Routing time step   ( seconds)"
"           1   No. of sub-reaches"
"            Peak outflow                   0.534    c.m/sec"
"                0.320     0.536     0.534     0.048 c.m/sec"
" 40        HYDROGRAPH Next link "
"          5   Next link "
"                0.320     0.534     0.534     0.048"
" 52        CHANNEL DESIGN"
"       0.534   Current peak flow    c.m/sec"
"       0.035   Manning 'n'"
"          0.   Cross-section type: 0=trapezoidal; 1=general"
"       2.000   Basewidth    metre"
"       2.950   Left bank slope"
"       3.000   Right bank slope"
"       0.950   Channel depth    metre"
"       1.040   Gradient   %"
"            Depth of flow                  0.221    metre"
"            Velocity                       0.907    m/sec"
"            Channel capacity               9.246    c.m/sec"
"            Critical depth                 0.177    metre"
" 53        ROUTE    Channel Route 40"
"       39.80      Channel Route 40 Reach length   ( metre)"
"       0.352   X-factor <= 0.5"
"      32.911   K-lag   ( seconds)"
"       0.000   Default(0) or user spec.(1) values used"
"       0.500   X-factor <= 0.5"
"      30.000   K-lag   ( seconds)"
"       0.500   Beta weighting factor"
"      37.500   Routing time step   ( seconds)"
"           1   No. of sub-reaches"
"            Peak outflow                   0.534    c.m/sec"
"                0.320     0.534     0.534     0.048 c.m/sec"
```

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" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    0.320     0.534     0.534     0.048"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.320     0.534     0.534     0.048"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total"
"             Maximum flow                    0.534    c.m/sec"
"             Hydrograph volume            2759.753    c.m"
"                    0.320     0.534     0.534     0.534"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.320     0.000     0.534     0.534"
" 33          CATCHMENT 20"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           20   Catchment 20"
"        0.000   % Impervious"
"        6.650   Total Area"
"      150.000   Flow length"
"        2.000   Overland Slope"
"        6.650   Pervious Area"
"      150.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"      150.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.316   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.234     0.000     0.534     0.534 c.m/sec"
"             Catchment 20           Pervious   Impervious Total Area "
"             Surface Area           6.650      0.000      6.650      hectare"
"             Time of concentration  47.507     5.395      47.507     minutes"
"             Time to Centroid       151.963    91.698     151.963    minutes"
"             Rainfall depth         61.359     61.359     61.359     mm"
"             Rainfall volume        4080.39    0.00       4080.39    c.m"
"             Rainfall losses        41.963     5.633      41.963     mm"
"             Runoff depth           19.396     55.726     19.396     mm"
"             Runoff volume          1289.82    0.00       1289.82    c.m"
"             Runoff coefficient     0.316      0.000      0.316      "
"             Maximum flow           0.234      0.000      0.234      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.234     0.234     0.534     0.534"
" 33          CATCHMENT 21"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           21   Catchment 20"
"       10.000   % Impervious"
"        0.820   Total Area"
```

```
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.738   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.082   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.316   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.897   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.049     0.234     0.534     0.534 c.m/sec"
"             Catchment 21           Pervious   Impervious Total Area "
"             Surface Area           0.738      0.082      0.820      hectare"
"             Time of concentration  21.495     2.441      16.926     minutes"
"             Time to Centroid       122.241    87.742     113.968    minutes"
"             Rainfall depth         61.359     61.359     61.359     mm"
"             Rainfall volume        452.83     50.31      503.15     c.m"
"             Rainfall losses        41.967     6.310      38.401     mm"
"             Runoff depth           19.392     55.050     22.958     mm"
"             Runoff volume          143.12     45.14      188.26     c.m"
"             Runoff coefficient     0.316      0.897      0.374      "
"             Maximum flow           0.043      0.024      0.049      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.049     0.263     0.534     0.534"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.049     0.263     0.263     0.534"
" 64          SHOW TABLE"
"            2   Flow hydrograph"
"            4   Inflow Hydrograph"
"             Maximum flow                 0.263    c.m/sec"
"             Hydrograph volume         1478.082    c.m"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total"
"             Maximum flow                 0.794    c.m/sec"
"             Hydrograph volume         4237.834    c.m"
"                    0.049     0.263     0.263     0.794"
" 38          START/RE-START TOTALS 21"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                    22.700    hectare"
"             Total Impervious area                    0.082    hectare"
"             Total % impervious                       0.361"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                          Sunday, February 07, 2010"
"           10   Units used:                                              ie METRIC"
"                Job folder:          W:\Kitchener\411-2011\411009\Design Data\"
"                                  Modelling Files\2017-01-02\Existing\2017-03-07"
"                Output filename:                  411009_25YR EX_MARCH 2017.out"
"                Licensee name:                                              gmbp"
"                Company                                  Hewlett-Packard Company"
"                Date & Time last used:                    3/8/2017 at 8:31:55 AM"
" 31          TIME PARAMETERS"
"       5.000   Time Step"
"     180.000   Max. Storm length"
"    3600.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"           1   Chicago storm"
"    3701.648   Coefficient A"
"      25.500   Constant B"
"       0.937   Exponent C"
"       0.380   Fraction R"
"     180.000   Duration"
"       1.000   Time step multiplier"
"            Maximum intensity          143.371    mm/hr"
"            Total depth                 75.581    mm"
"           6   025hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 30"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"          30   Catchment 30"
"       0.000   % Impervious"
"       0.780   Total Area"
"      75.000   Flow length"
"       2.000   Overland Slope"
"       0.780   Pervious Area"
"      75.000   Pervious length"
"       2.000   Pervious slope"
"       0.000   Impervious Area"
"      75.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      74.000   Pervious SCS Curve No."
"       0.377   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"       8.924   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.000   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                   0.059     0.000     0.000     0.000 c.m/sec"
"            Catchment 30           Pervious   Impervious Total Area "
"            Surface Area           0.780      0.000      0.780      hectare"
"            Time of concentration  27.338     3.366      27.338     minutes"
"            Time to Centroid       127.236    88.558     127.236    minutes"
"            Rainfall depth         75.581     75.581     75.581     mm"
"            Rainfall volume        589.53     0.00       589.53     c.m"
"            Rainfall losses        47.096     7.005      47.096     mm"
"            Runoff depth           28.485     68.576     28.485     mm"
"            Runoff volume          222.18     0.00       222.18     c.m"
"            Runoff coefficient     0.377      0.000      0.377      "
"            Maximum flow           0.059      0.000      0.059      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
```

```
"           4   Add Runoff "
"                   0.059     0.059     0.000     0.000"
" 33         CATCHMENT 31"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"          31   Catchment 31"
"       0.000   % Impervious"
"       0.220   Total Area"
"      40.000   Flow length"
"       2.000   Overland Slope"
"       0.220   Pervious Area"
"      40.000   Pervious length"
"       2.000   Pervious slope"
"       0.000   Impervious Area"
"      40.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      74.000   Pervious SCS Curve No."
"       0.376   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"       8.924   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.000   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                   0.020     0.059     0.000     0.000 c.m/sec"
"            Catchment 31          Pervious   Impervious Total Area "
"            Surface Area          0.220      0.000      0.220      hectare"
"            Time of concentration 18.749     2.308      18.749     minutes"
"            Time to Centroid      117.510    87.059     117.510    minutes"
"            Rainfall depth        75.581     75.581     75.581     mm"
"            Rainfall volume       166.28     0.00       166.28     c.m"
"            Rainfall losses       47.127     6.593      47.127     mm"
"            Runoff depth          28.453     68.988     28.453     mm"
"            Runoff volume         62.60      0.00       62.60      c.m"
"            Runoff coefficient    0.376      0.000      0.376      "
"            Maximum flow          0.020      0.000      0.020      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                   0.020     0.078     0.000     0.000"
" 40         HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                   0.020     0.078     0.078     0.000"
" 40         HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               To Walser Street"
"            Maximum flow                0.078    c.m/sec"
"            Hydrograph volume           284.778  c.m"
"                   0.020     0.078     0.078     0.078"
" 40         HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                   0.020     0.000     0.078     0.078"
" 33         CATCHMENT 10"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"          10   Catchment 10"
"       0.000   % Impervious"
"       7.760   Total Area"
"     150.000   Flow length"
```

```
"        2.000   Overland Slope"
"        7.760   Pervious Area"
"      150.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"      150.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.377   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.454     0.000     0.078     0.078 c.m/sec"
"             Catchment 10           Pervious   Impervious Total Area "
"             Surface Area           7.760      0.000      7.760      hectare"
"             Time of concentration  41.437     5.102      41.437     minutes"
"             Time to Centroid       143.191    90.751     143.190    minutes"
"             Rainfall depth         75.581     75.581     75.581     mm"
"             Rainfall volume        5865.07    0.01       5865.07    c.m"
"             Rainfall losses        47.093     5.908      47.093     mm"
"             Runoff depth           28.488     69.673     28.488     mm"
"             Runoff volume          2210.64    0.01       2210.65    c.m"
"             Runoff coefficient     0.377      0.000      0.377      "
"             Maximum flow           0.454      0.000      0.454      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                 0.454     0.454     0.078     0.078"
" 33          CATCHMENT 11"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"          11   Catchment 11"
"        0.000   % Impervious"
"        0.130   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.130   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.376   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.012     0.454     0.078     0.078 c.m/sec"
"             Catchment 11           Pervious   Impervious Total Area "
"             Surface Area           0.130      0.000      0.130      hectare"
"             Time of concentration  18.749     2.308      18.749     minutes"
"             Time to Centroid       117.510    87.059     117.510    minutes"
"             Rainfall depth         75.581     75.581     75.581     mm"
```

```
"              Rainfall volume          98.25      0.00       98.26      c.m"
"              Rainfall losses          47.127     6.593      47.127     mm"
"              Runoff depth             28.453     68.988     28.453     mm"
"              Runoff volume            36.99      0.00       36.99      c.m"
"              Runoff coefficient       0.376      0.000      0.376      "
"              Maximum flow             0.012      0.000      0.012      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                    0.012     0.461     0.078     0.078"
" 33           CATCHMENT 40"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"            40   Catchment 40"
"         0.000   % Impervious"
"         6.340   Total Area"
"        60.000   Flow length"
"         2.000   Overland Slope"
"         6.340   Pervious Area"
"        60.000   Pervious length"
"         2.000   Pervious slope"
"         0.000   Impervious Area"
"        60.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        74.000   Pervious SCS Curve No."
"         0.377   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         8.924   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.000   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                    0.520     0.461     0.078     0.078 c.m/sec"
"              Catchment 40             Pervious   Impervious Total Area "
"              Surface Area             6.340      0.000      6.340      hectare"
"              Time of concentration    23.913     2.944      23.913     minutes"
"              Time to Centroid         123.357    87.974     123.357    minutes"
"              Rainfall depth           75.581     75.581     75.581     mm"
"              Rainfall volume          4791.82    0.00       4791.83    c.m"
"              Rainfall losses          47.108     6.942      47.107     mm"
"              Runoff depth             28.473     68.639     28.473     mm"
"              Runoff volume            1805.21    0.00       1805.21    c.m"
"              Runoff coefficient       0.377      0.000      0.377      "
"              Maximum flow             0.520      0.000      0.520      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                    0.520     0.940     0.078     0.078"
" 54           POND DESIGN"
"         0.940   Current peak flow    c.m/sec"
"         0.050   Target outflow    c.m/sec"
"        4052.8   Hydrograph volume    c.m"
"            6.   Number of stages"
"       409.630   Minimum water level    metre"
"       410.750   Maximum water level    metre"
"       409.630   Starting water level    metre"
"             0   Keep Design Data: 1 = True; 0 = False"
"                   Level Discharge    Volume"
"                 409.630     0.000     0.000"
"                 409.750    0.5400   232.250"
"                 410.000     1.632  2017.880"
"                 410.250     3.737  5148.940"
```

```
"              410.500     1.345  9472.330"
"              410.750     1.885  15057.74"
"           Peak outflow                    0.736    c.m/sec"
"           Maximum level                 409.795    metre"
"           Maximum storage               553.883    c.m"
"           Centroidal lag                  2.393   hours"
"                0.520     0.940     0.736     0.078 c.m/sec"
" 40        HYDROGRAPH Next link "
"          5   Next link "
"                0.520     0.736     0.736     0.078"
" 52        CHANNEL DESIGN"
"       0.736   Current peak flow    c.m/sec"
"       0.035   Manning 'n'"
"          0.   Cross-section type: 0=trapezoidal; 1=general"
"       0.000   Basewidth    metre"
"       7.410   Left bank slope"
"       6.000   Right bank slope"
"       0.950   Channel depth    metre"
"       1.040   Gradient   %"
"            Depth of flow                  0.349    metre"
"            Velocity                       0.903    m/sec"
"            Channel capacity              10.655    c.m/sec"
"            Critical depth                 0.301    metre"
" 53        ROUTE    Channel Route 72"
"       72.40      Channel Route 72 Reach length   ( metre)"
"       0.413   X-factor <= 0.5"
"      60.155   K-lag   ( seconds)"
"       0.000   Default(0) or user spec.(1) values used"
"       0.500   X-factor <= 0.5"
"      30.000   K-lag   ( seconds)"
"       0.500   Beta weighting factor"
"      60.000   Routing time step   ( seconds)"
"           1   No. of sub-reaches"
"            Peak outflow                   0.735    c.m/sec"
"                0.520     0.736     0.735     0.078 c.m/sec"
" 40        HYDROGRAPH Next link "
"          5   Next link "
"                0.520     0.735     0.735     0.078"
" 52        CHANNEL DESIGN"
"       0.735   Current peak flow    c.m/sec"
"       0.035   Manning 'n'"
"          0.   Cross-section type: 0=trapezoidal; 1=general"
"       2.000   Basewidth    metre"
"       2.950   Left bank slope"
"       3.000   Right bank slope"
"       0.950   Channel depth    metre"
"       1.040   Gradient   %"
"            Depth of flow                  0.264    metre"
"            Velocity                       1.000    m/sec"
"            Channel capacity               9.246    c.m/sec"
"            Critical depth                 0.214    metre"
" 53        ROUTE    Channel Route 40"
"       39.80      Channel Route 40 Reach length   ( metre)"
"       0.326   X-factor <= 0.5"
"      29.854   K-lag   ( seconds)"
"       0.000   Default(0) or user spec.(1) values used"
"       0.500   X-factor <= 0.5"
"      30.000   K-lag   ( seconds)"
"       0.500   Beta weighting factor"
"      37.500   Routing time step   ( seconds)"
"           1   No. of sub-reaches"
"            Peak outflow                   0.735    c.m/sec"
"                0.520     0.735     0.735     0.078 c.m/sec"
```

```
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    0.520     0.735     0.735     0.078"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.520     0.735     0.735     0.078"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total"
"             Maximum flow                    0.735    c.m/sec"
"             Hydrograph volume            4053.139    c.m"
"                    0.520     0.735     0.735     0.735"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.520     0.000     0.735     0.735"
" 33          CATCHMENT 20"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           20   Catchment 20"
"         0.000   % Impervious"
"         6.650   Total Area"
"       150.000   Flow length"
"         2.000   Overland Slope"
"         6.650   Pervious Area"
"       150.000   Pervious length"
"         2.000   Pervious slope"
"         0.000   Impervious Area"
"       150.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        74.000   Pervious SCS Curve No."
"         0.377   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         8.924   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.000   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                    0.389     0.000     0.735     0.735 c.m/sec"
"              Catchment 20           Pervious   Impervious Total Area "
"              Surface Area           6.650      0.000      6.650      hectare"
"              Time of concentration  41.437     5.102      41.437     minutes"
"              Time to Centroid       143.191    90.751     143.190    minutes"
"              Rainfall depth         75.581     75.581     75.581     mm"
"              Rainfall volume        5026.12    0.01       5026.13    c.m"
"              Rainfall losses        47.093     5.908      47.093     mm"
"              Runoff depth           28.488     69.673     28.488     mm"
"              Runoff volume          1894.43    0.00       1894.44    c.m"
"              Runoff coefficient     0.377      0.000      0.377      "
"              Maximum flow           0.389      0.000      0.389      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.389     0.389     0.735     0.735"
" 33          CATCHMENT 21"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           21   Catchment 20"
"        10.000   % Impervious"
"         0.820   Total Area"
```

```
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.738   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.082   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.376   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.913   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.078     0.389     0.735     0.735 c.m/sec"
"             Catchment 21           Pervious   Impervious Total Area "
"             Surface Area           0.738      0.082      0.820      hectare"
"             Time of concentration  18.749     2.308      15.260     minutes"
"             Time to Centroid       117.510    87.059     111.048    minutes"
"             Rainfall depth         75.581     75.581     75.581     mm"
"             Rainfall volume        557.79     61.98      619.76     c.m"
"             Rainfall losses        47.127     6.593      43.074     mm"
"             Runoff depth           28.453     68.988     32.507     mm"
"             Runoff volume          209.99     56.57      266.56     c.m"
"             Runoff coefficient     0.376      0.913      0.430      "
"             Maximum flow           0.068      0.028      0.078      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.078     0.435     0.735     0.735"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.078     0.435     0.435     0.735"
" 64          SHOW TABLE"
"            2   Flow hydrograph"
"            4   Inflow Hydrograph"
"             Maximum flow                 0.435    c.m/sec"
"             Hydrograph volume         2160.991    c.m"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total"
"             Maximum flow                 1.148    c.m/sec"
"             Hydrograph volume         6214.133    c.m"
"                    0.078     0.435     0.435     1.148"
" 38          START/RE-START TOTALS 21"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                      22.700    hectare"
"             Total Impervious area                      0.082    hectare"
"             Total % impervious                         0.361"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                            Sunday, February 07, 2010"
"           10   Units used:                                              ie METRIC"
"                Job folder:          W:\Kitchener\411-2011\411009\Design Data\"
"                                   Modelling Files\2017-01-02\Existing\2017-03-07"
"                Output filename:                  411009_50YR EX_MARCH 2017.out"
"                Licensee name:                                                gmbp"
"                Company                                    Hewlett-Packard Company"
"                Date & Time last used:                      3/8/2017 at 8:34:38 AM"
" 31          TIME PARAMETERS"
"       5.000   Time Step"
"     180.000   Max. Storm length"
"    3600.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"           1   Chicago storm"
"    5089.418   Coefficient A"
"      30.000   Constant B"
"       0.967   Exponent C"
"       0.380   Fraction R"
"     180.000   Duration"
"       1.000   Time step multiplier"
"            Maximum intensity           156.350    mm/hr"
"            Total depth                  86.737    mm"
"           6   050hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 30"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"          30   Catchment 30"
"       0.000   % Impervious"
"       0.780   Total Area"
"      75.000   Flow length"
"       2.000   Overland Slope"
"       0.780   Pervious Area"
"      75.000   Pervious length"
"       2.000   Pervious slope"
"       0.000   Impervious Area"
"      75.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      74.000   Pervious SCS Curve No."
"       0.418   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"       8.924   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.000   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"               0.080     0.000     0.000     0.000 c.m/sec"
"            Catchment 30           Pervious   Impervious Total Area "
"            Surface Area           0.780      0.000      0.780      hectare"
"            Time of concentration  25.140     3.243      25.140     minutes"
"            Time to Centroid       123.790    88.110     123.790    minutes"
"            Rainfall depth         86.737     86.737     86.737     mm"
"            Rainfall volume        676.55     0.00       676.55     c.m"
"            Rainfall losses        50.521     7.225      50.521     mm"
"            Runoff depth           36.216     79.512     36.216     mm"
"            Runoff volume          282.49     0.00       282.49     c.m"
"            Runoff coefficient     0.418      0.000      0.418      "
"            Maximum flow           0.080      0.000      0.080      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
```

```
"            4   Add Runoff "
"                    0.080     0.080     0.000     0.000"
" 33          CATCHMENT 31"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           31   Catchment 31"
"        0.000   % Impervious"
"        0.220   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.220   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.417   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.027     0.080     0.000     0.000 c.m/sec"
"             Catchment 31           Pervious   Impervious Total Area "
"             Surface Area           0.220      0.000      0.220      hectare"
"             Time of concentration  17.241     2.224      17.241     minutes"
"             Time to Centroid       114.897    86.667     114.897    minutes"
"             Rainfall depth         86.737     86.737     86.737     mm"
"             Rainfall volume        190.82     0.00       190.82     c.m"
"             Rainfall losses        50.540     6.773      50.540     mm"
"             Runoff depth           36.197     79.963     36.197     mm"
"             Runoff volume          79.63      0.00       79.63      c.m"
"             Runoff coefficient     0.417      0.000      0.417      "
"             Maximum flow           0.027      0.000      0.027      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.027     0.105     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.027     0.105     0.105     0.000"
" 40          HYDROGRAPH   Combine    2"
"            6   Combine "
"            2   Node #"
"                To Walser Street"
"             Maximum flow                 0.105    c.m/sec"
"             Hydrograph volume          362.120    c.m"
"                    0.027     0.105     0.105     0.105"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.027     0.000     0.105     0.105"
" 33          CATCHMENT 10"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           10   Catchment 10"
"        0.000   % Impervious"
"        7.760   Total Area"
"      150.000   Flow length"
```

```
"        2.000   Overland Slope"
"        7.760   Pervious Area"
"      150.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"      150.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.418   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.618     0.000     0.105     0.105 c.m/sec"
"             Catchment 10           Pervious   Impervious Total Area "
"             Surface Area           7.760      0.000      7.760      hectare"
"             Time of concentration  38.106     4.916      38.106     minutes"
"             Time to Centroid       138.366    90.175     138.366    minutes"
"             Rainfall depth         86.737     86.737     86.737     mm"
"             Rainfall volume        6730.77    0.01       6730.77    c.m"
"             Rainfall losses        50.510     5.941      50.510     mm"
"             Runoff depth           36.227     80.796     36.227     mm"
"             Runoff volume          2811.21    0.01       2811.22    c.m"
"             Runoff coefficient     0.418      0.000      0.418      "
"             Maximum flow           0.618      0.000      0.618      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.618     0.618     0.105     0.105"
" 33          CATCHMENT 11"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           11   Catchment 11"
"        0.000   % Impervious"
"        0.130   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.130   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.417   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.016     0.618     0.105     0.105 c.m/sec"
"             Catchment 11           Pervious   Impervious Total Area "
"             Surface Area           0.130      0.000      0.130      hectare"
"             Time of concentration  17.241     2.224      17.241     minutes"
"             Time to Centroid       114.897    86.667     114.896    minutes"
"             Rainfall depth         86.737     86.737     86.737     mm"
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"              Rainfall volume          112.76      0.00        112.76      c.m"
"              Rainfall losses          50.540      6.773       50.540      mm"
"              Runoff depth             36.197      79.963      36.197      mm"
"              Runoff volume            47.06       0.00        47.06       c.m"
"              Runoff coefficient       0.417       0.000       0.417       "
"              Maximum flow             0.016       0.000       0.016       c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                    0.016     0.628     0.105     0.105"
" 33           CATCHMENT 40"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"            40   Catchment 40"
"         0.000   % Impervious"
"         6.340   Total Area"
"        60.000   Flow length"
"         2.000   Overland Slope"
"         6.340   Pervious Area"
"        60.000   Pervious length"
"         2.000   Pervious slope"
"         0.000   Impervious Area"
"        60.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        74.000   Pervious SCS Curve No."
"         0.417   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         8.924   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.000   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                    0.703     0.628     0.105     0.105 c.m/sec"
"              Catchment 40             Pervious    Impervious Total Area "
"              Surface Area             6.340       0.000       6.340       hectare"
"              Time of concentration    21.990      2.837       21.990      minutes"
"              Time to Centroid         120.254     87.552      120.254     minutes"
"              Rainfall depth           86.737      86.737      86.737      mm"
"              Rainfall volume          5499.11     0.01        5499.11     c.m"
"              Rainfall losses          50.538      7.307       50.538      mm"
"              Runoff depth             36.199      79.429      36.199      mm"
"              Runoff volume            2295.03     0.01        2295.03     c.m"
"              Runoff coefficient       0.417       0.000       0.417       "
"              Maximum flow             0.703       0.000       0.703       c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                    0.703     1.261     0.105     0.105"
" 54           POND DESIGN"
"          1.261   Current peak flow    c.m/sec"
"          0.050   Target outflow    c.m/sec"
"         5153.3   Hydrograph volume    c.m"
"             6.   Number of stages"
"        409.630   Minimum water level    metre"
"        410.750   Maximum water level    metre"
"        409.630   Starting water level    metre"
"              0   Keep Design Data: 1 = True; 0 = False"
"                    Level Discharge    Volume"
"                  409.630     0.000     0.000"
"                  409.750    0.5400   232.250"
"                  410.000     1.632  2017.880"
"                  410.250     3.737  5148.940"
```

```
"              410.500     1.345  9472.330"
"              410.750     1.885  15057.74"
"           Peak outflow                    0.935    c.m/sec"
"           Maximum level                 409.841    metre"
"           Maximum storage               880.637    c.m"
"           Centroidal lag                  2.362   hours"
"                0.703     1.261     0.935     0.105 c.m/sec"
" 40        HYDROGRAPH Next link "
"          5   Next link "
"                0.703     0.935     0.935     0.105"
" 52        CHANNEL DESIGN"
"       0.935   Current peak flow    c.m/sec"
"       0.035   Manning 'n'"
"         0.    Cross-section type: 0=trapezoidal; 1=general"
"       0.000   Basewidth    metre"
"       7.410   Left bank slope"
"       6.000   Right bank slope"
"       0.950   Channel depth    metre"
"       1.040   Gradient   %"
"            Depth of flow                  0.381    metre"
"            Velocity                       0.958    m/sec"
"            Channel capacity              10.655    c.m/sec"
"            Critical depth                 0.331    metre"
" 53        ROUTE    Channel Route 72"
"       72.40      Channel Route 72 Reach length   ( metre)"
"       0.405   X-factor <= 0.5"
"      56.662   K-lag   ( seconds)"
"       0.000   Default(0) or user spec.(1) values used"
"       0.500   X-factor <= 0.5"
"      30.000   K-lag   ( seconds)"
"       0.500   Beta weighting factor"
"      60.000   Routing time step   ( seconds)"
"           1   No. of sub-reaches"
"            Peak outflow                   0.934    c.m/sec"
"                0.703     0.935     0.934     0.105 c.m/sec"
" 40        HYDROGRAPH Next link "
"          5   Next link "
"                0.703     0.934     0.934     0.105"
" 52        CHANNEL DESIGN"
"       0.934   Current peak flow    c.m/sec"
"       0.035   Manning 'n'"
"         0.    Cross-section type: 0=trapezoidal; 1=general"
"       2.000   Basewidth    metre"
"       2.950   Left bank slope"
"       3.000   Right bank slope"
"       0.950   Channel depth    metre"
"       1.040   Gradient   %"
"            Depth of flow                  0.301    metre"
"            Velocity                       1.074    m/sec"
"            Channel capacity               9.246    c.m/sec"
"            Critical depth                 0.247    metre"
" 53        ROUTE    Channel Route 40"
"       39.80      Channel Route 40 Reach length   ( metre)"
"       0.305   X-factor <= 0.5"
"      27.794   K-lag   ( seconds)"
"       0.000   Default(0) or user spec.(1) values used"
"       0.500   X-factor <= 0.5"
"      30.000   K-lag   ( seconds)"
"       0.500   Beta weighting factor"
"      37.500   Routing time step   ( seconds)"
"           1   No. of sub-reaches"
"            Peak outflow                   0.934    c.m/sec"
"                0.703     0.934     0.934     0.105 c.m/sec"
```

```
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    0.703     0.934     0.934     0.105"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.703     0.934     0.934     0.105"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total"
"             Maximum flow                  0.934    c.m/sec"
"             Hydrograph volume          5154.222    c.m"
"                    0.703     0.934     0.934     0.934"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.703     0.000     0.934     0.934"
" 33          CATCHMENT 20"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           20   Catchment 20"
"        0.000   % Impervious"
"        6.650   Total Area"
"      150.000   Flow length"
"        2.000   Overland Slope"
"        6.650   Pervious Area"
"      150.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"      150.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.418   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.530     0.000     0.934     0.934 c.m/sec"
"             Catchment 20           Pervious   Impervious Total Area "
"             Surface Area           6.650      0.000      6.650      hectare"
"             Time of concentration  38.106     4.916      38.106     minutes"
"             Time to Centroid       138.366    90.175     138.366    minutes"
"             Rainfall depth         86.737     86.737     86.737     mm"
"             Rainfall volume        5767.99    0.01       5768.00    c.m"
"             Rainfall losses        50.510     5.941      50.510     mm"
"             Runoff depth           36.227     80.796     36.227     mm"
"             Runoff volume          2409.09    0.01       2409.10    c.m"
"             Runoff coefficient     0.418      0.000      0.418      "
"             Maximum flow           0.530      0.000      0.530      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.530     0.530     0.934     0.934"
" 33          CATCHMENT 21"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           21   Catchment 20"
"       10.000   % Impervious"
"        0.820   Total Area"
```

```
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.738   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.082   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.417   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.922   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.103     0.530     0.934     0.934 c.m/sec"
"             Catchment 21           Pervious   Impervious Total Area "
"             Surface Area           0.738      0.082      0.820      hectare"
"             Time of concentration  17.241     2.224      14.282     minutes"
"             Time to Centroid       114.897    86.667     109.333    minutes"
"             Rainfall depth         86.737     86.737     86.737     mm"
"             Rainfall volume        640.12     71.12      711.24     c.m"
"             Rainfall losses        50.540     6.773      46.163     mm"
"             Runoff depth           36.197     79.963     40.574     mm"
"             Runoff volume          267.13     65.57      332.70     c.m"
"             Runoff coefficient     0.417      0.922      0.468      "
"             Maximum flow           0.091      0.031      0.103      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.103     0.592     0.934     0.934"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                  0.103     0.592     0.592     0.934"
" 64          SHOW TABLE"
"            2   Flow hydrograph"
"            4   Inflow Hydrograph"
"             Maximum flow                 0.592    c.m/sec"
"             Hydrograph volume         2741.804    c.m"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total"
"             Maximum flow                 1.478    c.m/sec"
"             Hydrograph volume         7896.021    c.m"
"                  0.103     0.592     0.592     1.478"
" 38          START/RE-START TOTALS 21"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                    22.700    hectare"
"             Total Impervious area                    0.082    hectare"
"             Total % impervious                       0.361"
" 19          EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                            Sunday, February 07, 2010"
"           10   Units used:                                                ie METRIC"
"                Job folder:          W:\Kitchener\411-2011\411009\Design Data\"
"                                   Modelling Files\2017-01-02\Existing\2017-03-07"
"                Output filename:                  411009_100YR EX_MARCH 2017.out"
"                Licensee name:                                              gmbp"
"                Company                                    Hewlett-Packard Company"
"                Date & Time last used:                      3/8/2017 at 8:38:25 AM"
" 31          TIME PARAMETERS"
"       5.000   Time Step"
"     180.000   Max. Storm length"
"    3600.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"           1   Chicago storm"
"    6933.019   Coefficient A"
"      34.699   Constant B"
"       0.998   Exponent C"
"       0.380   Fraction R"
"     180.000   Duration"
"       1.000   Time step multiplier"
"            Maximum intensity          168.777    mm/hr"
"            Total depth                 97.921    mm"
"           6   100hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 30"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"          30   Catchment 30"
"       0.000   % Impervious"
"       0.780   Total Area"
"      75.000   Flow length"
"       2.000   Overland Slope"
"       0.780   Pervious Area"
"      75.000   Pervious length"
"       2.000   Pervious slope"
"       0.000   Impervious Area"
"      75.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      74.000   Pervious SCS Curve No."
"       0.453   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"       8.924   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.000   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                 0.102     0.000     0.000     0.000 c.m/sec"
"            Catchment 30           Pervious   Impervious Total Area "
"            Surface Area           0.780      0.000      0.780      hectare"
"            Time of concentration  23.441     3.140      23.441     minutes"
"            Time to Centroid       121.062    87.744     121.061    minutes"
"            Rainfall depth         97.921     97.921     97.921     mm"
"            Rainfall volume        763.79     0.00       763.79     c.m"
"            Rainfall losses        53.525     7.562      53.525     mm"
"            Runoff depth           44.396     90.359     44.396     mm"
"            Runoff volume          346.29     0.00       346.29     c.m"
"            Runoff coefficient     0.453      0.000      0.453      "
"            Maximum flow           0.102      0.000      0.102      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
```

```
"            4   Add Runoff "
"                    0.102     0.102     0.000     0.000"
" 33          CATCHMENT 31"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           31   Catchment 31"
"        0.000   % Impervious"
"        0.220   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.220   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.453   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.034     0.102     0.000     0.000 c.m/sec"
"             Catchment 31           Pervious   Impervious Total Area "
"             Surface Area           0.220      0.000      0.220      hectare"
"             Time of concentration  16.076     2.153      16.076     minutes"
"             Time to Centroid       112.853    86.345     112.853    minutes"
"             Rainfall depth         97.921     97.921     97.921     mm"
"             Rainfall volume        215.43     0.00       215.43     c.m"
"             Rainfall losses        53.605     6.948      53.605     mm"
"             Runoff depth           44.316     90.973     44.316     mm"
"             Runoff volume          97.50      0.00       97.50      c.m"
"             Runoff coefficient     0.453      0.000      0.453      "
"             Maximum flow           0.034      0.000      0.034      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.034     0.134     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.034     0.134     0.134     0.000"
" 40          HYDROGRAPH   Combine    2"
"            6   Combine "
"            2   Node #"
"                To Walser Street"
"             Maximum flow                 0.134    c.m/sec"
"             Hydrograph volume            443.787  c.m"
"                    0.034     0.134     0.134     0.134"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.034     0.000     0.134     0.134"
" 33          CATCHMENT 10"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           10   Catchment 10"
"        0.000   % Impervious"
"        7.760   Total Area"
"      150.000   Flow length"
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"        2.000   Overland Slope"
"        7.760   Pervious Area"
"      150.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"      150.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.454   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.801     0.000     0.134     0.134 c.m/sec"
"             Catchment 10           Pervious   Impervious Total Area "
"             Surface Area           7.760      0.000      7.760      hectare"
"             Time of concentration  35.531     4.759      35.530     minutes"
"             Time to Centroid       134.554    89.737     134.554    minutes"
"             Rainfall depth         97.921     97.921     97.921     mm"
"             Rainfall volume        7598.69    0.01       7598.69    c.m"
"             Rainfall losses        53.501     6.084      53.501     mm"
"             Runoff depth           44.420     91.837     44.420     mm"
"             Runoff volume          3447.00    0.01       3447.01    c.m"
"             Runoff coefficient     0.454      0.000      0.454      "
"             Maximum flow           0.801      0.000      0.801      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                  0.801     0.801     0.134     0.134"
" 33          CATCHMENT 11"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"          11   Catchment 11"
"        0.000   % Impervious"
"        0.130   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.130   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.453   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.020     0.801     0.134     0.134 c.m/sec"
"             Catchment 11           Pervious   Impervious Total Area "
"             Surface Area           0.130      0.000      0.130      hectare"
"             Time of concentration  16.076     2.153      16.076     minutes"
"             Time to Centroid       112.853    86.345     112.853    minutes"
"             Rainfall depth         97.921     97.921     97.921     mm"
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"              Rainfall volume        127.30     0.00       127.30     c.m"
"              Rainfall losses        53.605     6.948      53.605     mm"
"              Runoff depth           44.316     90.973     44.316     mm"
"              Runoff volume          57.61      0.00       57.61      c.m"
"              Runoff coefficient     0.453      0.000      0.453      "
"              Maximum flow           0.020      0.000      0.020      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                   0.020     0.813     0.134     0.134"
" 33           CATCHMENT 40"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"            40   Catchment 40"
"         0.000   % Impervious"
"         6.340   Total Area"
"        60.000   Flow length"
"         2.000   Overland Slope"
"         6.340   Pervious Area"
"        60.000   Pervious length"
"         2.000   Pervious slope"
"         0.000   Impervious Area"
"        60.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        74.000   Pervious SCS Curve No."
"         0.453   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         8.924   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.000   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                   0.877     0.813     0.134     0.134 c.m/sec"
"              Catchment 40           Pervious   Impervious Total Area "
"              Surface Area           6.340      0.000      6.340      hectare"
"              Time of concentration  20.504     2.747      20.504     minutes"
"              Time to Centroid       117.777    87.189     117.777    minutes"
"              Rainfall depth         97.921     97.921     97.921     mm"
"              Rainfall volume        6208.20    0.01       6208.21    c.m"
"              Rainfall losses        53.532     7.496      53.532     mm"
"              Runoff depth           44.389     90.426     44.389     mm"
"              Runoff volume          2814.26    0.01       2814.27    c.m"
"              Runoff coefficient     0.453      0.000      0.453      "
"              Maximum flow           0.877      0.000      0.877      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                   0.877     1.614     0.134     0.134"
" 54           POND DESIGN"
"         1.614   Current peak flow    c.m/sec"
"         0.050   Target outflow    c.m/sec"
"        6318.9   Hydrograph volume    c.m"
"            6.   Number of stages"
"       409.630   Minimum water level    metre"
"       410.750   Maximum water level    metre"
"       409.630   Starting water level    metre"
"             0   Keep Design Data: 1 = True; 0 = False"
"                   Level Discharge    Volume"
"                   409.630     0.000     0.000"
"                   409.750    0.5400   232.250"
"                   410.000     1.632  2017.880"
"                   410.250     3.737  5148.940"
```

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"              410.500     1.345  9472.330"
"              410.750     1.885  15057.74"
"           Peak outflow                  1.157    c.m/sec"
"           Maximum level               409.891    metre"
"           Maximum storage            1241.886    c.m"
"           Centroidal lag                2.341   hours"
"                0.877     1.614     1.157     0.134 c.m/sec"
" 40        HYDROGRAPH Next link "
"          5   Next link "
"                0.877     1.157     1.157     0.134"
" 52        CHANNEL DESIGN"
"       1.157   Current peak flow    c.m/sec"
"       0.035   Manning 'n'"
"          0.   Cross-section type: 0=trapezoidal; 1=general"
"       0.000   Basewidth    metre"
"       7.410   Left bank slope"
"       6.000   Right bank slope"
"       0.950   Channel depth    metre"
"       1.040   Gradient   %"
"           Depth of flow                 0.413    metre"
"           Velocity                      1.011    m/sec"
"           Channel capacity             10.655    c.m/sec"
"           Critical depth                0.360    metre"
" 53        ROUTE    Channel Route 72"
"       72.40      Channel Route 72 Reach length   ( metre)"
"       0.397   X-factor <= 0.5"
"      53.723   K-lag   ( seconds)"
"       0.000   Default(0) or user spec.(1) values used"
"       0.500   X-factor <= 0.5"
"      30.000   K-lag   ( seconds)"
"       0.500   Beta weighting factor"
"      60.000   Routing time step   ( seconds)"
"           1   No. of sub-reaches"
"           Peak outflow                  1.153    c.m/sec"
"                0.877     1.157     1.153     0.134 c.m/sec"
" 40        HYDROGRAPH Next link "
"          5   Next link "
"                0.877     1.153     1.153     0.134"
" 52        CHANNEL DESIGN"
"       1.153   Current peak flow    c.m/sec"
"       0.035   Manning 'n'"
"          0.   Cross-section type: 0=trapezoidal; 1=general"
"       2.000   Basewidth    metre"
"       2.950   Left bank slope"
"       3.000   Right bank slope"
"       0.950   Channel depth    metre"
"       1.040   Gradient   %"
"           Depth of flow                 0.336    metre"
"           Velocity                      1.142    m/sec"
"           Channel capacity              9.246    c.m/sec"
"           Critical depth                0.280    metre"
" 53        ROUTE    Channel Route 40"
"       39.80      Channel Route 40 Reach length   ( metre)"
"       0.284   X-factor <= 0.5"
"      26.130   K-lag   ( seconds)"
"       0.000   Default(0) or user spec.(1) values used"
"       0.500   X-factor <= 0.5"
"      30.000   K-lag   ( seconds)"
"       0.500   Beta weighting factor"
"      33.333   Routing time step   ( seconds)"
"           1   No. of sub-reaches"
"           Peak outflow                  1.153    c.m/sec"
"                0.877     1.153     1.153     0.134 c.m/sec"
```

```
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    0.877     1.153     1.153     0.134"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.877     1.153     1.153     0.134"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total"
"             Maximum flow                  1.153    c.m/sec"
"             Hydrograph volume          6312.710    c.m"
"                    0.877     1.153     1.153     1.153"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.877     0.000     1.153     1.153"
" 33          CATCHMENT 20"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           20   Catchment 20"
"        0.000   % Impervious"
"        6.650   Total Area"
"      150.000   Flow length"
"        2.000   Overland Slope"
"        6.650   Pervious Area"
"      150.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"      150.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.454   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.687     0.000     1.153     1.153 c.m/sec"
"             Catchment 20           Pervious   Impervious Total Area "
"             Surface Area           6.650      0.000      6.650      hectare"
"             Time of concentration  35.531     4.759      35.530     minutes"
"             Time to Centroid       134.554    89.737     134.554    minutes"
"             Rainfall depth         97.921     97.921     97.921     mm"
"             Rainfall volume        6511.76    0.01       6511.77    c.m"
"             Rainfall losses        53.501     6.084      53.501     mm"
"             Runoff depth           44.420     91.837     44.420     mm"
"             Runoff volume          2953.94    0.01       2953.94    c.m"
"             Runoff coefficient     0.454      0.000      0.454      "
"             Maximum flow           0.687      0.000      0.687      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.687     0.687     1.153     1.153"
" 33          CATCHMENT 21"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           21   Catchment 20"
"       10.000   % Impervious"
"        0.820   Total Area"
```

```
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.738   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.082   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.453   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.929   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.134     0.687     1.153     1.153 c.m/sec"
"             Catchment 21            Pervious   Impervious Total Area "
"             Surface Area            0.738      0.082      0.820      hectare"
"             Time of concentration   16.076     2.153      13.490     minutes"
"             Time to Centroid        112.853    86.345     107.930    minutes"
"             Rainfall depth          97.921     97.921     97.921     mm"
"             Rainfall volume         722.66     80.30      802.95     c.m"
"             Rainfall losses         53.605     6.948      48.939     mm"
"             Runoff depth            44.316     90.973     48.982     mm"
"             Runoff volume           327.05     74.60      401.65     c.m"
"             Runoff coefficient      0.453      0.929      0.500      "
"             Maximum flow            0.115      0.034      0.134      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.134     0.763     1.153     1.153"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                  0.134     0.763     0.763     1.153"
" 64          SHOW TABLE"
"            2   Flow hydrograph"
"            4   Inflow Hydrograph"
"             Maximum flow                 0.763    c.m/sec"
"             Hydrograph volume         3355.596    c.m"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total"
"             Maximum flow                 1.850    c.m/sec"
"             Hydrograph volume         9668.306    c.m"
"                  0.134     0.763     0.763     1.850"
" 38          START/RE-START TOTALS 21"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                    22.700    hectare"
"             Total Impervious area                    0.082    hectare"
"             Total % impervious                       0.361"
" 19          EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                          Sunday, February 07, 2010"
"           10   Units used:                                              ie METRIC"
"                Job folder:          W:\Kitchener\411-2011\411009\Design Data\"
"                                  Modelling Files\2017-01-02\Existing\2017-03-07"
"                Output filename:                  411009_REG EX_MARCH 2017.out"
"                Licensee name:                                              gmbp"
"                Company                                  Hewlett-Packard Company"
"                Date & Time last used:                    3/8/2017 at 8:41:16 AM"
" 31          TIME PARAMETERS"
"       60.000   Time Step"
"     2880.000   Max. Storm length"
"    12000.000   Max. Hydrograph"
" 32          STORM Historic"
"           5   Historic"
"     2880.000   Duration"
"       48.000   Rainfall intensity values"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.026     2.026     2.026     2.028"
"                  2.026     6.000     4.000     6.000    13.000"
"                 17.000    13.000    23.000    13.000    13.000"
"                 53.000    38.000    13.000"
"             Maximum intensity            53.000    mm/hr"
"             Total depth                 285.000    mm"
"           6   200hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 30"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"          30   Catchment 30"
"        0.000   % Impervious"
"        0.780   Total Area"
"       75.000   Flow length"
"        2.000   Overland Slope"
"        0.780   Pervious Area"
"       75.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       75.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.719   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.087     0.000     0.000     0.000 c.m/sec"
"             Catchment 30           Pervious   Impervious Total Area "
"             Surface Area           0.780      0.000      0.780      hectare"
"             Time of concentration  27.920     4.957      27.920     minutes"
"             Time to Centroid       2555.648   2258.090   2555.648   minutes"
"             Rainfall depth         285.000    285.000    285.000    mm"
"             Rainfall volume        2223.00    0.00       2223.00    c.m"
```

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"             Rainfall losses         80.023     36.749     80.023     mm"
"             Runoff depth            204.977    248.251    204.977    mm"
"             Runoff volume           1598.82    0.00       1598.82    c.m"
"             Runoff coefficient      0.719      0.000      0.719      "
"             Maximum flow            0.087      0.000      0.087      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.087     0.087     0.000     0.000"
" 33          CATCHMENT 31"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           31   Catchment 31"
"        0.000   % Impervious"
"        0.220   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.220   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.723   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.023     0.087     0.000     0.000 c.m/sec"
"             Catchment 31            Pervious   Impervious Total Area "
"             Surface Area            0.220      0.000      0.220      hectare"
"             Time of concentration   19.148     3.399      19.148     minutes"
"             Time to Centroid        2545.193   2266.333   2545.193   minutes"
"             Rainfall depth          285.000    285.000    285.000    mm"
"             Rainfall volume         627.00     0.00       627.00     c.m"
"             Rainfall losses         78.940     42.646     78.940     mm"
"             Runoff depth            206.060    242.354    206.060    mm"
"             Runoff volume           453.33     0.00       453.33     c.m"
"             Runoff coefficient      0.723      0.000      0.723      "
"             Maximum flow            0.023      0.000      0.023      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.023     0.110     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                  0.023     0.110     0.110     0.000"
" 40          HYDROGRAPH   Combine    2"
"            6   Combine "
"            2   Node #"
"                To Walser Street"
"             Maximum flow                  0.110    c.m/sec"
"             Hydrograph volume          2052.151    c.m"
"                  0.023     0.110     0.110     0.110"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                  0.023     0.000     0.110     0.110"
" 33          CATCHMENT 10"
"            1   Triangular SCS"
```

```
"           1   Equal length"
"           1   SCS method"
"          10   Catchment 10"
"       0.000   % Impervious"
"       7.760   Total Area"
"     150.000   Flow length"
"       2.000   Overland Slope"
"       7.760   Pervious Area"
"     150.000   Pervious length"
"       2.000   Pervious slope"
"       0.000   Impervious Area"
"     150.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      74.000   Pervious SCS Curve No."
"       0.714   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"       8.924   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.000   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                   0.881     0.000     0.110     0.110 c.m/sec"
"            Catchment 10           Pervious   Impervious Total Area "
"            Surface Area           7.760      0.000      7.760      hectare"
"            Time of concentration  42.319     7.513      42.319     minutes"
"            Time to Centroid       2572.242   2276.224   2572.241   minutes"
"            Rainfall depth         285.000    285.000    285.000    mm"
"            Rainfall volume        2.2116     0.0000     2.2116     ha-m"
"            Rainfall losses        81.644     25.621     81.644     mm"
"            Runoff depth           203.356    259.379    203.356    mm"
"            Runoff volume          1.5780     0.0000     1.5780     ha-m"
"            Runoff coefficient     0.714      0.000      0.714      "
"            Maximum flow           0.881      0.000      0.881      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"          4   Add Runoff "
"                   0.881     0.881     0.110     0.110"
" 33         CATCHMENT 11"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"          11   Catchment 11"
"       0.000   % Impervious"
"       0.130   Total Area"
"      40.000   Flow length"
"       2.000   Overland Slope"
"       0.130   Pervious Area"
"      40.000   Pervious length"
"       2.000   Pervious slope"
"       0.000   Impervious Area"
"      40.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      74.000   Pervious SCS Curve No."
"       0.723   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"       8.924   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.000   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
```

```
"                0.014     0.881     0.110     0.110 c.m/sec"
"            Catchment 11           Pervious   Impervious Total Area "
"            Surface Area           0.130      0.000      0.130      hectare"
"            Time of concentration  19.148     3.399      19.148     minutes"
"            Time to Centroid       2545.193   2266.333   2545.193   minutes"
"            Rainfall depth         285.000    285.000    285.000    mm"
"            Rainfall volume        370.50     0.00       370.50     c.m"
"            Rainfall losses        78.940     42.646     78.940     mm"
"            Runoff depth           206.060    242.354    206.060    mm"
"            Runoff volume          267.88     0.00       267.88     c.m"
"            Runoff coefficient     0.723      0.000      0.723      "
"            Maximum flow           0.014      0.000      0.014      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                0.014     0.894     0.110     0.110"
" 33         CATCHMENT 40"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"          40   Catchment 40"
"       0.000   % Impervious"
"       6.340   Total Area"
"      60.000   Flow length"
"       2.000   Overland Slope"
"       6.340   Pervious Area"
"      60.000   Pervious length"
"       2.000   Pervious slope"
"       0.000   Impervious Area"
"      60.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      74.000   Pervious SCS Curve No."
"       0.716   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"       8.924   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.000   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                0.688     0.894     0.110     0.110 c.m/sec"
"            Catchment 40           Pervious   Impervious Total Area "
"            Surface Area           6.340      0.000      6.340      hectare"
"            Time of concentration  24.421     4.336      24.421     minutes"
"            Time to Centroid       2549.942   2258.969   2549.942   minutes"
"            Rainfall depth         285.000    285.000    285.000    mm"
"            Rainfall volume        1.8069     0.0000     1.8069     ha-m"
"            Rainfall losses        80.848     39.404     80.848     mm"
"            Runoff depth           204.152    245.596    204.152    mm"
"            Runoff volume          1.2943     0.0000     1.2943     ha-m"
"            Runoff coefficient     0.716      0.000      0.716      "
"            Maximum flow           0.688      0.000      0.688      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                0.688     1.582     0.110     0.110"
" 54         POND DESIGN"
"       1.582   Current peak flow    c.m/sec"
"       0.050   Target outflow    c.m/sec"
"    28991.5    Hydrograph volume    c.m"
"          6.   Number of stages"
"     409.630   Minimum water level    metre"
"     410.750   Maximum water level    metre"
"     409.630   Starting water level    metre"
```

```
"          0   Keep Design Data: 1 = True; 0 = False"
"              Level Discharge    Volume"
"             409.630     0.000     0.000"
"             409.750    0.5400   232.250"
"             410.000     1.632  2017.880"
"             410.250     3.737  5148.940"
"             410.500     1.345  9472.330"
"             410.750     1.885  15057.74"
"           Peak outflow                  1.422    c.m/sec"
"           Maximum level               409.952    metre"
"           Maximum storage            1675.131    c.m"
"           Centroidal lag               42.968   hours"
"               0.688     1.582     1.422     0.110 c.m/sec"
" 40        HYDROGRAPH Next link "
"          5   Next link "
"                 0.688     1.422     1.422     0.110"
" 52        CHANNEL DESIGN"
"       1.422   Current peak flow    c.m/sec"
"       0.035   Manning 'n'"
"          0.   Cross-section type: 0=trapezoidal; 1=general"
"       0.000   Basewidth    metre"
"       7.410   Left bank slope"
"       6.000   Right bank slope"
"       0.950   Channel depth    metre"
"       1.040   Gradient   %"
"            Depth of flow                0.446    metre"
"            Velocity                     1.064    m/sec"
"            Channel capacity            10.655    c.m/sec"
"            Critical depth               0.391    metre"
" 53        ROUTE    Channel Route 72"
"       72.40      Channel Route 72 Reach length   ( metre)"
"       0.389   X-factor <= 0.5"
"      51.023   K-lag   ( seconds)"
"       0.000   Default(0) or user spec.(1) values used"
"       0.500   X-factor <= 0.5"
"      30.000   K-lag   ( seconds)"
"       0.500   Beta weighting factor"
"      62.069   Routing time step   ( seconds)"
"           1   No. of sub-reaches"
"            Peak outflow                 1.415    c.m/sec"
"                 0.688     1.422     1.415     0.110 c.m/sec"
" 40        HYDROGRAPH Next link "
"          5   Next link "
"                 0.688     1.415     1.415     0.110"
" 52        CHANNEL DESIGN"
"       1.415   Current peak flow    c.m/sec"
"       0.035   Manning 'n'"
"          0.   Cross-section type: 0=trapezoidal; 1=general"
"       2.000   Basewidth    metre"
"       2.950   Left bank slope"
"       3.000   Right bank slope"
"       0.950   Channel depth    metre"
"       1.040   Gradient   %"
"            Depth of flow                0.375    metre"
"            Velocity                     1.212    m/sec"
"            Channel capacity             9.246    c.m/sec"
"            Critical depth               0.315    metre"
" 53        ROUTE    Channel Route 40"
"       39.80      Channel Route 40 Reach length   ( metre)"
"       0.262   X-factor <= 0.5"
"      24.631   K-lag   ( seconds)"
"       0.000   Default(0) or user spec.(1) values used"
"       0.500   X-factor <= 0.5"
```

```
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       36.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                  1.412    c.m/sec"
"                    0.688     1.415     1.412     0.110 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    0.688     1.412     1.412     0.110"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.688     1.412     1.412     0.110"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total"
"             Maximum flow                  1.412    c.m/sec"
"             Hydrograph volume         29214.979    c.m"
"                    0.688     1.412     1.412     1.412"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.688     0.000     1.412     1.412"
" 33          CATCHMENT 20"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           20   Catchment 20"
"         0.000   % Impervious"
"         6.650   Total Area"
"       150.000   Flow length"
"         2.000   Overland Slope"
"         6.650   Pervious Area"
"       150.000   Pervious length"
"         2.000   Pervious slope"
"         0.000   Impervious Area"
"       150.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        74.000   Pervious SCS Curve No."
"         0.714   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         8.924   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.000   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                    0.755     0.000     1.412     1.412 c.m/sec"
"             Catchment 20           Pervious   Impervious Total Area "
"             Surface Area           6.650      0.000      6.650      hectare"
"             Time of concentration  42.319     7.513      42.319     minutes"
"             Time to Centroid       2572.242   2276.224   2572.241   minutes"
"             Rainfall depth         285.000    285.000    285.000    mm"
"             Rainfall volume        1.8952     0.0000     1.8952     ha-m"
"             Rainfall losses        81.644     25.621     81.644     mm"
"             Runoff depth           203.356    259.379    203.356    mm"
"             Runoff volume          1.3523     0.0000     1.3523     ha-m"
"             Runoff coefficient     0.714      0.000      0.714      "
"             Maximum flow           0.755      0.000      0.755      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.755     0.755     1.412     1.412"
" 33          CATCHMENT 21"
```

```
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           21   Catchment 20"
"       10.000   % Impervious"
"        0.820   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.738   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.082   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.723   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.850   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.087     0.755     1.412     1.412 c.m/sec"
"             Catchment 21            Pervious   Impervious Total Area "
"             Surface Area            0.738      0.082      0.820      hectare"
"             Time of concentration   19.148     3.399      17.327     minutes"
"             Time to Centroid        2545.193   2266.333   2512.963   minutes"
"             Rainfall depth          285.000    285.000    285.000    mm"
"             Rainfall volume         2103.30    233.70     2337.00    c.m"
"             Rainfall losses         78.940     42.646     75.310     mm"
"             Runoff depth            206.060    242.354    209.690    mm"
"             Runoff volume           1520.72    198.73     1719.45    c.m"
"             Runoff coefficient      0.723      0.850      0.736      "
"             Maximum flow            0.078      0.010      0.087      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.087     0.840     1.412     1.412"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.087     0.840     0.840     1.412"
" 64          SHOW TABLE"
"            2   Flow hydrograph"
"            4   Inflow Hydrograph"
"             Maximum flow                  0.840    c.m/sec"
"             Hydrograph volume         15242.604    c.m"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total"
"             Maximum flow                  2.252    c.m/sec"
"             Hydrograph volume         44457.578    c.m"
"                    0.087     0.840     0.840     2.252"
" 38          START/RE-START TOTALS 21"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                      22.700    hectare"
"             Total Impervious area                      0.082    hectare"
"             Total % impervious                         0.361"
" 19          EXIT"
```

Ainley Farm Subdivision
Township of Centre Wellington (Elora)
G&M File: 411-009
April 17, 2017

Catchment 1000 & 1100 : Stormwater Management Facility No. 1

Stage Storage Volume Calculations

Elevation (m)	Stage (m)	Surface Area (m^2)	Increm. Storage (m^3)	Accum. Storage (m^3)	
411.00	0.00	6,075	0	0.0	Knockout
411.10	0.10	6,163	612	611.9	
411.20	0.20	6,252	621	1,232.7	
411.30	0.30	6,340	630	1,862.3	
411.40	0.40	6,429	638	2,500.7	
411.50	0.50	6,519	647	3,148.1	
411.60	0.60	6,609	656	3,804.5	CB.1 Lip
411.70	0.70	6,699	665	4,469.9	
411.75	0.75	6,744	336	4,806.0	CB.2 Lip
411.80	0.80	6,790	338	5,144.3	
411.85	0.85	6,835	341	5,485.0	Weir
412.00	1.00	3,972	811	6,295.5	Top of bank

Outlet #1
130 mm Diameter Knockout

Q =	0.026	m^3/s
Cd =	0.600	
H =	0.535	m
2g =	19.620	
A =	0.013	m^2
D =	0.130	m
D/2 =	0.065	m

Outlet #2
450 mm diameter pipe
300 mm orifice

Q =	0.188	m^3/s
Cd =	0.600	
H =	1.000	m
2g =	19.620	
A =	0.071	m^2
D =	0.300	m
D/2 =	0.150	m
Invert =	410.85	

Outlet #3
450 mm diameter pipe
200 mm orifice

Q =	0.086	m^3/s
Cd =	0.600	
H =	1.050	m
2g =	19.620	
A =	0.031	m^2
D =	0.200	m
D/2 =	0.100	m
Invert =	410.85	

Overflow Weir
Elevation = 411.90

d1 =	1.00	m
h =	0.85	m
H =	0.15	m
2g =	19.620	
L =	20.00	m
Q =	1.638	m^3/s

Ainley Farm Subdivision
Township of Centre Wellington (Elora)
G&M File: 411-009
April 17, 2017

Stage/Storage/Discharge Table

Elevation (m)	Stage (m)	Storage (m^3)	Outlet #1 130 mm (m^3/s)	Outlet #2 450 mm (m^3/s)	Outlet #3 450mm (m^3/s)	Overflow Weir (m^3/s)	Actual Discharge (m^3/s)	
411.00	0.00	0.0	0.000	0.000	0.000	0.000	0.000	Knockout
411.10	0.10	611.9	0.006	0.000	0.000	0.000	0.006	
411.20	0.20	1,232.7	0.013	0.000	0.000	0.000	0.013	
411.30	0.30	1,862.3	0.017	0.000	0.000	0.000	0.017	
411.40	0.40	2,500.7	0.020	0.000	0.000	0.000	0.020	
411.50	0.50	3,148.1	0.023	0.000	0.000	0.000	0.023	
411.60	0.60	3,804.5	0.026	0.000	0.000	0.000	0.026	CB.1 Lip
411.70	0.70	4,469.9	0.000	0.157	0.000	0.000	0.157	
411.75	0.75	4,806.0	0.000	0.163	0.000	0.000	0.163	CB.2 Lip
411.80	0.80	5,144.3	0.000	0.168	0.077	0.000	0.245	
411.85	0.85	5,485.0	0.000	0.173	0.079	0.000	0.252	Weir
412.00	1.00	6,295.5	0.000	0.188	0.086	1.638	1.912	Top of bank

Ainley Farm Subdivision
Township of Centre Wellington (Elora)
G&M File: 411-009
April 17, 2017

Catchment 2100 : Stormwater Management Facility No. 2

Stage Storage Volume Calculations

Elevation (m)	Stage (m)	Surface Area (m^2)	Increm. Storage (m^3)	Accum. Storage (m^3)	
410.65	0.00	488.80	0	0.0	Bottom of Pond/Knockout
410.70	0.05	511.10	25	25.0	
410.80	0.15	572.00	54	79.2	
410.90	0.25	634.70	60	139.5	
411.00	0.35	699.30	67	206.2	
411.10	0.45	765.60	73	279.4	
411.20	0.55	833.70	80	359.4	CB Lip
411.30	0.65	903.60	87	446.3	
411.40	0.75	975.23	94	540.2	
411.50	0.85	1048.80	101	641.4	
411.60	0.95	1124.10	109	750.1	
411.65	1.00	1150.00	57	806.9	Weir
411.95	1.30	1440.00	389	1,195.4	Top of bank

Outlet #1
150 mm Diameter Knockout

Q =	0.032	m^3/s
Cd =	0.600	
H =	0.475	m
2g =	19.620	
A =	0.018	m^2
D =	0.150	m
D/2 =	0.075	m

Outlet #2
450 mm diameter pipe

Q =	0.448	m^3/s
Cd =	0.600	
H =	0.725	m
2g =	19.620	
A =	0.159	m^2
D =	0.450	m
D/2 =	0.225	m
Invert =	410.60	

Overflow Weir
Elevation = 411.65

d1 =	1.30	m
h =	1.00	m
H =	0.30	m
2g =	19.62	
L =	10.00	m
Q =	2.369	m^3/s

Ainley Farm Subdivision
Township of Centre Wellington (Elora)
G&M File: 411-009
April 17, 2017

Stage/Storage/Discharge Table

Elevation (m)	Stage (m)	Storage (m^3)	Outlet #1 130 mm (m^3/s)	Outlet #2 425 mm (m^3/s)	Overflow Weir (m^3/s)	Actual Discharge (m^3/s)	
410.65	0.00	0.0	0.000	0.000	0.000	0.000	Bottom of Pond/Knockout
410.70	0.05	25.0	0.006	0.000	0.000	0.006	
410.80	0.15	79.2	0.013	0.000	0.000	0.013	
410.90	0.25	139.5	0.020	0.000	0.000	0.020	
411.00	0.35	206.2	0.025	0.000	0.000	0.025	
411.10	0.45	279.4	0.029	0.000	0.000	0.029	
411.20	0.55	359.4	0.032	0.000	0.000	0.032	CB Lip
411.30	0.65	446.3	0.000	0.291	0.000	0.291	
411.40	0.75	540.2	0.000	0.321	0.000	0.321	
411.50	0.85	641.4	0.000	0.347	0.000	0.347	
411.60	0.95	750.1	0.000	0.372	0.000	0.372	
411.65	1.00	806.9	0.000	0.384	0.000	0.384	Weir
411.95	1.30	1,195.4	0.000	0.448	2.369	2.818	Top of bank

Ainley Farm Subdivision
Township of Centre Wellington (Elora)
G&M File: 411-009
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Catchment 2200 : Private Stormwater Management Facility Multi-Family Block

Stage Storage Volume Calculations

Elevation (m)	Stage (m)	Surface Area (m^2)	Increm. Storage (m^3)	Accum. Storage (m^3)	
413.70	0.00	847	0	0.0	Bottom of Pond/Knockout
413.80	0.10	924	89	88.6	
413.90	0.20	1,049	99	187.2	
414.00	0.30	1,175	111	298.4	
414.10	0.40	1,302	124	422.2	
414.20	0.50	1,431	137	558.9	
414.30	0.60	1,561	150	708.5	
414.40	0.70	1,692	163	871.1	CB Lip
414.50	0.80	1,825	176	1,046.9	
414.60	0.90	1,959	189	1,236.1	
414.70	1.00	2,094	203	1,438.7	Weir
415.00	1.30	2231	649	2,087.4	Top of bank

Outlet #1
110 mm Diameter Knockout

Q =	0.020	m^3/s
Cd =	0.600	
H =	0.645	m
2g =	19.620	
A =	0.010	m^2
D =	0.110	m
D/2 =	0.055	m

Outlet #2
450 mm diameter pipe

Q =	0.372	m^3/s
Cd =	0.600	
H =	0.775	m
2g =	19.620	
A =	0.159	m^2
D =	0.450	m
D/2 =	0.225	m
Invert =	413.7	

Overflow Weir
Elevation = 414.70

d1 =	1.30	m
h =	1.00	m
H =	0.30	m
2g =	19.62	
L =	10.00	m
Q =	2.369	m^3/s

Ainley Farm Subdivision
Township of Centre Wellington (Elora)
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Stage/Storage/Discharge Table

Elevation (m)	Stage (m)	Storage (m^3)	Outlet #1 110 mm (m^3/s)	Outlet #2 450 mm (m^3/s)	Overflow Weir (m^3/s)	Actual Discharge (m^3/s)	
413.70	0.00	0.0	0.000	0.000	0.000	0.000	Bottom of Pond/Knockout
413.80	0.10	88.6	0.005	0.000	0.000	0.005	
413.90	0.20	187.2	0.010	0.000	0.000	0.010	
414.00	0.30	298.4	0.013	0.000	0.000	0.013	
414.10	0.40	422.2	0.015	0.000	0.000	0.015	
414.20	0.50	558.9	0.017	0.000	0.000	0.017	
414.30	0.60	708.5	0.019	0.000	0.000	0.019	
414.40	0.70	871.1	0.020	0.000	0.000	0.020	CB Lip
414.50	0.80	1,046.9	0.000	0.321	0.000	0.321	
414.60	0.90	1,236.1	0.000	0.347	0.000	0.347	
414.70	1.00	1,438.7	0.000	0.372	0.000	0.372	Weir
415.00	1.30	2,087.4	0.000	0.438	2.369	2.808	Top of bank

Ainley Farm Subdivision
Township of Centre Wellington (Elora)
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Catchment 4000: Wetland

Stage Storage Volume Calculations

Elevation (m)	Stage (m)	Surface Area (m^2)	Increm. Storage (m^3)	Accum. Storage (m^3)	
409.63	0.00	0	0	0.0	Wetland Bottom
409.75	0.12	3871	232	232.2	
410.00	0.37	10414	1786	2017.9	
410.25	0.62	14634	3131	5148.9	
410.50	0.87	19953	4323	9472.3	Weir
410.75	1.12	24730	5585	15057.7	Overflow

WEIR CALCULATIONS

d1 =	1.12	m
h =	0.87	m
H =	0.25	m
2g =	19.62	
L =	3	m
Q =	0.540	m^3/s

Stage/Storage/Discharge Table

Elevation (m)	Stage (m)	Storage (m^3)	Actual Discharge (m^3/s)	
409.63	0.00	0.0	0.000	Wetland Bottom
409.75	0.12	232.2	0.540	
410.00	0.37	2017.9	1.632	
410.25	0.62	5148.9	3.737	
410.50	0.87	9472.3	1.345	Weir
410.75	1.12	15057.7	1.885	Overflow

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                          Sunday, February 07, 2010"
"           10   Units used:                                                ie METRIC"
"                Job folder:                        C:\Users\akroetsch\Documents\"
"                                    Work in Progress\411009 Ainley Farm SWM Junk"
"                Output filename:                                 411009_2YR POST.out"
"                Licensee name:                                                 gmbp"
"                Company                                  Hewlett-Packard Company"
"                Date & Time last used:                   4/17/2017 at 3:42:34 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"    12000.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      695.047   Coefficient A"
"        6.387   Constant B"
"        0.793   Exponent C"
"        0.380   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity            93.292    mm/hr"
"             Total depth                  33.014    mm"
"            6   002hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 3100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         3100   Catchment 3100"
"       60.000   % Impervious"
"        0.400   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.160   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.240   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.207   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.838   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.043     0.000     0.000     0.000 c.m/sec"
"             Catchment 3100          Pervious   Impervious Total Area "
"             Surface Area            0.160      0.240      0.400      hectare"
"             Time of concentration   20.437     1.868      4.499      minutes"
"             Time to Centroid        125.085    88.659     93.819     minutes"
"             Rainfall depth          33.014     33.014     33.014     mm"
"             Rainfall volume         52.82      79.23      132.06     c.m"
"             Rainfall losses         26.169     5.363      13.685     mm"
"             Runoff depth            6.845      27.651     19.329     mm"
"             Runoff volume           10.95      66.36      77.31      c.m"
"             Runoff coefficient      0.207      0.838      0.585      "
"             Maximum flow            0.003      0.043      0.043      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
```

```
"            4   Add Runoff "
"                    0.043     0.043     0.000     0.000"
" 56          DIVERSION"
"          3100   Node number"
"         0.062   Overflow threshold"
"         1.000   Required diverted fraction"
"            0   Conduit type; 1=Pipe;2=Channel"
"             Peak of diverted flow          0.000    c.m/sec"
"             Volume of diverted flow        0.000    c.m"
"             DIV03100.002hyd"
"             Major flow at 3100"
"                    0.043     0.043     0.043     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    0.043     0.043     0.043     0.000"
" 33          CATCHMENT 1000"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          1000   Catchment 1000"
"        50.000   % Impervious"
"        11.280   Total Area"
"        20.000   Flow length"
"         2.000   Overland Slope"
"         5.640   Pervious Area"
"        20.000   Pervious length"
"         2.000   Pervious slope"
"         5.640   Impervious Area"
"        20.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        78.000   Pervious SCS Curve No."
"         0.207   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         7.164   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.838   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                    1.014     0.043     0.043     0.000 c.m/sec"
"              Catchment 1000          Pervious   Impervious Total Area "
"              Surface Area            5.640      5.640      11.280     hectare"
"              Time of concentration   20.437     1.868      5.553      minutes"
"              Time to Centroid        125.085    88.659     95.887     minutes"
"              Rainfall depth          33.014     33.014     33.014     mm"
"              Rainfall volume         1861.98    1861.98    3723.96    c.m"
"              Rainfall losses         26.169     5.363      15.766     mm"
"              Runoff depth            6.845      27.651     17.248     mm"
"              Runoff volume           386.07     1559.50    1945.58    c.m"
"              Runoff coefficient      0.207      0.838      0.522      "
"              Maximum flow            0.110      1.008      1.014      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    1.014     1.057     0.043     0.000"
" 33          CATCHMENT 1100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          1100   Catchment 1100"
"         0.000   % Impervious"
"         0.470   Total Area"
"        20.000   Flow length"
```

```
"        2.000   Overland Slope"
"        0.470   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.207   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.009     1.057     0.043     0.000 c.m/sec"
"             Catchment 1100          Pervious   Impervious Total Area "
"             Surface Area            0.470      0.000      0.470      hectare"
"             Time of concentration   20.437     1.868      20.437     minutes"
"             Time to Centroid        125.085    88.659     125.085    minutes"
"             Rainfall depth          33.014     33.014     33.014     mm"
"             Rainfall volume         155.16     0.00       155.16     c.m"
"             Rainfall losses         26.169     5.363      26.169     mm"
"             Runoff depth            6.845      27.651     6.845      mm"
"             Runoff volume           32.17      0.00       32.17      c.m"
"             Runoff coefficient      0.207      0.000      0.207      "
"             Maximum flow            0.009      0.000      0.009      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.009     1.059     0.043     0.000"
" 54          POND DESIGN"
"        1.059   Current peak flow    c.m/sec"
"        0.756   Target outflow    c.m/sec"
"       2055.1   Hydrograph volume    c.m"
"          12.   Number of stages"
"        0.000   Minimum water level    metre"
"        3.000   Maximum water level    metre"
"        0.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                 411.000     0.000     0.000"
"                 411.100   0.00600   612.000"
"                 411.200   0.01300  1233.000"
"                 411.300   0.01700  1862.000"
"                 411.400   0.02000  2501.000"
"                 411.500   0.02300  3148.000"
"                 411.600   0.02600  3805.000"
"                 411.700    0.1570  4470.000"
"                 411.750    0.1630  4806.000"
"                 411.800    0.2450  5144.000"
"                 411.850    0.2520  5485.000"
"                 412.000     1.912  6295.000"
"             Peak outflow                  0.017    c.m/sec"
"             Maximum level               411.307    metre"
"             Maximum storage            1908.194    c.m"
"             Centroidal lag               29.598   hours"
"                0.009     1.059     0.017     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                  0.009     0.017     0.017     0.000"
" 33          CATCHMENT 4000"
```

```
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         4000   Catchment 4000"
"        0.000   % Impervious"
"        6.340   Total Area"
"       60.000   Flow length"
"        2.000   Overland Slope"
"        6.340   Pervious Area"
"       60.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       60.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.155   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.054     0.017     0.017     0.000 c.m/sec"
"              Catchment 4000          Pervious   Impervious Total Area "
"              Surface Area            6.340      0.000      6.340      hectare"
"              Time of concentration   45.052     3.611      45.052     minutes"
"              Time to Centroid        156.495    91.497     156.495    minutes"
"              Rainfall depth          33.014     33.014     33.014     mm"
"              Rainfall volume         2093.07    0.00       2093.08    c.m"
"              Rainfall losses         27.895     5.642      27.895     mm"
"              Runoff depth            5.119      27.372     5.119      mm"
"              Runoff volume           324.52     0.00       324.52     c.m"
"              Runoff coefficient      0.155      0.000      0.155      "
"              Maximum flow            0.054      0.000      0.054      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                     0.054     0.069     0.017     0.000"
" 54           POND DESIGN"
"        0.069   Current peak flow    c.m/sec"
"        0.756   Target outflow    c.m/sec"
"       2377.8   Hydrograph volume    c.m"
"           6.   Number of stages"
"      409.630   Minimum water level    metre"
"      410.750   Maximum water level    metre"
"      409.630   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                  409.630     0.000     0.000"
"                  409.750    0.5400   232.250"
"                  410.000     1.632  2017.880"
"                  410.250     3.737  5148.940"
"                  410.500     1.345  9472.330"
"                  410.750     1.885  15057.74"
"              Peak outflow                    0.067    c.m/sec"
"              Maximum level                 409.645    metre"
"              Maximum storage                28.760    c.m"
"              Centroidal lag                 26.034    hours"
"                   0.054     0.069     0.067     0.000 c.m/sec"
" 40           HYDROGRAPH Next link "
"             5   Next link "
"                     0.054     0.067     0.067     0.000"
```

```
" 52          CHANNEL DESIGN"
"        0.067   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        0.000   Basewidth    metre"
"        7.410   Left bank slope"
"        6.000   Right bank slope"
"        0.950   Channel depth    metre"
"        1.040   Gradient   %"
"             Depth of flow                  0.142    metre"
"             Velocity                       0.496    m/sec"
"             Channel capacity              10.655    c.m/sec"
"             Critical depth                 0.115    metre"
" 53          ROUTE    Channel Route 72"
"        72.40       Channel Route 72 Reach length   ( metre)"
"        0.465   X-factor <= 0.5"
"      109.515   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"      100.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                   0.067    c.m/sec"
"                    0.054     0.067     0.067     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    0.054     0.067     0.067     0.000"
" 52          CHANNEL DESIGN"
"        0.067   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        2.000   Basewidth    metre"
"        2.950   Left bank slope"
"        3.000   Right bank slope"
"        0.950   Channel depth    metre"
"        1.040   Gradient   %"
"             Depth of flow                  0.067    metre"
"             Velocity                       0.452    m/sec"
"             Channel capacity               9.246    c.m/sec"
"             Critical depth                 0.047    metre"
" 53          ROUTE    Channel Route 40"
"        39.80       Channel Route 40 Reach length   ( metre)"
"        0.452   X-factor <= 0.5"
"       66.003   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       60.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                   0.067    c.m/sec"
"                    0.054     0.067     0.067     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    0.054     0.067     0.067     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.054     0.067     0.067     0.000"
" 64          SHOW TABLE"
"            2   Flow hydrograph"
"            4   Inflow Hydrograph"
"             Maximum flow                   0.067    c.m/sec"
```

```
"            Hydrograph volume          2377.747    c.m"
" 40         HYDROGRAPH   Combine    999"
"           6   Combine "
"         999   Node #"
"               To Wetland"
"            Maximum flow                  0.067    c.m/sec"
"            Hydrograph volume          2377.747    c.m"
"                  0.054     0.067     0.067     0.067"
" 40         HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                 0.054     0.000     0.067     0.067"
" 47         FILEI_O Read/Open DIV03100.002hyd"
"           1   1=read/open; 2=write/save"
"           2   1=rainfall; 2=hydrograph"
"           1   1=runoff; 2=inflow; 3=outflow; 4=junction"
"            DIV03100.002hyd"
"            Major flow at 3100"
"            Total volume                  0.000    c.m"
"            Maximum flow                  0.000    c.m/sec"
"                 0.000     0.000     0.067     0.067 c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                 0.000     0.000     0.067     0.067"
" 33         CATCHMENT 3200"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"        3200   Catchment 3200"
"      60.000   % Impervious"
"       0.350   Total Area"
"      20.000   Flow length"
"       2.000   Overland Slope"
"       0.140   Pervious Area"
"      20.000   Pervious length"
"       2.000   Pervious slope"
"       0.210   Impervious Area"
"      20.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      78.000   Pervious SCS Curve No."
"       0.207   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"       7.164   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.838   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                 0.038     0.000     0.067     0.067 c.m/sec"
"            Catchment 3200          Pervious   Impervious Total Area "
"            Surface Area            0.140      0.210      0.350      hectare"
"            Time of concentration   20.437     1.868      4.499      minutes"
"            Time to Centroid        125.085    88.659     93.819     minutes"
"            Rainfall depth          33.014     33.014     33.014     mm"
"            Rainfall volume         46.22      69.33      115.55     c.m"
"            Rainfall losses         26.169     5.363      13.685     mm"
"            Runoff depth            6.845      27.651     19.329     mm"
"            Runoff volume           9.58       58.07      67.65      c.m"
"            Runoff coefficient      0.207      0.838      0.585      "
"            Maximum flow            0.003      0.038      0.038      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                 0.038     0.038     0.067     0.067"
```

```
" 33          CATCHMENT 3300"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         3300   Catchment 3300"
"       60.000   % Impervious"
"        0.220   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.088   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.132   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.207   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.838   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.024     0.038     0.067     0.067 c.m/sec"
"             Catchment 3300          Pervious   Impervious Total Area "
"             Surface Area            0.088      0.132      0.220      hectare"
"             Time of concentration   20.437     1.868      4.499      minutes"
"             Time to Centroid        125.085    88.659     93.819     minutes"
"             Rainfall depth          33.014     33.014     33.014     mm"
"             Rainfall volume         29.05      43.58      72.63      c.m"
"             Rainfall losses         26.169     5.363      13.685     mm"
"             Runoff depth            6.845      27.651     19.329     mm"
"             Runoff volume           6.02       36.50      42.52      c.m"
"             Runoff coefficient      0.207      0.838      0.585      "
"             Maximum flow            0.002      0.024      0.024      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.024     0.061     0.067     0.067"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.024     0.061     0.061     0.067"
" 64          SHOW TABLE"
"            2   Flow hydrograph"
"            4   Inflow Hydrograph"
"             Maximum flow                  0.061    c.m/sec"
"             Hydrograph volume           110.173    c.m"
" 40          HYDROGRAPH   Combine    999"
"            6   Combine "
"          999   Node #"
"                To Wetland"
"             Maximum flow                  0.073    c.m/sec"
"             Hydrograph volume          2487.915    c.m"
"                    0.024     0.061     0.061     0.073"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.024     0.000     0.061     0.073"
" 33          CATCHMENT 2100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2100   Catchment 2100"
```

```
"       60.000   % Impervious"
"        2.180   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.872   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        1.308   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.207   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.834   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.248     0.000     0.061     0.073 c.m/sec"
"             Catchment 2100          Pervious   Impervious Total Area "
"             Surface Area            0.872      1.308      2.180      hectare"
"             Time of concentration   30.977     2.832      6.834      minutes"
"             Time to Centroid        137.612    90.217     96.956     minutes"
"             Rainfall depth          33.014     33.014     33.014     mm"
"             Rainfall volume         287.88     431.82     719.70     c.m"
"             Rainfall losses         26.164     5.467      13.746     mm"
"             Runoff depth            6.850      27.547     19.268     mm"
"             Runoff volume           59.73      360.32     420.05     c.m"
"             Runoff coefficient      0.207      0.834      0.584      "
"             Maximum flow            0.013      0.245      0.248      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.248     0.248     0.061     0.073"
" 54          POND DESIGN"
"        0.248   Current peak flow    c.m/sec"
"        0.396   Target outflow    c.m/sec"
"        420.0   Hydrograph volume    c.m"
"          13.   Number of stages"
"        0.000   Minimum water level    metre"
"        3.000   Maximum water level    metre"
"        0.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                 410.650     0.000     0.000"
"                 410.700   0.00600    25.000"
"                 410.800   0.01300    79.000"
"                 410.900   0.02000   139.000"
"                 411.000   0.02500   206.000"
"                 411.100   0.02900   279.000"
"                 411.200   0.03200   359.000"
"                 411.300    0.2910   446.000"
"                 411.400    0.3210   540.000"
"                 411.500    0.3470   641.000"
"                 411.600    0.3720   750.000"
"                 411.650    0.3840   807.000"
"                 411.950     2.818  1195.000"
"             Peak outflow                  0.028    c.m/sec"
"             Maximum level               411.064    metre"
"             Maximum storage             252.820    c.m"
"             Centroidal lag                3.690   hours"
"                  0.248     0.248     0.028     0.073 c.m/sec"
```

```
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    0.248     0.028     0.028     0.073"
" 33          CATCHMENT 2200"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2200   Catchment 2200"
"        0.000   % Impervious"
"        0.910   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.910   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.207   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.014     0.028     0.028     0.073 c.m/sec"
"             Catchment 2200          Pervious   Impervious Total Area "
"             Surface Area            0.910      0.000      0.910      hectare"
"             Time of concentration   30.977     2.832      30.977     minutes"
"             Time to Centroid        137.612    90.217     137.612    minutes"
"             Rainfall depth          33.014     33.014     33.014     mm"
"             Rainfall volume         300.43     0.00       300.43     c.m"
"             Rainfall losses         26.164     5.467      26.164     mm"
"             Runoff depth            6.850      27.547     6.850      mm"
"             Runoff volume           62.33      0.00       62.33      c.m"
"             Runoff coefficient      0.207      0.000      0.207      "
"             Maximum flow            0.014      0.000      0.014      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.014     0.041     0.028     0.073"
" 33          CATCHMENT 2300"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2300   Catchment 2300"
"       10.000   % Impervious"
"        0.470   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.423   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.047   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.207   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
```

```
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.834   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.010     0.041     0.028     0.073 c.m/sec"
"             Catchment 2300          Pervious   Impervious Total Area "
"             Surface Area            0.423      0.047      0.470      hectare"
"             Time of concentration   30.977     2.832      22.285     minutes"
"             Time to Centroid        137.612    90.217     122.974    minutes"
"             Rainfall depth          33.014     33.014     33.014     mm"
"             Rainfall volume         139.65     15.52      155.16     c.m"
"             Rainfall losses         26.164     5.467      24.094     mm"
"             Runoff depth            6.850      27.547     8.919      mm"
"             Runoff volume           28.97      12.95      41.92      c.m"
"             Runoff coefficient      0.207      0.834      0.270      "
"             Maximum flow            0.006      0.009      0.010      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.010     0.048     0.028     0.073"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                    0.010     0.048     0.048     0.073"
" 64          SHOW TABLE"
"           2   Flow hydrograph"
"           4   Inflow Hydrograph"
"            Maximum flow                  0.048    c.m/sec"
"            Hydrograph volume           524.342    c.m"
" 40          HYDROGRAPH   Combine    999"
"           6   Combine "
"         999   Node #"
"               To Wetland"
"            Maximum flow                  0.116    c.m/sec"
"            Hydrograph volume          3012.260    c.m"
"                    0.010     0.048     0.048     0.116"
" 40          HYDROGRAPH   Confluence    999"
"           7   Confluence "
"         999   Node #"
"               To Wetland"
"            Maximum flow                  0.116    c.m/sec"
"            Hydrograph volume          3012.260    c.m"
"                    0.010     0.116     0.048     0.000"
" 38          START/RE-START TOTALS 999"
"           3   Runoff Totals on EXIT"
"            Total Catchment area                      22.620    hectare"
"            Total Impervious area                      7.577    hectare"
"            Total % impervious                        33.497"
" 19          EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                            Sunday, February 07, 2010"
"           10   Units used:                                                ie METRIC"
"                Job folder:                          C:\Users\akroetsch\Documents\"
"                                    Work in Progress\411009 Ainley Farm SWM Junk"
"                Output filename:                                  411009_5YR POST.out"
"                Licensee name:                                                 gmbp"
"                Company                                     Hewlett-Packard Company"
"                Date & Time last used:                      4/17/2017 at 3:43:15 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"    12000.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1459.072   Coefficient A"
"       13.690   Constant B"
"        0.850   Exponent C"
"        0.380   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          113.586    mm/hr"
"             Total depth                 49.792    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 3100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         3100   Catchment 3100"
"       60.000   % Impervious"
"        0.400   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.160   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.240   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.319   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.883   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.062     0.000     0.000     0.000 c.m/sec"
"             Catchment 3100          Pervious   Impervious Total Area "
"             Surface Area            0.160      0.240      0.400      hectare"
"             Time of concentration   14.957     1.691      4.264      minutes"
"             Time to Centroid        114.999    87.210     92.599     minutes"
"             Rainfall depth          49.792     49.792     49.792     mm"
"             Rainfall volume         79.67      119.50     199.17     c.m"
"             Rainfall losses         33.921     5.811      17.055     mm"
"             Runoff depth            15.871     43.981     32.737     mm"
"             Runoff volume           25.39      105.55     130.95     c.m"
"             Runoff coefficient      0.319      0.883      0.657      "
"             Maximum flow            0.009      0.059      0.062      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
```

```
"            4   Add Runoff "
"                    0.062     0.062     0.000     0.000"
" 56          DIVERSION"
"          3100   Node number"
"         0.062   Overflow threshold"
"         1.000   Required diverted fraction"
"             0   Conduit type; 1=Pipe;2=Channel"
"              Peak of diverted flow          0.000    c.m/sec"
"              Volume of diverted flow        0.000    c.m"
"              DIV03100.005hyd"
"              Major flow at 3100"
"                    0.062     0.062     0.062     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    0.062     0.062     0.062     0.000"
" 33          CATCHMENT 1000"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          1000   Catchment 1000"
"        50.000   % Impervious"
"        11.280   Total Area"
"        20.000   Flow length"
"         2.000   Overland Slope"
"         5.640   Pervious Area"
"        20.000   Pervious length"
"         2.000   Pervious slope"
"         5.640   Impervious Area"
"        20.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        78.000   Pervious SCS Curve No."
"         0.319   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         7.164   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.883   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                    1.493     0.062     0.062     0.000 c.m/sec"
"              Catchment 1000          Pervious   Impervious Total Area "
"              Surface Area            5.640      5.640      11.280     hectare"
"              Time of concentration   14.957     1.691      5.209      minutes"
"              Time to Centroid        115.000    87.210     94.579     minutes"
"              Rainfall depth          49.792     49.792     49.792     mm"
"              Rainfall volume         2808.25    2808.25    5616.50    c.m"
"              Rainfall losses         33.921     5.811      19.866     mm"
"              Runoff depth            15.871     43.981     29.926     mm"
"              Runoff volume           895.12     2480.51    3375.63    c.m"
"              Runoff coefficient      0.319      0.883      0.601      "
"              Maximum flow            0.329      1.386      1.493      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    1.493     1.555     0.062     0.000"
" 33          CATCHMENT 1100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          1100   Catchment 1100"
"         0.000   % Impervious"
"         0.470   Total Area"
"        20.000   Flow length"
```

```
"        2.000   Overland Slope"
"        0.470   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.319   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.027     1.555     0.062     0.000 c.m/sec"
"             Catchment 1100          Pervious   Impervious Total Area "
"             Surface Area            0.470      0.000      0.470      hectare"
"             Time of concentration   14.957     1.691      14.957     minutes"
"             Time to Centroid        115.000    87.210     114.999    minutes"
"             Rainfall depth          49.792     49.792     49.792     mm"
"             Rainfall volume         234.02     0.00       234.02     c.m"
"             Rainfall losses         33.921     5.811      33.921     mm"
"             Runoff depth            15.871     43.981     15.871     mm"
"             Runoff volume           74.59      0.00       74.59      c.m"
"             Runoff coefficient      0.319      0.000      0.319      "
"             Maximum flow            0.027      0.000      0.027      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.027     1.565     0.062     0.000"
" 54          POND DESIGN"
"        1.565   Current peak flow    c.m/sec"
"        0.756   Target outflow    c.m/sec"
"       3581.2   Hydrograph volume    c.m"
"         12.    Number of stages"
"        0.000   Minimum water level    metre"
"        3.000   Maximum water level    metre"
"        0.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                411.000     0.000     0.000"
"                411.100   0.00600   612.000"
"                411.200   0.01300  1233.000"
"                411.300   0.01700  1862.000"
"                411.400   0.02000  2501.000"
"                411.500   0.02300  3148.000"
"                411.600   0.02600  3805.000"
"                411.700    0.1570  4470.000"
"                411.750    0.1630  4806.000"
"                411.800    0.2450  5144.000"
"                411.850    0.2520  5485.000"
"                412.000     1.912  6295.000"
"             Peak outflow                    0.024    c.m/sec"
"             Maximum level                 411.535    metre"
"             Maximum storage              3379.855    c.m"
"             Centroidal lag                 32.923    hours"
"                  0.027     1.565     0.024     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                  0.027     0.024     0.024     0.000"
" 33          CATCHMENT 4000"
```

```
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"        4000   Catchment 4000"
"       0.000   % Impervious"
"       6.340   Total Area"
"      60.000   Flow length"
"       2.000   Overland Slope"
"       6.340   Pervious Area"
"      60.000   Pervious length"
"       2.000   Pervious slope"
"       0.000   Impervious Area"
"      60.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      74.000   Pervious SCS Curve No."
"       0.258   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"       8.924   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.000   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                 0.186     0.024     0.024     0.000 c.m/sec"
"            Catchment 4000          Pervious   Impervious Total Area "
"            Surface Area            6.340      0.000      6.340      hectare"
"            Time of concentration   31.736     3.269      31.736     minutes"
"            Time to Centroid        136.024    89.581     136.024    minutes"
"            Rainfall depth          49.792     49.792     49.792     mm"
"            Rainfall volume         3156.79    0.00       3156.79    c.m"
"            Rainfall losses         36.968     6.236      36.968     mm"
"            Runoff depth            12.824     43.556     12.824     mm"
"            Runoff volume           813.01     0.00       813.02     c.m"
"            Runoff coefficient      0.258      0.000      0.258      "
"            Maximum flow            0.186      0.000      0.186      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"          4   Add Runoff "
"                 0.186     0.206     0.024     0.000"
" 54         POND DESIGN"
"       0.206   Current peak flow    c.m/sec"
"       0.756   Target outflow    c.m/sec"
"      4390.5   Hydrograph volume    c.m"
"          6.   Number of stages"
"     409.630   Minimum water level    metre"
"     410.750   Maximum water level    metre"
"     409.630   Starting water level    metre"
"           0   Keep Design Data: 1 = True; 0 = False"
"                 Level Discharge    Volume"
"               409.630     0.000     0.000"
"               409.750    0.5400   232.250"
"               410.000     1.632  2017.880"
"               410.250     3.737  5148.940"
"               410.500     1.345  9472.330"
"               410.750     1.885  15057.74"
"            Peak outflow                  0.195    c.m/sec"
"            Maximum level               409.673    metre"
"            Maximum storage              83.982    c.m"
"            Centroidal lag               27.365   hours"
"                 0.186     0.206     0.195     0.000 c.m/sec"
" 40         HYDROGRAPH Next link "
"          5   Next link "
"                 0.186     0.195     0.195     0.000"
```

```
" 52          CHANNEL DESIGN"
"        0.195   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        0.000   Basewidth    metre"
"        7.410   Left bank slope"
"        6.000   Right bank slope"
"        0.950   Channel depth    metre"
"        1.040   Gradient   %"
"             Depth of flow                  0.212    metre"
"             Velocity                       0.648    m/sec"
"             Channel capacity              10.655    c.m/sec"
"             Critical depth                 0.177    metre"
" 53          ROUTE    Channel Route 72"
"        72.40      Channel Route 72 Reach length   ( metre)"
"        0.447   X-factor <= 0.5"
"       83.846   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       75.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                   0.194    c.m/sec"
"                    0.186     0.195     0.194     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    0.186     0.194     0.194     0.000"
" 52          CHANNEL DESIGN"
"        0.194   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        2.000   Basewidth    metre"
"        2.950   Left bank slope"
"        3.000   Right bank slope"
"        0.950   Channel depth    metre"
"        1.040   Gradient   %"
"             Depth of flow                  0.125    metre"
"             Velocity                       0.654    m/sec"
"             Channel capacity               9.246    c.m/sec"
"             Critical depth                 0.094    metre"
" 53          ROUTE    Channel Route 40"
"        39.80      Channel Route 40 Reach length   ( metre)"
"        0.413   X-factor <= 0.5"
"       45.609   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       50.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                   0.193    c.m/sec"
"                    0.186     0.194     0.193     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    0.186     0.193     0.193     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.186     0.193     0.193     0.000"
" 64          SHOW TABLE"
"            2   Flow hydrograph"
"            4   Inflow Hydrograph"
"             Maximum flow                   0.193    c.m/sec"
```

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"             Hydrograph volume          4390.465    c.m"
" 40          HYDROGRAPH   Combine    999"
"           6   Combine "
"         999   Node #"
"               To Wetland"
"             Maximum flow                  0.193    c.m/sec"
"             Hydrograph volume          4390.465    c.m"
"                    0.186     0.193     0.193     0.193"
" 40          HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                    0.186     0.000     0.193     0.193"
" 47          FILEI_O Read/Open DIV03100.005hyd"
"           1   1=read/open; 2=write/save"
"           2   1=rainfall; 2=hydrograph"
"           1   1=runoff; 2=inflow; 3=outflow; 4=junction"
"             DIV03100.005hyd"
"             Major flow at 3100"
"             Total volume                  0.000    c.m"
"             Maximum flow                  0.000    c.m/sec"
"                  0.000     0.000     0.193     0.193 c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.000     0.000     0.193     0.193"
" 33          CATCHMENT 3200"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"        3200   Catchment 3200"
"      60.000   % Impervious"
"       0.350   Total Area"
"      20.000   Flow length"
"       2.000   Overland Slope"
"       0.140   Pervious Area"
"      20.000   Pervious length"
"       2.000   Pervious slope"
"       0.210   Impervious Area"
"      20.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      78.000   Pervious SCS Curve No."
"       0.319   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"       7.164   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.883   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                    0.054     0.000     0.193     0.193 c.m/sec"
"             Catchment 3200          Pervious   Impervious Total Area "
"             Surface Area            0.140      0.210      0.350      hectare"
"             Time of concentration   14.957     1.691      4.264      minutes"
"             Time to Centroid        114.999    87.210     92.599     minutes"
"             Rainfall depth          49.792     49.792     49.792     mm"
"             Rainfall volume         69.71      104.56     174.27     c.m"
"             Rainfall losses         33.921     5.811      17.055     mm"
"             Runoff depth            15.871     43.981     32.737     mm"
"             Runoff volume           22.22      92.36      114.58     c.m"
"             Runoff coefficient      0.319      0.883      0.657      "
"             Maximum flow            0.008      0.052      0.054      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.054     0.054     0.193     0.193"
```

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" 33          CATCHMENT 3300"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         3300   Catchment 3300"
"       60.000   % Impervious"
"        0.220   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.088   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.132   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.319   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.883   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.034     0.054     0.193     0.193 c.m/sec"
"             Catchment 3300          Pervious   Impervious Total Area "
"             Surface Area            0.088      0.132      0.220      hectare"
"             Time of concentration   14.957     1.691      4.264      minutes"
"             Time to Centroid        115.000    87.210     92.599     minutes"
"             Rainfall depth          49.792     49.792     49.792     mm"
"             Rainfall volume         43.82      65.73      109.54     c.m"
"             Rainfall losses         33.921     5.811      17.055     mm"
"             Runoff depth            15.871     43.981     32.737     mm"
"             Runoff volume           13.97      58.05      72.02      c.m"
"             Runoff coefficient      0.319      0.883      0.657      "
"             Maximum flow            0.005      0.032      0.034      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.034     0.088     0.193     0.193"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                  0.034     0.088     0.088     0.193"
" 64          SHOW TABLE"
"            2   Flow hydrograph"
"            4   Inflow Hydrograph"
"             Maximum flow                  0.088    c.m/sec"
"             Hydrograph volume           186.600    c.m"
" 40          HYDROGRAPH   Combine    999"
"            6   Combine "
"          999   Node #"
"                To Wetland"
"             Maximum flow                  0.208    c.m/sec"
"             Hydrograph volume          4577.066    c.m"
"                  0.034     0.088     0.088     0.208"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                  0.034     0.000     0.088     0.208"
" 33          CATCHMENT 2100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2100   Catchment 2100"
```

```
"       60.000   % Impervious"
"        2.180   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.872   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        1.308   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.319   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.878   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.338     0.000     0.088     0.208 c.m/sec"
"             Catchment 2100          Pervious   Impervious Total Area "
"             Surface Area            0.872      1.308      2.180      hectare"
"             Time of concentration   22.670     2.563      6.484      minutes"
"             Time to Centroid        124.006    88.517     95.437     minutes"
"             Rainfall depth          49.792     49.792     49.792     mm"
"             Rainfall volume         434.18     651.28     1085.46    c.m"
"             Rainfall losses         33.904     6.066      17.201     mm"
"             Runoff depth            15.888     43.726     32.591     mm"
"             Runoff volume           138.54     571.94     710.48     c.m"
"             Runoff coefficient      0.319      0.878      0.655      "
"             Maximum flow            0.040      0.328      0.338      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.338     0.338     0.088     0.208"
" 54          POND DESIGN"
"        0.338   Current peak flow    c.m/sec"
"        0.396   Target outflow    c.m/sec"
"        710.5   Hydrograph volume    c.m"
"          13.   Number of stages"
"        0.000   Minimum water level    metre"
"        3.000   Maximum water level    metre"
"        0.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                410.650     0.000     0.000"
"                410.700   0.00600    25.000"
"                410.800   0.01300    79.000"
"                410.900   0.02000   139.000"
"                411.000   0.02500   206.000"
"                411.100   0.02900   279.000"
"                411.200   0.03200   359.000"
"                411.300    0.2910   446.000"
"                411.400    0.3210   540.000"
"                411.500    0.3470   641.000"
"                411.600    0.3720   750.000"
"                411.650    0.3840   807.000"
"                411.950     2.818  1195.000"
"             Peak outflow                    0.103    c.m/sec"
"             Maximum level                 411.227    metre"
"             Maximum storage               382.700    c.m"
"             Centroidal lag                  3.642   hours"
"                  0.338     0.338     0.103     0.208 c.m/sec"
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" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    0.338     0.103     0.103     0.208"
" 33          CATCHMENT 2200"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2200   Catchment 2200"
"        0.000   % Impervious"
"        0.910   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.910   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.319   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.042     0.103     0.103     0.208 c.m/sec"
"             Catchment 2200          Pervious   Impervious Total Area "
"             Surface Area            0.910      0.000      0.910      hectare"
"             Time of concentration   22.670     2.563      22.670     minutes"
"             Time to Centroid        124.006    88.517     124.005    minutes"
"             Rainfall depth          49.792     49.792     49.792     mm"
"             Rainfall volume         453.10     0.00       453.10     c.m"
"             Rainfall losses         33.904     6.066      33.904     mm"
"             Runoff depth            15.888     43.726     15.888     mm"
"             Runoff volume           144.58     0.00       144.58     c.m"
"             Runoff coefficient      0.319      0.000      0.319      "
"             Maximum flow            0.042      0.000      0.042      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.042     0.141     0.103     0.208"
" 33          CATCHMENT 2300"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2300   Catchment 2300"
"       10.000   % Impervious"
"        0.470   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.423   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.047   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.319   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
```

```
"        0.015    Impervious Manning 'n'"
"       98.000    Impervious SCS Curve No."
"        0.878    Impervious Runoff coefficient"
"        0.100    Impervious Ia/S coefficient"
"        0.518    Impervious Initial abstraction"
"                    0.023     0.141     0.103     0.208 c.m/sec"
"             Catchment 2300          Pervious   Impervious Total Area "
"             Surface Area            0.423      0.047      0.470      hectare"
"             Time of concentration   22.670     2.563      17.961     minutes"
"             Time to Centroid        124.006    88.517     115.695    minutes"
"             Rainfall depth          49.792     49.792     49.792     mm"
"             Rainfall volume         210.62     23.40      234.02     c.m"
"             Rainfall losses         33.904     6.066      31.120     mm"
"             Runoff depth            15.888     43.726     18.672     mm"
"             Runoff volume           67.21      20.55      87.76      c.m"
"             Runoff coefficient      0.319      0.878      0.375      "
"             Maximum flow            0.019      0.012      0.023      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.023     0.162     0.103     0.208"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                    0.023     0.162     0.162     0.208"
" 64          SHOW TABLE"
"           2   Flow hydrograph"
"           4   Inflow Hydrograph"
"            Maximum flow                  0.162    c.m/sec"
"            Hydrograph volume           944.229    c.m"
" 40          HYDROGRAPH   Combine    999"
"           6   Combine "
"         999   Node #"
"               To Wetland"
"            Maximum flow                  0.349    c.m/sec"
"            Hydrograph volume          5521.301    c.m"
"                    0.023     0.162     0.162     0.349"
" 40          HYDROGRAPH   Confluence    999"
"           7   Confluence "
"         999   Node #"
"               To Wetland"
"            Maximum flow                  0.349    c.m/sec"
"            Hydrograph volume          5521.301    c.m"
"                    0.023     0.349     0.162     0.000"
" 38          START/RE-START TOTALS 999"
"           3   Runoff Totals on EXIT"
"            Total Catchment area                      22.620    hectare"
"            Total Impervious area                      7.577    hectare"
"            Total % impervious                        33.497"
" 19          EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                            Sunday, February 07, 2010"
"           10   Units used:                                                ie METRIC"
"                Job folder:                          C:\Users\akroetsch\Documents\"
"                                      Work in Progress\411009 Ainley Farm SWM Junk"
"                Output filename:                                 411009_10YR POST.out"
"                Licensee name:                                                 gmbp"
"                Company                                    Hewlett-Packard Company"
"                Date & Time last used:                     4/17/2017 at 3:43:59 PM"
" 31          TIME PARAMETERS"
"       5.000   Time Step"
"     180.000   Max. Storm length"
"   12000.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"           1   Chicago storm"
"    2327.596   Coefficient A"
"      19.500   Constant B"
"       0.894   Exponent C"
"       0.380   Fraction R"
"     180.000   Duration"
"       1.000   Time step multiplier"
"            Maximum intensity          126.171    mm/hr"
"            Total depth                 61.359    mm"
"           6   010hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 3100"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"        3100   Catchment 3100"
"      60.000   % Impervious"
"       0.400   Total Area"
"      20.000   Flow length"
"       2.000   Overland Slope"
"       0.160   Pervious Area"
"      20.000   Pervious length"
"       2.000   Pervious slope"
"       0.240   Impervious Area"
"      20.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      78.000   Pervious SCS Curve No."
"       0.379   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"       7.164   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.901   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                    0.075     0.000     0.000     0.000 c.m/sec"
"            Catchment 3100          Pervious   Impervious Total Area "
"            Surface Area            0.160      0.240      0.400      hectare"
"            Time of concentration   13.094     1.611      4.125      minutes"
"            Time to Centroid        111.234    86.563     91.965     minutes"
"            Rainfall depth          61.359     61.359     61.359     mm"
"            Rainfall volume         98.17      147.26     245.44     c.m"
"            Rainfall losses         38.098     6.044      18.866     mm"
"            Runoff depth            23.262     55.315     42.494     mm"
"            Runoff volume           37.22      132.76     169.97     c.m"
"            Runoff coefficient      0.379      0.901      0.693      "
"            Maximum flow            0.014      0.069      0.075      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
```

```
"            4   Add Runoff "
"                    0.075     0.075     0.000     0.000"
" 56          DIVERSION"
"          3100   Node number"
"         0.062   Overflow threshold"
"         1.000   Required diverted fraction"
"             0   Conduit type; 1=Pipe;2=Channel"
"              Peak of diverted flow         0.013    c.m/sec"
"              Volume of diverted flow       6.527    c.m"
"              DIV03100.010hyd"
"              Major flow at 3100"
"                    0.075     0.075     0.062     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    0.075     0.062     0.062     0.000"
" 33          CATCHMENT 1000"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          1000   Catchment 1000"
"        50.000   % Impervious"
"        11.280   Total Area"
"        20.000   Flow length"
"         2.000   Overland Slope"
"         5.640   Pervious Area"
"        20.000   Pervious length"
"         2.000   Pervious slope"
"         5.640   Impervious Area"
"        20.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        78.000   Pervious SCS Curve No."
"         0.379   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         7.164   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.901   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                    1.840     0.062     0.062     0.000 c.m/sec"
"              Catchment 1000          Pervious   Impervious Total Area "
"              Surface Area            5.640      5.640      11.280     hectare"
"              Time of concentration   13.094     1.611      5.010      minutes"
"              Time to Centroid        111.234    86.563     93.866     minutes"
"              Rainfall depth          61.359     61.359     61.359     mm"
"              Rainfall volume         3460.66    3460.66    6921.32    c.m"
"              Rainfall losses         38.098     6.044      22.071     mm"
"              Runoff depth            23.262     55.315     39.288     mm"
"              Runoff volume           1311.96    3119.77    4431.73    c.m"
"              Runoff coefficient      0.379      0.901      0.640      "
"              Maximum flow            0.509      1.619      1.840      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    1.840     1.902     0.062     0.000"
" 33          CATCHMENT 1100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          1100   Catchment 1100"
"         0.000   % Impervious"
"         0.470   Total Area"
"        20.000   Flow length"
```

```
"        2.000   Overland Slope"
"        0.470   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.379   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.042     1.902     0.062     0.000 c.m/sec"
"             Catchment 1100          Pervious   Impervious Total Area "
"             Surface Area            0.470      0.000      0.470      hectare"
"             Time of concentration   13.094     1.611      13.094     minutes"
"             Time to Centroid        111.234    86.563     111.234    minutes"
"             Rainfall depth          61.359     61.359     61.359     mm"
"             Rainfall volume         288.39     0.00       288.39     c.m"
"             Rainfall losses         38.098     6.044      38.097     mm"
"             Runoff depth            23.262     55.315     23.262     mm"
"             Runoff volume           109.33     0.00       109.33     c.m"
"             Runoff coefficient      0.379      0.000      0.379      "
"             Maximum flow            0.042      0.000      0.042      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                  0.042     1.922     0.062     0.000"
" 54          POND DESIGN"
"        1.922   Current peak flow    c.m/sec"
"        0.756   Target outflow    c.m/sec"
"       4704.5   Hydrograph volume    c.m"
"          12.   Number of stages"
"        0.000   Minimum water level    metre"
"        3.000   Maximum water level    metre"
"        0.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                 411.000     0.000     0.000"
"                 411.100   0.00600   612.000"
"                 411.200   0.01300  1233.000"
"                 411.300   0.01700  1862.000"
"                 411.400   0.02000  2501.000"
"                 411.500   0.02300  3148.000"
"                 411.600   0.02600  3805.000"
"                 411.700    0.1570  4470.000"
"                 411.750    0.1630  4806.000"
"                 411.800    0.2450  5144.000"
"                 411.850    0.2520  5485.000"
"                 412.000     1.912  6295.000"
"             Peak outflow                  0.108    c.m/sec"
"             Maximum level               411.663    metre"
"             Maximum storage            4221.662    c.m"
"             Centroidal lag               30.799   hours"
"                0.042     1.922     0.108     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"           5   Next link "
"                  0.042     0.108     0.108     0.000"
" 33          CATCHMENT 4000"
```

```
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         4000   Catchment 4000"
"        0.000   % Impervious"
"        6.340   Total Area"
"       60.000   Flow length"
"        2.000   Overland Slope"
"        6.340   Pervious Area"
"       60.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       60.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.316   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.320     0.108     0.108     0.000 c.m/sec"
"             Catchment 4000          Pervious   Impervious Total Area "
"             Surface Area            6.340      0.000      6.340      hectare"
"             Time of concentration   27.416     3.114      27.416     minutes"
"             Time to Centroid        128.990    88.727     128.990    minutes"
"             Rainfall depth          61.359     61.359     61.359     mm"
"             Rainfall volume         3890.17    0.00       3890.18    c.m"
"             Rainfall losses         41.968     6.469      41.968     mm"
"             Runoff depth            19.392     54.890     19.392     mm"
"             Runoff volume           1229.42    0.00       1229.42    c.m"
"             Runoff coefficient      0.316      0.000      0.316      "
"             Maximum flow            0.320      0.000      0.320      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.320     0.343     0.108     0.000"
" 54          POND DESIGN"
"        0.343   Current peak flow    c.m/sec"
"        0.756   Target outflow    c.m/sec"
"       5929.3   Hydrograph volume    c.m"
"           6.   Number of stages"
"      409.630   Minimum water level    metre"
"      410.750   Maximum water level    metre"
"      409.630   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                409.630     0.000     0.000"
"                409.750    0.5400   232.250"
"                410.000     1.632  2017.880"
"                410.250     3.737  5148.940"
"                410.500     1.345  9472.330"
"                410.750     1.885  15057.74"
"             Peak outflow                    0.319    c.m/sec"
"             Maximum level                 409.701    metre"
"             Maximum storage               137.358    c.m"
"             Centroidal lag                 24.978    hours"
"                  0.320     0.343     0.319     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    0.320     0.319     0.319     0.000"
```

```
" 52          CHANNEL DESIGN"
"         0.319   Current peak flow    c.m/sec"
"         0.035   Manning 'n'"
"            0.   Cross-section type: 0=trapezoidal; 1=general"
"         0.000   Basewidth    metre"
"         7.410   Left bank slope"
"         6.000   Right bank slope"
"         0.950   Channel depth    metre"
"         1.040   Gradient   %"
"              Depth of flow                  0.255    metre"
"              Velocity                       0.732    m/sec"
"              Channel capacity              10.655    c.m/sec"
"              Critical depth                 0.215    metre"
" 53          ROUTE    Channel Route 72"
"         72.40      Channel Route 72 Reach length   ( metre)"
"         0.437   X-factor <= 0.5"
"        74.139   K-lag   ( seconds)"
"         0.000   Default(0) or user spec.(1) values used"
"         0.500   X-factor <= 0.5"
"        30.000   K-lag   ( seconds)"
"         0.500   Beta weighting factor"
"        75.000   Routing time step   ( seconds)"
"             1   No. of sub-reaches"
"              Peak outflow                   0.316    c.m/sec"
"                     0.320     0.319     0.316     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"             5   Next link "
"                     0.320     0.316     0.316     0.000"
" 52          CHANNEL DESIGN"
"         0.316   Current peak flow    c.m/sec"
"         0.035   Manning 'n'"
"            0.   Cross-section type: 0=trapezoidal; 1=general"
"         2.000   Basewidth    metre"
"         2.950   Left bank slope"
"         3.000   Right bank slope"
"         0.950   Channel depth    metre"
"         1.040   Gradient   %"
"              Depth of flow                  0.165    metre"
"              Velocity                       0.768    m/sec"
"              Channel capacity               9.246    c.m/sec"
"              Critical depth                 0.128    metre"
" 53          ROUTE    Channel Route 40"
"         39.80      Channel Route 40 Reach length   ( metre)"
"         0.387   X-factor <= 0.5"
"        38.845   K-lag   ( seconds)"
"         0.000   Default(0) or user spec.(1) values used"
"         0.500   X-factor <= 0.5"
"        30.000   K-lag   ( seconds)"
"         0.500   Beta weighting factor"
"        42.857   Routing time step   ( seconds)"
"             1   No. of sub-reaches"
"              Peak outflow                   0.316    c.m/sec"
"                     0.320     0.316     0.316     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"             5   Next link "
"                     0.320     0.316     0.316     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"             8   Copy to Outflow"
"                     0.320     0.316     0.316     0.000"
" 64          SHOW TABLE"
"             2   Flow hydrograph"
"             4   Inflow Hydrograph"
"              Maximum flow                   0.316    c.m/sec"
```

```
"             Hydrograph volume          5929.319    c.m"
" 40          HYDROGRAPH   Combine    999"
"           6   Combine "
"         999   Node #"
"               To Wetland"
"             Maximum flow                  0.316    c.m/sec"
"             Hydrograph volume          5929.319    c.m"
"                   0.320     0.316     0.316     0.316"
" 40          HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                   0.320     0.000     0.316     0.316"
" 47          FILEI_O Read/Open DIV03100.010hyd"
"           1   1=read/open; 2=write/save"
"           2   1=rainfall; 2=hydrograph"
"           1   1=runoff; 2=inflow; 3=outflow; 4=junction"
"             DIV03100.010hyd"
"             Major flow at 3100"
"             Total volume                  6.527    c.m"
"             Maximum flow                  0.013    c.m/sec"
"                  0.013     0.000     0.316     0.316 c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                   0.013     0.013     0.316     0.316"
" 33          CATCHMENT 3200"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"        3200   Catchment 3200"
"      60.000   % Impervious"
"       0.350   Total Area"
"      20.000   Flow length"
"       2.000   Overland Slope"
"       0.140   Pervious Area"
"      20.000   Pervious length"
"       2.000   Pervious slope"
"       0.210   Impervious Area"
"      20.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      78.000   Pervious SCS Curve No."
"       0.379   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"       7.164   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.901   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                   0.066     0.013     0.316     0.316 c.m/sec"
"             Catchment 3200          Pervious   Impervious Total Area "
"             Surface Area            0.140      0.210      0.350      hectare"
"             Time of concentration   13.094     1.611      4.125      minutes"
"             Time to Centroid        111.234    86.563     91.965     minutes"
"             Rainfall depth          61.359     61.359     61.359     mm"
"             Rainfall volume         85.90      128.85     214.76     c.m"
"             Rainfall losses         38.098     6.044      18.866     mm"
"             Runoff depth            23.262     55.315     42.494     mm"
"             Runoff volume           32.57      116.16     148.73     c.m"
"             Runoff coefficient      0.379      0.901      0.693      "
"             Maximum flow            0.013      0.060      0.066      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                   0.066     0.078     0.316     0.316"
```

```
" 33          CATCHMENT 3300"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"          3300   Catchment 3300"
"        60.000   % Impervious"
"         0.220   Total Area"
"        20.000   Flow length"
"         2.000   Overland Slope"
"         0.088   Pervious Area"
"        20.000   Pervious length"
"         2.000   Pervious slope"
"         0.132   Impervious Area"
"        20.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        78.000   Pervious SCS Curve No."
"         0.379   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         7.164   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.901   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                      0.041     0.078     0.316     0.316 c.m/sec"
"              Catchment 3300          Pervious   Impervious Total Area "
"              Surface Area            0.088      0.132      0.220      hectare"
"              Time of concentration   13.094     1.611      4.125      minutes"
"              Time to Centroid        111.234    86.563     91.965     minutes"
"              Rainfall depth          61.359     61.359     61.359     mm"
"              Rainfall volume         54.00      80.99      134.99     c.m"
"              Rainfall losses         38.098     6.044      18.866     mm"
"              Runoff depth            23.262     55.315     42.494     mm"
"              Runoff volume           20.47      73.02      93.49      c.m"
"              Runoff coefficient      0.379      0.901      0.693      "
"              Maximum flow            0.008      0.038      0.041      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                      0.041     0.120     0.316     0.316"
" 40          HYDROGRAPH Copy to Outflow"
"             8   Copy to Outflow"
"                      0.041     0.120     0.120     0.316"
" 64          SHOW TABLE"
"             2   Flow hydrograph"
"             4   Inflow Hydrograph"
"              Maximum flow                  0.120    c.m/sec"
"              Hydrograph volume           248.741    c.m"
" 40          HYDROGRAPH   Combine    999"
"             6   Combine "
"           999   Node #"
"                 To Wetland"
"              Maximum flow                  0.338    c.m/sec"
"              Hydrograph volume          6178.059    c.m"
"                      0.041     0.120     0.120     0.338"
" 40          HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                      0.041     0.000     0.120     0.338"
" 33          CATCHMENT 2100"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"          2100   Catchment 2100"
```

```
"       60.000   % Impervious"
"        2.180   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.872   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        1.308   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.380   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.897   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.400     0.000     0.120     0.338 c.m/sec"
"             Catchment 2100          Pervious   Impervious Total Area "
"             Surface Area            0.872      1.308      2.180      hectare"
"             Time of concentration   19.847     2.441      6.272      minutes"
"             Time to Centroid        118.992    87.742     94.620     minutes"
"             Rainfall depth          61.359     61.359     61.359     mm"
"             Rainfall volume         535.05     802.58     1337.63    c.m"
"             Rainfall losses         38.054     6.310      19.008     mm"
"             Runoff depth            23.305     55.050     42.352     mm"
"             Runoff volume           203.22     720.05     923.27     c.m"
"             Runoff coefficient      0.380      0.897      0.690      "
"             Maximum flow            0.065      0.381      0.400      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.400     0.400     0.120     0.338"
" 54          POND DESIGN"
"        0.400   Current peak flow    c.m/sec"
"        0.396   Target outflow    c.m/sec"
"        923.3   Hydrograph volume    c.m"
"          13.   Number of stages"
"        0.000   Minimum water level    metre"
"        3.000   Maximum water level    metre"
"        0.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                410.650     0.000     0.000"
"                410.700   0.00600    25.000"
"                410.800   0.01300    79.000"
"                410.900   0.02000   139.000"
"                411.000   0.02500   206.000"
"                411.100   0.02900   279.000"
"                411.200   0.03200   359.000"
"                411.300    0.2910   446.000"
"                411.400    0.3210   540.000"
"                411.500    0.3470   641.000"
"                411.600    0.3720   750.000"
"                411.650    0.3840   807.000"
"                411.950     2.818  1195.000"
"             Peak outflow                  0.195    c.m/sec"
"             Maximum level               411.263    metre"
"             Maximum storage             413.673    c.m"
"             Centroidal lag                3.255   hours"
"                  0.400     0.400     0.195     0.338 c.m/sec"
```

```
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    0.400     0.195     0.195     0.338"
" 33          CATCHMENT 2200"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2200   Catchment 2200"
"        0.000   % Impervious"
"        0.910   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.910   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.380   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.067     0.195     0.195     0.338 c.m/sec"
"             Catchment 2200          Pervious   Impervious Total Area "
"             Surface Area            0.910      0.000      0.910      hectare"
"             Time of concentration   19.847     2.441      19.847     minutes"
"             Time to Centroid        118.992    87.742     118.992    minutes"
"             Rainfall depth          61.359     61.359     61.359     mm"
"             Rainfall volume         558.37     0.00       558.37     c.m"
"             Rainfall losses         38.054     6.310      38.054     mm"
"             Runoff depth            23.305     55.050     23.305     mm"
"             Runoff volume           212.07     0.00       212.07     c.m"
"             Runoff coefficient      0.380      0.000      0.380      "
"             Maximum flow            0.067      0.000      0.067      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.067     0.262     0.195     0.338"
" 33          CATCHMENT 2300"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2300   Catchment 2300"
"       10.000   % Impervious"
"        0.470   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.423   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.047   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.380   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
```

```
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.897   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.036     0.262     0.195     0.338 c.m/sec"
"             Catchment 2300          Pervious   Impervious Total Area "
"             Surface Area            0.423      0.047      0.470      hectare"
"             Time of concentration   19.847     2.441      16.228     minutes"
"             Time to Centroid        118.992    87.742     112.496    minutes"
"             Rainfall depth          61.359     61.359     61.359     mm"
"             Rainfall volume         259.55     28.84      288.39     c.m"
"             Rainfall losses         38.054     6.310      34.880     mm"
"             Runoff depth            23.305     55.050     26.479     mm"
"             Runoff volume           98.58      25.87      124.45     c.m"
"             Runoff coefficient      0.380      0.897      0.432      "
"             Maximum flow            0.031      0.014      0.036      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.036     0.298     0.195     0.338"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                    0.036     0.298     0.298     0.338"
" 64          SHOW TABLE"
"           2   Flow hydrograph"
"           4   Inflow Hydrograph"
"            Maximum flow                  0.298    c.m/sec"
"            Hydrograph volume          1256.451    c.m"
" 40          HYDROGRAPH   Combine    999"
"           6   Combine "
"         999   Node #"
"               To Wetland"
"            Maximum flow                  0.566    c.m/sec"
"            Hydrograph volume          7434.511    c.m"
"                    0.036     0.298     0.298     0.566"
" 40          HYDROGRAPH   Confluence    999"
"           7   Confluence "
"         999   Node #"
"               To Wetland"
"            Maximum flow                  0.566    c.m/sec"
"            Hydrograph volume          7434.511    c.m"
"                    0.036     0.566     0.298     0.000"
" 38          START/RE-START TOTALS 999"
"           3   Runoff Totals on EXIT"
"            Total Catchment area                      22.620    hectare"
"            Total Impervious area                      7.577    hectare"
"            Total % impervious                        33.497"
" 19          EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                          Sunday, February 07, 2010"
"           10   Units used:                                              ie METRIC"
"                Job folder:                        C:\Users\akroetsch\Documents\"
"                                    Work in Progress\411009 Ainley Farm SWM Junk"
"                Output filename:                                 411009_25YR POST.out"
"                Licensee name:                                                 gmbp"
"                Company                                    Hewlett-Packard Company"
"                Date & Time last used:                     4/17/2017 at 3:44:40 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"    12000.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     3701.648   Coefficient A"
"       25.500   Constant B"
"        0.937   Exponent C"
"        0.380   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          143.371    mm/hr"
"             Total depth                 75.581    mm"
"            6   025hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 3100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         3100   Catchment 3100"
"       60.000   % Impervious"
"        0.400   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.160   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.240   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.441   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.916   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.092     0.000     0.000     0.000 c.m/sec"
"             Catchment 3100         Pervious   Impervious Total Area "
"             Surface Area           0.160      0.240      0.400      hectare"
"             Time of concentration  11.553     1.523      3.959      minutes"
"             Time to Centroid       108.042    85.984     91.342     minutes"
"             Rainfall depth         75.581     75.581     75.581     mm"
"             Rainfall volume        120.93     181.39     302.32     c.m"
"             Rainfall losses        42.253     6.330      20.699     mm"
"             Runoff depth           33.328     69.250     54.882     mm"
"             Runoff volume          53.32      166.20     219.53     c.m"
"             Runoff coefficient     0.441      0.916      0.726      "
"             Maximum flow           0.022      0.081      0.092      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
```

```
"            4   Add Runoff "
"                    0.092     0.092     0.000     0.000"
" 56          DIVERSION"
"          3100   Node number"
"         0.062   Overflow threshold"
"         1.000   Required diverted fraction"
"            0   Conduit type; 1=Pipe;2=Channel"
"             Peak of diverted flow          0.030    c.m/sec"
"             Volume of diverted flow       20.839    c.m"
"             DIV03100.025hyd"
"             Major flow at 3100"
"                    0.092     0.092     0.062     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    0.092     0.062     0.062     0.000"
" 33          CATCHMENT 1000"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          1000   Catchment 1000"
"        50.000   % Impervious"
"        11.280   Total Area"
"        20.000   Flow length"
"         2.000   Overland Slope"
"         5.640   Pervious Area"
"        20.000   Pervious length"
"         2.000   Pervious slope"
"         5.640   Impervious Area"
"        20.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        78.000   Pervious SCS Curve No."
"         0.441   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         7.164   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.916   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                    2.321     0.062     0.062     0.000 c.m/sec"
"              Catchment 1000          Pervious   Impervious Total Area "
"              Surface Area            5.640      5.640      11.280     hectare"
"              Time of concentration   11.553     1.523      4.782      minutes"
"              Time to Centroid        108.042    85.984     93.151     minutes"
"              Rainfall depth          75.581     75.581     75.581     mm"
"              Rainfall volume         4262.76    4262.76    8525.52    c.m"
"              Rainfall losses         42.253     6.330      24.292     mm"
"              Runoff depth            33.328     69.250     51.289     mm"
"              Runoff volume           1879.71    3905.72    5785.43    c.m"
"              Runoff coefficient      0.441      0.916      0.679      "
"              Maximum flow            0.765      1.907      2.321      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    2.321     2.383     0.062     0.000"
" 33          CATCHMENT 1100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          1100   Catchment 1100"
"         0.000   % Impervious"
"         0.470   Total Area"
"        20.000   Flow length"
```

```
"        2.000   Overland Slope"
"        0.470   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.441   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.064     2.383     0.062     0.000 c.m/sec"
"             Catchment 1100          Pervious   Impervious Total Area "
"             Surface Area            0.470      0.000      0.470      hectare"
"             Time of concentration   11.553     1.523      11.553     minutes"
"             Time to Centroid        108.042    85.984     108.042    minutes"
"             Rainfall depth          75.581     75.581     75.581     mm"
"             Rainfall volume         355.23     0.00       355.23     c.m"
"             Rainfall losses         42.253     6.330      42.253     mm"
"             Runoff depth            33.328     69.250     33.328     mm"
"             Runoff volume           156.64     0.00       156.64     c.m"
"             Runoff coefficient      0.441      0.000      0.441      "
"             Maximum flow            0.064      0.000      0.064      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.064     2.420     0.062     0.000"
" 54          POND DESIGN"
"        2.420   Current peak flow    c.m/sec"
"        0.756   Target outflow    c.m/sec"
"       6140.8   Hydrograph volume    c.m"
"          12.   Number of stages"
"        0.000   Minimum water level    metre"
"        3.000   Maximum water level    metre"
"        0.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                411.000     0.000     0.000"
"                411.100   0.00600   612.000"
"                411.200   0.01300  1233.000"
"                411.300   0.01700  1862.000"
"                411.400   0.02000  2501.000"
"                411.500   0.02300  3148.000"
"                411.600   0.02600  3805.000"
"                411.700    0.1570  4470.000"
"                411.750    0.1630  4806.000"
"                411.800    0.2450  5144.000"
"                411.850    0.2520  5485.000"
"                412.000     1.912  6295.000"
"             Peak outflow                    0.220    c.m/sec"
"             Maximum level                 411.785    metre"
"             Maximum storage              5041.114    c.m"
"             Centroidal lag                 25.177    hours"
"                  0.064     2.420     0.220     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                  0.064     0.220     0.220     0.000"
" 33          CATCHMENT 4000"
```

```
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"        4000   Catchment 4000"
"       0.000   % Impervious"
"       6.340   Total Area"
"      60.000   Flow length"
"       2.000   Overland Slope"
"       6.340   Pervious Area"
"      60.000   Pervious length"
"       2.000   Pervious slope"
"       0.000   Impervious Area"
"      60.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      74.000   Pervious SCS Curve No."
"       0.377   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"       8.924   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.000   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                   0.520     0.220     0.220     0.000 c.m/sec"
"            Catchment 4000          Pervious   Impervious Total Area "
"            Surface Area            6.340      0.000      6.340      hectare"
"            Time of concentration   23.913     2.944      23.913     minutes"
"            Time to Centroid        123.357    87.974     123.357    minutes"
"            Rainfall depth          75.581     75.581     75.581     mm"
"            Rainfall volume         4791.82    0.00       4791.83    c.m"
"            Rainfall losses         47.108     6.942      47.107     mm"
"            Runoff depth            28.473     68.639     28.473     mm"
"            Runoff volume           1805.21    0.00       1805.21    c.m"
"            Runoff coefficient      0.377      0.000      0.377      "
"            Maximum flow            0.520      0.000      0.520      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"          4   Add Runoff "
"                   0.520     0.615     0.220     0.000"
" 54         POND DESIGN"
"       0.615   Current peak flow    c.m/sec"
"       0.756   Target outflow    c.m/sec"
"      7942.9   Hydrograph volume    c.m"
"          6.   Number of stages"
"     409.630   Minimum water level    metre"
"     410.750   Maximum water level    metre"
"     409.630   Starting water level    metre"
"           0   Keep Design Data: 1 = True; 0 = False"
"                 Level Discharge    Volume"
"                 409.630     0.000     0.000"
"                 409.750    0.5400   232.250"
"                 410.000     1.632  2017.880"
"                 410.250     3.737  5148.940"
"                 410.500     1.345  9472.330"
"                 410.750     1.885  15057.74"
"            Peak outflow                  0.555    c.m/sec"
"            Maximum level               409.753    metre"
"            Maximum storage             256.902    c.m"
"            Centroidal lag               20.043   hours"
"                 0.520     0.615     0.555     0.000 c.m/sec"
" 40         HYDROGRAPH Next link "
"          5   Next link "
"                   0.520     0.555     0.555     0.000"
```

```
" 52          CHANNEL DESIGN"
"        0.555   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        0.000   Basewidth    metre"
"        7.410   Left bank slope"
"        6.000   Right bank slope"
"        0.950   Channel depth    metre"
"        1.040   Gradient   %"
"             Depth of flow                  0.314    metre"
"             Velocity                       0.841    m/sec"
"             Channel capacity              10.655    c.m/sec"
"             Critical depth                 0.269    metre"
" 53          ROUTE    Channel Route 72"
"        72.40       Channel Route 72 Reach length   ( metre)"
"        0.422   X-factor <= 0.5"
"       64.553   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       60.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                   0.554    c.m/sec"
"                    0.520     0.555     0.554     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    0.520     0.554     0.554     0.000"
" 52          CHANNEL DESIGN"
"        0.554   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        2.000   Basewidth    metre"
"        2.950   Left bank slope"
"        3.000   Right bank slope"
"        0.950   Channel depth    metre"
"        1.040   Gradient   %"
"             Depth of flow                  0.226    metre"
"             Velocity                       0.917    m/sec"
"             Channel capacity               9.246    c.m/sec"
"             Critical depth                 0.181    metre"
" 53          ROUTE    Channel Route 40"
"        39.80       Channel Route 40 Reach length   ( metre)"
"        0.349   X-factor <= 0.5"
"       32.539   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       37.500   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                   0.553    c.m/sec"
"                    0.520     0.554     0.553     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    0.520     0.553     0.553     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.520     0.553     0.553     0.000"
" 64          SHOW TABLE"
"            2   Flow hydrograph"
"            4   Inflow Hydrograph"
"             Maximum flow                   0.553    c.m/sec"
```

```
"            Hydrograph volume          7942.502    c.m"
" 40         HYDROGRAPH   Combine    999"
"           6   Combine "
"         999   Node #"
"               To Wetland"
"            Maximum flow                 0.553    c.m/sec"
"            Hydrograph volume         7942.502    c.m"
"                   0.520     0.553     0.553     0.553"
" 40         HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                   0.520     0.000     0.553     0.553"
" 47         FILEI_O Read/Open DIV03100.025hyd"
"           1   1=read/open; 2=write/save"
"           2   1=rainfall; 2=hydrograph"
"           1   1=runoff; 2=inflow; 3=outflow; 4=junction"
"            DIV03100.025hyd"
"            Major flow at 3100"
"            Total volume                20.839    c.m"
"            Maximum flow                 0.030    c.m/sec"
"                0.030     0.000     0.553     0.553 c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                   0.030     0.030     0.553     0.553"
" 33         CATCHMENT 3200"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"        3200   Catchment 3200"
"      60.000   % Impervious"
"       0.350   Total Area"
"      20.000   Flow length"
"       2.000   Overland Slope"
"       0.140   Pervious Area"
"      20.000   Pervious length"
"       2.000   Pervious slope"
"       0.210   Impervious Area"
"      20.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      78.000   Pervious SCS Curve No."
"       0.441   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"       7.164   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.916   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                   0.081     0.030     0.553     0.553 c.m/sec"
"            Catchment 3200          Pervious   Impervious Total Area "
"            Surface Area            0.140      0.210      0.350      hectare"
"            Time of concentration   11.553     1.523      3.959      minutes"
"            Time to Centroid        108.042    85.984     91.342     minutes"
"            Rainfall depth          75.581     75.581     75.581     mm"
"            Rainfall volume         105.81     158.72     264.53     c.m"
"            Rainfall losses         42.253     6.330      20.699     mm"
"            Runoff depth            33.328     69.250     54.881     mm"
"            Runoff volume           46.66      145.43     192.09     c.m"
"            Runoff coefficient      0.441      0.916      0.726      "
"            Maximum flow            0.019      0.071      0.081      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                   0.081     0.111     0.553     0.553"
```

```
" 33          CATCHMENT 3300"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         3300   Catchment 3300"
"       60.000   % Impervious"
"        0.220   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.088   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.132   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.441   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.916   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.051     0.111     0.553     0.553 c.m/sec"
"             Catchment 3300          Pervious   Impervious Total Area "
"             Surface Area            0.088      0.132      0.220      hectare"
"             Time of concentration   11.553     1.523      3.959      minutes"
"             Time to Centroid        108.042    85.984     91.342     minutes"
"             Rainfall depth          75.581     75.581     75.581     mm"
"             Rainfall volume         66.51      99.77      166.28     c.m"
"             Rainfall losses         42.253     6.330      20.699     mm"
"             Runoff depth            33.328     69.250     54.881     mm"
"             Runoff volume           29.33      91.41      120.74     c.m"
"             Runoff coefficient      0.441      0.916      0.726      "
"             Maximum flow            0.012      0.045      0.051      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.051     0.162     0.553     0.553"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.051     0.162     0.162     0.553"
" 64          SHOW TABLE"
"            2   Flow hydrograph"
"            4   Inflow Hydrograph"
"             Maximum flow                  0.162    c.m/sec"
"             Hydrograph volume           333.663    c.m"
" 40          HYDROGRAPH   Combine    999"
"            6   Combine "
"          999   Node #"
"                To Wetland"
"             Maximum flow                  0.582    c.m/sec"
"             Hydrograph volume          8276.165    c.m"
"                    0.051     0.162     0.162     0.582"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.051     0.000     0.162     0.582"
" 33          CATCHMENT 2100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2100   Catchment 2100"
```

```
"       60.000   % Impervious"
"        2.180   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.872   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        1.308   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.442   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.913   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.483     0.000     0.162     0.582 c.m/sec"
"             Catchment 2100          Pervious   Impervious Total Area "
"             Surface Area            0.872      1.308      2.180      hectare"
"             Time of concentration   17.510     2.308      6.016      minutes"
"             Time to Centroid        114.842    87.059     93.835     minutes"
"             Rainfall depth          75.581     75.581     75.581     mm"
"             Rainfall volume         659.06     988.60     1647.66    c.m"
"             Rainfall losses         42.200     6.593      20.835     mm"
"             Runoff depth            33.381     68.988     54.745     mm"
"             Runoff volume           291.08     902.37     1193.45    c.m"
"             Runoff coefficient      0.442      0.913      0.724      "
"             Maximum flow            0.100      0.447      0.483      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.483     0.483     0.162     0.582"
" 54          POND DESIGN"
"        0.483   Current peak flow    c.m/sec"
"        0.396   Target outflow    c.m/sec"
"       1193.5   Hydrograph volume    c.m"
"          13.   Number of stages"
"        0.000   Minimum water level    metre"
"        3.000   Maximum water level    metre"
"        0.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                410.650     0.000     0.000"
"                410.700   0.00600    25.000"
"                410.800   0.01300    79.000"
"                410.900   0.02000   139.000"
"                411.000   0.02500   206.000"
"                411.100   0.02900   279.000"
"                411.200   0.03200   359.000"
"                411.300    0.2910   446.000"
"                411.400    0.3210   540.000"
"                411.500    0.3470   641.000"
"                411.600    0.3720   750.000"
"                411.650    0.3840   807.000"
"                411.950     2.818  1195.000"
"             Peak outflow                    0.294    c.m/sec"
"             Maximum level                 411.311    metre"
"             Maximum storage               456.530    c.m"
"             Centroidal lag                  2.925   hours"
"                  0.483     0.483     0.294     0.582 c.m/sec"
```

```
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    0.483     0.294     0.294     0.582"
" 33          CATCHMENT 2200"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2200   Catchment 2200"
"        0.000   % Impervious"
"        0.910   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.910   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.442   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.105     0.294     0.294     0.582 c.m/sec"
"             Catchment 2200          Pervious   Impervious Total Area "
"             Surface Area            0.910      0.000      0.910      hectare"
"             Time of concentration   17.510     2.308      17.510     minutes"
"             Time to Centroid        114.842    87.059     114.842    minutes"
"             Rainfall depth          75.581     75.581     75.581     mm"
"             Rainfall volume         687.78     0.00       687.79     c.m"
"             Rainfall losses         42.200     6.593      42.199     mm"
"             Runoff depth            33.381     68.988     33.381     mm"
"             Runoff volume           303.77     0.00       303.77     c.m"
"             Runoff coefficient      0.442      0.000      0.442      "
"             Maximum flow            0.105      0.000      0.105      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.105     0.398     0.294     0.582"
" 33          CATCHMENT 2300"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2300   Catchment 2300"
"       10.000   % Impervious"
"        0.470   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.423   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.047   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.442   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
```

```
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.913   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.055     0.398     0.294     0.582 c.m/sec"
"            Catchment 2300          Pervious   Impervious Total Area "
"            Surface Area            0.423      0.047      0.470      hectare"
"            Time of concentration   17.510     2.308      14.671     minutes"
"            Time to Centroid        114.842    87.059     109.653    minutes"
"            Rainfall depth          75.581     75.581     75.581     mm"
"            Rainfall volume         319.71     35.52      355.23     c.m"
"            Rainfall losses         42.200     6.593      38.639     mm"
"            Runoff depth            33.381     68.988     36.942     mm"
"            Runoff volume           141.20     32.42      173.63     c.m"
"            Runoff coefficient      0.442      0.913      0.489      "
"            Maximum flow            0.049      0.016      0.055      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                  0.055     0.452     0.294     0.582"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                  0.055     0.452     0.452     0.582"
" 64          SHOW TABLE"
"           2   Flow hydrograph"
"           4   Inflow Hydrograph"
"            Maximum flow                 0.452    c.m/sec"
"            Hydrograph volume         1665.676    c.m"
" 40          HYDROGRAPH   Combine    999"
"           6   Combine "
"         999   Node #"
"               To Wetland"
"            Maximum flow                 0.897    c.m/sec"
"            Hydrograph volume         9941.869    c.m"
"                  0.055     0.452     0.452     0.897"
" 40          HYDROGRAPH   Confluence    999"
"           7   Confluence "
"         999   Node #"
"               To Wetland"
"            Maximum flow                 0.897    c.m/sec"
"            Hydrograph volume         9941.869    c.m"
"                  0.055     0.897     0.452     0.000"
" 38          START/RE-START TOTALS 999"
"           3   Runoff Totals on EXIT"
"            Total Catchment area                    22.620    hectare"
"            Total Impervious area                    7.577    hectare"
"            Total % impervious                      33.497"
" 19          EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                          Sunday, February 07, 2010"
"           10   Units used:                                                ie METRIC"
"                Job folder:                        C:\Users\akroetsch\Documents\"
"                                    Work in Progress\411009 Ainley Farm SWM Junk"
"                Output filename:                                 411009_50YR POST.out"
"                Licensee name:                                                 gmbp"
"                Company                                    Hewlett-Packard Company"
"                Date & Time last used:                     4/17/2017 at 3:45:25 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"    12000.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     5089.418   Coefficient A"
"       30.000   Constant B"
"        0.967   Exponent C"
"        0.380   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          156.350    mm/hr"
"             Total depth                 86.737    mm"
"            6   050hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 3100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         3100   Catchment 3100"
"       60.000   % Impervious"
"        0.400   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.160   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.240   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.481   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.924   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.107     0.000     0.000     0.000 c.m/sec"
"             Catchment 3100          Pervious   Impervious Total Area "
"             Surface Area            0.160      0.240      0.400      hectare"
"             Time of concentration   10.695     1.467      3.845      minutes"
"             Time to Centroid        106.283    85.675     90.985     minutes"
"             Rainfall depth          86.737     86.737     86.737     mm"
"             Rainfall volume         138.78     208.17     346.95     c.m"
"             Rainfall losses         44.994     6.561      21.934     mm"
"             Runoff depth            41.743     80.176     64.803     mm"
"             Runoff volume           66.79      192.42     259.21     c.m"
"             Runoff coefficient      0.481      0.924      0.747      "
"             Maximum flow            0.027      0.090      0.107      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
```

```
"            4   Add Runoff "
"                    0.107     0.107     0.000     0.000"
" 56          DIVERSION"
"          3100   Node number"
"         0.062   Overflow threshold"
"         1.000   Required diverted fraction"
"             0   Conduit type; 1=Pipe;2=Channel"
"              Peak of diverted flow         0.045    c.m/sec"
"              Volume of diverted flow      36.365    c.m"
"              DIV03100.050hyd"
"              Major flow at 3100"
"                    0.107     0.107     0.062     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    0.107     0.062     0.062     0.000"
" 33          CATCHMENT 1000"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         1000   Catchment 1000"
"       50.000   % Impervious"
"       11.280   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        5.640   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        5.640   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.481   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.924   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    2.726     0.062     0.062     0.000 c.m/sec"
"             Catchment 1000          Pervious   Impervious Total Area "
"             Surface Area            5.640      5.640      11.280     hectare"
"             Time of concentration   10.695     1.467      4.627      minutes"
"             Time to Centroid        106.283    85.675     92.731     minutes"
"             Rainfall depth          86.737     86.737     86.737     mm"
"             Rainfall volume         4891.95    4891.95    9783.91    c.m"
"             Rainfall losses         44.994     6.561      25.777     mm"
"             Runoff depth            41.743     80.176     60.959     mm"
"             Runoff volume           2354.31    4521.90    6876.22    c.m"
"             Runoff coefficient      0.481      0.924      0.703      "
"             Maximum flow            0.969      2.118      2.726      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    2.726     2.788     0.062     0.000"
" 33          CATCHMENT 1100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         1100   Catchment 1100"
"        0.000   % Impervious"
"        0.470   Total Area"
"       20.000   Flow length"
```

```
"        2.000   Overland Slope"
"        0.470   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.481   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.081     2.788     0.062     0.000 c.m/sec"
"             Catchment 1100          Pervious   Impervious Total Area "
"             Surface Area            0.470      0.000      0.470      hectare"
"             Time of concentration   10.695     1.467      10.695     minutes"
"             Time to Centroid        106.283    85.675     106.283    minutes"
"             Rainfall depth          86.737     86.737     86.737     mm"
"             Rainfall volume         407.66     0.00       407.66     c.m"
"             Rainfall losses         44.994     6.561      44.994     mm"
"             Runoff depth            41.743     80.176     41.743     mm"
"             Runoff volume           196.19     0.00       196.19     c.m"
"             Runoff coefficient      0.481      0.000      0.481      "
"             Maximum flow            0.081      0.000      0.081      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.081     2.843     0.062     0.000"
" 54          POND DESIGN"
"        2.843   Current peak flow    c.m/sec"
"        0.756   Target outflow    c.m/sec"
"       7295.3   Hydrograph volume    c.m"
"          12.   Number of stages"
"        0.000   Minimum water level    metre"
"        3.000   Maximum water level    metre"
"        0.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                411.000     0.000     0.000"
"                411.100   0.00600   612.000"
"                411.200   0.01300  1233.000"
"                411.300   0.01700  1862.000"
"                411.400   0.02000  2501.000"
"                411.500   0.02300  3148.000"
"                411.600   0.02600  3805.000"
"                411.700    0.1570  4470.000"
"                411.750    0.1630  4806.000"
"                411.800    0.2450  5144.000"
"                411.850    0.2520  5485.000"
"                412.000     1.912  6295.000"
"             Peak outflow                  0.464    c.m/sec"
"             Maximum level               411.869    metre"
"             Maximum storage            5588.438    c.m"
"             Centroidal lag               21.941    hours"
"                  0.081     2.843     0.464     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                  0.081     0.464     0.464     0.000"
" 33          CATCHMENT 4000"
```

```
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         4000   Catchment 4000"
"        0.000   % Impervious"
"        6.340   Total Area"
"       60.000   Flow length"
"        2.000   Overland Slope"
"        6.340   Pervious Area"
"       60.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       60.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.417   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.703     0.464     0.464     0.000 c.m/sec"
"             Catchment 4000          Pervious   Impervious Total Area "
"             Surface Area            6.340      0.000      6.340      hectare"
"             Time of concentration   21.990     2.837      21.990     minutes"
"             Time to Centroid        120.254    87.552     120.254    minutes"
"             Rainfall depth          86.737     86.737     86.737     mm"
"             Rainfall volume         5499.11    0.01       5499.11    c.m"
"             Rainfall losses         50.538     7.307      50.538     mm"
"             Runoff depth            36.199     79.429     36.199     mm"
"             Runoff volume           2295.03    0.01       2295.03    c.m"
"             Runoff coefficient      0.417      0.000      0.417      "
"             Maximum flow            0.703      0.000      0.703      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.703     0.864     0.464     0.000"
" 54          POND DESIGN"
"        0.864   Current peak flow    c.m/sec"
"        0.756   Target outflow    c.m/sec"
"       9583.6   Hydrograph volume    c.m"
"           6.   Number of stages"
"      409.630   Minimum water level    metre"
"      410.750   Maximum water level    metre"
"      409.630   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                409.630     0.000     0.000"
"                409.750    0.5400   232.250"
"                410.000     1.632  2017.880"
"                410.250     3.737  5148.940"
"                410.500     1.345  9472.330"
"                410.750     1.885  15057.74"
"             Peak outflow                    0.706    c.m/sec"
"             Maximum level                 409.788    metre"
"             Maximum storage               503.390    c.m"
"             Centroidal lag                 17.298    hours"
"                  0.703     0.864     0.706     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    0.703     0.706     0.706     0.000"
```

```
" 52          CHANNEL DESIGN"
"        0.706   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        0.000   Basewidth    metre"
"        7.410   Left bank slope"
"        6.000   Right bank slope"
"        0.950   Channel depth    metre"
"        1.040   Gradient   %"
"             Depth of flow                  0.343    metre"
"             Velocity                       0.893    m/sec"
"             Channel capacity              10.655    c.m/sec"
"             Critical depth                 0.296    metre"
" 53          ROUTE    Channel Route 72"
"        72.40       Channel Route 72 Reach length   ( metre)"
"        0.415   X-factor <= 0.5"
"       60.784   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       60.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                   0.705    c.m/sec"
"                    0.703     0.706     0.705     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    0.703     0.705     0.705     0.000"
" 52          CHANNEL DESIGN"
"        0.705   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        2.000   Basewidth    metre"
"        2.950   Left bank slope"
"        3.000   Right bank slope"
"        0.950   Channel depth    metre"
"        1.040   Gradient   %"
"             Depth of flow                  0.258    metre"
"             Velocity                       0.987    m/sec"
"             Channel capacity               9.246    c.m/sec"
"             Critical depth                 0.209    metre"
" 53          ROUTE    Channel Route 40"
"        39.80       Channel Route 40 Reach length   ( metre)"
"        0.330   X-factor <= 0.5"
"       30.231   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       37.500   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                   0.705    c.m/sec"
"                    0.703     0.705     0.705     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    0.703     0.705     0.705     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.703     0.705     0.705     0.000"
" 64          SHOW TABLE"
"            2   Flow hydrograph"
"            4   Inflow Hydrograph"
"             Maximum flow                   0.705    c.m/sec"
```

```
"            Hydrograph volume          9586.549    c.m"
" 40         HYDROGRAPH   Combine    999"
"          6   Combine "
"        999   Node #"
"              To Wetland"
"            Maximum flow                 0.705    c.m/sec"
"            Hydrograph volume         9586.549    c.m"
"                   0.703     0.705     0.705     0.705"
" 40         HYDROGRAPH Start - New Tributary"
"          2   Start - New Tributary"
"                   0.703     0.000     0.705     0.705"
" 47         FILEI_O Read/Open DIV03100.050hyd"
"          1   1=read/open; 2=write/save"
"          2   1=rainfall; 2=hydrograph"
"          1   1=runoff; 2=inflow; 3=outflow; 4=junction"
"            DIV03100.050hyd"
"            Major flow at 3100"
"            Total volume                36.365    c.m"
"            Maximum flow                 0.045    c.m/sec"
"                 0.045     0.000     0.705     0.705 c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"          4   Add Runoff "
"                   0.045     0.045     0.705     0.705"
" 33         CATCHMENT 3200"
"          1   Triangular SCS"
"          1   Equal length"
"          1   SCS method"
"       3200   Catchment 3200"
"     60.000   % Impervious"
"      0.350   Total Area"
"     20.000   Flow length"
"      2.000   Overland Slope"
"      0.140   Pervious Area"
"     20.000   Pervious length"
"      2.000   Pervious slope"
"      0.210   Impervious Area"
"     20.000   Impervious length"
"      2.000   Impervious slope"
"      0.250   Pervious Manning 'n'"
"     78.000   Pervious SCS Curve No."
"      0.481   Pervious Runoff coefficient"
"      0.100   Pervious Ia/S coefficient"
"      7.164   Pervious Initial abstraction"
"      0.015   Impervious Manning 'n'"
"     98.000   Impervious SCS Curve No."
"      0.924   Impervious Runoff coefficient"
"      0.100   Impervious Ia/S coefficient"
"      0.518   Impervious Initial abstraction"
"                   0.093     0.045     0.705     0.705 c.m/sec"
"            Catchment 3200          Pervious   Impervious Total Area "
"            Surface Area            0.140      0.210      0.350      hectare"
"            Time of concentration   10.695     1.467      3.845      minutes"
"            Time to Centroid        106.283    85.675     90.985     minutes"
"            Rainfall depth          86.737     86.737     86.737     mm"
"            Rainfall volume         121.43     182.15     303.58     c.m"
"            Rainfall losses         44.994     6.561      21.934     mm"
"            Runoff depth            41.743     80.176     64.803     mm"
"            Runoff volume           58.44      168.37     226.81     c.m"
"            Runoff coefficient      0.481      0.924      0.747      "
"            Maximum flow            0.024      0.079      0.093      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"          4   Add Runoff "
"                   0.093     0.138     0.705     0.705"
```

```
" 33          CATCHMENT 3300"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         3300   Catchment 3300"
"       60.000   % Impervious"
"        0.220   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.088   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.132   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.481   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.924   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.059     0.138     0.705     0.705 c.m/sec"
"             Catchment 3300          Pervious   Impervious Total Area "
"             Surface Area            0.088      0.132      0.220      hectare"
"             Time of concentration   10.695     1.467      3.845      minutes"
"             Time to Centroid        106.283    85.675     90.985     minutes"
"             Rainfall depth          86.737     86.737     86.737     mm"
"             Rainfall volume         76.33      114.49     190.82     c.m"
"             Rainfall losses         44.994     6.561      21.934     mm"
"             Runoff depth            41.743     80.176     64.803     mm"
"             Runoff volume           36.73      105.83     142.57     c.m"
"             Runoff coefficient      0.481      0.924      0.747      "
"             Maximum flow            0.015      0.050      0.059      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.059     0.197     0.705     0.705"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.059     0.197     0.197     0.705"
" 64          SHOW TABLE"
"            2   Flow hydrograph"
"            4   Inflow Hydrograph"
"             Maximum flow                  0.197    c.m/sec"
"             Hydrograph volume           405.739    c.m"
" 40          HYDROGRAPH   Combine    999"
"            6   Combine "
"          999   Node #"
"                To Wetland"
"             Maximum flow                  0.724    c.m/sec"
"             Hydrograph volume          9992.290    c.m"
"                    0.059     0.197     0.197     0.724"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.059     0.000     0.197     0.724"
" 33          CATCHMENT 2100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2100   Catchment 2100"
```

```
"       60.000   % Impervious"
"        2.180   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.872   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        1.308   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.481   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.922   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.546     0.000     0.197     0.724 c.m/sec"
"             Catchment 2100          Pervious   Impervious Total Area "
"             Surface Area            0.872      1.308      2.180      hectare"
"             Time of concentration   16.211     2.224      5.836      minutes"
"             Time to Centroid        112.570    86.667     93.357     minutes"
"             Rainfall depth          86.737     86.737     86.737     mm"
"             Rainfall volume         756.34     1134.52    1890.86    c.m"
"             Rainfall losses         44.974     6.774      22.054     mm"
"             Runoff depth            41.763     79.963     64.683     mm"
"             Runoff volume           364.17     1045.92    1410.09    c.m"
"             Runoff coefficient      0.481      0.922      0.746      "
"             Maximum flow            0.132      0.496      0.546      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.546     0.546     0.197     0.724"
" 54          POND DESIGN"
"        0.546   Current peak flow    c.m/sec"
"        0.396   Target outflow    c.m/sec"
"       1410.1   Hydrograph volume    c.m"
"          13.   Number of stages"
"        0.000   Minimum water level    metre"
"        3.000   Maximum water level    metre"
"        0.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                 410.650     0.000     0.000"
"                 410.700   0.00600    25.000"
"                 410.800   0.01300    79.000"
"                 410.900   0.02000   139.000"
"                 411.000   0.02500   206.000"
"                 411.100   0.02900   279.000"
"                 411.200   0.03200   359.000"
"                 411.300    0.2910   446.000"
"                 411.400    0.3210   540.000"
"                 411.500    0.3470   641.000"
"                 411.600    0.3720   750.000"
"                 411.650    0.3840   807.000"
"                 411.950     2.818  1195.000"
"             Peak outflow                    0.316    c.m/sec"
"             Maximum level                 411.383    metre"
"             Maximum storage               523.927    c.m"
"             Centroidal lag                  2.750   hours"
"                  0.546     0.546     0.316     0.724 c.m/sec"
```

```
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    0.546     0.316     0.316     0.724"
" 33          CATCHMENT 2200"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2200   Catchment 2200"
"        0.000   % Impervious"
"        0.910   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.910   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.481   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.138     0.316     0.316     0.724 c.m/sec"
"             Catchment 2200          Pervious   Impervious Total Area "
"             Surface Area            0.910      0.000      0.910      hectare"
"             Time of concentration   16.211     2.224      16.211     minutes"
"             Time to Centroid        112.570    86.667     112.570    minutes"
"             Rainfall depth          86.737     86.737     86.737     mm"
"             Rainfall volume         789.30     0.00       789.30     c.m"
"             Rainfall losses         44.974     6.773      44.974     mm"
"             Runoff depth            41.763     79.963     41.763     mm"
"             Runoff volume           380.04     0.00       380.04     c.m"
"             Runoff coefficient      0.481      0.000      0.481      "
"             Maximum flow            0.138      0.000      0.138      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.138     0.451     0.316     0.724"
" 33          CATCHMENT 2300"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2300   Catchment 2300"
"       10.000   % Impervious"
"        0.470   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.423   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.047   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.481   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
```

```
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.922   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.073     0.451     0.316     0.724 c.m/sec"
"             Catchment 2300          Pervious   Impervious Total Area "
"             Surface Area            0.423      0.047      0.470      hectare"
"             Time of concentration   16.211     2.224      13.757     minutes"
"             Time to Centroid        112.570    86.667     108.026    minutes"
"             Rainfall depth          86.737     86.737     86.737     mm"
"             Rainfall volume         366.90     40.77      407.66     c.m"
"             Rainfall losses         44.974     6.774      41.154     mm"
"             Runoff depth            41.763     79.963     45.583     mm"
"             Runoff volume           176.66     37.58      214.24     c.m"
"             Runoff coefficient      0.481      0.922      0.526      "
"             Maximum flow            0.064      0.018      0.073      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.073     0.523     0.316     0.724"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                    0.073     0.523     0.523     0.724"
" 64          SHOW TABLE"
"           2   Flow hydrograph"
"           4   Inflow Hydrograph"
"            Maximum flow                  0.523    c.m/sec"
"            Hydrograph volume          2002.184    c.m"
" 40          HYDROGRAPH   Combine    999"
"           6   Combine "
"         999   Node #"
"               To Wetland"
"            Maximum flow                  1.128    c.m/sec"
"            Hydrograph volume         11994.473    c.m"
"                    0.073     0.523     0.523     1.128"
" 40          HYDROGRAPH   Confluence    999"
"           7   Confluence "
"         999   Node #"
"               To Wetland"
"            Maximum flow                  1.128    c.m/sec"
"            Hydrograph volume         11994.472    c.m"
"                    0.073     1.128     0.523     0.000"
" 38          START/RE-START TOTALS 999"
"           3   Runoff Totals on EXIT"
"            Total Catchment area                      22.620    hectare"
"            Total Impervious area                      7.577    hectare"
"            Total % impervious                        33.497"
" 19          EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                                Version 2.25  rev. 473"
"                MIDUSS created                              Sunday, February 07, 2010"
"           10   Units used:                                                ie METRIC"
"                Job folder:                          C:\Users\akroetsch\Documents\"
"                                    Work in Progress\411009 Ainley Farm SWM Junk"
"                Output filename:                                 411009_100YR POST.out"
"                Licensee name:                                                 gmbp"
"                Company                                      Hewlett-Packard Company"
"                Date & Time last used:                       4/17/2017 at 3:46:06 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"    12000.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     6933.019   Coefficient A"
"       34.699   Constant B"
"        0.998   Exponent C"
"        0.380   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          168.777    mm/hr"
"             Total depth                 97.921    mm"
"            6   100hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 3100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         3100   Catchment 3100"
"       60.000   % Impervious"
"        0.400   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.160   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.240   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.515   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.931   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.121     0.000     0.000     0.000 c.m/sec"
"             Catchment 3100          Pervious   Impervious Total Area "
"             Surface Area            0.160      0.240      0.400      hectare"
"             Time of concentration   10.027     1.421      3.740      minutes"
"             Time to Centroid        104.871    85.423     90.664     minutes"
"             Rainfall depth          97.921     97.921     97.921     mm"
"             Rainfall volume         156.67     235.01     391.69     c.m"
"             Rainfall losses         47.483     6.787      23.065     mm"
"             Runoff depth            50.438     91.134     74.856     mm"
"             Runoff volume           80.70      218.72     299.42     c.m"
"             Runoff coefficient      0.515      0.931      0.764      "
"             Maximum flow            0.034      0.099      0.121      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
```

```
"            4   Add Runoff "
"                    0.121     0.121     0.000     0.000"
" 56          DIVERSION"
"          3100   Node number"
"         0.062   Overflow threshold"
"         1.000   Required diverted fraction"
"            0   Conduit type; 1=Pipe;2=Channel"
"             Peak of diverted flow         0.059    c.m/sec"
"             Volume of diverted flow      53.317    c.m"
"             DIV03100.100hyd"
"             Major flow at 3100"
"                    0.121     0.121     0.062     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    0.121     0.062     0.062     0.000"
" 33          CATCHMENT 1000"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          1000   Catchment 1000"
"        50.000   % Impervious"
"        11.280   Total Area"
"        20.000   Flow length"
"         2.000   Overland Slope"
"         5.640   Pervious Area"
"        20.000   Pervious length"
"         2.000   Pervious slope"
"         5.640   Impervious Area"
"        20.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        78.000   Pervious SCS Curve No."
"         0.515   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         7.164   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.931   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                    3.124     0.062     0.062     0.000 c.m/sec"
"              Catchment 1000          Pervious   Impervious Total Area "
"              Surface Area            5.640      5.640      11.280     hectare"
"              Time of concentration   10.027     1.421      4.487      minutes"
"              Time to Centroid        104.871    85.423     92.351     minutes"
"              Rainfall depth          97.921     97.921     97.921     mm"
"              Rainfall volume         0.5523     0.5523     1.1046     ha-m"
"              Rainfall losses         47.483     6.787      27.135     mm"
"              Runoff depth            50.438     91.134     70.786     mm"
"              Runoff volume           2844.72    5139.96    7984.69    c.m"
"              Runoff coefficient      0.515      0.931      0.723      "
"              Maximum flow            1.188      2.318      3.124      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    3.124     3.186     0.062     0.000"
" 33          CATCHMENT 1100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          1100   Catchment 1100"
"         0.000   % Impervious"
"         0.470   Total Area"
"        20.000   Flow length"
```

```
"        2.000   Overland Slope"
"        0.470   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.515   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.099     3.186     0.062     0.000 c.m/sec"
"             Catchment 1100          Pervious   Impervious Total Area "
"             Surface Area            0.470      0.000      0.470      hectare"
"             Time of concentration   10.027     1.421      10.027     minutes"
"             Time to Centroid        104.871    85.423     104.871    minutes"
"             Rainfall depth          97.921     97.921     97.921     mm"
"             Rainfall volume         460.23     0.00       460.23     c.m"
"             Rainfall losses         47.483     6.787      47.483     mm"
"             Runoff depth            50.438     91.134     50.438     mm"
"             Runoff volume           237.06     0.00       237.06     c.m"
"             Runoff coefficient      0.515      0.000      0.515      "
"             Maximum flow            0.099      0.000      0.099      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.099     3.258     0.062     0.000"
" 54          POND DESIGN"
"        3.258   Current peak flow    c.m/sec"
"        0.756   Target outflow    c.m/sec"
"       8467.9   Hydrograph volume    c.m"
"         12.    Number of stages"
"        0.000   Minimum water level    metre"
"        3.000   Maximum water level    metre"
"        0.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                411.000     0.000     0.000"
"                411.100   0.00600   612.000"
"                411.200   0.01300  1233.000"
"                411.300   0.01700  1862.000"
"                411.400   0.02000  2501.000"
"                411.500   0.02300  3148.000"
"                411.600   0.02600  3805.000"
"                411.700    0.1570  4470.000"
"                411.750    0.1630  4806.000"
"                411.800    0.2450  5144.000"
"                411.850    0.2520  5485.000"
"                412.000     1.912  6295.000"
"             Peak outflow                  0.917    c.m/sec"
"             Maximum level               411.910    metre"
"             Maximum storage            5809.319    c.m"
"             Centroidal lag               19.195   hours"
"                  0.099     3.258     0.917     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"           5   Next link "
"                    0.099     0.917     0.917     0.000"
" 33          CATCHMENT 4000"
```

```
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         4000   Catchment 4000"
"        0.000   % Impervious"
"        6.340   Total Area"
"       60.000   Flow length"
"        2.000   Overland Slope"
"        6.340   Pervious Area"
"       60.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       60.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.453   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.877     0.917     0.917     0.000 c.m/sec"
"              Catchment 4000          Pervious   Impervious Total Area "
"              Surface Area            6.340      0.000      6.340      hectare"
"              Time of concentration   20.504     2.747      20.504     minutes"
"              Time to Centroid        117.777    87.189     117.777    minutes"
"              Rainfall depth          97.921     97.921     97.921     mm"
"              Rainfall volume         6208.20    0.01       6208.21    c.m"
"              Rainfall losses         53.532     7.496      53.532     mm"
"              Runoff depth            44.389     90.426     44.389     mm"
"              Runoff volume           2814.26    0.01       2814.27    c.m"
"              Runoff coefficient      0.453      0.000      0.453      "
"              Maximum flow            0.877      0.000      0.877      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                     0.877     1.561     0.917     0.000"
" 54           POND DESIGN"
"         1.561   Current peak flow    c.m/sec"
"         0.756   Target outflow    c.m/sec"
"      11277.6   Hydrograph volume    c.m"
"           6.   Number of stages"
"       409.630   Minimum water level    metre"
"       410.750   Maximum water level    metre"
"       409.630   Starting water level    metre"
"             0   Keep Design Data: 1 = True; 0 = False"
"                   Level Discharge    Volume"
"                   409.630     0.000     0.000"
"                   409.750    0.5400   232.250"
"                   410.000     1.632  2017.880"
"                   410.250     3.737  5148.940"
"                   410.500     1.345  9472.330"
"                   410.750     1.885  15057.74"
"              Peak outflow                  1.104    c.m/sec"
"              Maximum level               409.880    metre"
"              Maximum storage            1158.570    c.m"
"              Centroidal lag               15.065    hours"
"                   0.877     1.561     1.104     0.000 c.m/sec"
" 40           HYDROGRAPH Next link "
"             5   Next link "
"                     0.877     1.104     1.104     0.000"
```

```
" 52          CHANNEL DESIGN"
"         1.104   Current peak flow    c.m/sec"
"         0.035   Manning 'n'"
"            0.   Cross-section type: 0=trapezoidal; 1=general"
"         0.000   Basewidth    metre"
"         7.410   Left bank slope"
"         6.000   Right bank slope"
"         0.950   Channel depth    metre"
"         1.040   Gradient   %"
"              Depth of flow                 0.406    metre"
"              Velocity                      0.999    m/sec"
"              Channel capacity             10.655    c.m/sec"
"              Critical depth                0.354    metre"
" 53          ROUTE    Channel Route 72"
"         72.40       Channel Route 72 Reach length   ( metre)"
"         0.399   X-factor <= 0.5"
"        54.356   K-lag   ( seconds)"
"         0.000   Default(0) or user spec.(1) values used"
"         0.500   X-factor <= 0.5"
"        30.000   K-lag   ( seconds)"
"         0.500   Beta weighting factor"
"        60.000   Routing time step   ( seconds)"
"             1   No. of sub-reaches"
"              Peak outflow                  1.103    c.m/sec"
"                     0.877     1.104     1.103     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"             5   Next link "
"                     0.877     1.103     1.103     0.000"
" 52          CHANNEL DESIGN"
"         1.103   Current peak flow    c.m/sec"
"         0.035   Manning 'n'"
"            0.   Cross-section type: 0=trapezoidal; 1=general"
"         2.000   Basewidth    metre"
"         2.950   Left bank slope"
"         3.000   Right bank slope"
"         0.950   Channel depth    metre"
"         1.040   Gradient   %"
"              Depth of flow                 0.329    metre"
"              Velocity                      1.128    m/sec"
"              Channel capacity              9.246    c.m/sec"
"              Critical depth                0.272    metre"
" 53          ROUTE    Channel Route 40"
"         39.80       Channel Route 40 Reach length   ( metre)"
"         0.288   X-factor <= 0.5"
"        26.470   K-lag   ( seconds)"
"         0.000   Default(0) or user spec.(1) values used"
"         0.500   X-factor <= 0.5"
"        30.000   K-lag   ( seconds)"
"         0.500   Beta weighting factor"
"        37.500   Routing time step   ( seconds)"
"             1   No. of sub-reaches"
"              Peak outflow                  1.103    c.m/sec"
"                     0.877     1.103     1.103     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"             5   Next link "
"                     0.877     1.103     1.103     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"             8   Copy to Outflow"
"                     0.877     1.103     1.103     0.000"
" 64          SHOW TABLE"
"             2   Flow hydrograph"
"             4   Inflow Hydrograph"
"              Maximum flow                  1.103    c.m/sec"
```

```
"             Hydrograph volume          11280.867    c.m"
" 40          HYDROGRAPH   Combine    999"
"           6   Combine "
"         999   Node #"
"               To Wetland"
"             Maximum flow                   1.103    c.m/sec"
"             Hydrograph volume          11280.867    c.m"
"                     0.877     1.103     1.103     1.103"
" 40          HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                     0.877     0.000     1.103     1.103"
" 47          FILEI_O Read/Open DIV03100.100hyd"
"           1   1=read/open; 2=write/save"
"           2   1=rainfall; 2=hydrograph"
"           1   1=runoff; 2=inflow; 3=outflow; 4=junction"
"             DIV03100.100hyd"
"             Major flow at 3100"
"             Total volume                  53.317    c.m"
"             Maximum flow                   0.059    c.m/sec"
"                0.059     0.000     1.103     1.103 c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                     0.059     0.059     1.103     1.103"
" 33          CATCHMENT 3200"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"        3200   Catchment 3200"
"      60.000   % Impervious"
"       0.350   Total Area"
"      20.000   Flow length"
"       2.000   Overland Slope"
"       0.140   Pervious Area"
"      20.000   Pervious length"
"       2.000   Pervious slope"
"       0.210   Impervious Area"
"      20.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      78.000   Pervious SCS Curve No."
"       0.515   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"       7.164   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.931   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                     0.106     0.059     1.103     1.103 c.m/sec"
"             Catchment 3200          Pervious   Impervious Total Area "
"             Surface Area            0.140      0.210      0.350      hectare"
"             Time of concentration   10.027     1.421      3.740      minutes"
"             Time to Centroid        104.871    85.423     90.664     minutes"
"             Rainfall depth          97.921     97.921     97.921     mm"
"             Rainfall volume         137.09     205.63     342.72     c.m"
"             Rainfall losses         47.483     6.787      23.065     mm"
"             Runoff depth            50.438     91.134     74.856     mm"
"             Runoff volume           70.61      191.38     262.00     c.m"
"             Runoff coefficient      0.515      0.931      0.764      "
"             Maximum flow            0.029      0.086      0.106      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                     0.106     0.164     1.103     1.103"
```

```
" 33          CATCHMENT 3300"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         3300   Catchment 3300"
"       60.000   % Impervious"
"        0.220   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.088   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.132   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.515   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.931   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.066     0.164     1.103     1.103 c.m/sec"
"             Catchment 3300          Pervious   Impervious Total Area "
"             Surface Area            0.088      0.132      0.220      hectare"
"             Time of concentration   10.027     1.421      3.740      minutes"
"             Time to Centroid        104.871    85.423     90.664     minutes"
"             Rainfall depth          97.921     97.921     97.921     mm"
"             Rainfall volume         86.17      129.26     215.43     c.m"
"             Rainfall losses         47.483     6.787      23.065     mm"
"             Runoff depth            50.438     91.134     74.856     mm"
"             Runoff volume           44.39      120.30     164.68     c.m"
"             Runoff coefficient      0.515      0.931      0.764      "
"             Maximum flow            0.019      0.054      0.066      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.066     0.230     1.103     1.103"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                  0.066     0.230     0.230     1.103"
" 64          SHOW TABLE"
"            2   Flow hydrograph"
"            4   Inflow Hydrograph"
"             Maximum flow                 0.230    c.m/sec"
"             Hydrograph volume          479.995    c.m"
" 40          HYDROGRAPH   Combine    999"
"            6   Combine "
"          999   Node #"
"                To Wetland"
"             Maximum flow                 1.129    c.m/sec"
"             Hydrograph volume        11760.858    c.m"
"                  0.066     0.230     0.230     1.129"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                  0.066     0.000     0.230     1.129"
" 33          CATCHMENT 2100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2100   Catchment 2100"
```

```
"       60.000   % Impervious"
"        2.180   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.872   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        1.308   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.517   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.929   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.616     0.000     0.230     1.129 c.m/sec"
"             Catchment 2100          Pervious   Impervious Total Area "
"             Surface Area            0.872      1.308      2.180      hectare"
"             Time of concentration   15.199     2.153      5.683      minutes"
"             Time to Centroid        110.688    86.345     92.932     minutes"
"             Rainfall depth          97.921     97.921     97.921     mm"
"             Rainfall volume         853.87     1280.81    2134.68    c.m"
"             Rainfall losses         47.301     6.948      23.089     mm"
"             Runoff depth            50.621     90.973     74.832     mm"
"             Runoff volume           441.41     1189.93    1631.34    c.m"
"             Runoff coefficient      0.517      0.929      0.764      "
"             Maximum flow            0.164      0.542      0.616      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.616     0.616     0.230     1.129"
" 54          POND DESIGN"
"        0.616   Current peak flow    c.m/sec"
"        0.396   Target outflow    c.m/sec"
"       1631.3   Hydrograph volume    c.m"
"          13.   Number of stages"
"        0.000   Minimum water level    metre"
"        3.000   Maximum water level    metre"
"        0.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                 410.650     0.000     0.000"
"                 410.700   0.00600    25.000"
"                 410.800   0.01300    79.000"
"                 410.900   0.02000   139.000"
"                 411.000   0.02500   206.000"
"                 411.100   0.02900   279.000"
"                 411.200   0.03200   359.000"
"                 411.300    0.2910   446.000"
"                 411.400    0.3210   540.000"
"                 411.500    0.3470   641.000"
"                 411.600    0.3720   750.000"
"                 411.650    0.3840   807.000"
"                 411.950     2.818  1195.000"
"             Peak outflow                    0.338    c.m/sec"
"             Maximum level                 411.469    metre"
"             Maximum storage               609.580    c.m"
"             Centroidal lag                  2.626   hours"
"                  0.616     0.616     0.338     1.129 c.m/sec"
```

```
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.616     0.338     0.338     1.129"
" 33          CATCHMENT 2200"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2200   Catchment 2200"
"        0.000   % Impervious"
"        0.910   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.910   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.517   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.172     0.338     0.338     1.129 c.m/sec"
"             Catchment 2200          Pervious   Impervious Total Area "
"             Surface Area            0.910      0.000      0.910      hectare"
"             Time of concentration   15.199     2.153      15.198     minutes"
"             Time to Centroid        110.688    86.345     110.688    minutes"
"             Rainfall depth          97.921     97.921     97.921     mm"
"             Rainfall volume         891.08     0.00       891.08     c.m"
"             Rainfall losses         47.301     6.948      47.301     mm"
"             Runoff depth            50.621     90.973     50.621     mm"
"             Runoff volume           460.65     0.00       460.65     c.m"
"             Runoff coefficient      0.517      0.000      0.517      "
"             Maximum flow            0.172      0.000      0.172      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.172     0.504     0.338     1.129"
" 33          CATCHMENT 2300"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2300   Catchment 2300"
"       10.000   % Impervious"
"        0.470   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.423   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.047   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.517   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
```

```
"        0.015    Impervious Manning 'n'"
"       98.000    Impervious SCS Curve No."
"        0.929    Impervious Runoff coefficient"
"        0.100    Impervious Ia/S coefficient"
"        0.518    Impervious Initial abstraction"
"                    0.090     0.504     0.338     1.129 c.m/sec"
"             Catchment 2300          Pervious   Impervious Total Area "
"             Surface Area            0.423      0.047      0.470      hectare"
"             Time of concentration   15.199     2.153      13.027     minutes"
"             Time to Centroid        110.688    86.345     106.636    minutes"
"             Rainfall depth          97.921     97.921     97.921     mm"
"             Rainfall volume         414.21     46.02      460.23     c.m"
"             Rainfall losses         47.301     6.948      43.265     mm"
"             Runoff depth            50.621     90.973     54.656     mm"
"             Runoff volume           214.13     42.76      256.88     c.m"
"             Runoff coefficient      0.517      0.929      0.558      "
"             Maximum flow            0.080      0.019      0.090      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.090     0.593     0.338     1.129"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                    0.090     0.593     0.593     1.129"
" 64          SHOW TABLE"
"           2   Flow hydrograph"
"           4   Inflow Hydrograph"
"            Maximum flow                  0.593    c.m/sec"
"            Hydrograph volume          2354.448    c.m"
" 40          HYDROGRAPH   Combine    999"
"           6   Combine "
"         999   Node #"
"               To Wetland"
"            Maximum flow                  1.488    c.m/sec"
"            Hydrograph volume         14115.316    c.m"
"                    0.090     0.593     0.593     1.488"
" 40          HYDROGRAPH   Confluence    999"
"           7   Confluence "
"         999   Node #"
"               To Wetland"
"            Maximum flow                  1.488    c.m/sec"
"            Hydrograph volume         14115.318    c.m"
"                    0.090     1.488     0.593     0.000"
" 38          START/RE-START TOTALS 999"
"           3   Runoff Totals on EXIT"
"            Total Catchment area                      22.620    hectare"
"            Total Impervious area                      7.577    hectare"
"            Total % impervious                        33.497"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                          Sunday, February 07, 2010"
"           10   Units used:                                              ie METRIC"
"                Job folder:                        C:\Users\akroetsch\Documents\"
"                                    Work in Progress\411009 Ainley Farm SWM Junk"
"                Output filename:                                  411009_REG POST.out"
"                Licensee name:                                                 gmbp"
"                Company                                    Hewlett-Packard Company"
"                Date & Time last used:                     4/17/2017 at 3:46:47 PM"
" 31          TIME PARAMETERS"
"       60.000   Time Step"
"     2880.000   Max. Storm length"
"    12000.000   Max. Hydrograph"
" 32          STORM Historic"
"            5   Historic"
"     2880.000   Duration"
"       48.000   Rainfall intensity values"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.026     2.026     2.026     2.026     2.028"
"                  2.026     6.000     4.000     6.000    13.000"
"                 17.000    13.000    23.000    13.000    13.000"
"                 53.000    38.000    13.000"
"              Maximum intensity            53.000    mm/hr"
"              Total depth                 285.000    mm"
"            6   200hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 3100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         3100   Catchment 3100"
"       60.000   % Impervious"
"        0.400   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.160   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.240   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.754   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.846   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.049     0.000     0.000     0.000 c.m/sec"
"              Catchment 3100          Pervious   Impervious Total Area "
"              Surface Area            0.160      0.240      0.400      hectare"
"              Time of concentration   12.485     2.243      6.061      minutes"
"              Time to Centroid        2505.276   2290.972   2370.872   minutes"
"              Rainfall depth          285.000    285.000    285.000    mm"
"              Rainfall volume         456.00     684.00     1140.00    c.m"
```

```
"             Rainfall losses          70.073      43.972      54.413      mm"
"             Runoff depth             214.927     241.028     230.587     mm"
"             Runoff volume            343.88      578.47      922.35      c.m"
"             Runoff coefficient       0.754       0.846       0.809       "
"             Maximum flow             0.018       0.031       0.049       c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                   0.049     0.049     0.000     0.000"
" 56          DIVERSION"
"        3100   Node number"
"       0.062   Overflow threshold"
"       1.000   Required diverted fraction"
"           0   Conduit type; 1=Pipe;2=Channel"
"             Peak of diverted flow          0.000    c.m/sec"
"             Volume of diverted flow        0.000    c.m"
"             DIV03100.200hyd"
"             Major flow at 3100"
"                   0.049     0.049     0.049     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"           5   Next link "
"                   0.049     0.049     0.049     0.000"
" 33          CATCHMENT 1000"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"        1000   Catchment 1000"
"      50.000   % Impervious"
"      11.280   Total Area"
"      20.000   Flow length"
"       2.000   Overland Slope"
"       5.640   Pervious Area"
"      20.000   Pervious length"
"       2.000   Pervious slope"
"       5.640   Impervious Area"
"      20.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      78.000   Pervious SCS Curve No."
"       0.754   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"       7.164   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.846   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                   1.367     0.049     0.049     0.000 c.m/sec"
"             Catchment 1000           Pervious    Impervious Total Area "
"             Surface Area             5.640       5.640       11.280      hectare"
"             Time of concentration    12.485      2.243       7.071       minutes"
"             Time to Centroid         2505.277    2290.972    2391.990    minutes"
"             Rainfall depth           285.000     285.000     285.000     mm"
"             Rainfall volume          1.6074      1.6074      3.2148      ha-m"
"             Rainfall losses          70.073      43.972      57.023      mm"
"             Runoff depth             214.927     241.028     227.977     mm"
"             Runoff volume            1.2122      1.3594      2.5716      ha-m"
"             Runoff coefficient       0.754       0.846       0.800       "
"             Maximum flow             0.642       0.724       1.367       c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                   1.367     1.416     0.049     0.000"
" 33          CATCHMENT 1100"
"           1   Triangular SCS"
```

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"            1   Equal length"
"            1   SCS method"
"         1100   Catchment 1100"
"        0.000   % Impervious"
"        0.470   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.470   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.754   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.054     1.416     0.049     0.000 c.m/sec"
"              Catchment 1100          Pervious   Impervious Total Area "
"              Surface Area            0.470      0.000      0.470      hectare"
"              Time of concentration   12.485     2.243      12.485     minutes"
"              Time to Centroid        2505.277   2290.972   2505.276   minutes"
"              Rainfall depth          285.000    285.000    285.000    mm"
"              Rainfall volume         1339.50    0.00       1339.50    c.m"
"              Rainfall losses         70.073     43.972     70.073     mm"
"              Runoff depth            214.927    241.028    214.927    mm"
"              Runoff volume           1010.15    0.00       1010.16    c.m"
"              Runoff coefficient      0.754      0.000      0.754      "
"              Maximum flow            0.054      0.000      0.054      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                     0.054     1.469     0.049     0.000"
" 54           POND DESIGN"
"         1.469   Current peak flow    c.m/sec"
"         0.756   Target outflow    c.m/sec"
"      27648.3   Hydrograph volume    c.m"
"           12.   Number of stages"
"         0.000   Minimum water level    metre"
"         3.000   Maximum water level    metre"
"         0.000   Starting water level    metre"
"             0   Keep Design Data: 1 = True; 0 = False"
"                   Level Discharge    Volume"
"                  411.000     0.000     0.000"
"                  411.100   0.00600   612.000"
"                  411.200   0.01300  1233.000"
"                  411.300   0.01700  1862.000"
"                  411.400   0.02000  2501.000"
"                  411.500   0.02300  3148.000"
"                  411.600   0.02600  3805.000"
"                  411.700    0.1570  4470.000"
"                  411.750    0.1630  4806.000"
"                  411.800    0.2450  5144.000"
"                  411.850    0.2520  5485.000"
"                  412.000     1.912  6295.000"
"              Peak outflow                  1.322    c.m/sec"
"              Maximum level               411.956    metre"
"              Maximum storage            6057.783    c.m"
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"              Centroidal lag                49.341   hours"
"                   0.054     1.469     1.322     0.000 c.m/sec"
" 40           HYDROGRAPH Next link "
"             5   Next link "
"                   0.054     1.322     1.322     0.000"
" 33           CATCHMENT 4000"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"          4000   Catchment 4000"
"         0.000   % Impervious"
"         6.340   Total Area"
"        60.000   Flow length"
"         2.000   Overland Slope"
"         6.340   Pervious Area"
"        60.000   Pervious length"
"         2.000   Pervious slope"
"         0.000   Impervious Area"
"        60.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        74.000   Pervious SCS Curve No."
"         0.716   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         8.924   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.000   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                   0.688     1.322     1.322     0.000 c.m/sec"
"              Catchment 4000          Pervious   Impervious Total Area "
"              Surface Area            6.340      0.000      6.340      hectare"
"              Time of concentration   24.421     4.336      24.421     minutes"
"              Time to Centroid        2549.942   2258.969   2549.942   minutes"
"              Rainfall depth          285.000    285.000    285.000    mm"
"              Rainfall volume         1.8069     0.0000     1.8069     ha-m"
"              Rainfall losses         80.848     39.404     80.848     mm"
"              Runoff depth            204.152    245.596    204.152    mm"
"              Runoff volume           1.2943     0.0000     1.2943     ha-m"
"              Runoff coefficient      0.716      0.000      0.716      "
"              Maximum flow            0.688      0.000      0.688      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                   0.688     1.936     1.322     0.000"
" 54           POND DESIGN"
"          1.936   Current peak flow    c.m/sec"
"          0.756   Target outflow    c.m/sec"
"       40500.4   Hydrograph volume    c.m"
"            6.   Number of stages"
"        409.630   Minimum water level    metre"
"        410.750   Maximum water level    metre"
"        409.630   Starting water level    metre"
"              0   Keep Design Data: 1 = True; 0 = False"
"                    Level Discharge    Volume"
"                  409.630     0.000     0.000"
"                  409.750    0.5400   232.250"
"                  410.000     1.632  2017.880"
"                  410.250     3.737  5148.940"
"                  410.500     1.345  9472.330"
"                  410.750     1.885  15057.74"
"              Peak outflow                    1.869    c.m/sec"
"              Maximum level                 410.028    metre"
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"            Maximum storage            2369.749    c.m"
"            Centroidal lag               47.388   hours"
"                 0.688     1.936     1.869     0.000 c.m/sec"
" 40         HYDROGRAPH Next link "
"           5   Next link "
"                 0.688     1.869     1.869     0.000"
" 52         CHANNEL DESIGN"
"       1.869   Current peak flow    c.m/sec"
"       0.035   Manning 'n'"
"          0.   Cross-section type: 0=trapezoidal; 1=general"
"       0.000   Basewidth    metre"
"       7.410   Left bank slope"
"       6.000   Right bank slope"
"       0.950   Channel depth    metre"
"       1.040   Gradient   %"
"            Depth of flow                0.495    metre"
"            Velocity                     1.139    m/sec"
"            Channel capacity            10.655    c.m/sec"
"            Critical depth               0.436    metre"
" 53         ROUTE    Channel Route 72"
"       72.40      Channel Route 72 Reach length   ( metre)"
"       0.377   X-factor <= 0.5"
"      47.653   K-lag   ( seconds)"
"       0.000   Default(0) or user spec.(1) values used"
"       0.500   X-factor <= 0.5"
"      30.000   K-lag   ( seconds)"
"       0.500   Beta weighting factor"
"      59.016   Routing time step   ( seconds)"
"           1   No. of sub-reaches"
"            Peak outflow                 1.862    c.m/sec"
"                 0.688     1.869     1.862     0.000 c.m/sec"
" 40         HYDROGRAPH Next link "
"           5   Next link "
"                 0.688     1.862     1.862     0.000"
" 52         CHANNEL DESIGN"
"       1.862   Current peak flow    c.m/sec"
"       0.035   Manning 'n'"
"          0.   Cross-section type: 0=trapezoidal; 1=general"
"       2.000   Basewidth    metre"
"       2.950   Left bank slope"
"       3.000   Right bank slope"
"       0.950   Channel depth    metre"
"       1.040   Gradient   %"
"            Depth of flow                0.432    metre"
"            Velocity                     1.310    m/sec"
"            Channel capacity             9.246    c.m/sec"
"            Critical depth               0.368    metre"
" 53         ROUTE    Channel Route 40"
"       39.80      Channel Route 40 Reach length   ( metre)"
"       0.230   X-factor <= 0.5"
"      22.786   K-lag   ( seconds)"
"       0.000   Default(0) or user spec.(1) values used"
"       0.500   X-factor <= 0.5"
"      30.000   K-lag   ( seconds)"
"       0.500   Beta weighting factor"
"      34.951   Routing time step   ( seconds)"
"           1   No. of sub-reaches"
"            Peak outflow                 1.859    c.m/sec"
"                 0.688     1.862     1.859     0.000 c.m/sec"
" 40         HYDROGRAPH Next link "
"           5   Next link "
"                 0.688     1.859     1.859     0.000"
" 40         HYDROGRAPH Copy to Outflow"
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"            8   Copy to Outflow"
"                    0.688     1.859     1.859     0.000"
" 64          SHOW TABLE"
"            2   Flow hydrograph"
"            4   Inflow Hydrograph"
"             Maximum flow                   1.859    c.m/sec"
"             Hydrograph volume          40659.859    c.m"
" 40          HYDROGRAPH   Combine    999"
"            6   Combine "
"          999   Node #"
"                To Wetland"
"             Maximum flow                   1.859    c.m/sec"
"             Hydrograph volume          40659.859    c.m"
"                    0.688     1.859     1.859     1.859"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.688     0.000     1.859     1.859"
" 47          FILEI_O Read/Open DIV03100.200hyd"
"            1   1=read/open; 2=write/save"
"            2   1=rainfall; 2=hydrograph"
"            1   1=runoff; 2=inflow; 3=outflow; 4=junction"
"             DIV03100.200hyd"
"             Major flow at 3100"
"             Total volume                   0.000    c.m"
"             Maximum flow                   0.000    c.m/sec"
"                  0.000     0.000     1.859     1.859 c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.000     0.000     1.859     1.859"
" 33          CATCHMENT 3200"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         3200   Catchment 3200"
"        60.000   % Impervious"
"         0.350   Total Area"
"        20.000   Flow length"
"         2.000   Overland Slope"
"         0.140   Pervious Area"
"        20.000   Pervious length"
"         2.000   Pervious slope"
"         0.210   Impervious Area"
"        20.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        78.000   Pervious SCS Curve No."
"         0.754   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         7.164   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.846   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                    0.043     0.000     1.859     1.859 c.m/sec"
"             Catchment 3200          Pervious   Impervious Total Area "
"             Surface Area            0.140      0.210      0.350      hectare"
"             Time of concentration   12.485     2.243      6.061      minutes"
"             Time to Centroid        2505.277   2290.972   2370.872   minutes"
"             Rainfall depth          285.000    285.000    285.000    mm"
"             Rainfall volume         399.00     598.50     997.50     c.m"
"             Rainfall losses         70.073     43.972     54.413     mm"
"             Runoff depth            214.927    241.028    230.587    mm"
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"              Runoff volume          300.90     506.16     807.06     c.m"
"              Runoff coefficient     0.754      0.846      0.809      "
"              Maximum flow           0.016      0.027      0.043      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                      0.043     0.043     1.859     1.859"
" 33           CATCHMENT 3300"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"          3300   Catchment 3300"
"        60.000   % Impervious"
"         0.220   Total Area"
"        20.000   Flow length"
"         2.000   Overland Slope"
"         0.088   Pervious Area"
"        20.000   Pervious length"
"         2.000   Pervious slope"
"         0.132   Impervious Area"
"        20.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        78.000   Pervious SCS Curve No."
"         0.754   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         7.164   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.846   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                      0.027     0.043     1.859     1.859 c.m/sec"
"              Catchment 3300          Pervious   Impervious Total Area "
"              Surface Area            0.088      0.132      0.220      hectare"
"              Time of concentration   12.485     2.243      6.061      minutes"
"              Time to Centroid        2505.277   2290.972   2370.872   minutes"
"              Rainfall depth          285.000    285.000    285.000    mm"
"              Rainfall volume         250.80     376.20     627.00     c.m"
"              Rainfall losses         70.073     43.972     54.413     mm"
"              Runoff depth            214.927    241.028    230.587    mm"
"              Runoff volume           189.14     318.16     507.29     c.m"
"              Runoff coefficient      0.754      0.846      0.809      "
"              Maximum flow            0.010      0.017      0.027      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                      0.027     0.070     1.859     1.859"
" 40           HYDROGRAPH Copy to Outflow"
"             8   Copy to Outflow"
"                      0.027     0.070     0.070     1.859"
" 64           SHOW TABLE"
"             2   Flow hydrograph"
"             4   Inflow Hydrograph"
"              Maximum flow                  0.070     c.m/sec"
"              Hydrograph volume          1314.348     c.m"
" 40           HYDROGRAPH   Combine    999"
"             6   Combine "
"           999   Node #"
"                 To Wetland"
"              Maximum flow                  1.913     c.m/sec"
"              Hydrograph volume         41974.203     c.m"
"                      0.027     0.070     0.070     1.913"
" 40           HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
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"                    0.027     0.000     0.070     1.913"
" 33          CATCHMENT 2100"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"          2100   Catchment 2100"
"        60.000   % Impervious"
"         2.180   Total Area"
"        40.000   Flow length"
"         2.000   Overland Slope"
"         0.872   Pervious Area"
"        40.000   Pervious length"
"         2.000   Pervious slope"
"         1.308   Impervious Area"
"        40.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        78.000   Pervious SCS Curve No."
"         0.765   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         7.164   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.850   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                    0.258     0.000     0.070     1.913 c.m/sec"
"              Catchment 2100          Pervious   Impervious Total Area "
"              Surface Area            0.872      1.308      2.180      hectare"
"              Time of concentration   18.924     3.399      9.220      minutes"
"              Time to Centroid        2520.774   2266.333   2361.738   minutes"
"              Rainfall depth          285.000    285.000    285.000    mm"
"              Rainfall volume         2485.20    3727.80    6213.00    c.m"
"              Rainfall losses         66.918     42.646     52.354     mm"
"              Runoff depth            218.082    242.354    232.646    mm"
"              Runoff volume           1901.68    3170.00    5071.67    c.m"
"              Runoff coefficient      0.765      0.850      0.816      "
"              Maximum flow            0.094      0.165      0.258      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                    0.258     0.258     0.070     1.913"
" 54          POND DESIGN"
"         0.258   Current peak flow    c.m/sec"
"         0.396   Target outflow    c.m/sec"
"        5071.7   Hydrograph volume    c.m"
"           13.   Number of stages"
"         0.000   Minimum water level    metre"
"         3.000   Maximum water level    metre"
"         0.000   Starting water level    metre"
"             0   Keep Design Data: 1 = True; 0 = False"
"                   Level Discharge    Volume"
"                 410.650     0.000     0.000"
"                 410.700   0.00600    25.000"
"                 410.800   0.01300    79.000"
"                 410.900   0.02000   139.000"
"                 411.000   0.02500   206.000"
"                 411.100   0.02900   279.000"
"                 411.200   0.03200   359.000"
"                 411.300    0.2910   446.000"
"                 411.400    0.3210   540.000"
"                 411.500    0.3470   641.000"
"                 411.600    0.3720   750.000"
"                 411.650    0.3840   807.000"
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"              411.950     2.818  1195.000"
"            Peak outflow                  0.240    c.m/sec"
"            Maximum level               411.285    metre"
"            Maximum storage             432.765    c.m"
"            Centroidal lag               40.573   hours"
"                 0.258     0.258     0.240     1.913 c.m/sec"
" 40         HYDROGRAPH Next link "
"           5   Next link "
"                 0.258     0.240     0.240     1.913"
" 33         CATCHMENT 2200"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         2200  Catchment 2200"
"        0.000  % Impervious"
"        0.910  Total Area"
"       40.000  Flow length"
"        2.000  Overland Slope"
"        0.910  Pervious Area"
"       40.000  Pervious length"
"        2.000  Pervious slope"
"        0.000  Impervious Area"
"       40.000  Impervious length"
"        2.000  Impervious slope"
"        0.250  Pervious Manning 'n'"
"       78.000  Pervious SCS Curve No."
"        0.765  Pervious Runoff coefficient"
"        0.100  Pervious Ia/S coefficient"
"        7.164  Pervious Initial abstraction"
"        0.015  Impervious Manning 'n'"
"       98.000  Impervious SCS Curve No."
"        0.000  Impervious Runoff coefficient"
"        0.100  Impervious Ia/S coefficient"
"        0.518  Impervious Initial abstraction"
"                 0.098     0.240     0.240     1.913 c.m/sec"
"             Catchment 2200          Pervious   Impervious Total Area "
"             Surface Area            0.910      0.000      0.910      hectare"
"             Time of concentration   18.924     3.399      18.924     minutes"
"             Time to Centroid        2520.773   2266.333   2520.773   minutes"
"             Rainfall depth          285.000    285.000    285.000    mm"
"             Rainfall volume         2593.50    0.00       2593.50    c.m"
"             Rainfall losses         66.918     42.646     66.918     mm"
"             Runoff depth            218.082    242.354    218.082    mm"
"             Runoff volume           1984.55    0.00       1984.55    c.m"
"             Runoff coefficient      0.765      0.000      0.765      "
"             Maximum flow            0.098      0.000      0.098      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                 0.098     0.338     0.240     1.913"
" 33         CATCHMENT 2300"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         2300  Catchment 2300"
"       10.000  % Impervious"
"        0.470  Total Area"
"       40.000  Flow length"
"        2.000  Overland Slope"
"        0.423  Pervious Area"
"       40.000  Pervious length"
"        2.000  Pervious slope"
"        0.047  Impervious Area"
"       40.000  Impervious length"
```

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"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.765   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.850   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.051     0.338     0.240     1.913 c.m/sec"
"             Catchment 2300          Pervious   Impervious Total Area "
"             Surface Area            0.423      0.047      0.470      hectare"
"             Time of concentration   18.924     3.399      17.218     minutes"
"             Time to Centroid        2520.774   2266.333   2492.809   minutes"
"             Rainfall depth          285.000    285.000    285.000    mm"
"             Rainfall volume         1205.55    133.95     1339.50    c.m"
"             Rainfall losses         66.918     42.646     64.490     mm"
"             Runoff depth            218.082    242.354    220.510    mm"
"             Runoff volume           922.49     113.91     1036.39    c.m"
"             Runoff coefficient      0.765      0.850      0.774      "
"             Maximum flow            0.046      0.006      0.051      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.051     0.389     0.240     1.913"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                    0.051     0.389     0.389     1.913"
" 64          SHOW TABLE"
"           2   Flow hydrograph"
"           4   Inflow Hydrograph"
"            Maximum flow                  0.389    c.m/sec"
"            Hydrograph volume          8072.756    c.m"
" 40          HYDROGRAPH   Combine    999"
"           6   Combine "
"         999   Node #"
"               To Wetland"
"            Maximum flow                  2.277    c.m/sec"
"            Hydrograph volume         50046.957    c.m"
"                    0.051     0.389     0.389     2.277"
" 40          HYDROGRAPH   Confluence    999"
"           7   Confluence "
"         999   Node #"
"               To Wetland"
"            Maximum flow                  2.277    c.m/sec"
"            Hydrograph volume         50046.953    c.m"
"                    0.051     2.277     0.389     0.000"
" 38          START/RE-START TOTALS 999"
"           3   Runoff Totals on EXIT"
"            Total Catchment area                      22.620    hectare"
"            Total Impervious area                      7.577    hectare"
"            Total % impervious                        33.497"
" 19          EXIT"
```

Stormceptor®

Stormceptor Design Summary

PCSWMM for Stormceptor

Project Information

Date	03/08/2017
Project Name	Ainley Farm - STC 1 (Storm Outlet #2)
Project Number	411009
Location	Elora

Designer Information

Company	N/A
Contact	N/A

Notes

N/A

Drainage Area

Total Area (ha)	4.2
Imperviousness (%)	50

The Stormceptor System model STC 9000 achieves the water quality objective removing 83% TSS for a Fine (organics, silts and sand) particle size distribution and 95% runoff volume.

Rainfall

Name	TORONTO CENTRAL
State	ON
ID	100
Years of Records	1982 to 1999
Latitude	45°30'N
Longitude	90°30'W

Water Quality Objective

TSS Removal (%)	80
Runoff Volume (%)	90

Upstream Storage

Storage (ha-m)	Discharge (L/s)
0	0

Stormceptor Sizing Summary

Stormceptor Model	TSS Removal %	Runoff Volume %
STC 300	50	49
STC 750	62	71
STC 1000	62	71
STC 1500	63	71
STC 2000	69	82
STC 3000	70	82
STC 4000	75	89
STC 5000	76	89
STC 6000	79	92
STC 9000	**83**	**95**
STC 10000	83	95
STC 14000	86	97

Stormceptor®

Particle Size Distribution

Removing silt particles from runoff ensures that the majority of the pollutants, such as hydrocarbons and heavy metals that adhere to fine particles, are not discharged into our natural water courses. The table below lists the particle size distribution used to define the annual TSS removal.

Fine (organics, silts and sand)

Particle Size µm	Distribution %	Specific Gravity	Settling Velocity m/s		Particle Size µm	Distribution %	Specific Gravity	Settling Velocity m/s
20	20	1.3	0.0004					
60	20	1.8	0.0016					
150	20	2.2	0.0108					
400	20	2.65	0.0647					
2000	20	2.65	0.2870					

Stormceptor Design Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor version 1.0
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal.
- Only the STC 300 is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 750 to STC 6000 may accommodate multiple inlet pipes.
- Inlet and outlet invert elevation differences are as follows:

Inlet and Outlet Pipe Invert Elevations Differences

Inlet Pipe Configuration	STC 300	STC 750 to STC 6000	STC 9000 to STC 14000
Single inlet pipe	75 mm	25 mm	75 mm
Multiple inlet pipes	75 mm	75 mm	Only one inlet pipe.

- Design estimates are based on stable site conditions only, after construction is completed.
- Design estimates assume that the storm drain is not submerged during zero flows. For submerged applications, please contact your local Stormceptor representative.
- Design estimates may be modified for specific spills controls. Please contact your local Stormceptor representative for further assistance.
- For pricing inquiries or assistance, please contact Imbrium Systems Inc., 1-800-565-4801.

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Stormceptor Design Summary

PCSWMM for Stormceptor

Project Information

Date	02/09/2017
Project Name	Ainley Farm - STC 2 (Storm Outlet #3)
Project Number	411009
Location	Elora

Designer Information

Company	N/A
Contact	N/A

Notes

N/A

Drainage Area

Total Area (ha)	3.01
Imperviousness (%)	50

The Stormceptor System model STC 6000 achieves the water quality objective removing 82% TSS for a Fine (organics, silts and sand) particle size distribution and 95% runoff volume.

Rainfall

Name	TORONTO CENTRAL
State	ON
ID	100
Years of Records	1982 to 1999
Latitude	45°30'N
Longitude	90°30'W

Water Quality Objective

TSS Removal (%)	80
Runoff Volume (%)	90

Upstream Storage

Storage (ha-m)	Discharge (L/s)
0	0

Stormceptor Sizing Summary

Stormceptor Model	TSS Removal %	Runoff Volume %
STC 300	55	58
STC 750	66	78
STC 1000	67	78
STC 1500	67	78
STC 2000	73	86
STC 3000	74	86
STC 4000	79	92
STC 5000	79	92
STC 6000	**82**	**95**
STC 9000	86	97
STC 10000	86	97
STC 14000	89	98

Stormceptor®

Particle Size Distribution

Removing silt particles from runoff ensures that the majority of the pollutants, such as hydrocarbons and heavy metals that adhere to fine particles, are not discharged into our natural water courses. The table below lists the particle size distribution used to define the annual TSS removal.

Fine (organics, silts and sand)

Particle Size µm	Distribution %	Specific Gravity	Settling Velocity m/s		Particle Size µm	Distribution %	Specific Gravity	Settling Velocity m/s
20	20	1.3	0.0004					
60	20	1.8	0.0016					
150	20	2.2	0.0108					
400	20	2.65	0.0647					
2000	20	2.65	0.2870					

Stormceptor Design Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor version 1.0
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal.
- Only the STC 300 is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 750 to STC 6000 may accommodate multiple inlet pipes.
- Inlet and outlet invert elevation differences are as follows:

Inlet and Outlet Pipe Invert Elevations Differences

Inlet Pipe Configuration	STC 300	STC 750 to STC 6000	STC 9000 to STC 14000
Single inlet pipe	75 mm	25 mm	75 mm
Multiple inlet pipes	75 mm	75 mm	Only one inlet pipe.

- Design estimates are based on stable site conditions only, after construction is completed.
- Design estimates assume that the storm drain is not submerged during zero flows. For submerged applications, please contact your local Stormceptor representative.
- Design estimates may be modified for specific spills controls. Please contact your local Stormceptor representative for further assistance.
- For pricing inquiries or assistance, please contact Imbrium Systems Inc., 1-800-565-4801.

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Stormceptor Design Summary

PCSWMM for Stormceptor

Project Information

Date	02/09/2017
Project Name	Ainley Farm - STC 1 (Storm Outlet #4)
Project Number	411009
Location	Elora

Designer Information

Company	N/A
Contact	N/A

Notes

N/A

Drainage Area

Total Area (ha)	2.65
Imperviousness (%)	50

The Stormceptor System model STC 4000 achieves the water quality objective removing 80% TSS for a Fine (organics, silts and sand) particle size distribution and 93% runoff volume.

Rainfall

Name	TORONTO CENTRAL
State	ON
ID	100
Years of Records	1982 to 1999
Latitude	45°30'N
Longitude	90°30'W

Water Quality Objective

TSS Removal (%)	80
Runoff Volume (%)	90

Upstream Storage

Storage (ha-m)	Discharge (L/s)
0	0

Stormceptor Sizing Summary

Stormceptor Model	TSS Removal %	Runoff Volume %
STC 300	57	61
STC 750	68	80
STC 1000	68	80
STC 1500	69	80
STC 2000	75	88
STC 3000	76	88
STC 4000	**80**	**93**
STC 5000	81	93
STC 6000	84	95
STC 9000	87	97
STC 10000	87	97
STC 14000	90	98

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Particle Size Distribution

Removing silt particles from runoff ensures that the majority of the pollutants, such as hydrocarbons and heavy metals that adhere to fine particles, are not discharged into our natural water courses. The table below lists the particle size distribution used to define the annual TSS removal.

Fine (organics, silts and sand)

Particle Size µm	Distribution %	Specific Gravity	Settling Velocity m/s		Particle Size µm	Distribution %	Specific Gravity	Settling Velocity m/s
20	20	1.3	0.0004					
60	20	1.8	0.0016					
150	20	2.2	0.0108					
400	20	2.65	0.0647					
2000	20	2.65	0.2870					

Stormceptor Design Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor version 1.0
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal.
- Only the STC 300 is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 750 to STC 6000 may accommodate multiple inlet pipes.
- Inlet and outlet invert elevation differences are as follows:

Inlet and Outlet Pipe Invert Elevations Differences

Inlet Pipe Configuration	STC 300	STC 750 to STC 6000	STC 9000 to STC 14000
Single inlet pipe	75 mm	25 mm	75 mm
Multiple inlet pipes	75 mm	75 mm	Only one inlet pipe.

- Design estimates are based on stable site conditions only, after construction is completed.
- Design estimates assume that the storm drain is not submerged during zero flows. For submerged applications, please contact your local Stormceptor representative.
- Design estimates may be modified for specific spills controls. Please contact your local Stormceptor representative for further assistance.
- For pricing inquiries or assistance, please contact Imbrium Systems Inc., 1-800-565-4801.

Stormceptor®

Stormceptor Design Summary

PCSWMM for Stormceptor

Project Information

Date	02/09/2017
Project Name	Ainley Farm - STC 4 (Storm Outlet #5)
Project Number	411009
Location	Elora

Designer Information

Company	N/A
Contact	N/A

Notes

N/A

Drainage Area

Total Area (ha)	2.43
Imperviousness (%)	60

The Stormceptor System model STC 5000 achieves the water quality objective removing 80% TSS for a Fine (organics, silts and sand) particle size distribution and 93% runoff volume.

Rainfall

Name	TORONTO CENTRAL
State	ON
ID	100
Years of Records	1982 to 1999
Latitude	45°30'N
Longitude	90°30'W

Water Quality Objective

TSS Removal (%)	80
Runoff Volume (%)	90

Upstream Storage

Storage (ha-m)	Discharge (L/s)
0	0

Stormceptor Sizing Summary

Stormceptor Model	TSS Removal %	Runoff Volume %
STC 300	56	59
STC 750	67	79
STC 1000	67	79
STC 1500	68	79
STC 2000	74	87
STC 3000	75	87
STC 4000	79	93
STC 5000	**80**	**93**
STC 6000	83	95
STC 9000	86	97
STC 10000	86	97
STC 14000	89	98

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Particle Size Distribution

Removing silt particles from runoff ensures that the majority of the pollutants, such as hydrocarbons and heavy metals that adhere to fine particles, are not discharged into our natural water courses. The table below lists the particle size distribution used to define the annual TSS removal.

Fine (organics, silts and sand)

Particle Size µm	Distribution %	Specific Gravity	Settling Velocity m/s		Particle Size µm	Distribution %	Specific Gravity	Settling Velocity m/s
20	20	1.3	0.0004					
60	20	1.8	0.0016					
150	20	2.2	0.0108					
400	20	2.65	0.0647					
2000	20	2.65	0.2870					

Stormceptor Design Notes

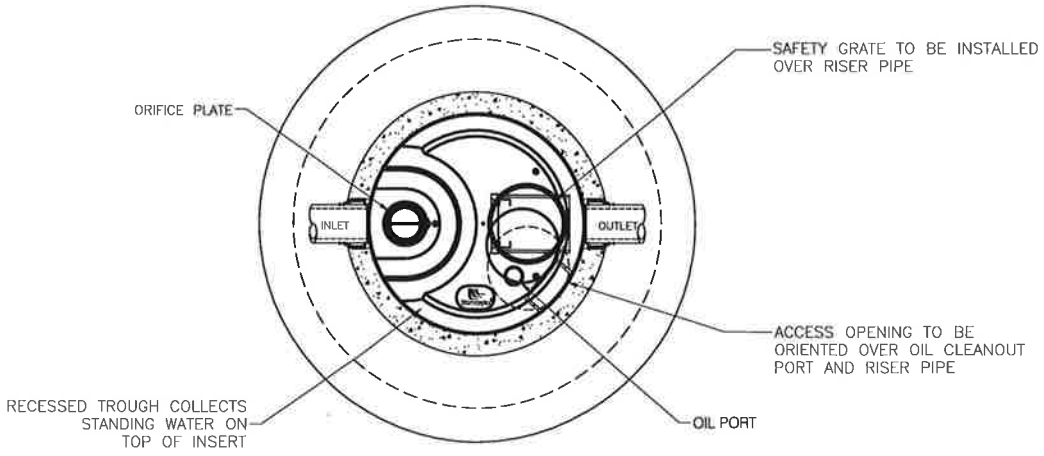
- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor version 1.0
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal.
- Only the STC 300 is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 750 to STC 6000 may accommodate multiple inlet pipes.
- Inlet and outlet invert elevation differences are as follows:

Inlet and Outlet Pipe Invert Elevations Differences

Inlet Pipe Configuration	STC 300	STC 750 to STC 6000	STC 9000 to STC 14000
Single inlet pipe	75 mm	25 mm	75 mm
Multiple inlet pipes	75 mm	75 mm	Only one inlet pipe.

- Design estimates are based on stable site conditions only, after construction is completed.
- Design estimates assume that the storm drain is not submerged during zero flows. For submerged applications, please contact your local Stormceptor representative.
- Design estimates may be modified for specific spills controls. Please contact your local Stormceptor representative for further assistance.
- For pricing inquiries or assistance, please contact Imbrium Systems Inc., 1-800-565-4801.

DRAWING NOT TO BE USED FOR CONSTRUCTION



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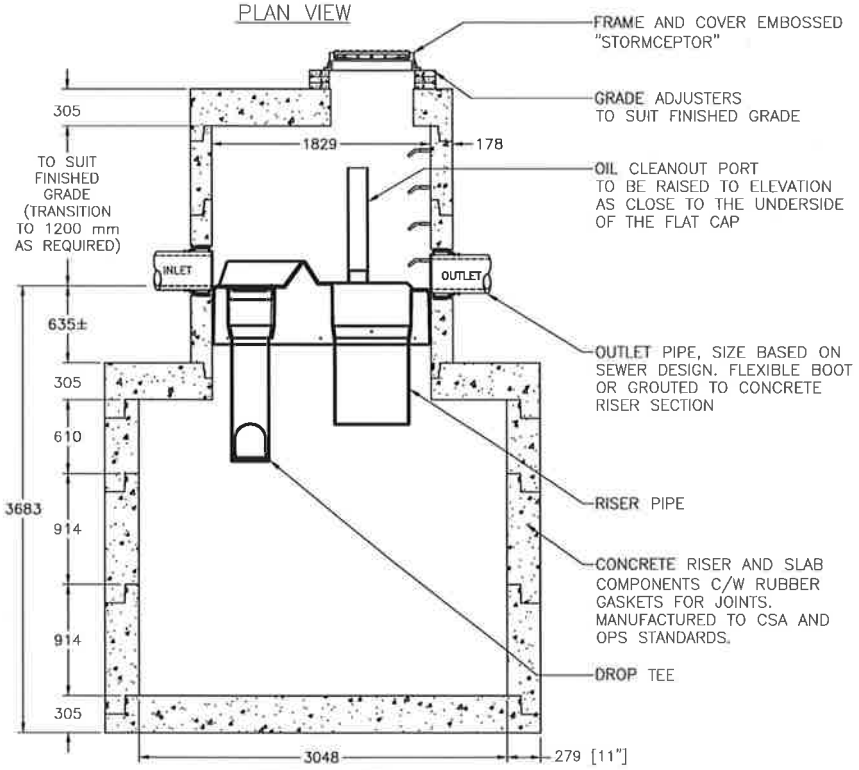

SECTION VIEW

Stormceptor®

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USA 888-279-8626 CA 800-565-4801 INTL +1-416-960-9900

STC 4000
STANDARD MODEL

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REV #	DATE	REVISION DESCRIPTION	BY

SHEET NUMBER 1 OF 1

DATE:######### | SCALE: 50 | PROJECT No.: ##### | DRAWN: ### | CHECKED: ###

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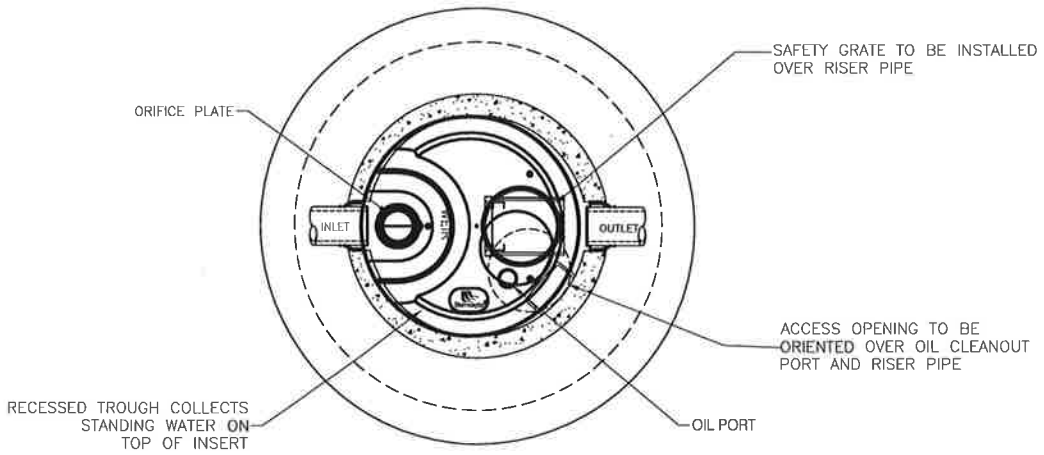
THE STORMCEPTOR SYSTEM IS PROTECTED BY ONE OR MORE OF THE FOLLOWING PATENTS:
United States Patent No. 5,753,115 • 5,849,181 • 6,068,765 • 6,371,690 • 7,582,216 • 7,666,303 | Australia Patent No. 729,096 • 779,401 • 2008,279,378 • 2008,288,900 | Canadian Patent No. 2,206,338 • 2,327,768 • 2,694,159 • 2,697,287 | European Paten No. EP 2,176,171 | Indonesian Patent No. 0,007,058 | Japan Patent No. 3,581,233 • 9-11476 • 5,555,160 | Korea Patent No. 10-1451593 • 0519,212 | Malaysia Patent No. 118,987 | New Zealand Patent No. 314,646 • 583,583 • 583,008 | South African Patent No. 2010,00683 • 2010,01796 |



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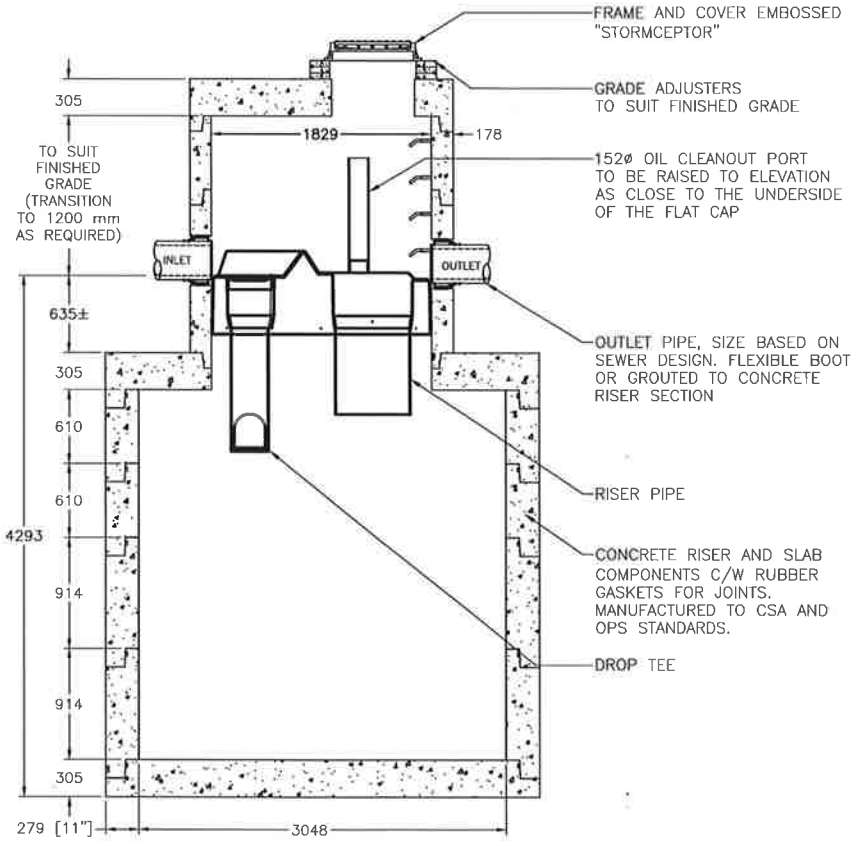

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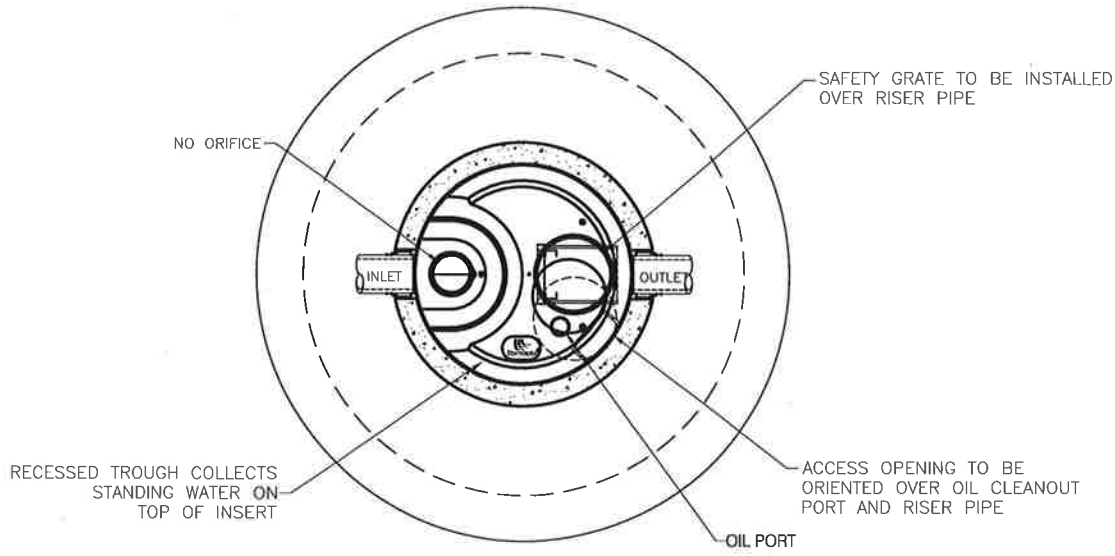

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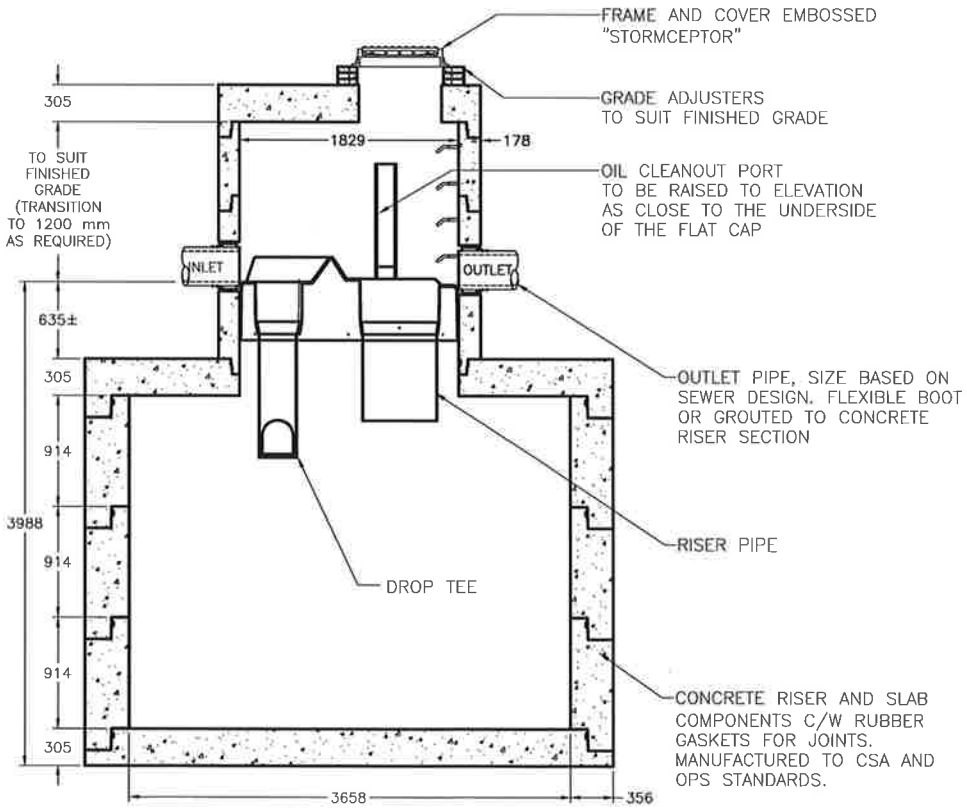

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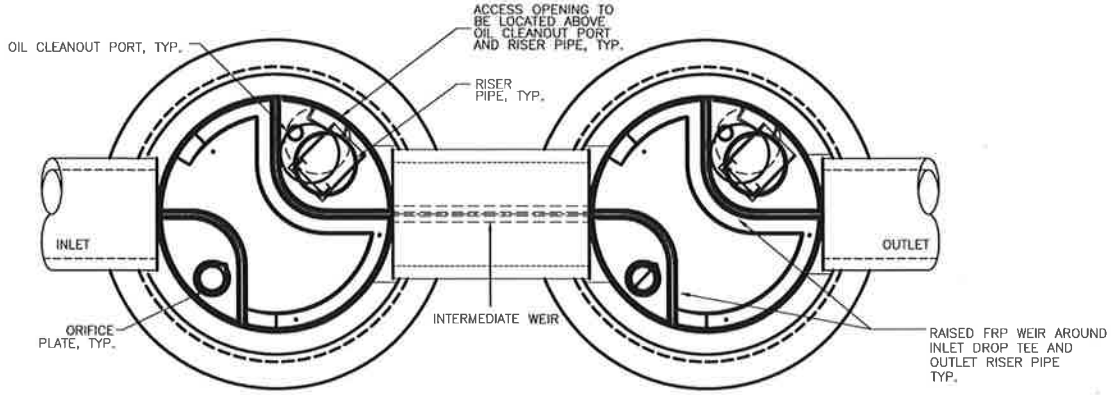

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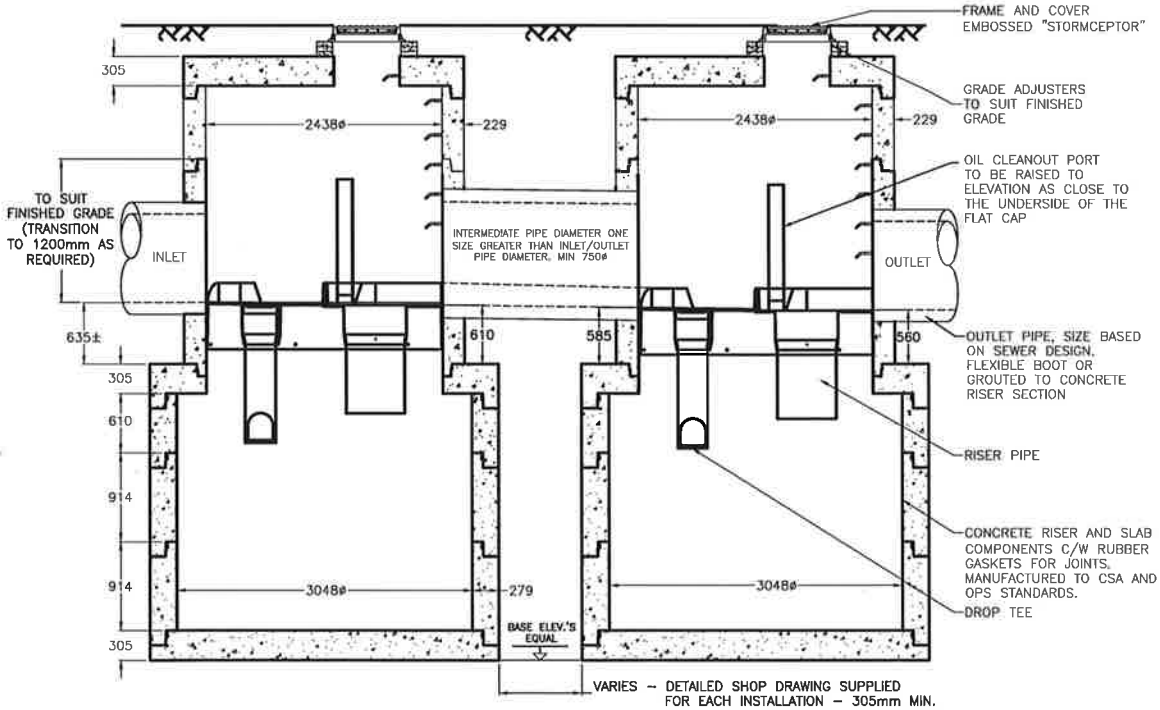

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