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TABLE 3-1
LAND COVER TYPES WITHIN LOCAL ASSESSMENT CATCHMENTS
AGGREGATE RESOURCE AREA 9-A
TOWN OF CALEDON, ONTARIO

<u>Local Assessment Catchment</u>		<u>Scenario A - Existing Condition</u>			<u>Development Scenarios B & C</u>			<u>CHANGE IN TOTAL AREA (ha)</u>
<u>No.</u>	<u>Land Cover Type</u>	<u>Area (ha)</u>	<u>% Catchment Area</u>	<u>% Study Area</u>	<u>Area (ha)</u>	<u>% Catchment Area</u>	<u>% Study Area</u>	
R1	Agriculture - Intensive	96	34%	2.8%	96	34%	2.8%	--
	Agriculture - Non-intensive	23	8%	0.7%	23	8%	0.7%	--
	Open Space	31	11%	0.9%	31	11%	0.9%	--
	Forest	70	25%	2.0%	70	25%	2.0%	--
	Wetland, Open Water	38	14%	1.1%	38	14%	1.1%	--
	Settlement	22	8%	0.6%	22	8%	0.6%	--
	Active Aggregate/Rehabilitated	--	--	--	--	--	--	--
			280	100%	8.2%	280	100%	8.2%
R2	Agriculture - Intensive	131	31%	3.8%	130	31%	3.8%	-1.4
	Agriculture - Non-intensive	49	12%	1.4%	49	12%	1.4%	--
	Open Space	69	16%	2.0%	67	16%	2.0%	-1.8
	Forest	89	21%	2.6%	89	21%	2.6%	--
	Wetland, Open Water	60	14%	1.8%	58	14%	1.7%	-1.6
	Settlement	24	6%	0.7%	24	6%	0.7%	-0.4
	Active Aggregate/Rehabilitated	--	--	--	--	--	--	--
			423	100%	12%	417	99%	12.2%
R3	Agriculture - Intensive	59	20%	1.7%	19	6%	0.6%	-39.4
	Agriculture - Non-intensive	44	15%	1.3%	16	5%	0.5%	-28.1
	Open Space	74	24%	2.2%	48	16%	1.4%	-26.2
	Forest	80	26%	2.3%	43	14%	1.2%	-37.0
	Wetland, Open Water	24	8%	0.7%	11	4%	0.3%	-13.4
	Settlement	21	7%	0.6%	14	5%	0.4%	-6.9
	Active Aggregate/Rehabilitated	--	--	--	170	56%	5.0%	170.3
			301	100%	8.8%	321	106%	9.4%
R4	Agriculture - Intensive	66	34%	1.9%	51	26%	1.5%	-15.5
	Agriculture - Non-intensive	14	7%	0.4%	14	7%	0.4%	-0.4
	Open Space	26	13%	0.8%	25	13%	0.7%	-0.4
	Forest	51	26%	1.5%	50	26%	1.5%	-0.6
	Wetland, Open Water	20	10%	0.6%	20	10%	0.6%	--
	Settlement	17	9%	0.5%	16	9%	0.5%	-0.2
	Active Aggregate/Rehabilitated	--	--	--	--	--	--	--
			193	100%	5.6%	176	91%	5.1%
R5	Agriculture - Intensive	111	30%	3.3%	111	30%	3.3%	--
	Agriculture - Non-intensive	49	13%	1.4%	49	13%	1.4%	--
	Open Space	33	9%	1.0%	33	9%	1.0%	--
	Forest	100	27%	2.9%	100	27%	2.9%	--
	Wetland, Open Water	59	16%	1.7%	59	16%	1.7%	--
	Settlement	22	6%	0.6%	22	6%	0.6%	--
	Active Aggregate/Rehabilitated	--	--	--	--	--	--	--
			374	100%	10.9%	374	100%	10.9%
R6	Agriculture - Intensive	58	13%	1.7%	58	13%	1.7%	--
	Agriculture - Non-intensive	8	2%	0.2%	8	2%	0.2%	--
	Open Space	62	14%	1.8%	62	14%	1.8%	--
	Forest	277	60%	8.1%	277	60%	8.1%	--
	Wetland, Open Water	17	4%	0.5%	17	4%	0.5%	--
	Settlement	38	8%	1.1%	38	8%	1.1%	--
	Active Aggregate/Rehabilitated	--	--	--	--	--	--	--
			460	100%	13%	460	100%	13.5%
S1	Agriculture - Intensive	13	2%	0.4%	10	2%	0.3%	-2.7
	Agriculture - Non-intensive	83	14%	2.4%	74	12%	2.2%	-8.9
	Open Space	202	34%	5.9%	188	32%	5.5%	-14.4
	Forest	180	30%	5.3%	175	29%	5.1%	-4.5
	Wetland, Open Water	71	12%	2.1%	68	12%	2.0%	-3.0
	Settlement	45	8%	1.3%	45	8%	1.3%	--
	Active Aggregate/Rehabilitated	--	--	--	25	4%	0.7%	25.0
			594	100%	17%	586	99%	17%
S2	Agriculture - Intensive	26	11%	0.7%	7	3%	0.2%	-19.0
	Agriculture - Non-intensive	9	4%	0.3%	5	2%	0.1%	-4.4
	Open Space	38	16%	1.1%	25	11%	0.7%	-12.9
	Forest	128	54%	3.7%	127	54%	3.7%	-0.7
	Wetland, Open Water	20	9%	0.6%	18	7%	0.5%	-2.6
	Settlement	16	7%	0.5%	14	6%	0.4%	-1.6
	Active Aggregate/Rehabilitated	--	--	--	53	22%	1.5%	52.9
			237	100%	6.9%	248	105%	7.3%
S3	Agriculture - Intensive	--	--	--	--	--	--	--
	Agriculture - Non-intensive	3	1%	0.1%	3	1%	0.1%	--
	Open Space	43	13%	1.3%	43	13%	1.3%	--
	Forest	200	61%	5.9%	200	61%	5.9%	--
	Wetland, Open Water	35	11%	1.0%	35	11%	1.0%	--
	Settlement	44	14%	1.3%	44	14%	1.3%	--
	Active Aggregate/Rehabilitated	--	--	--	--	--	--	--
			326	100%	9.5%	326	100%	9.5%
S4	Agriculture - Intensive	--	--	--	--	--	--	--
	Agriculture - Non-intensive	--	--	--	--	--	--	--
	Open Space	42	18%	1.2%	42	18%	1.2%	--
	Forest	153	66%	4.5%	153	66%	4.5%	--
	Wetland, Open Water	11	5%	0.3%	11	5%	0.3%	--
	Settlement	24	10%	0.7%	24	10%	0.7%	--
	Active Aggregate/Rehabilitated	--	--	--	--	--	--	--
			230	100%	6.7%	230	100%	6.7%

TABLE 4-1

**DIRECT IMPACTS
TERRESTRIAL AND AQUATIC SYSTEMS
AGGREGATE RESOURCE AREA 9-A CBSSES
TOWN OF CALEDON, ONTARIO**

Land Cover Types within Aggregate Resource Area 9-A

<i>Land Class</i>	<i>Land Cover Type</i>	<i>Area (ha)</i>	<i>% Resource Area</i>
Agriculture	Intensive agriculture	78.1	31.5%
	Non-intensive agriculture	41.8	16.8%
Forest	Coniferous	3.7	1.5%
	Deciduous	14.0	5.6%
	Mixed	2.0	0.8%
Cultural	Coniferous Plantation	21.4	8.6%
	Cultural Woodland	1.7	0.7%
	Cultural Meadow	41.1	16.6%
	Cultural Savanna	13.8	5.6%
	Cultural Thicket	0.8	0.3%
Wetland	Marsh	2.7	1.1%
	Meadow marsh	1.0	0.4%
	Deciduous swamp	4.7	1.9%
	Thicket swamp	6.1	2.4%
	Mixed swamp	4.9	2.0%
Aquatic	Offline Pond	0.8	0.3%
	Online Pond	0.5	0.2%
Settlement	Rural development	9.1	3.7%
		248.1	100.0%

Aquatic Habitat Communities within Aggregate Resource Area 9-A

<i>Fish Habitat Community</i>	<i>Length (m)</i>	<i>% Total Creek Length</i>	
Coldwater Community	90	1%	
Seasonal Warmwater Community	702	9%	
Seasonal Cool/Warmwater Community	960	12%	
Not Direct Fish Habitat	4,186	52%	
Undefined Habitat Type	2,132	26%	
		8,070	100%

TABLE 5-1

AVERAGE ANNUAL STREAM FLOW (HSP-F)
AGGREGATE RESOURCE AREA 9-A CBSES
TOWN OF CALEDON, ONTARIO

Local Assessment Catchment	HSPF Catchment	Average Annual Stream Flow (L/s)			
		Scenario A - Existing Conditions	Scenario B1 - Dewater Quarry to Creeks	Scenario B2 - Dewater Quarry out of Watershed	Scenario C - Rehabilitated Quarry as Lake
R1	1	4.08	4.08	4.08	4.11
	2	4.41	2.89	2.89	4.41
	Outlet 26	32.63	18.07	18.07	32.62
R2	3	14.09	4.98	4.98	14.07
	4	12.54	4.81	4.81	12.54
	31	1.30	0.71	0.71	0.71
	Outlet 29	33.07	12.80	12.80	32.46
R3	5	1.85	1.06	1.06	1.83
	6	3.49	1.32	1.32	3.49
	8	16.17	4.27	4.28	7.05
	10	1.34	9.19	0.00	0.78
	13	1.45	4.27	0.04	0.46
	100	na	93.21	93.21	17.02
Outlet 24	14.92	88.79	0.91	11.33	
R4	28	71.57	94.19	24.16	65.81
	Outlet 11	100.01	112.42	37.04	90.44
R5	15	4.22	4.22	4.22	4.22
	16	3.42	3.42	3.42	3.42
	30	6.03	6.03	6.03	6.03
	Outlet 17	18.29	18.28	18.28	18.28
R6	18	1.77	1.76	1.76	1.76
	Outlet 25	147.23	159.54	84.35	137.53
S1	7	14.20	6.27	6.27	14.19
	20	1.89	0.67	0.67	1.89
	21	8.38	2.99	2.99	8.06
	500	na	25.34	25.34	3.13
	Outlet 14	50.89	57.74	26.23	47.12
S2	9	42.46	62.97	17.95	40.17
	400	na	31.52	31.52	1.82
	Outlet 12	77.06	98.59	41.75	73.31
S3	19	61.95	79.06	33.84	58.70
	27	104.96	107.72	52.80	101.35
	Outlet 23	69.81	72.29	33.80	66.21
S4	Outlet 22	28.63	29.28	25.04	28.33

Note:

HSP-F Catchments 100, 400, and 500 are located inside Aggregate Resource Area 9-A extraction footprint as follows:

- 100 = Cell 1
- 400 = Cell 3
- 500 = Cell 2

As the extraction footprint does not apply to Scenario A, no values are reported for Catchments 100, 400 and 500 under existing conditions.

TABLE 5-2

AVERAGE ANNUAL STREAM BASEFLOW (HSP-F)
AGGREGATE RESOURCE AREA 9-A CBSSES
TOWN OF CALEDON, ONTARIO

Local Assessment Catchment	HSPF Catchment	Average Annual Baseflow (L/s)			
		Scenario A - Existing Conditions	Scenario B1 - Dewater Quarry to Creeks	Scenario B2 - Dewater Quarry out of Watershed	Scenario C - Rehabilitated Quarry as Lake
R1	1	3.15	3.15	3.15	3.15
	2	2.17	1.42	1.42	2.17
	Outlet 26	24.70	12.12	12.12	24.70
R2	3	9.85	2.29	2.29	9.84
	4	8.25	2.19	2.19	8.25
	31	0.97	0.53	0.53	0.53
	Outlet 29	21.56	5.94	5.94	21.14
R3	5	1.06	0.46	0.46	1.05
	6	2.44	0.57	0.57	2.44
	8	11.37	1.87	1.93	4.71
	10	0.58	6.21	0.00	0.09
	13	1.03	3.47	0.03	0.17
	100	na	75.89	75.89	11.48
Outlet 24	7.92	70.31	0.38	5.46	
R4	28	44.41	64.12	10.97	40.32
	Outlet 11	69.09	79.90	20.67	61.55
R5	15	3.26	3.26	3.26	3.26
	16	1.52	1.52	1.52	1.52
	30	4.46	4.46	4.46	4.46
	Outlet 17	12.54	12.54	12.54	12.54
R6	18	1.33	1.44	1.33	1.33
	Outlet 25	96.69	108.02	48.28	89.11
S1	7	7.43	2.69	2.69	7.43
	20	1.37	0.30	0.30	1.37
	21	5.69	1.30	1.30	5.49
	500	na	20.70	20.70	2.17
	Outlet 14	34.49	40.66	15.11	31.77
S2	9	26.12	43.32	7.85	24.45
	400	na	25.52	25.52	1.84
	Outlet 12	53.46	71.77	25.51	51.06
S3	19	40.23	55.11	18.38	38.23
	27	78.99	80.67	34.53	76.73
	Outlet 23	40.29	42.29	16.18	38.19
S4	Outlet 22	21.45	21.98	17.80	21.28

Note:

HSP-F Catchments 100, 400, and 500 are located inside Aggregate Resource Area 9-A extraction footprint as follows:

- 100 = Cell 1
- 400 = Cell 3
- 500 = Cell 2

As the extraction footprint does not apply to Scenario A, no values are reported for Catchments 100, 400 and 500 under existing conditions.

TABLE 5-3

2-YEAR STORM PEAK FLOW
AGGREGATE RESOURCE AREA 9-A CBSSES
TOWN OF CALEDON, ONTARIO

<i>Local Assessment Catchment</i>	<i>HSPF Catchment</i>	<i>2-Year Peak Flow (L/s)</i>			
		<i>Scenario A - Existing Conditions</i>	<i>Scenario B1 - Dewater Quarry to Creeks</i>	<i>Scenario B2 - Dewater Quarry out of Watershed</i>	<i>Scenario C - Rehabilitated Quarry as Lake</i>
R1	1	10.72	10.70	10.70	10.71
	2	22.72	8.98	8.98	22.72
	Outlet 26	101.03	70.22	70.22	100.96
R2	3	65.37	41.03	41.03	65.22
	4	60.96	33.09	32.65	60.96
	31	4.54	2.54	2.54	2.54
	Outlet 29	182.06	113.46	113.46	179.63
R3	5	12.33	7.34	7.34	12.18
	6	13.74	9.12	9.12	13.67
	8	74.85	38.82	38.82	35.59
	10	10.44	30.88	0.00	0.00
	13	4.42	10.27	0.26	0.26
	Outlet 24	96.69	224.27	4.02	14.53
R4	28	395.59	393.38	175.37	298.53
	Outlet 11	465.44	439.71	222.82	350.74
R5	15	10.77	10.76	10.76	10.76
	16	7.53	7.52	7.52	7.52
	30	16.61	16.61	16.61	16.62
	Outlet 17	51.40	51.33	51.33	51.32
R6	18	5.31	5.30	5.30	5.30
	Outlet 25	758.09	727.94	516.91	641.18
S1	7	75.00	41.32	41.32	75.00
	20	8.21	5.72	5.72	8.21
	21	31.54	12.50	14.71	29.19
	Outlet 14	228.67	235.29	160.37	212.50
S2	9	210.30	252.21	138.02	191.18
	Outlet 12	337.50	375.73	238.97	307.35
S3	19	279.41	325.73	180.88	249.26
	27	358.82	377.21	232.35	329.41
	Outlet 23	325.00	347.06	208.83	298.53
S4	Outlet 22	111.18	114.41	104.26	109.04

TABLE 5-4

**BANK FULL FLOW
AGGREGATE RESOURCE AREA 9-A CBSSES
TOWN OF CALEDON, ONTARIO**

<i>Local Assessment Catchment</i>	<i>HSPF Catchment</i>	<i>Bank Full Flow (L/s)</i>			
		<i>Scenario A - Existing Conditions</i>	<i>Scenario B1 - Dewater Quarry to Creeks</i>	<i>Scenario B2 - Dewater Quarry out of Watershed</i>	<i>Scenario C - Rehabilitated Quarry as Lake</i>
R1	1	8.57	8.56	8.56	8.56
	2	18.17	7.19	7.19	18.18
	Outlet 26	80.82	56.18	56.18	80.76
R2	3	52.29	32.82	32.82	52.18
	4	48.77	26.47	26.12	48.76
	Outlet 29	145.65	90.76	90.76	143.71
R3	5	9.86	5.87	5.87	9.74
	6	10.99	7.29	7.29	10.94
	8	59.88	31.06	31.06	28.47
	10	8.36	24.71	0.00	0.00
	Outlet 24	77.35	179.41	3.22	11.62
R4	28	316.47	314.71	140.29	238.82
	Outlet 11	372.35	351.76	178.26	280.59
R5	15	8.62	8.61	8.61	8.61
	16	6.03	6.02	6.02	6.02
	Outlet 17	41.12	41.06	41.06	41.06
R6	18	4.25	4.24	4.24	4.24
	Outlet 25	606.47	582.35	413.53	512.94
S1	7	60.00	33.06	33.06	60.00
	20	6.57	4.58	4.58	6.57
	Outlet 14	182.94	188.24	128.30	170.00
S2	9	168.24	201.76	110.41	152.94
	Outlet 12	270.00	300.59	191.18	245.88
S3	19	223.53	260.59	144.70	199.41
	27	287.06	301.76	185.88	263.53
	Outlet 23	260.00	277.65	167.06	238.82
S4	Outlet 22	88.94	91.53	83.41	87.24

Notes:

Bankfull flow assumed to be 80 percent of the 2-year storm flow.

TABLE 5-5

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SCENARIO B
CHANGE IN INDICATOR #2: GROUNDWATER DISCHARGE TO SURFACE WATER
AGGREGATE RESOURCE AREA 9-A CBSES
TOWN OF CALEDON, ONTARIO

(A) Creek Comparison - Scenario A versus Scenario B

Catchment	Scenario A (m ³ /day)	Scenario B (m ³ /day)	Difference (m ³ /day)	Change	
				(%)	Increase or Decrease
R1	-442	-321	121	-27	Decrease
R2	-449	-19	430	-96	Decrease
R3	-211	0	211	-100	Decrease
R4	-496	-123	373	-75	Decrease
R5	-299	-291	9	-3	Decrease
R6	-2870	-2879	-9	0	None
S1	-680	-54	626	-92	Decrease
S2	-716	-205	511	-71	Decrease
S3	-947	-947	0	0	None
S4	-680	-681	-1	0	None
SA	-483	-360	123	-26	Decrease
Area^a	-7,790	-5,519	2,271	-29	Decrease

(C) Non-Riverine Wetlands Comparison - Scenario A versus Scenario B

Catchment	Scenario A (m ³ /day)	Scenario B (m ³ /day)	Difference (m ³ /day)	Change	
				(%)	Increase or Decrease
R1	-294	-249	45	-15	Decrease
R2	-130	-2	128	-98	Decrease
R3	-126	0	126	-100	Decrease
R4	-252	-54	199	-79	Decrease
R5	-829	-802	27	-3	Decrease
R6	-634	-635	-1	0	None
S1	-400	-55	345	-86	Decrease
S2	-157	0	157	-100	Decrease
S3	-197	-188	9	-5	Decrease
S4	-97	-98	0	0	None
SA	0	0	0	0	None
Study Area^a	-3,117	-2,083	1,034	-33	Decrease

(B) Riverine Wetlands Comparison - Scenario A versus Scenario B

Catchment	Scenario A (m ³ /day)	Scenario B (m ³ /day)	Difference (m ³ /day)	Change	
				(%)	Increase or Decrease
R1	-819	-489	330	-40	Decrease
R2	-1133	-6	1127	-99	Decrease
R3	-1374	0	1374	-100	Decrease
R4	-1229	-209	1020	-83	Decrease
R5	-1932	-1919	13	-1	Decrease
R6	-477	-477	0	0	None
S1	-1750	-222	1528	-87	Decrease
S2	-1173	-278	895	-76	Decrease
S3	-946	-949	-3	0	None
S4	-371	-358	13	-4	Decrease
SA	-1018	-740	278	-27	Decrease
Area^a	-12,221	-5,647	6,574	-54	Decrease

(D) Total Groundwater Discharge (A + B + C) - Scenario A versus Scenario B

Catchment	Scenario A (m ³ /day)	Scenario B (m ³ /day)	Difference (m ³ /day)	Change	
				(%)	Increase or Decrease
R1	-1556	-1060	496	-32	Decrease
R2	-1711	-27	1684	-98	Decrease
R3	-1710	0	1710	-100	Decrease
R4	-1977	-386	1591	-80	Decrease
R5	-3061	-3012	49	-2	Decrease
R6	-3981	-3990	-10	0	None
S1	-2830	-331	2499	-88	Decrease
S2	-2046	-483	1563	-76	Decrease
S3	-2089	-2083	6	0	None
S4	-1148	-1136	12	-1	Decrease
SA	-1501	-1100	402	-27	Decrease
Study Area^a	-22,110	-12,509	9,601	-43	Decrease

Notes:

- (1) Negative values denote a decrease in groundwater discharge to surface water and a decrease in groundwater elevation.
(2) Positive values denote an increase in groundwater discharge to surface water and an increase in groundwater elevation.
(^a) Study Area excludes Supplemental Assessment Area (SA)

TABLE 5-6

CHANGE IN INDICATOR 3
2-YEAR PEAK STREAM FLOW
AGGREGATE RESOURCE AREA 9-A CBSES
TOWN OF CALEDON, ONTARIO

Scenario B1 Comparison - Full Extraction; Water Proportioned to Creeks Downstream of Quarry

Catchment	Representative Station	Scenario A Model (L/s)	Scenario B1 Model (L/s)	Difference (L/s)	Change	
					%	Increase/Decrease
R1	SW026	101.0	70.2	-31	-30	Decrease
R2	NS6	182.1	113.5	-69	-38	Decrease
R3	SW023	96.7	224.3	128	132	Increase
R4	SW009	465.4	439.7	-26	-6	Decrease
R5	SW015	51.4	51.3	0	0	None
R6	SW013	758.1	727.9	-30	-4	Decrease
S1	SW027	228.7	235.3	7	3	Increase
S2	SW022	337.5	375.7	38	11	Increase
S3	SW012	325.0	347.1	22	7	Increase
S4	SW011	111.2	114.4	3	3	Increase

Scenario B2 Comparison - Full Extraction; Water Removed from Watershed

Catchment	Representative Station	Scenario A Model (L/s)	Scenario B2 Model (L/s)	Difference (L/s)	Change	
					%	Increase/Decrease
R1	SW026	101.0	70.2	-31	-30	Decrease
R2	NS6	182.1	113.5	-69	-38	Decrease
R3	SW023	96.7	4.0	-93	-96	Decrease
R4	SW009	465.4	222.8	-243	-52	Decrease
R5	SW015	51.4	51.3	0	0	None
R6	SW013	758.1	516.9	-241	-32	Decrease
S1	SW027	228.7	160.4	-68	-30	Decrease
S2	SW022	337.5	239.0	-99	-29	Decrease
S3	SW012	325.0	208.8	-116	-36	Decrease
S4	SW011	111.2	104.3	-7	-6	Decrease

Scenario C Comparison - Long-term Rehabilitation; Water Proportioned to Creeks Downstream of Quarry

Catchment	Representative Station	Scenario A Model (L/s)	Scenario C Model (L/s)	Difference (L/s)	Change	
					%	Increase/Decrease
R1	SW026	101.0	101.0	0	0	None
R2	NS6	182.1	179.6	-2	-1	Decrease
R3	SW023	96.7	14.5	-82	-85	Decrease
R4	SW009	465.4	350.7	-115	-25	Decrease
R5	SW015	51.4	51.3	0	0	None
R6	SW013	758.1	641.2	-117	-15	Decrease
S1	SW027	228.7	212.5	-16	-7	Decrease
S2	SW022	337.5	307.4	-30	-9	Decrease
S3	SW012	325.0	298.5	-26	-8	Decrease
S4	SW011	111.2	109.0	-2	-2	Decrease

TABLE 5-7

CHANGE IN INDICATOR #3: 2-YEAR PEAK STREAM FLOW VELOCITY
AGGREGATE RESOURCE AREA 9-A CBSES
TOWN OF CALEDON, ONTARIO

Scenario B1 Comparison - Full Extraction; Water Proportioned to Creeks Downstream of Quarry

Catchment	Representative Station	Scenario A Model (m/s)	Scenario B1 Model (m/s)	Difference (m/s)	Change	
					%	Increase or Decrease
R1	SW001	0.10	0.10	0	0	None
R2	SW002	0.25	0.23	-0.02	-8	Decrease
R2	SW003	1.00	0.86	-0.14	-14	Decrease
R4	SW009	0.28	0.28	0	0	None
R5	SW015	0.44	0.44	0	0	None
R6	SW013	2.65	2.62	-0.03	-1	Decrease
S1	SW004	0.13	0.10	-0.03	-23	Decrease
S2	SW022	0.54	0.56	0.02	4	Increase
S2	SW005	0.53	0.55	0.02	4	Increase
S3	SW012	2.55	2.61	0.06	2	Increase

Scenario B2 Comparison - Full Extraction; Water Removed from Watershed

Catchment	Representative Station	Scenario A Model (m/s)	Scenario B2 Model (m/s)	Difference (m/s)	Change	
					%	Increase or Decrease
R1	SW001	0.10	0.10	0	0	None
R2	SW002	0.25	0.23	-0.02	-8	Decrease
R2	SW003	1.00	0.86	-0.14	-14	Decrease
R4	SW009	0.28	0.21	-0.07	-25	Decrease
R5	SW015	0.44	0.44	0	0	None
R6	SW013	2.65	2.32	-0.33	-12	Decrease
S1	SW004	0.13	0.10	-0.03	-23	Decrease
S2	SW022	0.54	0.48	-0.06	-11	Decrease
S2	SW005	0.53	0.49	-0.04	-8	Decrease
S3	SW012	2.55	2.17	-0.38	-15	Decrease

Scenario C Comparison - Long-term Rehabilitation; Water Proportioned to Creeks Downstream of Quarry

Catchment	Representative Station	Scenario A Model (m/s)	Scenario C Model (m/s)	Difference (m/s)	Change	
					%	Increase or Decrease
R1	SW001	0.10	0.10	0	0	None
R2	SW002	0.25	0.23	-0.02	-8	Decrease
R2	SW003	1.00	1.00	0	0	None
R4	SW009	0.28	0.25	-0.03	-11	Decrease
R5	SW015	0.44	0.44	0	0	None
R6	SW013	2.65	2.50	-0.15	-6	Decrease
S1	SW004	0.13	0.13	0	0	None
S2	SW022	0.54	0.52	-0.02	-4	Decrease
S2	SW005	0.53	0.52	-0.01	-2	Decrease
S3	SW012	2.55	2.47	-0.08	-3	Decrease

TABLE 5-8

CHANGE IN INDICATOR #4: OVERBANK DEPTH
AGGREGATE RESOURCE AREA 9-A CBSES
TOWN OF CALEDON, ONTARIO

Scenario B1 Comparison - Full Extraction; Water Proportioned to Creeks Downstream of Quarry

Catchment	Representative Station	Stream Classification	Overbank Depth		Difference (cm)	Channel Depth		Difference (cm)	Change	
			Scenario A (cm)	Scenario 1B (cm)		Scenario A (cm)	Scenario 1B (cm)		(%)	Increase or Decrease
R1	SW001	Permanent	-	-	-	3	3	0	0	None
R2	SW002	Intermittent	-	-	-	14	12	-2	-14	Decrease
R2	SW003	Intermittent	-	-	-	10	8	-2	-20	Decrease
R4	SW009	Permanent	12.1	12.1	0	52	52	0	0	None
R5	SW015	Intermittent	-	-	-	6	6	0	0	None
R6	SW013	Permanent	-	-	-	18	18	0	0	None
S1	SW004	Permanent	0.1	-	-	42	38	-4	-10	Decrease
S2	SW022	Permanent	-	-	-	23	25	2	9	Increase
S2	SW005	Intermittent	-	-	-	36	37	1	3	Increase
S3	SW012	Permanent	-	-	-	14	15	1	7	Increase

Scenario B2 Comparison - Full Extraction; Water Removed from Watershed

Catchment	Representative Station	Stream Classification	Overbank Depth		Difference (cm)	Channel Depth		Difference (cm)	Change	
			Scenario A (cm)	Scenario 2B (cm)		Scenario A (cm)	Scenario 2B (cm)		(%)	Increase or Decrease
R1	SW001	Permanent	-	-	-	3	3	0	0	None
R2	SW002	Intermittent	-	-	-	14	12	-2	-14	Decrease
R2	SW003	Intermittent	-	-	-	10	8	-2	-20	Decrease
R4	SW009	Permanent	12.1	3.1	-9	52	43	-9	-74	Decrease
R5	SW015	Intermittent	-	-	-	6	6	0	0	None
R6	SW013	Permanent	-	-	-	18	16	-2	-11	Decrease
S1	SW004	Permanent	0.1	-	-	42	38	-4	-10	Decrease
S2	SW022	Permanent	-	-	-	23	20	-3	-13	Decrease
S2	SW005	Intermittent	-	-	-	36	31	-5	-14	Decrease
S3	SW012	Permanent	-	-	-	14	12	-2	-14	Decrease

Scenario C Comparison - Long-term Rehabilitation; Water Proportioned to Creeks Downstream of Quarry

Catchment	Representative Station	Stream Classification	Overbank Depth		Difference (cm)	Channel Depth		Difference (cm)	Change	
			Scenario A (cm)	Scenario C (cm)		Scenario A (cm)	Scenario C (cm)		(%)	Increase or Decrease
R1	SW001	Permanent	-	-	-	3	3	0	0	None
R2	SW002	Intermittent	-	-	-	14	14	0	0	None
R2	SW003	Intermittent	-	-	-	10	10	0	0	None
R4	SW009	Permanent	12.1	8.1	-4	52	48	-4	-33	Decrease
R5	SW015	Intermittent	-	-	-	6	6	0	0	None
R6	SW013	Permanent	-	-	-	18	17	-1	-6	Decrease
S1	SW004	Permanent	0.1	-	-	42	42	0	0	None
S2	SW022	Permanent	-	-	-	23	22	-1	-4	Decrease
S2	SW005	Intermittent	-	-	-	36	34	-2	-6	Decrease
S3	SW012	Permanent	-	-	-	14	14	0	0	None

TABLE 5-9
HYDROPERIOD ASSESSMENT
SCENARIOS B2 AND C
AGGREGATE RESOURCE AREA 9-A CBSSES
TOWN OF CALEDON, ONTARIO

<i>Local Assessment Catchment</i>	<i>Change in Hydroperiod Duration</i>	
	<i>Scenario B2 Active Extraction</i>	<i>Scenario C Rehabilitation</i>
R1	<i>Moderate</i>	<i>Low</i>
R2	<i>High</i>	<i>Low</i>
R3	<i>High</i>	<i>Low</i>
R4	<i>High</i>	<i>Low</i>
R5	<i>Low</i>	<i>Low</i>
R6	<i>Moderate</i>	<i>Low</i>
S1	<i>High</i>	<i>Low</i>
S2	<i>High</i>	<i>Low</i>
S3	<i>Moderate</i>	<i>Low</i>
S4	<i>Low</i>	<i>Low</i>
SA	<i>Moderate</i>	<i>Low</i>

Notes:

LOW - Within expected normal variation. Hydroperiod increases or is not reduced more than the amount of what one might expect under normal climate variations. Generally change in flow duration of less than 1/5.

MODERATE - Readily observable change. Hydroperiod changes noticeably but maintains the majority of its previous duration. Generally change in flow duration of more than 1/5 but less than 1/2.

HIGH - Substantially changed. Majority of hydroperiod is lost. Generally change in flow duration of 1/2 or more.

TABLE 5-10

SCENARIO C
CHANGE IN INDICATOR #2: GROUNDWATER DISCHARGE TO SURFACE WATER
AGGREGATE RESOURCE AREA 9-A CBSES
TOWN OF CALEDON, ONTARIO

(A) Creek Comparison - Scenario A versus Scenario C

Catchment	Scenario A (m ³ /day)	Scenario C (m ³ /day)	Difference (m ³ /day)	Change*	
				(%)	Increase or Decrease
R1	-442	-446	-3	1	Increase
R2	-449	-456	-7	2	Increase
R3	-211	0	211	-100	Decrease
R4	-496	-545	-49	10	Increase
R5	-299	-305	-6	2	Increase
R6	-2870	-2877	-7	0	None
S1	-680	-586	94	-14	Decrease
S2	-716	-815	-99	14	Increase
S3	-947	-946	2	0	None
S4	-680	-675	4	-1	Decrease
SA	-483	-487	-4	1	Increase
Study Area^a	-7,790	-7,651	139	-2	Decrease

(C) Non-Riverine Wetlands Comparison - Scenario A versus Scenario C

Catchment	Scenario A (m ³ /day)	Scenario C (m ³ /day)	Difference (m ³ /day)	Change	
				(%)	Increase or Decrease
R1	-294	-295	-1	0	Increase
R2	-130	-150	-21	16	Increase
R3	-126	-143	-17	14	Increase
R4	-252	-269	-17	7	Increase
R5	-829	-829	0	0	None
R6	-634	-625	9	-1	Decrease
S1	-400	-414	-13	3	Increase
S2	-157	-170	-13	8	Increase
S3	-197	-195	2	-1	Decrease
S4	-97	-97	0	0	None
SA	0	-3.9	-3.9	>100	Increase
Study Area^a	-3,117	-3,192	-75	2	Increase

(B) Riverine Wetlands Comparison - Scenario A versus Scenario C

Catchment	Scenario A (m ³ /day)	Scenario C (m ³ /day)	Difference (m ³ /day)	Change*	
				(%)	Increase or Decrease
R1	-819	-821	-2	0	None
R2	-1,133	-1,145	-12	1	Increase
R3	-1,374	-799	575	-42	Decrease
R4	-1,229	-1,233	-4	0	None
R5	-1,932	-1,935	-3	0	None
R6	-477	-479	-2	0	None
S1	-1,750	-1,440	309	-18	Decrease
S2	-1,173	-1,137	36	-3	Decrease
S3	-946	-943	2	0	None
S4	-371	-371	0	0	None
SA	-1,018	-1,024	-5	1	Increase
Study Area^a	-12,221	-11,326	895	-7	Decrease

(D) Total Groundwater Discharge (A + B + C) - Scenario A versus Scenario C

Catchment	Scenario A (m ³ /day)	Scenario C (m ³ /day)	Difference (m ³ /day)	Change	
				(%)	Increase or Decrease
R1	-1556	-1562	-6	0	Increase
R2	-1711	-1752	-40	2	Increase
R3	-1710	-942	768	-45	Decrease
R4	-1977	-2047	-70	4	Increase
R5	-3061	-3069	-8	0	Increase
R6	-3981	-3981	0	0	None
S1	-2830	-2440	390	-14	Decrease
S2	-2046	-2123	-76	4	Increase
S3	-2089	-2084	5	0	None
S4	-1148	-1143	5	0	Decrease
SA	-1501	-1514	-13	1	Increase
Study Area^a	-22,110	-21,142	968	-4	Decrease

Notes

- (1) Negative values denote a decrease in groundwater discharge to surface water and a decrease in groundwater elevation.
- (2) Positive values denote an increase in groundwater discharge to surface water and an increase in groundwater elevation.
- (^a) Study Area excludes Supplemental Assessment Area (SA)
- (*) Values include the decrease in baseflow as a result of the direct removal of surface water features within the Resource Area.

There is an actual increase in groundwater discharge to surface water up and down gradient of the Resource Area due to mounding of the water table.

TABLE 5-11

HSP-F WATER BALANCE - STUDY AREA SUMMARY
AGGREGATE RESOURCE AREA 9-A CBSSES
TOWN OF CALEDON, ONTARIO

<i>Scenario</i>	<i>Average Active Groundwater Outflow (HSP-F Model Parameter AGWO)</i>	<i>Average Direct Surface Discharge to Receiving Watercourses (HSP-F Model Parameters IFWO + SURO)</i>	<i>Average Total Actual Evapotranspiration (HSP-F Model Parameter TAET + Sublimation)</i>	<i>Total</i>
	<i>(mm/yr)</i>	<i>(mm/yr)</i>	<i>(mm/yr)</i>	<i>(mm/yr)</i>
Scenario A	242	110	475	827
Scenario B1	224	137	465	827
Scenario B2	224	137	465	827
Scenario C	224	113	489	827

Notes:

A total precipitation rate of 827 mm/yr was input into the HSPF model. A total precipitation rate of 790 mm/yr was output from the model. This difference is attributed to sublimation not accounted for in the model and is considered as part of the evapotranspiration component. Further details on this are presented in Appendix M.

TABLE 5-12

**GROUNDWATER BUDGET
SCENARIO A - INITIAL CONDITIONS
AGGREGATE RESOURCE AREA 9-A CBSSES
TOWN OF CALEDON, ONTARIO**

<i>Local Assessment Catchment</i>	<i>Resource Area Extraction</i>		<i>Groundwater Recharge/Discharge (m³/day)</i>				<i>Catchment Surplus (m³/day)</i>	<i>Net Intercatchment Groundwater Flow Condition</i>
	<i>Area (km²)</i>	<i>Footprint (km²)</i>	<i>Infiltration</i>	<i>Creeks</i>	<i>Riverine Wetlands</i>	<i>Riverine Wetlands</i>		
R1	2.80		2,092	-442	-819	-294	537	Outflow
R2	4.23	0.05	2,839	-449	-1,133	-130	1,128	Outflow
R3	3.01	1.51	2,018	-211	-1,374	-126	308	Outflow
R4	1.93	0.17	1,383	-496	-1,229	-252	-594	Inflow
R5	3.74		2,967	-299	-1,932	-829	-94	Inflow
R6	<u>4.60</u>		<u>2,918</u>	<u>-2,870</u>	<u>-477</u>	<u>-634</u>	<u>-1,063</u>	<u>Inflow</u>
Rogers Creek	20.31		14,217	-4,767	-6,964	-2,265	222	Outflow
S1	5.94	0.34	4,294	-680	-1,750	-400	1,464	Outflow
S2	2.37	0.41	1,640	-716	-1,173	-157	-406	Inflow
S3	3.26		2,273	-947	-946	-197	183	Outflow
S4	<u>2.30</u>		<u>1,404</u>	<u>-680</u>	<u>-371</u>	<u>-97</u>	<u>255</u>	<u>Outflow</u>
Second Creek	13.86		9,611	-3,023	-4,239	-852	1,497	Outflow
SA	2.50		1,395	-483	-1,018	0	-106	Inflow
STUDY AREA	34.17	2.48	23,828	-7,790	-11,203	-3,117	1,719	Outflow

Notes:

- Positive values denote aquifer is gaining water from surface water features i.e., aquifer (groundwater) recharge.
- Negative values denote aquifer is losing water to surface water features i.e., aquifer (groundwater) discharge/baseflow.
- SA denotes Supplemental Assessment Area
- Study Area totals exclude Supplemental Assessment Area (SA) and areas to the east of the Credit River.
- Groundwater infiltration calculated from CBSSES HSPF AGWO output representing Net Groundwater Recharge.

TABLE 5-13
GROUNDWATER BUDGET
SCENARIO B - FULL EXTRACTION WITHOUT MITIGATION
AGGREGATE RESOURCE AREA 9-A CBSES
TOWN OF CALEDON, ONTARIO

Local Assessment Catchment	Area (km ²)	ARA 9-A Extraction Area (km ²)		Groundwater Recharge/Discharge (m ³ /day)					Catchment Surplus (m ³ /day)	Net Intercatchment Groundwater Flow Condition	Net Quarry Dewatering Flows (m ³ /day)	
				Infiltration	Quarry Recharge	Creeks	Riverine Wetlands	Non-Riverine Wetlands				Quarry GW Discharge
R1	2.80			2,092	0	-321	-489	-249	0	1,032	Outflow	0
R2	4.17			2,804	0	-19	-6	-2	0	2,777	Outflow	0
R3	3.21	Cell 1	1.70	1,014	2,458	0	0	0	-5,342	-1,870	Inflow	8,005
R4	1.76			1,255	0	-123	-209	-54	0	869	Outflow	0
R5	3.74			2,967	0	-291	-1,919	-802	0	-45	Inflow	0
R6	4.60			2,918	0	-2,879	-477	-635	0	-1,072	Inflow	0
Rogers Creek	20.28			13,051	2,458	-3,633	-3,100	-1,742	-5,342	1,691	Outflow	8,005
S1	5.86	Cell 3	0.25	4,066	360	-54	-222	-55	-2,339	1,756	Outflow	2,699
S2	2.48	Cell 2	0.53	1,359	764	-205	-278	0	-1,456	185	Outflow	2,220
S3	3.26			2,273	0	-947	-949	-188	0	189	Outflow	0
S4	2.30			1,404	0	-681	-358	-98	0	267	Outflow	0
Second Creek	13.89			9,102	1,124	-1,886	-1,807	-341	-3,795	2,397	Outflow	4,919
SA	2.50			1,395	0	-360	-740	0	0	295	Outflow	0
STUDY AREA	34.17	2.48		22,152	3,583	-5,519	-4,907	-2,083	-9,137	4,088	Outflow	12,925

Notes:

- Positive values denote aquifer is gaining water from surface water features i.e., aquifer (groundwater) recharge.
- Negative values denote aquifer is losing water to surface water features i.e., aquifer (groundwater) discharge/baseflow.
- SA denotes Supplemental Assessment Area.
- ARA denotes Aggregate Resource Area.
- Study Area totals exclude Supplemental Assessment Area (SA) and areas to the east of the Credit River.
- Groundwater infiltration calculated from CBSES HSPF AGWO output representing Net Groundwater Recharge.
- Quarry Recharge/Inflow equal to direct Precipitation minus Evaporation (PE) plus upgradient surface water inflows to the quarry cells (SW), as described below.
- Quarry Dewatering Flows:
 - Direct recharge into quarry cells calculated as Precipitation (P) minus Dry Quarry Floor Evaporation (E), where P = 827 mm/yr and E = 300 mm/yr
 - Precipitation value represents the average annual 1997 through 2006, as per CBSES HSPF model output results.
 - Net Quarry Dewatering Flows (QO) calculated as PE + SW - G_i

Scenario B	PE		SW		G _i		QO
	Direct Quarry Recharge	P-E	Upgradient Surface Water	Inflow into Quarry Cells	Quarry Groundwater Discharge	Net Quarry Dewatering Flows	
	mm/yr	m ³ /day	m ³ /day	m ³ /day	m ³ /day	m ³ /day	
Cell 1	527	2,458	205	205	-5,342	8,005	
Cell 2	527	764	0	0	-1,456	2,220	
Cell 3	527	360	0	0	-2,339	2,699	
Totals	527	3,583	205	205	-9,137	12,925	

TABLE 5-14

**GROUNDWATER BUDGET
SCENARIO C - PASSIVE REHABILITATION LAKE CONDITION
AGGREGATE RESOURCE AREA 9-A CBSES
TOWN OF CALEDON, ONTARIO**

Local Assessment Catchment	Area (km ²)	ARA 9-A Extraction Area (km ²)		Groundwater Recharge/Discharge (m ³ /day)					Catchment Surplus (m ³ /day)	Net Intercatchment Groundwater Flow Condition	Net Quarry Lake Surface Outflow (m ³ /day)	
				Infiltration	Quarry Recharge	Creeks	Riverine Wetlands	Non-Riverine Wetlands				Quarry GW Discharge
R1	2.80			2,092	0	-446	-821	-295	0	531	Outflow	0
R2	4.17			2,804	0	-456	-1,145	-150	0	1,053	Outflow	0
R3	3.21	Cell 1	1.70	1,014	1,124	0	-799	-143	732	1,928	Outflow	392
R4	1.76			1,255	0	-545	-1,233	-269	0	-792	Inflow	0
R5	3.74			2,967	0	-305	-1,935	-829	0	-102	Inflow	0
R6	4.60			2,918	0	-2,877	-479	-625	0	-1,063	Inflow	0
Rogers Creek	20.28			13,051	1,124	-4,629	-6,411	-2,312	732	1,555	Outflow	392
S1	5.86			Cell 3	0.25	4,066	135	-586	-1,440	-414	112	1,872
S2	2.48	Cell 2	0.53	1,359	286	-815	-1,137	-170	147	-331	Inflow	139
S3	3.26			2,273	0	-946	-943	-195	0	189	Outflow	0
S4	2.30			1,404	0	-675	-371	-97	0	260	Outflow	0
Second Creek	13.89			9,101	420	-3,022	-3,891	-877	259	1,990	Outflow	161
SA	2.50			1,395	0	-487	-1,024	-4	0	-119	Inflow	0
STUDY AREA	34.17	3.26		22,152	1,544	-7,651	-10,303	-3,188	991	3,545	Outflow	553

Notes:

- Positive values denote aquifer is gaining water from surface water features i.e., aquifer (groundwater) recharge.
- Negative values denote aquifer is losing water to surface water features i.e., aquifer (groundwater) discharge/baseflow.
- SA denotes Supplemental Assessment Area.
- Study Area totals exclude Supplemental Assessment Area and areas to the east of the Credit River.
- Groundwater infiltration calculated from CBSES HSPF AGWO output representing Net Groundwater Recharge.
- Quarry Lake Recharge/Inflow equal to direct Precipitation minus Evaporation (PE) plus upgradient surface water inflows into the Lake cells (SW), as described below.
- Quarry Lake Cell Flows:
 - Direct recharge onto quarry lake cells calculated as Precipitation (P) minus Lake Evaporation (E), where P = 827 mm/yr and E = 630 mm/yr
 - Precipitation value represents the average annual 1997 through 2006, as per CBSES HSPF model output results.
 - Net Quarry Lake Surface Water Outflows (LO) calculated as PE + SW - G_o

Scenario C15	PE		+	SW		-	G _o	=	LO	
	Direct Quarry Recharge			Upgradient Surface Water			Quarry Lake Groundwater		Net Quarry Lake	
	P- E			Inflow into Lake Cells			Net Outflow		Surface Water Outflows	
	mm/yr	m ³ /day		m ³ /day		m ³ /day		m ³ /day		
Cell 1	197	919		205		732		392		
Cell 2	197	286		0		147		139		
Cell 3	197	135		0		112		23		
Totals	197	1,339		205		991		553		

TABLE 6-1

INDICATOR PARAMETER RANGES
RESOURCE AREA 9-A CBSSES
TOWN OF CALEDON, ONTARIO

CBSSES STUDY AREA RECEPTORS:

- (A) Water Supply
- (B) Property Damage/Flooding
- (C) Channel Form (Fluvial Geomorphology)
- (D) Terrestrial (Upland) Forest
- (E) Non-Riverine Wetlands
- (F) Riverine Wetlands
- (G) Fisheries

PRIMARY INDICATORS:

- Indicator #1 – change in groundwater level (FEFLOW model output)
- Indicator #2 – change in groundwater discharge/baseflow (FEFLOW model output)
- Indicator #3 – change in 2-yr peak flow (HSP-F model output)
- Indicator #4 – change in overbank flow (HSP-F model output)

INDICATOR PARAMETER RANGES PER RECEPTOR:

(A) Water Supply (Groundwater/Aquifer Yield)

Indicator #1 (groundwater level):

Note: Need to distinguish between above and below escarpment as it's much more sensitive below escarpment.

Influence Below Escarpment to change in indicator #1 (groundwater level):

- Low = < 0.5 m decrease
- Moderate = 0.5 – 1.0 m decrease
- High = > 1 m decrease

Influence Above Escarpment to change in indicator #1 (groundwater level):

- Low = < 2.0 m decrease
- Moderate = 2.0 – 5.0 m decrease
- High = > 5 m decrease

TABLE 6-1

INDICATOR PARAMETER RANGES
RESOURCE AREA 9-A CBSSES
TOWN OF CALEDON, ONTARIO

(B) Property Damage/Flooding

Indicator #1 (groundwater level):

Low = < 1.0 m (decrease or increase)
Moderate = 1.0 – 3.0 m (decrease or increase)
High = > 3.0 m (decrease or increase)

} based on range of seasonal variations

Indicator #3 (2-yr peak flow):

Low = no increase
High = increase

(C) Channel Form

Assess for approximately 9 measurement areas (cross-sections) qualified in model.

Indicator #2 (baseflow/discharge):

Low = < 5% decrease
Moderate = 5% – 10% decrease
High = > 10% decrease

Indicator #3 (2-yr peak flow): Note: change in velocity range estimated from ΔQ .

Low = < 15% \pm (decrease/increase)
Moderate = 15% – 30% \pm (decrease/increase)
High = > 30% \pm (decrease/increase)

Indicator #4 (overbank flow):

Ephemeral Streams: Low = < 30% decrease
Medium = 30% – 60% decrease
High = > 60% decrease

Intermittent Streams: Low = < 15% decrease
Medium = 15% – 30% decrease
High = > 30% decrease

Permanent Streams: Low = < 10% decrease
Medium = 10% – 20% decrease
High = > 20% decrease

The ranges in values reflect the importance of overbank flow frequency—for ephemeral streams overbank flow is not as important as intermittent, and intermittent is not as important as permanent.

TABLE 6-1

INDICATOR PARAMETER RANGES
RESOURCE AREA 9-A CBSES
TOWN OF CALEDON, ONTARIO

(D) Terrestrial (Upland Forest) Habitat

Applies to FOD, FOM, and FOC units mapped where groundwater level is between 0 and 2 metres below ground surface. These upland forest units will most likely occur in association with wetlands.

Indicator #1 (groundwater level):

Low = < 0.5 m decrease
Moderate = 0.5 – 1.0 m decrease
High = > 1.0 m decrease

(E) Non-Riverine Wetland

Applies to all palustrine and isolated wetlands.

Indicator #1 (groundwater level):

Low = < 0.1 m decrease
Moderate = 0.1 – 0.5 m decrease
High = > 0.5 m decrease

Indicator #2 (baseflow/discharge):

Low = < 10% decrease
Moderate = 10% – 25% decrease
High = > 25% decrease

(F) Riverine Wetland

Indicator #1 (groundwater level change):

Low = < 0.1 m decrease
Moderate = 0.1 to – 0.5 m decrease
High = > 0.5 m decrease

Indicator #2 (baseflow/groundwater discharge):

Low = < 10% decrease
Moderate = 10% – 25% decrease
High = > 25% decrease

Indicator #4 (overbank flow): Secondary Indicator as per Channel Form (Fluvial Geomorphology)

TABLE 6-1

INDICATOR PARAMETER RANGES
RESOURCE AREA 9-A CBSSES
TOWN OF CALEDON, ONTARIO

(G) **Fisheries**

Indicator #2 (baseflow/discharge):

Community-Type Indicator Parameters

Groupings based on DFO general sensitivity ranking. *Group A* being the most sensitive habitats and *Group F* the least sensitive:

Group A: Cold water spawning, Cold water refugia, Cold water isolated

Low	< 2% decrease
Moderate	2% - 5% decrease
High	> 5% decrease

Group B: Cool water refugia, Permanent cold water

Low	<5% decrease
Moderate	5% - 10% decrease
High	>10% decrease

Group D: Cool water isolated, warm water refugia, intermittent cold water, intermittent cool water

Low	<10% decrease
Moderate	10% - 25% decrease
High	> 25% decrease

Group E: Warm water isolated, permanent cool water, intermittent warm water

Low	< 20% decrease
Moderate	20% - 40% decrease
High	> 40% decrease

Group F: Permanent warm water

Low	<50% decrease
Moderate	50% - 80% decrease
High	> 80% decrease

Group G: Ephemeral, contributing

Low	<100% decrease
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Secondary Indicator Parameters:

Indicator #3 (2-yr peak flow): Secondary Indicator as per Channel Form (Fluvial Geomorphology)

Indicator #4 (overbank flow): Secondary Indicator as per Channel Form (Fluvial Geomorphology)

TABLE 6-2

OVERALL CATCHMENT IMPACT
AGGREGATE RESOURCE AREA 9-A CBSES
TOWN OF CALEDON, ONTARIO

		IMPACT							
CBSES STUDY AREA	LOCAL CATCHMENT #	RECEPTORS							OVERALL IMPACT PER CATCHMENT
		Water Supply (Groundwater)	Property Damage/Flooding	Channel Form	Terrestrial Habitat	Non-Riverine Wetlands	Riverine Wetlands	Fisheries	
SCENARIO B: Interim Condition									
Roger's Creek (1203)	R1	H	L	H	H	H	H	M	High
	R2	H	H	H	H	H	H	H	High
	R3	H	H	H	H	H	H	M	High
	R4	H	H	H	H	H	H	H	High
	R5	L	L	L	L	M	M	L	Moderate
	R6	L	L	M	L	L	M	L	Moderate
Second Creek (1202)	S1	H	H	H	H	H	H	H	High
	S2	H	H	H	H	H	H	H	High
	S3	L	H	M	L	L	M	L	High
	S4	L	H	L	L	H	L	L	High
Supplemental Assessment Area		H	M	H	H	L	H	H	High
SCENARIO C: Rehabilitation Condition									
Roger's Creek (1203)	R1	L	L	L	L	L	L	L	Low
	R2	L	L	L	L	L	L	L	Low
	R3	L	L	L	L	L	L	L	Low
	R4	L	L	H	L	L	M	L	High
	R5	L	L	L	L	L	L	L	Low
	R6	L	L	L	L	L	L	L	Low
Second Creek (1202)	S1	L	L	M	L	L	M	L	Moderate
	S2	L	L	L	L	L	L	L	Low
	S3	L	L	L	L	L	L	L	Low
	S4	L	L	L	L	L	L	L	Low
Supplemental Assessment Area		L	L	L	L	L	L	L	Low

Notes:

1. The overall impact to a local catchment is based on the worst case impact to any receptor in the local catchment.
2. Direct impacts to features within the Resource Area are considered separately in Section 4.

TABLE 6-3

FLOODING/PROPERTY DAMAGE IMPACT ASSESSMENT
CHANGE IN INDICATOR 3
2-YR PEAK FLOW
AGGREGATE RESOURCE AREA 9-A CBSES
TOWN OF CALEDON, ONTARIO

Scenario B1 Comparison - Full Extraction; Water Proportioned to Creeks Downstream of Quarry

Catchment	Representative Station	Scenario A Model (L/s)	Scenario B1 Model (L/s)	Difference (L/s)	Change		Response
					%	Increase/Decrease	
R1	SW026	101.0	70.2	-31	-30	Decrease	Low
R2	NS6	182.1	113.5	-69	-38	Decrease	Low
R3	SW023	96.7	224.3	128	132	Increase	High
R4	SW009	465.4	439.7	-26	-6	Decrease	Low
R5	SW015	51.4	51.3	0	0	None	Low
R6	SW013	758.1	727.9	-30	-4	Decrease	Low
S1	SW027	228.7	235.3	7	3	Increase	High
S2	SW022	337.5	375.7	38	11	Increase	High
S3	SW012	325.0	347.1	22	7	Increase	High
S4	SW011	111.2	114.4	3	3	Increase	High

Scenario B2 Comparison - Full Extraction; Water Removed from Watershed

Catchment	Representative Station	Scenario A Model (L/s)	Scenario B2 Model (L/s)	Difference (L/s)	Change		Response
					%	Increase/Decrease	
R1	SW026	101.0	70.2	-31	-30	Decrease	Low
R2	NS6	182.1	113.5	-69	-38	Decrease	Low
R3	SW023	96.7	4.0	-93	-96	Decrease	Low
R4	SW009	465.4	222.8	-243	-52	Decrease	Low
R5	SW015	51.4	51.3	0	0	None	Low
R6	SW013	758.1	516.9	-241	-32	Decrease	Low
S1	SW027	228.7	160.4	-68	-30	Decrease	Low
S2	SW022	337.5	239.0	-99	-29	Decrease	Low
S3	SW012	325.0	208.8	-116	-36	Decrease	Low
S4	SW011	111.2	104.3	-7	-6	Decrease	Low

Scenario C Comparison - Long-term Rehabilitation; Water Proportioned to Creeks Downstream of Quarry

Catchment	Representative Station	Scenario A Model (L/s)	Scenario C Model (L/s)	Difference (L/s)	Change		Response
					%	Increase/Decrease	
R1	SW026	101.0	101.0	0	0	None	Low
R2	NS6	182.1	179.6	-2	-1	Decrease	Low
R3	SW023	96.7	14.5	-82	-85	Decrease	Low
R4	SW009	465.4	350.7	-115	-25	Decrease	Low
R5	SW015	51.4	51.3	0	0	None	Low
R6	SW013	758.1	641.2	-117	-15	Decrease	Low
S1	SW027	228.7	212.5	-16	-7	Decrease	Low
S2	SW022	337.5	307.4	-30	-9	Decrease	Low
S3	SW012	325.0	298.5	-26	-8	Decrease	Low
S4	SW011	111.2	109.0	-2	-2	Decrease	Low

Response Legend

Low No Increase
High Increase

TABLE 6-4

CHANNEL FORM IMPACT ASSESSMENT
CHANGE IN INDICATOR #2 - GROUNDWATER DISCHARGE TO SURFACE WATER
AGGREGATE RESOURCE AREA 9-A CBSES
TOWN OF CALEDON, ONTARIO

Creek Comparison - Scenario A versus Scenario B

Catchment	Scenario A (m ³ /day)	Scenario B (m ³ /day)	Difference (m ³ /day)	Change*		Response
				(%)	Increase or Decrease	
R1	-442	-321	121	-27	Decrease	High
R2	-449	-19	430	-96	Decrease	High
R3	-211	0	211	-100	Decrease	High
R4	-496	-123	373	-75	Decrease	High
R5	-299	-291	9	-3	Decrease	Low
R6	-2870	-2879	-9	0	None	Low
S1	-680	-54	626	-92	Decrease	High
S2	-716	-205	511	-71	Decrease	High
S3	-947	-947	0	0	None	Low
S4	-680	-681	-1	0	None	Low
SA	-483	-360	123	-26	Decrease	High
Study Area[†]	-7,790	-5,519	2,271	-29	Decrease	High

Riverine Wetlands Comparison - Scenario A versus Scenario B

Catchment	Scenario A (m ³ /day)	Scenario B (m ³ /day)	Difference (m ³ /day)	Change*		Response
				(%)	Increase or Decrease	
R1	-819	-489	330	-40	Decrease	High
R2	-1133	-6	1127	-99	Decrease	High
R3	-1374	0	1374	-100	Decrease	High
R4	-1229	-209	1020	-83	Decrease	High
R5	-1932	-1919	13	-1	Decrease	Low
R6	-477	-477	0	0	None	Low
S1	-1750	-222	1528	-87	Decrease	High
S2	-1173	-278	895	-76	Decrease	High
S3	-946	-949	-3	0	None	Low
S4	-371	-358	13	-4	Decrease	Low
SA	-1018	-740	278	-27	Decrease	High
Study Area[†]	-11,203	-4,907	6,295	-56	Decrease	High

Creeks plus Riverine Wetlands - Scenario A versus Scenario B

Catchment	Scenario A (m ³ /day)	Scenario B (m ³ /day)	Difference (m ³ /day)	Change*		Response
				(%)	Increase or Decrease	
R1	-1262	-811	451	-36	Decrease	High
R2	-1582	-25	1557	-98	Decrease	High
R3	-1584	0	1584	-100	Decrease	High
R4	-1725	-332	1393	-81	Decrease	High
R5	-2232	-2210	22	-1	Decrease	Low
R6	-3347	-3355	-8	0	None	Low
S1	-2430	-276	2154	-89	Decrease	High
S2	-1889	-483	1406	-74	Decrease	High
S3	-1893	-1896	-3	0	None	Low
S4	-1051	-1039	12	-1	Decrease	Low
SA	-1501	-1100	402	-27	Decrease	High
Study Area**	-18,993	-10,426	8,567	-45	Decrease	High

Notes

- (1) Negative values denote a decrease in groundwater discharge to surface water and a decrease in groundwater elevation.
- (2) Positive values denote an increase in groundwater discharge to surface water and an increase in groundwater elevation.
- (**) Study Area excludes Supplemental Assessment Area (SA)
- (*) Values include decrease in baseflows due to the direct removal of surface water features within the Resource Area.

Creek Comparison - Scenario A versus Scenario C

Catchment	Scenario A (m ³ /day)	Scenario C (m ³ /day)	Difference (m ³ /day)	Change*		Response
				(%)	Increase or Decrease	
R1	-442	-446	-3	1	Increase	Low
R2	-449	-456	-7	2	Increase	Low
R3	-211	0	211	-100	Decrease	High
R4	-496	-545	-49	10	Increase	Low
R5	-299	-305	-6	2	Increase	Low
R6	-2870	-2877	-7	0	None	Low
S1	-680	-586	94	-14	Decrease	High
S2	-716	-815	-99	14	Increase	Low
S3	-947	-946	2	0	None	Low
S4	-680	-675	4	-1	Decrease	Low
SA	-483	-487	-4	1	Increase	Low
Study Area[†]	-7,790	-7,651	139	-2	Decrease	Low

Riverine Wetlands Comparison - Scenario A versus Scenario C

Catchment	Scenario A (m ³ /day)	Scenario C (m ³ /day)	Difference (m ³ /day)	Change*		Response
				(%)	Increase or Decrease	
R1	-819	-821	-2	0	None	Low
R2	-1,133	-1,145	-12	1	Increase	Low
R3	-1,374	-799	575	-42	Decrease	High
R4	-1,229	-1,233	-4	0	None	Low
R5	-1,932	-1,935	-3	0	None	Low
R6	-477	-479	-2	0	None	Low
S1	-1,750	-1,440	309	-18	Decrease	High
S2	-1,173	-1,137	36	-3	Decrease	Low
S3	-946	-943	2	0	None	Low
S4	-371	-371	0	0	None	Low
SA	-1,018	-1,024	-5	1	Increase	Low
Study Area[†]	-11,203	-10,303	900	-8	Decrease	Moderate

Creeks plus Riverine Wetlands - Scenario A versus Scenario C

Catchment	Scenario A (m ³ /day)	Scenario C (m ³ /day)	Difference (m ³ /day)	Change*		Response
				(%)	Increase or Decrease	
R1	-1262	-1267	-5	0	None	Low
R2	-1582	-1601	-20	1	Increase	Low
R3	-1584	-799	786	-50	Decrease	High
R4	-1725	-1778	-53	3	Increase	Low
R5	-2232	-2240	-9	0	None	Low
R6	-3347	-3356	-9	0	None	Low
S1	-2430	-2027	403	-17	Decrease	High
S2	-1889	-1952	-63	3	Increase	Low
S3	-1893	-1889	4	0	None	Low
S4	-1051	-1046	5	0	None	Low
SA	-1501	-1510	-9	1	Increase	Low
Study Area**	-18,993	-17,954	1,039	-5	Decrease	Moderate

Indicator Parameter Ranges:

- Low = <5% decrease
- Moderate = 5% - 10% decrease
- High = >10% decrease

**CHANNEL FORM IMPACT ASSESSMENT
CHANGE INDICATOR #3
2-YEAR PEAK CHANNEL VELOCITY
AGGREGATE RESOURCE AREA 9-A CBSES
TOWN OF CALEDON, ONTARIO**

Scenario B1 Comparison - Full Extraction; Water Proportioned to Creeks Downstream of Quarry

Catchment	Representative Station	Scenario A Model (m/s)	Scenario B1 Model (m/s)	Difference (m/s)	Change		Response
					%	Increase or Decrease	
R1	SW001	0.10	0.10	0	0	None	Low
R2	SW002	0.25	0.23	-0.02	-8	Decrease	Low
R2	SW003	1.00	0.86	-0.14	-14	Decrease	Low
R4	SW009	0.28	0.28	0	0	None	Low
R5	SW015	0.44	0.44	0	0	None	Low
R6	SW013	2.65	2.62	-0.03	-1	Decrease	Low
S1	SW004	0.13	0.10	-0.03	-23	Decrease	Moderate
S2	SW022	0.54	0.56	0.02	4	Increase	Low
S2	SW005	0.53	0.55	0.02	4	Increase	Low
S3	SW012	2.55	2.61	0.06	2	Increase	Low

Scenario B2 Comparison - Full Extraction; Water Removed from Watershed

Catchment	Representative Station	Scenario A Model (m/s)	Scenario B2 Model (m/s)	Difference (m/s)	Change		Response
					%	Increase or Decrease	
R1	SW001	0.10	0.10	0	0	None	Low
R2	SW002	0.25	0.23	-0.02	-8	Decrease	Low
R2	SW003	1.00	0.86	-0.14	-14	Decrease	Low
R4	SW009	0.28	0.21	-0.07	-25	Decrease	Moderate
R5	SW015	0.44	0.44	0	0	None	Low
R6	SW013	2.65	2.32	-0.33	-12	Decrease	Low
S1	SW004	0.13	0.10	-0.03	-23	Decrease	Moderate
S2	SW022	0.54	0.48	-0.06	-11	Decrease	Low
S2	SW005	0.53	0.49	-0.04	-8	Decrease	Low
S3	SW012	2.55	2.17	-0.38	-15	Decrease	Moderate

Scenario C Comparison - Long-term Rehabilitation; Water Proportioned to Creeks Downstream of Quarry

Catchment	Representative Station	Scenario A Model (m/s)	Scenario C Model (m/s)	Difference (m/s)	Change		Response
					%	Increase or Decrease	
R1	SW001	0.10	0.10	0	0	None	Low
R2	SW002	0.25	0.23	-0.02	-8	Decrease	Low
R2	SW003	1.00	1.00	0	0	None	Low
R4	SW009	0.28	0.25	-0.03	-11	Decrease	Low
R5	SW015	0.44	0.44	0	0	None	Low
R6	SW013	2.65	2.50	-0.15	-6	Decrease	Low
S1	SW004	0.13	0.13	0	0	None	Low
S2	SW022	0.54	0.52	-0.02	-4	Decrease	Low
S2	SW005	0.53	0.52	-0.01	-2	Decrease	Low
S3	SW012	2.55	2.47	-0.08	-3	Decrease	Low

Response Legend

Low	< +/- 15%
Moderate	+/- 15% - 30%
High	> +/- 30%

TABLE 6-6

CHANGE IN INDICATOR #4 CHANNEL FORM IMPACT ASSESSMENT
OVERBANK DEPTH
AGGREGATE RESOURCE AREA 9-A CBSES
TOWN OF CALEDON, ONTARIO

Scenario B1 Comparison - Full Extraction; Water Proportioned to Creeks Downstream of Quarry

Catchment	Representative Station	Stream Classification	Overbank Depth		Difference (cm)	Channel Depth		Difference (cm)	Change		Response	Response Legend
			Scenario A (cm)	Scenario B1 (cm)		Scenario A (cm)	Scenario B1 (cm)		(%)	Increase or Decrease		
R1	SW001	Permanent	-	-	-	3	3	0	0	None	Low	Ephemeral Low < 30% decrease Moderate 30% - 60% decrease High > 60% decrease
R2	SW002	Intermittent	-	-	-	14	12	-2	-14	Decrease	Low	
R2	SW003	Intermittent	-	-	-	10	8	-2	-20	Decrease	Moderate	
R4	SW009	Permanent	12.1	12.1	0	52	52	0	0	None	Low	Intermittent Low < 15% decrease Moderate 15% - 30% decrease High > 30% decrease
R5	SW015	Intermittent	-	-	-	6	6	0	0	None	Low	
R6	SW013	Permanent	-	-	-	18	18	0	0	None	Low	
S1	SW004	Permanent	0.1	-	-	42	38	-4	-10	Decrease	Low	Permanent Low < 10% decrease Moderate 10% - 20% decrease High > 20% decrease
S2	SW022	Permanent	-	-	-	23	25	2	9	Increase	Low	
S2	SW005	Intermittent	-	-	-	36	37	1	3	Increase	Low	
S3	SW012	Permanent	-	-	-	14	15	1	7	Increase	Low	

Scenario B2 Comparison - Full Extraction; Water Removed from Watershed

Catchment	Representative Station	Stream Classification	Overbank Depth		Difference (cm)	Channel Depth		Difference (cm)	Change		Response
			Scenario A (cm)	Scenario B2 (cm)		Scenario A (cm)	Scenario B2 (cm)		(%)	Increase or Decrease	
R1	SW001	Permanent	-	-	-	3	3	0	0	None	Low
R2	SW002	Intermittent	-	-	-	14	12	-2	-14	Decrease	Low
R2	SW003	Intermittent	-	-	-	10	8	-2	-20	Decrease	Moderate
R4	SW009	Permanent	12.1	3.1	-9	52	43	-9	-74	Decrease	High
R5	SW015	Intermittent	-	-	-	6	6	0	0	None	Low
R6	SW013	Permanent	-	-	-	18	16	-2	-11	Decrease	Moderate
S1	SW004	Permanent	0.1	-	-	42	38	-4	-10	Decrease	Moderate
S2	SW022	Permanent	-	-	-	23	20	-3	-13	Decrease	Moderate
S2	SW005	Intermittent	-	-	-	36	31	-5	-14	Decrease	Low
S3	SW012	Permanent	-	-	-	14	12	-2	-14	Decrease	Moderate

Scenario C Comparison - Long-term Rehabilitation; Water Proportioned to Creeks Downstream of Quarry

Catchment	Representative Station	Stream Classification	Overbank Depth		Difference (cm)	Channel Depth		Difference (cm)	Change		Response
			Scenario A (cm)	Scenario C (cm)		Scenario A (cm)	Scenario C (cm)		(%)	Increase or Decrease	
R1	SW001	Permanent	-	-	-	3	3	0	0	None	Low
R2	SW002	Intermittent	-	-	-	14	14	0	0	None	Low
R2	SW003	Intermittent	-	-	-	10	10	0	0	None	Low
R4	SW009	Permanent	12.1	8.1	-4	52	48	-4	-33	Decrease	High
R5	SW015	Intermittent	-	-	-	6	6	0	0	None	Low
R6	SW013	Permanent	-	-	-	18	17	-1	-6	Decrease	Low
S1	SW004	Permanent	0.1	-	-	42	42	0	0	None	Low
S2	SW022	Permanent	-	-	-	23	22	-1	-4	Decrease	Low
S2	SW005	Intermittent	-	-	-	36	34	-2	-6	Decrease	Low
S3	SW012	Permanent	-	-	-	14	14	0	0	None	Low

TABLE 6-7

ANALYSIS OF GROUNDWATER AND SURFACE WATER MODELLING ON CHANNEL FORM
AGGREGATE RESOURCE AREA 9-A CBSSES
TOWN OF CALEDON, ONTARIO

Results of analysis of groundwater and surface water modelling on channel form for Scenario B

<i>Local Assessment Catchment</i>	<i>Primary Indicators</i>			<i>Overall Impact</i>
	<i>Indicator 2</i>	<i>Indicator 3</i>	<i>Indicator 4</i>	
	<i>Baseflow / Discharge</i>	<i>2-Year Peak Flow (Velocity)</i>	<i>Overbank Flow</i>	
R1	High	Low	Low	High
R2	High	Low	Moderate	High
R3	High	n/a	n/a	High
R4	High	Moderate	High	High
R5	Low	Low	Low	Low
R6	Low	Low	Moderate	Moderate
S1	High	Moderate	Moderate	High
S2	High	Low	High; Moderate	High
S3	Low	Moderate	Moderate	Moderate
S4	Low	n/a	n/a	Low
SA	High	n/a	n/a	High

Results of analysis of groundwater and surface water modelling on channel form for Scenario C

<i>Local Assessment Catchment</i>	<i>Primary Indicators</i>			<i>Overall Impact</i>
	<i>Indicator 2</i>	<i>Indicator 3</i>	<i>Indicator 4</i>	
	<i>Baseflow / Discharge</i>	<i>2-Year Peak Flow (Velocity)</i>	<i>Overbank Flow</i>	
R1	Low	Low	Low	Low
R2	Low	Low	Low	Low
R3	Low	n/a	n/a	Low
R4	Low	Low	High	High
R5	Low	Low	Low	Low
R6	Low	Low	Low	Low
S1	High	Low	Low	Moderate
S2	Low	Low	Low; Low	Low
S3	Low	Low	Low	Low
S4	Low	n/a	n/a	Low
SA	Low	n/a	n/a	Low

Note:
n/a = Not Assessed

TABLE 6-8

RIVERINE AND NON-RIVERINE WETLANDS IMPACT ASSESSMENT
 CHANGE IN INDICATOR #2 - GROUNDWATER DISCHARGE TO SURFACE WATER
 AGGREGATE RESOURCE AREA 9-A CBSSES
 TOWN OF CALEDON, ONTARIO

(B) Riverine Wetlands Comparison - Scenario A versus Scenario B

Catchment	Scenario A (m ³ /day)	Scenario B (m ³ /day)	Difference (m ³ /day)	Change*		Response
				(%)	Increase or Decrease	
R1	-819	-489	330	-40	Decrease	High
R2	-1133	-6	1127	-99	Decrease	High
R3	-1374	0	1374	-100	Decrease	High
R4	-1229	-209	1020	-83	Decrease	High
R5	-1932	-1919	13	-1	Decrease	Low
R6	-477	-477	0	0	None	Low
S1	-1750	-222	1528	-87	Decrease	High
S2	-1173	-278	895	-76	Decrease	High
S3	-946	-949	-3	0	None	Low
S4	-371	-358	13	-4	Decrease	Low
SA	-1018	-740	278	-27	Decrease	High
Study Area**	-11,203	-4,907	6,295	-56	Decrease	High

(B) Riverine Wetlands Comparison - Scenario A versus Scenario C

Catchment	Scenario A (m ³ /day)	Scenario C (m ³ /day)	Difference (m ³ /day)	Change*		Response
				(%)	Increase or Decrease	
R1	-819	-821	-2	0	None	Low
R2	-1,133	-1,145	-12	1	Increase	Low
R3	-1,374	-799	575	-42	Decrease	High
R4	-1,229	-1,233	-4	0	None	Low
R5	-1,932	-1,935	-3	0	None	Low
R6	-477	-479	-2	0	None	Low
S1	-1,750	-1,440	309	-18	Decrease	Moderate
S2	-1,173	-1,137	36	-3	Decrease	Low
S3	-946	-943	2	0	None	Low
S4	-371	-371	0	0	None	Low
SA	-1,018	-1,024	-5	1	Increase	Low
Study Area**	-11,203	-10,303	900	-8	Decrease	Low

(C) Non-Riverine Wetlands Comparison - Scenario A versus Scenario B

Catchment	Scenario A (m ³ /day)	Scenario B (m ³ /day)	Difference (m ³ /day)	Change		Response
				(%)	Increase or Decrease	
R1	-294	-249	45	-15	Decrease	Moderate
R2	-130	-2	128	-98	Decrease	High
R3	-126	0	126	-100	Decrease	High
R4	-252	-54	199	-79	Decrease	High
R5	-829	-802	27	-3	Decrease	Low
R6	-634	-635	-1	0	None	Low
S1	-400	-55	345	-86	Decrease	High
S2	-157	0	157	-100	Decrease	High
S3	-197	-188	9	-5	Decrease	Low
S4	-97	-98	0	0	None	Low
SA	0	0	0	0	None	Low
Study Area**	-3,117	-2,083	1,034	-33	Decrease	High

(C) Non-Riverine Wetlands Comparison - Scenario A versus Scenario C

Catchment	Scenario A (m ³ /day)	Scenario C (m ³ /day)	Difference (m ³ /day)	Change		Response
				(%)	Increase or Decrease	
R1	-294	-295	-1	0	Increase	Low
R2	-130	-150	-21	16	Increase	Low
R3	-126	-143	-17	14	Increase	Low
R4	-252	-269	-17	7	Increase	Low
R5	-829	-829	0	0	None	Low
R6	-634	-625	9	-1	Decrease	Low
S1	-400	-414	-13	3	Increase	Low
S2	-157	-170	-13	8	Increase	Low
S3	-197	-195	2	-1	Decrease	Low
S4	-97	-97	0	0	None	Low
SA	0	-3.9	-3.9	>100	Increase	Low
Study Area**	-3,117	-3,188	-72	2	Increase	Low

Notes:

- (1) Negative values denote a decrease in groundwater discharge to surface water and a decrease in groundwater elevation.
- (2) Positive values denote an increase in groundwater discharge to surface water and an increase in groundwater elevation.
- (**) Study Area excludes Supplemental Assessment Area (SA)
- (*) Values include decrease in baseflows due to the direct removal of surface water features within the Resource Area. There is an actual increase in groundwater discharge immediately up and down gradient of the Resource Area in R3 due to mounding of the water table.

Indicator Parameter Ranges:

- Low = <10% decrease
- Moderate = 10% - 25% decrease
- High = >25% decrease

TABLE 6-9

**DFO SENSITIVITY CRITERIA
AGGREGATE RESOURCE AREA 9-A CBSSES
TOWN OF CALEDON, ONTARIO**

Attribute	Description	Scales for Qualifying the attributes in freshwater ecosystems
Species Sensitivity	Sensitivity of species to changes in environmental conditions, such as suspended sediments, water temperature or salinity.	<ul style="list-style-type: none"> • Species present are resilient to change and perturbation (e.g. many cyprinid species) (Low Sensitivity) • Species present are moderately resilient to change and perturbation (e.g. pike, walleye and some cyprinids) (Moderate Sensitivity) • Species present are highly sensitive to perturbations (e.g. many salmonidae) (High Sensitivity)
Species Dependence on Habitat	Use of habitat (i.e. cover, food, reproduction, water quality, or migration routes) by fish species. For example, some species may be able to spawn in a wide range of habitats, while others may have very specific habitat requirements.	<ul style="list-style-type: none"> • No use by fish (N/A) • Used as migratory corridor only (Low Sensitivity) • Feeding, rearing (Moderate Sensitivity) • Spawning habitat; habitat critical to survival of species (High Sensitivity)
Rarity	The relative strength of a fish population or prevalence of a particular type of habitat.	<ul style="list-style-type: none"> • Habitat/species prevalent (Low Sensitivity) • Habitat/species has limited distribution confined to small areas (Moderate Sensitivity) • Habitat/species is rare (e.g. listed species under SARA) (High Sensitivity)
Habitat Resiliency	Ability of an aquatic ecosystem to recover from changes in environmental conditions (important considerations include flow and thermal regimes).	<p>Thermal regime</p> <ul style="list-style-type: none"> • Thermal regime unsuitable for any fish species (N/A) • Warm water thermal regime (Low Sensitivity) • Cool water systems; (Moderate Sensitivity) • Coldwater systems (High Sensitivity) <p>Physical characteristics</p> <ul style="list-style-type: none"> • System is stable and resilient to change perturbation (Low Sensitivity) • System is somewhat stable and resilient to change and perturbation (Moderate Sensitivity) • System is not stable and/or resilient to change and perturbation (High Sensitivity) • Flow regime: <ul style="list-style-type: none"> -Ephemeral (Low Sensitivity) -Intermittent- (Moderate Sensitivity) -Permanent- (High Sensitivity)

TABLE 6-10

FISH HABITAT/COMMUNITY OVERALL SENSITIVITY RANKINGS
AGGREGATE RESOURCE AREA 9-A CBSES
TOWN OF CALEDON, ONTARIO

<i>Fish/Fish Habitat Type</i>	<i>Species Sensitivity</i>	<i>Species Dependence on Habitat</i>	<i>Rarity</i>		<i>Habitat Resiliency</i>	<i>Overall Sensitivity</i>
			SP	HABT		
Coldwater spawning	H	H	M	H	H	H
Coldwater refugia	H	H	M	H	H	H
Coldwater isolated	H	H	M		H	H
Cool water isolated	L-M	H	L-M	N/A	H	M
Warmwater isolated	L	H	L	N/A	M-H	L-M
Cool water refugia	L-M	H	L-M	H	H	M-H
Warmwater refugia	L	H	L	M	M	M
Permanent coldwater	H	M-H	M	M	M-H	M-H
Permanent cool water	L-M	L-M	L-M	L-M	M	L-M
Permanent warmwater	L	L	L	L	L	L
Intermittent coldwater	H	L	M		M-H	M
Intermittent cool water	L-M	L	L-M		M-H	M
Intermittent Warmwater	L	L	L		M	L-M
Ephemeral warmwater	L	L	L	L	L-M	L
Contributing habitat	N/A	N/A	N/A	VL	VL	VL

TABLE 6-11
FISHERIES MOST SENSITIVE REACHES
AGGREGATE RESOURCE AREA 9-A CBSES
TOWN OF CALEDON, ONTARIO

<i>Catchment</i>	<i>Sensitivity Ranking</i>	<i>Fish Community</i>	<i>Justification</i>
R1	Low – Moderate	Perennial Warm Water, Isolated	<ul style="list-style-type: none"> • Isolated refuge habitat • Likely dependent on groundwater contribution
R2	Moderate-High	Perennial Cool Water	<ul style="list-style-type: none"> • Refuge habitat • Groundwater dependent • Isolated perennial reach
R3	Moderate	Intermittent Cool Water	<ul style="list-style-type: none"> • Only riverine direct fish habitat within the catchment • Isolated habitat • Groundwater dependant
R4	High	Perennial Cold Water Spawning	<ul style="list-style-type: none"> • Brook Trout spawning habitat • Directly dependant on groundwater discharge • Isolated brook trout habitat
R4 (Supplemental Assessment Reach)	Moderate	Intermittent Cool Water	<ul style="list-style-type: none"> • High simulated groundwater drawdown • Intermittent cool water system dependant on groundwater to sustain flows in spring
R5	High	Cold Water Spawning	<ul style="list-style-type: none"> • Brook Trout spawning habitat • Critical nursery habitat • Refugia habitat • Isolated habitat
R6	High	Cold water	<ul style="list-style-type: none"> • Cold water brook trout habitat • Groundwater dependent • Refuge habitat • Isolated habitat
S1	Moderate	Intermittent Cool Water	<ul style="list-style-type: none"> • High predicted groundwater drawdown • Groundwater dependant to sustain flow in spring
S2	High	Cold Water Spawning	<ul style="list-style-type: none"> • Brook trout spawning habitat • Refugia habitat • Isolated habitat • Strong groundwater influence
S2 (Supplemental Assessment Reach)	Low-Moderate	Intermittent Warm Water	<ul style="list-style-type: none"> • Proximity to Resource Area 9-A • Groundwater influence on hydroperiod

TABLE 6-11
FISHERIES MOST SENSITIVE REACHES
AGGREGATE RESOURCE AREA 9-A CBSSES
TOWN OF CALEDON, ONTARIO

<i>Catchment</i>	<i>Sensitivity Ranking</i>	<i>Fish Community</i>	<i>Justification</i>
S3	High	Cold Water Refugia	<ul style="list-style-type: none"> • Brook trout habitat • Refugia habitat • Isolated habitat
S4	Low-Moderate	Intermittent Warm Water	<ul style="list-style-type: none"> • Groundwater influence on hydroperiod
SA	Moderate-High	Intermittent Warm Water	

TABLE 6-12

FISHERIES IMPACT ASSESSMENT
CHANGE IN INDICATOR #2 - GROUNDWATER DISCHARGE TO SURFACE WATER
AGGREGATE RESOURCE AREA 9-A CBSES
TOWN OF CALEDON, ONTARIO

Creek Comparison - Scenario A versus Scenario B

Catchment	Representative Surface Water Monitoring Station	Scenario A (m ³ /day)	Scenario B (m ³ /day)	Difference (m ³ /day)	Change	
					(%)	Increase or Decrease
R1	SW004	-442	-321	121	-27	Decrease
R2	SW022	-449	-19	430	-96	Decrease
R3	SW005	-211	0	211	-100	Decrease
R4	SW012	-496	-123	373	-75	Decrease
R5	SW001	-299	-291	9	-3	Decrease
R6	SW002	-2870	-2879	-9	0	None
S1	SW003	-680	-54	626	-92	Decrease
S2	SW009	-716	-205	511	-71	Decrease
S3	SW015	-947	-947	0	0	None
S4	SW013	-680	-681	-1	0	None
SA	SW007/SW018	-483	-360	123	-26	Decrease
<i>Study Area</i> ^{**}		<i>-7,790</i>	<i>-5,519</i>	<i>2,271</i>	<i>-29</i>	<i>Decrease</i>

Creek Comparison - Scenario A versus Scenario C

Catchment	Representative Surface Water Monitoring Station	Scenario A (m ³ /day)	Scenario C (m ³ /day)	Difference (m ³ /day)	Change	
					(%)	Increase or Decrease
R1	SW004	-442	-446	-3	1	Increase
R2	SW022	-449	-456	-7	2	Increase
R3	SW005	-211	0	211	-100	Decrease*
R4	SW012	-496	-545	-49	10	Increase
R5	SW001	-299	-305	-6	2	Increase
R6	SW002	-2870	-2877	-7	0	None
S1	SW003	-680	-586	94	-14	Decrease
S2	SW009	-716	-815	-99	14	Increase
S3	SW015	-947	-946	2	0	None
S4	SW013	-680	-675	4	-1	Decrease
SA	SW007/SW018	-483	-487	-4	1	Increase
<i>Study Area</i> ^{**}		<i>-7,790</i>	<i>-7,651</i>	<i>139</i>	<i>-2</i>	<i>Decrease</i>

Most Sensitive Fisheries Reaches - Creek Comparison - Scenario A versus Scenario B

Catchment	Fish Habitat Community	Scenario A (m ³ /day)	Scenario B (m ³ /day)	Difference (m ³ /day)	Change		Response
					(%)	Increase or Decrease	
R1	Perennial Warm Water, Isolated	-62	-43	20	-32	Decrease	Moderate
R2	Perennial Cool Refugia	-28	0	28	-100	Decrease	High
R3	Intermittent Cool Water	-104	0	104	-100	Decrease	High
R4	Cold Water Spawning	-72	-72	1	-1	Decrease	Low
R4 - SAR	Intermittent Cool Water	-60	0	60	-100	Decrease	High
R5	Cold Water Spawning	-79	-80	-1	1	Increase	Low
R6	Perennial Cold Water Isolated	-32	-32	0	0	None	Low
S1	Intermittent Cool Water	-31	0	31	-100	Decrease	High
S2	Cold Water Spawning	-104	-103	1	-1	Decrease	Low
S2 - SAR	Intermittent Warm Water	-160	0	160	-100	Decrease	High
S3	Cold Water Spawning	-90	-90	0	0	None	Low
S4	Intermittent Warm Water	-45	-45	0	0	Decrease	Low
SA - Third Creek	Intermittent Warm Water	-52	-51	1	-2	Decrease	Low
SA - Fourth Creek	Intermittent Warm Water	-123	-26	97	-79	Decrease	High

Most Sensitive Fisheries Reaches - Creek Comparison - Scenario A versus Scenario C

Catchment	Fish Habitat Community	Scenario A (m ³ /day)	Scenario C (m ³ /day)	Difference (m ³ /day)	Change		Response
					(%)	Increase or Decrease	
R1	Perennial Warm Water	-62	-62	0	0	None	Low
R2	Perennial Cool Refugia	-28	-31	-3	11	Increase	Low
R3	Intermittent Cool Water	-104	0	104	-100	Decrease	Low
R4	Cold Water Spawning	-72	-72	0	0	None	Low
R4 - SAR	Intermittent Cool Water	-60	-60	0	0	None	Low
R5	Cold Water Spawning	-79	-82	-2	3	None	Low
R6	Perennial Cold Water Isolated	-32	-32	-1	2	None	Low
S1	Intermittent Cool Water	-31	-26	5	-17	Decrease	Low
S2	Cold Water Spawning	-104	-104	1	-1	Decrease	Low
S2 - SAR	Intermittent Warm Water	-160	-173	-13	8	Increase	Low
S3	Cold Water Spawning	-90	-90	0	0	None	Low
S4	Intermittent Warm Water	-45	-45	0	0	None	Low
SA - Third Creek	Intermittent Warm Water	-52	-52	0	0	None	Low
SA - Fourth Creek	Intermittent Warm Water	-123	-124	-1	1	Increase	Low

Notes

- (1) Negative values denote a decrease in groundwater discharge to surface water and a decrease in groundwater elevation.
 - (2) Positive values denote an increase in groundwater discharge to surface water and an increase in groundwater elevation.
 - (**) Study Area excludes Supplemental Assessment Area (SA)
 - (*) Values include decrease in baseflow due to the direct removal of surface water features within the Resource Area. There is an actual increase in groundwater discharge immediately up and down gradient of the Resource Area in R3 due to mounding of the water table.
- SAR - Supplemental Assessment Reach

Indicator Parameter Ranges:

Group A: Cold water spawning, Cold water refugia, Cold water isolated
 Low < 2% decrease
 Moderate 2% - 5% decrease
 High > 5% decrease

Group E: Warm water isolated, permanent cool water, intermittent warm water
 Low < 20% decrease
 Moderate 20% - 40% decrease
 High > 40% decrease

Group B: Cool water refugia, Permanent cold water
 Low < 5% decrease
 Moderate 5% - 10% decrease
 High > 10% decrease

Group F: Permanent warm water
 Low < 50% decrease
 Moderate 50% - 80% decrease
 High > 80% decrease

Group D: Cool water isolated, warm water refugia, intermittent cold water, intermittent cool water
 Low < 10% decrease
 Moderate 10% - 25% decrease
 High > 25% decrease

Group G: Ephemeral, contributing
 Low < 100% decrease

TABLE 6-F7

OVERALL FISHERIES IMPACT ANALYSIS
AGGREGATE RESOURCE AREA 9-A CBSES
TOWN OF CALEDON, ONTARIO

Overall Impact Analysis on Fisheries for Scenario B

<i>Subwatershed</i>	<i>Local Assessment Catchment</i>	<i>Primary Indicators</i>		<i>Secondary Indicators</i>		<i>Additional Consideration</i>	<i>Overall Impact to Fisheries</i>
		<i>Groundwater Discharge</i>	<i>Hydroperiod</i>	<i>Fluvial Geomorphology</i>	<i>Water Quality</i>	<i>Riverine Wetlands</i>	
Rogers Creek	R1	Moderate	Moderate	High	Moderate	High	Moderate
	R2	High	High	High	High	High	High
	R3	High	High	High	High	High	Moderate
	R4	High	High	High	High	High	High
	R5	Low	Low	Low	Low	Moderate	Low
	R6	Low	Moderate	High	Moderate	Low	Moderate
Second Creek	S1	High	High	High	High	High	High
	S2	High	High	High	High	High	High
	S3	Low	Moderate	Low	Moderate	Low	Moderate
	S4	Low	Low	Low	Low	Low	Low
Supplemental Assessment Area	SA	High	Moderate	High	High	High	High

Overall Impact Analysis on Fisheries for Scenario C

<i>Subwatershed</i>	<i>Local Assessment Catchment</i>	<i>Primary Indicators</i>		<i>Secondary Indicators</i>		<i>Additional Consideration</i>	<i>Overall Impact to Fisheries</i>
		<i>Groundwater Discharge</i>	<i>Hydroperiod</i>	<i>Fluvial Geomorphology</i>	<i>Water Quality</i>	<i>Riverine Wetlands</i>	
Rogers Creek	R1	Low	Low	Low	Low	Low	Low
	R2	Low	Low	low	low	Low	low
	R3	Low	Low	Low	Low	Low	Low
	R4	Low	Low	High	Low	Low	Low
	R5	Low	Low	Low	Low	Low	Low
	R6	Low	Low	Low	Low	Low	Low
Second Creek	S1	Low	Low	Moderate	Moderate	Moderate	Low
	S2	Low	Low	Low	Low	Low	Low
	S3	Low	Low	Low	Low	Low	Low
	S4	Low	Low	Low	Low	Low	Low
Supplemental Assessment Area	SA	Low	Low	Low	Low	Low	Low