HYDROGEOLOGICAL ASSESSMENT

RUSSELL WELL HEAD MONITORING PROGRAM

2004 ANNUAL REPORT

Report prepared for the Township of Russell
Prepared by Sauriol Environmental Inc.
Dated February 2005
Our File: P04-08a

SAURIOL
ENVIRONMENTAL Inc.

SAURIOL
ENVIRONNEMENT

GROUNDWATER IMPACT ASSESSMENT SPECIALIST
Helping society find solutions to environmental problems

SPÉCIALISTE DE L'ÉVALUATION D'IMPACT
SUR LES EAUX SOUTERRAINES
Contribuant à l'élaboration de solutions
aux problèmes environnementaux

February 18, 2005

Township of Russell
717 Notre Dame Street
Embrun, ON
K0A 1W1

Attention: Mr. Craig Cullen

Re: Hydrogeological Assessment
Russell Well Head Monitoring Program
Annual Report 2004
Our file P04-08a

Dear Sir:

The following report contains the Hydrogeological Assessment of the Russell Well Monitoring Program for the Year 2004.

The report includes a brief review of past studies, results from water level measurements and water samples taken in the summer and fall of 2004, including an analysis of the information.

Trusting that the above is satisfactory.

Yours Truly,
Sauriol Environmental Inc.

Jacques Sauriol M. Sc., P.Geo.
President

Circulation:
Township of Russell 4 copies
SEI file 1 copy

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HYDROGEOLOGICAL ASSESSMENT
RUSSELL WELL HEAD MONITORING PROGRAM
2004 ANNUAL REPORT

1.0 INTRODUCTION

The following document presents a Hydrogeological Assessment of the Russell Well Monitoring Program for the year of 2004. The program consisted of monitoring by both the Township and by Sauriol Environmental Inc.

The Russell well site is located on Lots 7 and 8, Concession 1 in Township of Russell, and is operated under the Certificate of Approval # 7-0744-87-886. The site consists of one production well, two observation wells. The photo on the cover page shows the site as flown over by the author on November 12, 2004.

1.1 Objectives

The primary objective of the year 2004 Hydrogeological Assessment of the Russell Well Monitoring Program is to ensure the protection of the production well and of the aquifer. Specifically, this is done by providing an interpretation of the monitoring data collected in 2004, including a review of aquifer hydraulics and an assessment of the transient and spatial changes to the well water quality.

Recommendations are given in the conclusion section of this report, and a proposed work plan for the year 2005 is presented in Appendix C.

1.2 Review of Past Surveys and Environmental Liabilities

The following subsection provides a brief review of the history and any environmental liabilities attached to the Russell Wells, based on previous hydrogeological assessments (i.e. Robinson Consultants Inc. 2000, 2001 & 2002 Annual Reports; SEI report 2003). A map of the study site, showing the relation of the study site to the village of Russell, is provided in Figure 1. The site plan, showing the locations of all production and observation wells is illustrated in Figure 2.

The site used to consist of two production wells (PW-1 and PW-2) and two observation wells (OW-1 and OW-2). During routine testing in 1998 by the Township staff, the presence of bacteria was identified in the second production well (PW-2). The well was taken offline in August of 1999 and was only used periodically for testing. The production well PW-2 was taken offline permanently in the summer of 2001. Production well PW-2 has been abandoned as per Ontario Regulation 903 in June 2003.

In both 2001 and 2002, the production well PW1 was sampled and had water levels measured on a monthly basis. The water levels of both observation wells were also measured on a monthly basis during the same period. On a semi-annual basis, the observation wells and the production well were sampled. Additionally, the Township also conducted quarterly monitoring of the production well water quality.

The raw water from the production well PW-1 has been documented in past reports to exceed the Ontario Drinking Water Standards (DWS) for Total Dissolved Solids (TDS), Iron, Manganese, and Hardness. Reported TDS values have been steady with time. It is noted that all these parameters have only Aesthetic Objectives under DWS, and are not health concerns. No other parameters were identified to be of concern.

A suspected nitrate source was identified in 2003 in the vicinity of OB-1. Well head controls of VOCs, herbicides and pesticides showed no concern nearby the production well head.

4.0 CONCLUSIONS

Overall the water quality measured in the bedrock aquifer nearby the well head was good and the results of the samples do not suggest any threat to the production or quality of the water from the production well PW-1 at the site. Organic scans completed in 2003 showed no threat to the water supply.

Water levels were measured twice at the two observation wells OB-1 and OB-2. Water levels were found to be similar to historical water level measurements. They have seasonally fluctuated over a range of 6 m over the last four years. The flow of groundwater was estimated to be in a northerly direction under summer / fall conditions for the data collected in 2004.

A limited amount of data was provided for the sampling of the production well PW-1 (Raw Water) by the Township. All aesthetic monitored parameters met with their DWS Criteria. Other general indicators of PW-1 show a mineralized groundwater with elevated Hardness, TDS and Conductivity. These concentrations at PW-1 were noted to be similar to historical data. Water consumption (the total amount of raw water used) in 2004 was less than the amount used in 2003.

SEI staff sampled the observation wells OB-1 and OB-2 (completed in the shallow bedrock aquifer) in the July and September of 2004. The samples were analyzed for selected parameters, (Cl, Conductivity, Nitrates, TDS, Na, Fe and Mn) as per the T of R. There were a few exceedences of Aesthetic Objectives of DWS by the parameters of TDS, Iron and Manganese at the observation wells in 2004. Nitrates were not detected in the sampling surveys of 2004.

4.1 Recommendations

The well head survey for the Village of Russell should be completed yearly to act as an early warning system, detecting any water supply changes in the future.

TABLE 1: POTENTIOMETRIC ELEVATIONS RUSSELL WELL MONITORING PROGRAM										
Station	Well Type	Top of Casing Elevation (m)	Potentiometric Elevation (m)							
			May-01	Oct-01	May-02	Oct-02	May-03	Oct-03	Jul-04	Sep-04
PW-1	Production	78.37	66.9	64.4	66.94	66.53	67.76	66.76		
OB-1	Observation	72.55	68.6	65.9	69.65	66.52	69.85	65.92	67.48	69.4
OB-2	Observation	71.59	68.2	66.4	68.37	66.35	68.9	66.5	67.3	68.17

Notes:

- May and October 2001 data estimated from Figure 3, Russell Well Monitoring Program, 2001 Annual Report by Robinson Consultants Inc.
- May and October 2002 data taken from Table 1, Russell Well Monitoring Program, 2002 Annual Report by Robinson Consultants Inc.
- In May 2003, the water level measurement for PW-1 was taken after the pump had run for a short time

TABLE 2A: CONCENTRATIONS OF SELECTED PARAMETERS RUSSELL WELL PW-1 (2000 - 2004) RUSSELL WELL MONITORING PROGRAM										
Parameter	ODWS	PW-1								
		Jul-00	Dec-00	Jun-01	Oct-01	Jul-02	Nov-02	May-03	Oct-03	Jul-04
Cl	250	38	48	41	48	39	48	-	-	32
TDS	500	**572**	**560**	-	-	-	-	-	-	**596**

Notes:
- 2000 to 2002 data taken from Tables, Russell Well Monitoring Program, 2002 Annual Report by Robinson Consultants Inc.
- Bold indicates that measured parameters exceeds Ontario Drinking Water Standard (ODWS)
" - " Data Unavailable

TABLE 2B: CONCENTRATIONS OF SELECTED PARAMETERS RUSSELL WELL OB-1 (2000 - 2004) RUSSELL WELL MONITORING PROGRAM											
Parameter	ODWS	OB-1									
		Jul-00	Dec-00	Jun-01	Oct-01	Jul-02	Oct-02	May-03	Oct-03	Jul-04	Sep-04
Cl	250	14	35	14	31	10	17			28	15
Na	200	9	14	6	13	7	9			12	9
TDS	500	452	472	-	-	-	-	-	-	516	532
Fe	0.3	0.08	0.12	0.18	0.05	0.19	0.09	0.15	0.91	0.18	0.39
$N\text{-}NO_3$	10 **	0.4	0.27	0.1	<0.10	0.14	<0.10	0.42	<0.10	<0.10	<0.10

Notes:
- 2000 to 2002 data taken from Tables, Russell Well Monitoring Program, 2002 Annual Report by Robinson Consultants Inc.
- Bold indicates that measured parameters exceeds Ontario Drinking Water Standard (ODWS)
" - " Data Unavailable

TABLE 2C: CONCENTRATIONS OF SELECTED PARAMETERS RUSSELL WELL OB-2 (2000 - 2004) RUSSELL WELL MONITORING PROGRAM											
Parameter	ODWS	OB-2									
		Jul-00	Dec-00	Jun-01	Oct-01	Jul-02	Oct-02	May-03	Oct-03	Jul-04	Sep-04
Cl	250	49	42	51	16	24				42	54
Na	200	25	32	26	16	18				21	24
TDS	500	480	476	-	-	-	-	-	-	450	500
Fe	0.3	0.47	0.98	0.35	0.12	0.75	-	1.46	2.99	1.84	0.71
$N\text{-}NO_3$	10 **	<0.10	<0.10	<0.10	<0.10	<0.10	-	<0.10	<0.10	<0.10	<0.10

Notes:
- 2000 to 2002 data taken from Tables, Russell Well Monitoring Program, 2002 Annual Report by Robinson Consultants Inc.
- Bold indicates that measured parameters exceeds Ontario Drinking Water Standard (ODWS)
- Sample results for OB-2 were in Oct 2002 were not located in past reports
" - " Data Unavailable

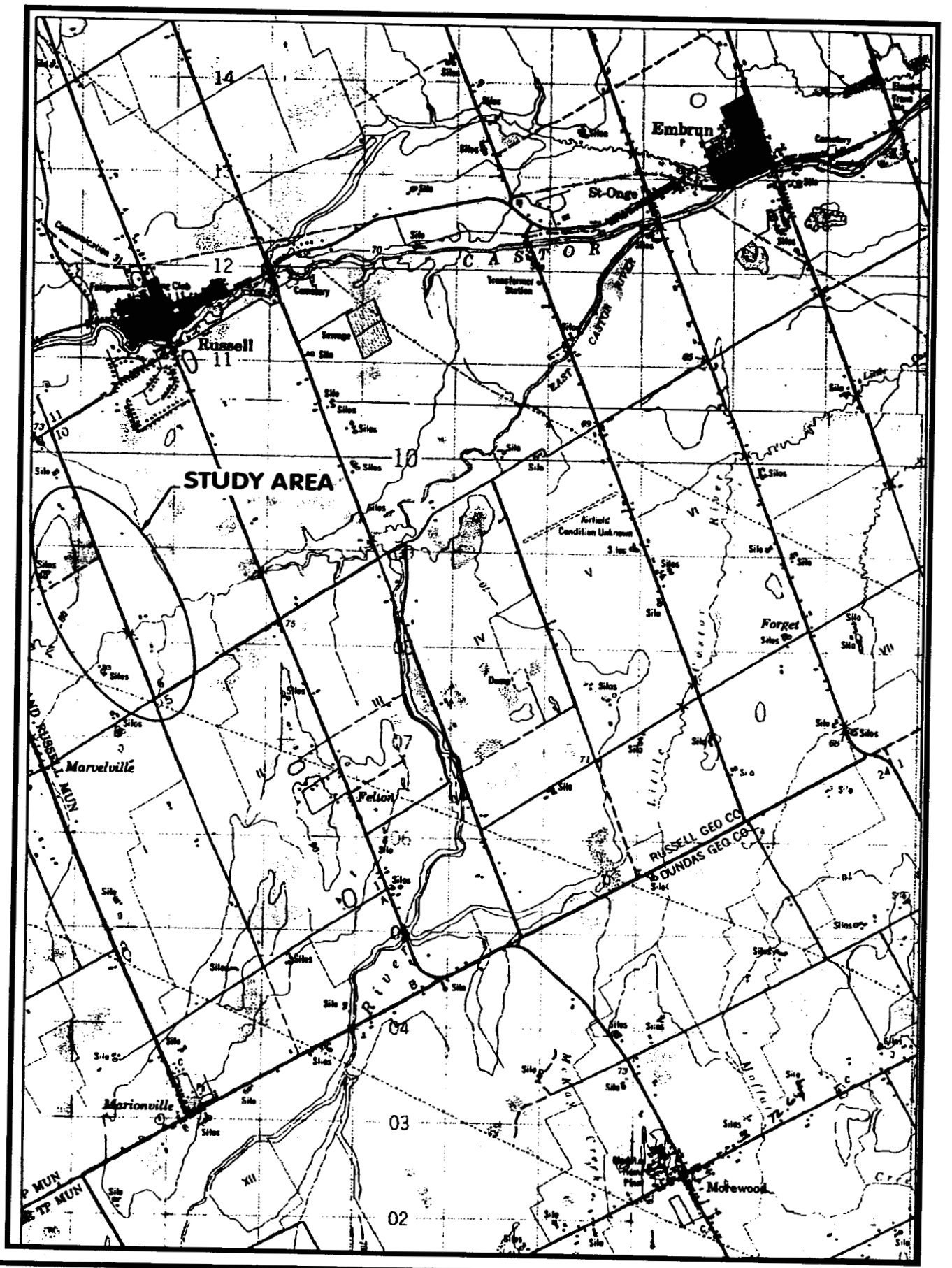


Figure 1

MAP OF RUSSELL WELLS STUDY SITE

(Russell Twp.)

SAURIOL ENVIRONMENTAL Inc.

MAP FILE : GEOPICSG 0508 - FEB 2005

DATE: JANUARY 2005 PROJECT No. P04-08a

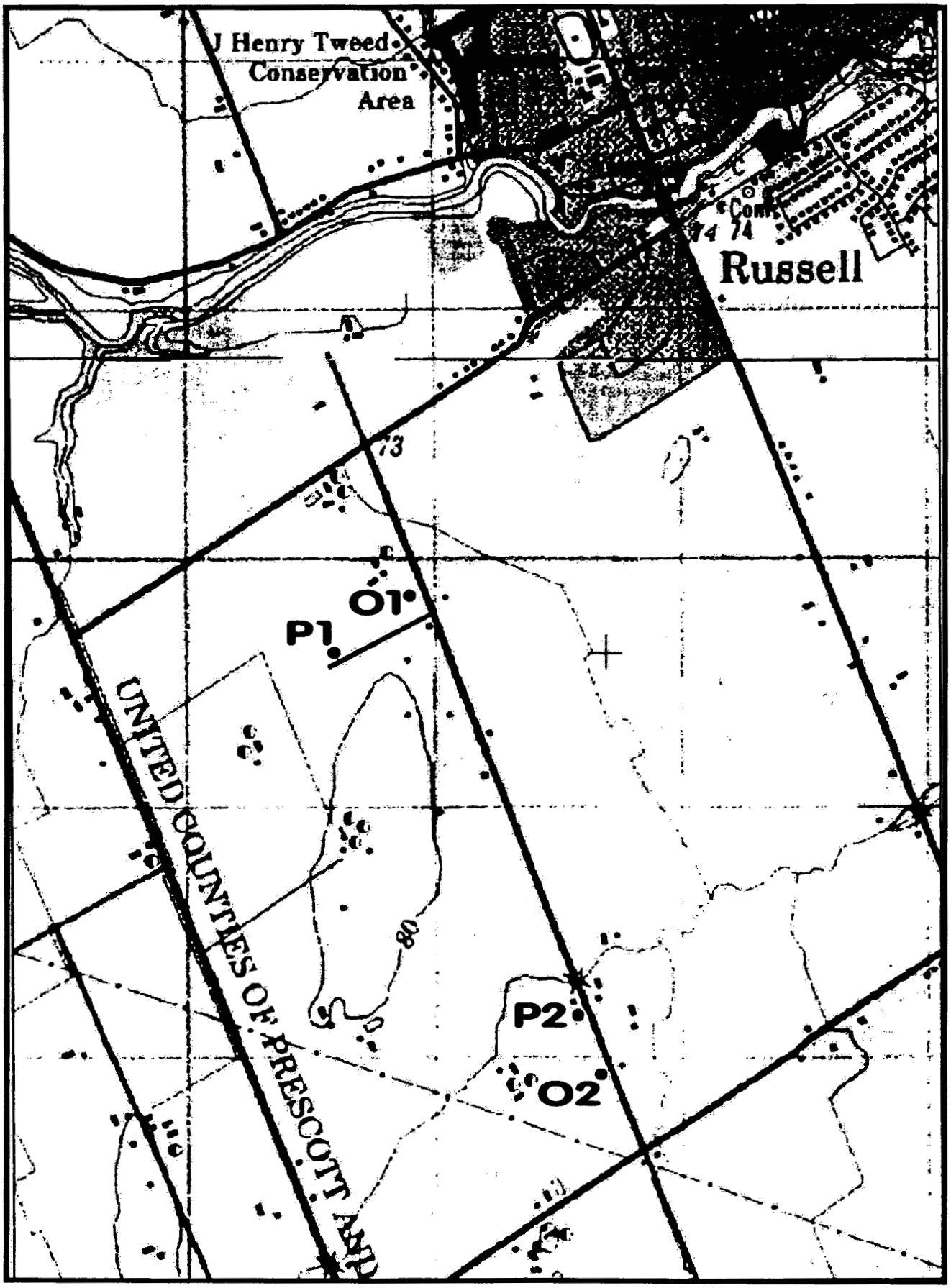


Figure 2

SITE PLAN of RUSSELL WELLS
(Russell Twp.)

SAURIOL ENVIRONMENTAL Inc.

MAP FILE: GEOPICSG0508 - FEB 2005

DATE: JANUARY 2005 PROJECT No. P04-08a

Figure 3. Potentiometric Elevations
PW-1
OB-1
OB-2
Potentiometric Elevation of Water (m)
71
70
69
68
67
66
65
64
63
62
61
Sample Dates
May-01
Jul-01
Sep-01
Nov-01
Jan-02
Mar-02
May-02
Jul-02
Sep-02
Nov-02
Jan-03
Mar-03
May-03
Jul-03
Sep-03
Nov-03
Jan-04
Mar-04
May-04
Jul-04
Sep-04

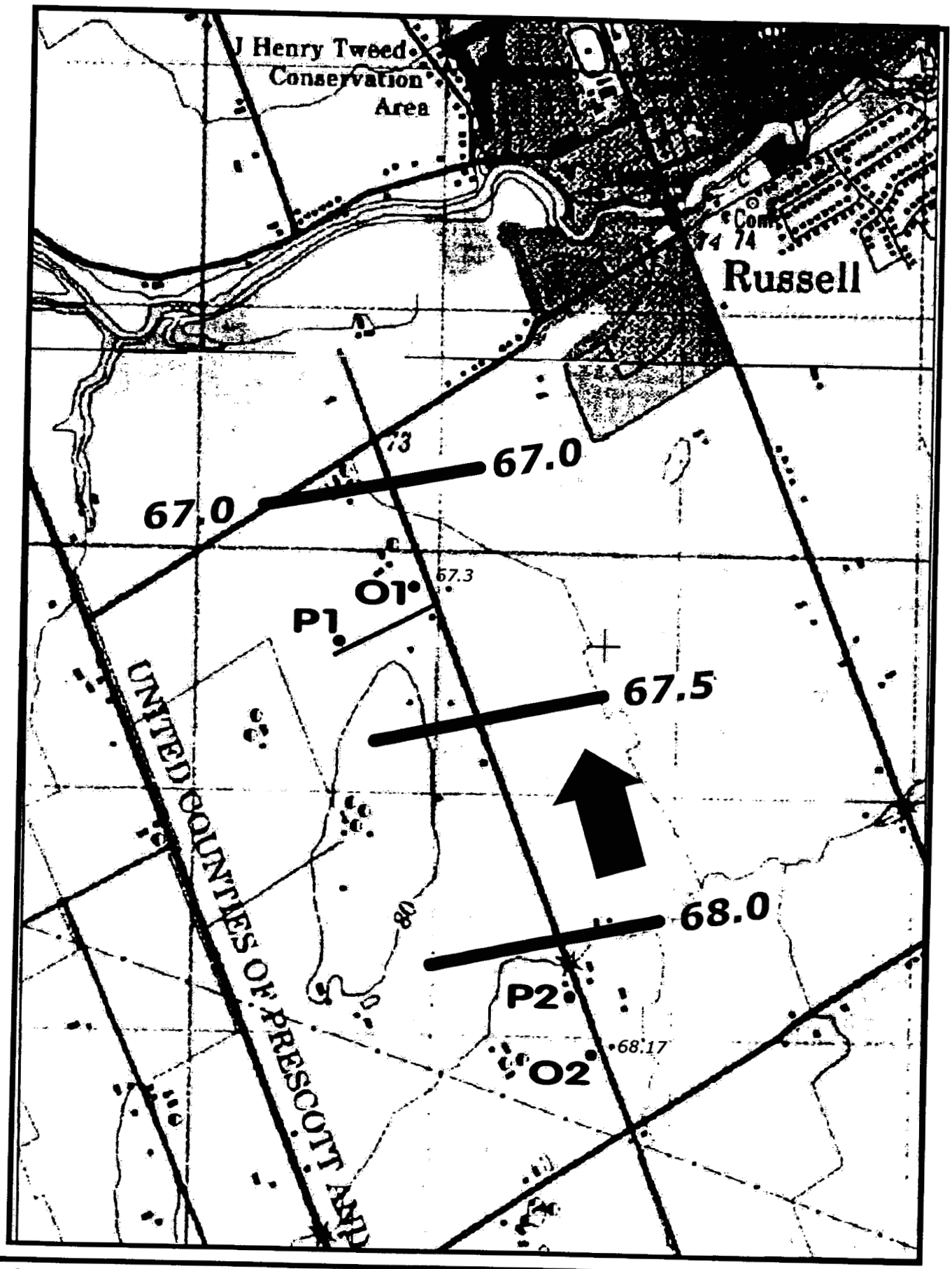


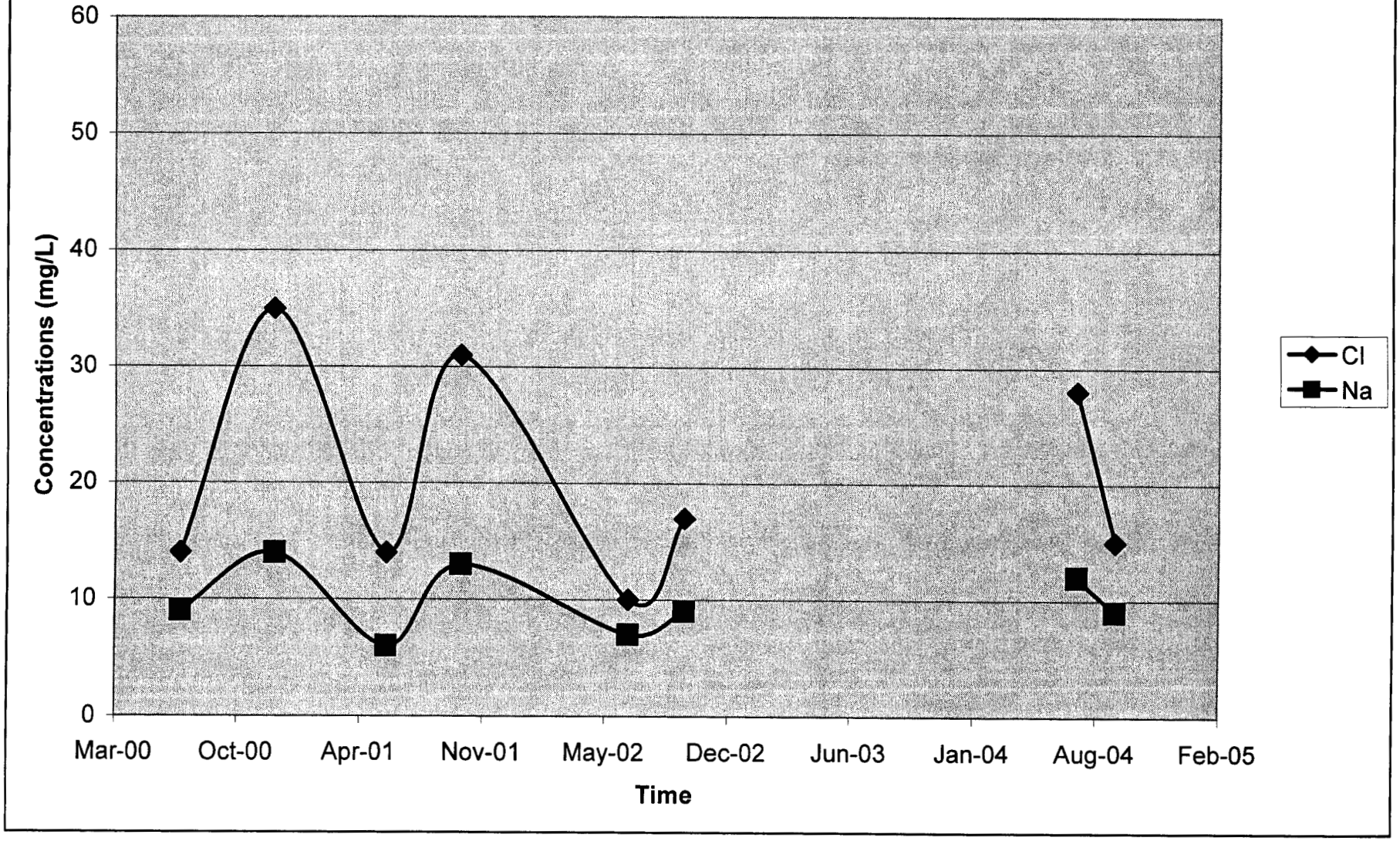
Figure 4
POTENTIOMETRIC ELEVATION DATA (m)
- Sept. 2004 -
(Township of Russell)

SAURIOL ENVIRONMENTAL Inc.

MAP FILE : GEOPICSG0508 - FEB 2005

DATE: JANUARY 2005 PROJECT No. P04-08a

Figure 5a: Concentration vs Time OB-1



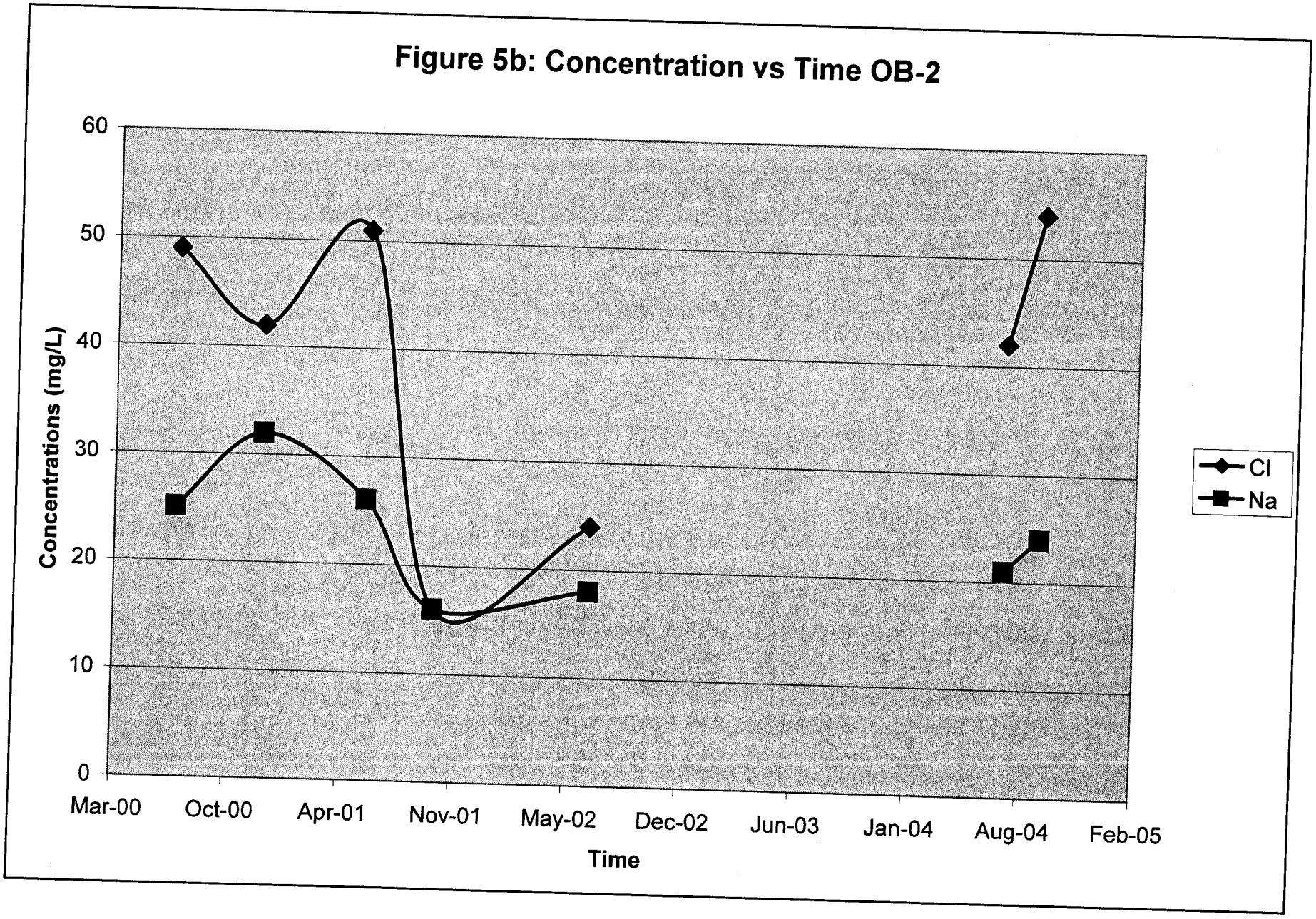


Figure 5b: Concentration vs Time OB-2
60
50
40
30
20
10
0
Concentrations (mg/L)
Mar-00
Oct-00
Apr-01
Nov-01
May-02
Dec-02
Jun-03
Jan-04
Aug-04
Feb-05
Time
Cl
Na

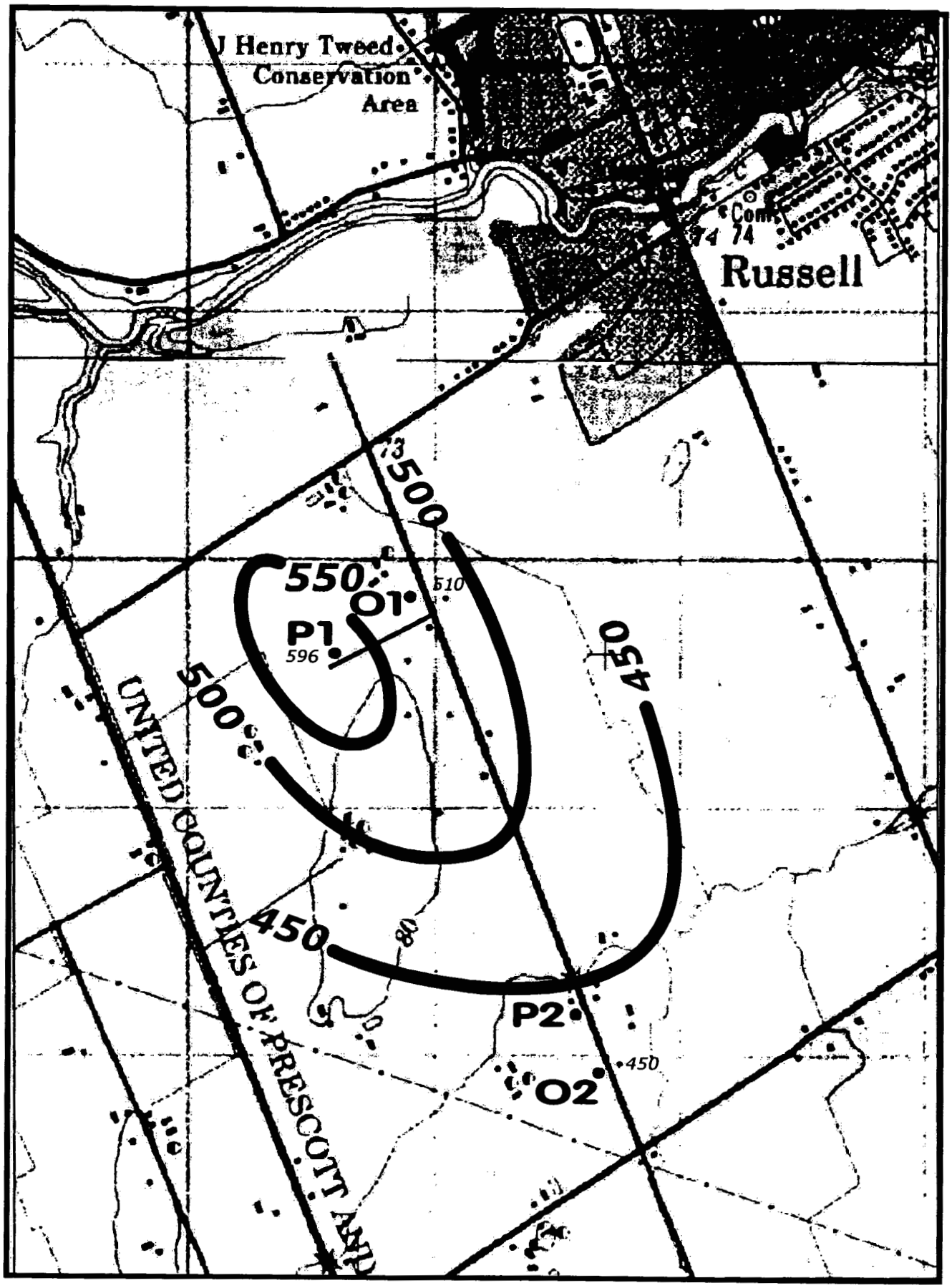


Figure 6

TDS Concentrations (mg/L))
- July. 2004 -
(Township of Russell)

SAURIOL ENVIRONMENTAL Inc.

MAP FILE : GEOPICSG 0508 - FEB 2005

DATE: JANUARY 2005 PROJECT No. P04-08a

APPENDIX A

LABORATORY RESULTS
RUSSELL WELL MONITORING PROGRAM

Table A-1 Field Measurements		
Date:July 6 2004	**stations**	
Parameters	**OB1**	**OB2**
Water Levels (m)	5.07	4.29
Conductivity (uMhos/cm)	670	560
Temp	13.5	18.6
pH	7.1	7.5
Date:September 23 2004	**stations**	
Parameters	**OB1**	**OB2**
Water Levels (m)	3.15	3.42
Conductivity (uMhos/cm)	675	650
Temp	10.6	11.5
pH	7.2	7.1

[redacted] ANALYTICAL LABORATORIES LTD [redacted] REPORT OF ANALYSIS

Client: **Township of Russell c/o Sauriol Environmental Inc.**
134 St. Paul St. P.O. Box 7181
Vanier, ON
K1L 8E3
Attention: **Mr. Jacques Sauriol**

Report Number: 2412787
Date: 2004-07-14
Date Submitted: 2004-07-07

Project: P04-08

P.O. Number:
Matrix: Water

			LAB ID:	329656	329657				GUIDELINE		
			Sample Date:	2004-07-06	2004-07-06						
			Sample ID:	OB-1	OB-2						
PARAMETER	**UNITS**	**MDL**							**TYPE**	**LIMIT**	**UNITS**
Chloride	mg/L	1		28	42						
Conductivity	uS/cm	5		794	692						
N-NO3 (Nitrate)	mg/L	0.10		<0.10	<0.10						
TDS (COND - CALC)	mg/L	5		516	450						
Sodium	mg/L	1		12	21						
Iron	mg/L	0.01		0.18	1.84						
Manganese	mg/L	0.01		0.08	0.04						

MDL = Method Detection Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration

Comment:

APPROVAL:
Ewan McRobbie
Inorganic Lab Supervisor

ACCUTEST LABORATORIES LTD

REPORT OF ANALYSIS

Client: Sauriol Environmental Inc.
134 St. Paul St. P.O. Box 7181
Vanier, ON
K1L 8E3
Attention: Mr. Jacques Sauriol

Report Number: 2418237
Date: 2004-09-28
Date Submitted: 2004-09-23
Project: P04-08
P.O. Number:
Matrix: Water

			LAB ID:	343725	343726				GUIDELINE		
			Sample Date:	2004-09-23	2004-09-23						
			Sample ID:	OB-1	OB-2						
PARAMETER	UNITS	MDL							TYPE	LIMIT	UNITS
Chloride	mg/L	1		15	54						
Conductivity	uS/cm	5		818	769						
N-NO3 (Nitrate)	mg/L	0.10		<0.10	<0.10						
TDS (COND - CALC)	mg/L	5		532	500						
Sodium	mg/L	1		9	24						
Iron	mg/L	0.01		0.39	0.71						
Manganese	mg/L	0.01		0.04	0.01						

MDL = Method Detection Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration

Comment:

APPROVAL:
Ewan MacRobbie
Inorganic Lab Supervisor

Results relate only to the parameters tested on the samples submitted for analysis.

APPENDIX B

TOWNSHIP MONITORING RESULTS
RUSSELL WELL MONITORING PROGRAM

ANNUAL SUMMARY - RAW WATER FLOWS

WATER WORKS NAME: RUSSELL WTP
YEAR: 2004
SERVICED POPULATION: 3579
DESIGN CAPACITY: 3500

MONTH	WELL #1		
	AVERAGE DAY ($1000\ m^3$)	MAXIMUM DAY ($1000\ m^3$)	MONTHLY TOTAL ($1000\ m^3$)
JAN	0.35	0.49	10.91
FEB	0.31	0.37	9.11
MAR	0.32	0.35	9.81
APR	0.32	0.49	9.68
MAY	0.42	0.53	12.89
JUN	0.43	0.58	12.82
JUL	0.39	0.47	12.16
AUG	0.32	0.38	9.95
SEP	0.33	0.39	9.95
OCT	0.30	0.36	9.32
NOV	0.35	0.38	10.42
DEC	0.33	0.45	10.37
TOTAL			127.39
AVERAGE	0.35		10.62
MAXIMUM		0.58	12.89

WELL 1	COLOUR	PH	TEMP	FE	MN	FL	TUR
JAN	4	7.4	9	0.20	0.064	0.43	0.29
FEB	3	7.5	9	0.16	0.076	0.44	0.31
MAR	3	7.5	7	0.24	0.076	0.36	0.06
APR	2	7.5	8	0.28	0.088	0.43	0.11
MAY	3	7.3	8	0.20	0.075		0.16
JUN	2	7.5	9	0.15	0.059		0.34
JUL							
AUG	2	7.5	9	0.22	0.082	0.45	0.14
SEP							
OCT							
NOV							
DEC							
AVG	3	7.4	8	0.20	0.074		0.20

RUSSELL WTP DAILY IN-HOUSE TESTING

2004

CLEAR WELL	COLOUR	PH	TEMP	FE	MN	FL	TUR MIN	TUR MAX	CL^2 TOTAL	CL^2 FREE MIN	CL^2 FREE MAX
JAN	3	7.5	9	0.10	0.024	0.42	0.18	0.37	0.98	0.63	0.89
FEB	3	7.5	9	0.08	0.037	0.38	0.15	0.36	0.98	0.68	0.96
MAR	2	7.5	9	0.08	0.036	0.39	0.15	0.36	0.95	0.63	0.82
APR	3	7.5	9	0.16	0.048		0.05	0.34	1.03	0.69	0.87
MAY	4	7.5	9	0.16	0.019		0.20	0.45	0.96	0.51	0.88
JUN	3	7.1	9	0.11	0.046		0.19	0.43	0.94	0.55	0.90
JUL	3	7.5	9				0.22	0.37	0.92	0.37	0.90
AUG	3	7.5	9	0.11		0.50	0.20	0.50	0.90	0.52	0.85
SEP	3	7.5	9				0.09	0.50	0.97	0.58	0.90
OCT	3	7.5	9	0.13	0.035		0.16	0.42	0.99	0.66	1.10
NOV	3	7.5	9				0.16	0.38	0.99	0.64	0.85
DEC	3	7.5	9				0.15	0.38	0.98	0.41	0.93
AVG	3	7.5	9	0.12	0.035	0.42	0.16	0.41	0.96	0.57	0.90

DISTRIBUTION	COLOUR	PH	TEMP	FE	MN	FL	TUR MIN	TUR MAX	CL^2 TOTAL	CL^2 FREE MIN	CL^2 FREE MAX
JAN	3	7.5	5				0.12	0.40	0.74	0.39	0.79
FEB	3	7.5	5				0.18	0.31	0.75	0.45	0.72
MAR	3	7.5	7	0.07	0.03		0.18	0.37	0.73	0.39	0.69
APR	4	7.5	8				0.14	0.34	0.78	0.44	0.75
MAY	4	7.5	10	0.14	0.02		0.17	0.37	0.70	0.42	0.69
JUN	3	7.3	12				0.20	0.36	0.71	0.36	0.81
JUL	3	7.5	14				0.17	0.36	0.71	0.36	0.73
AUG	3	7.5	14				0.22	0.51	0.52	0.37	0.66
SEP	3	7.5	13				0.20	0.35	0.65	0.34	0.76
OCT	3	7.5	12				0.20	0.38	0.68	0.39	0.68
NOV	4	7.5	11				0.16	0.36	0.75	0.35	0.75
DEC	3	7.5	10				0.19	0.33	0.80	0.45	0.78
AVG	3	7.5	10	0.11	0.026	#DIV/0!	0.18	0.37	0.71	0.39	0.73

ANNUAL SUMMARY - RAW WATER BACTERIOLOGICAL DATA

WATER WORKS NAME: RUSSELL
YEAR: 2004
SERVICED POPULATION: 3579
LABORATORIES WHICH PERFORMED ANALYSES: ACCUTEST LABORATORIES

MONTH	TOTAL COLIFORM				FECAL COLIFORM/ESCHERICHIA COLI		
	NO. OF SAMPLES COLLECTED	NO. OF SAMPLES 1-100 ORG./100ml	NO. OF SAMPLES 101-5000 ORG./100ml	NO. OF SAMPLES > 5000 ORG./100 ml	NO. OF SAMPLES 1-10 ORG./100ml	NO. OF SAMPLES 11-500 ORG./100ml	NO. OF SAMPLES >500 ORG./100 ml
JAN	4	2	0	0	0	0	0
FEB	4	0	0	0	0	0	0
MAR	5	3	0	0	0	0	0
APR	4	1	0	0	0	0	0
MAY	4	1	0	0	0	0	0
JUN	5	1	0	0	0	0	0
JUL	4	2	0	0	0	0	0
AUG	5	2	0	0	0	0	0
SEP	4	3	0	0	0	0	0
OCT	4	2	0	0	0	0	0
NOV	5	1	0	0	0	0	0
DEC	4	1	0	0	0	0	0
TOTAL	52	19	0	0	0	0	0

Client: **Township of Russell**
717 Notre Dame
Embrun, ON
K0A 1W1
Attention: **Mr. Craig Cullen**

Report Number: 2310183
Date: 2003-07-14
Date Submitted: 2003-07-07

Project: Chemicals- Not Reportable Russell

P.O. Number:
Matrix: Water

								GUIDELINE		
			LAB ID:	258935						
			Sample Date:	2003-07-07						
			Sample ID:	Russell Clearwell (treated)				MOE REG 170/03		
PARAMETER	UNITS	MDL						TYPE	LIMIT	UNITS
Alkalinity as CaCO3	mg/L	5	233					OG	500	mg/L
Chloride	mg/L	1	32					AO	250	mg/L
Conductivity	uS/cm	5	917							
Dissolved Organic Carbon	mg/L	0.5	1.6					AO	5.0	mg/L
N-NH3 (Ammonia)	mg/L	0.02	<0.02							
N-NH3 (unionized)	mg/L	0.02	<0.02							
pH			7.90					AO	6.5-8.5	
Sulphate	mg/L	1	205					AO	500	mg/L
TDS (COND - CALC)	mg/L	5	596					AO	500	
Total Kjeldahl Nitrogen	mg/L	0.05	0.13							
Hardness as CaCO3	mg/L	1	458					OG	100	mg/L
Calcium	mg/L	1	134							
Magnesium	mg/L	1	30							
Copper	mg/L	0.001	0.103					AO	1.0	mg/L
Iron	mg/L	0.01	0.05					AO	0.30	mg/L
Manganese	mg/L	0.005	0.020					AO	0.05	mg/L
Aluminum	mg/L	0.01	<0.01					OG	0.10	mg/L
Zinc	mg/L	0.005	<0.005					AO	5.0	mg/L

MDL = Method Detection Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration

Comment:

APPROVAL: _____
Peter Haulena
Analytical Services Manager

APPENDIX C

PROPOSED WORK PLAN (2005)
RUSSELL WELL MONITORING PROGRAM

YEAR 2005

Objectives:
Continued monitoring the hydraulics and water quality of aquifer with the Russell Well Monitoring Program.

Hydraulics:

- Measure Spring (May) and Fall (October) depth to water level survey in PW-1, OB-1, and OB-2
- Analyze spatial and transient water level trends

Water Quality:

- Collect water quality samples at OB-1 and OB-2 in the spring and fall and analyze for the following parameters Cl, TDS, Fe, Mn, NO3 and Na.
- Analyze spatial and transient water quality trends of the observation wells OB-1 and OB-2.
- Analyze spatial and transient water quality trends from monitoring data of PW-1 by the Township.