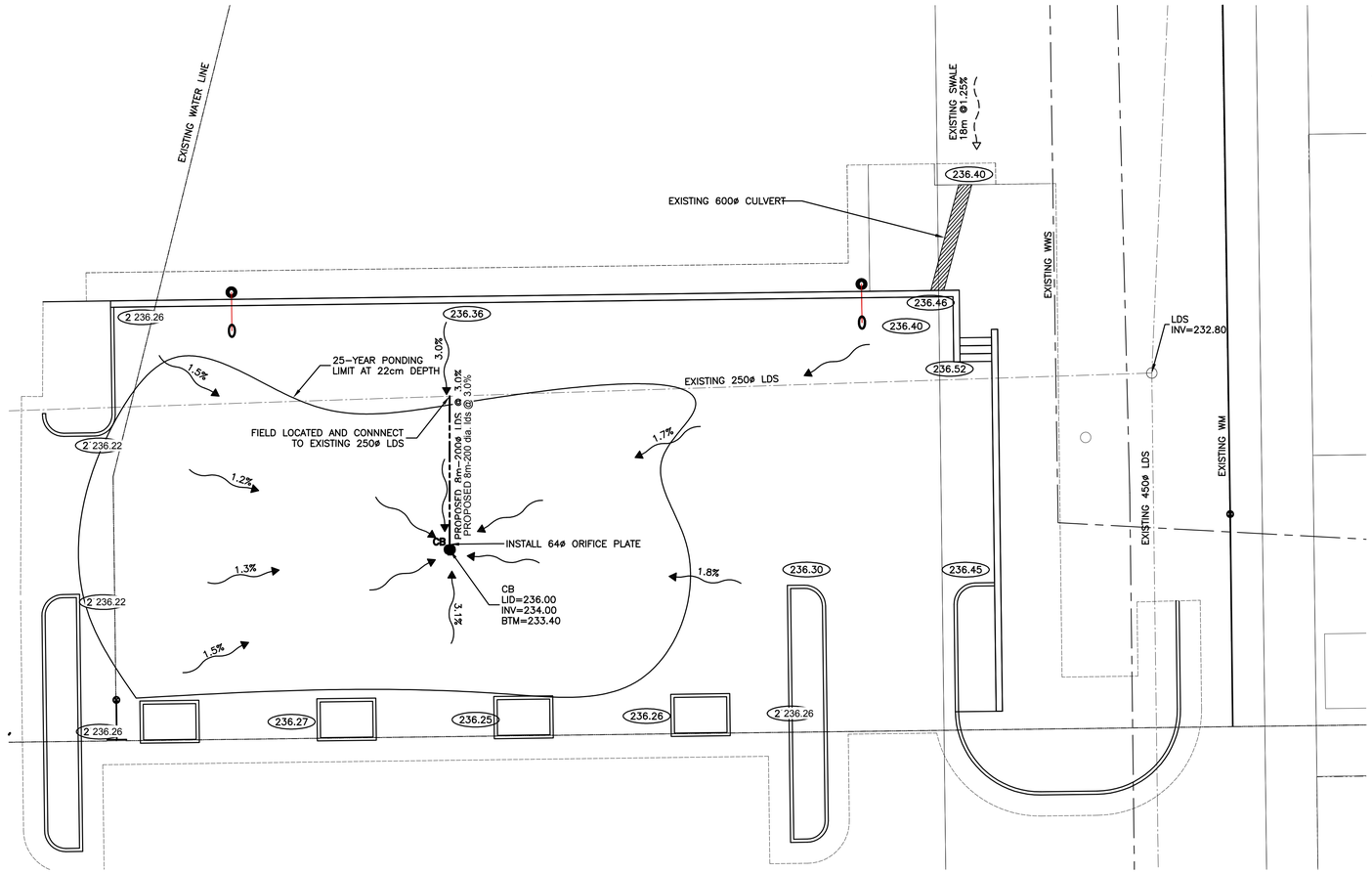
impervious area - surface storage capacity		**0.10**						Allowable runoff		
								Q = ciA =	0.45	cfs
Horton Equation				Total impervious area	0.27	acres		where c =	0.45	
imperial		metric		Total pervious area	0.02	acres		i_{5yr} =	3.52	in/hr
fo (in/hr)	3.000	fo (mm/hr)	76.200	Total area	0.29	acres		A =	0.29	acres
fc (in/hr)	0.118	fc (mm/hr)	2.997	Allowable runoff	0.45	cfs				
k (1/min)	-0.069	k (1/sec)	-0.00115	Requried Site Storage	926	ft^3		tc =	15	min
				Requried Site Storage	26	m^3				

City of Winnipeg 25 year Storm					Pervious Flow Calculation						
time	intensity	rain depth	sum	impervious runoff	infiltration (Horton Equ)	net intensity	pervious runoff	total runoff (pervious + impervious)	allowable off site discharge	runoff requiring storage	onsite storage required
min	in/hr	inches	inches	cfs	in/hr	in/hr	cfs	cfs	cfs	cfs	cfs
0	0.00	0.00	0.00	0.00	3.00	0.00	0.00	0.00	0.45	0.00	0
5	0.12	0.01	0.01	0.00	2.16	0.00	0.00	0.00	0.45	0.00	0
10	0.13	0.01	0.02	0.00	1.56	0.00	0.00	0.00	0.45	0.00	0
15	0.15	0.01	0.03	0.00	1.14	0.00	0.00	0.00	0.45	0.00	0
20	0.17	0.01	0.05	0.00	0.84	0.00	0.00	0.00	0.45	0.00	0
25	0.19	0.02	0.06	0.00	0.63	0.00	0.00	0.00	0.45	0.00	0
30	0.21	0.02	0.08	0.00	0.48	0.00	0.00	0.00	0.45	0.00	0
35	0.23	0.02	0.10	0.06	0.38	0.00	0.00	0.06	0.45	0.00	0
40	0.26	0.02	0.12	0.07	0.30	0.00	0.00	0.07	0.45	0.00	0
45	0.29	0.02	0.15	0.08	0.25	0.04	0.00	0.08	0.45	0.00	0
50	0.33	0.03	0.17	0.09	0.21	0.12	0.00	0.09	0.45	0.00	0
55	0.42	0.04	0.21	0.11	0.18	0.24	0.00	0.12	0.45	0.00	0
60	0.53	0.04	0.25	0.14	0.16	0.37	0.01	0.15	0.45	0.00	0
65	0.76	0.06	0.32	0.20	0.15	0.61	0.01	0.22	0.45	0.00	0
70	1.24	0.10	0.42	0.33	0.14	1.10	0.02	0.35	0.45	0.00	0
75	2.96	0.25	0.67	0.80	0.13	2.83	0.05	0.85	0.45	0.40	119
80	7.86	0.66	1.32	2.12	0.13	7.73	0.14	2.26	0.45	1.81	542
85	3.93	0.33	1.65	1.06	0.13	3.80	0.07	1.13	0.45	0.68	203
90	2.29	0.19	1.84	0.62	0.12	2.17	0.04	0.66	0.45	0.20	61
95	1.54	0.13	1.97	0.41	0.12	1.42	0.03	0.44	0.45	0.00	0
100	1.17	0.10	2.07	0.31	0.12	1.05	0.02	0.33	0.45	0.00	0
105	0.92	0.08	2.14	0.25	0.12	0.80	0.01	0.26	0.45	0.00	0
110	0.75	0.06	2.20	0.20	0.12	0.63	0.01	0.21	0.45	0.00	0
115	0.65	0.05	2.26	0.17	0.12	0.53	0.01	0.18	0.45	0.00	0
120	0.58	0.05	2.31	0.16	0.12	0.46	0.01	0.16	0.45	0.00	0
125	0.51	0.04	2.35	0.14	0.12	0.39	0.01	0.14	0.45	0.00	0
130	0.45	0.04	2.39	0.12	0.12	0.33	0.01	0.13	0.45	0.00	0
135	0.40	0.03	2.42	0.11	0.12	0.28	0.01	0.11	0.45	0.00	0
140	0.35	0.03	2.45	0.09	0.12	0.23	0.00	0.10	0.45	0.00	0
145	0.30	0.03	2.47	0.08	0.12	0.18	0.00	0.08	0.45	0.00	0
150	0.26	0.02	2.50	0.07	0.12	0.14	0.00	0.07	0.45	0.00	0
155	0.22	0.02	2.51	0.06	0.12	0.10	0.00	0.06	0.45	0.00	0
160	0.19	0.02	2.53	0.05	0.12	0.07	0.00	0.05	0.45	0.00	0
165	0.17	0.01	2.54	0.05	0.12	0.05	0.00	0.05	0.45	0.00	0
170	0.16	0.01	2.56	0.04	0.12	0.04	0.00	0.04	0.45	0.00	0
175	0.15	0.01	2.57	0.04	0.12	0.03	0.00	0.04	0.45	0.00	0
180	0.14	0.01	2.58	0.04	0.12	0.02	0.00	0.04	0.45	0.00	0
185	0.13	0.01	2.59	0.03	0.12	0.01	0.00	0.04	0.45	0.00	0
190	0.12	0.01	2.60	0.03	0.12	0.00	0.00	0.03	0.45	0.00	0
195	0.12	0.01	2.61	0.03	0.12	0.00	0.00	0.03	0.45	0.00	0
200	0.00	0.00	2.61	0.00	0.12	0.00	0.00	0.00	0.45	0.00	0

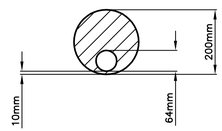


PROPOSED PARKING LOT SITE

SCALE 1:150

ORIFICE SIZING		
Q = FLOW = CUBIC METRES / SECOND		
C = CO-EFFICIENT OF DISCHARGE = 0.594 TO 0.600		
A = AREA = SQUARE METRE		
G = GRAVITY = 9.81 METRES PER SECOND SQUARED		
H = HEAD = METRES = AVAILABLE HEAD		
ALLOWABLE OUTFLOW	12.80	L/S
CB INLET ELEVATION	236.00	m
PONDING DEPTH	0.22	m
WATER SURFACE	236.22	m
INVERT OR OUTLET PIPE	234.00	m
OUTLET PIPE DIAMETER	0.20	m
HEAD	2.32	METRES
Q =C A √(2GH)		
FLOW =	0.01	CUBIC METRES / SECOND
HEAD =	2.32	METRES
CO-EFFICIENT OF DISCHARGE =	0.594	
ORIFICE DIAMETER =	64	MILLIMETRES
THUS A 64 mm DIAMETER ORIFICE WILL BE USED TO PERMIT A FLOW OF 12.80 L/S.		

PRE-DEVELOPMENT RUN OFF CALCULATIONS				
RATIONAL FORMULA Q = C I A				
WHERE				
Q = FLOW [CFS]				
C = PRE-DEVELOPMENT RUNOFF CO-EFFICIENT = 0.45				
I = RAINFALL INTENSITY [INCHES/HOUR]				
A = AREA [ACRES]				
I = 47.2/((T+8)^0.828)				
WHERE T = 15 MINUTES				
INTENSITY = 3.52 INCHES/HOUR				
LOT AREA =	1155	SQ. METRES		
=	0.29	ACRES		
Q=	0.45	X 3.52	X 0.285	
Q=	0.45	CFS		
Q=	12.80	LITRE/SECOND		
THEREFORE THE ALLOWABLE RUNOFF IS			12.80	LITRE/SECOND
THIS IS THE MAXIMUM ALLOWABLE OFF LOT FLOW - RESTRICTORS WILL BE REQUIRED TO REGULATE THE FLOW AT THE AMOUNT INDICATED ABOVE				



ORIFICE PLATE DETAIL

NOTES:

ALL UNDERGROUND AND SURFACE WORKS TO BE COMPLETED IN ACCORDANCE WITH LATEST REVISION OF CITY OF WINNIPEG CONSTRUCTION SPECIFICATION

LOT GRADING DESIGN COMPLETED BY OTHERS

SITE SURVEY PROVIDED BY OTHERS

SCALE BAR
(IN METRES)

3 0 1.5 3 6 9 12 15

1:150

No.	Date	Issue/Revision	By
1	12/05/16	ISSUED FOR TENDER	MF

Seal: T. J. SCHATKOWSKY, 2014/05/16

APEGM Certificate of Authorization, J.R. Cousin Consultants Ltd., No. 234, Date: May 16/14

Mechanical & Electrical Installer: SMS ENGINEERING

Civil Engineer: J. R. Cousin Consultants Ltd. Consulting Engineers and Project Managers
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Engineering Excellence since 1981

Landscape Architect: HILDERMAN THOMAS FRANK CRAM
Landscape Architecture + Planning
500-115 Bannatyne Avenue East, Winnipeg, Manitoba R3B 0R3
Telephone (204)944-0507 Facsimile (204)957-0287

The general contractor shall check & verify all dimensions and report any errors or omissions to the designers.

Project: ST JAMES CENTENNIAL PARKING LOT EXPANSION
WINNIPEG, MANITOBA

Sheet Title: PARKING LOT GRADING WITH RUNOFF CALCULATIONS
Sheet No.: M–1.0
Rev.:

Design	Drawn	Checked	Scale	Date	File
MF	MF	TS	1:150	12/03/23	F–534.05