Based on this information uranium issues are not identified for the site area.

4.4 Atmospheric Conditions

4.4.1 Climate

The climate of the southwest Nova Scotia region is typified by moderate to heavy rainfall amounts and moderate temperatures due to the effects of marine bodies in comparison to other Atlantic Canada regions. Site climate varies slightly from coastal areas in southwest Nova Scotia in that it has slightly less rainfall and a greater temperature range due to higher highs in the summer and lower lows in the winter.

Table 4-2 presents 30-year climate normals data from Yarmouth and Kemptville meteorologic stations. Other local stations at Shelburne exist, however discussions with Environment Canada representatives noted that the Kemptville station would be most representative of the interior southwest Nova Scotia region. Highlights of the data in Table 4-2 include:

- annual rainfall is 1242.6 mm, which is 85.2% of total precipitation (1458.6 mm).
- all months of the year have recordable rainfall.
- precipitation is relatively uniform in distribution between all months in the 100 mm/month range.
- snowfall is typically recorded for October through May and totals 216.2 mm for the 30 year normal.
- the daily maximum rainfall event was approximately 120 mm recorded in September 1980.
- temperature data indicates that average daily maximums range from +0.4 to 20.7^{0}C.
- the extreme minimum temperature on record is –21.1^{0}C and the extreme maximum on record is 30.0^{0}C.
- the mine site area typically has only three months (December, January and February) where the daily mean temperature is below 0^{0}C.

TABLE 4-2: CLIMATE DATA (40 YEAR NORMALS) - YARMOUTH AND KEMPTVILLE **

Yarmouth Data	Jan.	Feb.		Apr.	May	Jun.	Jul.	Aug.	Sept.		Nov.	Dec.	Year
Temperature													
	0.7	0.4	3.8	8.4	13.5	17.6	20.4	20.7	17.8	13.2	8.4	3.3	10.7
Daily Minimum (°C)	-6.8	-7.1	-3.4	0.8	5.1	9.2	12.1	12.4	9.4	5.3	1.3	-4.3	2.8
Daily Mean (°C)	-3	-3.3	0.2	4.7	9.3	13.4	16.3	16.5	13.6	9.3	4.8	-0.4	6.8
Extreme Maximum (°C)	13.3	12.8	16.2	22.4	24.9	28.3	30	29.4	29.4	25	18.8	16.1	
Date	1986/27	1976/02	1984/16	1990/28	1989/18	1957/17	1977/20+	1975/11+	1969/02	1970/09	1977/04	1950/11	
Extreme Minimum (°C)	-21.1	-21.1	-17.6	-9.4	-2.2	1.7	5.8	2	-2.3	-3.9	-9	-20	
Date	1951/31	1943/16	1989/07	1946/01	1972/11+	1945/03	1977/08	1990/11	1980/29	1974/22	1986/20	1942/20	
Degree-Days													
Above 18°C	0	0	0	0	0.5	0.7	5.4	8.4	1.9	0.1	0	0	17
Below 18°C	653.4	603.7	552.5	400.5	269.7	139.4	59.6	53.7	134.3	270.8	395.1	573.4	4106
Above 5°C	1.3	0.9	5.5	29.2	135.4	251.	348.9	357.7	257.6	137.8	44.9	9	1579
Below 0°C	117.5	111.8	45.7	2	0	0	0	0	0	0	4.7	6.1	350
Maximum Temperature >0°C	18	15	25	30	31	30	31	31	30	31	29	23	324
Freezing Precipitation	2	2	2	*	0	0	0	0	*	0	*	2	8
Fog	4	5	6	8	12	15	20	19	12	8	6	4	120
Thunderstorms	*	*	*	*	1	2	2	2	1	*	*	*	12
Sunshine (Hrs)	71.5	97.3	139.1	176	212.5	231.3	209.7	211.7	180.7	151.6	94	64.5	1821.8
Station Pressure (kPa)	100.78	100.84	100.81	100.80	101.00	100.93	100.99	101.08	101.24	101.21	101.00	100.90	100.96
Moisture													
Vapour Pressure (kPa)	0.43	0.41	0.51	0.68	0.95	1.29	1.58	1.61	1.33	1	0.74	0.52	0.92
Rel. Humidity- 0600L (%)	82	80	81	86	89	91	93	93	91	87	83	82	
Wind													
	21	21	21	19	17	16	14	14	15	17	20	21	18
Most Frequent Direction	NW	NW	NW	NW	W	S	S	W	W	NW	NW	NW	NW
Extreme Hourly Speed (km/h)	89	108	77	85	80	58	56	64	97	97	81	76	
Direction	S	S	NE	E	E	N	SE	SE	SE	SE	NW	W	
Extreme Gust Speed (km/h)	134	163	137	121	113	93	85	80	132	137	130	122	
Direction	S	SW	W	E	E	N	E	S	S	SE	NW	N	
KEMPTVILLE DATA	**Jan.**	**Feb.**	**Mar.**	**Apr.**	**May**	**Jun.**	**Jul.**		**Sept.**	**Oct.**	**Nov.**	**Dec.**	**Year**
Rainfall (mm)	81	65.6	80	110.1	110.7	104	106.8	98.4	106.9	114.7	145.7	118.8	1242.6
Snowfall (mm)	60.8	52.4	32.9	9.6	1.5	0	0	0	0	1.8	7.9	49.2	216.2
	141.7	118.1	112.9	119.5	112.2	104	106.8	98.4	106.9	116.5	153.7	168	1458.6
Daily Extreme Rainfall (mm)	90.4	64.5	66.6	68	68.6	66	93.5	110.7	119.6	85.1	107.2	90.9	
Date	1978/14	1955/07	1985/12	1984/16	1972/16	1982/29	1964/05	1952/18	1980/14	1959/01	1975/13	1967/04	
Extreme Daily Snowfall (mm)	35.6	40.6	30.5	15.2	12.7	0	0	0	0	17.8	30.5	25	
Extreme Daily Precipitation (mm)	90.4	64.5	66.6	68	68.6	66	93.5	110.7	119.6	85.1	107.2	90.9	
Date	1978/14	1955/07	1985/12	1984/16	1972/16	1982/29	1964/05	1952/18	1980/14	1959/01	1975/13	1967/04	
Month-end Snow Cover (cm)	N	N	N	N	0	0	0	0	0	0	N	N	
Days With													
	6	4	6	8	10	10	9	8	8	9	11	8	98
Measurable Snowfall	10	9	6	2	*	0	0	0	0	*	2	9	38
Measurable Precipitation	15	12	11	10	10	10	9	8	8	9	12	15	130

** Data from Kemptville and Yarmouth (temperature only) meteorological stations located 20 kilometres west and 40 kilometres southeast of the site, respectively.

4.4.2 Sound/Noise

A baseline noise survey was conducted at the White Rock Quartz Mine site on May 14 and 15, 2002. The sample site was selected along the north boundary of the mine site near the Tobeatic Wilderness Area boundary, approximately 300 metres northeast of Highway 203, Figure 4-3.

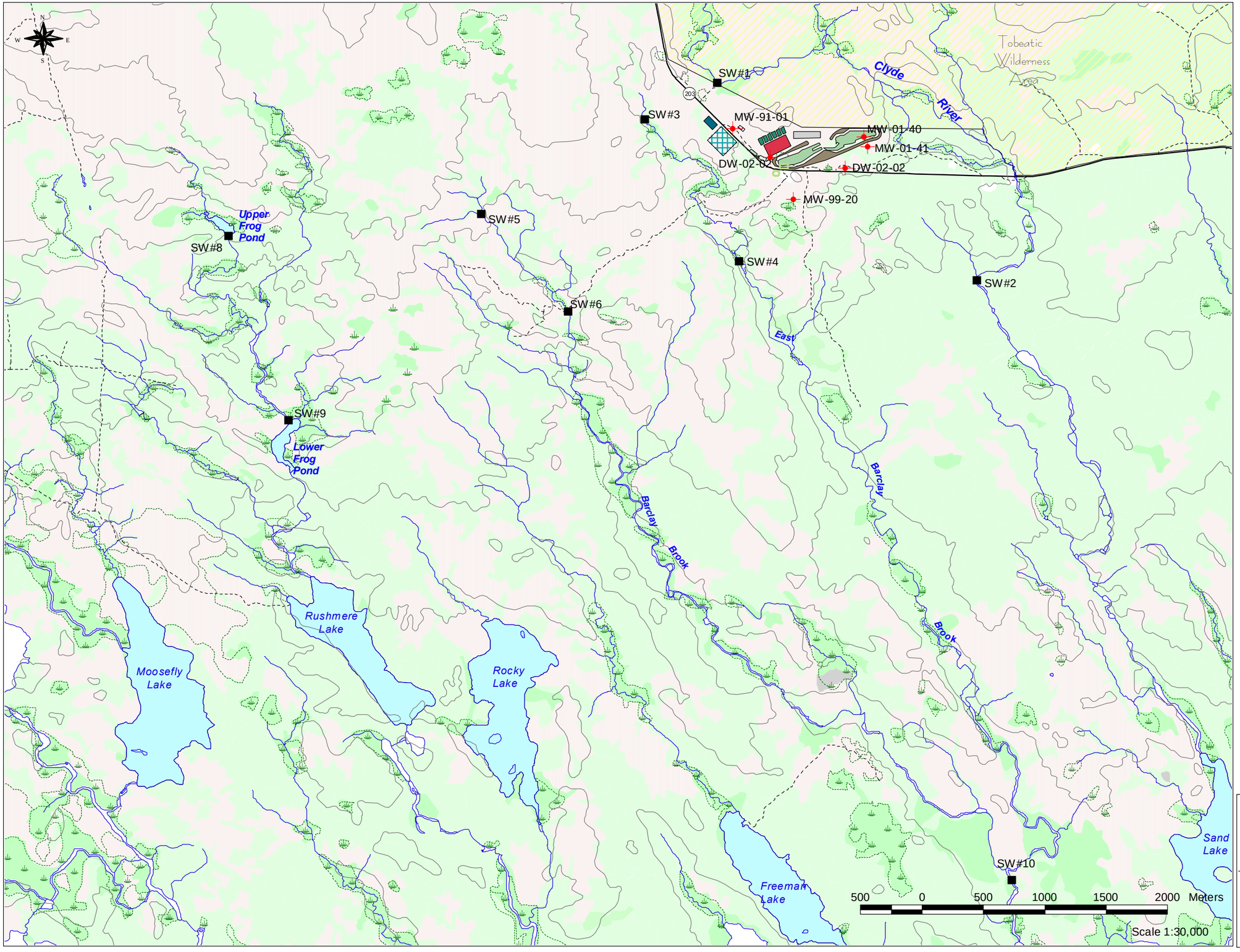
Sound levels were taken using a Larson Davis 870-B Integrating Sound Level Meter. This instrument averages the energy level of sound over various periods of time and expresses this Leq value in dBA (A-weighted decibels). The Leq value represents equivalent continuous sound level measurement. Hourly Leq values were recorded over a one day period.

The noise levels recorded are characteristic of a location as remote as this one, taking into consideration that there are no residential dwellings within 12.7 km of the mine site. Measured noise levels can be found on Table 4-3 along with a comparison to the Nova Scotia Department of Environment Guidelines for Noise Measurement and Assessment. Table 4-3 presents the hourly Leq's recorded for this survey along with the Lmin and the Lmax for each hour to gain an indication of the variability of noise in the area.

Wind action was noted and could have possibly impacted the noise levels from the time of 11:00 to 16:00 on May 14. At approximately 16:00 the wind diminished to a minimum and had no effect on the results of the remaining duration of the survey. The weather on both days was overcast with a light rain on May 14 ending at approximately 15:00.

TABLE 4-3: HOURLY Leq VALUES

Date	Time	Hourly L_{eq}	Hourly Lmin	Hourly Lmax	Noise Guideline Limit (NSDOE 1990)	Wind Effects
May 14, 02	11:00	49.2	41.7	64.1	65	Y
May 14, 02	12:00	47.4	42.6	56.3	65	Y
May 14, 02	13:00	44.4	39.5	57.3	65	Y
May 14, 02	14:00	42.0	37.7	52.7	65	Y
May 14, 02	15:00	40.7	37.6	47.3	65	Y
May 14, 02	16:00	43.1	37.6	71.5	65	Y
May 14, 02	17:00	39.6	36.9	50.3	65	N
May 14, 02	18:00	39.6	36.5	59.5	65	N
May 14, 02	19:00	38.4	36.1	47.8	65	N
May 14, 02	20:00	37.4	36	53.1	60	N
May 14, 02	21:00	39.1	36	45	60	N
May 14, 02	22:00	38.1	36	43.9	60	N
May 14, 02	23:00	38.7	36	48.5	60	N
May 15, 02	00:00	38.5	36	48.1	55	N
May 15, 02	01:00	39.0	35.9	46.9	55	N
May 15, 02	02:00	39.3	35.9	51.4	55	N
May 15, 02	03:00	39.8	36	46.9	55	N
May 15, 02	04:00	40.5	36	45.1	55	N
May 15, 02	05:00	39.7	36	48.7	55	N
May 15, 02	06:00	37.1	36	54.2	55	N
May 15, 02	07:00	43.0	35.9	70.2	65	N



LEGEND

- Road
- Trail
- Wetland
- Wetland / Tree Line
- Watercourse
- Surface Water Sampling Site
- Monitoring Well
- Bulk Sample Pit

Proposed Mine Infrastructure

- Proposed Quartz Pit
- Crushing Area
- Stockpile Area
- Berm
- Quartz Processing Plant
- Quartz Fines Storage Area
- Unprocessed Rock Storage
- Stormwater Holding Pond
- Sedimentation Pond
- Coagulation Addition Bldg
- Weigh Scales

DILLON CONSULTING	Map Title: Baseline Environmental Monitoring Sites	Figure No.: 4-3
Date: Aug. 2002	Project: White Rock Quartz Mine	Project No.: 00-8392

4.4.3 Air Quality

Regional air quality can be affected by natural conditions, local point sources, distant point sources and mobile sources. Air quality in southwest Nova Scotia is affected most by influences from the northeastern United States as regional sources near the White Rock Mine do not exist. Wind direction (from the west) is both effective in carrying airborne contaminants from the US but also in dispersing effects.

The White Rock Quartz Mine site is located in an area that has no current heavy industrial and very limited light industry. Forestry operations, aggregate pits and transportation of goods along existing roads have been identified as sources, which could effect air quality. All of these sources are dispersed effectively. Roadways adjacent to the mine site are paved and are not known to impact local air quality.

On May 15, 2002 an on-site visit was conducted to gain an indication of the existing air quality near the White Rock mine site. Visual inspection confirmed that, the area surrounding the proposed mine site falls within the Air Quality Regulations (Nova Scotia Environment Act) for particulate. The Nova Scotia Department of Environment and Labour Act criteria for ambient air quality are expressed as the following for maximum permissible ground level Total Suspended Particulate (TSP) concentrations:

Annual Geometric Mean	70 ug/m^3
Daily Average (24 hour)	120 ug/m^3

The background or existing TSP concentration can be expected to be relatively low in the proposed mine area, a background concentration ranging from 15-35 ug/m^3 is likely.

4.5 Watercourses and Surface Water Quality

4.5.1 Regional

The regional watercourses in southwest Nova Scotia are numerous with the Roseway, Clyde and Tusket Rivers being the dominant features. A large number of small lakes and ponds also form typical features of the regional landscape. Immediately east of the site the Clyde River drains north to south and the East Barclay and Barclay Brooks occur west of the site draining north to south as well. Baseline data collection at the White Rock Mine site has included surface water evaluations (location, character and quality). A compilation of all collected surface water data is presented in Appendix D. Table 4-4 describes the locations of the surface water locations and they are geographically present on Figure 4-3.

4.5.2 Local Baseline Sampling Program

The results of the chemical analyses of the samples illustrate considerable continuity of hydrochemical signatures within the three watersheds and considerable continuity from season to season. The surface hydrochemical signatures indicate the waters are very fresh (TDS = 12 mg/L to 64 mg/L), very soft (hardness = 1.3 mg/L to 7.4 mg/L and acidic (pH = 4.1 to 6.3).

The baseline program from April 2000 to present indicates that most chemical parameters conform to the Canadian Council of the Ministers of the Environment (CCME) Guidelines for Freshwater Aquatic Life with the exception of a few select metals. The laboratory reported aluminum and lead levels to be routinely in exceedence of the CCME guideline at each monitoring station sampled throughout the monitoring program. The laboratory also reported instances of copper and iron levels being above guideline for select sampling events. Zinc levels were reported above guidelines at SW-2 throughout the sampling program. The surface water chemistry is a direct reflection of local soil, till and bedrock mineral composition.

TABLE 4-4: SURFACE WATER MONITORING STATIONS PHYSICAL DESCRIPTIONS

SITE NO.	DESCRIPTION
SW-1	On Clyde River upstream of claim block.
SW-2	On Clyde River downstream of claim block.
SW-3	On East Barclay Brook west and upstream of proposed extraction areas.
SW-4	On East Barclay Brook west and downstream of proposed extraction areas.
SW-5	On the Barclay Brook west of proposed extraction areas.
SW-6	On the Barclay Brook west of proposed extraction areas.
SW-7	Not used due to dry conditions.
SW-8	At outflow from Upper Frog Pond.
SW-9	At inflow to Lower Frog Pond.
SW-10	At confluence of East Barclay and Barclay Brooks.
PIT POND	Settling pond near the bulk sample extraction area, north side of Highway #203.

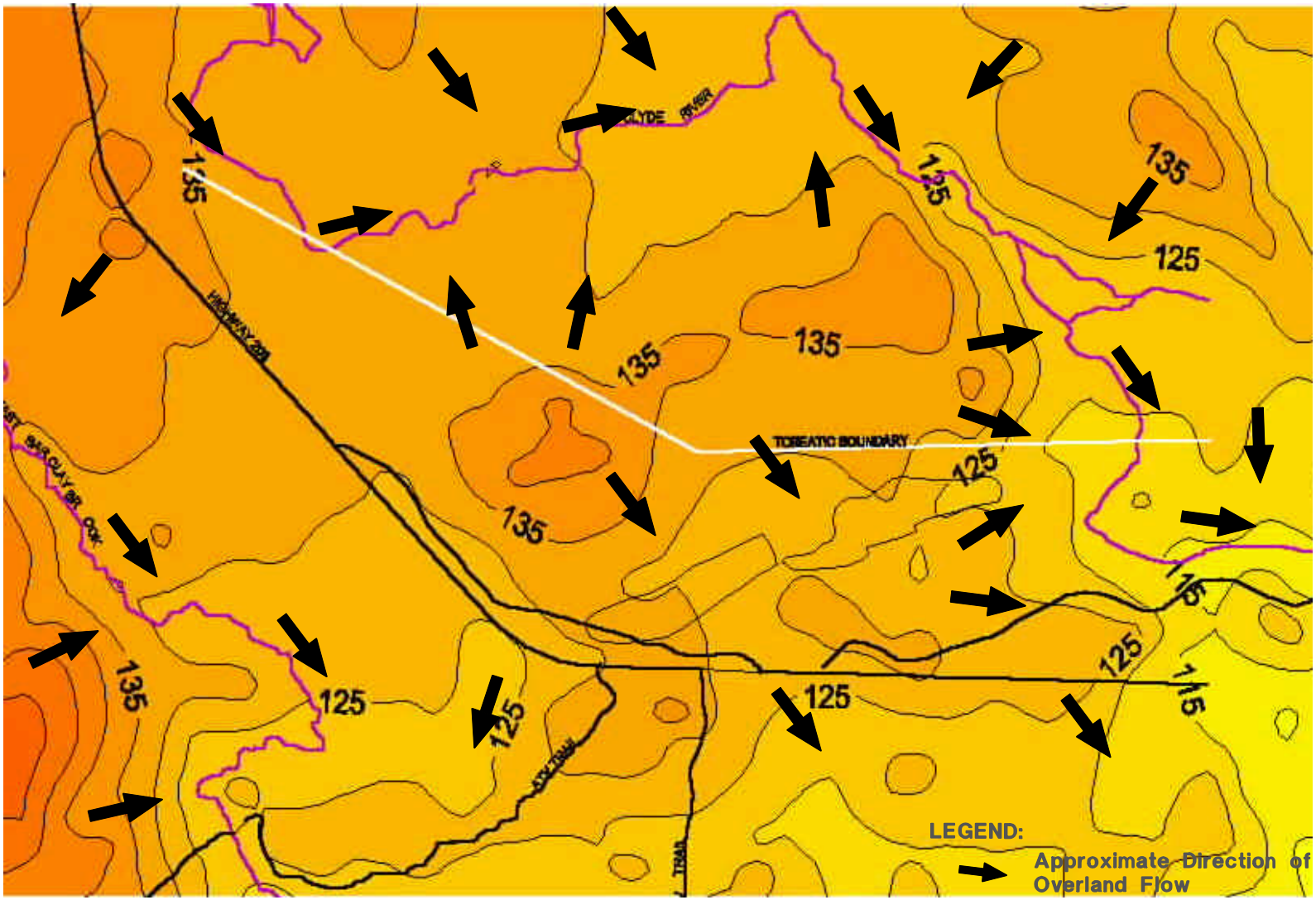
Figure 4-4 presents overland water flow directions for the site area noting that these are locally controlled by topography.

4.6 Regional and Local Hydrogeology and Baseline Sampling Program

Groundwater elevations were collected from 6 on-site monitoring well locations to determine the direction and gradient of groundwater flow. The groundwater flows in a south to southeast direction based on data collected and is locally controlled by topography. Black Bull anticipates having 8 (6 existing and 2 nested multi-wells, see Section 8.3) monitor wells in place prior to mine operations starting for long term monitoring of groundwater chemistry and elevations as part of the overall environmental monitoring program for the White Rock Mine. Table 4-5 summarizes the site hydrogeological data collected to July 2002 and groundwater flow is presented in Figure 4-5.

4.6.1 Site Groundwater Flow Model Description

The conceptual hydrostratigraphy consists of the upper layer of sandy till overburden, underlain by the granites to the north, meta-greywackes to the south, separated by a central quartz/kaolinite zone. The overburden layer is of variable to discontinuous thickness and composed of sandy conductive till materials. The highly irregular nature of the local topography will result in overburden flow expressing itself very locally in the numerous small moist/marshy areas observed regionally. Due to the low porosity levels in the granites and the meta-greywackes, flow will be predominately in the secondary or fracture porosity. Geologic field observations of the material in the central quartz/kaolinite zone show a highly resilicified material with no staining.



CADFILE No. 20232GF4-5

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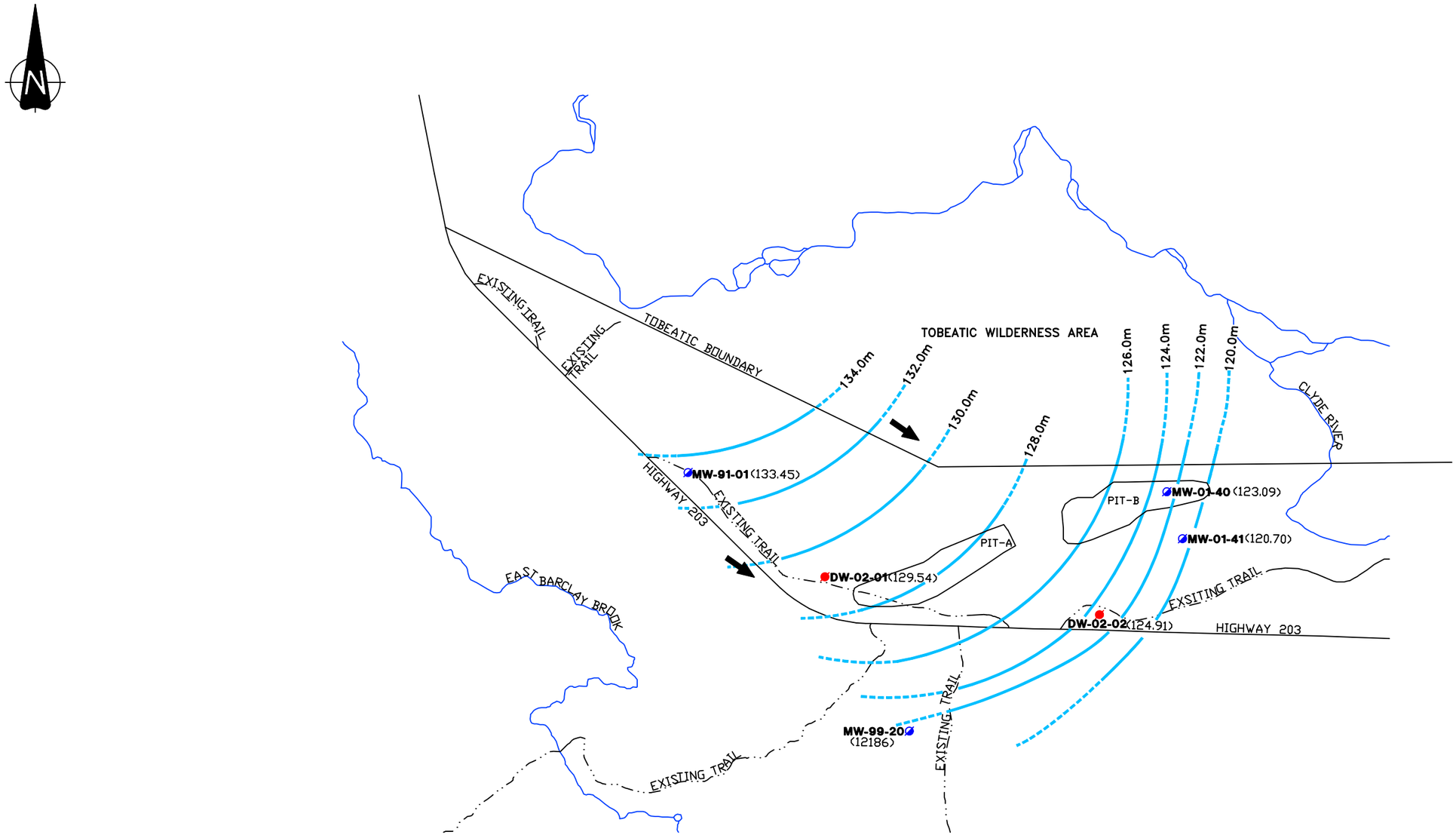
TITLE: Overland Flow		DATE: Aug. 2002	PROJECT NO.: 20232G
PROJECT: Hydrogeologic Baseline Study White Rock Mine Flintstone Rock, Nova Scotia		SCALE: N.T.S.	FIGURE NO.: 4-4
		DRAWN: SYC	

CADFILE No. 20232G4-4



Scale: 0 100 200 metres

LEGEND:

- **MW-91-01** Exiting Monitoring Well
- **DW-02-01** Drilled Test Well
- (129.54) Groundwater Elevation (m) July 2002
- **126.0m** Groundwater Equipotential (m)
- Groundwater Flow Direction

A member of the Family of Companies

TITLE: **Groundwater Flow**

PROJECT: **Hydrogeologic Baseline Study**
White Rock Mine
Flinstone Rock, Nova Scotia

DATE	PROJECT NO.
Aug. 2002	20232G
SCALE: 1:10000	FIGURE NO. 4-5
DRAWN: SYC	

Conceptually the flow system is predominately a bedrock groundwater flow system that moves from the higher elevation areas in the northwest toward the lower areas in the south and the east. The nature of the regional groundwater flow is confirmed by water level measurements from monitoring wells across the site. Other water fluxes to the flow system include infiltration due to recharge from precipitation and interaction with the East Barclay Brook and the Clyde River. Depending on the relative elevation of the surrounding groundwater and the brook and river channels, the East Barclay and Clyde are either groundwater recharging or discharging bodies of water. The low elevation of the Clyde River, south and east of the central quartz/kaolinite zone indicates that groundwater in this area would be recharging the river.

The scenario using median conductivity values, from the range of collected data, the equipotential head lines along East Barclay Brook and Clyde River remain essentially unchanged, areas immediately north of the quartz extraction area show a 4 m reduction in head levels decreasing to 1m at MW91-01 (approximately 400m distance). Areas immediately south of the quartz extraction areas show a 6 m reduction in head levels, which decreases with distance from the quartz extraction areas. Calculated total groundwater seepage flow into the two quartz extraction areas ranged from approximately 990 m^3/day (151.5s igpm) for a high conductivity scenario to approximately 275 m^3/day (42 igpm) for the low conductivity scenario. Negative effects are not predicted for the Clyde River or East Barclay based on the modeling. Appendix J provides the full groundwater modeling report.

TABLE 4-5: SITE HYDROGEOLOGICAL DATA

Well Construction Details			
Well ID	**Well Depth (m)***	**Top of Well Casing (TOC) Elevation***	
MW-91-01	39	135	
MW-99-20	50**	127.3	
MW-01-40	***	125	
MW-01-41	25	125	
DW-02-01	45.7	132.11	
DW-02-02	48.8	132.22	
Groundwater Elevations			
Well ID	**Date**	**Static Water Level**	**Groundwater Elevation**
MW-91-01	20-Dec-01	1.1	133.9
MW-99-20	20-Dec-01	5.1	123.7
MW-01-40	20-Dec-01	1.1	123.9
MW-01-41	20-Dec-01	4.4	120.6
MW-91-01	10-Jan-02	1.0	134
MW-99-20	10-Jan-02	5.2	123.6
MW-01-40	10-Jan-02	1.4	123.6
MW-01-41	10-Jan-02	4.6	120.4
MW-91-01	16-Apr-02	0.975	134.025
MW-99-20	17-Apr-02	4.635	124.0
MW-01-40	17-Apr-02	1.16	123.84
MW-01-41	17-Apr-02	4.19	120.81
DW-02-01	2-May-02	2.42	129.69
DW-02-02	27-May-02	6.45	125.77
MW-91-01	30-July-02	1.55	133.45
MW-99-20	30-July-02	5.44	121.86
MW-01-40	30-July-02	1.91	123.09
MW-01-41	30-July-02	4.30	120.70
DW-02-01	30-July-02	2.57	129.54
DW-02-02	30-July-02	7.31	124.91

Notes: * **Elevations and depths for MW series wells from previous information supplied to MGI. Elevations for DW series wells from survey carried out on May 16, 2002; depths from MGI records.**

** **Sloped borehole - 45° angle from vertical.**

*** **Data not available at this time.**