120 Rue Lusk Street

Functional Servicing and Stormwater Management Report

Project Location:
120 Rue Lusk Street, Ottawa, ON

Prepared for:
NECSA Holdings Corp
532 Newburgh Place
Ottawa, ON K2J 5X7

Prepared by:
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Kitchener, ON N2B 3X9

June 21, 2024
Revised: September 16, 2025

MTE File No.: 53510-100

Engineers, Scientists, Surveyors.

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1.0 INTRODUCTION

MTE Consultants Inc. was retained by NECSA Holdings Corp to complete the functional servicing and stormwater management design for the Medical Office Building, Restaurant and Daycare to be constructed at 120 Lusk Street in the City of Ottawa (herein referred to as the 'Site').

The Site is 0.60ha in size and referred to as Block 13, located within the O'Keefe Court – 416 Landsat the northeast quadrant of the intersection of Fallowfield Road and Strandherd Dive. The Site is bounded to the north by O'Keefe Court, to the west and east by future commercial development, and to the south by Lusk Street. For the exact location of the Site refer to the key plan located on the separately appended engineering drawings.

The proposed development for the Site is the construction of a three-storey medical office, restaurant, and daycare building, complete with a partial basement with associated driveway and at grade parking areas. The overall imperviousness of the proposed development is approximately 87.0% (C = 0.81).

This report addresses the functional servicing and stormwater management (SWM) requirements set forth by the City of Ottawa and the Design Brief for O'Keefe Court Business Park – 416 Lands Commercial Development, prepared by IBI Group, dated May 2018. The design requirements for the Site conforms to the criteria set forth by the City of Ottawa and the Jock River Reach One Subwatershed Study. The site grading, servicing and stormwater management details for the Site are illustrated on the separately appended MTE Engineering Drawings C1.1, C2.1, C2.2 and C2.3.

2.0 SERVICING

The new building is proposed to be serviced with sanitary, storm and water from the municipal services on Lusk Street.

2.1 Sanitary

There is an existing 250mm diameter municipal sanitary sewer within the Lusk Street right-of-way. There is an existing 250mm diameter sanitary service stubbed into the south side of the Site, constructed with an existing sanitary manhole inside the property line. The existing 250mm service stub will be removed up unto the existing manhole. A 200mm sanitary service connection is proposed to be connected to the existing manhole at a greater slope. The new 200mm diameter service connection is proposed to be installed at a slope of 0.6% within the Site, with a capacity of 25.39L/s.

The allowable sanitary flow rate for the Site was determined based on the design criteria within the IBI report, as per the City of Ottawa design criteria of 50,000L/day/ha. For this Site, the allowable sanitary release rate is 0.76L/s, including infiltration allowance. The total anticipated peak flow rate for the Site is calculated to be 0.375L/s, based on the common sewage flow rates for commercial developments, based on City of Ottawa design criteria. Refer to Appendix A for calculation details.

2.2 Storm

There is an existing 975mm diameter municipal storm sewer within the Lusk Street right-of-way. There is an existing 525mm diameter storm service stubbed into the south side of the Site, constructed with an existing storm manhole inside the property line. The existing 525mm service

stub will be removed up unto the existing manhole. Two 375mm diameter storm service connections are proposed to be connected to the existing manhole. The new service connections are proposed to be installed at a slope of 0.6% within the Site, with a capacity of 135.81L/s for each 375mm storm service.

The proposed on-site storm sewers are proposed to convey runoff from the building rooftop and surface runoff within the parking lot. The on-site storm sewer will outlet into the existing 975mm diameter municipal storm sewer within the Lusk Street right-of-way, which is then conveyed to a downstream municipal storm water management facility. During the 5-year storm event, the proposed development will produce a piped stormwater flow rate of 68L/s. Refer to Appendix B for calculation details.

2.3 Water

There is an existing 200mm diameter water service stubbed into the south side of the Site, which connects to the existing 300mm diameter municipal watermain along Lusk Street. There are two existing municipal fire hydrants in close proximity to the Site: one located on the southwest corner of the Site and one located on the southeast corner of the Site. A 200mm diameter water service is proposed to connect to the existing stub and continue north into the Site to service the proposed building. One new on-site hydrant is proposed to provide fire protection for the new building, in addition to the existing municipal hydrants located along the frontage of the Site.

The existing municipal watermain fronting the Site is currently a dead end watermain from the intersection of Lusk Street and Forager Road stubbed west of the Site, with no secondary source. A secondary municipal watermain connection and loop is planned to be constructed as part of Phase 2 of the 416 Lands subdivision; however, the timing of the connection has been delayed. In order for the development at 120 Lusk Street to proceed, the City of Ottawa requires a 200mm watermain loop to be constructed fronting the Site along Lusk Street. Therefore, a smaller 200mm diameter municipal watermain loop is proposed between Block 14 (140 Lusk) and Block 12 (100 Lusk), within the frontage of the properties at 140, 120 and 100 Lusk, to provide the required looping. The 200mm watermain loop will connect to the existing 200mm stubbed water service at 100 Lusk Street, and to the 200mm stubbed water service at the Site (140 Lusk Street), for a total watermain length of approximately 151.0m. Approval has been provided by the property owner at 100 Lusk to connect into their 200mm water service.

The proposed 200mm looped watermain will be constructed as part of the development at 140 Lusk Street as shown on MTE Drawing 52222-100 C3.1.

The following equation was used to determine the OBC (OBC,2012) fire flow demand:

$$Q = K \times V \times S_{tot}$$

Where:

- Q = minimum supply of water (L)
- K = water supply coefficient from Table 1 OBC, 2012
- V = total building volume (m^3)
- S_{tot} = total spatial coefficient values from property line exposure on all sides

The following equation was used to determine the FUS (FUS, 2020), fire flow demand:

$$RFF = 220C\sqrt{A}$$

Where:

RFF = the required fire flow (L/min)
C = the construction coefficient – Building Type II Noncombustible Construction
A = total effective floor area

Other factors that affect the FUS fire flow are the occupancy reduction, sprinkler protection and the building exposure. The occupancy reduction for this type of development was determined to be limited combustible components (-15%), the building will be equipped with sprinklers (-30%) and the building exposure was calculated based on the exposure to all property lines (+60%).

The required fire flow under the OBC, FUS and the domestic demands for the proposed building are summarized in the table below.

Table 2.1 – Required Water Demands

Guideline	OBC	FUS	Average Day	Maximum Day	Peak Hour	Maximum Day and Fire Flow
Required Fire Flow (L/s)	150	217	0.12	0.18	0.21	217

Refer to Appendix C for water demand calculations.

3.0 STORMWATER MANAGEMENT

3.1 Criteria

The stormwater management design criteria for the subject Site, as established by the Design Brief for the O'Keefe Court – 416 Lands Commercial Development, prepared by IBI Group, dated May 2018, and the City of Ottawa are as follows:

i) Attenuation of the post-development peak flows up to the 100-year storm event from the proposed development to maximum allowable release rate of 108L/s.

ii) Providing sufficient on-site storage, a minimum of 138.6m^3 as required in the O'Keefe Court – 416 Lands Commercial Development Design Brief (IBI Group, 2018), to ensure no overland flow for all storms up to and including the 100-year storm event.

iii) Water quality control will be provided in the downstream stormwater management facility within the O'Keefe Court – 416 Lands Commercial Development.

3.2 Methodology

In order to successfully complete the stormwater management design for this Site, the following specific tasks were undertaken:

i) Calculated the allowable runoff rates using MIDUSS NET.

ii) Determined the percent impervious of the site and catchment parameters for inclusion in MIDUSS modelling.

iii) Calculated post-development runoff hydrographs using MIDUSS NET.

iv) Revised the site grades to attain the required storage for runoff control.

Due to limited information about the 100-year design storm +20%, the intensity of the 100-year design storm was multiplied but 20% and added to the intensity of the 100-year storm. To determine the corresponding IDF parameters to input into MIDUSS, A was also multiplied by 1.2, and B and C were determined by adjusting based on the relationship between the 2-, 5- and 100-year design storms. Before proceeding with the quantity calculations, it was ensured that the intensity of the IDF parameters inputted were 20% more than 100-year design storm.

3.3 Catchment Parameters

Per the Design Brief for the O'Keefe Court – 416 Lands Commercial Development, provided by IBI Group, dated May 2018, the allowable peak flow for the Site is 108L/s for all storm events up to and including the 100-year storm event. The required on-site stormwater storage is 138.6m^3. Refer to Appendix D for the 416 Lands Storm Drainage Area Plan, prepared by IBI Group, dated May 18, 2022, for more detail.

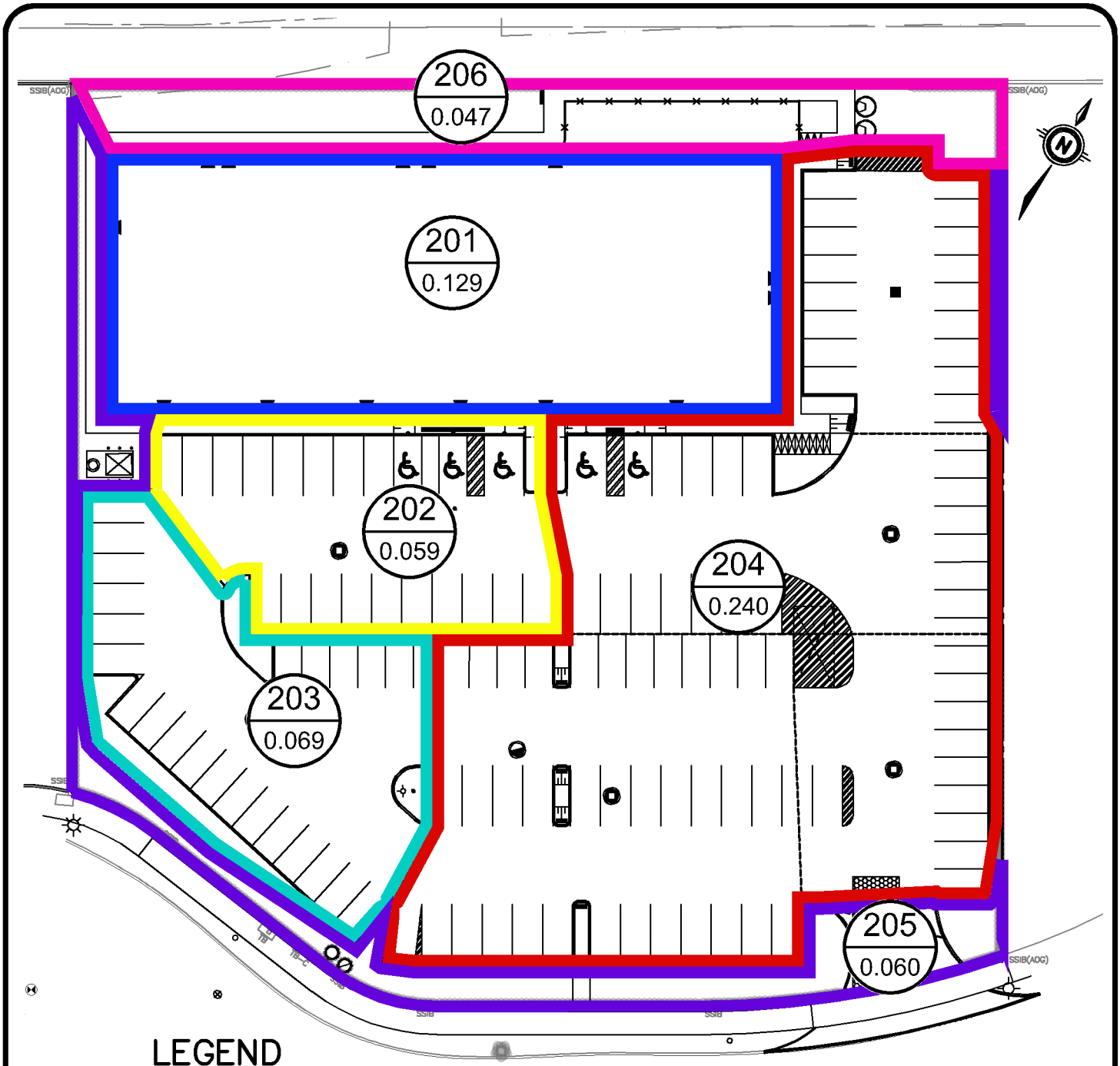
The following Table 3.1 summarizes the catchments used in the modelling of the Site. The post-development condition was separated into six catchment areas: the building rooftop area, the NW Parking Lot, the SW Parking Lot, the controlled area, the uncontrolled area draining towards Lusk Street, and the uncontrolled area towards O'Keefe Court. Figure 1.0 illustrates the limits of the post-development catchment areas.

Table 3.1 – Catchment Parameters

#	Catchment	Area (ha)	% Impervious	Pervious CN	Impervious CN	Slope (%)	Flow Length (m)
Post-Development Catchment Areas							
201	Building Rooftop Area (to Lusk Street)	0.129	100.0	75	98	1.5	10.0
202	NW Parking Lot (uncontrolled)	0.059	100.0	75	98	1.2	10.0
203	SW Parking Lot (controlled)	0.069	100.0	75	98	1.2	10.0
204	Controlled Area (to Lusk Street)	0.240	100.0	75	98	1.2	20.0
205	Uncontrolled Area draining to Lusk Street ROW	0.060	10.3	75	98	17.5	2.0
206	Uncontrolled Area draining to O'Keefe Court Street ROW	0.047	49.0	75	98	25.0	6.0

A geotechnical investigation was completed by Paterson Group on November 18, 2022. A complete copy will be provided for the City's records. The investigation revealed that the Site consists of silty sand to silty clay. Therefore, a pervious value of 75 for grassed areas is acceptable for the Site.

Groundwater was encountered on the Site, approximately 3.0-4.0m below ground surface.



LEGEND

- CATCHMENT 201
- CATCHMENT 202
- CATCHMENT 203
- CATCHMENT 204
- CATCHMENT 205
- CATCHMENT 206

201 / 0.129 — SUB-CATCHMENT NUMBER / AREA (ha.)

MTE
Engineers, Scientists, Surveyors

PROJECT
120 LUSK ST. MEDICAL BUILDING CIVIL WORKS

TITLE
POST DEVELOPMENT CATCHMENT AREAS

Drawn	Scale	Figure
EJJ	1:500	F1.0
Checked: JXN	Project No.: 53510-100	
Date: 2024-06-11	Rev No.: 0	

CAD: P:\P\53510\100\53510-100-F2.DWG
Plot Date: June 21, 2024 - 3:38 PM

3.4 Water Quantity – Modelling Results

It is proposed that stormwater runoff from the proposed development to be directed to the existing manhole located at the southwestern property line of the Site, and ultimately draining to the 975mm diameter municipal storm sewer.

In order to achieve the stormwater management requirements for the site, runoff generated from the controlled driveway and parking areas will be captured by the on-site storm sewer system. The controlled flow of the parking lot is separated into two sections: Catchment 203 controlled by a 90mm diameter casting orifice and Catchment 204 controlled by a 85mm diameter online orifice plate on the outlet pipe of CBMH3. Stormwater storage volume will be provided within the driveway and parking areas, on the building rooftop storage, and within the subsurface storm sewer system. The maximum depth of ponding permitted within the parking area by grading is 0.25m.

In addition, four flow control roof drains, single notch, are proposed to be installed on the roof of the proposed building. This will help to further reduce the post-development runoff from the site. Refer to appendix E for the flow control roof drain manufacturer specifications sheet.

The flow equations for the orifice and the IDF parameters for the 2-, 5-, 100-year and 100-year +20% storm events, as well as the MIDUSS NET output are included in Appendix F.

A combination of the surface storage, rooftop storage, and subsurface storage provides approximately 225.7m^3 of storage volume, which exceeds the required 138.6m^3 by the Design Brief for O'Keefe Commercial Development (IBI Group, 2018). The rooftop will provide a total of 35.95m^3 of storage to the maximum height of 15cm. The following tables, Table 3.2 and Table 3.3 illustrates the stage-storage-discharge relationship of on-site storage system.

Table 3.2 – Stage-Storage-Discharge Information – Rooftop (taken from MIDUSS)

Depth (m)	Head (m)	Controlled Flow (m^3/s)	Volume (m^3)	Remarks
0.00	0	0	0	Rooftop
0.081	**2-Year Ponding Elevation**			
	0.081	0.008	12.3	8.1cm of ponding on the roof
0.093	**5-Year Ponding Elevation**			
	0.093	0.009	19.1	9.3cm of ponding on the roof
0.119	**100-Year Ponding Elevation**			
	0.119	0.012	39.1	11.9cm of ponding on the roof
0.129	**100-Year +20% Ponding Elevation**			
	0.129	0.013	53.0	12.9cm of ponding on the roof

Table 3.3 – Stage-Storage-Discharge Information (Horizontal Orifice) – Parking Lot (taken from MIDUSS)

Elevation (m)	Head (m)	Orifice Flow (m^3/s)	Volume (m^3)	Remarks
103.55	0	0	0.0	90mm diameter Casting Orifice
103.622	**2-Year Ponding Elevation**			
	0.072	0.00742	1.0	7.2cm of Ponding
103.653	**5-Year Ponding Elevation**			
	0.103	0.00893	4.5	10.3cm of Ponding
103.701	**100-Year Ponding Elevation**			
	0.151	0.00975	13.8	15.1cm of Ponding
103.714	**100-Year +20% Ponding Elevation**			
	0.164	0.00994	18.6	16.4cm of Ponding
103.75	0.20	0.01051	30.9	Contour
103.80	0.25	0.01124	54.5	Contour

Table 3.4 – Stage-Storage-Discharge Information (Online Orifice) – Parking Lot (taken from MIDUSS)

Elevation (m)	Head (m)	Orifice Flow (m^3/s)	Volume (m^3)	Remarks
100.91	0	0	0	85mm diameter Online Orifice
103.55	0	0.02388	12.5	Top of Grate
103.609	**2-Year Ponding Elevation**			
	0.059	0.02319	13.2	5.9cm of Ponding
103.666	**5-Year Ponding Elevation**			
	0.116	0.02448	29.9	11.6cm of Ponding
103.70	0.15	0.02465	46.1	Contour
103.724	**100-Year Ponding Elevation**			
	0.174	0.02477	69.5	17.4cm of Ponding
103.744	**100-Year +20% Ponding Elevation**			
	0.194	0.02486	92.5	19.4cm of Ponding
103.75	0.20	0.02490	94.8	Contour
103.80	0.25	0.02515	171.2	Contour

With the addition of the 90mm diameter casting orifice plate and the 85mm diameter online orifice plate, the post-development runoff from the controlled portion of the Site for the 2-,5- and 100-year storm events is controlled to 0.049m^3/s, 0.058m^3/s, and 0.076m^3/s respectively. The following Table 3.3 summarizes the flows generated by the whole Site.

Table 3.5 – Summary of Flows

Modelling Condition	2-Year Storm Event (m^3/s)	5-Year Storm Event (m^3/s)	100-Year Storm Event (m^3/s)
Allowable Release Rate	0.108	0.108	0.108
Post-Development – Total Site	0.054	0.071	0.107

*see Table 3.2 above for storge summary for the 2-,5- and 100-year storm events.

3.5 Water Quality Control

The Site is located within the Jock River Reach One Subwatershed, which requires Enhanced Level of Protection water quality control (80% TSS removal). Per the Design Report for the O'Keefe Court – 416 Lands Commercial Development (IBI Group, 2013), the end-of-pipe stormwater management facility within the O'Keefe Court Commercial Business will provide water quality control. Therefore, no additional water quality control is required on-site.

3.6 Erosion & Sediment Control

In order to minimize the effects of erosion during the grading of the Site, the following measures are proposed during construction for erosion and sedimentation control:

i) Erosion and sedimentation facilities are to be installed prior to any area grading operations.

ii) All erosion control measures are to be inspected and monitored by the contractor and repairs are to be completed as required.

iii) All materials and equipment used for the purpose of site preparation and project completion should be operated and stored in a manner that prevents any deleterious substance from leaving the site.

iv) Re-vegetation of completed areas as soon as possible after construction, including those areas not slated for construction, within 60 days of rough grading.

v) To minimize the amount of mud being tracked onto the roadway, a mud mat should be installed at the primary construction entrance.

4.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the foregoing analysis, it is concluded that:

i) The sanitary, storm, and water service connections have adequate capacity to service the proposed development.

ii) The proposed SWM design provides adequate storage volume and attenuation of the 2-, 5- and 100-year storm events to the allowable release rate set by the Design Brief for O'Keefe Court Commercial Development (IBI Group, 2018).

iii) Upon completion of construction, the Site will conform to the design criteria specified by the City of Ottawa.

It is recommended that:

i) The site grading be undertaken according to the proposed elevations, details and erosion control measures shown on the separately appended engineering drawings.

ii) The stormwater management system be installed as detailed on the separately appended engineering drawings.

iii) The stormwater management facilities be inspected by MTE Consultants Inc. during construction and certified to the City of Ottawa upon completion.

All of which is respectfully submitted,

MTE Consultants Inc.

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JHN:dlb

https://mte85.sharepoint.com/sites/53510-100/Shared Documents/Reports/rpt_2025-09-16_FSSWM.docx

Appendix A

Sanitary Sewer Design Sheet

120 LUSK STREET
CITY OF OTTAWA

Project Number: 53510-100
Date: September 12, 2025
Design By: MLW
Checked By: CAD
File: Q:\53510\100\53510-100-Sanitary Sewer Design Sheet.xlsx

SANITARY SEWER DESIGN SHEET

ENGINEERING AND PUBLIC WORKS

Drainage Area Plan No:

Design Parameters

Average Daily Flow

Residential	0.00353	L/s/c
Commercial	50,000	L/day/Ha
Industrial	0.40	L/s/ha
Inst. / School	50,000	L/day/Ha

Mannings "*n*"	0.013	
Min. Velocity	0.8	m/sec
Max. Velocity	3.0	m/sec
Residential Harmon Peaking Factor	$F = 1 + 14/(4 + P^{0.5})$	
Extraneous Flow	0.25	L/s/ha

MTE

LOCATION				RESIDENTIAL AREAS and POPULATION											SCHOOL, INSTITUTIONAL			COMMERCIAL			INDUSTRIAL				INFILTRATION			DESIGN					
				HECTARES OF EACH DENSITY											HECTARES AND FLOW OF EACH ZONING																		
															0.58 *L/s/ha*			0.58 *L/s/ha*			0.40 *L/s/ha*											
STREET	AREA NO.	MANHOLE LOCATION		R2	R3	R4/R5	R6	R7	R8	R9	POPUL.	CUMUL POPUL.	PEAK FACTOR "F"	PEAK RES. FLOW	AREA	CUMUL AREA	PEAK FLOW	AREA	CUMUL	PEAK FLOW	AREA	CUMUL AREA	PEAK FLOW	TOTALS-C-I FLOW	AREA	CUMUL AREA	INFIL FLOW	TOTAL VOLUME FLOW	LENGTH	SLOPE	PIPE SIZE	CAPACITY	FULL FLOW VELOCITY
		FROM MH	TO MH	**36**	**72**	**143**	**196**	**312**	**387**	**775**																							
				ha	*ha*	*ha*	*ha*	*ha*	*ha*	*ha*	*1000s*	*1000s*		*L/sec*	*ha*	*ha*	*L/sec*	*ha*	*ha*	*L/sec*	*ha*	*ha*	*L/sec*	*L/sec*	*ha*	*ha*	*L/sec*	*L/sec*	*m*	*%*	*mm*	*L/sec*	*m/s*
	1	Building	MH1A															0.36	0.36	0.2083				0.2083	0.67	0.67	0.1665	0.3748	28.8	2.00	250	84.0571	1.713
		MH1A	EX MH-13																						0.00	0.67	0.1665	0.3748	23.7	2.00	250	84.0571	1.713

**MOE Design Guidelines for Sewage

Appendix B

Storm Sewer Design Sheet

120 LUSK STREET

CITY OF OTTAWA

STORM SEWER DESIGN SHEET

ENGINEERING AND PUBLIC WORKS

Project Number: 53510-100
Date: June 21, 2024
Design By: MLW/JHN
Checked By: CAD
File: Q:\53510\100\53510-100 - Storm Sewer Design Sheet.xlsx

Drainage Area Plan No:

Design Parameters

5 YEAR STORM

Q=kAIC, k=0.00278
Intensity (I) = a/(tc+b)^c
a = 998
b = 6.053
c = 0.814

Manning's "n" 0.013
Min. Velocity 0.800 m/s
Max. Velocity 6.000 m/s

LOCATION				STORMWATER FLOW								DESIGN					
STREET	AREA NUMBER	MANHOLE LOCATION FROM MH	MANHOLE LOCATION TO MH	AREA (A)	RUNOFF COEFF. (C)	A x C	CUMUL. A x C	CONCENTRATION TIME TOTAL	CONCENTRATION TIME IN PIPE	RAIN INTENSITY (I)	FLOW (Q)	PIPE SIZE	LENGTH	SLOPE	CAPACITY	FULL FLOW VELOCITY	PIPE FULL
				ha		*ha*	*ha*	*min*	*min*	*mm/hr*	*L/s*	*mm*	*m*	*%*	*L/s*	*m/s*	*%*
	201	Building	CBMH1	0.129	0.90	0.1161	0.1161	10.0000	0.1701	104.19303	33.62914	250	11.7	0.80	53.18937	1.0836	63.23
	202	CBMH1	CBMH2	0.059	0.90	0.0531	0.1692	10.1701	0.2410	103.30283	48.59117	300	16.3	0.60	74.90409	1.0597	64.87
	203	CBMH2	Ex. MH-STM	0.069	0.90	0.0621	0.2313	10.4111	0.2885	102.07045	65.63273	375	21.1	0.60	135.81014	1.2296	48.33
	204	CB6	CBMH5	0.043	0.90	0.0383	0.0383	10.0000	0.4568	104.19303	11.10544	300	20.8	0.60	74.90409	1.0597	14.83
		CBMH5	CBMH4	0.072	0.90	0.0644	0.1027	10.4568	0.3392	101.84028	29.07318	300	20.2	0.60	74.90409	1.0597	38.81
		CBMH4	CBMH3	0.040	0.90	0.0362	0.1389	10.7960	0.3808	100.16818	38.67079	300	24.4	0.60	74.90409	1.0597	51.63
		CBMH3	Ex. MH-STM	0.086	0.90	0.0771	0.2160	11.1768	0.3877	98.36239	59.06465	375	27.6	0.60	135.81014	1.2296	43.49

Appendix C

Water Demand Analysis

120 Lusk Street - Medical Office Building

FIRE FLOW DEMANDS

Ottawa, Ontario

Project #: 53510-100
Date: September 12, 2025
Date Printed: 9/16/2025
By: JHN

	Development Information[1]								Fire Flow[2]																Domestic Flow[3,4]				
									Ontario Building Code							Fire Underwriters Survey													
	Node ID / Area ID / Building #	F.F.E. (m.a.s.l.)	Description	Area		Bldg Area (1st Floor)	Total Bldg Area	Building Volume	K	V	S_{tot}	Q	F	F	C	A	F	(2) Occupancy Reduction	(3) Sprinkler Protection[5]	(4) Building Exposure[5]	F	F	Fire Flow (Max OBC/FUS)	Per Ottawa Design Guidelines	Average Day	Max Day	Peak Hour	Max Day + Fire Flow
				m^2		m^2	m^2	m^3		m^3		L	L/min	L/s		m^2	L/min				L/min	L/s	L/s	L/s	L/s	L/s	L/s	L/s
1		104.25	Commercial	0.36		1,262	4,364	13,092	17	13,092	1.90	422,872	9,000	150	0.80	4,364	11,627	-15%	-30%	60%	13,000	217	217	0.117	0.117	0.210	0.175	217
2																												
3																												
			TOTALS FOR SITE	**0.36**		**1262**	**4364**	**13092**					**Max Fire Flow =**	**150**							**Max Fire Flow =**	**217**	**217**	**0.12**	**0.12**	**0.21**	**0.18**	**217**

Sum of Maximum Day Flows + Largest Fire Flow (L/s) = 217

Notes:

1 Building is assumed to be classified as non-combustible construction type.

2 Building is classified as occupancy group E (Mercantile Occupancies)

3 Average Daily Demands for the building are based on "Ottawa Design Guildines - Water Distribution" by City of Ottawa, dated July 2010:

Commercial 28,000 L/gross ha/day

4 Peaking Factors based on ISD-2010-02 in Ottawa Water Design Guildines by City of Ottawa.

Maximum Day = 1.8 x Average Day

Maximum Hour = 1.5 x Average Day

5 The complete building will be equipped with automatic sprinkler protection in accordance to NFPA 13, therefore, 30% sprinkler reduction will be applied as per FUS Water Supply for Publick Protection (2010).

The building exposure reduction assumptions are as per below:

Direction	Separation from Building or PL (m)	OBC	FUS
N	6	0.4	20
S	35	0.0	0
E	19	0.0	15
W	3	0.5	25
		1.9	***60***

Appendix D

416 Lands Storm Discharge Area Plan (IBI Group, 2022)

REVIEWED BY
DEVELOPMENT REVIEW SERVICES BRANCH

Signed ______________________

Date ______________________ 2017

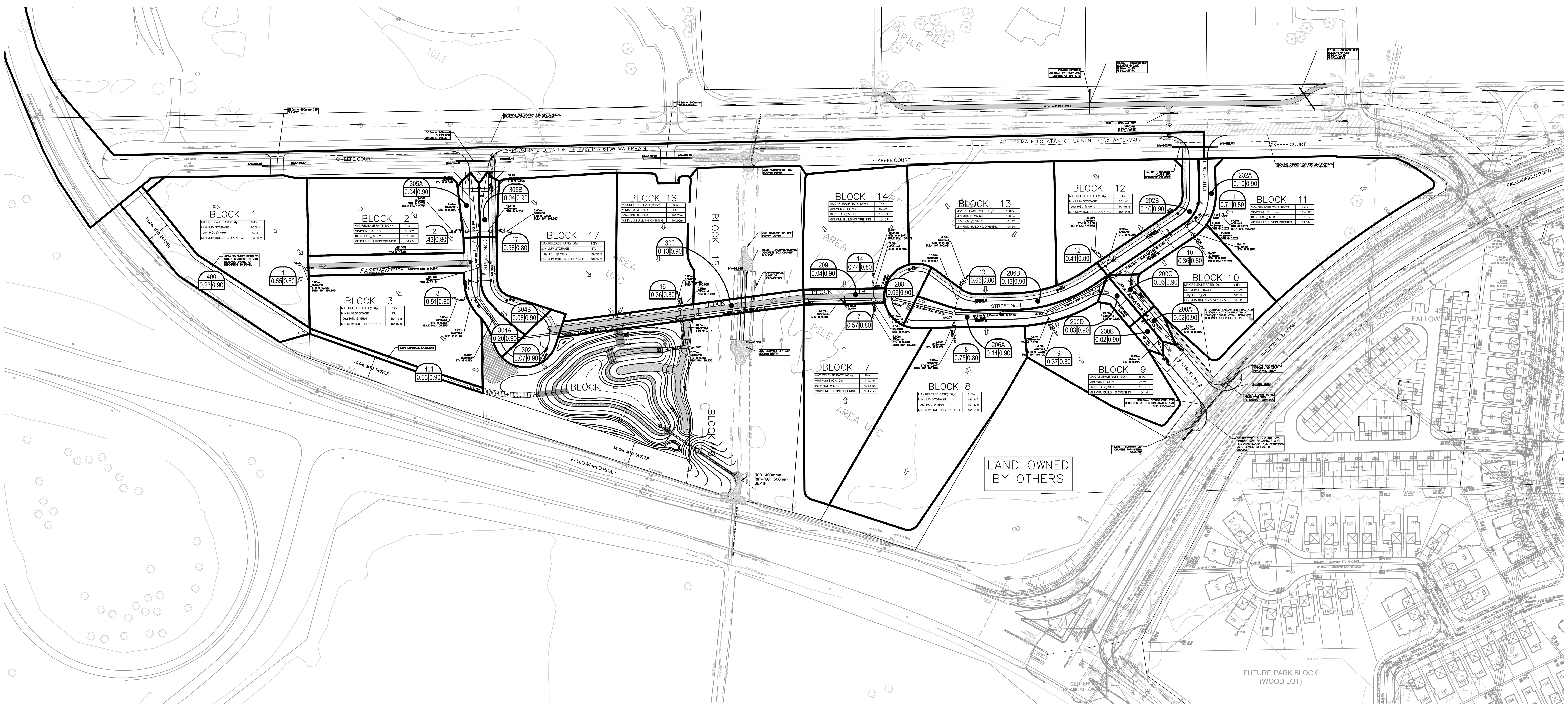
Plan Number ______________________

LEGEND :

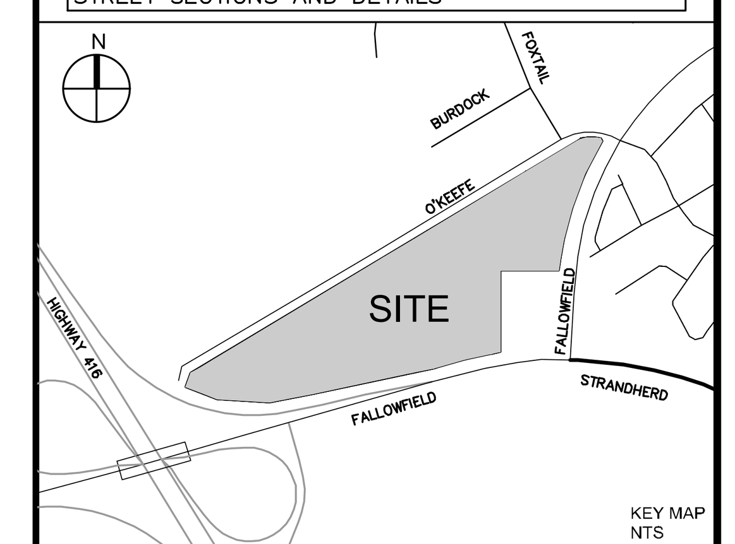
S168 — AREA NUMBER
0.80 — RUNOFF COEFFICIENT
2.01 — AREA IN HECTARES
⇨ EMERGENCY FLOW ROUTE

NOTE :

MINIMUM BUILDING OPENING TO BE CONFIRMED AT SITE PLAN STAGE.



SEE 010, 011, 012 FOR NOTES, LEGEND, CB TABLE, STREET SECTIONS AND DETAILS



KEY MAP
NTS

No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8			
7			
6			
5	REVISED PER CITY COMMENTS	DGY	18:05:22
4	REVISED PER CITY COMMENTS	DGY	18:04:06
3	REVISED PER CITY COMMENTS	DGY	18:01:10
2	REVISED PER CITY COMMENTS	DGY	17:09:26
1	ISSUED FOR CITY REVIEW	DGY	17:05:04

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K2E 6T8

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Ottawa ON K1S 5N4 Canada
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ibigroup.com

Project Title

416 LANDS
4401 FALLOWFIELD ROAD

LICENSED PROFESSIONAL ENGINEER
D. G. Yannoulopoulos
22/05/2018
PROVINCE OF ONTARIO

Drawing Title

STORM DRAINAGE AREA PLAN

Scale
1:1250

Design	Date
MB/RM	MARCH 2016
Drawn	Checked
EH	DGY
Project No.	Drawing No.
39744	500

CITY PLAN No. 17492

CITY FILE No. D07-16-13-0013

Appendix E

Roof Drain Specifications

ZURN CANADA

SPECIFICATION DRAINAGE

Control-Flo

Roof Drainage System

www.zurn.com

Control-Flo...Today's Successful Answer to More

THE ZURN "CONTROL-FLO CONCEPT"

Originally, Zurn introduced the scientifically-advanced "Control-Flo" drainage principle for dead-level roofs. Today, after thousands of successful applications in modern, large dead-level roof areas, Zurn engineers have adapted the comprehensive "Control-Flo" data to **sloped roof** areas.

WHAT IS "CONTROL-FLO"?

It is an advanced method of removing rain water off dead-level or sloped roofs. As contrasted with conventional drainage practices, which attempt to drain off storm water as quickly as it falls on the roof's surface, "Control-Flo" drains the roof at a controlled rate. Excess water accumulates on the roof under controlled conditions...then drains off at a lower rate after a storm abates.

CUTS DRAINAGE COSTS

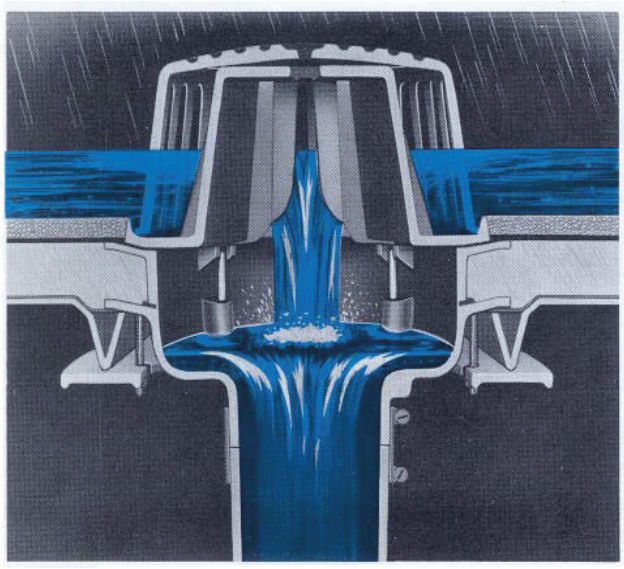
Fewer roof drains, smaller diameter piping, smaller sewer sizes, and lower installation costs are possible with a "Control-Flo" drainage system because roof areas are utilized as temporary storage reservoirs.

REDUCES PROBABILITY OF STORM DAMAGE

Lightens load on combination sewers by reducing rate of water drained from roof tops during severe storms thereby reducing probability of flooded sewers, and consequent backflow into basements and other low areas.

THANKS TO EXCLUSIVE ZURN "AQUA-WEIR" ACTION

Key to successful "Control-Flo" drainage is a unique scientifically-designed weir containing accurately calibrated notches with sides formed by parabolic curves which provide flow rates directly proportional to the head. Shape and size of notches are based on predetermined flow rates, and all factors involved in roof drainage to assure permanent regulation of drainage flow rates for specific geographic locations and rainfall intensities.

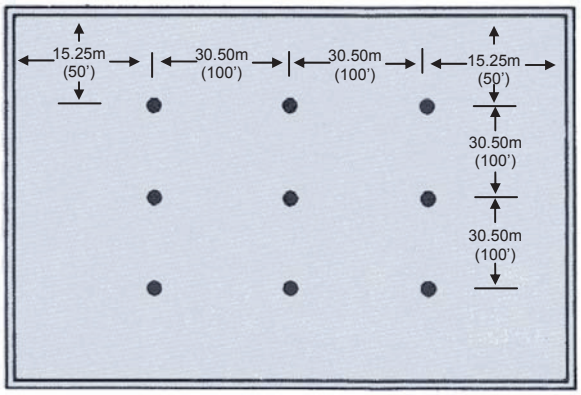


DEFINITION

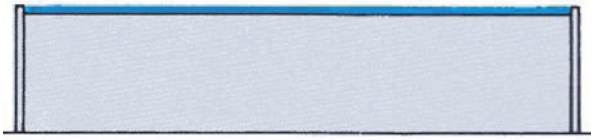
DEAD LEVEL ROOFS

DIAGRAM "A"

A dead-level roof for purposes of applying the Zurn "Control-Flo" drainage principle is one which has been designed for zero slope across its entire surface. Measurements shown are for maximum distances.



(Plan View)



(Section View)

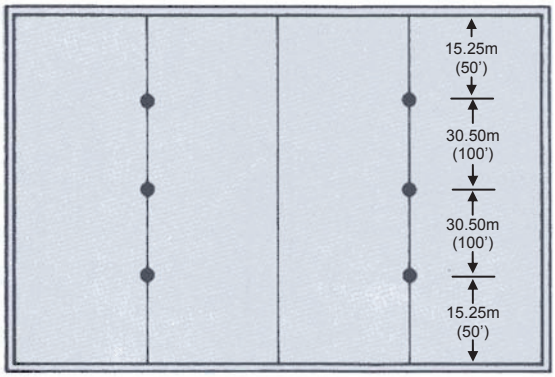
SLOPED ROOFS

DIAGRAM "B"

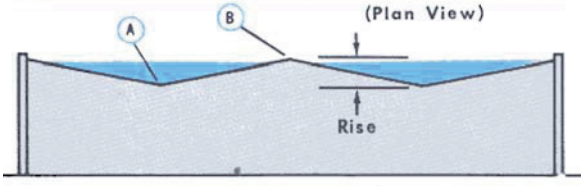
A sloped roof is one designed commonly with a shallow slope. The Zurn "Control-Flo" drainage system can be applied to any slope which results in a total rise up to 152mm (6").

The total rise of a roof as calculated for "Control-Flo" application is defined as the vertical increase in height in inches, from the low point or valley of a sloping roof (A) to the top of the sloping section (B). (Example: a roof that slopes 3mm (1/8") per foot having a 7.25m (24') span would have a rise of 7.25m x 3mm or 76mm (24' x 1/8" or 3")).

Measurements shown are for maximum distances.



(Plan View)

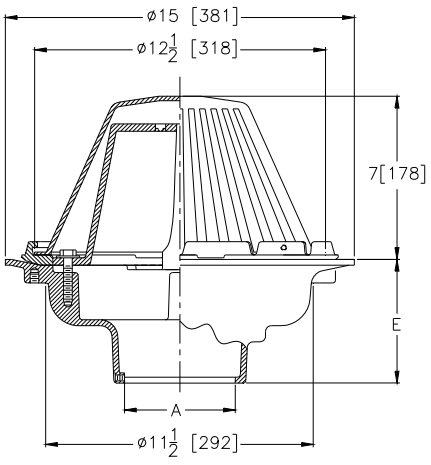


(Section View)

Dimensions and other measurements given in metric and imperial forms.

Economical Roof Drainage Installations

SPECIFICATION DATA



ENGINEERING SPECIFICATION: ZURN Z-105 "Control-Flo" roof drain for dead -level or sloped roof construction, Dura-Coated cast iron body. "Control-Flo" weir shall be linear functioning with integral membrane flashing clamp/ gravel guard and Poly-Dome. All data shall be verified proportional to flow rates.

ROOF DESIGN RECOMMENDATIONS

Basic roofing design should incorporate protection that will prevent roof overloading by installing adequate overflow scuppers in parapet walls.

GENERAL INFORMATION

The "Control-Flo" roof drainage data is tabulated for four areas (232.25m^2 (2500 sq. ft.), 464.502m^2 (5000 sq. ft.), 696.75m^2 (7500 sq. ft.), 929m^2 (10,000 sq. ft.) notch areas ratings) for each locality. For each notch area rating the maximum discharge in L.P.M. (G.P.M.) - draindown in hours, and maximum water depth at the drain in inches for a dead level roof — 51mm (2 inch) rise — 102mm (4 inch) rise and 152mm (6 inch) rise—are tabulated. The rise is the total change in elevation from the valley to the peak. Values for areas, rise or combination thereof other than those listed, can be arrived at by extrapolation. All data listed is based on the fifty-year return frequency storm. In other words the maximum conditions as listed will occur on the average of once every fifty years.

NOTE: The tabulated "Control-Flo" data enables the individual engineer to select his own design limiting condition. The limiting condition can be draindown time, roof load factor, or maximum water depth at the drain. If draindown time is the limiting factor because of possible freezing conditions, it must be recognized that the maximum time listed will occur on the average of once every 50 years and would most likely be during a heavy summer thunder storm. Average winter draindown times would be much shorter in duration than those listed.

GENERAL RECOMMENDATIONS

On sloping roofs, we recommend a design depth referred to as an equivalent depth. An equivalent depth is the depth of water attained at the drains that results in the same roof stresses as those realized on a dead-level roof. In all cases this equivalent depth is almost equal to that attained by using the same notch area rating for the different rises to 152mm (6"). With the same depth of water at the drain the roof stresses will decrease with increasing total rise. Therefore, it would be possible to have a depth in excess of 152mm (6") at the drain on a sloping roof without exceeding stresses normally encountered in a 152mm (6") depth on a dead-level roof. However, it is recommended that scuppers be placed to limit the maximum water depth on any roof to 152mm (6") to prevent the overflow of the weirs on the drains and consequent overloading of drain piping. In the few cases where the data shows a flow rate in excess of 136 L.P.M. (30 G.P.M.) if all drains and drain lines are sized according to recommendations, and the one storm in fifty years occurs, the only consequence will be a brief flow through the scuppers or over-flow drains.

NOTE: An equivalent depth is that depth of water attained at the drains at the lowest line or valley of the roof with all other conditions such as notch area and rainfall intensity being equal. For Toronto, Ontario a notch area rating of 464.50m^2 (5,000 sq. ft.) results in a 74mm (2.9 inch) depth on a dead level roof for a 50-year storm. For the same notch area and conditions, equivalent depths for a 51mm (2"), 102mm (4") and 152mm (6") rise respectively on a sloped roof would be 86mm (3.4"), 104mm (4.1") and 124mm (4.9"). Roof stresses will be approximately equal in all cases.

Control-Flo Drain Selection Is Quick and Easy...

The exclusive Zurn “Selecta-Drain” Chart (pages 8—11) tabulates selection data for 34 localities in Canada. Proper use of this chart constitutes your best assurance of sure, safe, economical application of Zurn “Control-Flo” systems for your specific geographical area. If the “Selecta-Drain Chart does not cover your specific design criteria, contact Zurn Industries Limited, Mississauga, Ontario, for additional data for your locality. Listed below is additional information pertinent to proper engineering of the “Control-Flo” system.

ROOF USED AS TEMPORARY RETENTION

The key to economical “Control-Flo” is the utilization of large roof areas to temporarily store the maximum amount of water without overloading average roofs or creating excessive draindown time during periods of heavy rainfall. The data shown in the “Selecta-Drain” Chart enables the engineer to select notch area ratings from 232.25 m^2 (2,500 $ft.^2$) to 929m^2 (10,000 $ft.^2$) and to accurately predict all other design factors such as maximum roof load, L.P.M. (G.P.M.) discharge, draindown time and water depth at the drain. Obviously, as design factors permit the notch area rating to increase the resulting money saved in being able to use small leaders and drain lines will also increase.

ROOF LOADING AND RUN-OFF RATES

The four values listed in the “Selecta-Drain” Chart for notch area ratings for different localities will normally span the range of good design. If areas per notch below 232.25m^2 (2,500 $ft.^2$) are used considerable economy of the “Control-Flo” concept is being lost. The area per notch is limited to 929m^2 (10,000 $ft.^2$) to keep the draindown time within reasonable limits. Extensive studies show that stresses due to water load on a sloping roof for any fixed set of conditions are very nearly the same as those on a dead-level roof. A sloping roof tends to concentrate more water in the valleys and increase the water depth at this point. The greater depth around the drain leads to a faster run-off rate, particularly a faster early run -off rate. As a result, the total volume of water stored on the roof is less, and the total load on the sloping roof is less. By using the same area on the sloping roof as on the dead-level roof the increase in roof stresses due to increased water depth in the valleys is offset by the decrease in the total load due to less water stored. The net result of the maximum roof stress is approximately the same for any single span rise and fixed set of conditions. A fixed set of conditions, would be the same notch area, the same frequency store, and the same locality.

SPECIAL CONSIDERATIONS FOR STRUCTURAL SAFETY: Normal practice of roof design is based on 18kg (40 lbs.) per 929 cm^2 (sq ft.). (Subject to local codes and by-laws.) Thus it is extremely important that design is in accordance with normal load factors so deflection will be slight enough in any bay to prevent progressive deflection which could cause water depths to load the roof beyond its design limits.

ADDITIONAL NOTCH RATINGS

The ‘Selecta-Drain” Chart along with Tables I and II enables the engineer to select “Control-Flo” Drains and drain pipe sizes for most Canadian applications. These calculations are computed for a proportional flow weir that is sized to give a flow of 23 L.P.M. (5 G.P.M.) per inch of head. The 23 L.P.M. (5 G.P.M.) per inch of head notch opening is selected as the bases of design as it offers the most economical installation as applied to actual rainfall experienced in Canada.

Should you require design criteria for locations outside of Canada or for special project applications please contact Zurn Industries Limited, Mississauga, Ontario.

LEADER AND DRAIN PIPE SIZING

Since all data in the “Selecta-Drain” Chart is based on the 50-year-storm it is possible to exceed the water depth listed in these charts if a 100-year or 1000-year storm would occur. Therefore, for good design it is recommended that scuppers or other methods be used to limit water depth to the design depth and tables I and II be used to size the leaders and drain pipes. If the roof is capable of supporting more water than the design depth it is permissible to locate the scuppers or other overflow means at a height that will allow a greater water depth on the roof. However, in this case the leader and drain pipes should be sized to handle the higher flow rates possible based on a flow rate of 23 L.P.M. (5 G.P.M.) per inch of depth at the drain.

PROPER DRAIN LOCATION

The following good design practice is recommended for selecting the proper number of “Control-Flo” drains for a given area. **On dead-level roofs**, drains should be located no further than 15.25m (50 feet) from edge of roof and no further than 30.50m (100 feet) between drains. See diagram “A” page 2. **On sloping roofs**, drains should be located in the valleys at a distance no greater than 15.25m (50 feet) from each end of the valleys and no further than 30.50m (100 feet) between drains. See diagram “B” page 2. Compliance with these recommendations will assure good run off regardless of wind direction.

Saves Specification Time, Assures Proper Application

QUICK, EASY SELECTION

Using the "Selecta-Drain" Chart (pages 9—13) in combination with the steps and examples appearing below, should save you countless hours in engineering specification time. This vast compilation of data is related to the proper selection of drains for 34 cities. All cities in alphabetical order by province. If a specific city does not appear in the tabulation, chooses the city nearest your area and select the proper drain using these factors.

3 EASY STEPS…

AND 3 TYPICAL EXAMPLES FOR APPLICATION OF SURE, SCIENTIFIC CONTROL OF DRAINAGE FROM DEAD-LEVEL AND SLOPING ROOFS WITH THE ZURN CONCEPT.

NOTE: Where roof area to be drained is adjacent to one or more vertical walls projecting above the roof, then a percentage of the of the wall(s) must be added to the roof area in determining total roof area to be drained.

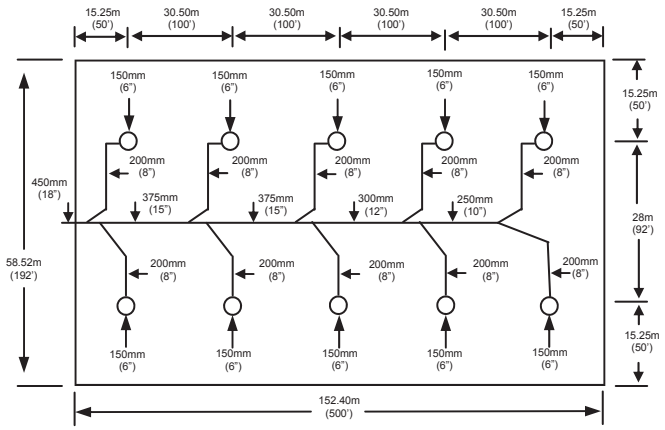
	TORONTO, ONTARIO	DEAD-LEVEL ROOF	102mm (4 INCH) SLOPE	152mm (6 INCH) SLOPE
1	Determine total roof area or individual areas when roof is divided by expansion joints or peaks in the case of sloping roof.	Roof Area: 56.52m x 152.40m = 8918.40m^2 (192ft x 500ft = 96,000 sq. ft.) (See Z105 layout bottom of this page.)	3 Individual Roof Areas: 19.50m x 152.40m = 2972.80m^2 (64ft x 500ft = 32,000 sq. ft.) Valleys 152.40m (500ft) long 3 x 2972.80 = 8918.40m^2 (3 x 32,000 = 96,000 sq. ft.)	2 Individual Roof Areas: 29.87m x 152.40m = 4552m^2 (98ft x 500ft = 49,000 sq. ft.) Valleys 152.40m (500ft) long 2 x 4552 = 9104m^2 (2 x 49,000 = 98,000 sq. ft.)
2	Divide roof area or individual areas by Zurn Notch Area Rating selected to obtain the total number of notches required.	Zurn Notch Area Rating selected for Toronto = 464.50m^2 (5,000 sq. ft.) from "Selecta-Drain Chart, page 11. Total Roof Area = 8918.40m^2 (96,000 sq. ft.) Entire roof. 464.50m^2 (5,000 sq. ft.) notch area = 19.2 notches—USE 20.	Zurn Notch Area Rating selected for Toronto = 464.50m^2 (5,000 sq. ft.) from "Selecta-Drain Chart, page 11. Total Roof Area = 2972.80m^2 (32,000 sq. ft.) Each area. 464.50m^2 (5,000 sq. ft.) notch area = 6.4 notches—USE 7 PER AREA.	Zurn Notch Area Rating selected for Toronto = 464.50m^2 (5,000 sq. ft.) from "Selecta-Drain Chart, page 11. Total Roof Area = 4552m^2 (49,000 sq. ft.) Each area. 464.50m^2 (5,000 sq. ft.) notch area = 9.8 notches—USE 10 PER AREA.
3	Determine total number of drains required by not exceeding maximum spacing dimensions in the preceding instructions. See Diagrams "A" or "B", page 2. Divide total number of notches required to determine the number of notches per drain. Note maximum water depth at drain and use this dimension to determine scupper height. Maximum scupper height to be used is 152mm (6"). *Use this flow rate to size leaders and drain lines.*	*10 drains required. All drains must have two notches each for a total of 20 notches. Flow rate is 66 L.P.M. (14.5 G.P.M.) per notch. Size leaders for 2 notch weirs for a flow rate of 66 L.P.M. (14.5 G.P.M.) 50 mm (two inch) pipe size leaders required. Maximum water depth and scupper height is 74mm (2.9"). Requires 19 hours draindown time maximum. For drain, vertical and horizontal pipe sizing data see Tables I and II on page 6 and 7.	**5 drains per area required located in the valleys 15.25m (50ft.) from each end with 3 in the middle at 30.50m (100ft.) spacings. Two drains on ends with two notches—3 drains in middle on notch each for a total of 7 notches. Maximum flow rate 93 L.P.M. (20.5 G.P.M.) per notch. Leader size 50mm (2") for single notch weirs—75mm (3") notch weirs. Maximum water depth and scupper height is 104mm (4.1"). Requires 11 hours draindown time maximum. For drain, vertical and horizontal pipe sizing data see Tables I and II on page 6 and 7.	**5 drains per area required located in the valleys 15.25m (50ft.) from each end with 3 in the middle at 30.50m (100ft.) spacing in the middle. 10 notches are required therefore all drains must have two notches. Flow rate is 111 L.P.M. (24.5 G.P.M.) per notch. Size all leaders for 2 notch weirs. 75mm (3") pipe size required. Maximum water depth and scupper height is 124mm (4.9"). Requires 9 hours draindown time maximum. For drain, vertical and horizontal pipe sizing data see Tables I and II on page 6 and 7.

*See Diagram "A" page 2 for recommended drain placement.
**See Diagram "B" page 2 for recommended drain placement.

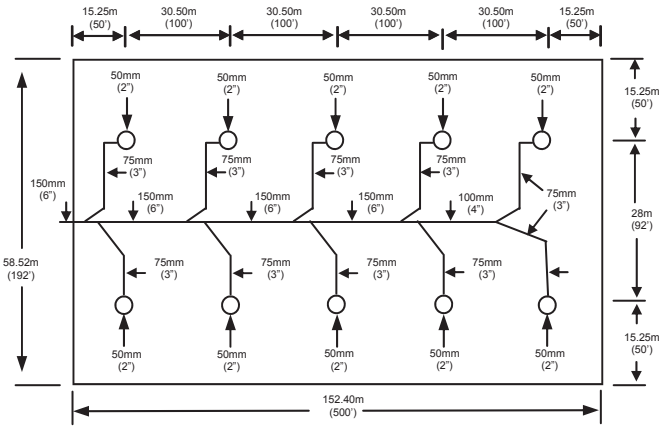
DEAD LEVEL ROOF

6mm (1/4") PER FT. SLOPE STORM DRAIN

CONVENTIONAL — "UNCONTROLLED" — RUN OFF



"CONTROL-FLO" — RUN OFF



Select The Proper Vertical Drain Leaders

ROOF DRAINAGE DATA

The flow rate for any design condition can be easily read from the data contained on the following pages; the tabulations shown below (and on the opposite page) can be used to simplify selection of drain line sizes.

TABLE 1 - SUGGESTED RELATION OF DRAIN OUTLET AND VERTICAL LEADER SIZE TO ZURN CONTROL-FLO ROOF DRAINS (BASED ON NATIONAL PLUMBING CODE ASA -A40.8 DATA ON VERTICAL LEADERS).

No. of Notches in Drain	Max. Flow per Notch in L.P.M. (G.P.M.)		
	Pipe Size		
	50mm (2")	75mm (3")	100mm (4")
1	136* (30*)	—	—
2	68 (15)	136* (30*)	—
3	45 (10)	136* (30*)	—
4	—	105 (23)	136* (30*)
5	—	82 (18)	136* (30*)
6	—	68 (15)	136* (30*)

*Maximum flow obtainable from 1 notch with 152mm (6") water depth at drain.

Table 1 should be used to select **vertical drain** leaders which at the same time establishes the drain outlet size. This table illustrates the minimum flow per notch in L.P.M. (G.P.M.) Since the Z-105 drain is available with a minimum of one and a maximum of six notches, calculations have already been a made and are listed in this table for any quantity of weir notch openings established in your design. It was determined ten drains with two notches each weir would be required in the Dead-Level Roof example on page 5. A 66 L.P.M. (14.5 G.P.M.) discharge per notch flow rate was also established.

Once this design criteria has been determined it will be the key to the proper selection of all drain outlet sizes, vertical and horizontal storm drain sizes in Table I and II. Enter the column "Number of Notches in Drain", Table I, read down the column to the figure 2 which indicates two notches in weir, then read across until you reach a figure equal to or closest figure in excess of 66 L.P.M. (14.5 G.P.M.) You will find fifteen in the column under 50mm (2") which represents the pipe size. Therefore all drain outlets and vertical leaders are 50mm (2") size.

Let us digress for a moment assuming a specific structure requires a total of six drains each containing a weir with a different number of notches. One with 1, one with 2, etc. Table 1 discloses the pipe size for one notch is 50mm (2"), two notch is 50mm (2"), three notch is 75mm (3"), four notch is 75mm (3"), five notch is 75mm (3") and six notch is 75mm (3") as they all equal or closely exceed the 66 L.P.M. (14.5 G.P.M.) design.

NOTE: Although pipe size calculations should be based on accumulated flow rate, local by-laws should be referred to for minimum pipe size requirements and roof drain spacing.

TABLE II should be used to select **horizontal** storm drain piping. Use the same flow rate 66 L.P.M. (14.5 G.P.M.) used to establish the vertical leaders to size the storm drainage system and main storm drain. Let us assume the ten drains each with two notch weirs were actually on the roof in two separate lines of five drains each and joined at a common point before leaving the building. Since Table II includes 3mm (1/8"), 6mm (1/4") and 13mm (1/2") per foot slope, let **us use 6mm (1/4") as our basis for selection** which will take us to the centre section. Starting with the first of five drains we enter the extreme left column in Table II and read down to the figure 2 since this drain has two notches in weir, read across horizontally and the size of first section of horizontal storm drain is 75mm (3") between 1st and 2nd drain, return to left hand column proceed reading down until you reach figure 4 then read across horizontally and the pipe size will be 100mm (4") between 2nd and 3rd drain, 100mm (4") between 3rd and 4th and 125mm (5") (if available) between 4th and 5th. If not available use 150mm (6"). (You may be tempted to use 100mm (4") since the capacity is close. We recommend you go to the larger size.) Pipe size leaving 5th drain would be 150mm (6"). The same sizing would hold true for the second line of five drains. Since both columns of five drains each are being joined together before leaving the building there will be total of twenty notches discharging into the main building storm sewer. Enter left hand column Table II, read down until you reach the figure twenty, then read across horizontally to the 6mm (1/4") per 305mm (1') slope column and you will see a 150mm (6") storm drain will handle the job adequately. The same procedure should be followed for sloped roof installations. The above method of sizing was done to better acquaint you with Table II and its use. The more economical and practical way of laying out and installing this same job is illustrated in the control-flo layout shown on bottom of page 5.

NOTE: Although pipe size calculations should be based on accumulated flow rates, local by-laws should be referred to for minimum pipe size requirements and roof drain spacing.

Select Proper Horizontal Storm Drain Piping

Table II — SUGGESTED RELATION OF HORIZONTAL STORM DRAIN SIZE TO ZURN CONTROL-FLO ROOF DRAINAGE

Total No. of Notches Discharging to Storm Drain	MAX. FLOW PER NOTCH IN L.P.M. (G.P.M.) Storm Drain Size 3mm (1/8") per 305mm (1') Slope								MAX. FLOW PER NOTCH IN L.P.M. (G.P.M.) Storm Drain Size 6mm (1/4") per 305mm (1') Slope							MAX. FLOW PER NOTCH IN L.P.M. (G.P.M.) Storm Drain Size 13mm (1/2") per 305mm (1') Slope						
	75 (3")	100 (4")	125 (5")	150 (6")	200 (8")	250 (10")	300 (12")	375 (15")	75 (3")	100 (4")	125 (5")	150 (6")	200 (8")	250 (10")	300 (12")	75 (3")	100 (4")	125 (5")	150 (6")	200 (8")	250 (10")	300 (12")
1	136* (30*)	—	—	—	—	—	—	—	136* (30*)	—	—	—	—	—	—	136* (30*)	—	—	—	—	—	—
2	77 (17)	136* (30*)	—	—	—	—	—	—	109 (24)	136* (30*)	—	—	—	—	—	136* (30*)	—	—	—	—	—	—
3	50 (11)	118 (26)	136* (30*)	—	—	—	—	—	73 (16)	136* (30*)	—	—	—	—	—	100 (22)	136* (30*)	—	—	—	—	—
4	36 (8)	86 (19)	136* (30*)	—	—	—	—	—	55 (12)	127 (28)	136* (30*)	—	—	—	—	77 (17)	136* (30*)	—	—	—	—	—
5	—	65 (15)	127* (28*)	136* (30*)	—	—	—	—	—	100 (22)	136* (30*)	—	—	—	—	59 (13)	136* (30*)	—	—	—	—	—
6	—	59 (13)	105 (23)	136* (30*)	—	—	—	—	—	82 (18)	136* (30*)	—	—	—	—	50 (11)	118 (26)	136* (30*)	—	—	—	—
7	—	50 (11)	91 (20)	136* (30*)	—	—	—	—	—	73 (16)	127 (28)	136* (30*)	—	—	—	—	100 (22)	136* (30*)	—	—	—	—
8	—	—	77 (17)	127 (28)	136* (30*)	—	—	—	—	64 (14)	114 (25)	136* (30*)	—	—	—	—	86 (19)	136* (30*)	—	—	—	—
9	—	—	68 (15)	114 (25)	136* (30*)	—	—	—	—	55 (12)	100 (22)	136* (30*)	—	—	—	—	77 (17)	136* (30*)	—	—	—	—
10	—	—	64 (14)	100 (22)	136* (30*)	—	—	—	—	—	91 (20)	136* (30*)	—	—	—	—	68 (15)	123 (27)	136* (30*)	—	—	—
11	—	—	55 (12)	91 (20)	136* (30*)	—	—	—	—	—	82 (18)	132 (29)	136* (30*)	—	—	—	64 (14)	114 (25)	136* (30*)	—	—	—
12	—	—	—	82 (18)	136* (30*)	—	—	—	—	—	73 (16)	118 (26)	136* (30*)	—	—	—	59 (13)	105 (23)	136* (30*)	—	—	—
13	—	—	—	77 (17)	136* (30*)	—	—	—	—	—	68 (15)	109 (24)	136* (30*)	—	—	—	55 (12)	95 (21)	136* (30*)	—	—	—
14	—	—	—	73 (16)	136* (30*)	—	—	—	—	—	64 (14)	100 (22)	136* (30*)	—	—	—	—	86 (19)	136* (30*)	—	—	—
15	—	—	—	68 (15)	136* (30*)	—	—	—	—	—	59 (13)	95 (21)	136* (30*)	—	—	—	—	82 (18)	132 (29)	136* (30*)	—	—
16	—	—	—	64 (14)	136* (30*)	—	—	—	—	—	—	91 (20)	136* (30*)	—	—	—	—	77 (17)	123 (27)	136* (30*)	—	—
17	—	—	—	59 (13)	127 (28)	136* (30*)	—	—	—	—	—	82 (18)	136* (30*)	—	—	—	—	73 (16)	118 (26)	136* (30*)	—	—
18	—	—	—	55 (12)	118 (26)	136* (30*)	—	—	—	—	—	77 (17)	136* (30*)	—	—	—	—	68 (15)	109 (24)	136* (30*)	—	—
19	—	—	—	—	114 (25)	136* (30*)	—	—	—	—	—	73 (16)	136* (30*)	—	—	—	—	64 (14)	105 (23)	136* (30*)	—	—
20	—	—	—	—	109 (24)	136* (30*)	—	—	—	—	—	68 (15)	136* (30*)	—	—	—	—	59 (13)	100 (22)	136* (30*)	—	—
23	—	—	—	—	91 (20)	136* (30*)	—	—	—	—	—	64 (14)	132 (29)	136* (30*)	—	—	—	55 (12)	86 (19)	136* (30*)	—	—
25	—	—	—	—	86 (19)	136* (30*)	—	—	—	—	—	59 (13)	123 (27)	136* (30*)	—	—	—	—	77 (17)	136* (30*)	—	—
30	—	—	—	—	73 (16)	127 (28)	136* (30*)	—	—	—	—	—	100 (22)	136* (30*)	—	—	—	—	64 (14)	136* (30*)	—	—
35	—	—	—	—	59 (13)	109 (24)	136* (30*)	—	—	—	—	—	86 (19)	136* (30*)	—	—	—	—	55 (12)	123 (27)	136* (30*)	—
40	—	—	—	—	55 (12)	95 (21)	136* (30*)	—	—	—	—	—	77 (17)	136* (30*)	—	—	—	—	—	105 (23)	136* (30*)	—
45	—	—	—	—	—	86 (19)	136* (30*)	—	—	—	—	—	68 (15)	123 (27)	136* (30*)	—	—	—	—	95 (21)	136* (30*)	—
50	—	—	—	—	—	77 (17)	123 (27)	136* (30*)	—	—	—	—	59 (13)	109 (24)	136* (30*)	—	—	—	—	86 (19)	136* (30*)	—
55	—	—	—	—	—	68 (15)	114 (25)	136* (30*)	—	—	—	—	—	100 (22)	136* (30*)	—	—	—	—	77 (17)	136* (30*)	—
60	—	—	—	—	—	64 (14)	105 (23)	136* (30*)	—	—	—	—	—	91 (20)	136* (30*)	—	—	—	—	68 (15)	127 (28)	136* (30*)
65	—	—	—	—	—	59 (13)	95 (21)	136* (30*)	—	—	—	—	—	82 (18)	136* (30*)	—	—	—	—	64 (14)	118 (26)	136* (30*)
70	—	—	—	—	—	55 (12)	91 (20)	136* (30*)	—	—	—	—	—	77 (17)	127 (28)	—	—	—	—	59 (13)	109 (24)	136* (30*)

*Maximum flow obtainable from 1 notch with 152mm (6") water depth at drain.

TABLE III - TO BE USED WHEN ROOF STORM WATER RUN OFF AND OTHER SURFACE WATER RUN OFF IS BEING CONSOLIDATED INTO ONE COMMON MAIN HORIZONTAL STORM SEWER.

Flow capacity of vertical leaders litres per minute (gallons per minute)

Pipe Size	Maximum Capacity L.P.M. (G.P.M.)
50mm (2”)	136 (30)
75mm (3”)	409 (90)
100mm (4”)	864 (190)
†125mm (5”)	1582 (348)
150mm (6”)	2550 (561)

†In some areas 125mm (5”) drainage pipe may not be available.

Flow capacity of horizontal storm sewers litres per minute (gallons per minute).

Pipe Size	Slope per 305mm (1’0”)		
	3mm (1/8”)	6mm (1/4”)	13mm (1/2”)
75mm (3”)	163 (36)	232 (51)	327 (72)
100mm (4”)	355 (78)	505 (111)	714 (157)
†125mm (5”)	646 (142)	914 (201)	1291 (284)
150mm (6”)	1050 (231)	1487 (327)	2100 (462)
200mm (8”)	2264 (498)	3205 (705)	4528 (996)
250mm (10”)	4100 (902)	5796 (1275)	8201 (1804)
300mm (12”)	6669 (1467)	9437 (2076)	13338 (2934)
375mm (15”)	12120 (2666)	17157 (3774)	24239 (5332)

Note: Although pipe size calculations should be based on accumulated flow rate, local by-laws should be referred to for minimum pipe size requirements and roof drain spacing.

SCUPPER AND OVERFLOW DRAINS

Roofing members and understructures, weakened by seepage and rot resulting from improper drainage and roof construction can give away under the weight of rapidly accumulated water during flash storms. Thus, it is recommended, and often required by building codes, to install scuppers and overflow drains in parapet-type roofs. Properly selected and sized scuppers and overflow drains are vital to a well-engineered drainage system to prevent excessive loading, erosion, seepage and rotting.

Selecta-Drain Chart

ZURN

LOCATION	SQUARE METRE (SQUARE FOOT) NOTCH AREA RATING	ROOF LOAD FACTOR KGS. (LBS.)	TOTAL ROOF SLOPE											
			DEAD LEVEL			51mm (2") RISE			102mm (4") RISE			152mm (6") RISE		
			L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (in.) Water Depth
Calgary, Alberta	232 (2,500)	4.7 (10.4)	45.5 (10)	7	51 (2)	57 (12.5)	6	63.5 (2.5)	72.5 (16)	4	81.5 (3.2)	86.5 (19)	3.2	96.5 (3.8)
	465 (5,000)	5.9 (13)	57 (12.5)	17	63.5 (2.5)	66 (14.5)	14	73.5 (2.9)	82 (18)	9	91.5 (3.6)	97.5 (21.5)	7.5	109 (4.3)
	697 (7,500)	6.4 (14)	61.5 (13.5)	28	68.5 (2.7)	72.5 (16)	22	81.5 (3.2)	88.5 (19.5)	15	99 (3.9)	104.5 (23)	12	117 (4.6)
	929 (10,000)	6.8 (15.1)	66 (14.5)	38	73.5 (2.9)	77.5 (17)	31	86.5 (3.4)	93 (20.5)	22	104 (4.1)	109 (24)	17	122 (4.8)
Edmonton, Alberta	232 (2,500)	4.5 (9.9)	43 (9.5)	7	48.5 (1.9)	57 (12.5)	6	63.5 (2.5)	72.5 (16)	4	81.5 (3.2)	82 (18)	3	91.5 (3.6)
	465 (5,000)	5.9 (13)	57 (12.5)	17	63.5 (2.5)	68 (15)	14.5	76 (3)	84 (18.5)	9.5	94 (3.7)	97.5 (21.5)	7.5	109 (4.3)
	697 (7,500)	6.6 (14.5)	63.5 (14)	28	71 (2.8)	75 (16.5)	24	84 (3.3)	97.5 (21.5)	16	104 (4.1)	107 (23.5)	12	119.5 (4.7)
	929 (10,000)	7.1 (15.6)	68 (15)	38	76 (3.0)	79.5 (17.5)	32	89 (3.5)	100 (22)	22	112 (4.4)	113.5 (25)	18	127 (5.0)
Penticton, British Columbia	232 (2,500)	3.8 (8.3)	36.5 (8)	6	40.5 (1.6)	38.5 (8.5)	4	43 (1.7)	52.5 (11.5)	3	58.5 (2.3)	61.5 (13.5)	2.3	68.5 (2.7)
	465 (5,000)	4.0 (8.8)	38.5 (8.5)	13	43 (1.7)	41 (9)	9	45.5 (1.8)	57 (12.5)	6	63.5 (2.5)	68 (15)	5	76 (3)
	697 (7,500)	4.2 (9.3)	41 (9)	21	45.5 (1.8)	43 (9.5)	14.5	48.5 (1.9)	61.5 (13.5)	10.5	68.5 (2.7)	72.5 (16)	8	81.5 (3.2)
	929 (10,000)	4.2 (9.3)	41 (9)	27	45.5 (1.8)	45.5 (10)	20	51 (2)	63.5 (14)	14	71 (2.8)	75 (16.5)	11	84 (3.3)
Vancouver, British Columbia	232 (2,500)	3.3 (7.3)	32 (7)	5.5	35.5 (1.4)	38.5 (8.5)	4	43 (1.7)	47.5 (10.5)	2.8	53.5 (2.1)	57 (12.5)	2	63.5 (2.5)
	465 (5,000)	4.0 (8.8)	38.5 (8.5)	13	43 (1.7)	45.5 (10)	10	51 (2)	57 (12.5)	6	63.5 (2.5)	68 (15)	5	76 (3)
	697 (7,500)	4.5 (9.9)	43 (9.5)	22	48.5 (1.9)	50 (11)	17	56 (2.2)	63.5 (14)	11	71 (2.8)	75 (16.5)	8.5	84 (3.3)
	929 (10,000)	4.9 (10.9)	47.5 (10.5)	30	53.5 (2.1)	54.5 (12)	24	61 (2.4)	68 (15)	15	76 (3)	79.5 (17.5)	12	89 (3.5)
Victoria, British Columbia	232 (2,500)	3.3 (7.3)	32 (7)	5.5	35.5 (1.4)	38.5 (8.5)	4	43 (1.7)	43 (9.5)	2.5	48.5 (1.9)	54.5 (12)	2	61 (2.4)
	465 (5,000)	4.0 (8.8)	38.5 (8.5)	13	43 (1.7)	45.5 (10)	10	51 (2)	54.5 (12)	6	61 (2.4)	68 (15)	5	76 (3)
	697 (7,500)	4.5 (9.9)	43 (9.5)	22	48.5 (1.9)	50 (11)	16	56 (2.2)	59 (13)	10	66 (2.6)	75 (16.5)	8	84 (3.3)
	929 (10,000)	4.7 (10.4)	45.5 (10)	30	51 (2)	54.5 (12)	23	61 (2.4)	63.5 (14)	14	71 (2.8)	79.5 (17.5)	12	89 (3.5)
Brandon, Manitoba	232 (2,500)	5.9 (13)	57 (12.5)	8	63.5 (2.5)	68 (15)	7	76 (3)	82 (18)	4.5	91.5 (3.6)	92.5 (21)	3.5	106.5 (4.2)
	465 (5,000)	7.3 (16.1)	73 (16)	20	81.5 (3.2)	84 (18.5)	17	94 (3.7)	97.5 (21.5)	11	109 (4.3)	113.5 (25)	8.5	127 (5)
	697 (7,500)	8.3 (18.2)	79.5 (17.5)	32	89 (3.5)	93 (20.5)	27	104 (4.1)	107 (23.5)	19	119.5 (4.7)	125 (27.5)	15	139.5 (5.5)
	929 (10,000)	9.0 (19.8)	86.5 (19)	43	96.5 (3.8)	100 (22)	38	112 (4.4)	113.5 (25)	26	127 (5.0)	132 (29)	21	147.5 (5.8)
Winnipeg, Manitoba	232 (2,500)	4.7 (10.4)	45.5 (10)	7	51 (2)	57 (12.5)	6	63.5 (2.5)	75 (16.5)	4	84 (3.3)	86.5 (19)	3.2	96.5 (3.8)
	465 (5,000)	5.9 (13)	57 (12.5)	17	63.5 (2.5)	68 (15)	15	76 (3)	84 (18.5)	10	94 (3.7)	100 (22)	7.5	112 (4.4)
	697 (7,500)	6.6 (14.5)	63.5 (14)	28	71 (2.8)	75 (16.5)	24	84 (3.3)	93 (20.5)	16	104 (4.1)	107 (23.5)	12	119.5 (4.7)
	929 (10,000)	7.1 (15.6)	68 (15)	39	76 (3)	82 (18)	32	91.5 (3.6)	97.5 (21.5)	22	109 (4.3)	113.5 (25)	17	127 (5.0)
Campbellton, New Brunswick	232 (2,500)	6.4 (14)	62 (13.5)	9	68.5 (2.7)	70.5 (15.5)	7	78.5 (3.1)	79.5 (17.5)	4.5	89 (3.5)	91 (20)	3.5	101.5 (4.0)
	465 (5,000)	9.0 (19.8)	86.5 (19)	22	96.5 (3.8)	91 (20)	18	101.5 (4)	102.5 (22.5)	12	115 (4.5)	113.5 (25)	9	127 (5.0)
	697 (7,500)	10.4 (22.9)	100 (22)	35	112 (4.4)	102.5 (22.5)	28	114.5 (4.5)	118 (26)	20	132 (5.2)	132 (29)	15	147.5 (5.8)
	929 (10,000)	11.3 (25)	109 (24)	47	122 (4.8)	111.5 (24.5)	40	124.5 (4.9)	127.5 (28)	29	142 (5.6)	141 (31)	22	157.5 (6.2)

Selecta-Drain Chart

LOCATION	SQUARE METRE (SQUARE FOOT) NOTCH AREA RATING	ROOF LOAD FACTOR KGS. (LBS.)	TOTAL ROOF SLOPE											
			DEAD LEVEL			51mm (2") RISE			102mm (4") RISE			152mm (6") RISE		
			L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (in.) Water Depth
Chatham, New Brunswick	232 (2,500)	4.5 (9.9)	43 (9.5)	7	48.5 (1.9)	52.5 (11.5)	5.5	58.5 (2.3)	63.5 (14)	3.5	71 (2.8)	77.5 (17)	2.9	86.5 (3.4)
	465 (5,000)	5.7 (12.5)	54.5 (12)	16	61 (2.4)	63.5 (14)	13	71 (2.8)	77.5 (17)	9	86.5 (3.4)	91 (20)	7	101.5 (4.0)
	697 (7,500)	6.4 (14)	61.5 (13.5)	27	68.5 (2.7)	68 (15)	22	76 (3)	84 (18.5)	14	94 (3.7)	102.5 (22.5)	12	114.5 (4.5)
	929 (10,000)	6.6 (14.6)	63.5 (14)	37	71 (2.8)	75 (16.5)	30	84 (3.3)	91 (20)	20	101.5 (4.0)	107 (23.5)	16	119.5 (4.7)
Moncton, New Brunswick	232 (2,500)	4.3 (9.4)	41 (9)	7	45.5 (1.8)	54.5 (12)	6	61 (2.4)	63.5 (14)	3.5	71 (2.8)	72.5 (16)	2.7	81.5 (3.2)
	465 (5,000)	5.9 (13)	57 (12.5)	17	63.5 (2.5)	68 (15)	14	76 (3)	82 (18)	9	91.5 (3.6)	93 (20.5)	7	104 (4.1)
	697 (7,500)	6.6 (14.6)	63.5 (14)	28	71 (2.8)	79.5 (17.5)	24	89 (3.5)	93 (20.5)	16	104 (4.1)	104.5 (23)	12	117 (4.6)
	929 (10,000)	7.5 (16.6)	73.5 (16)	39	81.5 (3.2)	84 (18.5)	34	94 (3.7)	100 (22)	23	112 (4.4)	113.5 (25)	17	127 (5.0)
Saint John, New Brunswick	232 (2,500)	5.7 (12.5)	54.5 (12)	8	61 (2.4)	57 (12.5)	6	63.5 (2.5)	75 (16.5)	4	84 (3.3)	86.5 (19)	3	96.5 (3.8)
	465 (5,000)	7.5 (16.6)	72.5 (16)	20	81.5 (3.2)	79.5 (17.5)	16	89 (3.5)	95.5 (21)	11	106.5 (4.2)	104.5 (23)	8	117 (4.6)
	697 (7,500)	8.7 (19.2)	84 (18.5)	32	94 (3.7)	93 (20.5)	27	104 (4.1)	107 (23.5)	19	119.5 (4.7)	118 (26)	13.5	132 (5.2)
	929 (10,000)	9.7 (21.3)	93 (20.5)	44	104 (4.1)	104.5 (23)	38	117 (4.6)	113.5 (25)	27	127 (5.0)	127.5 (28)	20	142 (5.6)
Gander, Newfound-land	232 (2,500)	3.5 (7.8)	34 (7.5)	5.5	38 (1.5)	45.5 (10)	5	51 (2.0)	57 (12.5)	3.5	63.5 (2.5)	68 (15)	2.5	76 (3.0)
	465 (5,000)	4.7 (10.4)	45.5 (10)	15	51 (2.0)	57 (12.5)	12	63.5 (2.5)	72.5 (16)	8	81.5 (3.2)	82 (18)	6.5	91.5 (3.6)
	697 (7,500)	5.7 (12.5)	54.5 (12)	25	61 (2.4)	63.5 (14)	21	71 (2.8)	79.5 (17.5)	13.5	89 (3.5)	93 (20.5)	11	104 (4.1)
	929 (10,000)	6.1 (13.5)	59 (13)	35	66 (2.6)	70.5 (15.5)	29	78.5 (3.1)	84 (18.5)	19	94 (3.7)	100 (22)	15	112 (4.4)
St. Andrews, Newfound-land	232 (2,500)	3.5 (7.8)	34 (7.5)	5.5	38 (1.5)	45.5 (10)	5	51 (2.0)	59 (13)	3.5	66 (2.6)	63.5 (14)	2.5	71 (2.8)
	465 (5,000)	5.2 (11.4)	47.5 (10.5)	15	53.5 (2.1)	59 (13)	13	66 (2.6)	72.5 (16)	8	81.5 (3.2)	79.5 (17.5)	6	89 (3.5)
	697 (7,500)	5.9 (13)	57 (12.5)	26	63.5 (2.5)	66 (14.5)	21	73.5 (2.9)	82 (18)	14	91.5 (3.6)	88.5 (19.5)	10	99 (3.9)
	929 (10,000)	6.6 (14.6)	63.5 (14)	36	71 (2.8)	72.5 (16)	30	81.5 (3.2)	86.5 (19)	20	96.5 (3.8)	95.5 (21)	14.5	106.5 (4.2)
St. John's, Newfound-land	232 (2,500)	5.9 (13)	57 (12.5)	8	63.5 (2.6)	68 (15)	7	76 (3.0)	77.5 (17)	4.5	86.5 (3.4)	86.5 (19)	3.2	96.5 (3.8)
	465 (5,000)	8.5 (18.7)	82 (18)	21	91.5 (3.6)	91 (20)	18	101 (4.0)	100 (22)	11	112 (4.4)	113.5 (25)	9	127 (5.0)
	697 (7,500)	10.6 (23.4)	102.5 (22.5)	34	114.5 (4.5)	109 (24)	29	122 (4.8)	122.5 (27)	21	137 (5.4)	132 (29)	15	147.5 (5.8)
	929 (10,000)	11.8 (26)	113.5 (25)	48	127 (5.0)	129.5 (28.5)	43	145 (5.7)	143 (31.5)	33	160 (6.3)	150 (33)	24	167.5 (6.6)
Torbay, Newfound-land	232 (2,500)	4.9 (10.9)	47.5 (10.5)	7.5	53.5 (2.1)	61.5 (13.5)	6.5	68.5 (2.7)	75 (16.5)	4	84 (3.3)	84 (18.5)	3	94 (3.7)
	465 (5,000)	6.4 (14)	61.5 (13.5)	18	68.5 (2.7)	75 (16.5)	15.5	84 (3.3)	88.5 (19.5)	10	99 (3.9)	102.5 (22.5)	8	114.5 (4.5)
	697 (7,500)	7.3 (16.1)	70.5 (15.5)	29	78.5 (3.1)	84 (18.5)	25	94 (3.7)	100 (22)	17.5	112 (4.4)	113.5 (25)	13	127 (5)
	929 (10,000)	8.0 (17.7)	77.5 (17)	40	86.5 (3.4)	88.5 (19.5)	34	99 (3.9)	107 (23.5)	24	119.5 (4.7)	122.5 (27)	19	137 (5.4)
Halifax, Nova Scotia	232 (2,500)	5.9 (13)	57 (12.5)	8	63.5 (2.5)	68 (15)	7	76 (3.0)	77.5 (17)	4.5	86.5 (3.4)	86.5 (19)	3.2	96.5 (3.8)
	465 (5,000)	8.5 (18.7)	82 (18)	21	91.5 (3.6)	91 (20)	18	101.5 (4.0)	100 (22)	11	112 (4.4)	113.5 (25)	9	127 (5.0)
	697 (7,500)	10.6 (23.4)	102.5 (22.5)	34	114.5 (4.5)	109 (24)	29	122 (4.8)	122.5 (27)	21	137 (5.4)	132 (29)	15	147.5 (5.8)
	929 (10,000)	11.8 (26)	113.5 (25)	48	127 (5.0)	129.5 (28.5)	43	145 (5.7)	143 (31.5)	33	160 (6.3)	150 (33)	24	167.5 (6.6)

Selecta-Drain Chart

LOCATION	SQUARE METRE (SQUARE FOOT) NOTCH AREA RATING	ROOF LOAD FACTOR KGS. (LBS.)	TOTAL ROOF SLOPE											
			DEAD LEVEL			51mm (2") RISE			102mm (4") RISE			152mm (6") RISE		
			L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (in.) Water Depth
Sydney, Nova Scotia	232 (2,500)	4.3 (9.4)	41 (9)	6.5	45.5 (1.8)	45.5 (10)	5	51 (2.0)	57 (12.5)	3.5	6.5 (2.5)	68 (15)	2.5	76 (3)
	465 (5,000)	5.7 (12.5)	54.5 (12)	16	61 (2.4)	59 (13)	13	66 (2.6)	75 (16.5)	8	84 (3.3)	84 (18.5)	6.5	94 (3.7)
	697 (7,500)	6.4 (14)	61.5 (13.5)	28	68.5 (2.7)	68 (15)	22	76 (3)	84 (18.5)	14	94 (3.7)	97.5 (21.5)	11	109 (4.3)
	929 (10,000)	7.1 (15.6)	68 (15)	38	76 (3)	75 (16.5)	30	84 (3.3)	91 (20)	20	101.5 (4)	104.5 (23)	16	117 (4.6)
Yarmouth, Nova Scotia	232 (2,500)	6.4 (14)	61.5 (13.5)	9	68.5 (2.7)	70.5 (15.5)	7.5	78.5 (3.1)	82 (18)	4.5	91.5 (3.6)	91 (20)	3.5	101.5 (4)
	465 (5,000)	8.3 (18.2)	79.5 (17.5)	21	89 (3.5)	88.5 (19.5)	18	99 (3.9)	104.5 (23)	12	117 (4.6)	116 (25.5)	9	129.5 (5.1)
	697 (7,500)	9.4 (20.8)	91 (20)	34	101.5 (4)	102.5 (22.5)	29	114.5 (4.5)	118 (26)	21	132 (5.2)	132 (29)	15	147.5 (5.8)
	929 (10,000)	10.4 (22.9)	100 (22)	45	112 (4.4)	109 (24)	41	122 (4.8)	129.5 (28.5)	29	145 (5.7)	141 (31)	22	157.5 (6.2)
Thunder Bay, Ontario	232 (2,500)	4.9 (10.9)	47.5 (10.5)	7.5	53.5 (2.1)	61.5 (13.5)	6.5	68.5 (2.7)	75 (16.5)	4	84 (3.3)	88.5 (19.5)	3.5	91.5 (3.6)
	465 (5,000)	6.1 (13.5)	59 (13)	18	66 (2.6)	72.5 (16)	15	81.5 (3.2)	86.5 (19)	9.5	96.5 (3.8)	102.5 (22.5)	7.5	114.5 (4.5)
	697 (7,500)	6.6 (14.6)	63.5 (14)	28	71 (2.8)	77.5 (17)	24	86.5 (3.4)	93 (20.5)	16	104 (4.1)	109 (24)	13	122 (4.8)
	929 (10,000)	7.1 (15.6)	68 (15)	38	76 (3)	84 (18.5)	33	94 (3.7)	97.5 (21.5)	22	109 (4.3)	116 (25.5)	18	129.5 (5.1)
Guelph, Ontario	232 (2,500)	5.7 (12.5)	54.5 (12)	8	61 (2.4)	63.5 (14)	7	71 (2.8)	86.5 (19)	5	96.5 (3.8)	100 (22)	3.7	112 (4.4)
	465 (5,000)	6.6 (14.6)	63.5 (14)	19	71 (2.8)	75 (16.5)	15.5	84 (3.3)	97.5 (21.5)	11	109 (4.3)	116 (25.5)	9	129.5 (5.1)
	697 (7,500)	7.3 (16.1)	70.5 (15.5)	29	78.5 (3.1)	82 (18)	25	91.5 (3.6)	104.5 (23)	18	117 (4.6)	125 (27.5)	14	139.5 (5.5)
	929 (10,000)	8.0 (17.7)	77.5 (17)	40	86.5 (3.4)	84 (18.5)	34	94 (3.7)	109 (24)	26	122 (4.8)	132 (29)	20	147.5 (5.8)
Hamilton, Ontario	232 (2,500)	5.9 (13)	57 (12.5)	8.5	63.5 (2.5)	72.5 (16)	7.5	81.5 (3.2)	93 (20.5)	5	104 (4.1)	109 (24)	4	122 (4.8)
	465 (5,000)	6.6 (14.6)	63.5 (14)	19	71 (2.8)	79.5 (17.5)	16	89 (3.5)	104.5 (23)	12	117 (4.6)	122.5 (27)	9	137 (5.4)
	697 (7,500)	6.8 (15.1)	66 (14.5)	28	73.5 (2.9)	84 (18.5)	26	94 (3.7)	111.5 (24.5)	20	124.5 (4.9)	127.5 (28)	15	142 (5.6)
	929 (10,000)	7.1 (15.6)	68 (15)	39	76 (3)	86.5 (19)	34	96.5 (3.8)	116 (25.5)	27	129.5 (5.1)	134 (29.5)	21	150 (5.9)
Kingston, Ontario	232 (2,500)	6.4 (14)	61.5 (13.5)	9	68.5 (2.7)	77.5 (17)	8	86.5 (3.4)	91 (20)	5	101.5 (4)	109 (24)	4	122 (4.8)
	465 (5,000)	7.5 (16.6)	72.5 (16)	20	81.5 (3.2)	86.5 (19)	18	96.5 (3.8)	104.5 (23)	12	117 (4.6)	122.5 (27)	9.5	137 (5.4)
	697 (7,500)	8.5 (18.7)	82 (18)	31	91.5 (3.6)	93 (20.5)	28	104 (4.1)	111.5 (24.5)	20	124.5 (4.9)	132 (29)	15	147.5 (5.8)
	929 (10,000)	8.7 (19.2)	86.5 (19)	42	96.5 (3.8)	97.5 (21.5)	38	109 (4.3)	116 (25.5)	27	129.5 (5.1)	68 (15)	21	152.5 (6)
London, Ontario	232 (2,500)	6.1 (13.5)	59 (13)	8.5	66 (2.6)	72.5 (16)	7.5	81.5 (3.2)	88.5 (19.5)	5	99 (3.9)	107 (23.5)	4	119.5 (4.7)
	465 (5,000)	7.1 (15.6)	68 (15)	20	76 (3)	84 (18.5)	17	94 (3.7)	102.5 (22.5)	12	114.5 (4.5)	122.5 (27)	9.5	137 (5.4)
	697 (7,500)	8.0 (17.7)	77.5 (17)	30	86.5 (3.4)	88.5 (19.5)	27	99 (3.9)	109 (24)	19	122 (4.8)	129.5 (28.5)	15	145 (5.7)
	929 (10,000)	8.5 (18.7)	82 (18)	41	91.5 (3.6)	91 (20)	36	101.5 (4)	113.5 (25)	27	127 (5)	134 (29.5)	21	150 (5.9)
North Bay, Ontario	232 (2,500)	5.7 (12.5)	54.5 (12)	8	61 (2.4)	68 (15)	7	76 (3)	86.5 (19)	5	96.5 (3.8)	100 (22)	3.8	112 (4.4)
	465 (5,000)	6.6 (14.6)	63.5 (14)	19	71 (2.8)	79.5 (17.5)	16	89 (3.5)	97.5 (21.5)	11	109 (4.3)	113.5 (25)	9	127 (5)
	697 (7,500)	7.5 (16.6)	72.5 (16)	30	81.5 (3.2)	86.5 (19)	26	96.5 (3.8)	107 (23.5)	19	119.5 (4.7)	122.5 (27)	14	137 (5.4)
	929 (10,000)	8.3 (18.2)	77.5 (17)	40	86.5 (3.4)	93 (20.5)	36	104 (4.1)	111.5 (24.5)	26	124.5 (4.9)	127.5 (28)	20	142 (5.6)

Selecta-Drain Chart

LOCATION	SQUARE METRE (SQUARE FOOT) NOTCH AREA RATING	ROOF LOAD FACTOR KGS. (LBS.)	TOTAL ROOF SLOPE											
			DEAD LEVEL			51mm (2") RISE			102mm (4") RISE			152mm (6") RISE		
			L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (in.) Water Depth
Ottawa, Ontario	232 (2,500)	4.7 (10.4)	45.5 (10)	7	51 (2)	59 (13)	6.5	66 (2.6)	77.5 (17)	4.5	86.5 (3.4)	86.5 (19)	3.2	96.5 (3.8)
	465 (5,000)	5.9 (13)	57 (12.5)	17	63.5 (2.5)	68 (15)	14	76 (3)	86.5 (19)	10	96.5 (3.8)	100 (22)	7.5	112 (4.4)
	697 (7,500)	6.4 (14)	61.5 (13.5)	27	68.5 (2.7)	75 (16.5)	23	84 (3.3)	93 (20.5)	16	104 (4.1)	107 (23.5)	12	119.5 (4.7)
	929 (10,000)	6.6 (14.6)	63.5 (14)	36	71 (2.8)	79.5 (17.5)	32	89 (3.5)	97.5 (21.5)	22	109 (4.3)	113.5 (25)	18	127 (5)
St. Thomas, Ontario	232 (2,500)	5.7 (12.5)	54.5 (12)	8	61 (2.4)	68 (15)	7	76 (3.0)	86.5 (19)	5	96.5 (3.8)	104.5 (23)	4	117 (4.6)
	465 (5,000)	6.6 (14.6)	63.5 (14)	19	71 (2.8)	77.5 (17)	16	86.5 (3.4)	97.5 (21.5)	11	109 (4.3)	118 (26)	9	132 (5.2)
	697 (7,500)	7.1 (16.6)	68 (15)	29	76 (3.0)	82 (18)	26	91.5 (3.6)	102.5 (22.5)	18	114.5 (4.5)	125 (27.5)	15	139.5 (5.5)
	929 (10,000)	7.5 (16.6)	72.5 (16)	40	81.5 (3.2)	86.5 (19)	34	96.5 (3.8)	107 (23.5)	24	119.5 (4.7)	132 (29)	20	147.5 (5.8)
Timmins, Ontario	232 (2,500)	4.3 (9.4)	41 (9)	7	45.5 (1.8)	57 (12.5)	6	63.5 (2.5)	72.5 (16)	4	81.5 (3.2)	86.5 (19)	3.3	96.5 (3.8)
	465 (5,000)	5.7 (12.5)	54.5 (12)	16	61 (2.4)	63.5 (14)	14	71 (2.8)	82 (18)	9	91.5 (3.6)	97.5 (21.5)	7.5	109 (4.3)
	697 (7,500)	6.4 (14)	61.5 (13.5)	27	68.5 (2.7)	70.5 (15.5)	22	78.5 (3.1)	86.5 (19)	15	96.5 (3.8)	104.5 (23)	12	117 (4.6)
	929 (10,000)	6.6 (14.6)	63.5 (14)	36	71 (2.8)	72.5 (16)	30	81.5 (3.2)	91 (20)	21	101.5 (4.0)	109 (24)	17	122 (4.8)
Toronto, Ontario	232 (2,500)	5.7 (12.5)	54.5 (12)	8	61 (2.4)	66 (14.5)	7	73.5 (2.9)	82 (18)	4.5	91.5 (3.6)	97.5 (21.5)	3.5	109 (4.3)
	465 (5,000)	6.8 (15.1)	66 (14.5)	19	73.5 (2.9)	77.5 (17)	16	86.5 (3.4)	93 (20.5)	11	104 (4.1)	111.5 (24.5)	9	124.5 (4.9)
	697 (7,500)	8.0 (17.7)	77.5 (17)	30	86.5 (3.4)	84 (18.5)	26	94 (3.7)	100 (22)	18	112 (4.4)	120.5 (26.5)	14	134.5 (5.3)
	929 (10,000)	8.7 (19.2)	82 (18)	42	91.5 (3.6)	86.5 (19)	34	96.5 (3.8)	104.5 (23)	24	117 (4.6)	127.5 (28)	20	142 (5.6)
Windsor, Ontario	232 (2,500)	6.1 (13.5)	59 (13)	8.5	66 (2.6)	70.5 (15.5)	7.5	78.5 (3.1)	84 (18.5)	4.5	94 (3.7)	107 (23.5)	4	119.5 (4.7)
	465 (5,000)	7.1 (15.6)	68 (15)	20	76 (3.0)	79.5 (17.5)	16	89 (3.5)	97.5 (21.5)	11	109 (4.3)	118 (26)	9	132 (5.2)
	697 (7,500)	8.0 (17.7)	77.5 (17)	30	86.5 (3.4)	86.5 (19)	26	96.5 (3.8)	107 (23.5)	18	119.5 (4.7)	125 (27.5)	15	139.5 (5.5)
	929 (10,000)	8.7 (19.2)	82 (18)	42	91.5 (3.6)	91 (20)	36	101.5 (4.0)	113.5 (25)	26	127 (5.0)	129.5 (28.5)	20	145 (5.7)
Charlottetown, Prince Edward Island	232 (2,500)	4.9 (10.9)	47.5 (10.5)	7.5	53.5 (2.1)	57 (12.5)	6	63.5 (2.5)	68 (15)	3.8	76 (3.0)	79.5 (17.5)	3	89 (3.5)
	465 (5,000)	6.6 (14.6)	63.5 (14)	19	71 (2.8)	75 (16.5)	15.5	84 (3.3)	88.5 (19.5)	10	99 (3.9)	100 (22)	7.5	112 (4.4)
	697 (7,500)	7.8 (17.2)	75 (16.5)	31	84 (3.3)	86.5 (19)	26	96.5 (3.8)	102.5 (22.5)	18	114.5 (4.5)	113.5 (25)	13	127 (5.0)
	929 (10,000)	8.7 (19.2)	84 (18.5)	42	94 (3.7)	97.5 (21.5)	37	106.5 (4.2)	111.5 (24.5)	26	124.5 (4.9)	125 (27.5)	20	139.5 (5.5)
Montreal, Quebec	232 (2,500)	5.2 (11.4)	50 (11)	7.5	56 (2.2)	61.5 (13.5)	7	68.5 (2.7)	79.5 (17.5)	4.5	89 (3.5)	97.5 (21.5)	3.5	109 (4.36)
	465 (5,000)	5.9 (13)	57 (12.5)	17	63.5 (2.5)	70.5 (15.5)	15	78.5 (3.1)	88.5 (19.5)	10	99 (3.9)	109 (24)	8	122 (4.8)
	697 (7,500)	6.1 (13.5)	59 (13)	27	66 (2.6)	72.5 (16)	23	81.5 (3.2)	93 (20.5)	16	104 (4.1)	113.5 (25)	13	127 (5.0)
	929 (10,000)	6.4 (14)	61.5 (13.5)	36	68.5 (2.7)	77.5 (17)	31	86.5 (3.4)	95.5 (21)	22	106.5 (4.2)	120.5 (26.5)	19	134.5 (5.3)
Quebec City, Quebec	232 (2,500)	5.4 (12)	52.5 (11.5)	8	58.5 (2.3)	63.5 (14)	7	71 (2.8)	79.5 (17.5)	4.5	89 (3.5)	97.5 (21.5)	3.5	109 (4.3)
	465 (5,000)	6.4 (14)	61.5 (13.5)	18	68.5 (2.7)	70.5 (15.5)	15	78.5 (3.1)	84 (18.5)	10	94 (3.7)	104.5 (23)	8	117 (4.6)
	697 (7,500)	6.6 (14.6)	63.5 (14)	28	71 (2.8)	72.5 (16)	23	81.5 (3.2)	86.5 (19)	15	96.5 (3.8)	107 (23.5)	12	119.5 (4.7)
	929 (10,000)	7.1 (15.6)	68 (15)	37	76 (3.0)	77.5 (17)	31	86.5 (3.4)	88.5 (19.5)	20	99 (3.9)	109 (24)	17	122 (4.8)

Selecta-Drain Chart

LOCATION	SQUARE METRE (SQUARE FOOT) NOTCH AREA RATING	ROOF LOAD FACTOR KGS. (LBS.)	TOTAL ROOF SLOPE											
			DEAD LEVEL			51mm (2") RISE			102mm (4") RISE			152mm (6") RISE		
			L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth
Regina, Saskatchewan	232 (2,500)	4.5 (9.9)	43 (9.5)	**7**	48.5 (1.9)	54.5 (12)	**6**	61 (2.4)	72.5 (16)	**4**	81.5 (3.2)	79.5 (17.5)	**3**	89 (3.5)
	465 (5,000)	6.4 (14)	61.5 (13.5)	**18**	68.5 (2.7)	68 (15)	**14**	76 (3.0)	86.5 (19)	**10**	96.5 (3.8)	97.5 (21.5)	**7.5**	109 (4.3)
	697 (7,500)	7.3 (16.1)	70.5 (15.5)	**29**	78.5 (3.1)	77.5 (17)	**24**	86.5 (3.4)	100 (22)	**17**	112 (4.4)	109 (24)	**12**	122 (4.8)
	929 (10,000)	8.3 (18.2)	79.5 (17.5)	**40**	89 (3.5)	82 (18)	**32**	91.5 (3.6)	104.5 (23)	**24**	117 (4.6)	118 (26)	**18**	132 (5.2)
Saskatoon, Saskatchewan	232 (2,500)	4.0 (8.8)	38.5 (8.5)	**6**	43 (1.7)	57 (12.5)	**6**	63.5 (2.5)	66 (14.5)	**3.8**	73.5 (2.9)	77.5 (17)	**2.8**	86.5 (3.4)
	465 (5,000)	5.7 (12.5)	54.5 (12)	**16**	61 (2.4)	68 (15)	**14.5**	76 (3.0)	82 (18)	**9**	91.5 (3.6)	95.5 (21)	**7**	106.5 (4.2)
	697 (7,500)	6.6 (14.6)	63.5 (14)	**28**	71 (2.8)	75 (16.5)	**24**	84 (3.3)	91 (20)	**16**	101.5 (4.0)	104.5 (23)	**12**	117 (4.6)
	929 (10,000)	7.1 (15.6)	68 (15)	**38**	76 (3.0)	82 (18)	**32**	91.5 (3.6)	97.5 (21.5)	**22**	109 (4.3)	113.5 (25)	**18**	127 (5.0)

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Appendix F

MIDUSS Calculations, IDF Parameters & MIDUSS Output

CALCULATIONS

Orifice Equation (MIDUSS NET)

$$Q = C_c \, p/4 \, D5 \, \text{sqrt}(2g(H-2/3D))$$

where C_c coefficient of contraction
H head relative to the invert of the orifice
D orifice diameter
g gravitational acceleration

IDF Parameters

IDF Parameters	2-Year Storm Event	5-Year Storm Event	100-Year Storm Event	100-Year Storm Event + 20%
A	732.951	998.071	1735.688	2082.82
B	6.199	6.053	6.014	5.890
C	0.810	0.814	0.820	0.824

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                            Version 2.25  rev. 473"
"                MIDUSS created                          Sunday, February 7, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:                            Q:\53510\100\MIDUSS\JHN"
"                Output filename:                                  2 year v3.out"
"                Licensee name:                                               A"
"                Company                                                       "
"                Date & Time last used:                  6/21/2024 at 2:47:51 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      732.951   Coefficient A"
"        6.199   Constant B"
"        0.810   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           103.571    mm/hr"
"             Total depth                  31.880    mm"
"            6   002hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 201"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          201   Building Rooftop"
"      100.000   % Impervious"
"        0.129   Total Area"
"       10.000   Flow length"
"        1.500   Overland Slope"
"        0.000   Pervious Area"
"       10.000   Pervious length"
"        1.500   Pervious slope"
"        0.129   Impervious Area"
"       10.000   Impervious length"
"        1.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.000   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.827   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.028     0.000     0.000     0.000 c.m/sec"
```

```
"             Catchment 201          Pervious   Impervious Total Area "
"             Surface Area           0.000      0.129      0.129      hectare"
"             Time of concentration  16.174     1.278      1.278      minutes"
"             Time to Centroid       122.762    89.774     89.774     minutes"
"             Rainfall depth         31.880     31.880     31.880     mm"
"             Rainfall volume        0.00       41.12      41.12      c.m"
"             Rainfall losses        26.820     5.515      5.515      mm"
"             Runoff depth           5.060      26.364     26.364     mm"
"             Runoff volume          0.00       34.01      34.01      c.m"
"             Runoff coefficient     0.000      0.827      0.827      "
"             Maximum flow           0.000      0.028      0.028      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.028     0.028     0.000     0.000"
" 54          POND DESIGN"
"         0.028   Current peak flow    c.m/sec"
"         0.037   Target outflow    c.m/sec"
"          34.0   Hydrograph volume    c.m"
"           11.   Number of stages"
"         0.000   Minimum water level    metre"
"         0.150   Maximum water level    metre"
"         0.000   Starting water level    metre"
"             0   Keep Design Data: 1 = True; 0 = False"
"                   Level Discharge    Volume"
"                   0.000     0.000     0.000"
"                 0.01500   0.00151   0.07760"
"                 0.03000   0.00302    0.6208"
"                 0.04500   0.00454     2.095"
"                 0.06000   0.00605     4.966"
"                 0.07500   0.00756     9.700"
"                 0.09000   0.00907    16.762"
"                  0.1050   0.01058    26.617"
"                  0.1200   0.01210    39.715"
"                  0.1350   0.01361    54.265"
"                  0.1500   0.01512    68.815"
"            1.   ROOFTOP"
"                 Roof area  Store area  Area/drain  Drain flow  Roof slope"
"                   hectare     hectare    sq.metre  L/min/25mm      g H:1V"
"                     0.129       0.097     250.000      37.800      66.667"
"               Using 4 roofdrains on roofstorage area of 970. square metre"
"               Peak outflow                   0.008    c.m/sec"
"               Maximum level                  0.081    metre"
"               Maximum storage               12.319    c.m"
"               Centroidal lag                 1.744   hours"
"                    0.028     0.028     0.008     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    1"
"             6   Combine "
"             1   Node #"
"                 Total Site"
"               Maximum flow                   0.008    c.m/sec"
```

```
"             Hydrograph volume            33.972    c.m"
"                    0.028     0.028     0.008     0.008"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.028     0.000     0.008     0.008"
" 33          CATCHMENT 202"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          202   West Parking Lot 1"
"      100.000   % Impervious"
"        0.059   Total Area"
"       10.000   Flow length"
"        1.200   Overland Slope"
"        0.000   Pervious Area"
"       10.000   Pervious length"
"        1.200   Pervious slope"
"        0.059   Impervious Area"
"       10.000   Impervious length"
"        1.200   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.000   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.829   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.013     0.000     0.008     0.008 c.m/sec"
"             Catchment 202          Pervious   Impervious Total Area "
"             Surface Area           0.000      0.059      0.059      hectare"
"             Time of concentration  17.293     1.367      1.367      minutes"
"             Time to Centroid       124.048    89.900     89.899     minutes"
"             Rainfall depth         31.880     31.880     31.880     mm"
"             Rainfall volume        0.00       18.81      18.81      c.m"
"             Rainfall losses        26.815     5.445      5.445      mm"
"             Runoff depth           5.065      26.435     26.435     mm"
"             Runoff volume          0.00       15.60      15.60      c.m"
"             Runoff coefficient     0.000      0.829      0.829      "
"             Maximum flow           0.000      0.013      0.013      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.013     0.013     0.008     0.008"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.013     0.013     0.013     0.008"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
```

```
"            1   Node #"
"                Total Site"
"             Maximum flow                  0.019    c.m/sec"
"             Hydrograph volume            49.568    c.m"
"                    0.013     0.013     0.013     0.019"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.013     0.000     0.013     0.019"
" 33          CATCHMENT 203"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          203   SW Parking Lot"
"      100.000   % Impervious"
"        0.069   Total Area"
"       10.000   Flow length"
"        1.200   Overland Slope"
"        0.000   Pervious Area"
"       10.000   Pervious length"
"        1.200   Pervious slope"
"        0.069   Impervious Area"
"       10.000   Impervious length"
"        1.200   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.000   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.829   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.015     0.000     0.013     0.019 c.m/sec"
"             Catchment 203          Pervious   Impervious Total Area "
"             Surface Area           0.000      0.069      0.069      hectare"
"             Time of concentration  17.293     1.367      1.367      minutes"
"             Time to Centroid       124.048    89.900     89.899     minutes"
"             Rainfall depth         31.880     31.880     31.880     mm"
"             Rainfall volume        0.00       22.00      22.00      c.m"
"             Rainfall losses        26.815     5.445      5.445      mm"
"             Runoff depth           5.065      26.435     26.435     mm"
"             Runoff volume          0.00       18.24      18.24      c.m"
"             Runoff coefficient     0.000      0.829      0.829      "
"             Maximum flow           0.000      0.015      0.015      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.015     0.015     0.013     0.019"
" 54          POND DESIGN"
"        0.015   Current peak flow    c.m/sec"
```

```
"        0.037   Target outflow    c.m/sec"
"         18.2   Hydrograph volume    c.m"
"           7.   Number of stages"
"      103.400   Minimum water level    metre"
"      103.750   Maximum water level    metre"
"      103.400   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                103.400     0.000     0.000"
"                103.550   0.00689  1.01E-05"
"                103.600   0.00795    0.7100"
"                103.650   0.00889     4.340"
"                103.700   0.00973    13.820"
"                103.750   0.01051    30.870"
"                103.800   0.01124    54.500"
"           1.   HOR. ORIFICES"
"                Orifice   Orifice   Orifice Number of"
"                 invert coefficie  diameter  orifices"
"                103.400     0.630    0.0900     1.000"
"             Peak outflow                  0.008    c.m/sec"
"             Maximum level               103.622    metre"
"             Maximum storage               2.302    c.m"
"             Centroidal lag                1.528   hours"
"                  0.015     0.015     0.008     0.019 c.m/sec"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total Site"
"             Maximum flow                  0.027    c.m/sec"
"             Hydrograph volume            67.482    c.m"
"                      0.015     0.015     0.008     0.027"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                      0.015     0.000     0.008     0.027"
" 33          CATCHMENT 204"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          204   Controlled Area"
"      100.000   % Impervious"
"        0.240   Total Area"
"       20.000   Flow length"
"        1.200   Overland Slope"
"        0.000   Pervious Area"
"       20.000   Pervious length"
"        1.200   Pervious slope"
"        0.240   Impervious Area"
"       20.000   Impervious length"
"        1.200   Impervious slope"
"        0.250   Pervious Manning 'n'"
```

```
"       75.000   Pervious SCS Curve No."
"        0.000   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.832   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.049     0.000     0.008     0.027 c.m/sec"
"             Catchment 204          Pervious   Impervious Total Area "
"             Surface Area           0.000      0.240      0.240      hectare"
"             Time of concentration  26.212     2.072      2.072      minutes"
"             Time to Centroid       134.673    90.977     90.977     minutes"
"             Rainfall depth         31.880     31.880     31.880     mm"
"             Rainfall volume        0.00       76.51      76.51      c.m"
"             Rainfall losses        26.812     5.351      5.351      mm"
"             Runoff depth           5.068      26.528     26.528     mm"
"             Runoff volume          0.00       63.67      63.67      c.m"
"             Runoff coefficient     0.000      0.832      0.832      "
"             Maximum flow           0.000      0.049      0.049      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"              4   Add Runoff "
"                     0.049     0.049     0.008     0.027"
" 54          POND DESIGN"
"        0.049   Current peak flow    c.m/sec"
"        0.037   Target outflow    c.m/sec"
"         63.7   Hydrograph volume    c.m"
"           7.   Number of stages"
"      101.220   Minimum water level    metre"
"      103.800   Maximum water level    metre"
"      101.220   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                101.220     0.000     0.000"
"                103.550   0.02388    12.450"
"                103.600   0.02414    13.960"
"                103.650   0.02439    22.230"
"                103.700   0.02465    46.120"
"                103.750   0.02490    94.800"
"                103.800   0.02515   171.200"
"             1.   ORIFICES"
"                  Orifice   Orifice   Orifice Number of"
"                   invert coefficie  diameter  orifices"
"                101.220     0.630    0.0850     1.000"
"             Peak outflow                 0.024    c.m/sec"
"             Maximum level               103.622    metre"
"             Maximum storage              17.609    c.m"
"             Centroidal lag                1.675   hours"
"                  0.049     0.049     0.024     0.027 c.m/sec"
```

```
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total Site"
"             Maximum flow                  0.049    c.m/sec"
"             Hydrograph volume           130.989    c.m"
"                     0.049     0.049     0.024     0.049"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.049     0.000     0.024     0.049"
" 33          CATCHMENT 205"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          205   Uncontrolled to Lusk"
"       10.300   % Impervious"
"        0.060   Total Area"
"        2.000   Flow length"
"       17.500   Overland Slope"
"        0.054   Pervious Area"
"        2.000   Pervious length"
"       17.500   Pervious slope"
"        0.006   Impervious Area"
"        2.000   Impervious length"
"       17.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.156   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.729   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.002     0.000     0.024     0.049 c.m/sec"
"             Catchment 205          Pervious   Impervious Total Area "
"             Surface Area           0.054      0.006      0.060      hectare"
"             Time of concentration  2.947      0.233      1.998      minutes"
"             Time to Centroid       107.105    87.928     100.402    minutes"
"             Rainfall depth         31.880     31.880     31.880     mm"
"             Rainfall volume        17.16      1.97       19.13      c.m"
"             Rainfall losses        26.915     8.650      25.034     mm"
"             Runoff depth           4.965      23.230     6.846      mm"
"             Runoff volume          2.67       1.44       4.11       c.m"
"             Runoff coefficient     0.156      0.729      0.215      "
"             Maximum flow           0.001      0.001      0.002      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.002     0.002     0.024     0.049"
```

```
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.002     0.002     0.002     0.049"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total Site"
"             Maximum flow                  0.051    c.m/sec"
"             Hydrograph volume           135.097    c.m"
"                     0.002     0.002     0.002     0.051"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.002     0.000     0.002     0.051"
" 33          CATCHMENT 206"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          206   Uncontrolled to O'Keefe"
"       49.000   % Impervious"
"        0.047   Total Area"
"        6.000   Flow length"
"       25.000   Overland Slope"
"        0.024   Pervious Area"
"        6.000   Pervious length"
"       25.000   Pervious slope"
"        0.023   Impervious Area"
"        6.000   Impervious length"
"       25.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.158   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.751   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.005     0.000     0.002     0.051 c.m/sec"
"             Catchment 206          Pervious   Impervious Total Area "
"             Surface Area           0.024      0.023      0.047      hectare"
"             Time of concentration  5.119      0.405      1.252      minutes"
"             Time to Centroid       109.571    89.027     92.719     minutes"
"             Rainfall depth         31.880     31.880     31.880     mm"
"             Rainfall volume        7.64       7.34       14.98      c.m"
"             Rainfall losses        26.839     7.931      17.574     mm"
"             Runoff depth           5.041      23.949     14.306     mm"
"             Runoff volume          1.21       5.52       6.72       c.m"
"             Runoff coefficient     0.158      0.751      0.449      "
"             Maximum flow           0.001      0.005      0.005      c.m/sec"
```

```
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.005     0.005     0.002     0.051"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.005     0.005     0.005     0.051"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total Site"
"             Maximum flow                  0.054    c.m/sec"
"             Hydrograph volume           141.821    c.m"
"                     0.005     0.005     0.005     0.054"
" 38          START/RE-START TOTALS 206"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                      0.604    hectare"
"             Total Impervious area                     0.526    hectare"
"             Total % impervious                       87.121"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                            Version 2.25  rev. 473"
"                MIDUSS created                          Sunday, February 7, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:                            Q:\53510\100\MIDUSS\JHN"
"                Output filename:                                 5 year v3.out"
"                Licensee name:                                               A"
"                Company                                                       "
"                Date & Time last used:                  6/21/2024 at 2:45:17 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      998.071   Coefficient A"
"        6.053   Constant B"
"        0.814   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          141.178    mm/hr"
"             Total depth                 42.540    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 201"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          201   Building Rooftop"
"      100.000   % Impervious"
"        0.129   Total Area"
"       10.000   Flow length"
"        1.500   Overland Slope"
"        0.000   Pervious Area"
"       10.000   Pervious length"
"        1.500   Pervious slope"
"        0.129   Impervious Area"
"       10.000   Impervious length"
"        1.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.000   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.855   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.041     0.000     0.000     0.000 c.m/sec"
```

```
"             Catchment 201          Pervious   Impervious Total Area "
"             Surface Area           0.000      0.129      0.129      hectare"
"             Time of concentration  11.398     1.115      1.115      minutes"
"             Time to Centroid       114.963    88.504     88.504     minutes"
"             Rainfall depth         42.540     42.540     42.540     mm"
"             Rainfall volume        0.00       54.88      54.88      c.m"
"             Rainfall losses        32.792     6.152      6.152      mm"
"             Runoff depth           9.748      36.388     36.388     mm"
"             Runoff volume          0.00       46.94      46.94      c.m"
"             Runoff coefficient     0.000      0.855      0.855      "
"             Maximum flow           0.000      0.041      0.041      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.041     0.041     0.000     0.000"
" 54          POND DESIGN"
"         0.041   Current peak flow    c.m/sec"
"         0.037   Target outflow    c.m/sec"
"          46.9   Hydrograph volume    c.m"
"           11.   Number of stages"
"         0.000   Minimum water level    metre"
"         0.150   Maximum water level    metre"
"         0.000   Starting water level    metre"
"             0   Keep Design Data: 1 = True; 0 = False"
"                   Level Discharge    Volume"
"                   0.000     0.000     0.000"
"                 0.01500   0.00151   0.07760"
"                 0.03000   0.00302    0.6208"
"                 0.04500   0.00454     2.095"
"                 0.06000   0.00605     4.966"
"                 0.07500   0.00756     9.700"
"                 0.09000   0.00907    16.762"
"                  0.1050   0.01058    26.617"
"                  0.1200   0.01210    39.715"
"                  0.1350   0.01361    54.265"
"                  0.1500   0.01512    68.815"
"            1.   ROOFTOP"
"                 Roof area  Store area  Area/drain  Drain flow  Roof slope"
"                   hectare     hectare    sq.metre  L/min/25mm      g H:1V"
"                     0.129       0.097     250.000      37.800      66.667"
"               Using 4 roofdrains on roofstorage area of 970. square metre"
"               Peak outflow                   0.009    c.m/sec"
"               Maximum level                  0.093    metre"
"               Maximum storage               19.057    c.m"
"               Centroidal lag                 1.819   hours"
"                    0.041     0.041     0.009     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    1"
"             6   Combine "
"             1   Node #"
"                 Total Site"
"               Maximum flow                   0.009    c.m/sec"
```

```
"             Hydrograph volume            46.938    c.m"
"                    0.041     0.041     0.009     0.009"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.041     0.000     0.009     0.009"
" 33          CATCHMENT 202"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          202   West Parking Lot 1"
"      100.000   % Impervious"
"        0.059   Total Area"
"       10.000   Flow length"
"        1.200   Overland Slope"
"        0.000   Pervious Area"
"       10.000   Pervious length"
"        1.200   Pervious slope"
"        0.059   Impervious Area"
"       10.000   Impervious length"
"        1.200   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.000   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.859   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.018     0.000     0.009     0.009 c.m/sec"
"             Catchment 202          Pervious   Impervious Total Area "
"             Surface Area           0.000      0.059      0.059      hectare"
"             Time of concentration  12.187     1.192      1.192      minutes"
"             Time to Centroid       115.968    88.643     88.643     minutes"
"             Rainfall depth         42.540     42.540     42.540     mm"
"             Rainfall volume        0.00       25.10      25.10      c.m"
"             Rainfall losses        32.779     6.010      6.010      mm"
"             Runoff depth           9.761      36.530     36.530     mm"
"             Runoff volume          0.00       21.55      21.55      c.m"
"             Runoff coefficient     0.000      0.859      0.859      "
"             Maximum flow           0.000      0.018      0.018      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.018     0.018     0.009     0.009"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.018     0.018     0.018     0.009"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
```

```
"            1   Node #"
"                Total Site"
"             Maximum flow                  0.026    c.m/sec"
"             Hydrograph volume            68.490    c.m"
"                    0.018     0.018     0.018     0.026"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.018     0.000     0.018     0.026"
" 33          CATCHMENT 203"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          203   SW Parking Lot"
"       100.000   % Impervious"
"         0.069   Total Area"
"        10.000   Flow length"
"         1.200   Overland Slope"
"         0.000   Pervious Area"
"        10.000   Pervious length"
"         1.200   Pervious slope"
"         0.069   Impervious Area"
"        10.000   Impervious length"
"         1.200   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        75.000   Pervious SCS Curve No."
"         0.000   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         8.467   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.859   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                    0.022     0.000     0.018     0.026 c.m/sec"
"             Catchment 203          Pervious   Impervious Total Area "
"             Surface Area           0.000      0.069      0.069      hectare"
"             Time of concentration  12.187     1.192      1.192      minutes"
"             Time to Centroid       115.968    88.643     88.643     minutes"
"             Rainfall depth         42.540     42.540     42.540     mm"
"             Rainfall volume        0.00       29.35      29.35      c.m"
"             Rainfall losses        32.779     6.010      6.010      mm"
"             Runoff depth           9.761      36.530     36.530     mm"
"             Runoff volume          0.00       25.21      25.21      c.m"
"             Runoff coefficient     0.000      0.859      0.859      "
"             Maximum flow           0.000      0.022      0.022      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.022     0.022     0.018     0.026"
" 54          POND DESIGN"
"         0.022   Current peak flow    c.m/sec"
```

```
"        0.037   Target outflow    c.m/sec"
"         25.2   Hydrograph volume    c.m"
"           7.   Number of stages"
"      103.400   Minimum water level    metre"
"      103.750   Maximum water level    metre"
"      103.400   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                103.400     0.000     0.000"
"                103.550   0.00689  1.01E-05"
"                103.600   0.00795    0.7100"
"                103.650   0.00889     4.340"
"                103.700   0.00973    13.820"
"                103.750   0.01051    30.870"
"                103.800   0.01124    54.500"
"           1.   HOR. ORIFICES"
"                Orifice   Orifice   Orifice Number of"
"                 invert coefficie  diameter  orifices"
"                103.400     0.630    0.0900     1.000"
"             Peak outflow                  0.009    c.m/sec"
"             Maximum level               103.653    metre"
"             Maximum storage               4.991    c.m"
"             Centroidal lag                1.540   hours"
"                  0.022     0.022     0.009     0.026 c.m/sec"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total Site"
"             Maximum flow                  0.034    c.m/sec"
"             Hydrograph volume            93.551    c.m"
"                      0.022     0.022     0.009     0.034"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                      0.022     0.000     0.009     0.034"
" 33          CATCHMENT 204"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          204   Controlled Area"
"      100.000   % Impervious"
"        0.240   Total Area"
"       20.000   Flow length"
"        1.200   Overland Slope"
"        0.000   Pervious Area"
"       20.000   Pervious length"
"        1.200   Pervious slope"
"        0.240   Impervious Area"
"       20.000   Impervious length"
"        1.200   Impervious slope"
"        0.250   Pervious Manning 'n'"
```

```
"       75.000   Pervious SCS Curve No."
"        0.000   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.868   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.071     0.000     0.009     0.034 c.m/sec"
"             Catchment 204          Pervious   Impervious Total Area "
"             Surface Area           0.000      0.240      0.240      hectare"
"             Time of concentration  18.473     1.807      1.807      minutes"
"             Time to Centroid       124.045    89.542     89.542     minutes"
"             Rainfall depth         42.540     42.540     42.540     mm"
"             Rainfall volume        0.00       102.10     102.10     c.m"
"             Rainfall losses        32.771     5.622      5.622      mm"
"             Runoff depth           9.769      36.918     36.918     mm"
"             Runoff volume          0.00       88.60      88.60      c.m"
"             Runoff coefficient     0.000      0.868      0.868      "
"             Maximum flow           0.000      0.071      0.071      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.071     0.071     0.009     0.034"
" 54          POND DESIGN"
"        0.071   Current peak flow    c.m/sec"
"        0.037   Target outflow    c.m/sec"
"         88.6   Hydrograph volume    c.m"
"           7.   Number of stages"
"      101.220   Minimum water level    metre"
"      103.800   Maximum water level    metre"
"      101.220   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                101.220     0.000     0.000"
"                103.550   0.02388    12.450"
"                103.600   0.02414    13.960"
"                103.650   0.02439    22.230"
"                103.700   0.02465    46.120"
"                103.750   0.02490    94.800"
"                103.800   0.02515   171.200"
"           1.   ORIFICES"
"                Orifice   Orifice   Orifice Number of"
"                 invert coefficie  diameter  orifices"
"                101.220     0.630    0.0850     1.000"
"             Peak outflow                 0.024    c.m/sec"
"             Maximum level              103.666    metre"
"             Maximum storage             30.094    c.m"
"             Centroidal lag               1.705   hours"
"                  0.071     0.071     0.024     0.034 c.m/sec"
```

```
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total Site"
"             Maximum flow                  0.058    c.m/sec"
"             Hydrograph volume           182.355    c.m"
"                     0.071     0.071     0.024     0.058"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.071     0.000     0.024     0.058"
" 33          CATCHMENT 205"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          205   Uncontrolled to Lusk"
"       10.300   % Impervious"
"        0.060   Total Area"
"        2.000   Flow length"
"       17.500   Overland Slope"
"        0.054   Pervious Area"
"        2.000   Pervious length"
"       17.500   Pervious slope"
"        0.006   Impervious Area"
"        2.000   Impervious length"
"       17.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.227   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.757   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.005     0.000     0.024     0.058 c.m/sec"
"             Catchment 205          Pervious   Impervious Total Area "
"             Surface Area           0.054      0.006      0.060      hectare"
"             Time of concentration  2.077      0.203      1.557      minutes"
"             Time to Centroid       102.829    86.644     98.341     minutes"
"             Rainfall depth         42.540     42.540     42.540     mm"
"             Rainfall volume        22.90      2.63       25.52      c.m"
"             Rainfall losses        32.895     10.317     30.570     mm"
"             Runoff depth           9.645      32.223     11.970     mm"
"             Runoff volume          5.19       1.99       7.18       c.m"
"             Runoff coefficient     0.227      0.757      0.281      "
"             Maximum flow           0.003      0.002      0.005      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.005     0.005     0.024     0.058"
```

```
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.005     0.005     0.005     0.058"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total Site"
"             Maximum flow                  0.063    c.m/sec"
"             Hydrograph volume           189.537    c.m"
"                     0.005     0.005     0.005     0.063"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.005     0.000     0.005     0.063"
" 33          CATCHMENT 206"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          206   Uncontrolled to O'Keefe"
"       49.000   % Impervious"
"        0.047   Total Area"
"        6.000   Flow length"
"       25.000   Overland Slope"
"        0.024   Pervious Area"
"        6.000   Pervious length"
"       25.000   Pervious slope"
"        0.023   Impervious Area"
"        6.000   Impervious length"
"       25.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.225   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.774   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.008     0.000     0.005     0.063 c.m/sec"
"             Catchment 206          Pervious   Impervious Total Area "
"             Surface Area           0.024      0.023      0.047      hectare"
"             Time of concentration  3.607      0.353      1.107      minutes"
"             Time to Centroid       105.245    87.761     91.815     minutes"
"             Rainfall depth         42.540     42.540     42.540     mm"
"             Rainfall volume        10.20      9.80       19.99      c.m"
"             Rainfall losses        32.985     9.598      21.526     mm"
"             Runoff depth           9.555      32.942     21.014     mm"
"             Runoff volume          2.29       7.59       9.88       c.m"
"             Runoff coefficient     0.225      0.774      0.494      "
"             Maximum flow           0.001      0.007      0.008      c.m/sec"
```

```
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.008     0.008     0.005     0.063"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                  0.008     0.008     0.008     0.063"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total Site"
"             Maximum flow                  0.071    c.m/sec"
"             Hydrograph volume           199.413    c.m"
"                  0.008     0.008     0.008     0.071"
" 38          START/RE-START TOTALS 206"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                      0.604    hectare"
"             Total Impervious area                     0.526    hectare"
"             Total % impervious                       87.121"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                            Version 2.25  rev. 473"
"                MIDUSS created                          Sunday, February 7, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:                           Q:\53510\100\MIDUSS\JHN"
"                Output filename:                              100 year v3.out"
"                Licensee name:                                              A"
"                Company                                                      "
"                Date & Time last used:                 6/21/2024 at 2:40:26 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1735.688   Coefficient A"
"        6.014   Constant B"
"        0.820   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          242.704    mm/hr"
"             Total depth                 71.708    mm"
"            6   100hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 201"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          201   Building Rooftop"
"      100.000   % Impervious"
"        0.129   Total Area"
"       10.000   Flow length"
"        1.500   Overland Slope"
"        0.000   Pervious Area"
"       10.000   Pervious length"
"        1.500   Pervious slope"
"        0.129   Impervious Area"
"       10.000   Impervious length"
"        1.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.000   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.886   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.073     0.000     0.000     0.000 c.m/sec"
```

```
"             Catchment 201          Pervious   Impervious Total Area "
"             Surface Area           0.000      0.129      0.129      hectare"
"             Time of concentration  7.086      0.886      0.886      minutes"
"             Time to Centroid       106.059    86.668     86.668     minutes"
"             Rainfall depth         71.708     71.708     71.708     mm"
"             Rainfall volume        0.00       92.50      92.50      c.m"
"             Rainfall losses        44.867     8.171      8.171      mm"
"             Runoff depth           26.841     63.536     63.536     mm"
"             Runoff volume          0.00       81.96      81.96      c.m"
"             Runoff coefficient     0.000      0.886      0.886      "
"             Maximum flow           0.000      0.073      0.073      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.073     0.073     0.000     0.000"
" 54          POND DESIGN"
"         0.073   Current peak flow    c.m/sec"
"         0.037   Target outflow    c.m/sec"
"          82.0   Hydrograph volume    c.m"
"           11.   Number of stages"
"         0.000   Minimum water level    metre"
"         0.150   Maximum water level    metre"
"         0.000   Starting water level    metre"
"             0   Keep Design Data: 1 = True; 0 = False"
"                   Level Discharge    Volume"
"                   0.000     0.000     0.000"
"                 0.01500   0.00151   0.07760"
"                 0.03000   0.00302    0.6208"
"                 0.04500   0.00454     2.095"
"                 0.06000   0.00605     4.966"
"                 0.07500   0.00756     9.700"
"                 0.09000   0.00907    16.762"
"                  0.1050   0.01058    26.617"
"                  0.1200   0.01210    39.715"
"                  0.1350   0.01361    54.265"
"                  0.1500   0.01512    68.815"
"            1.   ROOFTOP"
"                 Roof area  Store area  Area/drain  Drain flow  Roof slope"
"                   hectare     hectare    sq.metre  L/min/25mm      g H:1V"
"                     0.129       0.097     250.000      37.800      66.667"
"               Using 4 roofdrains on roofstorage area of 970. square metre"
"               Peak outflow                   0.012    c.m/sec"
"               Maximum level                  0.119    metre"
"               Maximum storage               39.059    c.m"
"               Centroidal lag                 2.028   hours"
"                    0.073     0.073     0.012     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total Site"
"             Maximum flow                   0.012    c.m/sec"
```

```
"             Hydrograph volume            81.883    c.m"
"                    0.073     0.073     0.012     0.012"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.073     0.000     0.012     0.012"
" 33          CATCHMENT 202"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          202   West Parking Lot 1"
"      100.000   % Impervious"
"        0.059   Total Area"
"       10.000   Flow length"
"        1.200   Overland Slope"
"        0.000   Pervious Area"
"       10.000   Pervious length"
"        1.200   Pervious slope"
"        0.059   Impervious Area"
"       10.000   Impervious length"
"        1.200   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.000   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.891   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.033     0.000     0.012     0.012 c.m/sec"
"             Catchment 202          Pervious   Impervious Total Area "
"             Surface Area           0.000      0.059      0.059      hectare"
"             Time of concentration  7.577      0.947      0.947      minutes"
"             Time to Centroid       106.707    86.768     86.768     minutes"
"             Rainfall depth         71.708     71.708     71.708     mm"
"             Rainfall volume        0.00       42.31      42.31      c.m"
"             Rainfall losses        44.799     7.852      7.852      mm"
"             Runoff depth           26.909     63.856     63.856     mm"
"             Runoff volume          0.00       37.67      37.67      c.m"
"             Runoff coefficient     0.000      0.891      0.891      "
"             Maximum flow           0.000      0.033      0.033      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.033     0.033     0.012     0.012"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.033     0.033     0.033     0.012"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
```

```
"            1   Node #"
"                Total Site"
"             Maximum flow                  0.043    c.m/sec"
"             Hydrograph volume           119.558    c.m"
"                    0.033     0.033     0.033     0.043"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.033     0.000     0.033     0.043"
" 33          CATCHMENT 203"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          203   SW Parking Lot"
"      100.000   % Impervious"
"        0.069   Total Area"
"       10.000   Flow length"
"        1.200   Overland Slope"
"        0.000   Pervious Area"
"       10.000   Pervious length"
"        1.200   Pervious slope"
"        0.069   Impervious Area"
"       10.000   Impervious length"
"        1.200   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.000   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.891   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.039     0.000     0.033     0.043 c.m/sec"
"             Catchment 203          Pervious   Impervious Total Area "
"             Surface Area           0.000      0.069      0.069      hectare"
"             Time of concentration  7.577      0.947      0.947      minutes"
"             Time to Centroid       106.707    86.768     86.768     minutes"
"             Rainfall depth         71.708     71.708     71.708     mm"
"             Rainfall volume        0.00       49.48      49.48      c.m"
"             Rainfall losses        44.799     7.852      7.852      mm"
"             Runoff depth           26.909     63.856     63.856     mm"
"             Runoff volume          0.00       44.06      44.06      c.m"
"             Runoff coefficient     0.000      0.891      0.891      "
"             Maximum flow           0.000      0.039      0.039      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.039     0.039     0.033     0.043"
" 54          POND DESIGN"
"        0.039   Current peak flow    c.m/sec"
```

```
"        0.037   Target outflow    c.m/sec"
"         44.1   Hydrograph volume    c.m"
"           7.   Number of stages"
"      103.400   Minimum water level    metre"
"      103.750   Maximum water level    metre"
"      103.400   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                103.400     0.000     0.000"
"                103.550   0.00689  1.01E-05"
"                103.600   0.00795    0.7100"
"                103.650   0.00889     4.340"
"                103.700   0.00973    13.820"
"                103.750   0.01051    30.870"
"                103.800   0.01124    54.500"
"           1.   HOR. ORIFICES"
"                Orifice   Orifice   Orifice Number of"
"                 invert coefficie  diameter  orifices"
"                103.400     0.630    0.0900     1.000"
"             Peak outflow                  0.010    c.m/sec"
"             Maximum level               103.701    metre"
"             Maximum storage              14.142    c.m"
"             Centroidal lag                1.645   hours"
"                  0.039     0.039     0.010     0.043 c.m/sec"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total Site"
"             Maximum flow                  0.052    c.m/sec"
"             Hydrograph volume           164.090    c.m"
"                      0.039     0.039     0.010     0.052"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                      0.039     0.000     0.010     0.052"
" 33          CATCHMENT 204"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          204   Controlled Area"
"      100.000   % Impervious"
"        0.240   Total Area"
"       20.000   Flow length"
"        1.200   Overland Slope"
"        0.000   Pervious Area"
"       20.000   Pervious length"
"        1.200   Pervious slope"
"        0.240   Impervious Area"
"       20.000   Impervious length"
"        1.200   Impervious slope"
"        0.250   Pervious Manning 'n'"
```

```
"       75.000   Pervious SCS Curve No."
"        0.000   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.910   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.131     0.000     0.010     0.052 c.m/sec"
"             Catchment 204          Pervious   Impervious Total Area "
"             Surface Area           0.000      0.240      0.240      hectare"
"             Time of concentration  11.484     1.436      1.436      minutes"
"             Time to Centroid       111.952    87.537     87.537     minutes"
"             Rainfall depth         71.708     71.708     71.708     mm"
"             Rainfall volume        0.00       172.10     172.10     c.m"
"             Rainfall losses        44.682     6.464      6.464      mm"
"             Runoff depth           27.026     65.244     65.244     mm"
"             Runoff volume          0.00       156.59     156.59     c.m"
"             Runoff coefficient     0.000      0.910      0.910      "
"             Maximum flow           0.000      0.131      0.131      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"              4   Add Runoff "
"                     0.131     0.131     0.010     0.052"
" 54          POND DESIGN"
"        0.131   Current peak flow    c.m/sec"
"        0.037   Target outflow    c.m/sec"
"        156.6   Hydrograph volume    c.m"
"           7.   Number of stages"
"      101.220   Minimum water level    metre"
"      103.800   Maximum water level    metre"
"      101.220   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                101.220     0.000     0.000"
"                103.550   0.02388    12.450"
"                103.600   0.02414    13.960"
"                103.650   0.02439    22.230"
"                103.700   0.02465    46.120"
"                103.750   0.02490    94.800"
"                103.800   0.02515   171.200"
"             1.   ORIFICES"
"                  Orifice   Orifice   Orifice Number of"
"                   invert coefficie  diameter  orifices"
"                101.220     0.630    0.0850     1.000"
"             Peak outflow                 0.025    c.m/sec"
"             Maximum level               103.724    metre"
"             Maximum storage              69.850    c.m"
"             Centroidal lag                1.900   hours"
"                  0.131     0.131     0.025     0.052 c.m/sec"
```

```
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total Site"
"             Maximum flow                  0.076    c.m/sec"
"             Hydrograph volume           320.510    c.m"
"                     0.131     0.131     0.025     0.076"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.131     0.000     0.025     0.076"
" 33          CATCHMENT 205"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          205   Uncontrolled to Lusk"
"       10.300   % Impervious"
"        0.060   Total Area"
"        2.000   Flow length"
"       17.500   Overland Slope"
"        0.054   Pervious Area"
"        2.000   Pervious length"
"       17.500   Pervious slope"
"        0.006   Impervious Area"
"        2.000   Impervious length"
"       17.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.369   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.796   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.014     0.000     0.025     0.076 c.m/sec"
"             Catchment 205          Pervious   Impervious Total Area "
"             Surface Area           0.054      0.006      0.060      hectare"
"             Time of concentration  1.291      0.161      1.067      minutes"
"             Time to Centroid       97.800     84.840     95.225     minutes"
"             Rainfall depth         71.708     71.708     71.708     mm"
"             Rainfall volume        38.59      4.43       43.02      c.m"
"             Rainfall losses        45.258     14.609     42.101     mm"
"             Runoff depth           26.450     57.098     29.606     mm"
"             Runoff volume          14.24      3.53       17.76      c.m"
"             Runoff coefficient     0.369      0.796      0.413      "
"             Maximum flow           0.011      0.004      0.014      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.014     0.014     0.025     0.076"
```

```
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.014     0.014     0.014     0.076"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total Site"
"             Maximum flow                  0.090    c.m/sec"
"             Hydrograph volume           338.274    c.m"
"                     0.014     0.014     0.014     0.090"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.014     0.000     0.014     0.090"
" 33          CATCHMENT 206"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          206   Uncontrolled to O'Keefe"
"       49.000   % Impervious"
"        0.047   Total Area"
"        6.000   Flow length"
"       25.000   Overland Slope"
"        0.024   Pervious Area"
"        6.000   Pervious length"
"       25.000   Pervious slope"
"        0.023   Impervious Area"
"        6.000   Impervious length"
"       25.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.372   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.806   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.017     0.000     0.014     0.090 c.m/sec"
"             Catchment 206          Pervious   Impervious Total Area "
"             Surface Area           0.024      0.023      0.047      hectare"
"             Time of concentration  2.243      0.280      0.917      minutes"
"             Time to Centroid       99.241     85.825     90.178     minutes"
"             Rainfall depth         71.708     71.708     71.708     mm"
"             Rainfall volume        17.19      16.51      33.70      c.m"
"             Rainfall losses        45.035     13.919     29.789     mm"
"             Runoff depth           26.672     57.788     41.919     mm"
"             Runoff volume          6.39       13.31      19.70      c.m"
"             Runoff coefficient     0.372      0.806      0.585      "
"             Maximum flow           0.004      0.013      0.017      c.m/sec"
```

```
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.017     0.017     0.014     0.090"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.017     0.017     0.017     0.090"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total Site"
"             Maximum flow                  0.107    c.m/sec"
"             Hydrograph volume           357.976    c.m"
"                     0.017     0.017     0.017     0.107"
" 38          START/RE-START TOTALS 206"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                      0.604    hectare"
"             Total Impervious area                     0.526    hectare"
"             Total % impervious                       87.121"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                            Version 2.25  rev. 473"
"                MIDUSS created                          Sunday, February 7, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:                             Q:\53510\100\MIDUSS\JHN"
"                Output filename:                         100 year + 20%  v3.out"
"                Licensee name:                                              A"
"                Company                                                      "
"                Date & Time last used:                  6/21/2024 at 2:46:37 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     2082.820   Coefficient A"
"        5.890   Constant B"
"        0.824   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           291.166    mm/hr"
"             Total depth                  84.315    mm"
"            6   120hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 201"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          201   Building Rooftop"
"      100.000   % Impervious"
"        0.129   Total Area"
"       10.000   Flow length"
"        1.500   Overland Slope"
"        0.000   Pervious Area"
"       10.000   Pervious length"
"        1.500   Pervious slope"
"        0.129   Impervious Area"
"       10.000   Impervious length"
"        1.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.000   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.891   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.088     0.000     0.000     0.000 c.m/sec"
```

```
"             Catchment 201          Pervious   Impervious Total Area "
"             Surface Area           0.000      0.129      0.129      hectare"
"             Time of concentration  6.211      0.822      0.822      minutes"
"             Time to Centroid       103.769    86.143     86.143     minutes"
"             Rainfall depth         84.315     84.315     84.315     mm"
"             Rainfall volume        0.00       108.77     108.77     c.m"
"             Rainfall losses        48.746     9.212      9.212      mm"
"             Runoff depth           35.569     75.103     75.103     mm"
"             Runoff volume          0.00       96.88      96.88      c.m"
"             Runoff coefficient     0.000      0.891      0.891      "
"             Maximum flow           0.000      0.088      0.088      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.088     0.088     0.000     0.000"
" 54          POND DESIGN"
"         0.088   Current peak flow    c.m/sec"
"         0.037   Target outflow    c.m/sec"
"          96.9   Hydrograph volume    c.m"
"           11.   Number of stages"
"         0.000   Minimum water level    metre"
"         0.150   Maximum water level    metre"
"         0.000   Starting water level    metre"
"             0   Keep Design Data: 1 = True; 0 = False"
"                   Level Discharge    Volume"
"                   0.000     0.000     0.000"
"                 0.01500   0.00151   0.07760"
"                 0.03000   0.00302    0.6208"
"                 0.04500   0.00454     2.095"
"                 0.06000   0.00605     4.966"
"                 0.07500   0.00756     9.700"
"                 0.09000   0.00907    16.762"
"                  0.1050   0.01058    26.617"
"                  0.1200   0.01210    39.715"
"                  0.1350   0.01361    54.265"
"                  0.1500   0.01512    68.815"
"            1.   ROOFTOP"
"                 Roof area  Store area  Area/drain  Drain flow  Roof slope"
"                   hectare     hectare    sq.metre  L/min/25mm      g H:1V"
"                     0.129       0.097     250.000      37.800      66.667"
"               Using 4 roofdrains on roofstorage area of 970. square metre"
"               Peak outflow                   0.013    c.m/sec"
"               Maximum level                  0.129    metre"
"               Maximum storage               48.317    c.m"
"               Centroidal lag                 2.114   hours"
"                    0.088     0.088     0.013     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total Site"
"             Maximum flow                   0.013    c.m/sec"
```

```
"             Hydrograph volume            96.990    c.m"
"                    0.088     0.088     0.013     0.013"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.088     0.000     0.013     0.013"
" 33          CATCHMENT 202"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          202   West Parking Lot 1"
"      100.000   % Impervious"
"        0.059   Total Area"
"       10.000   Flow length"
"        1.200   Overland Slope"
"        0.000   Pervious Area"
"       10.000   Pervious length"
"        1.200   Pervious slope"
"        0.059   Impervious Area"
"       10.000   Impervious length"
"        1.200   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.000   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.895   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.040     0.000     0.013     0.013 c.m/sec"
"             Catchment 202          Pervious   Impervious Total Area "
"             Surface Area           0.000      0.059      0.059      hectare"
"             Time of concentration  6.641      0.879      0.879      minutes"
"             Time to Centroid       104.399    86.209     86.209     minutes"
"             Rainfall depth         84.315     84.315     84.315     mm"
"             Rainfall volume        0.00       49.75      49.75      c.m"
"             Rainfall losses        48.839     8.819      8.819      mm"
"             Runoff depth           35.476     75.496     75.496     mm"
"             Runoff volume          0.00       44.54      44.54      c.m"
"             Runoff coefficient     0.000      0.895      0.895      "
"             Maximum flow           0.000      0.040      0.040      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.040     0.040     0.013     0.013"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.040     0.040     0.040     0.013"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
```

```
"            1   Node #"
"                Total Site"
"             Maximum flow                  0.050    c.m/sec"
"             Hydrograph volume           141.532    c.m"
"                    0.040     0.040     0.040     0.050"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.040     0.000     0.040     0.050"
" 33          CATCHMENT 203"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          203   SW Parking Lot"
"      100.000   % Impervious"
"        0.069   Total Area"
"       10.000   Flow length"
"        1.200   Overland Slope"
"        0.000   Pervious Area"
"       10.000   Pervious length"
"        1.200   Pervious slope"
"        0.069   Impervious Area"
"       10.000   Impervious length"
"        1.200   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.000   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.895   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.047     0.000     0.040     0.050 c.m/sec"
"             Catchment 203          Pervious   Impervious Total Area "
"             Surface Area           0.000      0.069      0.069      hectare"
"             Time of concentration  6.641      0.879      0.879      minutes"
"             Time to Centroid       104.399    86.209     86.209     minutes"
"             Rainfall depth         84.315     84.315     84.315     mm"
"             Rainfall volume        0.00       58.18      58.18      c.m"
"             Rainfall losses        48.840     8.819      8.819      mm"
"             Runoff depth           35.476     75.496     75.496     mm"
"             Runoff volume          0.00       52.09      52.09      c.m"
"             Runoff coefficient     0.000      0.895      0.895      "
"             Maximum flow           0.000      0.047      0.047      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.047     0.047     0.040     0.050"
" 54          POND DESIGN"
"        0.047   Current peak flow    c.m/sec"
```

```
"        0.037   Target outflow    c.m/sec"
"         52.1   Hydrograph volume    c.m"
"           7.   Number of stages"
"      103.400   Minimum water level    metre"
"      103.750   Maximum water level    metre"
"      103.400   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                103.400     0.000     0.000"
"                103.550   0.00689  1.01E-05"
"                103.600   0.00795    0.7100"
"                103.650   0.00889     4.340"
"                103.700   0.00973    13.820"
"                103.750   0.01051    30.870"
"                103.800   0.01124    54.500"
"           1.   HOR. ORIFICES"
"                Orifice   Orifice   Orifice Number of"
"                 invert coefficie  diameter  orifices"
"                103.400     0.630    0.0900     1.000"
"             Peak outflow                  0.010    c.m/sec"
"             Maximum level               103.714    metre"
"             Maximum storage              18.622    c.m"
"             Centroidal lag                1.693   hours"
"                  0.047     0.047     0.010     0.050 c.m/sec"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total Site"
"             Maximum flow                  0.060    c.m/sec"
"             Hydrograph volume           193.519    c.m"
"                     0.047     0.047     0.010     0.060"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.047     0.000     0.010     0.060"
" 33          CATCHMENT 204"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          204   Controlled Area"
"      100.000   % Impervious"
"        0.240   Total Area"
"       20.000   Flow length"
"        1.200   Overland Slope"
"        0.000   Pervious Area"
"       20.000   Pervious length"
"        1.200   Pervious slope"
"        0.240   Impervious Area"
"       20.000   Impervious length"
"        1.200   Impervious slope"
"        0.250   Pervious Manning 'n'"
```

```
"       75.000   Pervious SCS Curve No."
"        0.000   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.918   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.159     0.000     0.010     0.060 c.m/sec"
"             Catchment 204          Pervious   Impervious Total Area "
"             Surface Area           0.000      0.240      0.240      hectare"
"             Time of concentration  10.066     1.332      1.332      minutes"
"             Time to Centroid       109.081    86.965     86.965     minutes"
"             Rainfall depth         84.315     84.315     84.315     mm"
"             Rainfall volume        0.00       202.36     202.36     c.m"
"             Rainfall losses        48.746     6.899      6.899      mm"
"             Runoff depth           35.570     77.416     77.416     mm"
"             Runoff volume          0.00       185.80     185.80     c.m"
"             Runoff coefficient     0.000      0.918      0.918      "
"             Maximum flow           0.000      0.159      0.159      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"              4   Add Runoff "
"                     0.159     0.159     0.010     0.060"
" 54          POND DESIGN"
"        0.159   Current peak flow    c.m/sec"
"        0.037   Target outflow    c.m/sec"
"        185.8   Hydrograph volume    c.m"
"           7.   Number of stages"
"      101.220   Minimum water level    metre"
"      103.800   Maximum water level    metre"
"      101.220   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                101.220     0.000     0.000"
"                103.550   0.02388    12.450"
"                103.600   0.02414    13.960"
"                103.650   0.02439    22.230"
"                103.700   0.02465    46.120"
"                103.750   0.02490    94.800"
"                103.800   0.02515   171.200"
"             1.   ORIFICES"
"                  Orifice   Orifice   Orifice Number of"
"                   invert coefficie  diameter  orifices"
"                101.220     0.630    0.0850     1.000"
"             Peak outflow                 0.025    c.m/sec"
"             Maximum level               103.744    metre"
"             Maximum storage              89.077    c.m"
"             Centroidal lag                2.009   hours"
"                  0.159     0.159     0.025     0.060 c.m/sec"
```

```
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total Site"
"             Maximum flow                  0.084    c.m/sec"
"             Hydrograph volume           379.431    c.m"
"                     0.159     0.159     0.025     0.084"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.159     0.000     0.025     0.084"
" 33          CATCHMENT 205"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          205   Uncontrolled to Lusk"
"       10.300   % Impervious"
"        0.060   Total Area"
"        2.000   Flow length"
"       17.500   Overland Slope"
"        0.054   Pervious Area"
"        2.000   Pervious length"
"       17.500   Pervious slope"
"        0.006   Impervious Area"
"        2.000   Impervious length"
"       17.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.413   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.806   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.019     0.000     0.025     0.084 c.m/sec"
"             Catchment 205          Pervious   Impervious Total Area "
"             Surface Area           0.054      0.006      0.060      hectare"
"             Time of concentration  1.132      0.150      0.952      minutes"
"             Time to Centroid       96.382     84.305     94.171     minutes"
"             Rainfall depth         84.315     84.315     84.315     mm"
"             Rainfall volume        45.38      5.21       50.59      c.m"
"             Rainfall losses        49.494     16.361     46.082     mm"
"             Runoff depth           34.821     67.954     38.234     mm"
"             Runoff volume          18.74      4.20       22.94      c.m"
"             Runoff coefficient     0.413      0.806      0.453      "
"             Maximum flow           0.015      0.004      0.019      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.019     0.019     0.025     0.084"
```

```
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.019     0.019     0.019     0.084"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total Site"
"             Maximum flow                  0.103    c.m/sec"
"             Hydrograph volume           402.371    c.m"
"                     0.019     0.019     0.019     0.103"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.019     0.000     0.019     0.103"
" 33          CATCHMENT 206"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          206   Uncontrolled to O'Keefe"
"       49.000   % Impervious"
"        0.047   Total Area"
"        6.000   Flow length"
"       25.000   Overland Slope"
"        0.024   Pervious Area"
"        6.000   Pervious length"
"       25.000   Pervious slope"
"        0.023   Impervious Area"
"        6.000   Impervious length"
"       25.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.419   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.813   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.022     0.000     0.019     0.103 c.m/sec"
"             Catchment 206          Pervious   Impervious Total Area "
"             Surface Area           0.024      0.023      0.047      hectare"
"             Time of concentration  1.966      0.260      0.855      minutes"
"             Time to Centroid       97.607     85.226     89.547     minutes"
"             Rainfall depth         84.315     84.315     84.315     mm"
"             Rainfall volume        20.21      19.42      39.63      c.m"
"             Rainfall losses        49.001     15.753     32.709     mm"
"             Runoff depth           35.314     68.563     51.606     mm"
"             Runoff volume          8.46       15.79      24.25      c.m"
"             Runoff coefficient     0.419      0.813      0.612      "
"             Maximum flow           0.006      0.016      0.022      c.m/sec"
```

```
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.022     0.022     0.019     0.103"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.022     0.022     0.022     0.103"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total Site"
"             Maximum flow                  0.125    c.m/sec"
"             Hydrograph volume           426.626    c.m"
"                     0.022     0.022     0.022     0.125"
" 38          START/RE-START TOTALS 206"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                      0.604    hectare"
"             Total Impervious area                     0.526    hectare"
"             Total % impervious                       87.121"
" 19          EXIT"
```