APPENDIX 14

DEPTH OF PERMAFROST

1. STUDY SCOPE

Depth of permafrost is important for mine construction and operation because it defines the depth of the active layer (freeze-thaw layer) and the potential for movement of shallow groundwater during the summer season. Thermistor strings to measure temperature were targeted for both the George and Goose lake areas; however only the Goose Lake site was examined in 1997.

2. METHODS

Thermistor strings were installed at 4 foot (1.2 m) intervals to a depth of 25 feet down an open (unfrozen) drill hole at Goose Lake in late summer 1997. The drill hole is designated 97GO-014. The approximate location is shown on Figure 4.1-1. Actual depths below the surface will be adjusted for the slope of the diamond drill hole prior to data evaluation. Thermistors were connected to a junction box grouted in place on a stand above the drill hole. The thermistor resistances were measured on two occasions with a digital ohmmeter and converted by means of a calibration chart supplied by the manufacturer, R Technical, to temperatures.

3. RESULTS

Table 1 lists results of the two measurements made in early and mid September 1997. The table indicates permafrost was at 1.5 m.

TABLE 1
GOOSE LAKE THERMISTOR DATA

Location: Drill Hole: 97GO-014

Date	Depth (m)	Resistance (ohms)	Temp (°C)
05-Sep-97	1.2	5.16	7.1
	2.4	6.14	3.8
	3.6	7.09	0.8
	4.8	7.63	-0.8
	12	8.52	-2.0
	14.2	8.90	-3.0
21-Sep-97	1.2	6.28	3.1
	2.4	6.88	1.7
	3.6	7.15	0.8
	4.8	7.56	-0.8
	12	8.03	-1.7
	14.2	8.39	-2.6

HPPENDIX 15

NORECOL DAMES & MOORE

A DAMES & MOORE SUBSIDIARY

650 West Georgia Street
Suite 1900
P.O. Box 11507
Vancouver, BC, Canada V6B 4N7
604 681 1672 Tel
604 687 3446 Fax
van@dames.com E-mail

October 23, 1997
File: 36203-001-310

Kit Resources, Ltd.
340 - 666 Burrard Street
Vancouver, B.C.
V6C 2X8

RECEIVED

Attention: **Jane Howe**

Re: Water Balance Estimates, Revised Water License Application

Dear Ms. Howe:

Norecol, Dames & Moore, Inc. (NDM) has prepared this revised letter-report to present our estimates for the water balance of the area containing the stockpiled bulk sample from the Goose Claim. Based on conversations with you, we have assumed that these estimates were needed for the exploratory program beginning in April 1998 until no later than March 1999, when the stockpiled bulk sample would be removed from the area.

BACKGROUND

We understand that Kit Resources, Ltd. is applying for a Water License Application for exploratory drilling at the Goose Claim, situated adjacent to Goose Lake in the Northwest Territories approximately 400 kilometres southwest of Cambridge Bay and 150 kilometres southwest of Bathhurst Inlet. The application requires that a water balance be estimated to provide data to evaluate various physical conditions during the exploratory program.

Based on information supplied by you, in April 1998, Kit Resources plans to collect a small bulk sample from the Goose Deposit. The sample will be stockpiled at the site for eight to ten months, and then trucked over a winter road to the Lupin Mine to perform pilot tests. The stockpile will be roughly 35 x 70 metres wide and 3 metres tall. The stockpile will be protected from runoff by an encircling berm, so that no runoff from adjacent areas will discharge to the stockpile. All runoff from the stockpile will be collected into a settling pond approximately 5 x 50 metres and then discharged to Goose Lake through a controlled ditch.

OBJECTIVES

Based on conversations with you, the following hydrologic conditions need to be estimated:

- the volume of water to be held in storage by the proposed settling pond;
- mean annual and mean monthly water balance for the stockpile area draining to the settling pond;

- an estimated maximum volume of water delivered to the settling pond.

WATER BALANCE EQUATION

The water balance relationship is as follows:

$$P - AET - \Delta GWS - R = 0,$$

Where P = precipitation,
AET = actual evapotranspiration,
ΔGWS = the change in groundwater storage, and
R = runoff.

The project area is in crystalline rock and surface water likely dominates water movement. The area is within the zone of continuous permafrost, which with the nature of crystalline rock, restricts exchanges between surface water and subpermafrost groundwater. The main contribution to runoff comes from seasonal rainfall and snowmelt. Groundwater does not maintain a base flow in most of the drainages during the winter and therefore contributes little to the hydrologic cycle. In this case, the ΔGWS is assumed to be negligible; thus, the water balance equation simplifies to:

$$P - AET - R = 0.$$

In this case, because of the protective berm, runoff (R) will be derived only from the stockpile area during snowmelt or rainfall events. Thus, the majority of the volume of water discharged to the settling pond will occur during spring break-up and during summer rain/snowmelt events.

ESTIMATES FOR THE WATER BALANCE PARAMETERS

There are no long-term weather or streamflow records for the Goose Lake project area. Estimates for the project area are made based on comparison with data from nearby areas.

Precipitation

The nearest AES station for recording precipitation is Contwoyto Lake/Lupin Mine with a combined period of record from 1959 to the present. The Contwoyto Lake/Lupin Mine area is located approximately 165 km to the west. Precipitation data were collected at Contwoyto Lake from 1959 to 1981, and Lupin Mine from 1982 to the present. The Contwoyto Station was moved to the Lupin Mine in 1982.

Mean monthly total precipitation from *Environment Canada* for both Contwoyto and Lupin are summarized in Table 1. In general, the data indicate that approximately 68% to 70% of the annual precipitation occurred from June to October, and that the maximum mean monthly precipitation occurred during August. The mean annual precipitation for Contwoyto Lake (1959-81) was 251.6 mm, and for Lupin Mine (1982-96) 295.4.

The maximum and minimum recorded mean monthly precipitation for each month is also shown on Table 1. A maximum recorded monthly precipitation of 156 mm occurred during August 1996, whereas the minimum (no recorded precipitation) has occurred several times during the months of January, February and March. The maximum annual precipitation was 429.5 in 1996.

Runoff

The Goose Claim is in the Goose Lake watershed, which is bounded on the east by the Back River watershed. Based on data presented in *"Hydrology and Bathymetry of Goose Lake and its Watershed,"* (Hubert and Associates, September 1994), mean monthly runoff for the Goose Lake watershed was estimated from comparisons with the adjacent Back River data and from the Gordon River watershed, located approximately 120 km to the north of Goose Lake. These data are summarised in Table 2. The mean annual runoff for the Goose Lake watershed was estimated by Hubert and Associates to be 171 DAM^3/km^2, or 171 mm. The National Atlas of Canada indicates that the mean annual runoff for this area of the mainland tundra to be around 100 mm. This indicates that there is some variability in estimating runoff due to a number of factors, including but not limited to, watershed area, lake area within each watershed, and physiography. We have assumed that the mean annual runoff is 171 mm for this study.

The data in Table 2 indicate that for both the Gordon River and Back River drainages, and by extrapolation to the Goose Lake watershed, mean monthly runoff rises quickly due to spring break-up from nil in May to a peak in June. Mean monthly runoff then decreases systematically throughout the year until little or no runoff occurs during freeze-up in late November and early December. Runoff is negligible during the winter from December through April.

Evapotranspiration

In this case, mean monthly evapotranspiration (ET) was estimated using both the available lake evaporation data and the water balance relationship.

ET is typically not as readily measured as evaporation. Evaporation is measured as pan evaporation or lake evaporation. Actual Evapotranspiration (AET) can be estimated from lake evaporation data, assuming that lake evaporation is an indicator of potential evapotranspiration (PET) (PET is the maximum amount of ET that would occur if a water source was not limiting), so that AET is some fraction of lake evaporation.

The closest weather station where pan and lake evaporation data were collected is at Yellowknife, located approximately 650 km to the southwest. Although Yellowknife is a long distance from the project area, it is reasonable to assume that monthly evapotranspiration at the Goose Claim is proportional to monthly lake evaporation at Yellowknife.

Mean monthly lake evaporation data for Yellowknife from *Environment Canada* is summarized in Table 3 for the period from 1966 to 1997. Based on the Yellowknife data, evaporation and by correlation, AET is negligible throughout the winter (late October to late April) until late April or early May, is at a maximum during June and July, and then steadily decreases during August through October.

Assuming the mean monthly precipitation from Contwoyto Lake/Lupin Mine and the mean monthly runoff for Goose Lake as described above, then from the water balance equation, annual evapotranspiration is estimated to be 80.6 mm.

Water Balance

Three scenarios of monthly water balances (for the period from April 1998 to March 1999) for the Goose Claim stockpile were estimated: 1) using the 1959-81 Contwoyto Lake precipitation data only, 2) using the 1982-96 Lupin Mine precipitation data only, and 3) using an estimated maximum monthly precipitation based on the 1982-96 Lupin Mine data.

The following conditions were assumed:

- the stockpile and berm will be built beginning in April 1998;
- the stockpile area is 35 m x 70 m (2450 m^2), and the settling pond is approximately 250 m^2;
- there is no net change in groundwater storage;
- there is no discharge from the settling pond.

The following parameters were defined as:

- PET at Yellowknife is approximately equal to Yellowknife Lake Evaporation;
- Mean Annual Potential Runoff (MAPR) = Mean Annual Runoff at Goose Lake, or 171.0 DAM^3/m^2 (or 171 mm);
- Mean Monthly Potential Runoff (MPR) = Mean Monthly Runoff at Goose Lake;
- AET = PET x [(Mean Annual Precipitation – MAPR)/Total PET];
- Maximum Monthly Precipitation at Lupin (1982-96) = {Maximum Annual Precipitation/Mean Annual Precipitation} x Mean Monthly Precipitation;
- Maximum Monthly Potential Runoff (MPR_{max}) = MPR x {Lupin Maximum Annual Precipitation/ Lupin Mean Annual Precipitation}.

The three scenarios are summarized in Tables 4, 5 and 6. For the first scenario using the 1959-81 Contwoyto Lake precipitation data, the following conditions were estimated:

1. By November the settling pond will have received 227.5 m^3 of runoff from the stockpile, and 123.0 m^3 will have evaporated leaving by 104.5 m^3 of water in the pond (assuming no discharge to Goose Lake).

2. About half of this runoff will occur in August and September, and there will be no appreciable runoff from November through early May.
3. During spring break-up and early summer (May, June and July), there is a net deficit at the stockpile (i.e., potential runoff and evapotranspiration are greater than precipitation). These conditions prevail until August when precipitation is at a maximum and AET and MPR are decreasing; thus the stockpile does not begin to accumulate water until August, but will continue to do so throughout the remainder of the year. By March 1998, assuming the stockpile would be removed by then, approximately 191.4 m^3 of water in the form of snow and ice would be contained in the stockpile.
4. During May, June, and July, almost all of the runoff to the pond evaporates. Runoff to the pond is relatively high during August, September, and October. The total estimated volume of water held in storage by November is 104.5 m^3, so that the minimum average depth of the pond (without freeboard) would need to be approximately 0.42 m.

For the second scenario using the 1982-96 Lupin Mine precipitation data, the following conditions were estimated:

1. By November the settling pond will have received 256.7 m^3 of runoff from the stockpile, and 123.0 m^3 will have evaporated leaving by 133.7 m^3 of water in the pond (assuming no discharge to Goose Lake).
2. Runoff rates will be fairly uniform from June through September, reaching a peak in August; and there will be no appreciable runoff from November through early May.
3. During spring break-up and early summer (May, June and July), there is a net deficit at the stockpile (i.e., potential runoff and evapotranspiration are greater than precipitation). These conditions prevail until August when precipitation is at a maximum and AET and MPR are decreasing; thus the stockpile does not begin to accumulate water until August, but will continue to do so throughout the remainder of the year. By March 1998, assuming the stockpile would be removed by then, approximately 269.6 m^3 of water in the form of snow and ice would be contained in the stockpile.
4. During May, June, and July, almost all of the runoff to the pond evaporates. Runoff to the pond is relatively high during August, September, and October. The total estimated volume of water held in storage by November is 133.7 m^3, so that the minimum average depth of the pond (without freeboard) would need to be approximately 0.53 m.

For the third scenario using an estimated maximum monthly precipitation based on the 1982-96 Lupin Mine precipitation data, the following conditions are estimated:

1. By November the settling pond will have received 424.4 m^3 of runoff from the stockpile, and 126.4 m^3 will have evaporated leaving by 298.0 m^3 of water in the pond (assuming no discharge to Goose Lake).
2. Runoff rates from the stockpile will rise rapidly during break-up, peak in June and stay fairly high through September; and there will be no appreciable runoff from November through early May.
3. During spring break-up and early summer (May, June and July), there is a net deficit at the stockpile (i.e., potential runoff and evapotranspiration are greater than precipitation). These conditions prevail until August when precipitation is at a maximum and AET and MPR are decreasing; thus the

stockpile does not begin to accumulate water until August, but will continue to do so throughout the remainder of the year. By March 1998, assuming the stockpile would be removed by then, approximately 430.9 m^3 of water in the form of snow and ice would be contained in the stockpile.

4. During May, June, and July, almost all of the runoff to the pond evaporates. Runoff to the pond is relatively high during August, September, and October. The total estimated volume of water held in storage by November is 298.0 m^3, so that the minimum average depth of the pond (without freeboard) would need to be approximately 1.19 m.

REPORT LIMITATIONS

The data presented in this letter report have been prepared for specific application to this project and have been prepared in a manner consistent with that level of care and skill normally exercised by members of the environmental science profession currently practising under similar conditions in the area. No other warranty, expressed or implied, is made. This report is for the exclusive use of Kit Resources, Ltd. and their representatives.

Please call the undersigned at (604) 681-1672 if you have any questions.

Very truly yours,

NORECOL, DAMES & MOORE, INC.

per:

Stephen C. Wilbur, Ph.D.
Senior Hydrologist

SCW:ijk

cc: Bruce Ott, NDM

Table 1A	Total Precipitation (mm)			Contwoyto Lake									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1959	9.1	25.9	17.3	7.4	18.5	116.8	30.7	26.7	18.3	25.9	14.7	14.0	325.3
1960	5.8	16.0	13.2	11.7	7.9	7.9	49.0	65.0	55.6	47.5	12.2	11.7	303.5
1961	8.9	11.4	13.5	9.4	27.2	39.4	63.8	64.8	22.4	19.8	20.1	9.1	309.8
1962	5.8	4.1	14.5	8.6	15.5	13.0	27.4	19.8	16.8	27.2	32.3	11.9	196.9
1963	5.8	2.5	10.4	13.5	16.5	59.4	28.7	41.4	6.1	24.1	27.9	14.0	250.3
1964	9.7	14.0	4.6	14.5	9.1	19.3	70.6	23.4	26.9	28.7	4.8	20.8	246.4
1965	7.4	0.3	12.7	5.8	6.1	20.8	36.1	30.5	17.0	11.9	12.7	2.5	163.8
1966	0.0	4.3	8.9	4.8	8.9	16.5	42.9	42.9	42.2	6.9	4.8	8.9	192.0
1967	6.9	7.4	2.8	4.6	8.9	58.2	53.8	37.1	84.6	28.2	11.9	11.7	316.1
1968	11.7	8.9	5.1	17.8	54.1	6.9	13.7	22.4	54.9	36.1	16.3	5.6	253.5
1969	3.0	6.6	5.3	11.9	8.9	31.2	71.1	45.0	7.6	5.1	29.0	7.4	232.1
1970	2.8	3.8	6.6	12.4	7.9	31.5	14.2	71.4	52.6	46.5	6.1	5.6	261.4
1971	5.8	33.5	23.4	17.8	27.2	1.0	35.8	35.6	76.7	34.0	10.2	8.4	309.4
1972	11.2	6.4	8.6	18.8	26.4	6.9	44.5	42.4	29.5	22.4	11.4	3.8	232.3
1973	11.7	1.3	23.9	7.1	9.7	27.7	18.3	87.9	30.5	31.0	4.8	1.3	255.2
1974	3.0	7.6	4.6	11.4	26.4	37.6	42.9	29.2	32.8	62.5	8.1	11.7	277.8
1975	2.8	2.8	2.0	10.9	21.3	3.8	22.4	63.2	12.7	26.2	10.2	10.7	189.0
1976	11.7	7.1	5.6	3.3	40.1	53.6	34.5	22.6	50.5	36.8	20.8	6.1	292.7
1977	11.0	17.5	15.7	26.8	15.8	14.4	16.4	38.0	13.8	19.2	14.4	38.4	241.4
1978	8.7	5.7	8.9	10.0	15.9	38.4	18.5	37.4	7.5	88.8	16.5	17.9	274.2
1979	9.5	0.0	5.9	19.9	23.0	14.2	42.0	38.3	21.7	28.0	17.9	12.4	232.8
1980	1.6	1.1	3.5	0.7	8.4	2.0	23.5	34.3	23.0	35.2	24.9	9.3	167.5
1981	0.0	16.5	26.3	3.4	5.1	30.0	37.9	34.4	54.5	20.4	23.0	3.3	254.8
Mean	7.0	8.9	10.6	11.0	17.8	28.3	36.5	41.5	33.0	31.0	15.4	10.7	251.5
% of Annual	2.8	3.5	4.2	4.4	7.1	11.2	14.5	16.5	13.1	12.3	6.1	4.3	100.0

Table 1B Total Precipitation (mm) Lupin Mine

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1982	0.8	3.0	0.0	13.2	12.8	44.9	36.0	62.4	36.6	21.3	14.1	15.0	260.1
1983	24.6	5.5	16.8	16.5	18.0	10.4	77.7	75.2	77.0	41.8	10.8	6.0	380.3
1984	6.8	19.4	16.2	19.3	17.8	60.0	69.6	53.7	19.8	25.4	13.2	9.2	330.4
1985	9.2	11.6	10.4	25.8	10.2	19.4	89.0	46.6	44.7	24.0	9.4	6.6	306.9
1986	20.0	9.2	5.2	19.7	29.2	17.5	18.0	100.8	30.0	28.0	13.6	12.8	304.0
1987	11.6	6.6	5.6	6.6	8.6	67.8	41.8	47.1	35.0	34.1	45.0	25.4	335.2
1988	1.8	3.6	4.2	6.0	10.8	50.3	32.4	18.7	43.4	32.2	22.2	8.2	233.8
1989	20.0	4.0	10.2	3.1	36.1	6.3	35.0	27.5	33.7	11.7	14.4	16.5	218.5
1990	11.8	6.0	12.0	8.3	2.4	23.4	23.3	54.0	48.5	20.1	9.2	14.7	233.7
1991	7.9	13.2	12.4	26.1	14.0	12.4	42.8	76.2	46.5	26.4	17.6	19.4	314.9
1992	17.6	8.6	9.8	20.4	21.4	21.2	14.8	47.0	31.2	43.8	15.4	4.2	255.4
1993	6.1	19.2	13.2	6.2	28.4	24.0	87.0	28.8	29.9	19.4	14.8	12.0	289.0
1994	3.4	2.2	22.0	8.2	15.4	39.2	13.8	47.2	43.4	29.2	11.0	14.8	249.8
1995	5.2	3.4	38.8	6.6	11.2	20.8	40.2	79.0	49.4	37.0	7.4	23.8	322.8
1996	5.6	18.4	4.4	8.0	24.8	53.2	57.7	156.0	68.8	12.4	13.6	6.6	429.5
1997	6.6	6.6	6.8	12.8	29.6	21.2	18.2						
Mean	9.9	8.8	11.8	12.9	18.2	30.8	43.6	61.3	42.5	27.1	15.4	13.0	295.3
% of Annual	3.4	3.0	4.0	4.4	6.2	10.4	14.8	20.8	14.4	9.2	5.2	4.4	100.0

Table 2 Month by Month Runoff Volumes Estimated for the Goose Lake Watershed				
Month	**Gordon River**	**Back River**	**Goose Lake**	
	DAM^3/km^2	**DAM^3/km^2 (historic range)**	**DAM^3/km^2**	**DAM^3 Total**
Jan	0.	0.7	0.	0
Feb	0.	0.3	0.	0
Mar	0.	0.2	0.	0
Apr	0.	0.2	0.	0
May	1.3	3.0 (0 - 13)	3.0	279
Jun	75.3	65. (12 - 157)	65.0	6,035
Jul	50.9	46.3 (14 - 59)	45.0	4,178
Aug	24.9	24.9 (12 - 34)	25.0	2,321
Sep	24.5	20. (12 - 33)	20.	1,857
Oct	10.4	12.3 (4 - 21)	12.	1,114
Nov	1.3	4.4 (<1 - 10)	1.	93
Dec	0.	1.8	0.	0
Total Mean Annual Runoff (estimated DAM^3)				15,877

* From Hubert & Associates (1994)

Table 3 Mean Daily Lake Evaporation (mm) Yellowknife, Northwest Territories (1966-1996)					
Day of Month	**May**	**June**	**July**	**August**	**September**
1	2.4	4.2	5.2	5.2	2.0
2	2.4	5.3	5.1	4.4	2.2
3	2.5	4.7	4.5	4.3	2.1
4	2.6	4.9	4.7	4.2	2.0
5	2.7	4.9	4.9	3.8	2.3
6	2.7	4.8	5.1	3.4	2.4
7	2.8	4.8	5.0	3.8	2.3
8	2.9	4.9	5.5	3.8	2.0
9	2.9	5.1	5.5	4.1	1.8
10	2.1	5.0	5.3	4.3	1.9
11	3.8	5.4	5.6	3.7	1.8
12	3.4	4.9	5.3	3.7	1.7
13	3.4	6.0	5.8	3.8	1.6
14	2.8	5.4	4.8	3.4	2.0
15	4.0	5.1	4.9	3.7	1.4
16	4.4	4.8	5.0	3.7	1.9
17	5.5	5.7	4.7	3.5	1.6
18	3.9	5.3	5.2	3.7	1.6
19	4.4	4.8	4.8	2.9	1.5
20	3.1	5.3	4.5	3.3	1.5
21	3.5	4.9	5.1	3.3	1.3
22	4.1	5.4	4.8	3.0	1.3
23	3.4	5.3	4.8	3.2	1.0
24	3.2	5.1	5.0	3.1	1.1
25	3.3	5.1	5.1	3.0	1.1
26	3.8	5.1	4.7	2.4	1.1
27	5.3	5.0	4.9	2.6	0.8
28	4.6	5.4	4.5	3.0	0.5
29	4.5	5.2	4.6	2.9	0.6
30	4.4	4.8	4.5	3.0	0.8
31	4.5		4.7	2.6	
Monthly Mean	109.3	152.6	154.0	108.6	47.3
Daily Mean	3.5	5.1	5.0	3.5	1.6

Data from: *Climate Information Branch, Environment Canada*

Table 4 (Scenario A). Goose Claim Monthly Water Balance

1998-99	Precipitation		Evapotranspiration			Runoff					Monthly Balance		
	Contwoyto 1959-1981		Yellowknife (1966-1996)			MPR	into Pond from Stockpile		into Pond minus Pond Evaporation	Volume in Pond Storag	left on/in Stockpile (P-AET-R)		Est. Volume in/on Stockpile 1998-99
	P	P	PET*	AET	AET	R	R	R	(R-PET)	Cum(R-PET)			
Month	mm	m^3	mm	mm	m^3	DAM^3/km^2	DAM^3/km^2	m^3	m^3	m^3	mm	m^3	m^3
Apr	11.0	27.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.0	27.0	27.0
May	17.8	43.6	109.3	15.4	37.8	3.0	3.0	7.4	0.0	0.0	-0.6	-1.5	25.5
Jun	28.3	69.3	152.6	21.5	52.7	65.0	17.2	42.0	3.9	3.9	-10.4	-25.4	0.0
Jul	36.4	89.2	154.0	21.7	53.2	45.0	14.7	36.0	-2.5	1.4	0.0	0.0	0.0
Aug	41.5	101.7	108.6	15.3	37.5	25.0	25.0	61.3	34.1	35.5	1.2	2.9	2.9
Sep	33.0	80.9	47.3	6.7	16.3	20.0	20.0	49.0	37.2	72.7	6.3	15.5	18.4
Oct	31.0	76.0	0.0	0.0	0.0	12.0	12.0	29.4	29.4	102.1	19.0	46.6	65.0
Nov	15.4	37.7	0.0	0.0	0.0	1.0	1.0	2.5	2.5	104.5	14.4	35.3	100.3
Dec	10.7	26.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	104.5	10.7	26.2	126.5
Jan	7.0	17.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	104.5	7.0	17.2	143.6
Feb	8.9	21.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	104.5	8.9	21.8	165.4
Mar	10.6	26.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	104.5	10.6	26.0	191.4
Annual	251.6	616.4	571.8	80.6	197.5	171.0	92.9	227.5	104.5	N/A	78.2	191.5	N/A

assumptions: 1) begin to build stockpile in April

2) no change in groundwater storage

3) Yellowknife PET = Yellowknife lake evaporation

4) AET = PET X [(Mean Annual Precipitation at Contwoyto 1959-81) - MAPR)/Total PET)]

5) MAPR (Mean Annual Potential Runoff) = Mean Annual Runoff at Goose Lake X (Stockpile Area/Goose Lake Watershed Area)

6) stockpile area is 35 m X 70 m, and pond area is 5 m X 50 m

7) MPR (Monthly Potential Runoff) = Goose Lake Monthly Runoff X (Stockpile Area/Goose Lake Watershed Area)

Table 5 (Scenario B). Goose Claim Monthly Water Balance

1998-99	Precipitation		Evapotranspiration			Runoff					Monthly Balance		
	Lupin Mine 1982-96		Yellowknife (1966-1996)			MPR	into Pond from Stockpile		into Pond minus Pond Evaporation	Volume in Pond Storag	left on/in Stockpile (P-AET-R)		Est. Volume in/on Stockpile 1998-99
	P	P	PET*	AET	AET	R	R	R	(R-PET)	Cum(R-PET)			
Month	mm	m^3	mm	mm	m^3	DAM^3/km^2	DAM^3/km^2	m^3	m^3	m^3	mm	m^3	m^3
Apr	12.9	31.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.9	31.6	31.6
May	18.2	44.6	109.3	15.4	37.8	3.0	3.0	7.4	0.0	0.0	-0.2	-0.5	31.1
Jun	30.8	75.5	152.6	21.5	52.7	65.0	21.9	53.6	15.4	15.4	-12.6	-30.8	0.0
Jul	43.6	106.8	154.0	21.7	53.2	45.0	21.9	53.6	15.1	30.6	0.0	0.0	0.0
Aug	61.4	150.4	108.6	15.3	37.5	25.0	25.0	61.3	34.1	64.7	21.1	51.7	51.7
Sep	42.5	104.1	47.3	6.7	16.3	20.0	20.0	49.0	37.2	101.8	15.8	38.8	90.5
Oct	27.1	66.4	0.0	0.0	0.0	12.0	12.0	29.4	29.4	131.2	15.1	37.0	127.5
Nov	15.4	37.7	0.0	0.0	0.0	1.0	1.0	2.5	2.5	133.7	14.4	35.3	162.7
Dec	13.0	31.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	133.7	13.0	31.9	194.6
Jan	9.9	24.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	133.7	9.9	24.3	218.8
Feb	8.8	21.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	133.7	8.8	21.6	240.4
Mar	11.8	28.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	133.7	11.8	28.9	269.3
Annual	295.4	723.7	571.8	80.6	197.5	171.0	104.8	256.7	133.7	N/A	110.0	269.6	N/A

assumptions: 1) begin to build stockpile in April

2) no change in groundwater storage

3) Yellowknife PET = Yellowknife lake evaporation

4) AET = PET X [(Mean Annual Precipitation at Lupin Mine 1982-96) - MAPR)/Total PET)]

5) MAPR (Mean Annual Potential Runoff) = Mean Annual Runoff at Goose Lake X (Stockpile Area/Goose Lake Watershed Area)

6) stockpile area is 35 m X 70 m, and pond area is 5 m X 50 m

7) MPR (Monthly Potential Runoff) = Goose Lake Monthly Runoff X (Stockpile Area/Goose Lake Watershed Area)

Table 6 (Scenario C). Goose Claim Monthly Water Balance

1998-99	Precipitation		Evapotranspiration			Runoff					Monthly Balance		
	Lupin Max 1982-96		Yellowknife (1966-1996)			MPR	into Pond from Stockpile		into Pond minus Pond Evaporation	Volume in Pond Storag	left on/in Stockpile (P-AET-R)		Est. Volume in/on Stockpile 1998-99
	P	P	PET*	AET	AET	R	R	R	(R-PET)	Cum(R-PET)			
Month	mm	m^3	mm	mm	m^3	DAM^3/km^2	DAM^3/km^2	m^3	m^3	m^3	mm	m^3	m^3
Apr	18.8	46.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.8	46.1	46.1
May	26.5	64.9	109.3	15.4	37.8	4.4	4.4	10.8	0.0	0.0	6.7	16.4	62.4
Jun	44.8	109.8	152.6	21.5	52.7	94.5	48.7	119.4	81.2	81.2	-25.4	-62.3	0.0
Jul	63.4	155.3	154.0	21.7	53.2	65.4	41.7	102.2	63.7	144.9	0.0	0.0	0.0
Aug	89.3	218.8	108.6	15.3	37.5	36.3	36.3	88.9	61.8	206.7	37.7	92.3	92.3
Sep	61.8	151.4	47.3	6.7	16.3	29.1	29.1	71.3	59.5	266.2	26.0	63.8	156.1
Oct	39.4	96.5	0.0	0.0	0.0	17.4	12.0	29.4	29.4	295.6	27.4	67.1	223.3
Nov	22.4	54.9	0.0	0.0	0.0	29.1	1.0	2.5	2.5	298.0	21.4	52.4	275.7
Dec	18.9	46.3	0.0	0.0	0.0	17.4	0.0	0.0	0.0	298.0	18.9	46.3	322.0
Jan	14.4	35.3	0.0	0.0	0.0	1.5	0.0	0.0	0.0	298.0	14.4	35.3	357.3
Feb	12.8	31.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	298.0	12.8	31.4	388.7
Mar	17.2	42.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	298.0	17.2	42.1	430.8
Annual	429.7	1052.8	571.8	80.6	197.5	295.1	173.2	424.4	298.0	N/A	175.9	430.9	N/A

assumptions: 1) begin to build stockpile in April

2) no change in groundwater storage

3) Yellowknife PET = Yellowknife lake evaporation

4) AET = PET X [(Mean Annual Precipitation at Lupin Mine 1982-96) - MAPR)/Total PET)]

5) MAPR (Mean Annual Potential Runoff) = Mean Annual Runoff at Goose Lake X (Stockpile Area/Goose Lake Watershed Area)

6) stockpile area is 35 m X 70 m, and pond area is 5 m X 50 m

7) Lupin maximum precipitation = (Maximum Annual/Mean Annual) X Mean Monthly

8) MPR_{max} (Maximum Monthly Potential Runoff) = MPR X (Lupin Max Annual Precipitation/Lupin Mean Annual Precipitation)