NYMNPA

25/04/2018

Whitby Park and Ride Drainage

RETURN PERIOD: Y=	30
IMPERMIABILITY FACTOR:P=	1
ROUGHNESS FACTOR :ks=	0.6
KINEMATIC VISCOSITY : u=	0.0000011
GRAVITATIONAL ACCEL. : g=	9.81
TIME OF ENTRY (s)	180

(MM)

(SQM/S @ 15 DEG C)

(M/S/S)

CV	0.85
CR	1.3

Q =2.78*CV*CR*i*A

Concentration Time = Entry of Time + Flow Time

Comments	Pipe Ref	From-to	Length (m)	Ground Level (m)	Soffit Level (m)	Intlet Invert (m)	Ground Level (m)	Soffit Level (m)	Outlet Invert (m)	Difference	Hydraulic Gradient	Pipe Diameter (mm)	Velocity (m/s)	Discharge (l/s)	Flow Time (s)	Concentration Time (s)	Concentration Time (mins)	Rainfall Intensity (mm/hr)	Road Area (sqm)	Gravel Area (sqm)	Total Area (sqm)	Rate of Flow (l/s)			
ok	md01	GP01-HW01	16.2	106.253	105.253	105.103	105.917	105.167	105.017	0.086	0.0053	150	0.7276	12.8600	22.2640	202.2640	3.3711	124.0000	300		300	11.4275	0.0006	0.0000011	0.1249933
ok	md02	RE01-CP01	24	106.612	105.712	105.562	105.891	104.991	104.841	0.721	0.0300	150	1.7495	30.9209	13.7179	193.7179	3.2286	124.0000		513.66	513.66	19.5661	0.0006	0.0000011	0.2973426
	me02	md02-CP01	10			104.841			104.541	0.3	0.0300	150	1.7483	30.8993	5.7198	185.7198							0.0006	0.0000011	0.2971363
Too Small	md03	CP01-HW02	20.7	105.591	104.766	104.541	105.368	104.693	104.468	0.073	0.0035	225	0.7703	30.6302	26.8740	206.8740	3.4479	125.0000	300	513.66	813.66	31.2435	0.0006	0.0000011	0.124772
ok	dr08	RE02-CP02	49.4	106.506	105.606	105.381	105.497	104.597	104.372	1.009	0.0204	225	1.8727	74.4696	26.3790	206.3790	3.4397	124.0000		936.59	936.59	35.6762	0.0006	0.0000011	0.3002776
ok	md04	dr08-CP02	13			104.372			104.105	0.267	0.0205	225	1.8779	74.6776	6.9225	186.9225	3.1154						0.0006	0.0000011	0.3011097
ok	md05	CP02-HW03	22.6	105.23	104.405	104.105	104.944	104.344	104.044	0.061	0.0027	300	0.8097	57.2446	27.9102	207.9102	3.4652	125.0000	150	936.59	1086.59	41.7237	0.0006	0.0000011	0.1260436
ok	dr01	RE03-CP03	53.4	106.259	105.359	105.134	105.158	104.258	104.033	1.101	0.0206	225	1.8816	74.8231	28.3803	208.3803	3.4730	125.0000		781.46	781.46	30.0071	0.0006	0.0000011	0.301692
ok	md07	GP07-CP03	32.3	105.451	104.551	104.401	105.158	104.183	104.033	0.368	0.0114	150	1.0721	18.9486	30.1268	210.1268	3.5021	123.0000	450		450	17.0030	0.0006	0.0000011	0.1831124
ok	dr02	CP03-CP04	44.9	105.158	104.258	104.033	103.782	102.882	102.657	1.376	0.0306	225	2.2971	91.3444	19.5468	199.5468	3.3258	124.0000		2213.41	2213.41	84.3122	0.0006	0.0000011	0.3678128
ok	md09	CP04-HW06	14.29	103.782	102.957	102.657	103.438	102.838	102.538	0.119	0.0083	300	1.4324	101.2651	9.9761	189.9761	3.1663	125.0000	1200	1313.41	2513.41	96.5118	0.0006	0.0000011	0.2213948
ok	md10	GP16-inter	22.3	104.48	103.58	103.43	103.949	103.049	102.899	0.531	0.0238	150	1.5561	27.5016	14.3309	194.3309	3.2388	125.0000	300		300	11.5196	0.0006	0.0000011	0.264722
ok	md11	GP17-HW05	15.6	103.98	103.08	102.855	103.692	103.017	102.792	0.063	0.0040	225	0.8252	32.8144	18.9048	198.9048	3.3151	127.0000	450		450	17.5559	0.0006	0.0000011	0.1335207
ok	dr03	RE04-CP05	46.8	104.692	103.792	103.567	103.81	102.91	102.685	0.882	0.0188	225	1.7983	71.5114	26.0245	206.0245	3.4337	125.0000		696.59	696.59	26.7482	0.0006	0.0000011	0.2884378
	md13			103.949	103.049	102.899	103.81	102.835	102.685	0.214		150													
ok	dr04	CP05-CP06	33.8	103.81	102.91	102.685	103.162	102.262	102.037	0.648	0.0192	225	1.8139	72.1310	18.6340	198.6340	3.3106	124.0000		1489.76	1489.76	56.7473	0.0006	0.0000011	0.2909175
ok	md15	CP06-MH01	13.75	103.162	102.262	102.037	102.62	101.72	101.495	0.542	0.0394	225	2.6071	103.6718	5.2742	185.2742	3.0879	127.0000	1639.76		1639.76	63.9722	0.0006	0.0000011	0.4171469
ok	md16	MH01-HW07	8.3	102.62	101.72	101.495	101.207	101.532	101.307	0.188	0.0227	225	1.9728	78.4514	4.2072	184.2072	3.0701	127.0000	1936.76		1936.76	75.5591	0.0006	0.0000011	0.3162137
ok	DR05	RE05-CP07	33	104.134	103.234	103.084	103.328	102.428	102.278	0.806	0.0244	150	1.5761	27.8563	20.9372	200.9372	3.3490	123.0000		482.93	289.758	10.9483	0.0006	0.0000011	0.2681055
ok	md18	CP07-MH02	25.6	103.328	102.503	102.278	102.61	101.71	101.485	0.793	0.0310	225	2.3095	91.8389	11.0847	191.0847	3.1847	124.0000	932.93		932.93	35.5368	0.0006	0.0000011	0.3697919
ok	md19	MH02-MH03	22.5	102.535	101.635	101.485	100.21	99.31	99.16	2.325	0.1033	150	3.2569	57.5610	6.9085	186.9085	3.1151	124.0000	1082.93		1082.93	41.2505	0.0006	0.0000011	0.5514617
ok	md20	MH03-MH05	58.4	100.285	99.385	99.16	99.351	98.451	98.226	0.934	0.0160	225	1.6555	65.8329	35.2761	215.2761	3.5879	124.0000	1082.93		1082.93	41.2505	0.0006	0.0000011	0.2657099
ok	md21	MH05-HW17	13.7	99.351	98.451	98.226	98.569	97.894	97.669	0.557	0.0407	225	2.6479	105.2970	5.1739	185.1739	3.0862	122.0000	1082.93		1082.93	40.5852	0.0006	0.0000011	0.4236508
ok	me22	GP30-HW14	55.6	100.003	99.103	98.953	98.694	97.75	97.6	1.353	0.0243	150	1.5732	27.8046	35.3416	215.3416	3.5890	122.0000	450		450	16.8647	0.0006	0.0000011	0.2676126
	md23	GP33-me23	8.73			99.29			99.091	0.199	0.0228	150	1.5222	26.9028	5.7352	185.7352	3.0956						0.0006	0.0000011	0.2590088
ok	me23	md23-MH08	36.73	100.141	99.241	99.091	99.278	98.378	98.228	0.863	0.0235	150	1.5290	27.0232	24.0222	204.0222	3.4004	125.0000	450		450	17.2794	0.0006	0.0000011	0.2629602
ok	md24	MH08-HW13	16.3	99.278	98.378	98.228	98.778	98.003	97.853	0.375	0.0230	225	1.5290	60.8021	10.6606	190.6606	3.1777	124.0000	750		750	28.5687	0.0006	0.0000011	0.3186857
ok	md25	GP40-CP08	21.9	102.031	101.131	100.981	101.066	100.166	100.016	0.965	0.0441	150	2.1218	37.5007	10.3213	190.3213	3.1720	124.0000	300		300	11.4275	0.0006	0.0000011	0.3601113
	md26	GP38-CP08	18.1	101.848	100.948	100.798	101.066	100.166	100.016	0.782	0.0432	150	2.1009	37.1307	8.6154	188.6154	3.1436						0.0006	0.0000011	0.3565818
ok	dr06	RE06-CP08	55.2	103.126	102.226	102.076	101.066	100.166	100.016	2.06	0.0373	150	1.9516	34.4915	28.2850	208.2850	3.4714	125.0000	790.24		790.24	30.3442	0.0006	0.0000011	0.3314051
ok	dr07	CP08-CP09	43	101.066	100.166	100.016	99.244	98.344	98.119	1.897	0.0441	225	2.7589	109.7088	15.5861	195.5861	3.2598	123.0000		2169.51	2169.51	81.9736	0.0006	0.0000011	0.4413064
ok	md29	CP09-MH10	10	99.3	98.419	98.119	99.102	98.202	97.902	0.217	0.0217	225	2.3241	92.4200	4.3027	184.3027	3.0717	127.0000	2319.51		2319.51	90.4913	0.0006	0.0000011	0.3095071
	md30	HW08-HW09	27.248		101.35	101.05			99.998	1.052	0.0386	150	3.3241	58.7493	8.1971	188.1971							0.0006	0.0000011	0.3370821
	md31	HW11-MH10	33.5			99.343			97.902	1.441	0.0430	150	4.3241	76.4231	7.7473	187.7473							0.0006	0.0000011	0.355799
ok	md32	MH10-HW12	17.3	99.102	98.352	97.902	98.788	98.234	97.784	0.118	0.0068	300	1.2951	91.5556	13.3583	193.3583	3.2226	125.0000	2319.51		2319.51	89.0663	0.0006	0.0000011	0.2003679
ok	md34	HW19-CP10	22.8	98.584	97.684	97.534	98	96.8	96.65	0.884	0.0388	150	1.2215	21.5885	18.6656	198.6656	3.3111	120.0000	150		150	5.5294	0.0006	0.0000011	0.3377955
ok	md35	GP47-MH3	113.9	100.407	99.507	99.282	98	96.275	96.05	3.232	0.0284	225	1.9290	76.7085	59.0461	239.0461	3.9841	123.0000	1500		1500	56.6766	0.0006	0.0000011	0.3539277
ok	md36	HW20-CP10	23	97.269	96.519	96.369	98	96.419	96.269	0.1	0.0043	150	0.6375	11.2670	36.0784	216.0784	3.6013	124.0000	150		150	5.7137	0.0006	0.0000011	0.1131179
ok	md37	CP10-HW27	5	98	96.569	96.269	98	96.544	96.244	0.025	0.0050	300	1.1070	78.2594	4.5167	184.5167	3.0753	128.0000	300		300	11.7961	0.0006	0.0000011	0.1715517
Too Small	md38	HW28-CP	5.5	-	96.225	96	-	96.125	95.9	0.1	0.018181818	225	1.7661	70.2298	3.1142	183.1142	3.0519	128.0000	1800		1800	70.7766	0.0006	0.0000011	0.2833084
ok	md39	CP-MH2	20.4	-	95.65	95.5	95.85	94.95	94.8	0.7	0.034313725	150	1.8708	33.0634	10.9046	190.9046	3.1817	126.0000				6.0000	0.0006	0.0000011	0.3177818
#DIV/0!													#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!						0.0006	0.0000011	0

ok	MDR3	MH2- CP2	9.419	Difference in Level		0.1					0.010616838	375	1.8661	206.1293	5.0475	185.0475	3.0841	128.0000	1350	1800	3150	123.8590
ok	MDR4	MH3-MH2	82.604	Difference in Level		1.25					0.015132439	225	1.6100	64.0219	51.3078	231.3078	3.8551	123.0000	1050		1050	39.6736
ok	MDR5	MH4-MH3	13.882	Difference in Level		0.1					0.007203573	225	1.1066	44.0034	12.5452	192.5452	3.2091	125.0000	750		750	28.7991
ok	MDR6	GP14/15-MH4	23.951	Difference in Level		0.15					0.006262787	225	1.0309	40.9933	23.2339	203.2339	3.3872	125.0000	450		450	17.2794
ok	MDR7	GP16	15.198	Difference in Level		0.275					0.018094486	150	1.3547	23.9424	11.2188	191.2188	3.1870	120.0000			150	5.5294
ok	MDR8	GP13	11.105	Difference in Level		0.3					0.027014858	150	1.6583	29.3091	6.6964	186.6964	3.1116	122.0000			150	5.6216
ok	MDR9	GP8-MH4	14.516	Difference in Level		0.2					0.0137779	150	1.1804	20.8615	12.2979	192.2979	3.2050	125.0000	300		300	11.5196
ok	MDR10	GP6/7-GP8	16.237	Difference in Level		0.165					0.010161976	150	1.0118	17.8823	16.0477	196.0477	3.2675	125.0000	150		150	5.7598
ok	MDR12	MH5-EMH1	5	Difference in Level		0.099					0.0198	150	1.4177	25.0566	3.5268	183.5268	3.0588	128.0000			450	17.6941
ok	MDR2a	CP2- CP1	90	Difference in Level		3.65					0.040555556	300	3.1780	224.6694	28.3196	208.3196	3.4720	125.0000	150		3300	126.7159
ok	MDR2b	CP1-MH1	60.33	Difference in Level		1.05					0.017404276	300	2.0770	146.8339	29.0466	209.0466	3.4841	125.0000			3300	126.7159
ok	MDR1	MH1-headC	14.495	Difference in Level		0.55					0.037944119	375	3.5404	391.0757	4.0942	184.0942	3.0682	128.0000			3300	129.7571

0.0006 0.0000011 0.2794877
0.0006 0.0000011 0.2584611
0.0006 0.0000011 0.178326
0.0006 0.0000011 0.1662741
0.0006 0.0000011 0.2307641
0.0006 0.0000011 0.2819658
0.0006 0.0000011 0.2013662
0.0006 0.0000011 0.1729355
0.0006 0.0000011 0.2413947
0.0006 0.0000011 0.4885796
0.0006 0.0000011 0.3200649
0.0006 0.0000011 0.5283691

			2	85.8	2	107.8	2	85.8	2	107.8
			2.17	84.3	2.17	106	2.17	84.3	2.17	106
			2.33	82.5	2.33	104	2.33	82.5	2.33	104
			2.50	80.9	2.50	101.8	2.5	80.9	2.5	101.8
			#REF!	77.7	#REF!	98.3	2.83	77.7	2.83	98.3
			#REF!	76.5	#REF!	96.5				
0.0010811	2.9106806		#REF!	75.1	#REF!	95	3	76.5	3	96.5
0.0010811	2.9419595									
0.0010811	2.9419431									
0.0007207	3.0866795		#REF!	73.8	#REF!	93.5	3.17	75.1	3.17	95
0.0007207	3.1182807									
0.0007207	3.1183451									
0.0005405	3.2121447		#REF!	72.7	#REF!	91.9	3.33	73.8	3.33	93.5
0.0007207	3.11839									
0.0010811	2.9275287		#REF!	71.5	#REF!	90.4	3.5	72.7	3.5	91.9
0.0007207	3.1225808									
0.0005405	3.2349947		#REF!	70.4	#REF!	89.1	3.67	71.5	3.67	90.4
0.0010811	2.9390707		#REF!	69.3	#REF!	87.9	3.83	70.4	3.83	89.1
0.0007207	3.0901099		#REF!	68.3	#REF!	86.7	4	69.3	4	87.9
0.0007207	3.1173252									
0.0007207	3.1175316									
0.0007207	3.1248591		#REF!	67.2	#REF!	85.4	4.17	68.3	4.17	86.7
0.0007207	3.1194567		#REF!	66.2	#REF!	84.3	4.33	67.2	4.33	85.4
0.0010811	2.939402									
0.0007207	3.1226836		#REF!	65.2	#REF!	83.1	4.5	66.2	4.5	84.3
0.0010811	2.9529359		#REF!	64.2	#REF!	81.9	4.67	65.2	4.67	83.1
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0.0007207	3.1251207		#REF!	61.9	#REF!	78.9	5.17	62.7	5.17	80
0.0010811	2.9393542		#REF!	61	#REF!	78.1	5.33	61.9	5.33	78.9
0.0010811	2.9384922									
0.0010811	2.9388949		#REF!	59.5	#REF!	76.1	5.67	60.2	5.67	77.1
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0.0010811	2.943475		#REF!	52.3	#REF!	67.8				
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0.0004324	3.3383994
0.0007207	3.1145267
0.0007207	3.1026294
0.0007207	3.0998945
0.0010811	2.9352257
0.0010811	2.9406787
0.0010811	2.9308909
0.0010811	2.9253599
0.0010811	2.9365419
0.0005405	3.252295
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0.0004324	3.3503078

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#REF!	47.4	#REF!	61.9
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#REF!	44.9	#REF!	58.9
#REF!	44.1	#REF!	58
#REF!	43.4	#REF!	57.1
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#REF!	39.5	#REF!	52.3
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#REF!	31.2	#REF!	42.2
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#REF!	20.2	#REF!	27.4
40.00	19.2	40.00	26
42.00	18.6	42.00	25.2
45.00	17.7	45.00	24

47.00	17.2	47.00	23.3
50.00	16.5	50.00	22.3
52.00	16.1	52.00	21.7
55.00	15.5	55.00	20.9
60.00	14.6	60.00	19.7
65.00	13.9	65.00	18.7
70.00	13.2	70.00	17.7
75.00	12.6	75.00	16.9
80.00	12.1	80.00	16.2
85.00	11.6	85.00	15.5
90.00	11.2	90.00	14.9
95.00	10.8	95.00	14.4
100.00	10.4	100.00	13.9
105.00	10	105.00	13.5
110.00	9.7	110.00	13