APPENDIX B

POND CONTROLS – QUALITY, EXTENDED DETENTION AND QUANTITY SEDIMENT FOREBAY CALCULATIONS

Table B-1: Criteria for Required Storage Volumes

Pond	Area [1] (ha)	Imperviousness (%)	Storage Volume for Impervious Level [2] (m^3/ha)
N/A	N/A	55	190
SWM Facility	40.354	67	218.00
N/A	N/A	70	225

[1] Refer to Appendix C for drainage areas to SWM Facility.

[2] Protection Level for Wet Pond: Enhanced 80% long-term S.S. removal.
SWM Planning & Design Manual, Table 3.2, p.3-10 (March 2003).

Table B-2: Required Storage Volumes for SWM Facility

Pond Component	Required Volume (m^3)	Provided Volume [4] (m^3)	Volume Ratio	Provided Area [5] (m^2)	Provided Elevation (m)
Permanent Pool (PP) [1]	7183	11180	1.56	8731	121.200
Quality Control [2]	1614	1614	1.00	N/A	121.378
Extended Detention [3]	6759	8137	1.20	N/A	122.000
Forebay (20% PP)	1437	N/A	N/A	2844	121.200
PP - Forebay	5746	N/A	N/A	5887	121.200
			Area Ratio (%) [6] =	33	

[1] Required PP volume based on Table B-1 (218.00 - 40 = 178.00 m^3/ha).

[2] Required quality control volume based on 40 m^3/ha.

[3] Required extended detention volume based on the volume of the 25 mm storm.

[4] Provided volume based on stage-storage curve and extended detention (refer to Tables B-3 and B-4 of Appendix B).

[5] Based on grading plan provided by DSEL (refer to Figure 2).

[6] As per MOE, Maximum Forebay Area: 33% of Total Permanent Pool.

Table B-3: Extended Detention Parameters for SWM Facility

Permanent Pool Parameters			Quality Orifice Parameters		
Area (C3)	8,731	m^2	Diameter	0.230	m
Volume	11,180	m^3			
PP Elev	121.200	m	Area	0.042	m^2
QC Elev	121.378	m	Invert	121.200	m
h (m)	0.178	m	C_o	0.62	

Notes:
- C3 is the intercept from the area-depth linear regression.
- PP Elev indicates the elevation of the permanent pool.
- QC Elev indicates the elevation of the storage volume required by MOE for quality control.
- h is the maximum water elevation above the orifice (m).

Table B-4: Extended Detention Drawdown Time for SWM Facility

Elev.	Active Storage			C2	Drawdown Time	Drawdown Time	Flow	Demarkation
(m)	V (m^3)	A (m^2)	depth (m)	(m^2/m)	(h)	(days)	(m^3/s)	Point
121.20	**0.00**	**8731.10**	**0.00**				**0.000**	**PP Elev**
121.25	437.18	8756.64	0.05	511	9.50	0.40	0.008	
121.30	888.48	9031.49	0.10	3004	13.58	0.57	0.017	
121.35	1350.53	9270.82	0.15	3598	16.78	0.70	0.025	
121.378	**1614.00**	**9400.07**	**0.18**	**3762**	**18.35**	**0.76**	**0.030**	**QC Elev**
121.40	1824.10	9503.14	0.20	3860	19.54	0.81	0.034	
121.45	2290.85	9795.36	0.25	4257	22.08	0.92	0.042	
121.50	2780.83	9801.89	0.30	3569	24.19	1.01	0.049	
121.55	3272.74	9882.72	0.35	3290	26.21	1.09	0.055	
121.60	3779.71	10173.70	0.40	3606	28.31	1.18	0.061	
121.65	4296.48	10386.82	0.45	3679	30.26	1.26	0.066	
121.70	4822.85	10576.22	0.50	3690	32.11	1.34	0.071	
121.75	5354.98	10734.05	0.55	3642	33.87	1.41	0.075	
121.80	5896.90	10898.50	0.60	3612	35.58	1.48	0.079	
121.85	6445.15	11071.49	0.65	3601	37.26	1.55	0.083	
121.90	7022.98	11254.94	0.70	3605	38.91	1.62	0.087	
121.95	7561.82	11512.32	0.75	3708	40.63	1.69	0.091	
122.00	**8137.06**	**11553.98**	**0.80**	**3529**	**42.02**	**1.75**	**0.094**	**Ext. Det.**
122.05	8716.13	11563.30	0.85	3332	43.33	1.81	0.133	
122.10	9300.77	11697.98	0.90	3297	44.79	1.87	0.172	
122.15	9888.00	11780.74	0.95	3210	46.15	1.92	0.211	
122.159	**9994.53**	**11795.53**	**0.96**	**3195**	**46.39**	**1.93**	**0.218**	**2-Year**
122.20	10479.84	11862.91	1.00	3132	47.48	1.98	0.249	
122.25	11071.87	11936.64	1.05	3053	48.77	2.03	0.288	
122.30	11673.98	12009.60	1.10	2980	50.04	2.09	0.326	
122.35	12276.86	12081.41	1.15	2913	51.29	2.14	0.364	
122.395	**12821.62**	**12149.75**	**1.19**	**2861**	**52.41**	**2.18**	**0.399**	**5-Year**
122.40	12882.14	12157.34	1.20	2855	52.53	2.19	0.402	
122.45	13491.46	12229.82	1.25	2799	53.74	2.24	0.441	
122.50	14105.47	12304.70	1.30	2749	54.94	2.29	0.479	
122.549	**14710.97**	**12376.02**	**1.35**	**2702**	**56.10**	**2.34**	**0.516**	**10-Year**
122.55	14723.33	12377.47	1.35	2701	56.13	2.34	0.517	
122.60	15344.26	12454.27	1.40	2659	57.30	2.39	0.555	
122.65	15968.35	12527.71	1.45	2618	58.46	2.44	0.591	
122.70	16598.21	12601.73	1.50	2580	59.60	2.48	0.625	

Table B-4: Extended Detention Drawdown Time for SWM Facility

Elev.	Active Storage			C2	Drawdown Time	Drawdown Time	Flow	Demarkation
(m)	V (m^3)	A (m^2)	depth (m)	(m^2/m)	(h)	(days)	(m^3/s)	Point
122.75	17233.54	12679.30	1.55	2547	60.74	2.53	0.658	
122.750	**17233.54**	**12679.30**	**1.55**	**2547**	**60.74**	**2.53**	**0.658**	**25-Year**
122.80	17869.63	12750.62	1.60	2512	61.86	2.58	0.688	
122.85	18510.24	12825.70	1.65	2482	62.97	2.62	0.717	
122.890	**19023.19**	**12886.44**	**1.69**	**2459**	**63.86**	**2.66**	**0.740**	**50-Year**
122.90	19151.42	12901.63	1.70	2453	64.08	2.67	0.745	
122.95	19803.65	12973.73	1.75	2424	65.17	2.72	0.772	
123.00	20451.36	13051.58	1.80	2400	66.26	2.76	0.798	
123.036	**20922.62**	**13103.77**	**1.84**	**2382**	**67.03**	**2.79**	**0.816**	**100-Year**
123.05	21105.89	13124.06	1.85	2375	67.33	2.81	0.823	
123.10	21764.74	13200.48	1.90	2352	68.40	2.85	0.847	
123.15	22429.25	13274.98	1.95	2330	69.47	2.89	0.870	
123.20	23097.89	13349.66	2.00	2309	70.52	2.94	0.893	

Notes:

C2 is the slope coefficient from the area-depth linear regression.

PP Elev indicates the elevation of the permanent pool.

QC Elev indicates the elevation of the storage volume required by MOE for quality control.

Ext. Det. indicates the elevation of extended detention provided based on the volume of the 25 mm storm.

Orifice selected to provide a drawdown time between 24 and 48 hours for the extended detention volume.

2- to 100-year 24-hour Chicago storm elevations under free outfall conditions are noted.

Table B-5: Stage-Storage-Outflow Curve for SWM Facility

			Quality Control 1		Quantity Control 1		Quantity Control 2		Quantity Control 3		Quantity Control 4		Emergency Overflow 1		Emergency Spillway			
			Vertical Circ. Orifice		Vertical Circ. Orifice		Sharp-Crested Weir		Sharp-Crested Weir		Sharp-Crested Weir		Sharp-Crested Weir		Broad-Crested Weir			
			Dia (m)	0.230	Dia (m)	0.600	L (m)	8.400	L (m)	8.400	L (m)	8.400	L (m)	8.400	L (m)	10.000		
			Area (m^2)	0.042	Area (m^2)	0.283	C_w	1.800	C_w	1.800	C_w	1.800	C_w	1.800	C_w	1.580		
			Invert (m)	121.20	Invert (m)	122.00	Invert (m)	124.55	Invert (m)	124.55	Invert (m)	124.55	Invert (m)	124.80	Invert (m)	124.80		
			C_o	0.62	C_o	0.62	n contr.	2	n contr.	2	n contr.	2	n contr.	2	n contr.	0		
			Q @ D	0.039	Q @ D	0.425	Top of 1.80x2.4 DIS		Top of 1.80x2.4 DIS		Top of 1.80x2.4 DIS		Top of 1.80x2.4 DIS					
Elevation	Active Sto.	Demarkation	Head	Outflow	Head	Outflow	Head	Outflow	Head	Outflow	Head	Outflow	Head	Outflow	Head	Outflow	Outflow	Storage
(m)	(m^3)	Points	(m)	(m^3/s)	(m)	(m^3/s)	(m)	(m^3/s)	(m)	(m^3/s)	(m)	(m^3/s)	(m)	(m^3/s)	(m)	(m^3/s)	(m^3/s)	(ha·m)
121.20	**0**	**PP Elev**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
121.25	437		0.050	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.044
121.30	888		0.100	0.017	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.017	0.089
121.35	1351		0.150	0.025	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.025	0.135
121.378	**1614**	**QC Elev**	**0.178**	**0.030**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.030**	**0.161**
121.40	1824		0.200	0.034	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.034	0.182
121.45	2291		0.250	0.042	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.042	0.229
121.50	2781		0.300	0.049	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.049	0.278
121.55	3273		0.350	0.055	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.055	0.327
121.60	3780		0.400	0.061	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.061	0.378
121.65	4296		0.450	0.066	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.066	0.430
121.70	4823		0.500	0.071	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.071	0.482
121.75	5355		0.550	0.075	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.075	0.535
121.80	5897		0.600	0.079	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.079	0.590
121.85	6445		0.650	0.083	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.083	0.645
121.90	7023		0.700	0.087	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.087	0.702
121.95	7562		0.750	0.091	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.091	0.756
122.00	**8137**	**Ext. Det.**	**0.800**	**0.094**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.094**	**0.814**
122.05	8716		0.850	0.098	0.050	0.035	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.133	0.872
122.10	9301		0.900	0.101	0.100	0.071	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.172	0.930
122.15	9888		0.950	0.104	0.150	0.106	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.211	0.989
122.159	**9995**	**2-Year**	**0.959**	**0.105**	**0.159**	**0.113**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.218**	**0.999**
122.20	10480		1.000	0.107	0.200	0.142	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.249	1.048
122.25	11072		1.050	0.110	0.250	0.177	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.288	1.107
122.30	11674		1.100	0.113	0.300	0.213	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.326	1.167
122.35	12277		1.150	0.116	0.350	0.248	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.364	1.228
122.395	**12822**	**5-Year**	**1.195**	**0.119**	**0.395**	**0.280**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.399**	**1.282**
122.40	12882		1.200	0.119	0.400	0.284	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.402	1.288
122.45	13491		1.250	0.122	0.450	0.319	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.441	1.349
122.50	14105		1.300	0.124	0.500	0.354	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.479	1.411
122.549	**14711**	**10-Year**	**1.349**	**0.127**	**0.549**	**0.389**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.516**	**1.471**
122.55	14723		1.350	0.127	0.550	0.390	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.517	1.472
122.60	15344		1.400	0.129	0.600	0.425	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.555	1.534
122.65	15968		1.450	0.132	0.650	0.459	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.591	1.597
122.70	16598		1.500	0.134	0.700	0.491	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.625	1.660
122.75	17234		1.550	0.137	0.750	0.521	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.658	1.723
122.750	**17234**	**25-Year**	**1.550**	**0.137**	**0.750**	**0.521**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.658**	**1.723**
122.80	17870		1.600	0.139	0.800	0.549	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.688	1.787
122.85	18510		1.650	0.141	0.850	0.576	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.717	1.851
122.890	**19023**	**50-Year**	**1.690**	**0.143**	**0.890**	**0.596**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.740**	**1.902**
122.90	19151		1.700	0.144	0.900	0.601	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.745	1.915
122.95	19804		1.750	0.146	0.950	0.626	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.772	1.980
123.00	20451		1.800	0.148	1.000	0.650	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.798	2.045
123.036	**20923**	**100-Year**	**1.836**	**0.150**	**1.036**	**0.666**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.816**	**2.092**
123.05	21106		1.850	0.150	1.050	0.672	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.823	2.111
123.10	21765		1.900	0.152	1.100	0.695	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.847	2.176
123.15	22429		1.950	0.155	1.150	0.716	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.870	2.243
123.20	23098		2.000	0.157	1.200	0.737	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.893	2.310
123.25	23765		2.050	0.159	1.250	0.757	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.916	2.377
123.30	24436		2.100	0.161	1.300	0.776	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.937	2.444
123.35	25116		2.150	0.163	1.350	0.796	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.958	2.512

Table B-5: Stage-Storage-Outflow Curve for SWM Facility

			Quality Control 1		Quantity Control 1		Quantity Control 2		Quantity Control 3		Quantity Control 4		Emergency Overflow 1		Emergency Spillway			
			Vertical Circ. Orifice		Vertical Circ. Orifice		Sharp-Crested Weir		Sharp-Crested Weir		Sharp-Crested Weir		Sharp-Crested Weir		Broad-Crested Weir			
			Dia (m)	0.230	Dia (m)	0.600	L (m)	8.400	L (m)	8.400	L (m)	8.400	L (m)	8.400	L (m)	10.000		
			Area (m^2)	0.042	Area (m^2)	0.283	C_w	1.800	C_w	1.800	C_w	1.800	C_w	1.800	C_w	1.580		
			Invert (m)	121.20	Invert (m)	122.00	Invert (m)	124.55	Invert (m)	124.55	Invert (m)	124.55	Invert (m)	124.80	Invert (m)	124.80		
			C_o	0.62	C_o	0.62	n contr.	2	n contr.	2	n contr.	2	n contr.	2	n contr.	0		
			Q @ D	0.039	Q @ D	0.425	Top of 1.80x2.4 DIS		Top of 1.80x2.4 DIS		Top of 1.80x2.4 DIS		Top of 1.80x2.4 DIS					
Elevation	Active Sto.	Demarkation Points	Head	Outflow	Head	Outflow	Head	Outflow	Head	Outflow	Head	Outflow	Head	Outflow	Head	Outflow	Outflow	Storage
(m)	(m^3)		(m)	(m^3/s)	(m)	(m^3/s)	(m)	(m^3/s)	(m)	(m^3/s)	(m)	(m^3/s)	(m)	(m^3/s)	(m)	(m^3/s)	(m^3/s)	(ha·m)
123.40	25794		2.200	0.165	1.400	0.814	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.979	2.579
123.45	26479		2.250	0.167	1.450	0.833	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.999	2.648
123.50	27169		2.300	0.169	1.500	0.851	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.019	2.717
123.55	27855		2.350	0.171	1.550	0.868	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.039	2.785
123.60	28552		2.400	0.172	1.600	0.885	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.058	2.855
123.65	29246		2.450	0.174	1.650	0.902	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.077	2.925
123.70	29950		2.500	0.176	1.700	0.919	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.095	2.995
123.75	30659		2.550	0.178	1.750	0.935	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.113	3.066
123.80	31375		2.600	0.180	1.800	0.951	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.131	3.137
123.85	32098		2.650	0.182	1.850	0.967	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.148	3.210
123.90	32820		2.700	0.183	1.900	0.982	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.166	3.282
123.95	33537		2.750	0.185	1.950	0.997	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.183	3.354
124.00	34265		2.800	0.187	2.000	1.012	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.199	3.427
124.05	34998		2.850	0.189	2.050	1.027	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.216	3.500
124.10	35733		2.900	0.190	2.100	1.042	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.232	3.573
124.15	36471		2.950	0.192	2.150	1.056	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.248	3.647
124.20	37212		3.000	0.194	2.200	1.070	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.264	3.721
124.25	37939		3.050	0.195	2.250	1.084	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.280	3.794
124.30	38690		3.100	0.197	2.300	1.098	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.295	3.869
124.35	39447		3.150	0.199	2.350	1.112	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.311	3.945
124.40	40207		3.200	0.200	2.400	1.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.326	4.021
124.45	40991		3.250	0.202	2.450	1.139	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.341	4.099
124.50	41735		3.300	0.204	2.500	1.152	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.355	4.173
124.55	42936		3.350	0.205	2.550	1.165	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.370	4.294
124.60	43730		3.400	0.207	2.600	1.178	0.050	0.169	0.050	0.169	0.050	0.169	0.050	0.000	0.000	0.000	1.891	4.373
124.65	44078		3.450	0.208	2.650	1.190	0.100	0.477	0.100	0.477	0.100	0.477	0.100	0.000	0.000	0.000	2.830	4.408
124.677	**44502**	**Regional**	**3.477**	**0.209**	**2.677**	**1.197**	**0.127**	**0.682**	**0.127**	**0.682**	**0.127**	**0.682**	**0.127**	**0.000**	**0.000**	**0.000**	**3.453**	**4.450**
124.70	44863		3.500	0.210	2.700	1.203	0.150	0.875	0.150	0.875	0.150	0.875	0.150	0.000	0.000	0.000	4.039	4.486
124.75	45694		3.550	0.211	2.750	1.215	0.200	1.346	0.200	1.346	0.200	1.346	0.200	0.000	0.000	0.000	5.465	4.569
124.80	**46556**	**Ovf Elev**	**3.600**	**0.213**	**2.800**	**1.228**	**0.250**	**1.879**	**0.250**	**1.879**	**0.250**	**1.879**	**0.250**	**1.879**	**0.000**	**0.000**	**8.956**	**4.656**
124.85	47434		3.650	0.215	2.850	1.240	0.300	2.467	0.300	2.467	0.300	2.467	0.300	2.467	0.050	0.177	11.498	4.743
124.90	48316		3.700	0.216	2.900	1.252	0.350	3.105	0.350	3.105	0.350	3.105	0.350	3.105	0.100	0.500	14.387	4.832
124.95	49301		3.750	0.218	2.950	1.264	0.400	3.789	0.400	3.789	0.400	3.789	0.400	3.789	0.150	0.918	17.554	4.930
125.00	50222		3.800	0.219	3.000	1.276	0.450	4.515	0.450	4.515	0.450	4.515	0.450	4.515	0.200	1.413	20.970	5.022
125.05	51018		3.850	0.221	3.050	1.288	0.500	5.282	0.500	5.282	0.500	5.282	0.500	5.282	0.250	1.975	24.612	5.102
125.10	51936		3.900	0.222	3.100	1.299	0.550	6.087	0.550	6.087	0.550	6.087	0.550	6.087	0.300	2.596	28.464	5.194
125.15	52880		3.950	0.223	3.150	1.311	0.600	6.927	0.600	6.927	0.600	6.927	0.600	6.927	0.350	3.272	32.513	5.288
125.20	53823		4.000	0.225	3.200	1.322	0.650	7.801	0.650	7.801	0.650	7.801	0.650	7.801	0.400	3.997	36.748	5.382
125.25	54727		4.050	0.226	3.250	1.334	0.700	8.708	0.700	8.708	0.700	8.708	0.700	8.708	0.450	4.770	41.160	5.473
125.30	55675		4.100	0.228	3.300	1.345	0.750	9.645	0.750	9.645	0.750	9.645	0.750	9.645	0.500	5.586	45.740	5.567
125.35	56624		4.150	0.229	3.350	1.356	0.800	10.613	0.800	10.613	0.800	10.613	0.800	10.613	0.550	6.445	50.482	5.662
125.40	57573		4.200	0.231	3.400	1.367	0.850	11.609	0.850	11.609	0.850	11.609	0.850	11.609	0.600	7.343	55.378	5.757
125.45	58521		4.250	0.232	3.450	1.378	0.900	12.633	0.900	12.633	0.900	12.633	0.900	12.633	0.650	8.280	60.422	5.852
125.50	**59470**	**Top of Berm**	**4.300**	**0.233**	**3.500**	**1.389**	**0.950**	**13.684**	**0.950**	**13.684**	**0.950**	**13.684**	**0.950**	**13.684**	**0.700**	**9.253**	**65.610**	**5.947**

Notes : PP Elev indicates the elevation of the permanent pool.
QC Elev indicates the elevation of the storage volume required by MOE for quality control.
Ext. Det. indicates the elevation of extended detention provided based on the volume of the 25 mm storm.
2- to 100-year 24-hour Chicago storm and Regional event elevations under free outfall conditions are noted.
Ovf Elev indicates the elevation of the emergency spillway provided above the Regional water level.
Top of Berm indicates the elevation at the top of the berm.

CALCULATION SHEET B-1: CONTROLS

Quality Control 1		
Vertical Circular Orifice		
Diameter	(m)	0.230
A_o	(m^2)	0.042
invert	(m)	121.20
C_o		0.62
Reg Water Level	(m)	124.677
Head of Water	(m)	3.477
Q_0	(m^3/s)	0.209
Orifice Equation:		
$Q_o = C_o A_o (2gh)^{0.5}$		
Not including reverse pipe losses		
Q_o is the orifice flow		
C_o is the orifice coefficient		
A_o is the orifice flow area		
g is the gravitational constant		
h is the head of water		

Quantity Control 1		
Vertical Circular Orifice		
Diameter	(m)	0.600
A_o	(m^2)	0.283
invert	(m)	122.000
C_o		0.62
Reg Water Level	(m)	124.677
Head of Water	(m)	2.677
Q_0	(m^3/s)	1.197
Orifice Equation:		
$Q_o = C_o A_o (2gh)^{0.5}$		
Q_o is the orifice flow		
C_o is the orifice coefficient		
A_o is the orifice flow area		
g is the gravitational constant		
h is the head of water		

Quantity Control 2		
Sharp-Crested Weir		
L	(m)	8.400
C_w		1.80
Invert	(m)	124.55
n		2
Reg Water Level	(m)	124.677
Head of Water	(m)	0.127
Q_w	(m^3/s)	0.682
Note:		
Top perimeter of 1.80x2.4 DIS		
Weir Equation:		
$Qw = C_w (L-0.1nh)h^{1.5}$		
Qw is the weir flow		
Cw is the weir coefficient		
L is the weir length		
h is the weir height		
n is the # of side contractions		

Quantity Control 3		
Sharp-Crested Weir		
L	(m)	8.400
C_w		1.80
Invert	(m)	124.55
n		2
Reg Water Level	(m)	124.677
Head of Water	(m)	0.127
Q_w	(m^3/s)	0.682
Note:		
Top perimeter of 1.80x2.4 DIS		
Weir Equation:		
$Qw = C_w (L-0.1nh)h^{1.5}$		
Qw is the weir flow		
Cw is the weir coefficient		
L is the weir length		
h is the weir height		
n is the # of side contractions		

Quantity Control 4		
Sharp-Crested Weir		
L	(m)	8.400
C_w		1.80
Invert	(m)	124.55
n		2
Reg Water Level	(m)	124.677
Head of Water	(m)	0.127
Q_w	(m^3/s)	0.682
Note:		
Top perimeter of 1.80x2.4 DIS		
Weir Equation:		
$Qw = C_w (L-0.1nh)h^{1.5}$		
Qw is the weir flow		
Cw is the weir coefficient		
L is the weir length		
h is the weir height		
n is the # of side contractions		

Emergency Overflow 1		
Sharp-Crested Weir		
L	(m)	8.400
C_w		1.80
Invert	(m)	124.80
n		2
Reg Water Level	(m)	124.940
Head of Water	(m)	0.140
$Q_{w\ (100\%\ Blockage)}$	(m^3/s)	0.789
Note:		
Top perimeter of 1.80x2.4 DIS		
Weir Equation:		
$Qw = C_w (L-0.1nh)h^{1.5}$		
Qw is the weir flow		
Cw is the weir coefficient		
L is the weir length		
h is the weir height		
n is the # of side contractions		
Spillway velocity		
Restangular Channel Equation:		
$Q = 1/n \times AR^{2/3}S^{1/2}$		
normal depth	(m)	0.083
n (roughness coef.)		0.03
W (width)	(m)	10.000
A (area of flow)	(m^2)	0.833
p (wetted perimeter)	(m)	10.167
R (hydraulic radius)	(m)	0.082
S (slope)	(m/m)	0.025
Q (flow)	(m^3/s)	0.828
v (velocity)	(m/s)	0.99

Emergency Overflow		
Broad Crested Weir		
L	(m)	10.000
C_w		1.58
Invert	(m)	124.800
n		0
Max Water Level	(m)	124.940
Head of Water	(m)	0.140
$Q_{w\ (100\%\ Blockage)}$	(m^3/s)	0.828
Note: Sloping Sides of weir are not considered in weir capacity (underestimated capacity)		
Weir Equation:		
$Qw = C_w (L-0.1nh)h^{1.5}$		
Qw is the weir flow		
Cw is the weir coefficient		
L is the weir length		
h is the weir height		
n is the # of side contractions		
Spillway velocity		
Restangular Channel Equation:		
$Q = 1/n \times AR^{2/3}S^{1/2}$		
normal depth	(m)	0.081
n (roughness coef.)		0.03
W (width)	(m)	10.000
A (area of flow)	(m^2)	0.814
p (wetted perimeter)	(m)	10.163
R (hydraulic radius)	(m)	0.080
S (slope)	(m/m)	0.027
Q (flow)	(m^3/s)	0.828
v (velocity)	(m/s)	1.02

Calculation Sheet B-2: Flow Depth and Spread at Location with Highest Emergency Peak Flow on Street Q

Sub-catchment(s)		A028NE	Comment
Location		Street Q	10.5 m wide road
$Q_{combined}$ [2]		1.277	for 100-year event
Tr	(m)	5.250	10.5 m wide road
So	(m/m)	0.005	
W	(m)	0.000	
Sw	(m/m)	0.000	
T	(m)	7.585	
Sx	(m/m)	0.02	
n_{road}		0.013	
dc	(m)	0.15	
Se	(m/m)	0.035	
$n_{shoulder}$		0.025	
dw	(m)	0.000	
Ts	(m)	7.585	
ds	(m)	0.152	
d	(m)	0.152	
d_{crown}	(m)	**0.105**	
dd	(m)	**0.047**	dd > 0.15 m, the max. depth over road crown of an arterial road
de	(m)	**0.002**	
Te	**(m)**	**0.049**	Flow is contained within ROW
$Q_{area(A+B)}$	(m^3/s)	0.000	
$Q_{area(B)}$	(m^3/s)	0.000	
$Q_{area(A)}$	(m^3/s)	0.000	
$Q_{area(B+C+D)}$	(m^3/s)	0.667	
$Q_{area(D)}$	(m^3/s)	0.029	
$Q_{area(B+C)}$	(m^3/s)	0.638	
$Q_{area(E)}$	(m^3/s)	0.000	
$Q_{area(A+B+C+E)}$	(m^3/s)	0.638	
$Q_{two\ sides}$	**(m^3/s)**	**1.277**	
d_{Flow} [3]	(m)	0.152	d_{flow} < 0.30 m, the maximum allowable depth of flow
$A_{flow\ two\ sides}$	(m^2)	1.042	
v	(m/s)	1.226	
v×d	**(m^2/s)**	**0.186**	v×d < 0.65 m^2/s

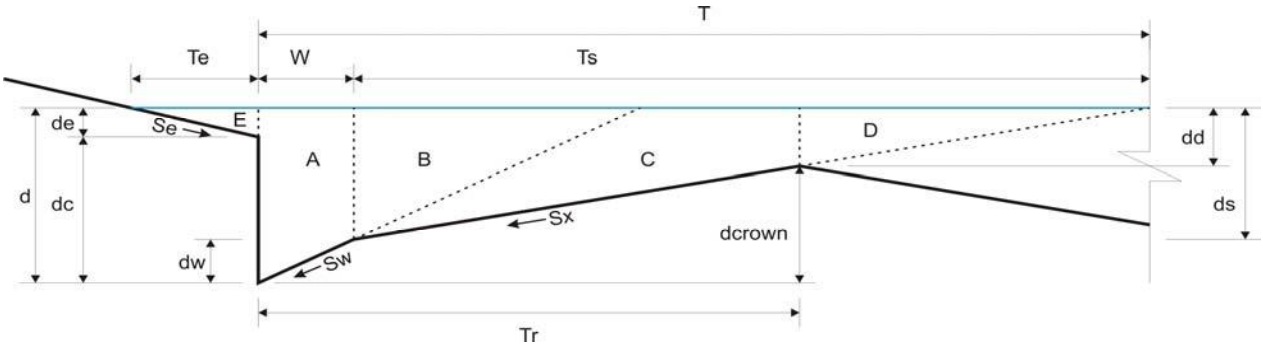
Notes:

[1] 100-year flow from PCSWMM model (Chicago storm).

[2] The computations assume that the total incoming flow is equally divided on both sides on the road.

[3] Computations based on methodology described in MTO Drainage Management Manual, 1997, Ch.4, pp. 59-60.

So is the longitudinal road slope



Equations:

$Q_{area(A+B)} = 0.375 \times So^{0.5} \times d^{2.667} / (n_{road} \times Sw)$

$Q_{area(B)} = 0.375 \times So^{0.5} \times (ds)^{2.667} / (n_{road} \times Sw)$

$Q_{area(B+C+D)} = 0.375 \times So^{0.5} \times (ds)^{2.667} / (n_{road} \times Sx)$

$Q_{area(D)} = 0.375 \times So^{0.5} \times (dd)^{2.667} / (n_{road} \times Sx)$

$Q_{area(E)} = 0.375 \times So^{0.5} \times (de)^{2.667} / (n_{shoulder} \times Se)$

CALCULATION SHEET B-3: REQUIRED CAPACITY OF EMERGENCY OVERLAND FLOW ROUTE

OVERLAND FLOW ROUTE FROM STREET Q TO SERVICING BLOCK 491 - CURB CUT WEIR

Approaching flow =	1.277	m^3/s	for Regional event (on MAJ road segment) Pond operating under 50% blockage of outlet controls
Curb cut width =	12	m	as per DSEL grading plan
Curb cut height =	0.050	m	as per DSEL
Maximum flow depth at gutter =	0.299	m	(0.15 m+0.035×4.25 m = 0.299 m for flow contained within RW)
Average head of water over curb cut =	0.249	m	0.05 m high curb cut
Curb cut weir coefficient =	1.84		
Maximum flow through cub cut =	2.739	m^3/s	for 100-yr event

Therefore the capacity of the curb cut (2.739 m^3/s) is higher than the computed overland flow (1.277 m^3/s)

OVERLAND FLOW ROUTE DOWNSTREAM OF CURB CUT

$Q = 1/n \times AR^{2/3}S^{1/2}$

	Min. Slope		Max. Slope
normal depth =	**0.332**	m	**0.173**
n =	0.03		0.03
Channel width =	3	m	3
Trapezoidal Side Slope (H:1V) =	3		3
A (area of flow) =	1.328	m^2	0.610
wetted perimeter =	5.102	m	4.096
R (hydraulic radius) =	0.260	m	0.149
S (slope) =	0.005	m/m	0.050
Q (flow) =	1.277	m^3/s	1.277
velocity =	0.96	m/s	2.09

Calculation Sheet B-4: Required Grate and Lead Pipe at Emergency Intake

MAJOR SYSTEM SEGMENT : ACREEK7B (STREET Q)

Max. Depth Above Crown = N/A m

Max. Allowable Depth Over DICB = 0.300 m

Type of Grates : DICB OPSD 403.01 / TOWN STD 3-1 (1.8 m Diameter)

$Q_{approach\ 100\%\ Blockage}$ = 1277 L/s

Scenario: No Blockage

Location	No. of DICBs	Maximum All.Head (m)	Maximum Capture (L/s)	Dia. Of Lead Pipe (m)	Head on Lead Pipe (m)	Capacity of Single Lead Pipe (L/s)	No. of Lead Pipes	Max Flow by Lead Pipe (L/s)	Capacity of All Lead Pipes (L/s)	
Block 491	1	0.300	3254	1500	1.350	7458	1	1277	7458	
			3254	> 1277					7458	> 1277

Scenario: 50% Blockage

Location	No. of DICBs	Maximum All.Head (m)	Maximum Capture (L/s)	Dia. Of Lead Pipe (m)	Head on Lead Pipe (m)	Capacity of Single Lead Pipe (L/s)	No. of Lead Pipes	Max Flow by Lead Pipe (L/s)	Capacity of All Lead Pipes (L/s)	
Block 491	1	0.300	1627	1500	1.350	7458	1	1277	7458	
			1627	> 1277					7458	> 1277

(1) Capacity of Horizontal Grate as per Table D-5.

CALCULATION SHEET B-5: FOREBAY SIZING FOR SWM FACILITY

Bronte Green Subdivision
SWM Pond
Town of Oakville
Calculation of Northeast Forebay Size

Settling Criteria

From the SWMP Manual, the required length for settling is as follows:

$$L_{min} = \left(\frac{r\,Q_p}{V_s}\right)^{0.5}$$

where:
- r = length to width ratio, at the invert of the inlet pipe.
- Q_p = peak outflow during design quality storm
- V_s = settling velocity

Input:

r =	2.86		(60 m / 21 m)
Q_p =	0.094	m^3/s	(at elevation 122 m)
V_s =	0.0003	m/s	

L_{min} = 29.99 m

The peak flow rate from the pond during the quality storm is taken as the flow that would occur just below the quantity controls (Refer to Table B-5 of Appendix B)

Dispersion Criteria

From the SWMP Manual, the required length for dispersion is as follows:

$$L_{min} = \frac{8\,Q}{d\,V_f}$$

where:
- Q = Inlet flowrate (10-Year, 24-Hour Chicago Storm)
- d = depth of pond during peak 10-year inflow (8h:00min)
- V_f = desired final velocity

Input:

Q =	3.431	m^3/s
d =	1.70	m
Vf =	0.5	m/s

L_{min} = 32.25 m

The minimum forebay length is determined by the larger of the settling or dispersion criteria.

Minimum Length of Forebay Required	32.25 m	
Length of Forebay Provided	**60.00 m**	(at elevation 121.2 m)

Average Forebay Velocity

From the SWMP Manual, the maximum allowable average velocity is 0.15 m/s:

$$V_{avg} = \frac{Q}{d\,W_{avg}}$$

where:
- Q = Inlet flowrate (10-Year, 24-Hour Chicago Storm)
- d = depth of pond during peak 10-year inflow (8h:00min)
- W_{avg} = average width of forebay

Input:

Q =	3.431	m^3/s	
d =	1.70	m	
W_{avg} =	14	m	(6 m bottom, 21 m permanent pool)

V = 0.15 m/s = 0.15 m/s

CALCULATION SHEET B-6: FOREBAY SIZING FOR SWM FACILITY

Bronte Green Subdivision
SWM Pond
Town of Oakville
Calculation of Northwest Forebay Size

Settling Criteria

From the SWMP Manual, the required length for settling is as follows:

$$L_{min} = \left(\frac{r\,Q_p}{V_s}\right)^{0.5}$$

where:
- r = length to width ratio, at the invert of the inlet pipe.
- Q_p = peak outflow during design quality storm
- V_s = settling velocity

Input:

r =	1.61		(37 m / 23 m)
Q_p =	0.094	m^3/s	(at elevation 122 m)
V_s =	0.0003	m/s	

L_{min} = 22.50 m

The peak flow rate from the pond during the quality storm is taken as the flow that would occur just below the quantity controls (Refer to Table B-5 of Appendix B)

Dispersion Criteria

From the SWMP Manual, the required length for dispersion is as follows:

$$L_{min} = \frac{8\,Q}{d\,V_f}$$

where:
- Q = Inlet flowrate (10-Year, 24-Hour Chicago Storm)
- d = depth of pond during peak 10-year inflow (8h:00min)
- V_f = desired final velocity

Input:

Q =	3.572	m^3/s
d =	1.70	m
Vf =	0.5	m/s

L_{min} = 33.58 m

The minimum forebay length is determined by the larger of the settling or dispersion criteria.

Minimum Length of Forebay Required	33.58 m	
Length of Forebay Provided	**37.00 m**	(at elevation 121.2 m)

Average Forebay Velocity

From the SWMP Manual, the maximum allowable average velocity is 0.15 m/s:

$$V_{avg} = \frac{Q}{d\,W_{avg}}$$

where:
- Q = Inlet flowrate (10-Year, 24-Hour Chicago Storm)
- d = depth of pond during peak 10-year inflow (8h:00min)
- W_{avg} = average width of forebay

Input:

Q =	3.572	m^3/s	
d =	1.70	m	
W_{avg} =	16	m	(9 m bottom, 23 m permanent pool)

V = 0.13 m/s < 0.15 m/s

CALCULATION SHEET B-7: FOREBAY SIZING FOR SWM FACILITY

Bronte Green Subdivision
SWM Pond
Town of Oakville
Calculation of South Forebay Size

Settling Criteria

From the SWMP Manual, the required length for settling is as follows:

$$L_{min} = \left(\frac{r\,Q_p}{V_s}\right)^{0.5}$$

where:
- r = length to width ratio, at the invert of the inlet pipe.
- Q_p = peak outflow during design quality storm
- V_s = settling velocity

Input:

r =	2.00		(42 m / 21 m)
Q_p =	0.094	m^3/s	(at elevation 122 m)
V_s =	0.0003	m/s	

L_{min} = 25.09 m

The peak flow rate from the pond during the quality storm is taken as the flow that would occur just below the quantity controls (Refer to Table B-5 of Appendix B)

Dispersion Criteria

From the SWMP Manual, the required length for dispersion is as follows:

$$L_{min} = \frac{8\,Q}{d\,V_f}$$

where:
- Q = Inlet flowrate (10-Year, 24-Hour Chicago Storm)
- d = depth of pond during peak 10-year inflow (8h:00min)
- V_f = desired final velocity

Input:

Q =	2.619	m^3/s
d =	1.70	m
Vf =	0.5	m/s

L_{min} = 24.62 m

The minimum forebay length is determined by the larger of the settling or dispersion criteria.

Minimum Length of Forebay Required	25.09 m	
Length of Forebay Provided	**42.00 m**	(at elevation 121.2 m)

Average Forebay Velocity

From the SWMP Manual, the maximum allowable average velocity is 0.15 m/s:

$$V_{avg} = \frac{Q}{d\,W_{avg}}$$

where:
- Q = Inlet flowrate (10-Year, 24-Hour Chicago Storm)
- d = depth of pond during peak 10-year inflow (8h:00min)
- W_{avg} = average width of forebay

Input:

Q =	2.619	m^3/s	
d =	1.70	m	
W_{avg} =	14	m	(6 m bottom, 21 m permanent pool)

V = 0.11 m/s < 0.15 m/s

APPENDIX C

DRAINAGE AREAS

Table C-1 : Drainage Area to SWM Facility

Segment ID [1]	Area (ha)	Imperviousness (%)	Area x Imp.
Drainage to Bronte Green Pond			
A001SE	0.275	74	20.35
A003DV1	0.224	79	17.70
A003DV2	0.177	68	12.04
A003NE	0.22	69	15.18
A003NW	0.054	52	2.81
A006SW	0.158	71	11.22
A007R1	0.15	50	7.50
A007R2	0.151	41	6.19
A007SE	0.154	77	11.86
A007SW	0.354	82	29.03
A008R1	0.112	48	5.38
A010DV1	0.798	100	79.80
A011NE	0.251	83	20.83
A012NE	0.376	80	30.08
A012R1	0.165	48	7.92
A012R2	0.13	48	6.24
A013NE	0.354	74	26.20
A014NE	0.168	69	11.59
A014R1	0.082	40	3.28
A014R2	0.155	32	4.96
A014SW	0.103	72	7.42
A016NE	0.235	67	15.75
A016R1	0.13	42	5.46
A017NE	0.135	53	7.16
A019NE	0.445	68	30.26
A019R1	0.116	44	5.10
A020NE	0.422	69	29.12
A021NE	0.395	80	31.60
A022NE	0.326	67	21.84
A025NE	0.3	65	19.50
A026R1	0.123	44	5.41
A026R2	0.143	48	6.86
A027NE	0.343	69	23.67
A027R1	0.146	40	5.84
A029NE	0.614	69	42.37
A029R1	0.298	36	10.73
A030NE	0.17	79	13.43
A032NW	0.212	59	12.51
A032R1	0.128	49	6.27
A032R2	0.076	47	3.57
A032R3	0.091	37	3.37
A032SC1	0.944	86	81.18
A032SW	0.426	79	33.65
A034R1	0.144	47	6.77
A034R2	0.159	46	7.31
A034SC1	0.912	86	78.43
A034SE	0.479	79	37.84
A035R1	0.154	50	7.70
A035R2	0.172	52	8.94
A036R1	0.164	50	8.20
A036R2	0.155	50	7.75
A036SE	0.328	79	25.91

Table C-1 : Drainage Area to SWM Facility

Segment ID [1]	Area (ha)	Imperviousness (%)	Area x Imp.
A037NE	0.13	74	9.62
A040NE	0.113	91	10.28
A040SE	0.217	78	16.93
A043NE	0.25	75	18.75
A043SE	0.214	95	20.33
A044NE	0.299	84	25.12
A045NE	0.259	83	21.50
A048NE	0.22	93	20.46
A048SE	0.246	75	18.45
A049NW	0.344	62	21.33
A049R1	0.118	51	6.02
A051SE	0.191	82	15.66
A052DV1	0.871	100	87.10
A052NE	0.297	74	21.98
A055NE	0.188	82	15.42
A055SW	0.07	70	4.90
A056NE	0.269	79	21.25
A058NW	0.136	73	9.93
A058PK1	2.129	29	61.74
A058R1	0.068	46	3.13
A058R2	0.055	48	2.64
A058R3	0.107	49	5.24
A059NE	0.407	75	30.53
A059PK1	0.302	29	8.76
A059R1	0.102	51	5.20
A059R2	0.082	72	5.90
A060NE	0.182	73	13.29
A060R1	0.169	47	7.94
A061R1	0.14	48	6.72
A061R2	0.135	48	6.48
A062NE	0.231	78	18.02
A062NW	0.042	57	2.39
A062R1	0.111	38	4.22
A062SE	0.193	81	15.63
A063SW	0.349	74	25.83
A067NE	0.717	76	54.49
A069R1	0.152	47	7.14
A069R2	0.161	48	7.73
A069R3	0.19	48	9.12
A072NE	0.238	80	19.04
A073NE	0.312	74	23.09
A075NW	0.369	74	27.31
A075R1	0.133	47	6.25
A075R2	0.168	48	8.06
A075SW	0.498	76	37.85
A077NE	0.169	78	13.18
A077R1	0.137	36	4.93
A077R2	0.116	50	5.80
A078NE	0.241	76	18.32
A079DV1	0.729	79	57.59
A079NE	0.25	66	16.50
A080NE	0.207	73	15.11
A082NW	0.234	77	18.02

Table C-1 : Drainage Area to SWM Facility

Segment ID [1]	Area (ha)	Imperviousness (%)	Area x Imp.
A082R1	0.054	48	2.59
A082R2	0.031	48	1.49
A083R1	0.065	11	0.72
A084NW	0.28	74	20.72
A084R1	0.177	41	7.26
A084R2	0.08	46	3.68
A085NE	0.408	72	29.38
A085R1	0.165	44	7.26
A087NE	0.407	79	32.15
A088NE	0.096	84	8.06
A090NE	0.214	63	13.48
A090NW	0.174	71	12.35
A090W	0.047	80	3.76
A091NE	0.086	68	5.85
A092R1	0.043	47	2.02
A092R2	0.111	48	5.33
A093NE	0.241	77	18.56
A093NW	0.237	76	18.01
A093R1	0.173	46	7.96
A093R2	0.175	35	6.13
A093R3	0.105	43	4.52
A094N1	0.239	68	16.25
A094NE	0.429	76	32.60
A094SE	0.359	81	29.08
A097NE	0.591	79	46.69
A105NE	0.079	79	6.24
A105SE	0.227	73	16.57
A106NE	0.191	57	10.89
A109DV1	0.15	79	11.85
A109DV2	0.097	79	7.66
A109DV3	0.127	79	10.03
A109DV4	0.083	79	6.56
A109NE	0.131	70	9.17
A109R1	0.051	80	4.08
A109R2	0.044	80	3.52
A109R3	0.095	80	7.60
A109R4	0.053	80	4.24
A109W1	0.024	79	1.90
A109W2	0.024	79	1.90
A109WK1	0.003	80	0.24
A109WK2	0.003	80	0.24
A109WK3	0.003	80	0.24
A111NE	0.283	75	21.23
A112NE	0.251	76	19.08
A113NE	0.068	66	4.49
A115NE	0.19	69	13.11
A115NW	0.074	66	4.88
A116NE	0.097	82	7.95
A116NW	0.119	57	6.78
A117NE	0.325	64	20.80
A119NE	0.257	73	18.76
A119R1	0.129	41	5.29
A120NW	0.248	71	17.61

Table C-1 : Drainage Area to SWM Facility

Segment ID [1]	Area (ha)	Imperviousness (%)	Area x Imp.
A120R1	0.126	49	6.17
A120R2	0.171	45	7.70
A5010WK1	0.017	63	1.07
ABGRD01	1.086	71	77.11
AOUTSR1	0.056	41	2.30
AOUTSR2	0.027	47	1.27
APOND1	1.964	52	102.13
APONDR1	0.259	48	12.43
APONDR2	0.26	46	11.96
APONDR3	0.184	43	7.91
APONDWK1	0.021	38	0.80
APONDWK2	0.017	50	0.85
Drainage to Oil and Grit Separators			
A200NE	0.15	77	11.55
A201DV1	1.148	86	98.73
A201NE	0.089	100	8.90
A203NE	0.245	80	19.60
A802NE	0.227	64	14.53
A805NE	0.228	62	14.14
A805NW	0.155	69	10.70
A805SE	0.026	100	2.60
A806NE	0.338	76	25.69
Drainage to Creek			
A500R1	0.12	23	2.76
A500R2	0.057	47	2.68
A5010HC1	0.264	29	7.66
A5010HC2	0.276	29	8.00
A5010R1	0.062	48	2.98
A5010WK1	0.017	63	1.07
A501R1	0.015	46	0.69
A501R2	0.018	7	0.13
A501R3	0.128	31	3.97
A502R1	0.068	49	3.33
A502R2	0.055	47	2.59
A502R3	0.039	49	1.91
A503R1	0.067	49	3.28
A504HC1	0.152	29	4.41
A505R1	0.065	46	2.99
A505R2	0.08	49	3.92
A505R3	0.041	48	1.97
A506R1	0.084	46	3.86
A507R1	0.048	39	1.87
A508R1	0.043	49	2.11
A508R2	0.051	49	2.50
A508R3	0.067	39	2.61
A509R1	0.055	39	2.15
A509R2	0.047	47	2.21
A509R3	0.043	48	2.06
ABGRD02	1.449	77	111.57
ACREEK10	0.11	21	2.31
ACREEK2	0.224	22	4.93
ACREEK3	0.17	24	4.08
ACREEK4	0.024	7	0.17

Table C-1 : Drainage Area to SWM Facility

Segment ID [1]	Area (ha)	Imperviousness (%)	Area x Imp.
ACREEK5A	0.176	20	3.52
ACREEK5B	0.341	20	6.82
ACREEK6A	0.603	26	15.68
ACREEK6B	0.035	7	0.25
ACREEK7A	0.111	30	3.33
ACREEK7B	0.042	25	1.05
ACREEK8	0.149	19	2.83
ACREEK9	0.351	23	8.07
ACREEKPK	0.106	7	0.74
ACREEKPK1	0.19	29	5.51
ACREEKR1	0.208	26	5.41
ACREEKR4	0.076	64	4.86
ANHS-1	0.163	10	1.63
ANHS-2	0.371	7	2.60
ANHS-3	0.481	7	3.37
ANHS-4	0.147	7	1.03
ANHS-5	0.211	7	1.48
AOUT00	0.152	11	1.67
AOUT01	0.221	29	6.41
AOUT-E1	0.168	21	3.53
AOUT-E2	0.375	31	11.63
AOUT-E3	0.211	7	1.48
AOUT-N1	0.08	70	5.60
AOUT-N2	0.154	15	2.31
AOUT-N3	0.044	25	1.10
AOUTNR1	0.038	38	1.44
AOUT-W1	0.039	79	3.08
ATURTLE	2.125	7	14.88
Total	**54.267**	**59**	**3214.23**

[1] Refer to Figure 2

Weighted Average Imperviousness = S(Area x Imp) / Total Area = 3214.228 / 54.267 = 59 %

Table C-2 : Summary of Total Drainage Area

Land Use [1]	Area (ha)	Imperviousness	Area x Imp.
Drainage to Bronte Green Pond	40.354	67	2689.752
Drainage to Oil and Grit Separators	2.606	79	206.425
Drainage to Creek	11.307	28	318.051
Total	54.267	59	3214.228

[1] Refer to Figure 2

Weighted Average Imperviousness = S(Area x Imp) / Total Area = 3214.228 / 54.267 = 59 %

APPENDIX D

POND MONITORING LOCATION PLAN, PROGRAM AND INSPECTION FORM

POND MONITORING LOCATION PLAN

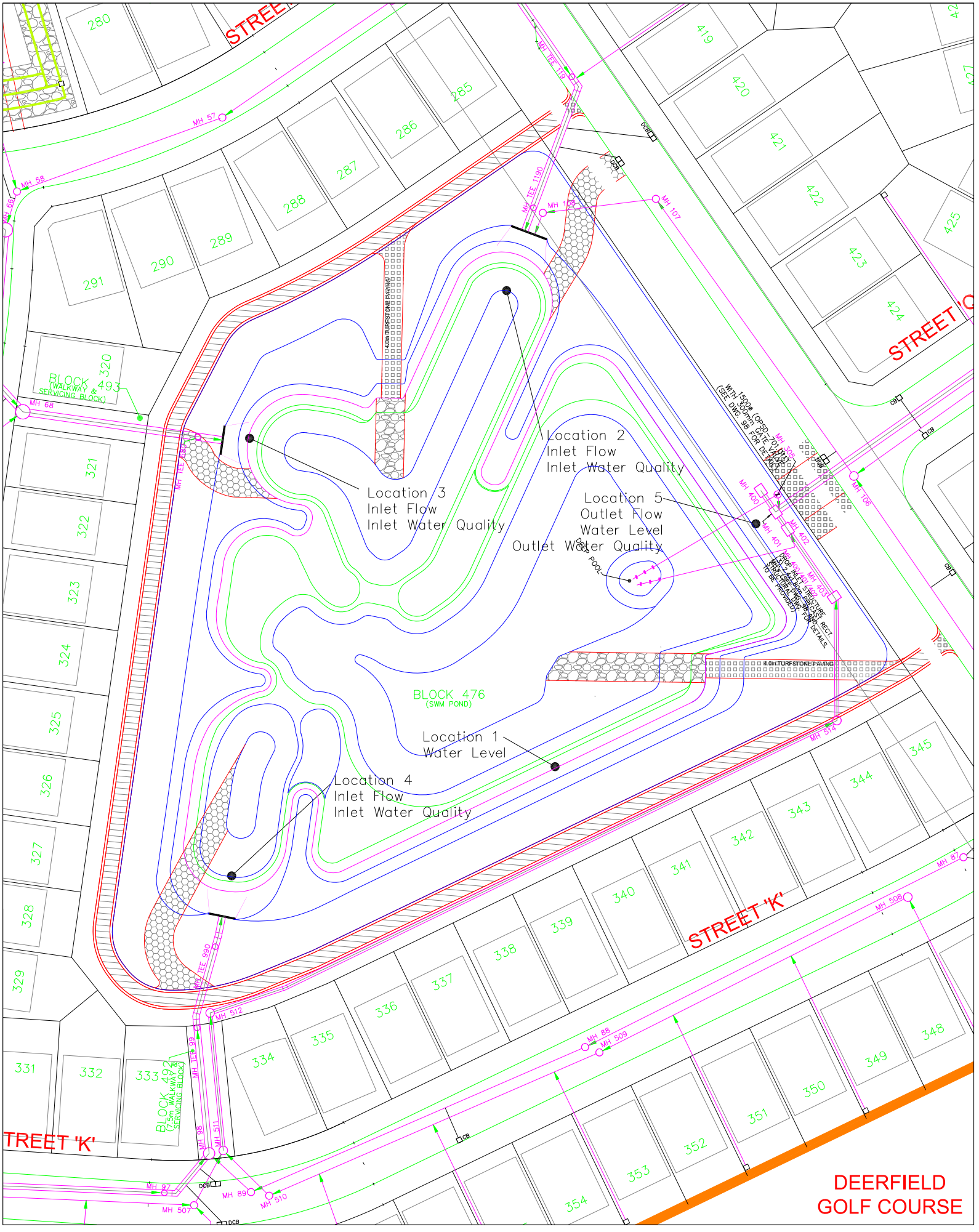


Table 1. NORTH OAKVILLE MONITORING PROGRAM FOR STORMWATER MANAGEMENT FACILITIES

MONITORING PARAMETERS	EXPECTED RESULT	METHOD/EQUIPMENT	LOCATION	FREQUENCY/DURATION	OTHER/COMMENTS
HYDRAULIC/PERFORMANCE MONITORING					
Water Level	1. Drawdown Time 2. Rough Estimate of Outflow Hydrograph	Water Level Meter – Datalogger w/ pressure transducer (vented)	Location 1	6-8 events per year; Construction to Assumption	
Flow 1.	Inlet Flow 2. Outlet Flow 3. Response to Storm Events	Flow Meter – Velocity Area Flowmeter; capable of submerged flow accuracy (ie. ISCO 2150)	Locations 2, 3, 4 and 5	6-8 events per year; Construction to Assumption	
Water Quality (TSS, TP) (Temperature)	1. Pollutant Removal Efficiency (% Removal) 2. Water Quality Discharge 3. Particle Size Distribution	Automatic Samplers during and after storm event; Multiparameter Water Quality Sensor	Locations 2, 3, 4 and 5 Location 5	6-8 samples collected an analyzed per year; Construction to Assumption	
FUNCTIONAL MONITORING					
Sediment Depth	1. Storage Volume 2. Estimate of Sediment Removal workplan	Disk/Rod Method or Town-Approved Alternative	Sediment Forebay – min. 2 perpendicular transects, min. 5 points per transect (see diagram) or as deemed necessary; Main Cell – TBD based on main cell configuration	Minimum requirement 1:3 years from Construction to Assumption; 1:2 years during **heavy construction** or as deemed appropriate by Town. Sediment Removal as needed	
INSPECTION MONITORING					
See Attached: Town of Oakville Stormwater Management Facility Inspection Form	Log book of routine inspections performed throughout the year	Observation	As needed	Following Rainfall Events; Minimum 4 inspections per year; Construction to Assumption	

*Notes:

1. The above program overview should be implemented in accordance with the North Oakville Guidelines for Operations, Maintenance and Monitoring Program for SWM
2. The Annual Monitoring Report is to be certified by a qualified profession(s) and prepared to the satisfaction of the Town of Oakville.
3. Design Conformance Certification should be prepared by a qualified professional follow the construction of the SWMF and subsequent years, as required by the Town of Oakville.
4. Inspection Monitoring should apply the Town of Oakville's Stormwater Management Facility Inspection Form as appropriate for the SWMF site specific design.
5. Storm events should target a minimum 10mm of precipitation or greater.
6. Monitoring equipment and techniques for sampling/measurement shall be approved by the Town of Oakville.
7. Location of Monitoring Stations should be in accordance with the attached Pond Monitoring Location Plan

Stormwater Management Facility Inspection Form

1. General Details

Inspected by:_____

Facility Number:_____ Date of Inspection:_____

Facility Name:_____ Rainfall 24 hours prior: ____mm

Intersection:_____ Rainfall 72 hours prior: ____mm

Discharges to:_____

Watershed:_____

Facility Type: circle

wet pond wetland hybrid dry pond

off-line

Upstream or source controls? Yes No Describe: _____

2. Observations:

					NOTES
Staff Gauge Reading: ____cm					_____
Water temperature at outall: _____^{o}C					_____
Water Colour:	Clear	Green	Brown	Other_____	
Foul Odour	None	Minor	Moderate	High	_____
Floating Material	None	Minor	Moderate	High	_____
algae	None	Minor	Moderate	High	_____
debris	None	Minor	Moderate	High	_____
oil/sheen	None	Minor	Moderate	High	_____
floatables	None	Minor	Moderate	High	_____

Sediment depth: _____cm Date of Last Sediment Survey _____

Is sediment visible below or above water surface? yes no _____

NOTES:_____

3. Inspection of Structural Components

INLET					NOTES
Blockage/Debris	None	Minor	Moderate	High	_____
Sediment Accumulation	None	Minor	Moderate	High	_____
Cracking/damage concrete	None	Minor	Moderate	High	_____
Damage to other components	None	Minor	Moderate	High	_____
Seepage	None	Minor	Moderate	High	_____
Grate secure	yes	no			_____
OUTLET SWALE					
Blockage	None	Minor	Moderate	High	_____
Erosion	None	Minor	Moderate	High	_____
Clarity of flow out of pond	clear	clear-brown	brown		_____
Depth sediment in receiver	_____	cm			_____

NOTES:_____

_____

Severity Ranking:
None-No issue
Minor-Requires monitoring
Moderate-Requires routine maintenance
High-Requires immediate Maintenance

3. Inspection of Structural Components (continued)

OUTLET					NOTES
Blockage/Debris	None	Minor	Moderate	High	_____
Sediment Accumulation	None	Minor	Moderate	High	_____
Cracking/damage concrete	None	Minor	Moderate	High	_____
Seepage/dampness	None	Minor	Moderate	High	_____
Damage to other components	None	Minor	Moderate	High	_____
Grate secure	yes	no			_____
Cap locked	yes	no			_____
outer holes clogged	None	Minor	Moderate	High	_____
inner holes clogged	None	Minor	Moderate	High	_____
outer pipe rusted	None	Minor	Moderate	High	_____
structural damage	None	Minor	Moderate	High	_____
valves function (open/close)	yes	no			_____
armourstone	None	Minor	Moderate	High	_____
EMERGENCY OVERFLOW					
Erosion	None	Minor	Moderate	High	_____
Short Circuiting	None	Minor	Moderate	High	_____
Evidence of overtopping	yes	no			_____

NOTES:_____
_____

4. Inspection of Vegetation

					NOTES
Aquatic	None	Sparse	Moderate	Abundant	_____
Shoreline	None	Sparse	Moderate	Abundant	_____
Trees/Shrubs	None	Sparse	Moderate	Abundant	_____
Noxious Weeds	None	Sparse	Moderate	Abundant	_____

Re-seeding/Replanting Requirements:_____
NOTES:_____

5. Overall Conditions

					NOTES
Overall Erosion of Area	None	Minor	Moderate	High	_____
Access Roads	None	Minor	Moderate	High	_____
Fences	None	Minor	Moderate	High	_____
Gates	None	Minor	Moderate	High	_____
Locks	None	Minor	Moderate	High	_____
Signage	None	Minor	Moderate	High	_____
Evidence of Encroachments	None	Minor	Moderate	High	_____
Evidence of Beaver Activity	None	Minor	Moderate	High	_____
Evidence of Waterfowl Activity	None	Minor	Moderate	High	_____
Evidence of Fish	None	Minor	Moderate	High	_____

OTHER COMMENTS:_____
_____
_____

Severity Ranking:
None-No issue
Minor-Requires monitoring
Moderate-Requires routine maintenance
High-Requires immediate Maintenance

APPENDIX E

"BRONTE GREEN DEVELOPMENT / FLOOD PROTECTION AND SURFACE WATER BALANCE" MEMO (APRIL 2018, JFSA)

J.F. Sabourin and Associates Inc.
WATER RESOURCES AND ENVIRONMENTAL CONSULTANTS

52 Springbrook Drive
Ottawa (Stittsville), ON K2S 1B9
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FAX: (613) 836-0332
WEB: www.jfsa.com

April 3rd, 2018

David Schaeffer Engineering Limited
600 Alden Road, Suite 500
Markham, Ontario L3R 0E7

Attention: **Mr. David Schaeffer, P.Eng.**

Subject: **Bronte Green Development / Flood Protection and Surface Water Balance**

our file: 1051-12

An updated PCSWMM model of the Fourteen Mile Creek watershed under existing conditions was provided by AMEC on July 5, 2016. A subcatchment boundary plan provided by AMEC of the existing conditions Fourteen Mile Creek model is presented in Attachment A Drawing 1, marked with the locations of the proposed Bronte Green development, as well as the adjacent Enns land to the east and Deerfield lands to the south.

In support of the proposed Bronte Green development and in accordance with discussions had with representatives of the Town, Conservation Halton and the Region, the model was modified in the January 25, 2017 *Bronte Green Development / Flood Protection* memo to determine the quantity control measures necessary on-site to ensure that downstream flows at key locations do not exceed existing levels. Key locations are shown on Figure A3 of Attachment A. As part of the study, the cumulative impact of two potential adjacent developments, on the Enns land and Deerfield lands, was also considered. The following scenarios were modelled in the January 2017 study:

(i) Existing conditions, as per the AMEC June 2016 model, modified to best represent site-specific pre-development conditions on the Bronte Green, Enns land and Deerfield lands;

(ii) Proposed conditions for the Bronte Green development only, without Stormwater Management (SWM) controls;

(iii) Proposed conditions for the Bronte Green, Enns land and Deerfield developments, without SWM controls;

(iv) Proposed conditions for the Bronte Green development only, with SWM controls;

(v) Proposed conditions for the Bronte Green, Enns land and Deerfield developments, with SWM controls.

The Bronte Green subdivision, Low Impact Development (LID) measures and Stormwater Management (SWM) facility have subsequently proceeded to detailed design, as per the March 2018 *Stormwater Management Report for the Bronte Green Subdivision* and the March 2018 *Design Brief for the Stormwater Management Pond for the Bronte Green Subdivision*. To confirm that the detailed design of the subdivision and pond are in conformance with the requirements presented in the January 2017 *Flood Protection* memo, Scenario (v) has been re-visited to demonstrate that downstream flows at key locations do not exceed existing levels under full proposed conditions build-out with the proposed SWM controls in place.

Pre- and post-development conditions drainage plans for the area of interest are presented in Figures A-1 and A-2, respectively, of Attachment A.

EXISTING / PRE-DEVELOPMENT CONDITIONS MODEL

In coordination with reviewers at the Town of Oakville, Conservation Halton, and the Region, the existing conditions PCSWMM model was modified to best represent site-specific pre-development conditions on the Bronte Green, Enns land, and Deerfield lands. Refer to the January 2017 *Flood Protection* memo for further details.

Refer to Figure A-1 of Attachment A for discretized pre-development subcatchment boundaries, key locations near the subject site, and a schematic showing the modelled discharge point of each subcatchment to the watercourse. The Figure also shows topographic data used to determine subcatchment boundaries and the geometry of the tributaries. In addition to the five key locations marked in yellow on Figure A-1; pre- and post-development flows were also compared at the following key locations downstream of Queen Elizabeth Way: (i) the confluence with a major storm outfall downstream of Queen Elizabeth Way; (ii) Speers Road; (iii) Rebecca Street; (iv) and Lakeshore Road.

The drainage area characteristics for the discretized subcatchments under pre-development conditions are summarized in Table B-1 of Attachment B. The existing conditions PCSWMM model was executed for the 2- to 100-year 24-hour Chicago design storms based on Town of Oakville IDF curves, the 48-hour Regional event (Hurricane Hazel), and 44 years of hourly rainfall data from the Toronto Pearson Airport (1960-2003; excluding 1970 due to instabilities). For the continuous simulation of hourly rainfall data, evaporation was set as 70% of the monthly pan-evaporation values provided by AMEC in June 2016 (refer to Attachment B). The 43 years (excluding 1970) of continuous simulation results were then used to generate 2- to 100-year frequency flows at key nodes based on the average of the following consolidated frequency analysis (CFA) methods; Generalised Extreme Value Distribution, Log Pearson Type III Distribution and 3 Parameter Lognormal Distribution.

A summary of peak flows and water levels simulated in PCSWMM for existing conditions (with pre-development conditions on-site) at key locations is presented in Attachment D. Note that these results are unchanged from the January 2017 *Flood Protection* study. Note that the water levels presented in Attachment D are for comparison purposes only and do not constitute actual flood levels, as the PCSWMM model does not include road crossings in order to avoid accounting in the estimate of peak flows for storage created artificially and potentially impermanently by manmade infrastructure.

POST-DEVELOPMENT CONDITIONS

As noted above, post-development conditions, with the detailed design of the Bronte Green property modelled per the March 2018 *SWM Report* and *Design Brief*, were analyzed for Scenario (v) with proposed SWM controls and all three of the Bronte Green, Deerfield and Enns land properties developed. Technical assumptions regarding development of the Enns land and Deerfield lands properties were provided by the Town. Refer to Figure A-2 of Attachment A for discretized post-development subcatchment boundaries (less the detailed subcatchments on the Bronte Green subdivision) and a schematic showing the modelled discharge point of each subcatchment to the watercourse. The boundaries of subcatchments adjacent to the Bronte Green subdivision were adjusted to match the detailed design boundary of the proposed development. The drainage area characteristics for the discretized subcatchments under post-development conditions are summarized in Table B-2 of Attachment B (less the detailed subcatchments on the Bronte Green Property). Please refer to the March 2018 *SWM Report* and *Design Brief* for the detailed design subdivision layout and subcatchments for the Bronte Green subdivision. Refer to the January 2017 *Flood Protection* memo for further details of proposed conditions modelling for the Enns and Deerfield lands.

Outflows from the Bronte Green subdivision to Fourteen Mile Creek were simulated in the detailed design PCSWMM model submitted with the March 2018 *SWM Report* and *Design Brief*, then input to the post-development model of the Fourteen Mile Creek watershed as hydrographs at nodes E238, E301, E344, E394, E505, E615, E618, E643, and E690 on Tributaries 14W-W1, 14W-W1-2 and 14W-W1-3, and nodes J684.977, J6301.693, J6358.901, J6435.935, J7132.593 and J7232.906 on the main branch.

STORMWATER MANAGEMENT FACILITIES

In order to provide quality and erosion protection, and to safely convey flows from the developments to Fourteen Mile Creek, four multi-function SWM facilities are intended to provide quality, erosion and quantity control to the Bronte Green property (south of the tributary), the Enns land property, the portion of the Deerfield property draining directly to the main branch of the creek, and the portion of the Deerfield property draining to the secondary culvert under Queen Elizabeth Way. Post- to pre-development quantity control is also required in the Enns land pond to respect the capacity of existing infrastructure on downstream Bronte Road, and in the second Deerfield pond to respect the capacity of the existing secondary culvert under Queen Elizabeth Way and the downstream ditch and pipe / road network to the main branch of Fourteen Mile Creek.

Note that no SWM facility is proposed for the northern enclave of the Bronte Green development, north of the tributaries, as: (i) the flows are small enough to be safely conveyed to the receiving watercourse without attenuation, and the uncontrolled post-development simulations in the January 2017 *Flood Protection* memo have shown that quantity control is not needed within the context of the larger watershed; (ii) quality control will be provided by an oil-and-grit separator and low impact development (LID) measures; and (iii) the erosion analysis documented in the January 2017 *Bronte Green Development / Quality and Erosion Protection* memo demonstrates that erosion controls are not needed for this portion of the site. A turtle pond adjacent to the northern enclave is proposed for ecological reasons, and provides some incidental benefit to flood control. However, for the purposes of the current study, post-development flows in Fourteen Mile Creek have been assessed under a more critical scenario wherein the potential SWM benefits of the wildlife pond are not relied upon, and thus the wildlife pond is not included in the current model.

The January 2017 *Bronte Green Development / Quality and Erosion Protection* memo documents the measures necessary to provide enhanced quality protection (80% TSS removal) and erosion protection in each of the four SWM facilities. Quality and thermal mitigation measures necessary to meet Red Side Dace guidelines are documented separately by DSEL.

The proposed Bronte Green SWM facility and LID measures are included in the detailed design PCSWMM model submitted with the March 2018 *SWM Report* and *Design Brief*, and their flood protection benefits reflected in the hydrographs extracted from the detailed PCSWMM model for input to the post-development Fourteen Mile Creek model. Refer to Attachment C for the proposed stage-storage-discharge curve of the facility. Further details are available in the March 2018 *SWM Report* and *Design Brief*, and the March 2018 *Bronte Green Development / LID Infiltration* memo.

The remaining three proposed SWM facilities for the Enns and Deerfield lands were incorporated into the post-development PCSWMM model of Fourteen Mile Creek, including the quality and erosion control measures as proposed in the January 2017 *Bronte Green Development / Quality and Erosion Protection* memo. Detailed stage-storage curves for the Enns land and two Deerfield lands ponds were estimated as proportionate to the curve provided for the Bronte Green SWM Facility in the January 2017 analysis, and outlet controls were selected to confirm that the proposed quantity control measures are practically feasible. Refer to Attachment C for the proposed stage-storage-discharge curves of the facilities. Refer to the January 2017 *Flood Protection* memo for further details of proposed SWM facilities for the Enns and Deerfield lands.

Depression storage for pervious areas at Enns land (undeveloped portion) was set to 10 mm in one scenario of

the January 2018 *Flood Protection* analysis, to simulate the benefits of a LID measures. However, for the purposes of the current study, post-development flows in Fourteen Mile Creek have been assessed under a more critical scenario wherein the LID at Enns land has not been implemented (Initial abstraction set to 5 mm).

FLOOD PROTECTION ANALYSIS RESULTS

The Bronte Green detailed design model and the post-development conditions PCSWMM model of Fourteen Mile Creek were executed, with proposed SWM controls in place, for the 2- to 100-year 24-hour Chicago and Regional events, and for 43 years of hourly rainfall data from the Toronto Pearson Airport for the generation of 2- to 100-year CFA frequency flows.

A summary of peak flows and water levels simulated in PCSWMM for post-development conditions at key locations are presented in Attachment D, with SWM controls in place, for comparison to existing conditions. As may be seen in Attachment D, the controlled post-development 2- to 100-year (single design event and frequency) and Regional flows are equal to or less than the existing conditions flows at all key locations, with the exception of the 2-year design flow at node E153 on Tributary 14W-W1, which is 63 L/s (2.6%) higher. Note that increases in the frequency flows identified in the January 2017 *Flood Protection* analysis at a few key locations along the main branch have been eliminated in the present analysis. The January 2017 post-development peak flows and water levels are also included in Attachment D for comparison purposes.

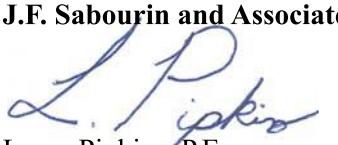
SURFACE WATER BALANCE

In support of the proposed Bronte Green development and in accordance with discussions had with representatives of the Town, Conservation Halton and the Region, previous analyses also included a comparison of pre- and post-development annual and monthly surface water volumes at key locations on Fourteen Mile Creek, per the January 25, 2017 *Bronte Green Development / Surface Water Balance* memo and the January 29, 2018 *Bronte Green Development / 14W-W1 Tributary Surface Water Budget* memo.

The average annual and monthly surface water peak flows and volumes are compared in Attachment E for the current study at the key locations marked in green in Figures A-1 and A-2 of Attachment A; at the downstream side of Bronte Road in Tributary 14W-W1-3, at the confluence of Tributaries 14W-W1-2 and 14W-W1-3, at the outlet of Tributary 14W-W1 to the main branch of Fourteen Mile Creek, and at the Queen Elizabeth Way crossing for the main branch of Fourteen Mile Creek.

As shown in Attachment E, the proposed conditions average annual and monthly surface water volumes are consistently equal to or higher than existing conditions volumes for all locations.

Yours truly,
J.F. Sabourin and Associates Inc.



Laura Pipkins, P.Eng.

cc: J.F. Sabourin, M.Eng, P.Eng.
Director of Water Resources Projects

Attachment A: Subcatchment Boundary (AMEC, January 2012)
Pre- and Post- Development Subcatchment Boundaries and Schematics
Key Locations on 14 Mile Creek

Attachment B: Pre- and Post- Development Subcatchment Characteristics
Monthly Evaporation Data (AMEC, June 2016)

Attachment C: SWM Facility Characteristics

Attachment D: Water Levels and Flows at Key Locations on Fourteen Mile Creek

Attachment E: Annual and Monthly Peak Flows and Runoff Volumes at Key Locations on Fourteen Mile Creek

ATTACHMENT

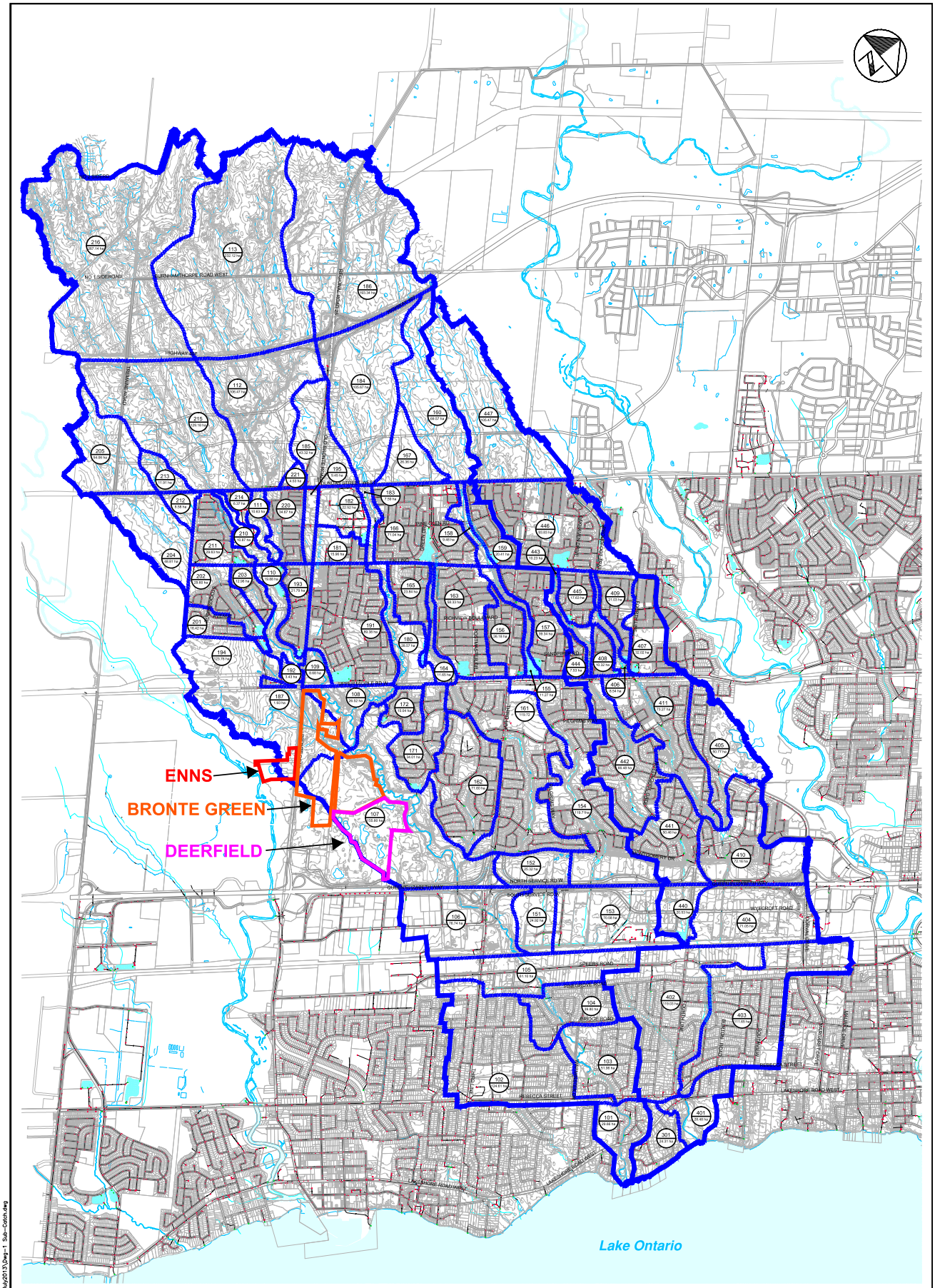
A

Subcatchment Boundary (AMEC, July 2016)

Pre- and Post-Development Subcatchment Boundaries and Schematic

Key Locations on 14 Mile Creek

JFSA Water Resources and Environmental Consultants


ENNS
BRONTE GREEN
DEERFIELD
Lake Ontario
LEGEND
WATERSHED BOUNDARY
SUBCATCHMENT BOUNDARY
SUBCATCHMENT NUMBER
SUBCATCHMENT AREA
SCALE VALID ONLY FOR 24"x36" VERSION
FOURTEEN MILE CREEK
McCRANEY CREEK SYSTEM FLOOD
MITIGATION OPPORTUNITIES STUDY
TOWN OF OAKVILLE
SUBCATCHMENT
BOUNDARY PLAN
amec
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Drawing No.
1
Jul 17/13 – richard.bartolo
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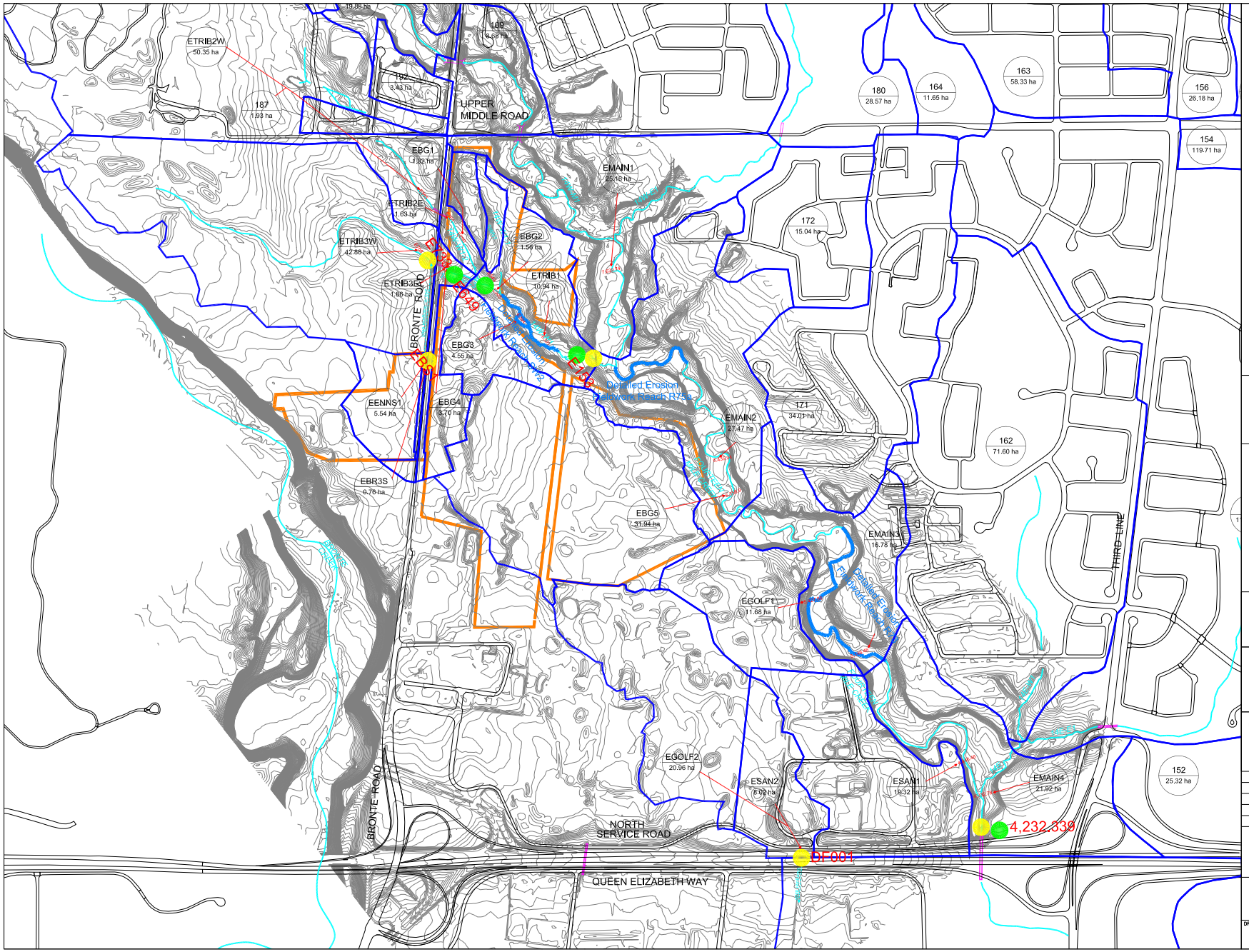

LEGEND :

- LIMITS OF PROPOSED SUBDIVISION
- SUBCATCHMENT BOUNDARIES
- SUBCATCHMENT ID / SUBCATCHMENT AREA (HA)
- CENTRELINE OF CREEK / CHANNEL ROUTING
- DITCH ROUTING
- SUBCATCHMENT OUTLET
- KEY NODES (FLOODING ANALYSIS)
- KEY NODES (WATER BUDGET ANALYSIS)
- E783 NODE ID
- DETAILED EROSION FIELDWORK REACHES

SCALE :

0 100 200 300 400 500 600m

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WATER RESOURCES AND ENVIRONMENTAL CONSULTANTS
OTTAWA (613) 836-3884
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CLIENT :

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600 ALDEN ROAD., SUITE 500
MARKHAM, ONTARIO., L3R 0E7
(905) 475-3080

PROJECT :

BRONTE GREEN DEVELOPMENT

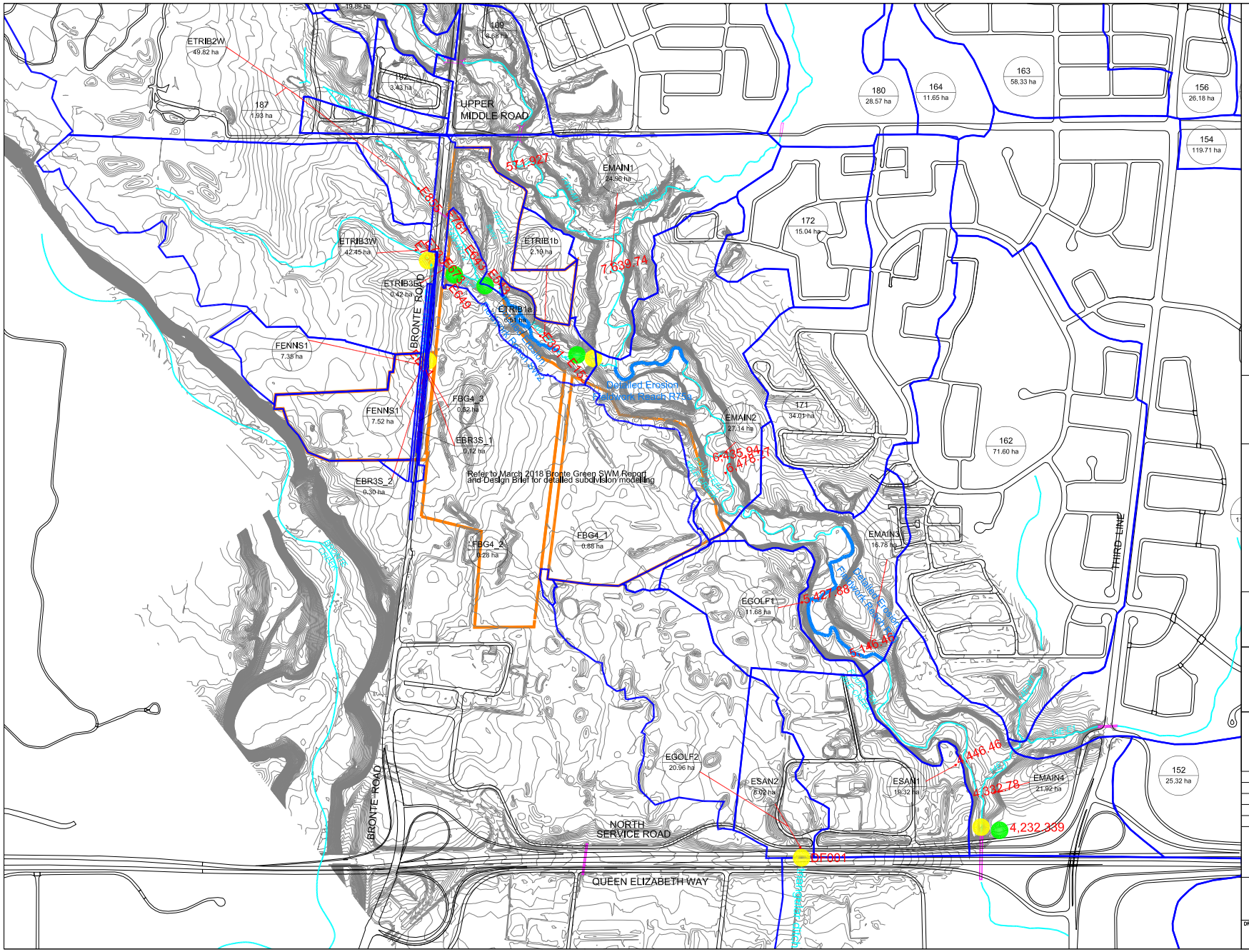
BY	DATE	DESCRIPTION	BY

PRE-DEVELOPMENT CONDITIONS SUBCATCHMENT BOUNDARIES AND SCHEMATIC

FIGURE A-1

DESIGNED:	
DRAWN:	LP
VERIFIED:	JFS
APPROVED:	JFS
DATE	PROJECT No.
Apr/18	1051-12

DRAWING REF.
1051-12\201803 Subm2b\Design\CAD\14 Mile Creek Figures.dwg



LEGEND :

- LIMITS OF PROPOSED SUBDIVISION
- SUBCATCHMENT BOUNDARIES
- SUBCATCHMENT ID / SUBCATCHMENT AREA (HA)
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- KEY NODES (FLOODING ANALYSIS)
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- E783 NODE ID
- DETAILED EROSION FIELDWORK REACHES

SCALE :

0 100 200 300 400 500 600m

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PROJECT :

BRONTE GREEN DEVELOPMENT

BY	DATE	DESCRIPTION	BY

POST-DEVELOPMENT CONDITIONS
SUBCATCHMENT BOUNDARIES
AND SCHEMATIC

FIGURE A-2

DESIGNED:	
DRAWN:	LP
VERIFIED:	JFS
APPROVED:	JFS
DATE	PROJECT No.
Apr/18	1051-12

DRAWING REF.
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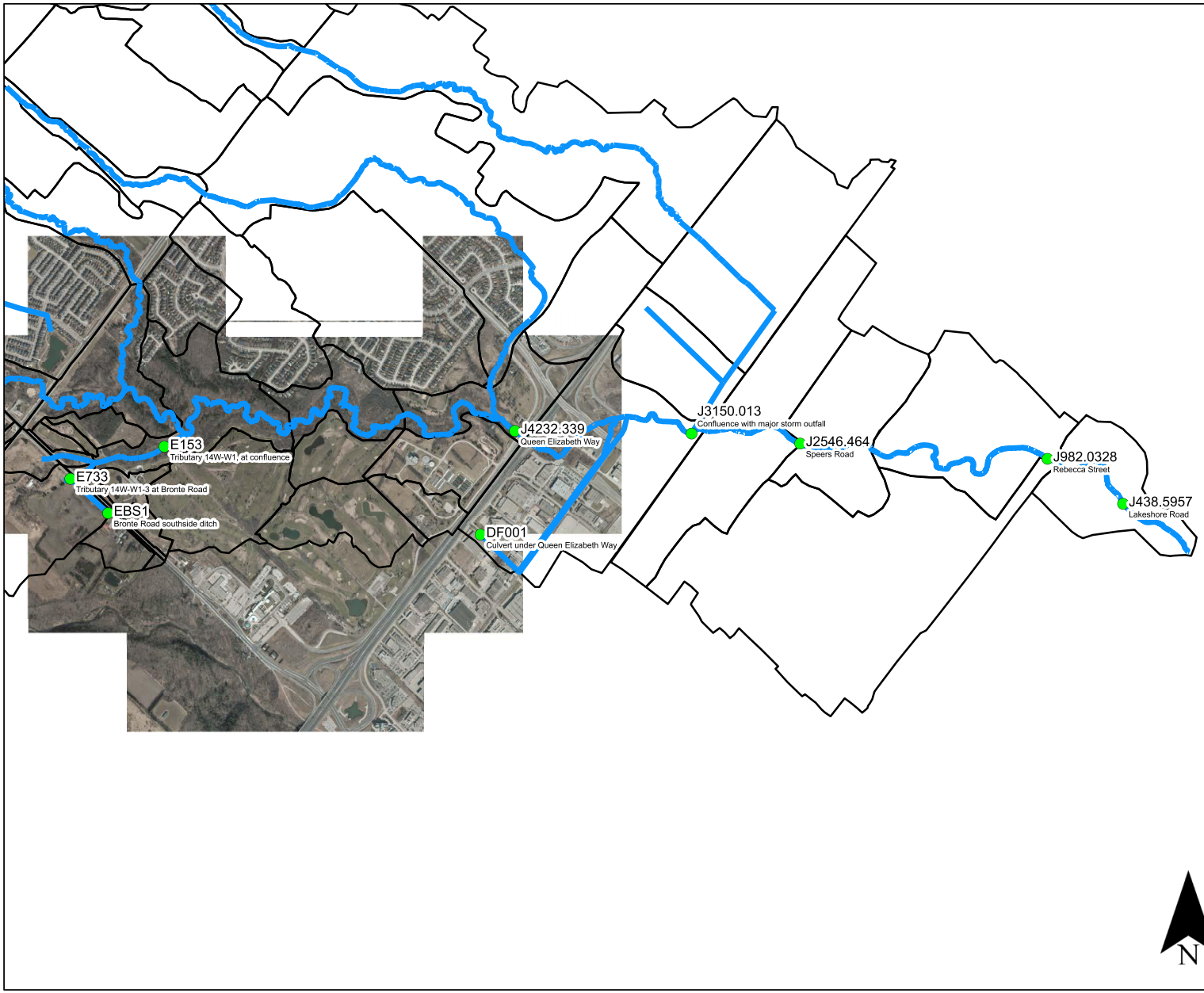

Legend

- Key Locations
- Water Course
- Subcatchments

NOTES:

Base Mapping from Google Earth (2014)

J.F. Sabourin and Associates Inc.

WATER RESOURCES
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CLIENT:

SCALE:

0 250 500 750 1,000 m

1051 - Bronte Green

TITLE:

Key Locations on 14 Mile Creek

FIGURE A3

PROJECT No.	1051-12
DRAWN:	JB
DATE:	Apr/18

ATTACHMENT

B

Pre- and Post-Development Subcatchment Characteristics

Monthly Evaporation Data (AMEC, June 2016)

JFSA Water Resources and Environmental Consultants

Table B-1: Existing Conditions Subcatchment Characteristics

Area ID	Outlet	Area (ha)	Width (m)	Slope (%)	Imperv (%)	N-Imperv	N-Perv	Dstore-Imp (mm)	Dstore-Per (mm)	Zero-Imp (%)	Subarea Routing	Percent Routed	Suction Head (mm)	Conductivity (mm/hr)	Initial Deficit
EBG1	E690	1.92	128	1.0	2	0.013	0.25	2.5	8.5	25	Outlet	100	56.04	1.18	0.19
EBG2	E505	1.56	104	1.0	2	0.013	0.25	2.5	8.5	25	Outlet	100	120.12	1.00	0.21
EBG3	E394	4.55	303	1.0	2	0.013	0.25	2.5	8.5	25	Outlet	100	108.74	1.03	0.20
EBG4	E673	3.70	247	1.0	2	0.013	0.25	2.5	8.5	25	Outlet	100	286.36	0.52	0.25
EBG5	J6358.901	31.94	2129	1.0	2	0.013	0.25	2.5	8.5	25	Outlet	100	97.63	1.06	0.20
EBR3S	EBS1	0.76	51	1.0	49	0.013	0.25	2.5	5.0	25	Outlet	100	50	1.2	0.2
EENNS1	EBS1	5.54	369	0.9	12	0.013	0.25	2.5	5.0	25	Outlet	100	50	1.2	0.2
EGOLF1	J5427.875	11.68	779	1.0	2	0.013	0.25	2.5	8.5	25	Outlet	100	50	1.2	0.2
EGOLF2	DF001	20.96	1397	1.0	2	0.013	0.25	2.5	8.5	25	Outlet	100	50	1.2	0.2
EMAIN1	J7639.745	25.16	1677	1.5	8	0.013	0.25	2.5	10.0	25	Outlet	100	50	1.2	0.2
EMAIN2	J6435.935	27.47	1831	2.3	8	0.013	0.25	2.5	10.0	25	Outlet	100	50	1.2	0.2
EMAIN3	J5146.464	16.78	1118	0.5	12	0.013	0.25	2.5	10.0	25	Outlet	100	50	1.2	0.2
EMAIN4	J4332.776	21.92	1461	0.7	21	0.013	0.25	2.5	10.0	25	Outlet	100	50	1.2	0.2
ESAN1	J4446.464	19.32	1288	1.1	29	0.013	0.25	2.5	5.0	25	Outlet	100	50	1.2	0.2
ESAN2	DF001	8.02	534	0.9	37	0.013	0.25	2.5	5.0	25	Outlet	100	50	1.2	0.2
ETRIB1a	E301	5.78	385	3.0	10	0.013	0.25	2.5	10.0	25	Outlet	100	50	1.2	0.2
ETRIB1b	E301	5.16	345	3.0	2	0.013	0.25	0	10.0	100	Outlet	100	50	1.2	0.2
ETRIB2E	E604	1.63	109	1.1	28	0.013	0.25	2.5	10.0	25	Outlet	100	50	1.2	0.2
ETRIB2W	E855	50.35	3357	1.2	9	0.013	0.25	2.5	10.0	25	Outlet	100	50	1.2	0.2
ETRIB3E	E673	1.86	190	1.3	62	0.013	0.25	2.5	10.0	25	Outlet	100	50	1.2	0.2
ETRIB3W	E768	42.88	2859	1.1	2	0.013	0.25	2.5	10.0	25	Outlet	100	50	1.2	0.2

Table B-2: Proposed (Full Development) Conditions Subcatchment Characteristics [1]

Area ID	Outlet	Area (ha)	Width (m)	Slope (%)	Imperv (%)	N-Imperv	N-Perv	Dstore-Imp (mm)	Dstore-Per (mm)	Zero-Imp (%)	Subarea Routing	Percent Routed	Suction Head (mm)	Conductivity (mm/hr)	Initial Deficit
FBG4_1	J6478.273	0.88	59	2.0	63	0.013	0.25	2.5	5.0	25	Outlet	100	135.81	0.95	0.21
FBG4_2	J6478.273	0.28	19	2.0	63	0.013	0.25	2.5	5.0	25	Outlet	100	135.81	0.95	0.21
FBG4_3	EBS1	0.52	34	2.0	79	0.013	0.25	2.5	5.0	25	Outlet	100	135.81	0.95	0.21
FENNS1	SFENNS1	7.52	501	2.0	86	0.013	0.25	2.5	5.0	25	Outlet	100	50	1.2	0.2
FENNS2	SFENNS1	7.35	490	2.0	2	0.013	0.25	2.5	5.0 /10.0	25	Outlet	100	50	1.2	0.2
FGOLF1	SFGOLF1	11.68	779	2.0	88	0.013	0.25	2.5	5.0	25	Outlet	100	50	1.2	0.2
FGOLF2	SFGOLF2	20.96	1397	2.0	81	0.013	0.25	2.5	5.0	25	Outlet	100	50	1.2	0.2
EBR3S_1	EBS1	0.12	8	1.0	79	0.013	0.25	2.5	5.0	25	Outlet	100	50	1.2	0.2
EBR3S_2	EBS1	0.30	33	1.0	2	0.013	0.25	2.5	5.0	25	Outlet	100	50	1.2	0.2
EMAIN1	J7639.745	24.96	1664	1.5	8	0.013	0.25	2.5	10.0	25	Outlet	100	50	1.2	0.2
EMAIN2	J6435.935	27.14	1809	2.3	8	0.013	0.25	2.5	10.0	25	Outlet	100	50	1.2	0.2
EMAIN3	J5146.464	16.78	1119	0.5	12	0.013	0.25	2.5	10.0	25	Outlet	100	50	1.2	0.2
EMAIN4	J4332.776	21.92	1461	0.7	21	0.013	0.25	2.5	10.0	25	Outlet	100	50	1.2	0.2
ESAN1	J4446.464	19.32	1288	1.1	29	0.013	0.25	2.5	5.0	25	Outlet	100	50	1.2	0.2
ESAN2	DF001	8.02	534	0.9	37	0.013	0.25	2.5	5.0	25	Outlet	100	50	1.2	0.2
ETRIB1a	E301	6.51	434	3.0	10	0.013	0.25	2.5	10.0	25	Outlet	100	50	1.2	0.2
ETRIB1b	E301	2.19	146	3.0	5	0.013	0.25	0	10.0	100	Outlet	100	50	1.2	0.2
ETRIB2W	E855	49.82	3322	1.2	9	0.013	0.25	2.5	10.0	25	Outlet	100	50	1.2	0.2
ETRIB3E	E673	0.42	28	1.3	79	0.013	0.25	2.5	10.0	25	Outlet	100	50	1.2	0.2
ETRIB3W	E768	42.45	2830	1.1	2	0.013	0.25	2.5	10.0	25	Outlet	100	50	1.2	0.2

[1] refer to the March 2018 *Stormwater Management Report for the Bronte Green Subdivision* and the March 2018 *Design Brief for the Stormwater Management Pond for the Bronte Green Subdivision* for the detailed design subdivision layout and subcatchments fo

Table B-3: Monthly Evaporation Data

Month	Average Pan Evaporation (mm/day) (Provided by AMEC)	Pan Evaporation (mm/day) x 0.7 (JFSA Adopted Value)
January	0.07	0.049
February	0.35	0.245
March	1.16	0.812
April	3.28	2.296
May	5.53	3.871
June	7.73	5.411
July	8.76	6.132
August	5.95	4.165
September	3.98	2.786
October	1.77	1.239
November	0.67	0.469
December	0.21	0.147

ATTACHMENT

C

SWM Facility Characteristics

JFSA Water Resources and Environmental Consultants

Table C-3: Stage-Storage-Outflow Curve for Enns SWM Facility

			Quality Control 1		Quantity Control 1		Quantity Control 2			
			Vertical Circ. Orifice		Vertical Circ. Orifice		Rectangular Weir			
			Dia (m)	0.140	Dia (m)	0.350	L (m)	6.000		
			Area (m^2)	0.015	Area (m^2)	0.096	C_w	1.700		
			Invert (m)	130.00	Invert (m)	130.50	Invert (m)	133.50		
			C_o	0.62	C_o	0.62	n contr.	0		
			Q @ D	0.011	Q @ D	0.111				
Elevation	Active Sto.	Demarkation	Head	Outflow	Head	Outflow	Head	Outflow	Outflow	Storage
(m)	(m^3)	Points	(m)	(m^3/s)	(m)	(m^3/s)	(m)	(m^3/s)	(m^3/s)	(ha·m)
130.00	**0**	**PP Elev**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
130.05	224		0.050	0.004	0.000	0.000	0.000	0.000	0.004	0.022
130.10	458		0.100	0.008	0.000	0.000	0.000	0.000	0.008	0.046
130.15	703		0.150	0.012	0.000	0.000	0.000	0.000	0.012	0.070
130.130	**603**	**QC Elev**	**0.130**	**0.010**	**0.000**	**0.000**	**0.000**	**0.000**	**0.010**	**0.060**
130.20	946		0.200	0.015	0.000	0.000	0.000	0.000	0.015	0.095
130.25	1203		0.250	0.018	0.000	0.000	0.000	0.000	0.018	0.120
130.30	1460		0.300	0.020	0.000	0.000	0.000	0.000	0.020	0.146
130.35	1722		0.350	0.022	0.000	0.000	0.000	0.000	0.022	0.172
130.40	1985		0.400	0.024	0.000	0.000	0.000	0.000	0.024	0.199
130.45	2253		0.450	0.026	0.000	0.000	0.000	0.000	0.026	0.225
130.50	**2522**	**Ext Det**	**0.500**	**0.028**	**0.000**	**0.000**	**0.000**	**0.000**	**0.028**	**0.252**
130.55	2793		0.550	0.029	0.050	0.016	0.000	0.000	0.045	0.279
130.60	3067		0.600	0.031	0.100	0.032	0.000	0.000	0.062	0.307
130.65	3344		0.650	0.032	0.150	0.047	0.000	0.000	0.080	0.334
130.70	3623		0.700	0.034	0.200	0.063	0.000	0.000	0.097	0.362
130.75	3905		0.750	0.035	0.250	0.079	0.000	0.000	0.114	0.391
130.80	4190		0.800	0.036	0.300	0.095	0.000	0.000	0.131	0.419
130.85	4497		0.850	0.037	0.350	0.111	0.000	0.000	0.148	0.450
130.90	4794		0.900	0.039	0.400	0.125	0.000	0.000	0.164	0.479
130.95	5056		0.950	0.040	0.450	0.139	0.000	0.000	0.178	0.506
131.00	5351		1.000	0.041	0.500	0.151	0.000	0.000	0.191	0.535
131.05	5649		1.050	0.042	0.550	0.162	0.000	0.000	0.204	0.565
131.10	5949		1.100	0.043	0.600	0.172	0.000	0.000	0.215	0.595
131.15	6250		1.150	0.044	0.650	0.182	0.000	0.000	0.226	0.625
131.20	6553		1.200	0.045	0.700	0.191	0.000	0.000	0.236	0.655
131.25	6858		1.250	0.046	0.750	0.200	0.000	0.000	0.246	0.686
131.30	7165		1.300	0.047	0.800	0.209	0.000	0.000	0.256	0.717
131.35	7474		1.350	0.048	0.850	0.217	0.000	0.000	0.265	0.747
131.40	7784		1.400	0.049	0.900	0.225	0.000	0.000	0.274	0.778
131.45	8096		1.450	0.050	0.950	0.233	0.000	0.000	0.282	0.810
131.50	8410		1.500	0.051	1.000	0.240	0.000	0.000	0.291	0.841
131.55	8727		1.550	0.051	1.050	0.247	0.000	0.000	0.299	0.873
131.60	9045		1.600	0.052	1.100	0.254	0.000	0.000	0.306	0.904
131.65	9365		1.650	0.053	1.150	0.261	0.000	0.000	0.314	0.936
131.70	9687		1.700	0.054	1.200	0.268	0.000	0.000	0.321	0.969
131.75	10011		1.750	0.055	1.250	0.274	0.000	0.000	0.329	1.001
131.80	10336		1.800	0.056	1.300	0.280	0.000	0.000	0.336	1.034
131.85	10666		1.850	0.056	1.350	0.286	0.000	0.000	0.343	1.067
131.90	10998		1.900	0.057	1.400	0.292	0.000	0.000	0.350	1.100
131.95	11330		1.950	0.058	1.450	0.298	0.000	0.000	0.356	1.133
132.00	11658		2.000	0.059	1.500	0.304	0.000	0.000	0.363	1.166
132.05	11988		2.050	0.059	1.550	0.310	0.000	0.000	0.369	1.199
132.10	12326		2.100	0.060	1.600	0.315	0.000	0.000	0.376	1.233
132.15	12666		2.150	0.061	1.650	0.321	0.000	0.000	0.382	1.267
132.20	13010		2.200	0.062	1.700	0.326	0.000	0.000	0.388	1.301
132.25	13355		2.250	0.062	1.750	0.332	0.000	0.000	0.394	1.336
132.30	13700		2.300	0.063	1.800	0.337	0.000	0.000	0.400	1.370
132.35	14042		2.350	0.064	1.850	0.342	0.000	0.000	0.406	1.404
132.40	14388		2.400	0.065	1.900	0.347	0.000	0.000	0.412	1.439
132.45	14739		2.450	0.065	1.950	0.352	0.000	0.000	0.417	1.474

Table C-3: Stage-Storage-Outflow Curve for Enns SWM Facility

			Quality Control 1		Quantity Control 1		Quantity Control 2			
			Vertical Circ. Orifice		Vertical Circ. Orifice		Rectangular Weir			
			Dia (m)	0.140	Dia (m)	0.350	L (m)	6.000		
			Area (m^2)	0.015	Area (m^2)	0.096	C_w	1.700		
			Invert (m)	130.00	Invert (m)	130.50	Invert (m)	133.50		
			C_o	0.62	C_o	0.62	n contr.	0		
			Q @ D	0.011	Q @ D	0.111				
Elevation	Active Sto.	Demarkation Points	Head	Outflow	Head	Outflow	Head	Outflow	Outflow	Storage
(m)	(m^3)		(m)	(m^3/s)	(m)	(m^3/s)	(m)	(m^3/s)	(m^3/s)	(ha·m)
132.50	15092		2.500	0.066	2.000	0.357	0.000	0.000	0.423	1.509
132.55	15447		2.550	0.067	2.050	0.362	0.000	0.000	0.428	1.545
132.60	15804		2.600	0.067	2.100	0.367	0.000	0.000	0.434	1.580
132.65	16162		2.650	0.068	2.150	0.371	0.000	0.000	0.439	1.616
132.70	16524		2.700	0.069	2.200	0.376	0.000	0.000	0.445	1.652
132.75	16885		2.750	0.069	2.250	0.381	0.000	0.000	0.450	1.688
132.80	17251		2.800	0.070	2.300	0.385	0.000	0.000	0.455	1.725
132.85	17618		2.850	0.070	2.350	0.390	0.000	0.000	0.460	1.762
132.90	17986		2.900	0.071	2.400	0.394	0.000	0.000	0.465	1.799
132.95	18357		2.950	0.072	2.450	0.399	0.000	0.000	0.470	1.836
133.00	18732		3.000	0.072	2.500	0.403	0.000	0.000	0.475	1.873
133.05	19107		3.050	0.073	2.550	0.407	0.000	0.000	0.480	1.911
133.10	19487		3.100	0.074	2.600	0.411	0.000	0.000	0.485	1.949
133.15	19864		3.150	0.074	2.650	0.416	0.000	0.000	0.490	1.986
133.20	20255		3.200	0.075	2.700	0.420	0.000	0.000	0.495	2.026
133.25	20863		3.250	0.075	2.750	0.424	0.000	0.000	0.499	2.086
133.30	21015		3.300	0.076	2.800	0.428	0.000	0.000	0.504	2.101
133.35	21404		3.350	0.077	2.850	0.432	0.000	0.000	0.509	2.140
133.40	21802		3.400	0.077	2.900	0.436	0.000	0.000	0.513	2.180
133.45	22229		3.450	0.078	2.950	0.440	0.000	0.000	0.518	2.223
133.50	**22658**		**3.500**	**0.078**	**3.000**	**0.444**	**0.000**	**0.000**	**0.522**	**2.266**
133.55	23093		3.550	0.079	3.050	0.448	0.050	0.121	0.648	2.309
133.60	23529		3.600	0.079	3.100	0.452	0.100	0.342	0.873	2.353
133.65	23972		3.650	0.080	3.150	0.456	0.150	0.627	1.163	2.397
133.70	24415		3.700	0.081	3.200	0.460	0.200	0.966	1.506	2.441
133.75	24861		3.750	0.081	3.250	0.463	0.250	1.350	1.894	2.486
133.80	25311		3.800	0.082	3.300	0.467	0.300	1.775	2.323	2.531
133.85	25763		3.850	0.082	3.350	0.471	0.350	2.236	2.789	2.576
133.90	26219		3.900	0.083	3.400	0.474	0.400	2.732	3.289	2.622
133.95	26698		3.950	0.083	3.450	0.478	0.450	3.260	3.822	2.670
134.00	27166		4.000	0.084	3.500	0.482	0.500	3.818	4.384	2.717
134.05	**27602**		4.050	0.084	3.550	0.485	0.550	4.405	4.975	2.760
134.10	**28071**	**Top of Berm**	**4.100**	**0.085**	**3.600**	**0.489**	**0.600**	**5.019**	**5.593**	**2.807**

Notes : PP Elev indicates the elevation of the permanent pool.
QC Elev indicates the elevation of the storage volume required by MOE for quality control.
Ext Det indicates the elevation of extended detention required based on 25 mm storm volume.
Top of Berm indicates the elevation at the top of the berm.

Table C-4: Stage-Storage-Outflow Curve for Bronte Green SWM Facility

			Quality Control 1		Quantity Control 1		Quantity Control 2		Quantity Control 3		Quantity Control 4		Emergency Overflow 1		Emergency Spillway			
			Vertical Circ. Orifice		Vertical Circ. Orifice		Sharp-Crested Weir		Sharp-Crested Weir		Sharp-Crested Weir		Sharp-Crested Weir		Broad-Crested Weir			
			Dia (m)	0.230	Dia (m)	0.600	L (m)	8.400	L (m)	8.400	L (m)	8.400	L (m)	8.400	L (m)	10.000		
			Area (m^2)	0.042	Area (m^2)	0.283	C_w	1.800	C_w	1.800	C_w	1.800	C_w	1.800	C_w	1.580		
			Invert (m)	121.20	Invert (m)	122.00	Invert (m)	124.55	Invert (m)	124.55	Invert (m)	124.55	Invert (m)	124.80	Invert (m)	124.80		
			C_o	0.62	C_o	0.62	n contr.	2	n contr.	2	n contr.	2	n contr.	2	n contr.	0		
			Q @ D	0.039	Q @ D	0.425	Top of 1.80x2.4 DIS		Top of 1.80x2.4 DIS		Top of 1.80x2.4 DIS		Top of 1.80x2.4 DIS					
Elevation	Active Sto.	Demarkation	Head	Outflow	Head	Outflow	Head	Outflow	Head	Outflow	Head	Outflow	Head	Outflow	Head	Outflow	Outflow	Storage
(m)	(m^3)	Points	(m)	(m^3/s)	(m)	(m^3/s)	(m)	(m^3/s)	(m)	(m^3/s)	(m)	(m^3/s)	(m)	(m^3/s)	(m)	(m^3/s)	(m^3/s)	(ha·m)
121.20	**0**	**PP Elev**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
121.25	437		0.050	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.044
121.30	888		0.100	0.017	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.017	0.089
121.35	1351		0.150	0.025	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.025	0.135
121.378	**1614**	**QC Elev**	**0.178**	**0.030**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.030**	**0.161**
121.40	1824		0.200	0.034	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.034	0.182
121.45	2291		0.250	0.042	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.042	0.229
121.50	2781		0.300	0.049	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.049	0.278
121.55	3273		0.350	0.055	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.055	0.327
121.60	3780		0.400	0.061	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.061	0.378
121.65	4296		0.450	0.066	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.066	0.430
121.70	4823		0.500	0.071	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.071	0.482
121.75	5355		0.550	0.075	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.075	0.535
121.80	5897		0.600	0.079	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.079	0.590
121.85	6445		0.650	0.083	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.083	0.645
121.90	7023		0.700	0.087	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.087	0.702
121.95	7562		0.750	0.091	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.091	0.756
122.00	**8137**	**Ext. Det.**	**0.800**	**0.094**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.094**	**0.814**
122.05	8716		0.850	0.098	0.050	0.035	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.133	0.872
122.10	9301		0.900	0.101	0.100	0.071	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.172	0.930
122.15	9888		0.950	0.104	0.150	0.106	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.211	0.989
122.159	**9995**	**2-Year**	**0.959**	**0.105**	**0.159**	**0.113**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.218**	**0.999**
122.20	10480		1.000	0.107	0.200	0.142	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.249	1.048
122.25	11072		1.050	0.110	0.250	0.177	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.288	1.107
122.30	11674		1.100	0.113	0.300	0.213	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.326	1.167
122.35	12277		1.150	0.116	0.350	0.248	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.364	1.228
122.395	**12822**	**5-Year**	**1.195**	**0.119**	**0.395**	**0.280**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.399**	**1.282**
122.40	12882		1.200	0.119	0.400	0.284	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.402	1.288
122.45	13491		1.250	0.122	0.450	0.319	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.441	1.349
122.50	14105		1.300	0.124	0.500	0.354	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.479	1.411
122.549	**14711**	**10-Year**	**1.349**	**0.127**	**0.549**	**0.389**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.516**	**1.471**
122.55	14723		1.350	0.127	0.550	0.390	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.517	1.472
122.60	15344		1.400	0.129	0.600	0.425	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.555	1.534
122.65	15968		1.450	0.132	0.650	0.459	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.591	1.597
122.70	16598		1.500	0.134	0.700	0.491	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.625	1.660
122.75	17234		1.550	0.137	0.750	0.521	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.658	1.723
122.750	**17234**	**25-Year**	**1.550**	**0.137**	**0.750**	**0.521**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.658**	**1.723**
122.80	17870		1.600	0.139	0.800	0.549	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.688	1.787
122.85	18510		1.650	0.141	0.850	0.576	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.717	1.851
122.890	**19023**	**50-Year**	**1.690**	**0.143**	**0.890**	**0.596**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.740**	**1.902**
122.90	19151		1.700	0.144	0.900	0.601	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.745	1.915
122.95	19804		1.750	0.146	0.950	0.626	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.772	1.980
123.00	20451		1.800	0.148	1.000	0.650	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.798	2.045
123.036	**20923**	**100-Year**	**1.836**	**0.150**	**1.036**	**0.666**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.816**	**2.092**
123.05	21106		1.850	0.150	1.050	0.672	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.823	2.111
123.10	21765		1.900	0.152	1.100	0.695	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.847	2.176
123.15	22429		1.950	0.155	1.150	0.716	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.870	2.243
123.20	23098		2.000	0.157	1.200	0.737	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.893	2.310
123.25	23765		2.050	0.159	1.250	0.757	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.916	2.377
123.30	24436		2.100	0.161	1.300	0.776	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.937	2.444
123.35	25116		2.150	0.163	1.350	0.796	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.958	2.512

Table C-4: Stage-Storage-Outflow Curve for Bronte Green SWM Facility

			Quality Control 1		Quantity Control 1		Quantity Control 2		Quantity Control 3		Quantity Control 4		Emergency Overflow 1		Emergency Spillway			
			Vertical Circ. Orifice		Vertical Circ. Orifice		Sharp-Crested Weir		Sharp-Crested Weir		Sharp-Crested Weir		Sharp-Crested Weir		Broad-Crested Weir			
			Dia (m)	0.230	Dia (m)	0.600	L (m)	8.400	L (m)	8.400	L (m)	8.400	L (m)	8.400	L (m)	10.000		
			Area (m^2)	0.042	Area (m^2)	0.283	C_w	1.800	C_w	1.800	C_w	1.800	C_w	1.800	C_w	1.580		
			Invert (m)	121.20	Invert (m)	122.00	Invert (m)	124.55	Invert (m)	124.55	Invert (m)	124.55	Invert (m)	124.80	Invert (m)	124.80		
			C_o	0.62	C_o	0.62	n contr.	2	n contr.	2	n contr.	2	n contr.	2	n contr.	0		
			Q @ D	0.039	Q @ D	0.425	Top of 1.80x2.4 DIS		Top of 1.80x2.4 DIS		Top of 1.80x2.4 DIS		Top of 1.80x2.4 DIS					
Elevation	Active Sto.	Demarkation Points	Head	Outflow	Head	Outflow	Head	Outflow	Head	Outflow	Head	Outflow	Head	Outflow	Head	Outflow	Outflow	Storage
(m)	(m^3)		(m)	(m^3/s)	(m)	(m^3/s)	(m)	(m^3/s)	(m)	(m^3/s)	(m)	(m^3/s)	(m)	(m^3/s)	(m)	(m^3/s)	(m^3/s)	(ha·m)
123.40	25794		2.200	0.165	1.400	0.814	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.979	2.579
123.45	26479		2.250	0.167	1.450	0.833	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.999	2.648
123.50	27169		2.300	0.169	1.500	0.851	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.019	2.717
123.55	27855		2.350	0.171	1.550	0.868	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.039	2.785
123.60	28552		2.400	0.172	1.600	0.885	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.058	2.855
123.65	29246		2.450	0.174	1.650	0.902	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.077	2.925
123.70	29950		2.500	0.176	1.700	0.919	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.095	2.995
123.75	30659		2.550	0.178	1.750	0.935	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.113	3.066
123.80	31375		2.600	0.180	1.800	0.951	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.131	3.137
123.85	32098		2.650	0.182	1.850	0.967	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.148	3.210
123.90	32820		2.700	0.183	1.900	0.982	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.166	3.282
123.95	33537		2.750	0.185	1.950	0.997	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.183	3.354
124.00	34265		2.800	0.187	2.000	1.012	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.199	3.427
124.05	34998		2.850	0.189	2.050	1.027	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.216	3.500
124.10	35733		2.900	0.190	2.100	1.042	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.232	3.573
124.15	36471		2.950	0.192	2.150	1.056	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.248	3.647
124.20	37212		3.000	0.194	2.200	1.070	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.264	3.721
124.25	37939		3.050	0.195	2.250	1.084	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.280	3.794
124.30	38690		3.100	0.197	2.300	1.098	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.295	3.869
124.35	39447		3.150	0.199	2.350	1.112	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.311	3.945
124.40	40207		3.200	0.200	2.400	1.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.326	4.021
124.45	40991		3.250	0.202	2.450	1.139	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.341	4.099
124.50	41735		3.300	0.204	2.500	1.152	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.355	4.173
124.55	42936		3.350	0.205	2.550	1.165	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.370	4.294
124.60	43730		3.400	0.207	2.600	1.178	0.050	0.169	0.050	0.169	0.050	0.169	0.050	0.000	0.000	0.000	1.891	4.373
124.65	44078		3.450	0.208	2.650	1.190	0.100	0.477	0.100	0.477	0.100	0.477	0.100	0.000	0.000	0.000	2.830	4.408
124.677	**44502**	**Regional**	**3.477**	**0.209**	**2.677**	**1.197**	**0.127**	**0.682**	**0.127**	**0.682**	**0.127**	**0.682**	**0.127**	**0.000**	**0.000**	**0.000**	**3.453**	**4.450**
124.70	44863		3.500	0.210	2.700	1.203	0.150	0.875	0.150	0.875	0.150	0.875	0.150	0.000	0.000	0.000	4.039	4.486
124.75	45694		3.550	0.211	2.750	1.215	0.200	1.346	0.200	1.346	0.200	1.346	0.200	0.000	0.000	0.000	5.465	4.569
124.80	**46556**	**Ovf Elev**	**3.600**	**0.213**	**2.800**	**1.228**	**0.250**	**1.879**	**0.250**	**1.879**	**0.250**	**1.879**	**0.250**	**1.879**	**0.000**	**0.000**	**8.956**	**4.656**
124.85	47434		3.650	0.215	2.850	1.240	0.300	2.467	0.300	2.467	0.300	2.467	0.300	2.467	0.050	0.177	11.498	4.743
124.90	48316		3.700	0.216	2.900	1.252	0.350	3.105	0.350	3.105	0.350	3.105	0.350	3.105	0.100	0.500	14.387	4.832
124.95	49301		3.750	0.218	2.950	1.264	0.400	3.789	0.400	3.789	0.400	3.789	0.400	3.789	0.150	0.918	17.554	4.930
125.00	50222		3.800	0.219	3.000	1.276	0.450	4.515	0.450	4.515	0.450	4.515	0.450	4.515	0.200	1.413	20.970	5.022
125.05	51018		3.850	0.221	3.050	1.288	0.500	5.282	0.500	5.282	0.500	5.282	0.500	5.282	0.250	1.975	24.612	5.102
125.10	51936		3.900	0.222	3.100	1.299	0.550	6.087	0.550	6.087	0.550	6.087	0.550	6.087	0.300	2.596	28.464	5.194
125.15	52880		3.950	0.223	3.150	1.311	0.600	6.927	0.600	6.927	0.600	6.927	0.600	6.927	0.350	3.272	32.513	5.288
125.20	53823		4.000	0.225	3.200	1.322	0.650	7.801	0.650	7.801	0.650	7.801	0.650	7.801	0.400	3.997	36.748	5.382
125.25	54727		4.050	0.226	3.250	1.334	0.700	8.708	0.700	8.708	0.700	8.708	0.700	8.708	0.450	4.770	41.160	5.473
125.30	55675		4.100	0.228	3.300	1.345	0.750	9.645	0.750	9.645	0.750	9.645	0.750	9.645	0.500	5.586	45.740	5.567
125.35	56624		4.150	0.229	3.350	1.356	0.800	10.613	0.800	10.613	0.800	10.613	0.800	10.613	0.550	6.445	50.482	5.662
125.40	57573		4.200	0.231	3.400	1.367	0.850	11.609	0.850	11.609	0.850	11.609	0.850	11.609	0.600	7.343	55.378	5.757
125.45	58521		4.250	0.232	3.450	1.378	0.900	12.633	0.900	12.633	0.900	12.633	0.900	12.633	0.650	8.280	60.422	5.852
125.50	**59470**	**Top of Berm**	**4.300**	**0.233**	**3.500**	**1.389**	**0.950**	**13.684**	**0.950**	**13.684**	**0.950**	**13.684**	**0.950**	**13.684**	**0.700**	**9.253**	**65.610**	**5.947**

Notes : PP Elev indicates the elevation of the permanent pool.
QC Elev indicates the elevation of the storage volume required by MOE for quality control.
Ext. Det. indicates the elevation of extended detention provided based on the volume of the 25 mm storm.
2- to 100-year 24-hour Chicago storm and Regional event elevations under free outfall conditions are noted.
Ovf Elev indicates the elevation of the emergency spillway provided above the Regional water level.
Top of Berm indicates the elevation at the top of the berm.

Table C-5: Stage-Storage-Outflow Curve for Deerfield SWM Facility 1

			Quality Control 1		Quantity Control 1		Quantity Control 2			
			Vertical Circ. Orifice		Vertical Circ. Orifice		Rectangular Weir			
			Dia (m)	0.125	Dia (m)	0.350	L (m)	25.000		
			Area (m^2)	0.012	Area (m^2)	0.096	C_w	1.700		
			Invert (m)	121.40	Invert (m)	122.15	Invert (m)	124.70		
			C_o	0.62	C_o	0.62	n contr.	0		
			Q @ D	0.008	Q @ D	0.111				
Elevation	Active Sto.	Demarkation	Head	Outflow	Head	Outflow	Head	Outflow	Outflow	Storage
(m)	(m^3)	Points	(m)	(m^3/s)	(m)	(m^3/s)	(m)	(m^3/s)	(m^3/s)	(ha·m)
121.40	**0**	**PP Elev**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
121.45	170		0.050	0.003	0.000	0.000	0.000	0.000	0.003	0.017
121.50	348		0.100	0.007	0.000	0.000	0.000	0.000	0.007	0.035
121.532	**467**	**QC Elev**	**0.132**	**0.009**	**0.000**	**0.000**	**0.000**	**0.000**	**0.009**	**0.047**
121.55	534		0.150	0.010	0.000	0.000	0.000	0.000	0.010	0.053
121.60	719		0.200	0.012	0.000	0.000	0.000	0.000	0.012	0.072
121.65	914		0.250	0.015	0.000	0.000	0.000	0.000	0.015	0.091
121.70	1110		0.300	0.016	0.000	0.000	0.000	0.000	0.016	0.111
121.75	1309		0.350	0.018	0.000	0.000	0.000	0.000	0.018	0.131
121.80	1509		0.400	0.020	0.000	0.000	0.000	0.000	0.020	0.151
121.85	1712		0.450	0.021	0.000	0.000	0.000	0.000	0.021	0.171
121.90	1917		0.500	0.022	0.000	0.000	0.000	0.000	0.022	0.192
121.95	2123		0.550	0.024	0.000	0.000	0.000	0.000	0.024	0.212
122.00	2331		0.600	0.025	0.000	0.000	0.000	0.000	0.025	0.233
122.05	2541		0.650	0.026	0.000	0.000	0.000	0.000	0.026	0.254
122.10	2754		0.700	0.027	0.000	0.000	0.000	0.000	0.027	0.275
122.15	**2968**	**Ext Det**	**0.750**	**0.028**	**0.000**	**0.000**	**0.000**	**0.000**	**0.028**	**0.297**
122.20	3184		0.800	0.029	0.050	0.016	0.000	0.000	0.045	0.318
122.25	3418		0.850	0.030	0.100	0.032	0.000	0.000	0.061	0.342
122.30	3643		0.900	0.031	0.150	0.047	0.000	0.000	0.078	0.364
122.35	3842		0.950	0.032	0.200	0.063	0.000	0.000	0.095	0.384
122.40	4067		1.000	0.033	0.250	0.079	0.000	0.000	0.112	0.407
122.45	4293		1.050	0.033	0.300	0.095	0.000	0.000	0.128	0.429
122.50	4521		1.100	0.034	0.350	0.111	0.000	0.000	0.145	0.452
122.55	4750		1.150	0.035	0.400	0.125	0.000	0.000	0.160	0.475
122.60	4981		1.200	0.036	0.450	0.139	0.000	0.000	0.175	0.498
122.65	5212		1.250	0.037	0.500	0.151	0.000	0.000	0.187	0.521
122.70	5446		1.300	0.037	0.550	0.162	0.000	0.000	0.199	0.545
122.75	5680		1.350	0.038	0.600	0.172	0.000	0.000	0.210	0.568
122.80	5916		1.400	0.039	0.650	0.182	0.000	0.000	0.221	0.592
122.85	6153		1.450	0.040	0.700	0.191	0.000	0.000	0.231	0.615
122.90	6392		1.500	0.040	0.750	0.200	0.000	0.000	0.241	0.639
122.95	6632		1.550	0.041	0.800	0.209	0.000	0.000	0.250	0.663
123.00	6874		1.600	0.042	0.850	0.217	0.000	0.000	0.259	0.687
123.05	7117		1.650	0.042	0.900	0.225	0.000	0.000	0.267	0.712
123.10	7362		1.700	0.043	0.950	0.233	0.000	0.000	0.276	0.736
123.15	7608		1.750	0.044	1.000	0.240	0.000	0.000	0.284	0.761
123.20	7856		1.800	0.044	1.050	0.247	0.000	0.000	0.292	0.786
123.25	8106		1.850	0.045	1.100	0.254	0.000	0.000	0.299	0.811
123.30	8359		1.900	0.046	1.150	0.261	0.000	0.000	0.307	0.836
123.35	8611		1.950	0.046	1.200	0.268	0.000	0.000	0.314	0.861
123.40	8860		2.000	0.047	1.250	0.274	0.000	0.000	0.321	0.886
123.45	9111		2.050	0.048	1.300	0.280	0.000	0.000	0.328	0.911
123.50	9368		2.100	0.048	1.350	0.286	0.000	0.000	0.335	0.937
123.55	9626		2.150	0.049	1.400	0.292	0.000	0.000	0.341	0.963
123.60	9887		2.200	0.049	1.450	0.298	0.000	0.000	0.348	0.989
123.65	10150		2.250	0.050	1.500	0.304	0.000	0.000	0.354	1.015
123.70	10412		2.300	0.050	1.550	0.310	0.000	0.000	0.360	1.041
123.75	10672		2.350	0.051	1.600	0.315	0.000	0.000	0.366	1.067
123.80	10935		2.400	0.052	1.650	0.321	0.000	0.000	0.372	1.094
123.85	11202		2.450	0.052	1.700	0.326	0.000	0.000	0.378	1.120

Table C-5: Stage-Storage-Outflow Curve for Deerfield SWM Facility 1

			Quality Control 1		Quantity Control 1		Quantity Control 2			
			Vertical Circ. Orifice		Vertical Circ. Orifice		Rectangular Weir			
			Dia (m)	0.125	Dia (m)	0.350	L (m)	25.000		
			Area (m^2)	0.012	Area (m^2)	0.096	C_w	1.700		
			Invert (m)	121.40	Invert (m)	122.15	Invert (m)	124.70		
			C_o	0.62	C_o	0.62	n contr.	0		
			Q @ D	0.008	Q @ D	0.111				
Elevation	Active Sto.	Demarkation Points	Head	Outflow	Head	Outflow	Head	Outflow	Outflow	Storage
(m)	(m^3)		(m)	(m^3/s)	(m)	(m^3/s)	(m)	(m^3/s)	(m^3/s)	(ha·m)
123.90	11470		2.500	0.053	1.750	0.332	0.000	0.000	0.384	1.147
123.95	11740		2.550	0.053	1.800	0.337	0.000	0.000	0.390	1.174
124.00	12011		2.600	0.054	1.850	0.342	0.000	0.000	0.396	1.201
124.05	12283		2.650	0.054	1.900	0.347	0.000	0.000	0.401	1.228
124.10	12558		2.700	0.055	1.950	0.352	0.000	0.000	0.407	1.256
124.15	12832		2.750	0.055	2.000	0.357	0.000	0.000	0.412	1.283
124.20	13111		2.800	0.056	2.050	0.362	0.000	0.000	0.418	1.311
124.25	13389		2.850	0.056	2.100	0.367	0.000	0.000	0.423	1.339
124.30	13669		2.900	0.057	2.150	0.371	0.000	0.000	0.428	1.367
124.35	13951		2.950	0.057	2.200	0.376	0.000	0.000	0.433	1.395
124.40	14236		3.000	0.058	2.250	0.381	0.000	0.000	0.438	1.424
124.45	14521		3.050	0.058	2.300	0.385	0.000	0.000	0.443	1.452
124.50	14810		3.100	0.059	2.350	0.390	0.000	0.000	0.448	1.481
124.55	15097		3.150	0.059	2.400	0.394	0.000	0.000	0.453	1.510
124.60	15394		3.200	0.060	2.450	0.399	0.000	0.000	0.458	1.539
124.65	15856		3.250	0.060	2.500	0.403	0.000	0.000	0.463	1.586
124.70	**15971**		**3.300**	**0.061**	**2.550**	**0.407**	**0.000**	**0.000**	**0.468**	**1.597**
124.75	16267		3.350	0.061	2.600	0.411	0.050	0.475	0.948	1.627
124.80	16570		3.400	0.062	2.650	0.416	0.100	1.344	1.821	1.657
124.85	16894		3.450	0.062	2.700	0.420	0.150	2.469	2.951	1.689
124.90	17220		3.500	0.062	2.750	0.424	0.200	3.801	4.288	1.722
124.95	17551		3.550	0.063	2.800	0.428	0.250	5.312	5.804	1.755
125.00	17882		3.600	0.063	2.850	0.432	0.300	6.983	7.479	1.788
125.05	18218		3.650	0.064	2.900	0.436	0.350	8.800	9.300	1.822
125.10	18555		3.700	0.064	2.950	0.440	0.400	10.752	11.256	1.856
125.15	18895		3.750	0.065	3.000	0.444	0.450	12.829	13.338	1.889
125.20	19236		3.800	0.065	3.050	0.448	0.500	15.026	15.539	1.924
125.25	19580		3.850	0.066	3.100	0.452	0.550	17.335	17.853	1.958
125.30	19926		3.900	0.066	3.150	0.456	0.600	19.752	20.274	1.993
125.35	20290		3.950	0.066	3.200	0.460	0.650	22.272	22.798	2.029
125.40	20646		4.000	0.067	3.250	0.463	0.700	24.891	25.421	2.065
125.45	20978		4.050	0.067	3.300	0.467	0.750	27.605	28.139	2.098
125.50	**21334**	**Top of Berm**	**4.100**	**0.068**	**3.350**	**0.471**	**0.800**	**30.411**	**30.949**	**2.133**

Notes : PP Elev indicates the elevation of the permanent pool.
QC Elev indicates the elevation of the storage volume required by MOE for quality control.
Ext Det indicates the elevation of extended detention required based on 25 mm storm volume.
Top of Berm indicates the elevation at the top of the berm.

Table C-6: Stage-Storage-Outflow Curve for Deerfield SWM Facility 2

			Quality Control 1		Quantity Control 1		Quantity Control 2			
			Vertical Circ. Orifice		Vertical Circ. Orifice		Rectangular Weir			
			Dia (m)	0.160	Dia (m)	0.450	L (m)	25.000		
			Area (m^2)	0.020	Area (m^2)	0.159	C_w	1.700		
			Invert (m)	121.40	Invert (m)	122.15	Invert (m)	124.70		
			C_o	0.62	C_o	0.62	n contr.	0		
			Q @ D	0.016	Q @ D	0.207				
Elevation	Active Sto.	Demarkation	Head	Outflow	Head	Outflow	Head	Outflow	Outflow	Storage
(m)	(m^3)	Points	(m)	(m^3/s)	(m)	(m^3/s)	(m)	(m^3/s)	(m^3/s)	(ha·m)
121.40	**0**	**PP Elev**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
121.45	282		0.050	0.005	0.000	0.000	0.000	0.000	0.005	0.028
121.50	578		0.100	0.010	0.000	0.000	0.000	0.000	0.010	0.058
121.542	**838**	**QC Elev**	**0.142**	**0.014**	**0.000**	**0.000**	**0.000**	**0.000**	**0.014**	**0.084**
121.55	885		0.150	0.015	0.000	0.000	0.000	0.000	0.015	0.089
121.60	1192		0.200	0.019	0.000	0.000	0.000	0.000	0.019	0.119
121.65	1516		0.250	0.023	0.000	0.000	0.000	0.000	0.023	0.152
121.70	1840		0.300	0.026	0.000	0.000	0.000	0.000	0.026	0.184
121.75	2170		0.350	0.029	0.000	0.000	0.000	0.000	0.029	0.217
121.80	2501		0.400	0.031	0.000	0.000	0.000	0.000	0.031	0.250
121.85	2838		0.450	0.034	0.000	0.000	0.000	0.000	0.034	0.284
121.90	3177		0.500	0.036	0.000	0.000	0.000	0.000	0.036	0.318
121.95	3520		0.550	0.038	0.000	0.000	0.000	0.000	0.038	0.352
122.00	3865		0.600	0.040	0.000	0.000	0.000	0.000	0.040	0.386
122.05	4213		0.650	0.042	0.000	0.000	0.000	0.000	0.042	0.421
122.10	4566		0.700	0.043	0.000	0.000	0.000	0.000	0.043	0.457
122.15	**4921**	**Ext Det**	**0.750**	**0.045**	**0.000**	**0.000**	**0.000**	**0.000**	**0.045**	**0.492**
122.20	5279		0.800	0.047	0.050	0.023	0.000	0.000	0.070	0.528
122.25	5666		0.850	0.048	0.100	0.046	0.000	0.000	0.094	0.567
122.30	6040		0.900	0.050	0.150	0.069	0.000	0.000	0.119	0.604
122.35	6370		0.950	0.052	0.200	0.092	0.000	0.000	0.144	0.637
122.40	6742		1.000	0.053	0.250	0.115	0.000	0.000	0.168	0.674
122.45	7117		1.050	0.054	0.300	0.138	0.000	0.000	0.193	0.712
122.50	7495		1.100	0.056	0.350	0.161	0.000	0.000	0.217	0.750
122.55	7875		1.150	0.057	0.400	0.184	0.000	0.000	0.241	0.788
122.60	8257		1.200	0.058	0.450	0.207	0.000	0.000	0.266	0.826
122.65	8642		1.250	0.060	0.500	0.229	0.000	0.000	0.289	0.864
122.70	9028		1.300	0.061	0.550	0.249	0.000	0.000	0.310	0.903
122.75	9417		1.350	0.062	0.600	0.267	0.000	0.000	0.330	0.942
122.80	9808		1.400	0.063	0.650	0.285	0.000	0.000	0.348	0.981
122.85	10201		1.450	0.065	0.700	0.301	0.000	0.000	0.366	1.020
122.90	10597		1.500	0.066	0.750	0.316	0.000	0.000	0.382	1.060
122.95	10995		1.550	0.067	0.800	0.331	0.000	0.000	0.398	1.100
123.00	11396		1.600	0.068	0.850	0.345	0.000	0.000	0.413	1.140
123.05	11800		1.650	0.069	0.900	0.359	0.000	0.000	0.428	1.180
123.10	12205		1.700	0.070	0.950	0.372	0.000	0.000	0.442	1.221
123.15	12613		1.750	0.071	1.000	0.385	0.000	0.000	0.456	1.261
123.20	13024		1.800	0.072	1.050	0.397	0.000	0.000	0.469	1.302
123.25	13440		1.850	0.073	1.100	0.409	0.000	0.000	0.482	1.344
123.30	13858		1.900	0.074	1.150	0.420	0.000	0.000	0.495	1.386
123.35	14276		1.950	0.076	1.200	0.431	0.000	0.000	0.507	1.428
123.40	14689		2.000	0.077	1.250	0.442	0.000	0.000	0.519	1.469
123.45	15105		2.050	0.078	1.300	0.453	0.000	0.000	0.530	1.511
123.50	15531		2.100	0.078	1.350	0.463	0.000	0.000	0.542	1.553
123.55	15959		2.150	0.079	1.400	0.473	0.000	0.000	0.553	1.596
123.60	16392		2.200	0.080	1.450	0.483	0.000	0.000	0.564	1.639
123.65	16827		2.250	0.081	1.500	0.493	0.000	0.000	0.575	1.683
123.70	17263		2.300	0.082	1.550	0.503	0.000	0.000	0.585	1.726
123.75	17693		2.350	0.083	1.600	0.512	0.000	0.000	0.595	1.769
123.80	18129		2.400	0.084	1.650	0.521	0.000	0.000	0.605	1.813
123.85	18571		2.450	0.085	1.700	0.530	0.000	0.000	0.615	1.857

Table C-6: Stage-Storage-Outflow Curve for Deerfield SWM Facility 2

			Quality Control 1		Quantity Control 1		Quantity Control 2			
			Vertical Circ. Orifice		Vertical Circ. Orifice		Rectangular Weir			
			Dia (m)	0.160	Dia (m)	0.450	L (m)	25.000		
			Area (m^2)	0.020	Area (m^2)	0.159	C_w	1.700		
			Invert (m)	121.40	Invert (m)	122.15	Invert (m)	124.70		
			C_o	0.62	C_o	0.62	n contr.	0		
			Q @ D	0.016	Q @ D	0.207				
Elevation	Active Sto.	Demarkation Points	Head	Outflow	Head	Outflow	Head	Outflow	Outflow	Storage
(m)	(m^3)		(m)	(m^3/s)	(m)	(m^3/s)	(m)	(m^3/s)	(m^3/s)	(ha·m)
123.90	19016		2.500	0.086	1.750	0.539	0.000	0.000	0.625	1.902
123.95	19463		2.550	0.087	1.800	0.548	0.000	0.000	0.635	1.946
124.00	19913		2.600	0.088	1.850	0.557	0.000	0.000	0.644	1.991
124.05	20364		2.650	0.089	1.900	0.565	0.000	0.000	0.654	2.036
124.10	20820		2.700	0.089	1.950	0.574	0.000	0.000	0.663	2.082
124.15	21275		2.750	0.090	2.000	0.582	0.000	0.000	0.672	2.127
124.20	21737		2.800	0.091	2.050	0.590	0.000	0.000	0.681	2.174
124.25	22198		2.850	0.092	2.100	0.598	0.000	0.000	0.690	2.220
124.30	22662		2.900	0.093	2.150	0.606	0.000	0.000	0.699	2.266
124.35	23130		2.950	0.094	2.200	0.614	0.000	0.000	0.707	2.313
124.40	23602		3.000	0.094	2.250	0.622	0.000	0.000	0.716	2.360
124.45	24075		3.050	0.095	2.300	0.629	0.000	0.000	0.724	2.407
124.50	24554		3.100	0.096	2.350	0.637	0.000	0.000	0.733	2.455
124.55	25029		3.150	0.097	2.400	0.644	0.000	0.000	0.741	2.503
124.60	25522		3.200	0.098	2.450	0.652	0.000	0.000	0.749	2.552
124.65	26288		3.250	0.098	2.500	0.659	0.000	0.000	0.757	2.629
124.70	**26479**		**3.300**	**0.099**	**2.550**	**0.666**	**0.000**	**0.000**	**0.765**	**2.648**
124.75	26969		3.350	0.100	2.600	0.673	0.050	0.475	1.248	2.697
124.80	27471		3.400	0.101	2.650	0.680	0.100	1.344	2.125	2.747
124.85	28008		3.450	0.101	2.700	0.687	0.150	2.469	3.258	2.801
124.90	28548		3.500	0.102	2.750	0.694	0.200	3.801	4.597	2.855
124.95	29098		3.550	0.103	2.800	0.701	0.250	5.312	6.116	2.910
125.00	29647		3.600	0.104	2.850	0.708	0.300	6.983	7.795	2.965
125.05	30204		3.650	0.104	2.900	0.714	0.350	8.800	9.619	3.020
125.10	30763		3.700	0.105	2.950	0.721	0.400	10.752	11.578	3.076
125.15	31325		3.750	0.106	3.000	0.728	0.450	12.829	13.663	3.133
125.20	31891		3.800	0.106	3.050	0.734	0.500	15.026	15.867	3.189
125.25	32462		3.850	0.107	3.100	0.741	0.550	17.335	18.183	3.246
125.30	33036		3.900	0.108	3.150	0.747	0.600	19.752	20.607	3.304
125.35	33639		3.950	0.109	3.200	0.753	0.650	22.272	23.134	3.364
125.40	34229		4.000	0.109	3.250	0.760	0.700	24.891	25.760	3.423
125.45	34779		4.050	0.110	3.300	0.766	0.750	27.605	28.480	3.478
125.50	**35370**	**Top of Berm**	**4.100**	**0.111**	**3.350**	**0.772**	**0.800**	**30.411**	**31.293**	**3.537**

Notes : PP Elev indicates the elevation of the permanent pool.
QC Elev indicates the elevation of the storage volume required by MOE for quality control.
Ext Det indicates the elevation of extended detention required based on 25 mm storm volume.
Top of Berm indicates the elevation at the top of the berm.

ATTACHMENT

D

PCSWMM Water Levels and Flows at Key Locations on Fourteen Mile Creek

JFSA Water Resources and Environmental Consultants

J438.5957 Lakeshore Road

Event	Peak Flows (1) Existing (m^3/s)	(2) Detailed Design BG_v10.2A (m^3/s)	(3) FSR (m^3/s)	Difference in Peak Flows (4) Detailed Design [(2)-(1)] (m^3/s)	(5) Detailed Design [(4)/(1)] (%)	(6) FSR [(3)-(1)] (m^3/s)	(7) FSR [(6)/(1)] (%)
2-Year Design	35.482	35.268	35.268	-0.214	-0.60	-0.214	-0.60
5-Year Design	58.784	58.365	58.365	-0.419	-0.71	-0.419	-0.71
10-Year Design	72.642	72.080	72.080	-0.562	-0.77	-0.562	-0.77
25-Year Design	93.046	92.551	92.544	-0.495	-0.53	-0.502	-0.54
50-Year Design	109.594	109.012	108.939	-0.582	-0.53	-0.655	-0.60
100-Year Design	128.816	128.075	128.065	-0.741	-0.58	-0.751	-0.58
Regional Event	267.815	266.386	267.336	-1.429	-0.53	-0.479	-0.18
2-Year Frequency	27.93	27.37	28.1	-0.567	-2.03	0.133	0.48
5-Year Frequency	47.23	46.30	47.3	-0.933	-1.98	0.067	0.14
10-Year Frequency	62.97	61.87	62.9	-1.100	-1.75	-0.033	-0.05
20-Year Frequency	80.43	79.33	80.3	-1.100	-1.37	-0.167	-0.21
50-Year Frequency	106.67	105.67	106.7	-1.000	-0.94	0.000	0.00
100-Year Frequency	129.67	129.33	129.7	-0.333	-0.26	0.000	0.00

Notes:

*Design storms based on Chicago 24 hour distribution and 48 hour Regional event.

*Frequency analysis based on 43 years of continuous simulations (excluding year 1970) using Consolidated Frequency Analysis (CFA)- Average of Three Distributions

Event	Peak Water Levels (m) (1) Existing (m)	(2) Detailed Design BG_v10.2A (m)	(3) FSR (m)	Difference in Peak WL (4) Detailed Design (m)	(5) FSR (m)
2-Year Design	78.70	78.70	78.70	0.00	0.00
5-Year Design	79.04	79.04	79.04	0.00	0.00
10-Year Design	79.20	79.20	79.20	0.00	0.00
25-Year Design	79.40	79.40	79.40	0.00	0.00
50-Year Design	79.55	79.54	79.54	-0.01	-0.01
100-Year Design	79.70	79.69	79.69	-0.01	-0.01
Regional Event	80.51	80.50	80.51	-0.01	0.00

J982.0328 **Rebecca Street**

Event	Peak Flows (1) Existing (m^3/s)	(2) Detailed Design BG_v10.2A (m^3/s)	(3) FSR (m^3/s)	Difference in Peak Flows (4) Detailed Design [(2)-(1)] (m^3/s)	(5) Detailed Design [(4)/(1)] (%)	(6) FSR [(3)-(1)] (m^3/s)	(7) FSR [(6)/(1)] (%)
2-Year Design	32.680	32.465	32.465	-0.215	-0.66	-0.215	-0.66
5-Year Design	54.205	53.778	53.778	-0.427	-0.79	-0.427	-0.79
10-Year Design	69.023	68.809	68.848	-0.214	-0.31	-0.175	-0.25
25-Year Design	92.489	91.905	91.899	-0.584	-0.63	-0.590	-0.64
50-Year Design	108.591	108.017	107.946	-0.574	-0.53	-0.645	-0.59
100-Year Design	127.633	126.900	126.892	-0.733	-0.57	-0.741	-0.58
Regional Event	263.029	261.828	262.513	-1.201	-0.46	-0.516	-0.20
2-Year Frequency	27.10	26.40	27.2	-0.700	-2.58	0.133	0.49
5-Year Frequency	46.43	45.27	46.2	-1.167	-2.51	-0.200	-0.43
10-Year Frequency	62.27	60.77	61.8	-1.500	-2.41	-0.433	-0.70
20-Year Frequency	79.90	78.23	79.2	-1.667	-2.09	-0.733	-0.92
50-Year Frequency	106.33	104.67	105.3	-1.667	-1.57	-1.000	-0.94
100-Year Frequency	130.00	128.67	128.3	-1.333	-1.03	-1.667	-1.28

Notes:

*Design storms based on Chicago 24 hour distribution and 48 hour Regional event.

*Frequency analysis based on 43 years of continuous simulations (excluding year 1970) using Consolidated Frequency Analysis (CFA)- Average of Three Distributions

Event	Peak Water Levels (m) (1) Existing (m)	(2) Detailed Design BG_v10.2A (m)	(3) FSR (m)	Difference in Peak WL (4) Detailed Design (m)	(5) FSR (m)
2-Year Design	83.61	83.60	83.60	-0.01	-0.01
5-Year Design	84.02	84.01	84.01	-0.01	-0.01
10-Year Design	84.23	84.23	84.23	0.00	0.00
25-Year Design	84.56	84.55	84.55	-0.01	-0.01
50-Year Design	84.76	84.75	84.75	-0.01	-0.01
100-Year Design	84.99	84.98	84.98	-0.01	-0.01
Regional Event	86.18	86.17	86.18	-0.01	0.00

J2546.464 **Speers Road**

Event	Peak Flows (1) Existing (m^3/s)	(2) Detailed Design BG_v10.2A (m^3/s)	(3) FSR (m^3/s)	Difference in Peak Flows (4) Detailed Design [(2)-(1)] (m^3/s)	(5) Detailed Design [(4)/(1)] (%)	(6) FSR [(3)-(1)] (m^3/s)	(7) FSR [(6)/(1)] (%)
2-Year Design	38.785	38.574	38.574	-0.211	-0.54	-0.211	-0.54
5-Year Design	59.695	59.185	59.185	-0.510	-0.85	-0.510	-0.85
10-Year Design	73.327	72.496	72.496	-0.831	-1.13	-0.831	-1.13
25-Year Design	94.019	93.675	93.648	-0.344	-0.37	-0.371	-0.39
50-Year Design	110.526	110.039	109.992	-0.487	-0.44	-0.534	-0.48
100-Year Design	128.710	128.003	128.025	-0.707	-0.55	-0.685	-0.53
Regional Event	259.195	258.514	258.792	-0.681	-0.26	-0.403	-0.16
2-Year Frequency	27.27	26.63	27.3	-0.633	-2.32	0.000	0.00
5-Year Frequency	46.17	45.23	46.2	-0.933	-2.02	0.000	0.00
10-Year Frequency	61.73	60.67	61.7	-1.067	-1.73	-0.067	-0.11
20-Year Frequency	79.10	78.13	79.0	-0.967	-1.22	-0.100	-0.13
50-Year Frequency	105.67	104.67	105.3	-1.000	-0.95	-0.333	-0.32
100-Year Frequency	129.00	128.67	128.7	-0.333	-0.26	-0.333	-0.26

Notes:

*Design storms based on Chicago 24 hour distribution and 48 hour Regional event.

*Frequency analysis based on 43 years of continuous simulations (excluding year 1970) using Consolidated Frequency Analysis (CFA)- Average of Three Distributions

Event	Peak Water Levels (m) (1) Existing (m)	(2) Detailed Design BG_v10.2A (m)	(3) FSR (m)	Difference in Peak WL (4) Detailed Design (m)	(5) FSR (m)
2-Year Design	93.48	93.48	93.48	0.00	0.00
5-Year Design	93.83	93.82	93.82	-0.01	-0.01
10-Year Design	94.02	94.01	94.01	-0.01	-0.01
25-Year Design	94.28	94.28	94.28	0.00	0.00
50-Year Design	94.45	94.44	94.44	-0.01	-0.01
100-Year Design	94.61	94.60	94.60	-0.01	-0.01
Regional Event	95.41	95.41	95.41	0.00	0.00

J3150.013 **Main Branch, at confluence with major storm outfall**

Event	Peak Flows (1) Existing (m^3/s)	(2) Detailed Design BG_v10.2A (m^3/s)	(3) FSR (m^3/s)	Difference in Peak Flows (4) Detailed Design [(2)-(1)] (m^3/s)	(5) Detailed Design [(4)/(1)] (%)	(6) FSR [(3)-(1)] (m^3/s)	(7) FSR [(6)/(1)] (%)
2-Year Design	36.357	36.135	36.135	-0.222	-0.61	-0.222	-0.61
5-Year Design	56.316	55.767	55.767	-0.549	-0.97	-0.549	-0.97
10-Year Design	69.782	69.591	69.632	-0.191	-0.27	-0.150	-0.21
25-Year Design	93.671	93.326	93.299	-0.345	-0.37	-0.372	-0.40
50-Year Design	110.182	109.699	109.652	-0.483	-0.44	-0.530	-0.48
100-Year Design	128.482	127.768	127.792	-0.714	-0.56	-0.690	-0.54
Regional Event	257.445	256.774	257.002	-0.671	-0.26	-0.443	-0.17
2-Year Frequency	26.23	25.70	26.2	-0.533	-2.03	0.000	0.00
5-Year Frequency	45.07	44.17	45.1	-0.900	-2.00	0.000	0.00
10-Year Frequency	60.73	59.70	60.8	-1.033	-1.70	0.033	0.05
20-Year Frequency	78.33	77.33	78.5	-1.000	-1.28	0.133	0.17
50-Year Frequency	105.33	104.67	105.7	-0.667	-0.63	0.333	0.32
100-Year Frequency	129.00	128.67	129.3	-0.333	-0.26	0.333	0.26

Notes:

*Design storms based on Chicago 24 hour distribution and 48 hour Regional event.

*Frequency analysis based on 43 years of continuous simulations (excluding year 1970) using Consolidated Frequency Analysis (CFA)- Average of Three Distributions

Event	Peak Water Levels (m) (1) Existing (m)	(2) Detailed Design BG_v10.2A (m)	(3) FSR (m)	Difference in Peak WL (4) Detailed Design (m)	(5) FSR (m)
2-Year Design	97.64	97.64	97.64	0.00	0.00
5-Year Design	97.98	97.97	97.97	-0.01	-0.01
10-Year Design	98.18	98.18	98.18	0.00	0.00
25-Year Design	98.49	98.48	98.48	-0.01	-0.01
50-Year Design	98.68	98.67	98.67	-0.01	-0.01
100-Year Design	98.87	98.87	98.87	0.00	0.00
Regional Event	100.00	99.99	100.00	-0.01	0.00

J4232.339 Main Branch, at Queen Elizabeth Way

Event	Peak Flows (1) Existing (m^3/s)	(2) Detailed Design BG_v10.2A (m^3/s)	(3) FSR (m^3/s)	Difference in Peak Flows (4) Detailed Design [(2)-(1)] (m^3/s)	(5) Detailed Design [(4)/(1)] (%)	(6) FSR [(3)-(1)] (m^3/s)	(7) FSR [(6)/(1)] (%)
2-Year Design	26.483	26.366	26.398	-0.117	-0.44	-0.085	-0.32
5-Year Design	47.356	47.205	47.265	-0.151	-0.32	-0.091	-0.19
10-Year Design	63.327	63.129	63.171	-0.198	-0.31	-0.156	-0.25
25-Year Design	84.749	84.435	84.414	-0.314	-0.37	-0.335	-0.40
50-Year Design	99.760	99.315	99.279	-0.445	-0.45	-0.481	-0.48
100-Year Design	116.337	115.714	115.749	-0.623	-0.54	-0.588	-0.51
Regional Event	220.170	220.021	220.159	-0.149	-0.07	-0.011	0.00
2-Year Frequency	23.00	22.60	23.1	-0.400	-1.74	0.100	0.43
5-Year Frequency	41.37	40.60	41.5	-0.767	-1.85	0.100	0.24
10-Year Frequency	56.17	55.23	56.3	-0.933	-1.66	0.133	0.24
20-Year Frequency	72.37	71.17	72.5	-1.200	-1.66	0.167	0.23
50-Year Frequency	96.43	95.63	96.8	-0.800	-0.83	0.400	0.41
100-Year Frequency	117.33	116.67	117.3	-0.667	-0.57	0.000	0.00

Notes:

*Design storms based on Chicago 24 hour distribution and 48 hour Regional event.

*Frequency analysis based on 43 years of continuous simulations (excluding year 1970) using Consolidated Frequency Analysis (CFA)- Average of Three Distributions

Event	Peak Water Levels (m) (1) Existing (m)	(2) Detailed Design BG_v10.2A (m)	(3) FSR (m)	Difference in Peak WL (4) Detailed Design (m)	(5) FSR (m)
2-Year Design	104.55	104.54	104.54	-0.01	-0.01
5-Year Design	104.98	104.97	104.97	-0.01	-0.01
10-Year Design	105.26	105.25	105.26	-0.01	0.00
25-Year Design	105.57	105.56	105.56	-0.01	-0.01
50-Year Design	105.74	105.74	105.74	0.00	0.00
100-Year Design	105.93	105.92	105.92	-0.01	-0.01
Regional Event	106.82	106.82	106.82	0.00	0.00

DF001 **Secondary culvert under Queen Elizabeth Way**

Event	Peak Flows (1) Existing (m^3/s)	(2) Detailed Design BG_v10.2A (m^3/s)	(3) FSR (m^3/s)	Difference in Peak Flows (4) Detailed Design [(2)-(1)] (m^3/s)	(5) Detailed Design [(4)/(1)] (%)	(6) FSR [(3)-(1)] (m^3/s)	(7) FSR [(6)/(1)] (%)
2-Year Design	1.105	0.828	0.828	-0.277	-25.07	-0.277	-25.07
5-Year Design	1.892	1.238	1.238	-0.654	-34.57	-0.654	-34.57
10-Year Design	2.489	1.522	1.522	-0.967	-38.85	-0.967	-38.85
25-Year Design	3.348	1.931	1.931	-1.417	-42.32	-1.417	-42.32
50-Year Design	3.984	2.251	2.251	-1.733	-43.50	-1.733	-43.50
100-Year Design	4.657	2.586	2.586	-2.071	-44.47	-2.071	-44.47
Regional Event	3.645	3.018	3.018	-0.627	-17.20	-0.627	-17.20
2-Year Frequency	0.68	0.36	0.4	-0.323	-47.32	-0.313	-45.85
5-Year Frequency	1.21	0.57	0.6	-0.640	-53.04	-0.617	-51.10
10-Year Frequency	1.61	0.73	0.8	-0.877	-54.56	-0.837	-52.07
20-Year Frequency	2.02	0.90	1.0	-1.120	-55.35	-1.063	-52.55
50-Year Frequency	2.62	1.16	1.2	-1.460	-55.80	-1.370	-52.36
100-Year Frequency	3.10	1.38	1.5	-1.723	-55.59	-1.603	-51.72

Notes:

*Design storms based on Chicago 24 hour distribution and 48 hour Regional event.

*Frequency analysis based on 43 years of continuous simulations (excluding year 1970) using Consolidated Frequency Analysis (CFA)- Average of Three Distributions

Event	Peak Water Levels (m) (1) Existing (m)	(2) Detailed Design BG_v10.2A (m)	(3) FSR (m)	Difference in Peak WL (4) Detailed Design (m)	(5) FSR (m)
2-Year Design	110.89	110.84	110.84	-0.05	-0.05
5-Year Design	111.01	110.92	110.92	-0.09	-0.09
10-Year Design	111.08	110.96	110.96	-0.12	-0.12
25-Year Design	111.17	111.02	111.02	-0.15	-0.15
50-Year Design	111.22	111.06	111.06	-0.16	-0.16
100-Year Design	111.28	111.09	111.09	-0.19	-0.19
Regional Event	111.21	111.15	111.15	-0.06	-0.06

E153 **Tributary 14W-W1, at confluence with main branch**

Event	Peak Flows (1) Existing (m^3/s)	(2) Detailed Design BG_v10.2A (m^3/s)	(3) FSR (m^3/s)	Difference in Peak Flows (4) Detailed Design [(2)-(1)] (m^3/s)	(5) Detailed Design [(4)/(1)] (%)	(6) FSR [(3)-(1)] (m^3/s)	(7) FSR [(6)/(1)] (%)
2-Year Design	2.447	2.510	2.269	0.063	2.57	-0.178	-7.27
5-Year Design	5.026	4.907	4.376	-0.119	-2.37	-0.650	-12.93
10-Year Design	7.290	7.028	6.387	-0.262	-3.59	-0.903	-12.39
25-Year Design	9.865	9.419	8.607	-0.446	-4.52	-1.258	-12.75
50-Year Design	12.216	11.680	10.653	-0.536	-4.39	-1.563	-12.79
100-Year Design	14.582	14.059	12.829	-0.523	-3.59	-1.753	-12.02
Regional Event	16.105	15.070	14.973	-1.035	-6.43	-1.132	-7.03
2-Year Frequency	2.37	2.17	2.1	-0.203	-8.58	-0.227	-9.56
5-Year Frequency	4.49	4.02	4.0	-0.473	-10.53	-0.490	-10.91
10-Year Frequency	6.16	5.47	5.5	-0.690	-11.20	-0.687	-11.14
20-Year Frequency	7.95	7.03	7.1	-0.927	-11.65	-0.890	-11.19
50-Year Frequency	10.55	9.29	9.4	-1.263	-11.97	-1.193	-11.31
100-Year Frequency	12.70	11.13	11.3	-1.567	-12.34	-1.400	-11.02

Notes:

*Design storms based on Chicago 24 hour distribution and 48 hour Regional event.

*Frequency analysis based on 43 years of continuous simulations (excluding year 1970) using Consolidated Frequency Analysis (CFA)- Average of Three Distributions

Event	Peak Water Levels (m) (1) Existing (m)	(2) Detailed Design BG_v10.2A (m)	(3) FSR (m)	Difference in Peak WL (4) Detailed Design (m)	(5) FSR (m)
2-Year Design	118.63	118.64	118.63	0.01	0.00
5-Year Design	118.70	118.70	118.69	0.00	-0.01
10-Year Design	118.75	118.75	118.73	0.00	-0.02
25-Year Design	118.80	118.79	118.78	-0.01	-0.02
50-Year Design	118.84	118.83	118.81	-0.01	-0.03
100-Year Design	118.87	118.87	118.85	0.00	-0.02
Regional Event	118.97	118.96	118.96	-0.01	-0.01

E733 **Tributary 14W-W1-3 at Bronte Road (Enns lands and external areas)**

Event	Peak Flows			Difference in Peak Flows			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Existing	Detailed Design BG_v10.2A	FSR	Detailed Design		FSR	
	(m^3/s)	(m^3/s)	(m^3/s)	[(2)-(1)] (m^3/s)	[(4)/(1)] (%)	[(3)-(1)] (m^3/s)	[(6)/(1)] (%)
2-Year Design	0.895	0.770	0.745	-0.125	-13.97	-0.150	-16.76
5-Year Design	1.928	1.674	1.607	-0.254	-13.17	-0.321	-16.65
10-Year Design	2.723	2.384	2.306	-0.339	-12.45	-0.417	-15.31
25-Year Design	3.844	3.398	3.312	-0.446	-11.60	-0.532	-13.84
50-Year Design	4.679	4.161	4.071	-0.518	-11.07	-0.608	-12.99
100-Year Design	5.554	4.967	4.876	-0.587	-10.57	-0.678	-12.21
Regional Event	6.050	5.764	5.738	-0.286	-4.73	-0.312	-5.16
2-Year Frequency	0.93	0.81	0.8	-0.120	-12.90	-0.097	-10.39
5-Year Frequency	1.78	1.53	1.6	-0.247	-13.88	-0.180	-10.13
10-Year Frequency	2.43	2.09	2.2	-0.343	-14.11	-0.233	-9.59
20-Year Frequency	3.13	2.69	2.8	-0.443	-14.16	-0.290	-9.27
50-Year Frequency	4.13	3.54	3.8	-0.587	-14.22	-0.360	-8.72
100-Year Frequency	4.95	4.25	4.5	-0.700	-14.15	-0.413	-8.36

Notes:

*Design storms based on Chicago 24 hour distribution and 48 hour Regional event.

*Frequency analysis based on 43 years of continuous simulations (excluding year 1970) using Consolidated Frequency Analysis (CFA)- Average of Three Distributions

Event	Peak Water Levels (m)			Difference in Peak WL	
	(1)	(2)	(3)	(4)	(5)
	Existing	Detailed Design BG_v10.2A	FSR	Detailed Design	FSR
	(m)	(m)	(m)	(m)	(m)
2-Year Design	126.34	126.33	126.33	-0.01	-0.01
5-Year Design	126.43	126.42	126.41	-0.01	-0.02
10-Year Design	126.48	126.47	126.46	-0.01	-0.02
25-Year Design	126.53	126.52	126.51	-0.01	-0.02
50-Year Design	126.57	126.55	126.54	-0.02	-0.03
100-Year Design	126.60	126.58	126.57	-0.02	-0.03
Regional Event	126.61	126.60	126.60	-0.01	-0.01

EBS1 **Bronte Road southside ditch, east of Tributary 14W-W1-3 (Enns lands and external areas)**

Event	Peak Flows (1) Existing (m^3/s)	(2) Detailed Design BG_v10.2A (m^3/s)	(3) FSR (m^3/s)	Difference in Peak Flows (4) Detailed Design [(2)-(1)] (m^3/s)	(5) Detailed Design [(4)/(1)] (%)	(6) FSR [(3)-(1)] (m^3/s)	(7) FSR [(6)/(1)] (%)
2-Year Design	0.338	0.148	0.072	-0.190	-56.21	-0.266	-78.70
5-Year Design	0.542	0.216	0.153	-0.326	-60.15	-0.389	-71.77
10-Year Design	0.691	0.262	0.194	-0.429	-62.08	-0.497	-71.92
25-Year Design	0.902	0.323	0.238	-0.579	-64.19	-0.664	-73.61
50-Year Design	1.056	0.369	0.264	-0.687	-65.06	-0.792	-75.00
100-Year Design	1.217	0.424	0.288	-0.793	-65.16	-0.929	-76.34
Regional Event	0.803	0.586	0.544	-0.217	-27.02	-0.259	-32.25
2-Year Frequency	0.18	0.08	0.1	-0.095	-52.96	-0.107	-59.44
5-Year Frequency	0.30	0.14	0.1	-0.153	-51.69	-0.157	-52.81
10-Year Frequency	0.38	0.19	0.2	-0.190	-49.57	-0.183	-47.83
20-Year Frequency	0.47	0.25	0.3	-0.223	-47.18	-0.187	-39.44
50-Year Frequency	0.60	0.34	0.5	-0.257	-42.78	-0.147	-24.44
100-Year Frequency	0.70	0.43	0.7	-0.273	-39.05	-0.047	-6.67

Notes:

*Design storms based on Chicago 24 hour distribution and 48 hour Regional event.

*Frequency analysis based on 43 years of continuous simulations (excluding year 1970) using Consolidated Frequency Analysis (CFA)- Average of Three Distributions

Event	Peak Water Levels (m) (1) Existing (m)	(2) Detailed Design BG_v10.2A (m)	(3) FSR (m)	Difference in Peak WL (4) Detailed Design (m)	(5) FSR (m)
2-Year Design	127.48	127.36	127.27	-0.12	-0.21
5-Year Design	127.56	127.41	127.33	-0.15	-0.23
10-Year Design	127.61	127.43	127.37	-0.18	-0.24
25-Year Design	127.67	127.46	127.40	-0.21	-0.27
50-Year Design	127.71	127.49	127.42	-0.22	-0.29
100-Year Design	127.75	127.51	127.44	-0.24	-0.31
Regional Event	127.65	127.57	127.56	-0.08	-0.09

ATTACHMENT

E

Annual and Monthly Peak Flows and Runoff Volumes at Key Locations on Fourteen Mile Creek

JFSA Water Resources and Environmental Consultants

Table E-1: Existing Continuous Annual and Monthly Peak Flows at the Downstream Side of Bronte Road in 14W-W1-3 (Node E649)

Year	Annual Peak Flow (m^3/s)	Monthly Peak Flow (m^3/s)											
		January	February	March	April	May	June	July	August	September	October	November	December
1960	1.54	0.04	0.03	0.01	0.04	0.05	0.05	1.54	0.09	0.00	0.32	0.04	0.00
1961	0.60	0.00	0.00	0.00	0.06	0.04	0.60	0.11	0.11	0.12	0.02	0.06	0.04
1962	1.76	0.02	0.00	0.00	0.02	0.00	0.51	0.57	0.30	1.76	0.05	0.01	0.03
1963	0.85	0.00	0.00	0.03	0.05	0.08	0.85	0.29	0.06	0.14	0.01	0.07	0.01
1964	0.70	0.04	0.00	0.04	0.06	0.06	0.07	0.70	0.44	0.01	0.05	0.03	0.00
1965	0.39	0.00	0.05	0.00	0.07	0.10	0.11	0.08	0.18	0.05	0.39	0.05	0.03
1966	1.04	0.00	0.00	0.00	0.03	0.03	0.17	0.09	0.15	0.23	0.03	1.04	0.20
1967	0.36	0.02	0.04	0.00	0.25	0.03	0.36	0.08	0.04	0.19	0.04	0.02	0.11
1968	4.54	0.03	0.11	0.02	0.06	0.11	0.04	0.45	4.54	0.22	0.03	0.11	0.00
1969	2.01	0.00	0.00	0.06	0.24	0.31	0.02	2.01	0.54	0.03	0.03	0.03	0.01
1970	3.96	0.00	0.00	0.02	0.31	0.08	0.04	3.96	3.15	0.02	0.03	0.03	0.01
1971	1.87	0.00	0.04	0.00	0.02	0.07	0.42	0.41	1.87	0.04	0.03	0.02	0.06
1972	0.29	0.02	0.01	0.02	0.04	0.06	0.11	0.09	0.24	0.29	0.09	0.03	0.06
1973	0.63	0.02	0.04	0.21	0.04	0.06	0.06	0.63	0.25	0.09	0.17	0.06	0.04
1974	1.71	0.06	0.04	0.07	0.29	1.71	0.24	1.18	0.04	0.06	0.03	0.05	0.02
1975	0.64	0.05	0.14	0.00	0.00	0.11	0.36	0.53	0.64	0.38	0.24	0.05	0.02
1976	0.43	0.02	0.06	0.04	0.07	0.18	0.43	0.06	0.27	0.14	0.02	0.01	0.04
1977	2.02	0.00	0.02	0.11	0.09	0.08	0.48	1.64	1.59	2.02	0.00	0.05	0.04
1978	0.41	0.02	0.00	0.04	0.04	0.08	0.06	0.27	0.09	0.41	0.07	0.03	0.03
1979	2.72	0.02	0.03	0.02	0.04	0.08	1.23	2.72	0.20	0.00	0.03	0.05	0.30
1980	4.30	0.04	0.00	0.09	0.36	0.03	0.07	4.30	0.07	0.10	0.09	0.03	0.03
1981	1.51	0.00	0.02	0.00	0.08	0.04	0.08	0.10	1.51	0.25	0.13	0.04	0.01
1982	2.18	0.03	0.00	0.05	0.05	0.04	0.07	0.07	0.92	2.18	0.06	0.05	0.03
1983	1.39	0.02	0.04	0.05	0.11	0.06	0.03	0.01	1.39	0.06	0.06	0.04	0.03
1984	0.34	0.00	0.05	0.03	0.04	0.07	0.05	0.08	0.34	0.09	0.02	0.05	0.10
1985	1.33	0.00	0.03	0.06	0.05	0.09	0.06	0.91	1.33	0.08	0.03	0.00	0.04
1986	2.42	0.04	0.00	0.02	0.03	0.25	0.06	2.07	2.42	1.30	0.06	0.02	0.03
1987	2.34	0.00	0.00	0.03	0.02	0.05	0.33	0.97	0.05	2.34	0.03	0.18	0.02
1988	1.64	0.01	0.00	0.03	0.05	0.28	0.04	1.64	0.05	0.14	0.06	0.04	0.01
1989	0.65	0.00	0.00	0.00	0.03	0.03	0.39	0.65	0.06	0.26	0.06	0.05	0.00
1990	0.91	0.03	0.04	0.03	0.03	0.05	0.08	0.05	0.91	0.09	0.10	0.03	0.07
1991	1.15	0.01	0.00	0.23	0.15	0.38	0.11	0.28	1.15	0.08	0.03	0.05	0.01
1992	1.34	0.02	0.03	0.01	1.07	1.34	0.05	0.71	0.77	0.53	0.05	0.36	0.02
1993	1.02	0.04	0.00	0.00	0.05	0.04	0.72	1.02	0.05	0.04	0.08	0.09	0.00
1994	0.77	0.00	0.00	0.04	0.05	0.11	0.16	0.65	0.77	0.09	0.06	0.00	0.01
1995	2.09	0.24	0.00	0.06	0.50	0.24	0.16	0.11	2.09	0.04	1.85	0.23	0.00
1996	0.70	0.04	0.06	0.00	0.04	0.42	0.10	0.26	0.07	0.70	0.00	0.05	0.04
1997	0.26	0.01	0.04	0.02	0.01	0.26	0.07	0.04	0.16	0.03	0.04	0.05	0.03
1998	0.45	0.04	0.00	0.04	0.15	0.25	0.00	0.06	0.02	0.45	0.04	0.05	0.00
1999	1.10	0.00	0.00	0.00	0.02	0.03	0.05	0.29	0.45	1.10	0.47	0.00	0.00
2000	1.51	0.00	0.00	0.00	0.28	1.51	0.62	0.04	0.13	0.06	0.01	0.00	0.00
2001	0.16	0.00	0.00	0.00	0.03	0.16	0.08	0.04	0.04	0.05	0.08	0.00	0.00
2002	0.12	0.00	0.00	0.00	0.05	0.07	0.08	0.12	0.00	0.10	0.02	0.00	0.00
2003	0.52	0.00	0.00	0.00	0.07	0.43	0.14	0.36	0.52	0.37	0.08	0.00	0.00
Average	1.33	0.02	0.02	0.03	0.12	0.22	0.22	0.73	0.68	0.38	0.12	0.07	0.03

Table E-2: Proposed (Full Development with SWM Controls) Continuous Annual and Monthly Peak Flows at the Downstream Side of Bronte Road in 14W-W1-3 (Node E649)

Year	Annual Peak Flow (m^3/s)	Monthly Peak Flow (m^3/s)											
		January	February	March	April	May	June	July	August	September	October	November	December
1960	1.30	0.03	0.03	0.01	0.03	0.03	0.04	1.30	0.06	0.00	0.23	0.04	0.00
1961	0.45	0.00	0.00	0.00	0.04	0.03	0.45	0.08	0.07	0.07	0.01	0.05	0.04
1962	1.35	0.02	0.00	0.00	0.01	0.00	0.39	0.38	0.22	1.35	0.04	0.00	0.03
1963	0.67	0.00	0.00	0.03	0.04	0.05	0.67	0.23	0.05	0.09	0.01	0.04	0.00
1964	0.61	0.03	0.00	0.04	0.04	0.05	0.05	0.61	0.32	0.01	0.04	0.02	0.00
1965	0.31	0.00	0.04	0.00	0.04	0.07	0.07	0.05	0.11	0.04	0.31	0.04	0.03
1966	0.82	0.00	0.00	0.00	0.02	0.02	0.11	0.06	0.10	0.14	0.02	0.82	0.18
1967	0.29	0.02	0.03	0.00	0.17	0.03	0.29	0.05	0.02	0.12	0.02	0.02	0.07
1968	3.72	0.03	0.09	0.02	0.04	0.07	0.04	0.31	3.72	0.13	0.03	0.09	0.00
1969	1.58	0.00	0.00	0.04	0.19	0.27	0.02	1.58	0.41	0.02	0.03	0.03	0.01
1970	3.18	0.00	0.00	0.03	0.23	0.05	0.03	3.18	2.59	0.02	0.02	0.02	0.01
1971	1.41	0.00	0.03	0.00	0.01	0.05	0.32	0.32	1.41	0.03	0.03	0.02	0.05
1972	0.23	0.02	0.01	0.02	0.03	0.03	0.07	0.06	0.18	0.23	0.09	0.03	0.05
1973	0.49	0.02	0.03	0.16	0.04	0.04	0.04	0.49	0.20	0.06	0.11	0.05	0.03
1974	1.33	0.04	0.03	0.05	0.22	1.33	0.18	0.86	0.02	0.04	0.02	0.04	0.01
1975	0.56	0.04	0.09	0.00	0.00	0.09	0.27	0.36	0.56	0.30	0.17	0.04	0.02
1976	0.29	0.02	0.05	0.03	0.04	0.15	0.29	0.04	0.18	0.10	0.02	0.01	0.02
1977	1.66	0.00	0.02	0.07	0.06	0.05	0.37	1.24	1.20	1.66	0.01	0.04	0.02
1978	0.31	0.03	0.00	0.02	0.04	0.05	0.04	0.18	0.06	0.31	0.05	0.03	0.03
1979	2.11	0.02	0.03	0.02	0.03	0.05	0.93	2.11	0.12	0.00	0.03	0.04	0.26
1980	3.75	0.04	0.00	0.08	0.29	0.03	0.04	3.75	0.04	0.08	0.06	0.02	0.03
1981	1.19	0.00	0.02	0.00	0.06	0.03	0.05	0.08	1.19	0.20	0.11	0.04	0.00
1982	1.70	0.03	0.00	0.04	0.04	0.03	0.05	0.05	0.76	1.70	0.04	0.03	0.03
1983	1.07	0.02	0.03	0.04	0.09	0.04	0.02	0.01	1.07	0.05	0.04	0.03	0.03
1984	0.22	0.00	0.04	0.03	0.04	0.04	0.03	0.05	0.22	0.06	0.01	0.04	0.07
1985	0.99	0.00	0.03	0.04	0.04	0.05	0.05	0.67	0.99	0.06	0.02	0.00	0.02
1986	2.12	0.03	0.00	0.02	0.03	0.19	0.04	1.75	2.12	1.17	0.04	0.02	0.03
1987	1.80	0.00	0.00	0.02	0.02	0.03	0.27	0.71	0.04	1.80	0.02	0.16	0.02
1988	1.25	0.02	0.00	0.03	0.03	0.22	0.02	1.25	0.03	0.10	0.04	0.03	0.01
1989	0.44	0.00	0.00	0.00	0.02	0.02	0.31	0.44	0.03	0.18	0.04	0.04	0.00
1990	0.67	0.02	0.05	0.02	0.03	0.04	0.05	0.04	0.67	0.06	0.06	0.03	0.06
1991	0.92	0.01	0.00	0.18	0.09	0.26	0.07	0.22	0.92	0.05	0.02	0.03	0.01
1992	1.10	0.02	0.03	0.01	0.80	1.10	0.04	0.55	0.67	0.41	0.04	0.30	0.02
1993	0.83	0.04	0.00	0.00	0.04	0.03	0.57	0.83	0.04	0.03	0.06	0.08	0.00
1994	0.58	0.00	0.00	0.03	0.04	0.07	0.09	0.46	0.58	0.07	0.04	0.00	0.01
1995	1.62	0.20	0.00	0.04	0.41	0.18	0.10	0.07	1.60	0.02	1.62	0.19	0.00
1996	0.62	0.03	0.04	0.00	0.03	0.34	0.06	0.21	0.04	0.62	0.00	0.03	0.03
1997	0.20	0.01	0.04	0.01	0.02	0.20	0.04	0.02	0.13	0.02	0.04	0.04	0.02
1998	0.31	0.04	0.00	0.02	0.08	0.22	0.00	0.03	0.02	0.31	0.02	0.04	0.00
1999	0.89	0.00	0.00	0.00	0.03	0.03	0.04	0.19	0.33	0.89	0.38	0.00	0.00
2000	1.30	0.00	0.00	0.00	0.22	1.30	0.52	0.03	0.08	0.05	0.01	0.00	0.00
2001	0.14	0.00	0.00	0.00	0.02	0.14	0.05	0.03	0.03	0.03	0.07	0.00	0.00
2002	0.08	0.00	0.00	0.00	0.04	0.05	0.05	0.07	0.00	0.08	0.02	0.00	0.00
2003	0.40	0.00	0.00	0.00	0.04	0.34	0.08	0.27	0.40	0.30	0.05	0.00	0.00
Average	1.06	0.02	0.02	0.03	0.09	0.17	0.17	0.57	0.54	0.30	0.09	0.06	0.03
Difference from Existing	-0.27	0.00	0.00	-0.01	-0.03	-0.05	-0.06	-0.16	-0.15	-0.08	-0.02	-0.01	-0.01

Table E-3: Existing Continuous Annual and Monthly Peak Flows at the Confluence of 14W-W1-2 and 14W-W1-3 (Node E543)

Year	Annual Peak Flow (m^3/s)	Monthly Peak Flow (m^3/s)											
		January	February	March	April	May	June	July	August	September	October	November	December
1960	3.14	0.08	0.08	0.03	0.11	0.12	0.12	3.14	0.22	0.01	0.61	0.09	0.00
1961	1.14	0.00	0.00	0.00	0.15	0.11	1.14	0.26	0.28	0.30	0.04	0.17	0.10
1962	3.35	0.06	0.00	0.00	0.04	0.00	1.00	0.98	0.56	3.35	0.12	0.01	0.07
1963	1.73	0.00	0.00	0.08	0.13	0.18	1.73	0.60	0.14	0.29	0.03	0.17	0.01
1964	1.55	0.10	0.00	0.11	0.14	0.17	0.18	1.55	0.82	0.03	0.14	0.08	0.00
1965	0.78	0.00	0.10	0.00	0.19	0.26	0.28	0.20	0.39	0.13	0.78	0.11	0.07
1966	2.10	0.00	0.00	0.00	0.06	0.08	0.37	0.24	0.29	0.47	0.06	2.10	0.41
1967	0.78	0.05	0.10	0.00	0.56	0.07	0.78	0.20	0.11	0.43	0.09	0.04	0.22
1968	9.00	0.08	0.22	0.04	0.16	0.28	0.10	0.88	9.00	0.61	0.08	0.22	0.00
1969	4.03	0.00	0.00	0.14	0.48	0.63	0.06	4.03	1.06	0.08	0.08	0.09	0.03
1970	7.80	0.00	0.00	0.06	0.64	0.19	0.10	7.80	6.25	0.03	0.07	0.07	0.04
1971	3.57	0.00	0.09	0.00	0.05	0.19	0.83	0.85	3.57	0.09	0.07	0.06	0.15
1972	0.58	0.06	0.02	0.05	0.10	0.13	0.27	0.23	0.47	0.58	0.18	0.09	0.12
1973	1.09	0.05	0.10	0.40	0.11	0.14	0.16	1.09	0.50	0.23	0.36	0.17	0.09
1974	3.39	0.15	0.11	0.15	0.56	3.39	0.50	2.29	0.10	0.15	0.09	0.12	0.05
1975	1.16	0.13	0.28	0.00	0.00	0.24	0.71	0.96	1.16	0.80	0.58	0.13	0.06
1976	0.79	0.06	0.15	0.09	0.17	0.36	0.79	0.15	0.52	0.28	0.05	0.02	0.09
1977	4.04	0.00	0.05	0.19	0.24	0.19	0.91	3.20	3.11	4.04	0.01	0.14	0.10
1978	0.80	0.06	0.00	0.09	0.11	0.20	0.16	0.54	0.23	0.80	0.18	0.08	0.08
1979	5.22	0.04	0.08	0.05	0.09	0.21	2.43	5.22	0.39	0.00	0.07	0.12	0.60
1980	8.70	0.11	0.00	0.18	0.72	0.07	0.17	8.70	0.16	0.21	0.23	0.07	0.08
1981	3.01	0.00	0.05	0.00	0.19	0.09	0.20	0.22	3.01	0.48	0.25	0.10	0.01
1982	4.31	0.07	0.00	0.13	0.13	0.09	0.18	0.19	1.98	4.31	0.16	0.11	0.07
1983	2.76	0.06	0.10	0.13	0.21	0.16	0.07	0.03	2.76	0.14	0.14	0.10	0.08
1984	0.66	0.00	0.10	0.09	0.10	0.16	0.11	0.17	0.66	0.18	0.04	0.12	0.26
1985	2.59	0.00	0.08	0.17	0.13	0.22	0.17	1.90	2.59	0.16	0.07	0.00	0.09
1986	4.92	0.10	0.01	0.06	0.08	0.48	0.15	4.08	4.92	2.62	0.17	0.05	0.09
1987	4.50	0.00	0.00	0.06	0.05	0.12	0.66	2.03	0.12	4.50	0.07	0.37	0.05
1988	3.21	0.03	0.01	0.08	0.13	0.68	0.09	3.21	0.11	0.32	0.14	0.10	0.04
1989	1.14	0.00	0.00	0.00	0.08	0.07	0.78	1.14	0.13	0.52	0.14	0.12	0.00
1990	1.79	0.06	0.09	0.07	0.07	0.13	0.20	0.13	1.79	0.23	0.20	0.09	0.16
1991	2.34	0.03	0.00	0.44	0.32	0.73	0.28	0.55	2.34	0.20	0.06	0.11	0.03
1992	2.71	0.06	0.07	0.03	2.12	2.71	0.13	1.19	1.57	1.04	0.12	0.73	0.04
1993	2.09	0.10	0.00	0.00	0.12	0.10	1.15	2.09	0.12	0.09	0.19	0.18	0.00
1994	1.89	0.00	0.00	0.10	0.14	0.27	0.34	1.15	1.89	0.24	0.15	0.00	0.03
1995	4.06	0.48	0.01	0.14	1.04	0.48	0.37	0.26	4.06	0.10	3.74	0.46	0.00
1996	1.69	0.11	0.15	0.00	0.09	0.84	0.24	0.61	0.17	1.69	0.00	0.13	0.09
1997	0.50	0.02	0.11	0.05	0.03	0.50	0.15	0.09	0.33	0.07	0.11	0.10	0.06
1998	0.87	0.10	0.00	0.11	0.30	0.51	0.00	0.14	0.05	0.87	0.10	0.13	0.00
1999	2.24	0.00	0.00	0.00	0.05	0.08	0.13	0.57	0.96	2.24	0.95	0.00	0.00
2000	3.05	0.00	0.00	0.00	0.56	3.05	1.25	0.11	0.30	0.15	0.02	0.00	0.00
2001	0.33	0.00	0.00	0.00	0.07	0.33	0.20	0.10	0.10	0.12	0.16	0.00	0.00
2002	0.29	0.00	0.00	0.00	0.11	0.17	0.21	0.29	0.01	0.20	0.06	0.00	0.00
2003	1.03	0.00	0.00	0.00	0.15	0.85	0.30	0.68	1.03	0.75	0.21	0.00	0.00
Average	2.65	0.05	0.05	0.08	0.25	0.46	0.46	1.46	1.37	0.78	0.25	0.16	0.08

Table E-4: Proposed (Full Development with SWM Controls) Continuous Annual and Monthly Peak Flows at the Confluence of 14W-W1-2 and 14W-W1-3 (Node E543)

Year	Annual Peak Flow (m^3/s)	Monthly Peak Flow (m^3/s)											
		January	February	March	April	May	June	July	August	September	October	November	December
1960	2.95	0.13	0.10	0.04	0.15	0.15	0.17	2.95	0.33	0.02	0.57	0.13	0.00
1961	1.09	0.00	0.00	0.00	0.21	0.15	1.09	0.35	0.36	0.35	0.04	0.21	0.15
1962	3.22	0.08	0.00	0.00	0.04	0.01	0.95	1.02	0.55	3.22	0.16	0.01	0.10
1963	1.47	0.00	0.00	0.12	0.17	0.22	1.47	0.58	0.19	0.33	0.04	0.19	0.01
1964	1.80	0.14	0.00	0.15	0.19	0.20	0.23	1.80	0.80	0.04	0.16	0.09	0.00
1965	0.74	0.00	0.14	0.00	0.21	0.34	0.35	0.26	0.49	0.18	0.74	0.16	0.11
1966	1.99	0.00	0.00	0.00	0.07	0.09	0.47	0.28	0.38	0.52	0.07	1.99	0.41
1967	0.74	0.07	0.13	0.00	0.59	0.10	0.74	0.23	0.12	0.49	0.09	0.07	0.22
1968	8.41	0.11	0.22	0.07	0.18	0.37	0.13	0.88	8.41	0.51	0.11	0.23	0.00
1969	3.75	0.00	0.00	0.16	0.46	0.61	0.07	3.75	1.01	0.08	0.11	0.13	0.03
1970	7.24	0.00	0.00	0.09	0.60	0.24	0.12	7.24	5.95	0.04	0.07	0.09	0.04
1971	3.37	0.00	0.13	0.00	0.05	0.25	0.78	0.82	3.37	0.10	0.10	0.07	0.21
1972	0.56	0.07	0.02	0.06	0.13	0.16	0.35	0.30	0.51	0.56	0.21	0.13	0.14
1973	1.18	0.06	0.14	0.38	0.16	0.17	0.21	1.18	0.48	0.30	0.42	0.20	0.14
1974	3.15	0.20	0.14	0.19	0.54	3.15	0.53	2.66	0.10	0.19	0.09	0.16	0.05
1975	1.21	0.18	0.31	0.00	0.00	0.25	0.66	0.98	1.21	0.75	0.46	0.17	0.07
1976	0.86	0.08	0.21	0.13	0.20	0.45	0.86	0.19	0.62	0.28	0.08	0.02	0.09
1977	3.84	0.00	0.07	0.19	0.30	0.24	0.89	3.07	2.96	3.84	0.02	0.17	0.10
1978	0.74	0.09	0.00	0.09	0.14	0.24	0.18	0.61	0.50	0.74	0.23	0.09	0.12
1979	4.93	0.06	0.10	0.08	0.12	0.27	2.39	4.93	0.47	0.01	0.10	0.17	0.59
1980	8.26	0.13	0.00	0.19	0.69	0.10	0.21	8.26	0.19	0.23	0.30	0.08	0.12
1981	2.84	0.00	0.06	0.01	0.25	0.13	0.46	0.23	2.84	0.47	0.26	0.15	0.02
1982	4.07	0.10	0.00	0.15	0.17	0.10	0.22	0.23	1.97	4.07	0.19	0.14	0.11
1983	2.65	0.08	0.13	0.16	0.22	0.21	0.08	0.04	2.65	0.20	0.18	0.14	0.11
1984	0.70	0.00	0.14	0.13	0.15	0.20	0.13	0.22	0.70	0.20	0.04	0.16	0.36
1985	2.51	0.00	0.13	0.19	0.18	0.28	0.20	1.67	2.51	0.20	0.10	0.00	0.10
1986	4.72	0.13	0.01	0.07	0.12	0.47	0.20	3.93	4.72	2.58	0.21	0.07	0.13
1987	4.17	0.00	0.00	0.08	0.07	0.12	0.64	2.35	0.17	4.17	0.09	0.38	0.08
1988	3.06	0.04	0.02	0.10	0.14	0.53	0.10	3.06	0.12	0.41	0.18	0.12	0.04
1989	1.15	0.00	0.00	0.00	0.08	0.07	0.73	1.15	0.13	0.50	0.15	0.16	0.00
1990	2.24	0.07	0.13	0.10	0.10	0.19	0.29	0.17	2.24	0.28	0.24	0.13	0.18
1991	2.20	0.03	0.00	0.43	0.42	0.72	0.33	0.52	2.20	0.25	0.07	0.13	0.04
1992	2.55	0.06	0.09	0.04	1.98	2.55	0.15	1.33	1.28	0.98	0.15	0.71	0.06
1993	1.99	0.14	0.00	0.00	0.17	0.14	1.36	1.99	0.16	0.10	0.25	0.19	0.00
1994	1.41	0.00	0.00	0.11	0.19	0.35	0.43	1.16	1.41	0.32	0.18	0.00	0.04
1995	3.80	0.47	0.01	0.19	0.97	0.46	0.46	0.40	3.80	0.10	3.59	0.45	0.00
1996	1.48	0.14	0.17	0.00	0.13	0.80	0.47	0.52	0.20	1.48	0.00	0.13	0.13
1997	0.48	0.02	0.15	0.05	0.04	0.48	0.20	0.10	0.39	0.09	0.16	0.14	0.07
1998	0.88	0.15	0.00	0.11	0.34	0.51	0.00	0.15	0.07	0.88	0.11	0.16	0.00
1999	2.09	0.00	0.00	0.00	0.08	0.10	0.18	0.60	0.91	2.09	0.89	0.00	0.00
2000	2.90	0.00	0.00	0.00	0.54	2.90	1.19	0.11	0.37	0.21	0.03	0.00	0.00
2001	0.34	0.00	0.00	0.00	0.09	0.34	0.25	0.12	0.12	0.15	0.17	0.00	0.00
2002	0.46	0.00	0.00	0.00	0.16	0.23	0.46	0.38	0.01	0.21	0.08	0.00	0.00
2003	0.97	0.00	0.00	0.00	0.17	0.81	0.38	0.67	0.97	0.71	0.25	0.00	0.00
Average	2.53	0.06	0.06	0.09	0.27	0.46	0.49	1.44	1.34	0.76	0.27	0.18	0.09
Difference from Existing	-0.13	0.01	0.01	0.01	0.02	0.01	0.04	-0.01	-0.03	-0.02	0.01	0.02	0.02

Table E-5: Existing Continuous Annual and Monthly Peak Flows at the Outlet of Tributary 14W-W1 (Node E153)

Year	Annual Peak Flow (m^3/s)	Monthly Peak Flow (m^3/s)											
		January	February	March	April	May	June	July	August	September	October	November	December
1960	3.60	0.09	0.08	0.03	0.12	0.10	0.12	3.60	0.22	0.00	0.69	0.10	0.00
1961	1.35	0.00	0.00	0.00	0.16	0.11	1.35	0.28	0.25	0.27	0.02	0.17	0.10
1962	3.92	0.06	0.00	0.00	0.02	0.00	1.17	1.25	0.63	3.92	0.12	0.00	0.07
1963	1.90	0.00	0.00	0.08	0.13	0.19	1.90	0.62	0.14	0.30	0.02	0.14	0.00
1964	1.63	0.10	0.00	0.11	0.14	0.17	0.18	1.63	0.92	0.02	0.13	0.07	0.00
1965	0.91	0.00	0.11	0.00	0.15	0.27	0.25	0.20	0.42	0.12	0.91	0.10	0.08
1966	2.38	0.00	0.00	0.00	0.05	0.05	0.41	0.22	0.31	0.49	0.06	2.38	0.47
1967	0.88	0.05	0.11	0.00	0.61	0.07	0.88	0.16	0.08	0.43	0.04	0.05	0.23
1968	9.50	0.09	0.24	0.04	0.15	0.27	0.10	0.96	9.50	0.47	0.08	0.24	0.00
1969	4.55	0.00	0.00	0.11	0.56	0.71	0.05	4.55	1.23	0.06	0.08	0.09	0.02
1970	8.12	0.00	0.00	0.06	0.73	0.15	0.10	8.12	6.64	0.02	0.04	0.07	0.03
1971	4.13	0.00	0.10	0.00	0.04	0.19	0.96	0.97	4.13	0.08	0.07	0.05	0.15
1972	0.68	0.05	0.01	0.05	0.10	0.09	0.25	0.22	0.50	0.68	0.22	0.09	0.12
1973	1.43	0.04	0.10	0.45	0.11	0.11	0.13	1.43	0.56	0.23	0.40	0.17	0.09
1974	3.79	0.16	0.12	0.16	0.63	3.79	0.54	2.61	0.04	0.13	0.07	0.12	0.03
1975	1.47	0.14	0.31	0.00	0.00	0.28	0.80	1.11	1.47	0.90	0.53	0.13	0.06
1976	0.89	0.07	0.15	0.10	0.13	0.42	0.89	0.14	0.57	0.30	0.05	0.01	0.06
1977	4.45	0.00	0.05	0.21	0.22	0.19	1.07	3.61	3.61	4.45	0.02	0.15	0.08
1978	0.91	0.05	0.00	0.06	0.11	0.15	0.15	0.56	0.22	0.91	0.15	0.07	0.08
1979	5.84	0.05	0.08	0.05	0.09	0.21	2.72	5.84	0.44	0.00	0.07	0.13	0.70
1980	10.02	0.11	0.00	0.21	0.83	0.07	0.16	10.02	0.12	0.21	0.22	0.05	0.07
1981	3.34	0.00	0.04	0.00	0.20	0.09	0.15	0.23	3.34	0.56	0.29	0.11	0.01
1982	4.75	0.07	0.00	0.13	0.14	0.07	0.17	0.20	2.14	4.75	0.13	0.11	0.07
1983	3.08	0.06	0.10	0.13	0.24	0.15	0.06	0.02	3.08	0.14	0.14	0.09	0.07
1984	0.71	0.00	0.10	0.09	0.11	0.12	0.10	0.18	0.71	0.18	0.02	0.12	0.27
1985	2.95	0.00	0.08	0.16	0.13	0.21	0.17	2.13	2.95	0.16	0.07	0.00	0.07
1986	5.52	0.10	0.00	0.06	0.09	0.54	0.13	4.69	5.52	2.88	0.15	0.05	0.10
1987	5.05	0.00	0.00	0.06	0.05	0.08	0.74	2.23	0.13	5.05	0.07	0.41	0.05
1988	3.64	0.03	0.01	0.08	0.11	0.61	0.05	3.64	0.10	0.34	0.14	0.10	0.03
1989	1.44	0.00	0.00	0.00	0.06	0.04	0.90	1.44	0.09	0.57	0.10	0.12	0.00
1990	2.05	0.04	0.10	0.07	0.07	0.14	0.16	0.13	2.05	0.20	0.22	0.08	0.17
1991	2.73	0.02	0.00	0.50	0.34	0.78	0.26	0.63	2.73	0.17	0.05	0.10	0.02
1992	2.97	0.04	0.07	0.03	2.48	2.97	0.13	1.62	1.81	1.20	0.13	0.83	0.04
1993	2.30	0.11	0.00	0.00	0.12	0.09	1.65	2.30	0.13	0.07	0.18	0.20	0.00
1994	1.74	0.00	0.00	0.10	0.15	0.24	0.39	1.43	1.74	0.24	0.15	0.00	0.02
1995	4.33	0.56	0.00	0.15	1.20	0.53	0.41	0.28	4.33	0.05	4.21	0.54	0.00
1996	1.65	0.12	0.12	0.00	0.10	0.96	0.24	0.59	0.13	1.65	0.00	0.11	0.09
1997	0.58	0.01	0.10	0.03	0.03	0.58	0.12	0.06	0.38	0.07	0.12	0.10	0.06
1998	0.96	0.10	0.00	0.07	0.32	0.60	0.00	0.11	0.04	0.96	0.08	0.12	0.00
1999	2.47	0.00	0.00	0.00	0.06	0.08	0.13	0.59	1.07	2.47	1.09	0.00	0.00
2000	3.38	0.00	0.00	0.00	0.63	3.38	1.47	0.09	0.32	0.15	0.01	0.00	0.00
2001	0.39	0.00	0.00	0.00	0.05	0.39	0.19	0.09	0.11	0.12	0.18	0.00	0.00
2002	0.27	0.00	0.00	0.00	0.11	0.18	0.19	0.27	0.00	0.23	0.06	0.00	0.00
2003	1.17	0.00	0.00	0.00	0.12	0.98	0.31	0.77	1.17	0.87	0.21	0.00	0.00
Average	2.95	0.05	0.05	0.08	0.27	0.49	0.51	1.63	1.50	0.84	0.27	0.17	0.08

Table E-6: Proposed (Full Development with SWM Controls) Continuous Annual and Monthly Peak Flows at the Outlet of Tributary 14W-W1 (Node E153)

Year	Annual Peak Flow (m^3/s)	Monthly Peak Flow (m^3/s)											
		January	February	March	April	May	June	July	August	September	October	November	December
1960	3.32	0.13	0.11	0.04	0.16	0.14	0.17	3.32	0.32	0.00	0.66	0.14	0.00
1961	1.29	0.00	0.00	0.00	0.22	0.15	1.29	0.37	0.38	0.35	0.03	0.22	0.14
1962	3.72	0.08	0.00	0.00	0.03	0.00	1.12	1.22	0.62	3.72	0.17	0.01	0.10
1963	1.79	0.00	0.00	0.13	0.18	0.24	1.79	0.67	0.19	0.36	0.03	0.16	0.01
1964	1.57	0.14	0.00	0.15	0.18	0.21	0.23	1.57	0.93	0.03	0.16	0.09	0.00
1965	0.85	0.00	0.15	0.00	0.18	0.36	0.35	0.27	0.53	0.18	0.85	0.16	0.12
1966	2.19	0.00	0.00	0.00	0.07	0.08	0.50	0.24	0.34	0.58	0.07	2.19	0.46
1967	0.85	0.07	0.14	0.00	0.68	0.10	0.85	0.24	0.10	0.54	0.05	0.07	0.25
1968	8.75	0.11	0.25	0.07	0.18	0.38	0.14	1.05	8.75	0.57	0.12	0.26	0.00
1969	4.26	0.00	0.00	0.13	0.52	0.68	0.06	4.26	1.17	0.07	0.10	0.14	0.02
1970	7.59	0.00	0.00	0.09	0.68	0.22	0.13	7.59	6.22	0.02	0.05	0.09	0.03
1971	3.88	0.00	0.14	0.00	0.05	0.25	0.90	0.92	3.88	0.10	0.10	0.06	0.22
1972	0.64	0.07	0.01	0.06	0.13	0.13	0.35	0.32	0.51	0.64	0.23	0.13	0.16
1973	1.35	0.06	0.14	0.43	0.16	0.15	0.21	1.35	0.53	0.32	0.47	0.21	0.14
1974	3.49	0.21	0.15	0.20	0.61	3.49	0.61	2.52	0.05	0.18	0.08	0.16	0.04
1975	1.42	0.18	0.35	0.00	0.00	0.29	0.76	1.17	1.42	0.86	0.52	0.17	0.08
1976	0.99	0.09	0.23	0.12	0.14	0.48	0.99	0.18	0.71	0.31	0.08	0.02	0.07
1977	4.14	0.00	0.07	0.21	0.26	0.26	1.03	3.43	3.43	4.14	0.03	0.18	0.10
1978	0.83	0.09	0.00	0.07	0.15	0.21	0.19	0.68	0.31	0.83	0.22	0.10	0.12
1979	5.45	0.07	0.11	0.08	0.13	0.26	2.64	5.45	0.51	0.00	0.10	0.17	0.67
1980	9.33	0.15	0.00	0.22	0.78	0.11	0.22	9.33	0.14	0.27	0.32	0.07	0.12
1981	3.10	0.00	0.06	0.00	0.26	0.14	0.22	0.26	3.10	0.53	0.29	0.15	0.01
1982	4.42	0.09	0.00	0.16	0.18	0.09	0.22	0.24	2.02	4.42	0.19	0.15	0.11
1983	2.92	0.08	0.13	0.16	0.24	0.21	0.08	0.03	2.92	0.21	0.19	0.13	0.11
1984	0.80	0.00	0.15	0.13	0.16	0.18	0.14	0.24	0.80	0.21	0.03	0.18	0.36
1985	2.82	0.00	0.13	0.19	0.18	0.26	0.20	2.07	2.82	0.21	0.10	0.00	0.09
1986	5.21	0.13	0.00	0.07	0.13	0.53	0.19	4.38	5.21	2.79	0.19	0.07	0.14
1987	4.69	0.00	0.00	0.08	0.07	0.08	0.71	2.17	0.18	4.69	0.09	0.45	0.08
1988	3.44	0.04	0.01	0.10	0.12	0.60	0.05	3.44	0.11	0.44	0.20	0.12	0.04
1989	1.41	0.00	0.00	0.00	0.08	0.07	0.83	1.41	0.12	0.57	0.14	0.17	0.00
1990	1.97	0.06	0.13	0.10	0.10	0.20	0.23	0.17	1.97	0.23	0.27	0.13	0.20
1991	2.53	0.03	0.00	0.49	0.45	0.85	0.32	0.59	2.53	0.23	0.06	0.13	0.03
1992	2.76	0.05	0.09	0.04	2.38	2.76	0.15	1.52	1.67	1.12	0.16	0.79	0.07
1993	2.15	0.15	0.00	0.00	0.18	0.14	1.63	2.15	0.17	0.09	0.26	0.21	0.00
1994	1.63	0.00	0.00	0.12	0.20	0.33	0.46	1.42	1.63	0.33	0.19	0.00	0.04
1995	4.27	0.54	0.00	0.21	1.12	0.54	0.50	0.38	4.27	0.05	3.97	0.50	0.00
1996	1.59	0.15	0.15	0.00	0.14	0.92	0.31	0.58	0.15	1.59	0.00	0.12	0.14
1997	0.54	0.02	0.14	0.04	0.04	0.54	0.16	0.07	0.43	0.08	0.17	0.16	0.07
1998	1.03	0.15	0.00	0.08	0.39	0.57	0.00	0.13	0.07	1.03	0.10	0.15	0.00
1999	2.29	0.00	0.00	0.00	0.09	0.10	0.18	0.69	1.04	2.29	1.00	0.00	0.00
2000	3.18	0.00	0.00	0.00	0.60	3.18	1.37	0.12	0.41	0.22	0.01	0.00	0.00
2001	0.38	0.00	0.00	0.00	0.07	0.38	0.27	0.11	0.13	0.16	0.19	0.00	0.00
2002	0.40	0.00	0.00	0.00	0.16	0.24	0.24	0.40	0.00	0.23	0.09	0.00	0.00
2003	1.09	0.00	0.00	0.00	0.13	0.93	0.41	0.76	1.09	0.82	0.26	0.00	0.00
Average	2.78	0.07	0.06	0.09	0.29	0.50	0.53	1.58	1.45	0.83	0.28	0.19	0.10
Difference from Existing	-0.17	0.01	0.01	0.01	0.02	0.01	0.03	-0.05	-0.05	-0.01	0.02	0.02	0.02

Table E-7: Existing Continuous Annual and Monthly Peak Flows at the QEW crossing of Fourteen Mile Creek (Node J4232.339)

Year	Annual Peak Flow (m^3/s)	Monthly Peak Flow (m^3/s)											
		January	February	March	April	May	June	July	August	September	October	November	December
1960	39.20	1.49	0.55	0.21	0.82	0.94	1.46	39.20	2.24	0.14	8.40	1.27	0.02
1961	15.72	0.00	0.00	0.00	3.02	0.77	15.72	5.04	2.82	2.39	0.36	1.77	0.82
1962	29.29	0.44	0.00	0.01	0.37	0.08	13.25	10.13	8.32	29.29	1.17	0.20	0.61
1963	18.20	0.00	0.00	0.60	1.11	3.65	18.20	8.16	1.44	3.84	0.26	1.29	0.12
1964	22.05	0.73	0.03	0.82	1.04	1.19	1.46	22.05	15.55	0.32	0.98	0.57	0.01
1965	13.39	0.00	2.96	0.00	1.37	2.42	2.60	2.15	4.37	0.98	13.39	1.06	0.77
1966	27.02	0.00	0.00	0.00	0.47	0.70	5.28	1.85	4.33	5.69	0.48	27.02	6.28
1967	12.35	0.41	0.74	0.00	8.64	0.48	12.35	2.92	0.89	4.97	0.73	0.47	4.46
1968	81.50	0.58	4.51	0.43	1.14	2.90	1.49	9.26	81.50	5.06	0.53	4.62	0.10
1969	43.78	0.00	0.00	1.02	8.48	11.85	0.48	43.78	13.96	0.57	0.63	0.91	0.33
1970	70.76	0.00	0.00	0.61	10.53	1.59	0.71	70.76	51.58	0.38	0.73	0.48	0.32
1971	32.12	0.03	0.95	0.02	0.45	1.39	13.95	10.34	32.12	0.83	0.53	0.58	2.61
1972	10.27	0.44	0.24	0.40	0.69	1.19	2.62	2.07	5.22	10.27	4.60	0.74	3.86
1973	15.00	0.38	0.71	6.57	1.10	1.23	1.38	15.00	8.49	2.18	5.10	2.16	0.80
1974	33.36	1.69	0.84	3.48	8.45	33.36	7.86	21.89	0.82	1.19	0.69	0.85	0.47
1975	20.93	0.94	4.53	0.05	0.00	6.09	11.15	9.38	20.93	12.28	8.23	1.25	0.40
1976	7.18	0.45	1.55	0.66	1.36	6.49	7.18	1.10	4.98	5.92	0.51	0.13	0.70
1977	42.59	0.00	0.36	4.48	2.04	2.60	10.78	26.29	30.60	42.59	0.21	2.41	0.73
1978	11.48	0.48	0.00	0.65	0.77	1.50	1.14	5.42	2.06	11.48	1.47	0.56	0.70
1979	42.53	0.30	0.57	0.51	0.66	1.91	20.73	42.53	5.97	0.05	0.75	0.96	7.75
1980	127.73	0.90	0.01	4.04	11.26	0.64	2.96	127.73	1.32	4.56	2.25	0.60	1.07
1981	29.47	0.00	0.38	0.05	1.92	1.00	1.51	3.76	29.47	7.01	5.87	0.83	0.13
1982	48.17	0.53	0.01	0.93	2.07	0.73	3.19	1.41	24.48	48.17	1.15	0.89	0.65
1983	24.13	0.46	0.69	0.88	5.03	2.02	0.52	0.33	24.13	1.93	2.18	1.60	0.60
1984	6.50	0.00	1.56	0.61	1.42	2.07	0.92	3.56	6.50	3.94	0.33	3.10	2.38
1985	31.14	0.00	0.93	1.18	0.95	2.07	1.21	18.64	31.14	4.01	0.53	0.00	0.68
1986	62.87	0.69	0.11	0.43	0.73	5.75	1.19	53.37	62.87	33.26	1.22	0.51	1.29
1987	37.47	0.00	0.04	0.47	0.39	0.92	9.62	22.18	1.10	37.47	0.56	7.70	0.38
1988	27.17	0.24	0.09	0.57	0.99	8.04	0.82	27.17	0.86	6.33	1.83	0.70	0.28
1989	12.23	0.00	0.01	0.01	0.72	0.67	12.05	12.23	1.07	7.51	1.13	2.06	0.01
1990	16.77	0.50	3.27	0.55	0.50	1.81	1.68	0.96	16.77	1.68	4.00	1.03	4.97
1991	33.54	0.22	0.03	5.71	3.95	7.91	2.52	9.10	33.54	1.58	0.49	0.84	0.25
1992	29.29	0.43	0.48	0.23	27.02	29.29	0.90	17.66	23.15	14.46	0.85	8.60	0.42
1993	23.27	1.01	0.00	0.00	1.27	0.69	10.26	23.27	0.84	0.68	1.90	3.70	0.06
1994	16.13	0.00	0.00	0.74	1.16	2.39	3.66	12.39	16.13	2.20	1.04	0.00	0.26
1995	56.37	8.46	0.06	2.88	15.61	8.48	6.25	3.50	34.82	0.83	56.37	7.59	0.03
1996	24.29	0.93	1.11	0.01	0.85	12.25	3.09	7.94	1.38	24.29	0.03	0.94	1.68
1997	7.87	0.15	0.78	0.36	0.27	7.87	1.34	0.77	6.86	0.58	0.95	2.29	0.47
1998	9.38	1.05	0.00	0.85	3.91	9.38	0.00	1.16	0.52	8.64	0.85	0.90	0.01
1999	27.91	0.00	0.00	0.00	0.74	0.62	1.43	5.78	13.54	27.91	15.34	0.00	0.00
2000	37.94	0.00	0.00	0.00	8.77	37.94	17.67	0.81	4.56	1.28	0.19	0.00	0.00
2001	6.56	0.00	0.00	0.00	0.67	6.56	2.26	0.85	0.78	0.90	4.36	0.00	0.00
2002	5.05	0.00	0.00	0.00	1.07	1.36	1.64	2.98	0.08	5.05	0.45	0.01	0.00
2003	14.54	0.00	0.00	0.00	1.27	14.54	3.47	8.69	14.49	13.58	1.52	0.00	0.00
Average	29.65	0.54	0.64	0.93	3.30	5.62	5.45	16.26	14.74	9.05	3.53	2.12	1.08

Table E-8: Proposed (Full Development with SWM Controls) Continuous Annual and Monthly Peak Flows at the QEW crossing of Fourteen Mile Creek (Node J4232.339)

Year	Annual Peak Flow (m^3/s)	Monthly Peak Flow (m^3/s)											
		January	February	March	April	May	June	July	August	September	October	November	December
1960	39.17	1.59	0.55	0.21	0.83	0.94	1.54	39.17	2.39	0.14	8.44	1.35	0.03
1961	15.65	0.00	0.00	0.00	3.11	0.77	15.65	5.13	2.84	2.40	0.36	1.85	0.89
1962	29.21	0.44	0.00	0.01	0.38	0.08	13.27	10.18	8.39	29.21	1.19	0.20	0.73
1963	18.19	0.00	0.00	0.62	1.16	3.50	18.19	8.21	1.56	3.94	0.26	1.29	0.12
1964	22.20	0.81	0.03	0.82	1.04	1.19	1.60	22.20	15.50	0.32	0.98	0.57	0.01
1965	13.27	0.00	3.08	0.00	1.37	2.42	2.64	2.16	4.47	1.01	13.27	1.17	0.91
1966	26.87	0.00	0.00	0.00	0.48	0.71	5.36	1.85	4.43	5.77	0.48	26.87	6.32
1967	12.36	0.41	0.74	0.00	8.74	0.55	12.36	3.01	0.89	5.08	0.73	0.58	4.57
1968	81.44	0.58	4.60	0.51	1.14	2.91	1.60	9.35	81.44	5.15	0.53	4.74	0.11
1969	43.77	0.00	0.00	1.02	8.47	11.76	0.50	43.77	13.96	0.57	0.71	1.01	0.33
1970	75.85	0.00	0.00	0.78	10.48	1.59	0.85	75.85	51.94	0.38	0.73	0.48	0.32
1971	32.05	0.03	1.10	0.02	0.45	1.42	13.84	10.39	32.05	0.83	0.53	0.58	2.71
1972	10.26	0.45	0.24	0.40	0.69	1.21	2.62	2.08	5.30	10.26	4.65	0.75	3.99
1973	14.99	0.38	0.74	6.62	1.11	1.25	1.42	14.99	8.50	2.28	5.19	2.26	0.83
1974	33.24	1.78	0.97	3.59	8.52	33.24	7.86	21.65	0.82	1.21	0.70	0.90	0.47
1975	20.90	0.94	4.63	0.07	0.00	6.14	11.12	9.45	20.90	12.28	8.24	1.41	0.41
1976	7.28	0.45	1.65	0.66	1.36	6.51	7.28	1.11	4.98	6.01	0.54	0.14	0.70
1977	42.50	0.00	0.36	4.55	2.04	2.68	10.80	26.22	30.44	42.50	0.25	2.52	0.73
1978	11.46	0.50	0.00	0.65	0.77	1.50	1.14	5.51	2.06	11.46	1.48	0.58	0.75
1979	42.50	0.31	0.57	0.55	0.74	1.91	20.64	42.50	6.05	0.05	0.84	1.01	7.83
1980	126.82	1.14	0.01	4.09	11.21	0.77	3.04	126.82	1.32	4.65	2.35	0.61	1.15
1981	29.37	0.00	0.39	0.06	2.05	1.06	1.51	3.88	29.37	7.04	5.89	0.88	0.13
1982	47.92	0.54	0.01	0.93	2.14	0.73	3.28	1.41	24.47	47.92	1.17	0.93	0.68
1983	24.06	0.54	0.69	0.94	5.11	2.12	0.52	0.33	24.06	2.04	2.28	1.71	0.67
1984	6.59	0.00	1.70	0.66	1.54	2.18	0.93	3.65	6.59	4.03	0.33	3.19	2.38
1985	31.04	0.00	1.02	1.19	0.95	2.08	1.21	18.56	31.04	4.10	0.56	0.00	0.69
1986	62.76	0.69	0.11	0.43	0.78	5.83	1.23	53.04	62.76	32.84	1.22	0.57	1.37
1987	37.24	0.00	0.04	0.47	0.42	0.92	9.60	21.98	1.10	37.24	0.57	7.78	0.39
1988	27.02	0.26	0.09	0.58	0.99	8.11	0.83	27.02	0.86	6.38	1.93	0.76	0.28
1989	12.27	0.00	0.01	0.01	0.72	0.67	12.01	12.27	1.07	7.60	1.18	2.16	0.01
1990	16.78	0.50	3.38	0.57	0.51	1.90	1.69	0.97	16.78	1.68	4.08	1.13	5.07
1991	33.29	0.22	0.03	5.78	4.06	7.96	2.53	9.10	33.29	1.60	0.49	0.84	0.27
1992	29.22	0.43	0.48	0.24	27.08	29.22	0.90	17.53	23.22	14.37	0.85	8.63	0.49
1993	23.18	1.10	0.00	0.00	1.30	0.70	10.35	23.18	1.01	0.68	2.01	3.75	0.06
1994	16.06	0.00	0.00	0.74	1.20	2.39	3.75	12.44	16.06	2.43	1.04	0.00	0.27
1995	56.22	8.43	0.06	2.98	15.54	8.54	6.32	3.59	34.68	0.83	56.22	7.61	0.03
1996	24.29	1.07	1.11	0.02	0.89	12.24	3.16	8.00	1.38	24.29	0.04	0.94	1.80
1997	7.91	0.16	0.87	0.36	0.27	7.91	1.34	0.77	6.93	0.58	1.09	2.39	0.47
1998	9.35	1.13	0.00	0.85	4.02	9.35	0.01	1.16	0.57	8.73	0.85	0.90	0.01
1999	27.76	0.00	0.00	0.00	0.86	0.68	1.52	5.87	13.55	27.76	15.26	0.00	0.00
2000	37.95	0.00	0.00	0.00	8.85	37.95	17.65	0.81	4.63	1.32	0.19	0.00	0.00
2001	6.57	0.00	0.00	0.00	0.68	6.57	2.36	0.86	0.85	0.91	4.45	0.00	0.00
2002	5.14	0.00	0.00	0.00	1.12	1.36	1.64	2.99	0.08	5.14	0.45	0.01	0.00
2003	14.48	0.00	0.00	0.00	1.27	14.48	3.56	8.76	14.45	13.47	1.52	0.01	0.00
Average	29.69	0.57	0.66	0.95	3.33	5.64	5.48	16.36	14.75	9.06	3.55	2.16	1.11
Difference from Existing	0.04	0.02	0.03	0.02	0.03	0.01	0.03	0.09	0.01	0.00	0.02	0.04	0.03

Table E-9: Existing Continuous Annual and Monthly Volumes at the Downstream Side of Bronte Road in 14W-W1-3 (Node E649)

Year	Annual Volume (m^3)	Monthly Volume (m^3)											
		January	February	March	April	May	June	July	August	September	October	November	December
1960	25,559	1,014	818	152	1,372	988	1,375	14,109	1,061	62	2,962	1,646	0
1961	16,964	0	0	0	2,028	1,798	6,177	2,471	1,291	1,101	192	1,363	543
1962	33,373	526	0	7	192	62	4,248	5,383	4,266	16,103	1,857	64	665
1963	19,043	0	0	862	1,080	2,080	5,585	4,476	1,380	1,509	135	1,891	45
1964	29,991	1,232	10	460	1,590	942	1,004	10,270	12,707	169	1,185	422	0
1965	21,095	0	1,376	0	1,553	1,118	1,056	1,691	2,168	1,398	7,349	2,166	1,220
1966	26,440	0	0	0	464	760	2,864	345	2,404	1,852	420	12,124	5,207
1967	22,045	310	352	0	3,758	1,059	8,393	1,718	863	2,536	188	963	1,905
1968	60,243	738	1,657	508	783	2,785	1,398	3,355	42,941	2,892	536	2,650	0
1969	40,268	0	0	715	5,657	6,774	593	18,880	4,498	289	885	1,853	124
1970	51,952	0	0	714	4,638	1,353	835	20,255	22,744	199	306	805	103
1971	32,116	22	1,320	3	361	631	6,031	5,516	14,093	742	895	355	2,147
1972	23,335	174	68	495	937	650	3,129	852	3,825	5,161	4,671	1,517	1,856
1973	30,527	443	595	5,678	1,489	2,060	1,474	4,635	2,767	1,579	5,797	2,902	1,108
1974	44,047	957	655	1,367	3,719	19,101	6,329	7,783	176	1,119	438	2,050	353
1975	36,228	1,181	1,848	0	0	2,497	4,321	2,633	14,141	4,325	3,392	1,104	786
1976	21,365	270	1,522	1,396	1,319	6,322	2,767	1,804	1,906	2,621	1,000	139	299
1977	52,247	0	380	2,203	1,986	705	5,314	10,413	11,100	16,333	20	2,261	1,532
1978	21,134	856	0	356	1,707	1,675	523	1,614	1,603	9,297	1,483	1,149	871
1979	38,565	240	313	1,036	1,607	2,686	6,830	11,891	3,071	23	1,929	2,635	6,304
1980	76,671	876	5	2,467	7,003	1,301	2,293	56,083	801	1,576	2,612	519	1,135
1981	31,398	0	903	8	1,182	1,190	1,607	1,748	12,293	6,069	4,749	1,498	151
1982	44,400	346	14	971	1,036	983	3,384	645	13,832	18,006	993	2,501	1,689
1983	27,441	570	1,019	1,325	2,531	2,554	697	209	11,759	1,509	2,005	2,240	1,023
1984	18,070	0	1,251	947	1,318	3,250	1,162	1,942	2,410	2,187	388	2,276	939
1985	37,911	0	934	507	580	1,828	893	9,509	20,368	1,796	1,157	0	339
1986	100,182	399	35	458	1,263	3,253	1,324	20,238	37,397	32,741	1,371	660	1,043
1987	39,433	2	12	856	963	535	4,335	12,915	1,333	12,421	1,029	4,385	647
1988	22,810	436	69	411	1,196	2,394	449	10,650	712	3,069	1,707	1,586	131
1989	22,240	0	5	26	751	1,224	5,754	6,795	913	2,255	2,146	2,371	0
1990	23,560	619	1,492	539	1,107	2,304	1,549	1,649	7,230	973	2,904	927	2,267
1991	34,418	151	27	3,552	3,892	4,812	608	4,525	13,473	1,422	965	684	307
1992	70,612	355	581	244	12,985	12,193	690	8,739	18,592	8,831	1,397	5,441	564
1993	30,460	1,283	0	3	1,645	1,046	8,183	12,319	893	738	1,899	2,451	0
1994	17,979	0	0	351	2,064	2,117	1,582	4,272	5,129	1,259	674	3	528
1995	81,843	10,772	28	1,242	6,007	3,653	2,346	1,489	23,138	432	27,710	5,013	13
1996	45,955	1,335	327	9	1,977	7,834	2,988	5,952	1,058	21,910	0	560	2,005
1997	14,115	286	1,753	139	441	3,055	1,056	539	3,404	1,002	823	1,207	410
1998	14,901	1,304	0	185	2,305	5,929	1	957	594	2,040	787	794	5
1999	27,514	0	0	0	708	879	1,654	1,645	4,091	11,223	7,314	0	0
2000	42,645	0	0	0	3,536	17,555	17,568	522	1,333	1,868	263	0	0
2001	13,214	0	0	0	716	4,376	1,474	615	794	1,176	4,061	2	0
2002	10,425	0	0	0	2,272	2,128	1,249	1,487	85	2,343	858	3	0
2003	34,413	0	0	0	392	9,498	1,892	3,401	4,594	13,435	1,201	0	0
Average	34,753	607	440	686	2,139	3,453	3,068	6,794	7,619	4,991	2,378	1,709	870

Table E-10: Proposed (Full Development with SWM Controls) Continuous Annual and Monthly Volumes at the Downstream Side of Bronte Road in 14W-W1-3 (Node E649)

Year	Annual Volume (m^3)	Monthly Volume (m^3)											
		January	February	March	April	May	June	July	August	September	October	November	December
1960	45,328	2,639	2,153	302	2,940	3,090	3,538	18,606	2,588	137	4,697	4,631	7
1961	35,551	0	0	0	4,909	4,462	9,357	5,246	3,291	2,797	487	3,571	1,431
1962	52,269	1,387	3	16	481	128	6,378	8,608	7,552	21,185	4,501	275	1,756
1963	37,046	0	0	2,264	2,521	5,257	7,385	7,504	3,185	3,539	200	5,042	149
1964	51,763	3,223	44	1,209	4,067	2,470	2,538	14,615	18,985	433	3,059	1,117	2
1965	46,652	0	3,189	0	3,993	2,777	2,602	4,241	5,131	3,467	12,523	5,624	3,106
1966	47,144	0	0	0	1,182	1,961	6,404	826	5,347	3,971	1,098	17,528	8,828
1967	46,324	814	933	0	7,532	2,765	15,057	4,101	2,163	5,576	495	2,541	4,346
1968	88,036	1,933	3,117	1,323	1,984	7,147	3,421	5,262	49,402	6,657	1,398	6,370	21
1969	60,653	0	0	1,854	8,854	9,994	1,492	23,263	6,994	742	2,287	4,856	316
1970	70,343	0	0	1,881	7,394	3,385	1,967	20,913	30,133	1,488	799	2,098	285
1971	53,656	57	3,455	20	910	1,646	9,134	8,883	18,854	1,891	2,320	925	5,561
1972	48,972	458	174	1,298	2,421	1,606	7,554	2,286	6,589	8,455	9,788	3,963	4,380
1973	62,778	1,156	1,571	10,809	3,867	5,117	3,557	6,838	4,017	4,027	11,069	7,823	2,926
1974	70,642	2,453	1,713	2,885	7,444	24,889	10,806	9,667	447	2,870	1,143	5,397	928
1975	58,862	3,089	4,030	5	0	4,999	7,038	4,495	17,534	6,964	5,779	2,791	2,139
1976	46,435	711	3,939	2,982	3,648	10,621	6,255	4,423	4,485	5,602	2,594	400	774
1977	84,626	0	993	4,462	5,178	1,719	9,902	13,174	17,109	21,961	286	5,799	4,042
1978	42,857	2,263	3	913	4,483	4,224	1,336	3,328	3,954	13,933	4,037	3,026	1,357
1979	68,245	634	812	2,679	4,222	6,877	10,352	14,204	6,015	62	5,053	6,943	10,393
1980	107,122	2,314	14	4,752	11,933	2,934	5,706	62,987	1,928	3,686	6,543	1,348	2,977
1981	58,807	0	2,322	63	3,002	3,083	3,968	3,809	17,749	10,237	10,228	3,944	403
1982	73,834	913	35	2,460	2,718	2,491	7,594	1,676	18,986	23,434	2,411	6,666	4,451
1983	56,536	1,487	2,688	3,467	4,718	7,316	1,808	511	16,965	3,918	5,120	5,822	2,715
1984	42,576	0	2,943	2,476	3,435	7,372	2,985	4,321	4,790	5,417	1,002	5,382	2,453
1985	60,996	0	2,451	1,312	1,486	4,605	2,129	14,275	26,619	4,226	3,005	0	888
1986	133,828	1,056	94	1,198	3,314	6,483	3,364	25,010	43,168	41,029	4,635	1,735	2,741
1987	61,762	7	31	2,223	2,536	1,292	6,819	17,069	3,211	16,545	2,675	7,623	1,732
1988	42,469	1,064	271	1,076	3,060	3,986	1,108	14,870	1,887	6,210	4,422	4,169	345
1989	42,302	0	14	63	1,938	3,029	9,730	9,900	2,326	4,078	5,052	6,165	8
1990	52,384	1,628	3,466	1,402	2,892	5,954	3,664	4,500	12,181	2,357	6,980	2,445	4,914
1991	60,636	397	70	7,068	8,962	8,252	1,497	8,379	17,320	3,603	2,504	1,746	838
1992	105,465	932	1,518	623	18,488	14,825	1,769	14,286	24,699	13,268	3,641	9,977	1,438
1993	53,333	3,384	1	5	4,223	2,588	13,162	15,805	2,279	1,898	4,963	5,018	7
1994	35,960	0	0	895	5,044	5,177	4,024	7,223	7,400	3,252	1,710	17	1,218
1995	114,745	15,921	73	3,176	9,015	7,303	4,283	3,889	28,418	1,097	33,159	8,373	36
1996	76,802	3,515	843	23	5,080	11,660	7,295	9,864	2,623	29,386	13	1,426	5,076
1997	31,024	754	4,593	377	1,145	5,332	2,602	1,319	6,422	2,539	2,157	2,640	1,143
1998	28,437	3,433	0	470	4,403	8,961	21	2,351	1,552	3,126	2,036	2,074	12
1999	42,107	0	0	0	1,767	2,267	4,207	2,173	7,267	13,378	11,047	0	0
2000	63,495	0	0	0	6,757	22,721	24,377	1,308	2,908	4,739	684	1	0
2001	29,045	0	0	0	1,812	8,126	3,649	1,563	2,028	3,050	8,810	7	0
2002	25,032	0	0	0	5,811	5,175	3,163	3,547	217	4,869	2,241	8	0
2003	56,141	0	0	0	937	15,365	5,477	6,024	6,644	18,531	3,162	2	0
Average	58,478	1,310	1,081	1,546	4,375	6,169	5,693	9,480	10,758	7,719	4,587	3,802	1,958
Difference from Existing	23,724	703	641	860	2,236	2,716	2,625	2,686	3,139	2,728	2,208	2,094	1,088

Table E-11: Existing Continuous Annual and Monthly Volumes at the Confluence of 14W-W1-2 and 14W-W1-3 (Node E543)

Year	Annual Volume (m^3)	Monthly Volume (m^3)											
		January	February	March	April	May	June	July	August	September	October	November	December
1960	57,596	2,594	2,158	383	3,463	2,542	3,466	29,633	2,544	148	6,476	4,187	2
1961	39,552	0	0	0	4,973	4,524	13,091	5,710	3,077	2,761	484	3,505	1,426
1962	71,360	1,380	0	7	489	126	8,969	11,220	9,255	33,376	4,608	171	1,758
1963	43,075	0	0	2,235	2,798	5,031	11,081	9,611	3,295	3,648	308	4,951	118
1964	65,598	3,216	41	1,206	4,098	2,422	2,539	21,026	26,469	410	3,065	1,105	1
1965	50,523	0	3,236	0	3,974	2,712	2,605	4,235	5,196	3,559	16,265	5,602	3,141
1966	59,382	0	0	0	1,166	1,937	6,755	825	5,575	4,273	1,077	26,497	11,275
1967	51,658	820	929	0	8,732	2,747	18,670	4,067	2,162	5,966	469	2,538	4,559
1968	126,459	1,936	3,642	1,320	1,983	7,094	3,438	7,068	84,862	7,136	1,386	6,594	1
1969	86,307	0	0	1,861	12,068	14,585	1,467	38,479	9,665	723	2,291	4,846	320
1970	108,084	0	0	1,863	9,980	3,374	2,015	40,184	47,019	474	787	2,111	276
1971	69,412	56	3,447	5	915	1,624	12,818	11,979	27,956	1,881	2,320	923	5,490
1972	54,390	449	173	1,290	2,424	1,649	7,757	2,095	8,058	11,162	10,811	3,971	4,550
1973	70,669	1,147	1,577	12,569	3,826	5,139	3,532	9,674	5,690	3,982	13,154	7,465	2,913
1974	95,411	2,423	1,721	3,066	8,615	39,717	13,657	15,449	414	2,903	1,118	5,397	930
1975	77,577	3,100	4,279	0	0	5,799	9,375	5,720	27,339	9,474	7,569	2,834	2,087
1976	50,380	706	3,938	3,503	3,286	13,548	6,278	4,740	4,483	6,150	2,617	365	767
1977	112,707	0	983	4,959	5,173	1,657	11,989	21,450	22,583	34,041	85	5,755	4,033
1978	48,965	2,256	0	915	4,480	4,226	1,295	3,614	3,955	19,280	3,844	3,031	2,070
1979	86,801	619	812	2,714	4,201	6,838	15,824	23,439	6,450	47	5,056	6,928	13,874
1980	161,020	2,307	11	5,566	15,305	3,124	5,641	112,497	1,993	3,787	6,464	1,343	2,982
1981	70,608	0	2,351	15	2,947	3,103	3,953	4,036	25,903	12,784	11,174	3,947	395
1982	97,953	902	33	2,533	2,585	2,504	7,797	1,634	29,161	37,260	2,526	6,566	4,454
1983	64,617	1,490	2,677	3,480	5,980	6,366	1,785	503	24,910	3,847	5,066	5,810	2,703
1984	43,611	0	3,036	2,477	3,392	7,630	2,991	4,400	5,342	5,433	998	5,488	2,423
1985	84,586	0	2,446	1,312	1,480	4,642	2,130	22,565	41,796	4,315	3,009	6	885
1986	208,987	1,044	90	1,200	3,302	7,409	3,364	41,930	76,394	66,247	3,571	1,727	2,709
1987	85,284	4	28	2,237	2,502	1,316	9,357	27,000	3,332	25,305	2,666	9,841	1,696
1988	51,817	1,125	193	1,073	3,060	5,425	1,103	22,118	1,798	7,031	4,374	4,170	345
1989	50,036	0	9	53	1,940	3,153	12,524	13,718	2,323	4,934	5,373	6,007	2
1990	56,327	1,618	3,611	1,399	2,892	5,931	3,900	4,263	15,449	2,446	7,022	2,432	5,366
1991	76,180	396	69	8,103	9,185	10,356	1,462	10,066	27,821	3,628	2,510	1,772	813
1992	148,299	918	1,518	616	26,866	24,765	1,734	18,696	36,890	18,811	3,623	12,382	1,481
1993	69,075	3,374	0	2	4,235	2,684	17,165	26,866	2,281	1,881	4,985	5,600	1
1994	41,948	0	0	896	5,314	5,236	3,814	9,118	11,297	3,183	1,703	13	1,373
1995	171,138	22,745	72	3,110	12,883	8,339	5,137	3,603	46,684	1,069	56,692	10,771	33
1996	100,560	3,497	848	18	5,162	16,816	7,325	12,192	2,599	45,565	1	1,429	5,107
1997	33,239	747	4,610	363	1,131	6,666	2,621	1,344	7,196	2,556	2,138	2,779	1,089
1998	33,726	3,425	0	477	4,883	12,845	2	2,370	1,541	4,064	2,038	2,071	12
1999	58,939	0	0	0	1,768	2,278	4,196	3,576	8,849	22,908	15,363	0	0
2000	89,937	0	0	0	8,076	35,882	36,225	1,281	3,037	4,766	670	0	0
2001	31,387	0	0	0	1,822	9,818	3,633	1,522	2,027	3,047	9,512	6	0
2002	25,558	0	0	0	5,877	5,146	3,104	3,573	193	5,440	2,217	8	0
2003	74,180	0	0	0	935	20,614	4,574	7,261	9,652	28,009	3,136	0	0
Average	76,248	1,461	1,103	1,655	5,004	7,712	6,867	14,235	15,784	10,675	5,469	4,158	2,124

Table E-12: Proposed (Full Development with SWM Controls) Continuous Annual and Monthly Volumes at the Confluence of 14W-W1-2 and 14W-W1-3 (Node E543)

Year	Annual Volume (m^3)	Monthly Volume (m^3)											
		January	February	March	April	May	June	July	August	September	October	November	December
1960	88,293	5,259	4,347	640	6,266	5,449	6,794	36,028	4,981	256	9,477	8,787	9
1961	69,014	0	0	0	9,782	8,806	18,150	10,053	5,994	5,426	896	7,068	2,838
1962	101,474	2,673	3	19	907	204	12,139	16,904	14,427	41,248	8,969	418	3,563
1963	72,251	0	0	4,427	5,241	9,948	14,074	14,650	6,361	6,778	468	10,047	256
1964	102,071	6,425	73	2,401	8,054	4,779	4,741	29,218	37,487	767	5,965	2,157	3
1965	91,767	0	6,295	0	7,827	5,235	5,062	8,310	9,858	6,801	24,735	11,314	6,330
1966	91,836	0	0	0	2,199	3,772	12,426	1,488	10,246	7,543	2,032	34,591	17,539
1967	90,175	1,541	1,806	0	14,545	5,511	29,268	7,801	4,070	11,204	899	4,994	8,536
1968	172,501	3,819	6,109	2,652	3,816	14,194	6,719	10,585	96,125	13,061	2,719	12,677	25
1969	119,738	0	0	3,711	17,530	19,614	2,742	45,862	13,911	1,401	4,512	9,846	608
1970	138,120	0	0	3,757	14,450	6,538	3,812	44,098	57,477	1,907	1,482	4,072	527
1971	104,266	101	6,889	22	1,686	3,180	17,651	17,348	36,412	3,606	4,491	1,735	11,144
1972	96,520	849	322	2,502	4,785	3,040	15,249	4,230	12,891	16,729	19,241	8,068	8,613
1973	123,740	2,179	3,183	21,096	7,787	10,119	6,832	13,221	7,689	7,927	22,459	15,414	5,835
1974	137,742	4,805	3,430	5,649	14,448	48,077	21,077	19,036	755	5,613	2,145	10,928	1,778
1975	114,597	6,148	7,996	14	0	9,831	13,533	8,497	34,358	13,495	11,136	5,516	4,073
1976	91,183	1,367	7,992	6,317	6,879	21,254	11,788	8,799	8,473	10,884	5,194	742	1,494
1977	165,973	0	1,882	8,669	10,556	3,148	19,392	27,549	31,389	43,346	383	11,458	8,202
1978	84,711	4,524	3	1,754	9,145	8,354	2,454	6,249	7,794	27,180	7,857	6,038	3,360
1979	134,156	1,221	1,558	5,294	8,470	13,653	20,247	27,215	11,225	99	10,149	14,079	20,948
1980	210,480	4,628	22	9,475	23,286	5,839	11,039	123,998	3,669	6,983	12,917	2,596	6,026
1981	115,807	0	4,555	84	5,754	6,144	7,835	7,292	34,797	20,285	20,352	7,947	762
1982	146,004	1,776	61	4,892	5,153	4,829	15,087	3,150	36,876	46,908	4,796	13,552	8,924
1983	110,859	2,975	5,402	6,981	9,980	13,484	3,494	900	32,465	7,719	10,131	11,793	5,534
1984	83,856	0	5,975	4,993	6,824	14,598	5,834	8,207	9,286	10,609	1,881	10,895	4,754
1985	119,811	0	5,034	2,498	2,860	9,043	4,041	27,719	52,845	8,111	5,955	9	1,695
1986	261,875	2,064	164	2,290	6,628	12,900	6,506	48,487	85,026	80,875	8,102	3,412	5,422
1987	120,893	10	52	4,483	5,086	2,365	13,113	33,911	6,409	31,928	5,206	14,998	3,331
1988	82,085	2,137	444	2,090	5,997	7,539	2,068	28,762	3,456	11,871	8,679	8,386	655
1989	82,865	0	20	102	3,679	6,254	18,673	19,242	4,522	7,722	10,363	12,279	10
1990	103,297	3,121	6,668	2,788	5,691	11,938	7,266	8,686	24,144	4,691	13,755	4,952	9,597
1991	117,314	748	125	13,907	17,760	15,784	2,814	16,094	33,276	7,037	4,784	3,384	1,600
1992	206,828	1,774	3,023	1,170	36,869	29,074	3,256	28,123	47,633	25,725	7,305	19,932	2,943
1993	105,066	6,836	1	5	8,465	5,061	25,788	30,923	4,415	3,633	10,003	9,928	9
1994	70,645	0	0	1,700	10,375	10,265	7,683	14,027	14,516	6,234	3,341	27	2,478
1995	224,923	31,787	129	6,143	17,682	14,139	8,351	7,084	55,781	2,000	65,213	16,552	61
1996	151,469	7,093	1,608	44	10,330	23,083	14,411	19,005	4,865	57,975	19	2,807	10,230
1997	60,535	1,424	9,438	695	2,155	10,291	4,986	2,440	12,461	4,898	4,317	5,258	2,170
1998	55,796	7,032	0	891	8,429	17,647	27	4,497	3,072	6,162	3,962	4,061	19
1999	81,629	0	0	0	3,568	4,481	8,238	4,783	13,111	26,796	20,652	0	0
2000	124,553	0	0	0	13,381	44,737	47,969	2,364	5,354	9,461	1,287	1	0
2001	57,005	0	0	0	3,449	15,920	7,068	2,853	3,979	6,060	17,663	12	0
2002	48,996	0	0	0	11,797	10,215	6,084	6,790	364	9,408	4,325	12	0
2003	108,972	0	0	0	1,783	30,658	9,851	11,270	12,842	36,317	6,249	2	0
Average	114,584	2,598	2,150	3,049	8,667	12,068	11,037	18,585	20,843	15,106	9,011	7,562	3,907
Difference from Existing	38,336	1,137	1,047	1,394	3,663	4,356	4,170	4,350	5,059	4,431	3,542	3,405	1,783

Table E-13: Existing Continuous Annual and Monthly Volumes at the Outlet of Tributary 14W-W1 (Node E153)

Year	Annual Volume (m^3)	Monthly Volume (m^3)											
		January	February	March	April	May	June	July	August	September	October	November	December
1960	63,629	2,841	2,341	390	3,517	2,785	3,635	33,489	2,649	118	7,177	4,684	4
1961	42,758	0	0	0	5,334	4,782	14,721	6,006	3,155	2,920	471	3,811	1,558
1962	79,967	1,508	1	2	489	63	10,144	12,596	10,462	37,669	4,897	215	1,923
1963	47,916	0	0	2,391	2,980	5,431	13,237	10,678	3,466	3,901	208	5,491	133
1964	72,879	3,524	42	1,300	4,389	2,539	2,652	23,756	29,842	372	3,286	1,175	2
1965	55,272	0	3,553	0	4,237	2,821	2,751	4,479	5,543	3,667	18,667	6,129	3,425
1966	65,273	0	0	0	1,151	1,984	7,375	857	5,966	4,676	1,121	29,328	12,815
1967	56,453	887	1,006	0	9,607	2,861	20,950	4,276	2,200	6,433	486	2,742	5,004
1968	144,083	2,112	4,092	1,421	2,130	7,559	3,637	7,695	99,208	7,526	1,457	7,242	3
1969	97,406	0	0	2,012	13,693	16,201	1,426	44,346	10,907	744	2,449	5,281	346
1970	121,995	0	0	2,003	11,314	3,554	2,040	45,974	53,293	427	806	2,280	304
1971	77,677	58	3,759	4	951	1,700	14,431	13,504	31,755	1,988	2,482	967	6,077
1972	59,670	485	178	1,374	2,551	1,659	8,237	2,201	8,982	12,479	12,264	4,319	4,942
1973	78,255	1,253	1,713	14,065	4,092	5,363	3,650	11,090	6,476	4,288	14,795	8,292	3,181
1974	107,168	2,621	1,864	3,369	9,523	45,109	15,362	17,828	388	3,058	1,154	5,881	1,010
1975	87,272	3,381	4,819	0	0	6,372	10,631	6,154	31,647	10,523	8,404	2,997	2,344
1976	54,897	765	4,298	3,674	3,622	15,240	6,886	4,878	4,840	6,673	2,778	404	840
1977	127,368	0	1,060	5,485	5,566	1,726	13,318	24,367	25,914	39,052	213	6,241	4,426
1978	53,433	2,464	1	969	4,823	4,483	1,324	3,910	4,138	21,760	4,244	3,281	2,037
1979	97,243	677	890	2,911	4,502	7,308	17,869	27,171	6,987	20	5,445	7,551	15,911
1980	183,698	2,523	6	6,308	17,183	3,252	5,974	130,685	2,062	4,031	6,971	1,438	3,266
1981	78,435	0	2,543	16	3,101	3,242	4,176	4,303	29,537	14,401	12,402	4,290	425
1982	109,115	986	29	2,694	2,772	2,602	8,217	1,719	32,752	42,625	2,626	7,228	4,866
1983	70,511	1,618	2,934	3,752	6,511	6,731	1,833	418	27,825	4,101	5,525	6,304	2,958
1984	46,885	0	3,300	2,689	3,598	8,126	3,138	4,689	5,862	5,821	1,034	5,999	2,629
1985	93,890	0	2,668	1,412	1,545	4,854	2,185	24,426	48,037	4,597	3,206	1	959
1986	237,950	1,142	87	1,267	3,518	8,149	3,503	47,503	87,197	76,873	3,887	1,871	2,953
1987	95,333	3	24	2,414	2,626	1,281	10,449	29,959	3,506	29,506	2,855	10,850	1,860
1988	57,099	1,158	272	1,145	3,224	5,754	1,113	25,289	1,805	7,753	4,691	4,527	367
1989	55,529	0	3	27	2,013	3,129	14,175	15,914	2,444	5,496	5,752	6,573	3
1990	61,099	1,770	3,930	1,488	3,066	6,327	4,037	4,470	17,239	2,550	7,722	2,632	5,868
1991	85,308	429	69	9,004	9,961	11,749	1,488	11,214	32,042	3,922	2,650	1,891	890
1992	170,224	1,005	1,653	639	30,961	28,528	1,776	21,334	43,089	21,641	3,900	14,096	1,603
1993	78,056	3,699	0	1	4,526	2,764	19,588	31,253	2,389	1,986	5,378	6,471	1
1994	45,313	0	0	960	5,576	5,579	4,104	10,220	12,270	3,366	1,814	8	1,415
1995	195,053	26,357	73	3,384	14,632	9,147	5,607	3,806	53,312	1,060	65,435	12,208	32
1996	113,888	3,832	913	8	5,515	19,044	7,694	13,752	2,709	53,290	2	1,544	5,583
1997	35,884	816	5,033	378	1,156	7,399	2,671	1,315	7,922	2,662	2,271	3,049	1,212
1998	37,428	3,753	0	519	5,333	14,672	4	2,422	1,598	4,680	2,199	2,246	4
1999	66,729	0	0	0	1,886	2,398	4,406	3,833	9,818	26,705	17,684	0	0
2000	102,392	0	0	0	8,975	41,560	41,567	1,199	3,318	5,110	663	0	0
2001	33,882	0	0	0	1,883	10,933	3,746	1,534	2,132	3,239	10,413	3	0
2002	26,970	0	0	0	6,299	5,427	3,152	3,677	116	5,952	2,346	1	0
2003	83,180	0	0	0	978	23,052	4,866	8,026	10,894	32,021	3,343	0	0
Average	85,329	1,629	1,208	1,806	5,484	8,528	7,585	16,096	17,902	12,084	6,081	4,580	2,345

Table E-14: Proposed (Full Development with SWM Controls) Continuous Annual and Monthly Volumes at the Outlet of Tributary 14W-W1 (Node E153)

Year	Annual Volume (m^3)	Monthly Volume (m^3)											
		January	February	March	April	May	June	July	August	September	October	November	December
1960	94,655	5,612	4,593	621	6,363	5,705	7,004	39,909	5,064	204	10,106	9,460	15
1961	72,536	0	0	0	10,262	9,092	19,629	10,350	6,182	5,627	876	7,512	3,008
1962	110,330	2,833	5	7	895	105	13,198	18,223	15,572	45,817	9,416	486	3,772
1963	76,851	0	0	4,658	5,405	10,462	15,728	15,571	6,559	7,093	337	10,742	296
1964	108,932	6,816	81	2,508	8,421	4,903	4,801	31,580	40,586	695	6,275	2,260	5
1965	96,992	0	6,716	0	8,164	5,409	5,201	8,540	10,323	6,909	26,976	12,035	6,718
1966	98,812	0	0	0	2,164	3,800	13,256	1,543	10,708	8,000	2,098	38,110	19,133
1967	95,728	1,638	1,915	0	15,661	5,620	31,624	7,990	4,071	11,908	908	5,263	9,131
1968	188,618	4,028	6,638	2,771	3,986	14,772	6,931	10,854	108,525	13,797	2,794	13,483	40
1969	129,127	0	0	3,894	18,948	21,229	2,633	50,409	14,843	1,388	4,711	10,430	642
1970	149,886	0	0	3,934	15,627	6,744	3,816	48,932	62,528	1,946	1,500	4,285	573
1971	112,148	108	7,295	19	1,710	3,253	19,043	18,701	39,950	3,704	4,682	1,803	11,881
1972	102,049	900	339	2,598	4,945	3,044	15,821	4,427	13,544	18,024	20,759	8,523	9,125
1973	131,832	2,323	3,371	22,805	8,184	10,426	6,884	14,367	8,365	8,343	24,037	16,511	6,216
1974	149,640	5,070	3,616	6,027	15,429	53,918	22,666	20,793	691	5,763	2,198	11,585	1,886
1975	123,843	6,497	8,629	7	0	10,324	14,686	9,060	37,625	14,743	12,128	5,755	4,390
1976	96,003	1,443	8,502	6,488	7,348	22,788	12,293	8,858	9,009	11,491	5,390	804	1,591
1977	179,547	0	1,994	9,258	11,101	3,223	20,532	30,404	34,192	47,518	533	12,084	8,708
1978	89,194	4,792	5	1,822	9,545	8,674	2,460	6,554	7,705	29,572	8,378	6,363	3,322
1979	144,615	1,289	1,658	5,526	8,840	14,336	21,982	30,624	11,908	45	10,659	14,883	22,866
1980	229,998	4,895	18	10,178	25,251	5,980	11,440	138,275	3,736	7,373	13,746	2,715	6,392
1981	123,488	0	4,786	86	5,944	6,298	7,901	7,583	38,174	21,779	21,734	8,392	810
1982	156,475	1,880	58	5,071	5,390	4,907	15,623	3,191	40,485	51,101	4,900	14,394	9,477
1983	118,098	3,132	5,733	7,350	10,552	14,088	3,501	745	35,883	8,082	10,731	12,433	5,869
1984	87,570	0	6,318	5,247	7,092	15,284	5,922	8,534	9,556	11,110	1,919	11,595	4,992
1985	129,017	0	5,318	2,634	2,901	9,343	4,075	30,508	57,747	8,485	6,214	4	1,789
1986	288,584	2,181	164	2,384	6,881	13,719	6,635	54,001	94,548	90,123	8,611	3,600	5,739
1987	130,429	6	50	4,679	5,250	2,276	14,058	36,732	6,585	35,601	5,455	16,175	3,564
1988	87,808	2,188	539	2,190	6,173	8,106	2,037	31,755	3,492	12,664	9,126	8,852	687
1989	87,871	0	12	70	3,752	6,174	20,165	20,908	4,605	8,289	10,807	13,072	18
1990	108,285	3,317	7,060	2,896	5,880	12,437	7,297	8,899	25,695	4,729	14,652	5,211	10,212
1991	126,793	795	127	14,923	18,875	17,134	2,809	17,259	37,268	7,356	4,991	3,542	1,713
1992	225,277	1,879	3,200	1,192	39,997	31,992	3,265	30,032	53,071	28,342	7,655	21,571	3,082
1993	112,367	7,243	2	1	8,823	5,076	27,969	33,797	4,479	3,737	10,522	10,702	15
1994	74,135	0	0	1,787	10,709	10,616	7,952	14,942	15,610	6,483	3,491	25	2,519
1995	246,089	34,914	133	6,513	19,312	15,014	8,781	7,254	61,635	1,956	72,501	18,012	64
1996	163,344	7,532	1,688	24	10,767	25,158	14,698	20,525	4,961	64,148	14	2,932	10,896
1997	63,401	1,518	9,962	723	2,158	10,941	5,037	2,323	13,298	4,988	4,494	5,610	2,349
1998	59,080	7,449	1	939	9,001	19,170	17	4,523	3,131	6,407	4,151	4,279	13
1999	88,642	0	0	0	3,693	4,596	8,501	4,983	14,257	29,849	22,763	0	0
2000	134,808	0	0	0	14,402	49,236	52,162	2,228	5,617	9,898	1,265	0	0
2001	59,728	0	0	0	3,521	17,015	7,206	2,784	4,096	6,297	18,797	12	0
2002	50,444	0	0	0	12,284	10,583	5,920	6,919	240	10,008	4,486	4	0
2003	117,318	0	0	0	1,842	33,002	10,263	12,005	13,852	39,811	6,540	2	0
Average	123,191	2,779	2,285	3,223	9,169	12,863	11,669	20,191	22,727	16,391	9,644	8,080	4,171
Difference from Existing	37,862	1,150	1,077	1,417	3,685	4,335	4,084	4,095	4,824	4,307	3,563	3,499	1,826

Table E-15: Existing Continuous Annual and Monthly Volumes at the QEW crossing of Fourteen Mile Creek (Node J4232.339)

Year	Annual Volume (m^3)	Monthly Volume (m^3)											
		January	February	March	April	May	June	July	August	September	October	November	December
1960	1,799,795	94,953	61,701	3,002	83,290	91,680	117,599	833,225	118,069	1,674	230,378	162,777	1,445
1961	1,421,718	0	0	0	182,750	131,990	399,182	238,090	152,289	106,039	11,791	151,971	47,615
1962	2,322,382	38,146	1,043	244	11,679	1,226	293,976	377,345	385,168	949,214	192,799	12,603	58,938
1963	1,498,150	0	0	64,076	64,948	217,774	354,636	366,925	107,621	149,216	7,050	153,209	12,695
1964	2,098,656	91,695	1,993	33,861	108,517	75,255	93,633	597,314	933,073	26,172	100,463	36,219	462
1965	1,811,076	0	138,458	92	121,328	122,560	90,739	157,841	218,221	97,821	564,407	192,649	106,960
1966	2,084,310	0	0	0	27,031	53,323	311,630	24,177	267,888	179,802	34,441	732,041	453,977
1967	1,974,559	21,236	27,796	211	337,569	77,373	745,197	176,921	55,916	226,687	29,565	77,935	198,155
1968	3,650,583	51,250	181,340	40,775	57,053	263,387	120,515	253,243	2,123,017	268,166	41,611	244,294	5,931
1969	2,539,025	0	0	51,669	376,019	446,309	35,634	1,024,219	341,598	18,601	69,482	164,431	11,062
1970	2,918,808	0	0	51,602	329,394	102,805	54,261	936,481	1,290,141	57,881	22,693	60,774	12,776
1971	2,243,587	1,309	97,592	2,651	21,314	46,625	397,204	445,587	843,339	61,706	67,454	26,629	232,176
1972	1,996,341	11,538	5,089	36,018	66,890	38,840	234,338	91,952	297,165	391,755	483,580	143,652	195,522
1973	2,648,054	32,063	45,836	537,391	138,031	179,941	102,587	319,433	218,623	154,155	480,392	322,113	117,489
1974	2,942,077	86,596	50,178	156,071	322,109	1,040,026	515,668	438,695	13,939	75,498	37,080	176,502	29,715
1975	2,537,882	84,933	177,447	15,771	34	227,169	318,316	209,631	723,681	331,492	281,130	105,356	62,920
1976	1,837,644	18,614	126,844	77,756	109,581	535,314	285,019	114,497	195,873	258,070	76,452	13,922	25,704
1977	3,668,132	0	26,309	204,257	182,174	89,643	444,564	643,756	743,835	952,603	22,088	229,381	129,522
1978	1,668,283	63,387	1,120	24,385	126,424	124,968	40,226	145,432	155,056	708,027	149,986	94,994	34,277
1979	2,727,987	17,193	22,299	72,113	121,398	224,925	470,045	615,223	348,117	1,339	157,888	232,620	444,829
1980	4,419,206	65,875	434	222,363	564,859	101,570	208,019	2,567,937	64,002	178,936	298,229	47,168	99,815
1981	2,486,269	0	60,981	5,999	105,819	82,329	129,345	164,556	793,246	519,439	467,209	143,067	14,278
1982	2,871,648	25,416	673	60,968	111,637	64,899	247,845	56,791	893,824	961,503	86,123	218,683	143,285
1983	2,319,876	39,118	79,669	98,877	198,397	308,743	57,863	10,302	852,151	170,820	204,026	206,427	93,482
1984	1,705,360	0	91,523	70,597	112,504	297,632	91,904	206,920	225,095	244,757	28,307	231,300	104,821
1985	2,507,293	0	67,368	36,730	41,029	144,393	69,845	674,626	1,141,893	212,033	90,404	1,256	27,716
1986	5,507,931	29,209	2,484	32,816	93,832	277,507	91,011	1,067,606	1,813,795	1,779,090	162,393	53,435	104,754
1987	2,632,452	55	515	57,063	73,504	31,319	309,115	819,786	107,324	753,741	80,425	322,631	76,974
1988	1,747,378	28,920	8,182	29,114	81,866	208,734	26,692	655,574	76,971	320,536	167,801	131,388	11,599
1989	1,780,897	0	108	569	47,045	84,009	458,896	525,702	67,908	202,754	149,493	240,772	3,640
1990	1,993,369	45,529	171,002	54,038	83,821	198,174	91,318	132,294	540,603	64,788	314,835	78,591	218,376
1991	2,605,948	10,320	1,817	284,651	412,152	399,575	84,899	386,322	763,086	109,686	72,371	54,654	26,415
1992	4,590,787	25,497	43,756	16,794	808,058	640,585	46,507	635,802	1,129,103	663,585	114,618	429,634	36,850
1993	2,103,365	96,708	593	105	127,249	61,870	553,678	751,441	65,684	52,198	171,099	219,284	3,456
1994	1,366,899	0	0	22,497	145,626	169,598	157,619	320,337	340,953	118,674	56,863	1,580	33,150
1995	5,139,023	710,607	5,008	147,375	401,705	359,829	223,861	185,681	1,325,279	27,868	1,335,083	413,954	2,774
1996	3,086,251	101,374	24,717	897	135,931	493,000	283,962	467,501	94,785	1,237,389	4,560	45,981	196,153
1997	1,162,572	20,265	126,457	14,529	29,039	247,788	69,464	29,788	322,047	66,759	74,763	121,528	40,146
1998	1,137,415	98,515	108	11,262	228,746	392,226	495	64,228	42,094	175,117	61,207	63,097	321
1999	1,754,260	0	0	0	47,672	60,420	130,731	101,535	346,815	562,783	504,279	25	0
2000	2,815,587	0	0	0	286,095	1,031,550	1,118,736	52,498	151,597	155,778	19,267	66	0
2001	1,112,385	0	0	0	48,072	359,956	141,279	36,480	57,114	90,759	378,515	210	0
2002	848,806	0	0	0	156,982	171,002	103,178	127,377	3,970	207,581	78,499	217	0
2003	2,667,953	0	0	0	24,588	748,889	243,608	324,474	312,166	894,466	119,456	306	0
Average	2,426,181	43,416	37,510	57,709	162,586	250,607	235,565	417,626	478,730	336,067	184,103	144,530	77,731

Table E-16: Proposed (Full Development with SWM Controls) Continuous Annual and Monthly Volumes at the QEW crossing of Fourteen Mile Creek (Node J4232.339)

Year	Annual Volume (m^3)	Monthly Volume (m^3)											
		January	February	March	April	May	June	July	August	September	October	November	December
1960	1,962,945	108,712	72,922	3,345	98,054	109,127	136,235	865,525	131,219	2,006	244,573	189,625	1,601
1961	1,584,083	0	0	0	208,427	156,299	426,222	260,654	170,074	121,144	14,199	171,874	55,189
1962	2,483,512	45,069	1,146	179	14,110	1,286	311,936	402,953	412,596	995,174	215,958	14,781	68,322
1963	1,652,214	0	0	76,595	76,903	243,288	368,082	393,742	125,089	166,715	7,730	179,997	14,074
1964	2,292,517	108,568	2,305	40,071	129,409	89,049	107,191	637,592	990,368	28,709	116,631	42,120	504
1965	2,033,524	0	155,024	101	142,811	137,643	103,808	180,043	243,066	115,753	607,606	223,521	124,148
1966	2,264,539	0	0	0	32,893	63,567	340,936	28,395	293,770	197,829	40,394	779,973	486,781
1967	2,189,576	25,254	32,683	183	371,475	92,491	802,653	199,797	67,001	256,171	32,073	91,204	218,591
1968	3,888,659	60,874	194,560	47,726	67,240	301,706	144,042	266,917	2,173,617	300,865	49,251	275,526	6,335
1969	2,713,494	0	0	61,292	404,821	473,973	43,162	1,060,201	362,429	22,299	81,690	190,903	12,724
1970	3,098,207	0	0	61,487	353,254	120,979	64,641	977,011	1,341,264	66,947	26,848	71,291	14,485
1971	2,434,364	1,611	115,812	2,946	25,559	55,289	424,153	474,709	890,174	71,598	79,465	31,286	261,761
1972	2,226,272	13,818	6,091	42,619	80,095	46,725	273,648	105,848	323,099	420,848	535,416	160,520	217,545
1973	2,933,652	37,958	54,258	583,327	159,572	207,714	121,221	337,379	230,469	175,161	525,481	367,334	133,779
1974	3,168,454	99,233	59,362	170,344	354,159	1,085,909	554,623	454,588	16,575	90,001	43,436	205,658	34,566
1975	2,737,764	101,278	197,907	16,597	38	247,705	341,017	225,492	757,874	354,535	301,417	119,969	73,935
1976	2,053,856	22,122	148,118	91,757	131,686	572,259	314,939	136,776	217,412	282,586	89,916	16,528	29,757
1977	3,948,724	0	31,276	226,148	210,653	98,058	484,276	678,078	788,532	988,944	30,589	260,914	151,255
1978	1,860,923	75,053	1,224	28,974	150,497	148,132	46,931	159,731	175,124	751,878	172,721	111,408	39,250
1979	2,982,777	20,407	26,324	85,729	144,459	262,405	493,865	634,653	377,271	1,680	184,637	270,248	481,099
1980	4,675,316	78,176	511	241,291	609,785	116,920	238,501	2,615,946	73,522	197,728	332,878	54,218	115,840
1981	2,723,289	0	72,626	6,727	121,272	98,719	150,644	182,133	840,123	560,790	509,001	164,715	16,539
1982	3,124,994	30,124	857	72,832	126,623	77,645	288,580	65,685	935,271	1,009,758	95,217	255,568	166,832
1983	2,577,239	46,593	94,230	117,679	219,518	350,092	67,283	12,516	897,046	195,459	230,796	237,773	108,255
1984	1,922,496	0	108,016	83,705	131,167	336,782	107,437	228,050	246,169	273,107	33,597	258,172	116,292
1985	2,697,552	0	80,238	43,563	48,773	168,915	81,650	705,740	1,194,747	233,937	106,440	1,306	32,244
1986	5,753,504	34,675	2,992	39,036	111,555	306,452	108,376	1,103,096	1,856,364	1,816,979	187,944	62,403	123,632
1987	2,806,892	57	658	68,262	87,682	37,649	329,123	845,634	124,758	781,325	94,492	351,577	85,675
1988	1,915,240	34,190	9,929	34,708	97,739	221,826	32,116	691,340	87,806	346,384	191,730	154,084	13,389
1989	1,947,908	0	137	704	56,616	100,350	491,580	553,766	80,152	218,973	175,718	266,037	3,876
1990	2,257,063	53,929	185,611	61,580	99,511	228,937	109,507	157,456	598,577	76,162	353,680	92,099	240,014
1991	2,828,440	12,366	2,195	315,688	458,760	427,372	93,089	417,205	793,130	128,507	85,354	63,667	31,107
1992	4,889,361	30,231	51,681	20,051	856,132	660,111	56,077	680,547	1,188,102	700,024	134,148	468,558	43,700
1993	2,327,237	114,676	652	107	149,539	74,423	600,202	804,818	77,886	61,944	198,273	241,023	3,693
1994	1,523,629	0	0	26,810	171,245	197,394	178,000	347,263	359,608	137,197	66,002	1,723	38,388
1995	5,420,399	755,422	5,419	164,801	427,857	390,992	239,629	206,117	1,371,422	33,285	1,375,819	446,708	2,929
1996	3,352,470	120,525	29,274	1,037	162,189	526,412	321,375	506,529	108,803	1,294,788	4,941	53,225	223,373
1997	1,310,788	24,204	150,387	16,915	34,868	267,134	83,129	36,134	349,789	79,416	86,639	135,492	46,682
1998	1,256,595	117,485	115	13,439	250,140	415,752	812	76,110	50,431	186,388	71,773	73,796	354
1999	1,873,871	0	0	0	57,432	72,432	153,071	107,644	371,501	579,738	532,023	30	0
2000	2,993,450	0	0	0	313,375	1,072,519	1,177,113	60,065	165,403	181,972	22,930	75	0
2001	1,252,744	0	0	0	57,362	392,799	159,898	44,457	67,647	106,740	423,603	238	0
2002	976,549	0	0	0	187,733	198,873	119,650	145,522	5,063	229,107	90,351	251	0
2003	2,855,373	0	0	0	29,219	800,938	272,915	347,698	329,855	938,338	136,056	355	0
Average	2,631,192	49,377	43,058	65,190	182,323	273,978	258,258	441,399	505,914	358,611	203,169	162,677	87,239
Difference from Existing	205,011	5,961	5,548	7,481	19,737	23,371	22,693	23,773	27,183	22,544	19,066	18,147	9,508