



Severn Sound

Environmental Association

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A Brief Description of the Environmental Quality of MacDonald Creek, Township of Tiny

Prepared by: Keith Sherman
June 9, 2003

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A Brief Description of the Environmental Quality of MacDonald Creek, Township of Tiny

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The following information was collected by Severn Sound RAP and Severn Sound Environmental Association staff and contractors to support agricultural and fish community assessment projects carried out at various locations in the Severn Sound watershed. The chemical analyses were carried out by the Ministry of the Environment Laboratory Services Branch using standard methods. The benthic invertebrates were collected using qualitative methods that indicated presence and diversity of organisms. A single pass electro-shocking method was used with identifications made by a qualified fisheries biologist.

Flow of MacDonald Creek

The drainage basin for the Creek to the point where it enters the Wye River is 26.2 Km². The stream consists of two main branches, an eastern and western branch. The western branch receives drainage from site 41 (6.9 Km² to Baseline Rd). The eastern branch has a drainage of 12.1 Km² to Marshall Side Road. The Severn Sound RAP monitoring program included water quality sampling at a site (SSEA Station 42) below the confluence of the two branches at the crossing of Mertz Side Road (drainage area to road crossing 22.2. Km²).

Spot flow gauging measurements were carried out at Station 42 by Severn Sound RAP staff during 1993 using a calibrated Marsh-McBirney flow meter. These flows were gauged against a relative measurement of water level (measuring point from the top of the concrete box culvert at the upstream end of the crossing). Comparison of the spot flows against the mean daily flow for the Wye River near Wyevale (see Table 1, 02ED013 drainage area to station 112 Km²) provides a ratio of 0.48 which is more than twice as much as the ratio of drainage areas between the two sites. Since these measurements were taken for the most part during base flow periods, it would appear that MacDonald Creek has a higher unit base flow than the Wye River.

Measurements of flow at SSRAP Station 42 and the two branches of MacDonald Creek upstream of the confluence were made during the low flow period of 2002 as part of the North Simcoe Municipal Groundwater Study (Dixon-Golder draft). The measurements taken on August 28-29, 2002 resulted in a flow of 5 L/s at the western branch at Baseline Road (km²); 14 L/s at the eastern branch (km²); and 112 L/s at the confluence at Mertz Side Road (SSRAP Station 42 - km²). Little can be concluded from a single measurement but it was clear that the base flow of the eastern branch was stronger than that of the western branch. It is strongly suggested that a continuous, year round flow station with standards equivalent to Water Survey of Canada be established at the

crossing of Mertz Road and that additional spot flows measurements or ice-free continuous stations be established on the upstream branches to provide a better basis for establishing low flow conditions.

Temperature

Spot temperatures were collected using a thermometer during 1993, 1994 and 1995 and during benthos and fish monitoring in 2000. Temperature was monitored using a temperature logger from July 1 to September 10, 2002. The stream was characterized as a coolwater stream using the DFO protocol (Figure 2). Spot temperatures taken on August 28 and 29, 2002 (North Simcoe Municipal Groundwater Study draft data) indicated that the western branch was much warmer than the eastern branch and that the confluence was influenced by the eastern branch as was expected for the greater flow contribution at that time (western br. 17.3°C, eastern br. 15.3°C and confluence 15.1°C). Based on the lower downstream temperature, additional groundwater discharge to the Creek was occurring downstream of the east and possibly the west measuring points.

Basic Chemistry

Water chemistry samples were taken during 1993, 1994 and 1995 by Severn Sound RAP staff (Table 2) in order to assess agricultural projects in the watershed. Chlorides and conductivity remained relatively constant with means of 13.0 mg/L and between 335 and 414 uS/cm respectively. Base flow values of suspended solids and turbidity were typically 7 mg/L and 4 FTU respectively. Values were influenced by spring melt periods and rain events. Mean pH was alkaline at 8.2 units.

Nutrients

Ammonia nitrogen was low with mean values ranging between 0.009 and 0.075 mg/L. Nitrate was moderate and typical for an agricultural watershed with mean values ranging between 0.8 and 1.0 mg/L. Total phosphorus concentrations fluctuated with spring runoff and rain events with mean values ranging between 0.032 and 0.060 mg/L. The MOE Provincial Water Quality Guideline for total phosphorus in streams is 0.030 mg/L, suggesting that the Creek often did not meet provincial guidelines. Dissolved organic carbon concentration was relatively stable with mean values ranging between 2.9 and 3.7 mg/L.

Benthos

The stream benthos at Station 42 was sampled using a qualitative method (i.e. collection of as many different kinds of organisms without measuring their density). The stream substrate was a mixture of riffles and emergent vegetation near the banks with overhanging shrubs and grasses. Twenty three different kinds of organisms were noted with good representation of relatively sensitive organisms such as mayfly nymphs and caddisfly larvae.

Fish Community

The fish community in a 50-m reach downstream of Station 42 was sampled in late summer of 2000 as part of a characterization of fish community at a number of locations throughout the Severn Sound watershed. Rainbow trout, black-nosed dace, creek chub, mottled sculpin and other minnows were found with a total fish biomass of 17 kg/ha confirming that the stream has a coolwater fish community. The finding of coolwater species is consistent with fish collections made by MNR in 1990 and 2002.

[Tables 1 and 2a, b & c are below]

[Figure 1 is on a .pdf file attached]

[Figure 2 is on an attached jpg file attached]

Table 1
Spot flow measurements for MacDonald Creek
at Mertz Road (Station 42) and the
Wye River near Wyevale (02ED013)

	MacDonald Creek (1)	Wye River(2)
22-Jul-93	135.3	373
28-Jul-93	99.2	351
05-Aug-93	128.8	303
18-Aug-93	158.8	331
27-Aug-93	105.8	255
02-Sep-93	146.5	322
10-Sep-93	264.3	420
15-Sep-93	518.5	805
20-Sep-93	257.5	377
29-Aug-02	122.0	267

(1) 1993 - SSEA unpublished data

2002 - Dixon-Golder unpublished data

(2) Water Survey of Canada provisional data

Table 2a Water quality of MacDonald Creek at Station 42 during 1993 (results in mg/L unless otherwise noted)

Date	Temp. (oC)	E.coli (org/100ml)	Fecal Strep. (org/100ml)	P. arugenosa (org/100ml)	Chloride	Sodium	Potassium	Cond.	pH	Susp. Solids	Turbidity (FTU)	TKN	Ammonia	Nitrite	Nitrate	TP	Phosphate	DOC
27-May-93	13.0	44	36	2	14.9		1.64	404	8.30	7.6	4.70 S46	0.34	0.020	0.013	0.030	0.018	0.0025 <T	3.0
01-Jun-93	11.0	296	520	2	14.5		1.69	383	8.13	35.9	13.20 S46	0.60	0.034	0.016	0.725	0.066	0.0060	3.9
10-Jun-93	16.0	1120	340	8	18.3		1.64	403	8.39	15.5	8.13 S46	0.50	0.022	0.030	0.985	0.030	0.0065	4.4
15-Jun-93	18.0	170	130	4 <	11.2		1.67	388	8.12	14.9	6.51 S6+	0.36	0.034	0.022	0.795	0.032	0.0000 <T	2.9
22-Jun-93	17.0	8500	6400	24 A3C	15.9		2.15	426	8.15	12.8	9.99 S46	0.68	0.016	0.006	0.040	0.052	0.0135	9.1
28-Jun-93	18.0	220	120 <=>	4 <	12.4		1.68	395	8.26	14.3	6.68 S24	0.40	0.016	0.027	0.975	0.028	0.0058	3.2
03-Jul-93	19.0																	
15-Jul-93	17.0	100	100	2 <	12.3		1.71	383	8.15	9.1	4.79 S24	0.34	0.024	0.016	0.755	0.024	0.0035 <T	2.6
19-Jul-93	18.0	240	670		11.0		1.71	346	8.16	11.5	5.99 S24	0.28	0.024	0.013	0.690	0.022	0.0035	2.3
29-Jul-93	20.0	220	380	4 <	10.7		1.87	365	8.18	8.6	5.52 S6+	0.30	0.020	0.014	0.685	0.018	0.0045 <T	2.5
03-Aug-93	19.0	50 <=>	110	2 <	11.0		1.86	372	8.20	11.8	5.91 S46	0.32	0.020	0.014	0.715	0.020	0.0075	2.2
09-Aug-93	17.0	100	120	2 <	10.8		1.91	373	8.19	12.5	6.80 S24	0.30	0.018	0.012	0.740	0.026	0.0030	2.3
16-Aug-93	20.0	320	320	4	10.0		1.92	369	8.19	10.4	5.09 S46	0.30	0.022	0.014	0.760	0.200	0.0150 <T	2.4
23-Aug-93	16.5																	
30-Aug-93	17.0	130	210	68	10.7		2.02	381	8.34	7.4	4.00 S6+	0.26	0.024	0.014	0.830	0.018	0.0025 <T	2.0
07-Sep-93	13.5	160	160	2	9.5		1.86	395	8.13	13.5	6.77 S24	0.26	0.028	0.013	0.865	0.022	0.0060	2.4
13-Sep-93	15.0	1600	1250	22 A3C	11.5		2.24	403	8.20	5.1	3.31 S46	0.38	0.050	0.024	1.010	0.030	0.0075	2.6
20-Sep-93	10.0	50	50	80	14.8		1.91	417	8.32	5.1	7.11 S24	0.28	0.024	0.020	1.000	0.024	0.0035 <T	2.4
27-Sep-93	12.0	1660	1220	4	15.9		2.51	417	8.25	4.9	6.89 S24	0.38	0.006	0.020	0.920	0.034	0.0050	3.0
06-Oct-93	8.0	100	220	2	18.2		2.44	446	8.27	4.9	16.91	0.36	0.030	0.021	1.620	0.026	0.0095	2.6
13-Oct-93	7.0	40	20	2 <	16.0		2.05	437	8.23	5.1	5.13	0.30	0.014	0.015	1.310	0.016	0.0045 <T	2.1
Mean	15.3	224	230	5	13.1		1.92	395	8.22	11.1	7.02	0.37	0.023	0.017	0.813	0.037	0.0058	3.0
Max	20.0	8500	6400	80	18.3		2.51	446	8.39	35.9	16.91	0.68	0.050	0.030	1.620	0.200	0.0150	9.1
Min	7.0	40	20	2	9.5		1.64	346	8.12	4.9	3.31	0.26	0.006	0.006	0.030	0.016	0.0000	2.0
Median	17.0				12.3		1.87	395	8.20	10.4	6.51	0.34	0.022	0.015	0.795	0.026	0.0050	2.6
N	21	19	19	18	19.0		19.00	19	19	19	19	19	19	19	19	19	19	19

Date	Temp. (oC)	E.coli (org/100ml)	Fecal Strep. (org/100ml)	P. arugenosa (org/100ml)	Chloride	Sodium	Potassium	Cond.	pH	Susp. Solids	Turb.	TKN	Ammonia	Nitrite	Nitrate	TP	Phosphate	DOC
07-Mar-94	8.0				14.5		1.90	437	8.20	36.7	15.20 S46	0.26	0.050	0.022	1.350	0.030	0.0035 <T	1.4
21-Mar-94	7.0				13.6		1.94	436	8.24	34.9	15.90 S6+	0.30	0.580	0.018	1.290	0.032	0.0035 <T	1.6
23-Mar-94	7.0				9.9		4.21	286	7.71	195.0	27.00 S6+	2.20	0.364	0.033	1.660	0.385	0.0960	6.8
24-Mar-94	7.0				7.7		3.88	224	7.77	145.0	54.20 S6+	1.95	0.394	0.033	1.290	0.370	0.0820	6.2
04-Apr-94	7.0																	
05-Apr-94	8.5																	
13-Apr-94	9.5				14.2		2.28	367	8.04	37.1	20.50 S46	0.62	0.034	0.015	1.460	0.020	0.0160	4.9
14-Apr-94	9.0				13.1		2.18	393	8.13	17.5	11.00 S6+	0.52	0.026	0.026	1.590	0.044	0.0120	4.2
21-Apr-94	10.5				11.6		1.82	403	8.36	8.5	4.94 S24	0.92	0.044	0.023	1.470	0.020	0.0035 <T	2.4
27-Apr-94	15.0				13.3		3.15	385	8.35	48.3	35.10 S46	0.26	0.010	0.010	0.980	0.118	0.0330	6.2
03-May-94	11.0				15.0		1.88	426	8.33	8.9	5.82 S24	0.32	0.002 <W	0.007	1.240	0.024	0.0060	3
12-May-94	11.0				13.3		2.06	366	8.15	24.0	15.80 S24	0.58	0.028	0.014	0.855	0.050	0.0095 <T	5.5
18-May-94	15.0	50	70	2 <	13.6		1.74	404	8.63	4.8	2.97 S24	0.32	0.002 <W	0.010	1.170	0.012	0.0020 <T	3.5
25-May-94	16.0	72	48	0	12.2		1.78	402	8.28	7.0	3.50 S46	0.46	0.016	0.013	0.050	0.016	0.0035	2.8
01-Jun-94	14.0	1290	1410	20	13.8		2.21	406	8.28	17.8	13.60 S46	0.68	0.028	0.023	2.720	0.052	0.0225	5.4
06-Jun-94	17.0	130	27 <=>	4 <	17.3		1.75	424	8.33	6.3	3.94 S46	0.32	0.034	0.019	0.780	0.020	0.0035 <T	3.8
15-Jun-94	20.0	76	148	2 <	18.7		1.70	418	8.34	10.3	6.31 S24	0.40	0.030	0.023	0.700	0.022	0.0070	3.2
21-Jun-94	19.5	140	128	2 <	10.3		1.82	391	8.28	13.2	8.09 S46	0.34	0.036	0.030	0.795	0.030	0.0035 <T	2.5
28-Jun-94	17.0	56	108	2 <	11.1		1.80	394	8.27	15.2	6.98 S6+	0.34	0.012	0.029	0.780	0.032	0.0065	2.8
05-Jul-94																		
18-Jul-94		84	168	2 <	11.6		0.31	383	8.42	7.8	4.83 S6+	0.30	0.020	0.018	0.750	0.022	0.0070	2.6
02-Aug-94		284	424	2	11.4		1.89	386	8.29	8.0	4.45 S46	0.30	0.002 <W	0.014	0.600	0.026	0.0035 <T	2.6
16-Aug-94		20	104	2 <	12.0			401	8.32	6.8	3.69 S24	0.22	0.008 <T	0.013	0.870	0.014	0.0030 <T	1.7
31-Aug-94		250	1050	2	10.9		2.18	391	8.13	6.2	5.95 S24	0.30	0.002 <W	0.015	0.810	0.022	0.0020 <T	2.7
12-Sep-94		60 <=>	140 <=>	2 <	10.3													

Table 2c Water quality of MacDonald Creek at Station 42 during 1995 (results in mg/L unless otherwise noted)

Date	Temp. (oC)	E.coli (org/100ml)	Fecal Strep. (org/100ml)	P. aruginosa (org/100ml)	Chloride	Sodium	Potassium	Cond.	pH	Susp. Solids	Turb.	TKN	Ammonia	Nitrite	Nitrate	TP	Phosphate	DOC
12-Apr-95					38.8	17.3	7.10	640	8.04	192.0	23.40 S46	0.72	0.006	0.005	1.840	0.206	0.0620	3.8
12-Apr-95	8.0				14.5	9.49	1.77	428	8.24	8.1	3.30 S46	0.28	0.012	0.012	1.040	0.008	0.0025	2.2
27-Apr-95	6.0				14.4	9.56	1.74	430	8.29	10.7	7.91 S46	0.30	0.004	0.010	1.100	0.024	0.2650	2.3
10-May-95	10.0				17.7	11.7	1.75	423	8.27	11.6	3.46 S24	0.36	0.010	0.015	0.795	0.020	0.0015	3
25-May-95	11.5				13.9	9.51	1.61	417	8.32	4.8	2.82 S46	0.28	0.020	0.009	0.710	0.012	0.0005	3.3
29-May-95	13.0				15.7	10.4	1.76	429	8.22		3.54 S24	0.30	0.020	0.014	0.770	0.024	0.0020	2.9
5-Jun-95	16.0				14.9	9.93	1.71	445	8.33	6.5	4.23 S24	0.32	0.012	0.017	2.210	0.022	0.0060	3.3
12-Jun-95	16.5	68	56	0	12.6	8.5	1.66	408	8.28	9.2	6.59 S24	0.76	0.036	0.019	0.810	0.100	0.0030	2.3
21-Jun-95	21.5	44	92	0	11.2	7.91	1.77	380	8.31	9.0	4.07 S24	0.34	0.002	0.020	0.650	0.024	0.0035	2.4
28-Jun-95	21.5	190	540	2	14.1	9.2	1.83	393	8.36	6.0	4.02 S24	0.34	0.012	0.015	0.685	0.028	0.0025	2.8
6-Jul-95	22.0	50	200	2	10.0	6.79	1.76	380	8.47	5.0	2.95 S46	0.26	0.014	0.024	0.805	0.012	0.0030	2.1
11-Jul-95	19.0	80	156	2 <	10.4	7.28	1.90	390	8.33	6.5	4.13 S6+	0.26	0.002	0.022	0.805	0.012	0.0035	2.3
19-Jul-95	19.5	72	196	2 <	11.0	7.76	1.94	386	8.28	4.0	4.13 S24	0.26	0.002	0.020	0.830	0.028	0.0035	2.8
25-Jul-95	21.0	84	172	2	12.2	8.22	2.00	395	8.32	6.0	3.08 S24	0.28	0.010	0.015	0.765	0.014	0.0110	2.5
1-Aug-95	22.0	56	232	2	11.0	7.48	1.94	382	8.40	5.0	3.16 S24	0.28	0.002	0.019	0.780	0.018	0.0040	3
3-Aug-95	20.0	980	1500	8	11.0	7.34	1.97	374	8.16	7.0	3.90 S46	0.26	0.002	0.040	0.825	0.026	0.0070	2.4
8-Aug-95	19.0	20 <=>	250	2 <	12.2	8.16	2.04	396	8.35	5.0	3.42 S24	0.26	0.010	0.023	0.790	0.018	0.0080	2.8
16-Aug-95	20.5	40 <=>	520	2 <	13.6	8.56	2.33	405	8.28	6.0	4.29	0.24	0.002	0.050	0.790	0.022	0.0060	2.7
22-Aug-95	19.5	140 <=>	220	2	10.8	7.32	2.01	396	8.28	8.0	6.18 S24	0.22	0.002	0.041	0.925	0.018	0.0040	8.3
28-Aug-95	16.0	64	252	2 <	10.0	7.08	2.03	387	8.26	8.0	5.28 S46	0.24	0.002	0.039	0.925	0.016	0.0040	2
5-Oct-95	13.0				11.4	7.86	2.07	414	8.25	8.0	3.70 S24	0.24	0.006	0.018	1.010	0.012	0.0015	1.9
Mean	16.8	80	237		13.9	8.92	2.13	414	8.29	16.8	5.12	0.32	0.009	0.021	0.946	0.032	0.0192	2.9
Max	22.0	980	1500	8	38.8	17.30	7.10	640	8.47	192.0	23.40	0.76	0.036	0.050	2.210	0.206	0.2650	8.3
Min	6.0	20	56	0	10.0	6.79	1.61	374	8.04	4.0	2.82	0.22	0.002	0.005	0.650	0.008	0.0005	1.9
Median	19.0				12.2	8.22	1.90	396	8.28	6.5	4.02	0.28	0.006	0.019	0.805	0.020	0.0035	2.7
N	20	13	13	13	21	21	21	21	21	19	21	21	21	21	21	21	21	21

Note: Mean for E.coli and FS are geometric means
All analyses by MOE Lab Services Branch

MacDonald Creek

0 1 Kilometers

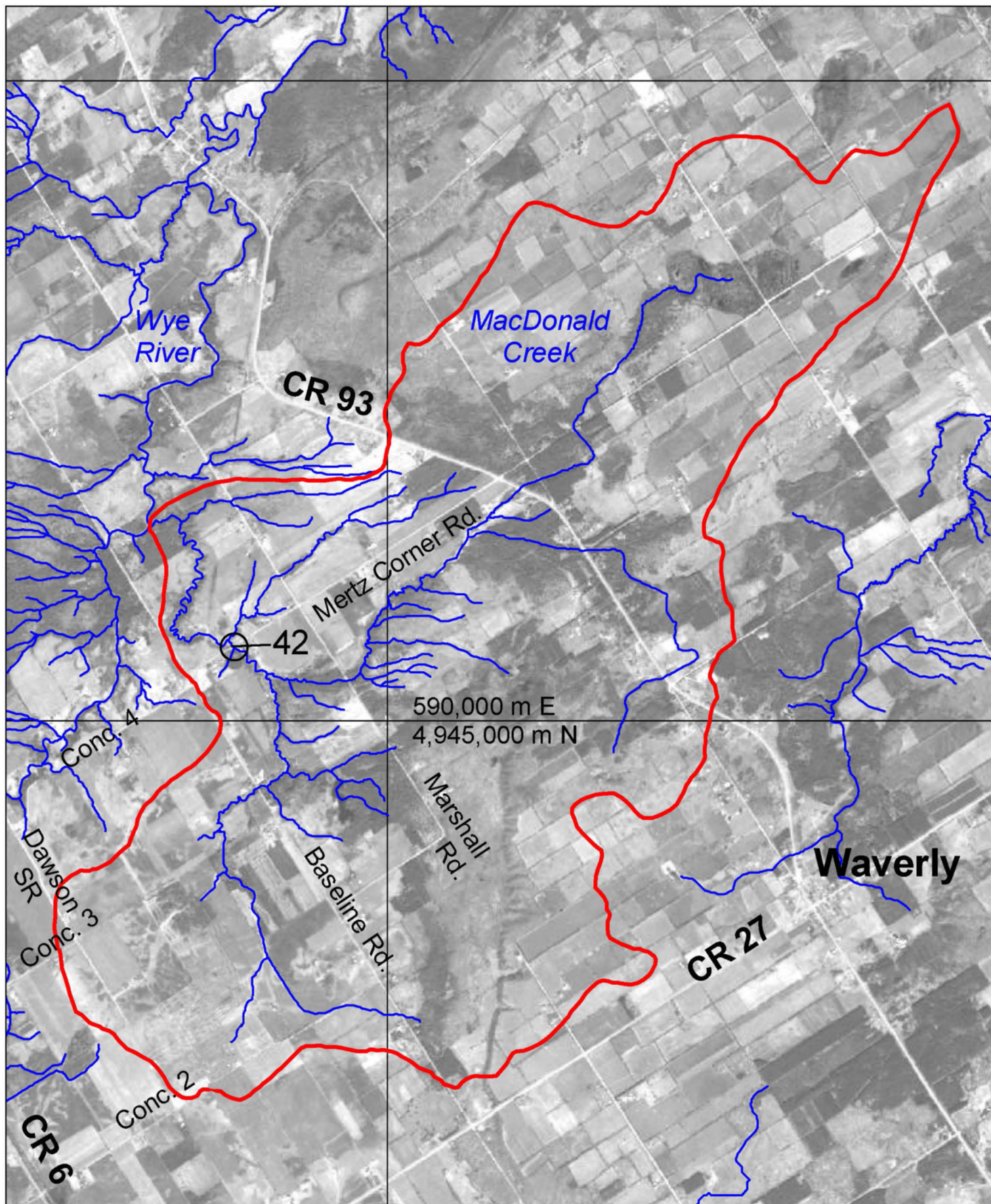


Figure 2 MacDonald Creek MC-1T
07/01/02 - 09/10/02

