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Peer Review Report

Osisko Canadian Malartic Project

Golder Report – Evaluation du Débit d'Exhaure et des Impacts Potentiels sur des Niveaux des Eaux Souterraines. Osisko Exploration Malartic Malartic, Québec

December 2008

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December 23, 2009

Attn: Paul Johnson, Ing.

Re: — Peer Review – Golder Report
Evaluation de Débit d'Exhaure et des Impacts Potentiels
Sur les Niveaux des Eaux Souterraines, Osisko Exploration Malartic,
Malartic, Québec

Dear Mr. Johnson,

1.0 Introduction

Further to your request I have reviewed the above report and herewith submit my review.

Osisko is planning to develop an open pit gold mine near Malartic, Quebec where 4 underground mines – Canadian Malartic, East Malartic, Sladen and Barnat, had operated periodically between 1935 and 2003.

The underground stopes and drifts are largely filled with water at the present time. It is proposed to maintain the underground water about 50 metres below the bottom of the open pit mine during mining. Some water from the underground mine is required to meet water requirements for the mill.

Osisko retained Golder associates to evaluate the impact the subterranean water will have on the proposed open pit mine program.

2.0 Project Objectives

— Define the area in the sector potentially affected by the dewatering operations of the Osisko project in regards to the users of underground water.

— Evaluate the actual use of underground waters.

— Define the hydraulic properties of the various hydrostratigraphic units (till, clay, sand, porphyry, greywacke) and the seepage conditions of the subterranean water in the rock.

— Characterize the underground water quality in the East Malartic pumping well (shaft).

— Evaluate the water balance of the projected open pit mine and evaluate the supplementary drainage capacity obtainable through the old underground mines.

— Evaluate the extent of the regional drawdown cone in the aquifer of the rock following mining operations in the open pit and the dewatering of the old underground mines.

— Evaluate the variations in the subterranean water level in the aquifer located in the loose deposits following the dewatering operations of the mine and pumping in the old underground mine.

— Identify potential problems associated with the project, such as the lowering of the wells of the Town of Malartic and/or domestic wells, settlement of fine soil and stability of support pillars modeled in the drawdown zone.

— **Note** – No mention has been made of mine closure and long-term potential of developing the open pit as a lake.

3.0 Methodology

Identify the hydrogeological process by numerical modelling to specify the drainage capacity and the effect of the open pit on the underground water resource.

Develop a model involving the open pit and underground mining to evaluate flow capacity and impact on the water resources, town and mining facilities.

4.0 Review of Existing Information

There is considerable existing information and data. It includes the following:

— Information concerning users of the water;

— Hundreds of mineralization and condemnation boreholes;

— Geology of superficial soils and bedrock;

— Topographic mapping;

— Hydraulic parameters;

— Hydrogeological conditions;

— Meteorology;

— Management of water in the underground mines.

5.0 Investigations – Testing Programs

The following investigation and testing programs were performed:

— Orientation of rock core in 5 boreholes;

— Performance of water packer permeability tests in 4 boreholes;

— Drilling of 43 boreholes in overburden including 9 observation holes;

— Installation of 30 piezometers plus 16 data loggers to measure water levels in the boreholes in soil and bedrock;

— Hydraulic conductivity tests were performed in many boreholes. The hydraulic conductivity in the good rock is very low;

— Installation of 2 pumps in the East Malartic Mine Shaft;

— Soundings were taken in 30 observation holes and 3 mine shafts to assess recharge. The effect of pumping was assessed in March and May 2008.

Hydraulic permeability tests (k) were performed in mine tailings. 'k' was calculated as 7.4×10^{-6} m/sec (7.4×10^{-4} cm/sec). This is typical of a silty soil.

6.0 Analysis of Subterranean Water

Tests were performed on the water in the East Malartic Mine shaft for metals, hydrocarbons, ammonium nitrate, cyanide, total alkalinity, suspended solids and hardness. Test results are provided in Annex D of the Golder Report.

Water chemistry is not discussed as it is not a personal specialty of mine. However, water from all 4 mine shafts should be tested as well as from the

Malartic water supply and all domestic wells in the area. A plan showing all domestic wells in use should be developed.

7.0 Evaluation of Recharge

Evaluation of the water balance is influenced by precipitation, evaporation, temperature, soil type, topography, use of the soil and vegetation. The Soil Conservation Service of Quebec has developed a manual to evaluate run-off recharge by hydrologic response and potential infiltration. Infiltration is calculated as follows:

$I = P - R_d - ET - S$

Where I = infiltration (mm)
P = precipitation (mm)
R_d = direct run-off (mm) Transports du Québec
ET = evapotranspiration (mm)
S = storage (mm)

Precipitation is based on the Val d'Or weather station. Soil types were determined by air photo interpretation.

It is recommended that a weather station be established at the mine near Malartic.

8.0 Numerical Modelling

Numerical modelling was used to quantify the drawdown in the rock and in the overburden produced by pumping before and during mining. It was used to evaluate the drainage volumes produced during mining the open pit and through the old mines. This allows quantification of infiltration in the open pit as well as the pumping rates from the underground. It allows estimates of the water levels in the esker supplying Malartic, in superficial rock where domestic wells are installed and the possibility of wells in the glacio-lacustrine soils.

The model uses Feflow – Finite Element Subsurface Flow System. The area covers about 225 Km^2. The three-dimensional model Gocad was also used. The model considers the underground openings of the 4 old mines. This was calibrated using actual pumping rates and water levels by trial and error, modifying the hydraulic parameters, storage and recharge.

Following calibration, predictive simulations were made for various stages of mining and pumping from the mine in 2013, 2018 and 2025. The pumping commences in 2010 at mine startup.

9.0 Region under Study

The region covers about 225 Km^2 extending north to Lake Malartic and south to Lake Fournière and approximately 8 Km west and east of Malartic.

The region is reasonably level, about 325m above sea level. It is partially wooded with spruce, larch and birch.

Water for the Town of Malartic is obtained from three wells about 4 Km NW at an average rate of 1700 m^3 per day. Well PP-6 produces 80% of the water and PP4 and PP5 each 10%. They are located on eskers. Some domestic wells, which are not detailed also apparently, exist.

All domestic wells that exist within the area that could be impacted by the proposed open pit should be documented.

10.0 Overburden Geology

A layer of till generally covers the bedrock south of Malartic. Elsewhere glacio-fluvial deposits are common. Eskers containing sand and gravel up to 30m high exist. Glacio-lacustrine, silt and clay occur at the lower elevations. Some peat deposits exist at the lowest levels.

11.0 Rock Geology

Several major faults exist in the region. They include the Cadillac, Raymond and Sladen faults. Common rock types include grano-diorite, schist, and greywacke overlying volcanic rocks. The gold is generally found in a diorite porphyry. The Golder report adequately describes the overburden and bedrock geology.

12.0 Groundwater

A piezometric map of water levels has been developed. Generally the subterranean flow is south to north. Considerable water level data is available around the underground mines. The water table generally is confined between 301m and 334m regionally and 300m – 305m around the old mines.

The potential to further develop water for Malartic from the esker near well PP6 is presently under study.

13.0 Water Flow in the Old Mines

The water level around the old mines is about 303m. Golder suggests there may be a survey error in some of the elevations. This should be checked. Lac Minerals (1984) gives hydraulic connections between mines.

- Canadian Malartic is connected to the Sladen Mine by a drain at 625' (190m);

— La Mine Sladen is connected to La Mine Barnat by a gallery at 725' (221m);

— La Mine Barnat is connected to the East Malartic Mine by a gallery at 1250' (381m).

Golder surmise that pumping from 190m or above will provide water from all old mines. Note that this is not deep enough to mine in the deeper open pit.

Golder have estimated the total mining voids for the four underground mines to be 36,330,000 tonnes or 14,532.000 m^3. To estimate the volume of water in the mines (to el. 303m) they assumed the water volume based on a rock density of 2500 Kg/m^3. The volume of rockfall has not been considered in the calculation.

Note that no information is included in the Golder report on the condition of the potential pumping shafts for pumping access and location.

14.0 Control of Water by Pumping

Osisko developed an initial pump in a shaft in the East Malartic mine in 2006. It pumped 180m^3 /hr from April to December. Towards mid-April a second pump was installed also pumping 180m^3/hour for one and one half months. The drop in water elevation was only 4 – 5 metres. The elevation of the pump is not stated.

Golder made an evaluation of recharge to help refine the model. This was based on precipitation at the Val d'Or meteorological station.

There is a rise in water-table during snow-melt and in April.

15.0 Hydrostratigraphic Parameters

Six hydrographic units are identified:

— Glacio-lacustrine

— Esker

— Glacial till

— Mine tailings

— Shallow rock

— Deeper rock

Conductivity tests were interpreted by the Brouwer-Rice and Hvorslev methods. The latter is considered to be more accurate.
Golder Table 7 (included on page 7a) summarizes the results.
Figures 14 and 15 of the Golder Report provide geologic cross-sections.

16.0 Underground Water Quality

Samples of water were collected in April and July 2008 from the East Malartic shaft. Test results are given in Golder Table 8 (included on page 7b).

Note the major differences in iron (Fe) and pH.

Samples from the other shafts should also be tested. Also samples from the Malartic town wells and domestic wells should be tested for water quality periodically.

17.0 Numerical Model

The numerical model used to develop groundwater simulations is Feflow (Finite Element Subsurface Flow System). It is described on the internet site WASY GmbH (www.wasy.de) The initial simulation was developed prior to the open pit for 1979 for various stages of mining. All simulations were developed using the hypothesis of equivalent porous medium in order to discretize the rock aquifer.

The model includes overburden and rock and covers an area of 225 Km^2 . It comprises 13 separate layers. Malartic Lake and Fournier Lake were selected as limiting locations and elevations.

In order to calibrate the model with pumping, a pumping well was incorporated in the model in the centre of the chambers of the East Malartic mine near the mine shaft location. Pumping rates for one pump were set at $180m^3$/hr. for one pump and $360m^3$/hr for two pumps.

Calibration of infiltration rates was also developed. The model was calibrated by trial and error using limits similar to the 1979 observations. Table 9 of the Golder report (included on page 7c) presents hydraulic properties of the hydrostratigraphic units for three calibrations — 1979, 2006-07 and the permanent regime.

Golder established a three-dimensional grid comprising nodes and triangular elements. Hydraulic conductivity values were assigned all materials. The

Tableau 7
Sommaire des différentes propriétés hydrauliques compilées et mesurées sur le terrain

Unité stratigraphique	Conductivité hydraulique (m/s)	Type d'essai	Source
Dépôts glaciolacustres	2×10^{-8}	Pompage courte durée (purge de puits d'observation)	Étude Rang 7, Génivar, 2008, préliminaire
	Minimum : 2×10^{-9} Maximum : 2×10^{-7} Moyenne : 7×10^{-8}	Essai perméabilité	Compilation de résultats d'essais perméabilité réalisés dans des argiles varvées d'Abitibi dans le cadre de projets Golder
Esker	1×10^{-3}	Essai de pompage longue durée	Étude hydrogéologique, GCE Consulteaux, 2006
Till	Minimum : 2×10^{-7} Maximum : 1×10^{-6} Moyenne : 6×10^{-7}	Pompage courte durée (purge de puits d'observation)	Étude rang 7 Génivar, 2008 - préliminaire
Roc	Minimum : 5×10^{-9} Maximum : 6×10^{-6} Moyenne : 2×10^{-6}	Pompage courte durée (purge de puits d'observation)	Étude Rang 7, Génivar, 2008, préliminaire
Roc (0-100m)	4×10^{-7}	Simple et double obturateur	Essais hydraulique en forage, Golder 2008
Roc (100m et +)	7×10^{-9}	Simple et double obturateur	Essais hydraulique en forage, Golder 2008
Résidus miniers	7×10^{-6}	Essai perméabilité	Golder, 2008

Tableau 8

Résultats analytiques pour les échantillons prélevés au puits de la mine Est Malartic

Paramètres	Unités	Dates d'échantillonnage	
		Avril 2008	Juillet 2008
Hydrocarbures pétroliers C_{10}-C_{50}	µg/L	<100	<100
Mercure (Hg)	µg/L	<0,1	<0,1
Aluminium (Al)	µg/L	<30	<30
Calcium (Ca)	µg/L	180000	190000
Antimoine (Sb)	µg/L	12	<6
Magnésium (Mg)	µg/L	58000	61000
Argent (Ag)	µg/L	<0,3	<0,3
Arsenic (As)	µg/L	<2	<2
Baryum (Ba)	µg/L	41	51
Cadmium (Cd)	µg/L	<1	<1
Chrome (Cr)	µg/L	<30	<30
Cobalt (Co)	µg/L	<30	<30
Cuivre (cu)	µg/L	3	<3
Plomb (Pb)	µg/L	<1	<1
Manganèse (Mn)	µg/L	1700	2000
Molybdène (Mo)	µg/L	<30	<30
Nickel (Ni)	µg/L	21	35
Sélénium (Se)	µg/L	<1	<1
Sodium (Na)	µg/L	23000	33000
Zinc (Zn)	µg/L	35	<3
Bore (B)	µg/L	66	94
Fer (Fe)	µg/L	<100	1000
Potassium (K)	µg/L	29000	35000
Azote ammoniacal (N-NH3)	mg/L	0,36	0,51
Conductivité	mmhos/cm	1,4	1,5
Cyanures libres (CN-)	mg/L	<0,01	<0,01
Cyanures totaux	mg/L	<0,01	<0.01
pH	pH	6,8	9,3
Alcalinité Totale (en CaCO3)	mg/L	260	260
Bicarbonates	mg/L	260	260
Carbonate	mg/L	<2	<2
Chlorures (Cl)	mg/L	24	27
Nitrate (N) et Nitrite (N)	mg/L	<0.02	<0.02
Sulfates (SO4)	mg/L	420	440
Matières en suspension (MES)	mg/L	5	6
Dureté totale	mg/L	700	730

Il est à noter que les résultats obtenus pour le fer, en particulier pour l'échantillon d'avril 2008, pourraient sous-estimer les concentrations réellement présentes. Ceci pourrait avoir été causé par la filtration de l'échantillon au laboratoire plutôt que sur le terrain.

Tableau 9

Sommaire des propriétés hydrauliques des unités hydrostratigraphiques assignées pour la calibration du modèle numérique d'écoulement

	Conductivité hydraulique assignée au modèle (m/s)	Anisotropie verticale	Emmagasinement spécifique (1/m)	Porosité de drainage
Calibration 1 – régime permanent – conditions initiales				
Roc (0-50m)	$9x10^{-6}$	10	$1x10^{-5}$	0,01
Roc (50-100m)	$5x10^{-7}$	10	$1x10^{-5}$	0,01
Roc (100m et +)	$5x10^{-8}$	10	$1x10^{-5}$	0,01
Chantiers des anciennes mines souterraines	1 m/s	1	$1x10^{-7}$	-
Galeries des anciennes mines souterraines (aire équivalente à 10 m²)	1 m/s	-	$1x10^{-7}$	0,80
Till	$1x10^{-7}$	10	$1x10^{-5}$	0,10
Résidus miniers (conductivité assignée similaire à celle du till puisque repose sur till et/ou argile)	$1x10^{-7}$	10	$1x10^{-5}$	0,10
Esker	$1x10^{-3}$	10	$1x10^{-4}$	0,30
Dépôts glaciolacustres	$1x10^{-8}$	10	$1x10^{-5}$	0,10
Calibration 2 – pompage 2006-2007				
Roc (0-50m)	$2x10^{-5}$	10	$1x10^{-5}$	0,01
Roc (50-100m)	$5x10^{-7}$	10	$1x10^{-5}$	0,01
Roc (100-300m)	$5x10^{-8}$	10	$1x10^{-5}$	0,01
Roc (300m et +)	$5x10^{-8}$	10	$1x10^{-5}$	0,01
Till	$1x10^{-7}$	10	$1x10^{-5}$	0,10
Résidus miniers (conductivité assignée similaire à celle du till puisque repose sur till et/ou argile)	$1x10^{-7}$	10	$1x10^{-5}$	0,10
Esker	$1x10^{-3}$	10	$1x10^{-4}$	0,30
Dépôts glaciolacustres	$1x10^{-8}$	10	$1x10^{-5}$	0,10
Calibration 3 – débit d'exhaure des mines souterraines en 1979				
Roc (0-50m)	$3x10^{-6}$	10	$1x10^{-5}$	0,01
Roc (50-100m)	$1x10^{-7}$	10	$1x10^{-5}$	0,01
Roc (100-300m)	$1x10^{-8}$	10	$1x10^{-5}$	0,01
Roc (300m et +)	$1x10^{-9}$	10	$1x10^{-5}$	0,01
Till	$1x10^{-7}$	10	$1x10^{-5}$	0,10
Résidus miniers (conductivité assignée similaire à celle du till puisque repose sur till et/ou argile)	$1x10^{-7}$	10	$1x10^{-5}$	0,10
Esker	$1x10^{-3}$	10	$1x10^{-4}$	0,30
Dépôts glaciolacustres	$1x10^{-8}$	10	$1x10^{-5}$	0,10

distribution of the various mine openings was developed from old mine plans. Many are connected hydraulically. Golder state some plans of the mine openings appear incomplete as some levels appear not to match.

18.0 Calibration

The model was first calibrated for the permanent regime. Specific storage, hydraulic conductivity and recharge values were adjusted to develop the simulation.

The pumping rate for one pump in the East Malartic shaft was set at 180m^3/hr. and 360m^3/hr. for 2 pumps. Figure 20 of the Golder report (included on page 8a) shows a graph of observed and simulated drawdowns for the period April 2006 to December 2007. The simulation overestimated the rate of drawdown but was reasonable approximation of the pumping rate for one pump only.

At the closure of the East Malartic mine the rate of drainage was 4900m^3/day. A rate of drainage of 5500m^3/day was obtained from simulations representing the group of four chambers for 1979 conditions.

19.0 Predictive Simulations

The dewatering simulations of the proposed pit and underground openings in the Osisko projects sought to —

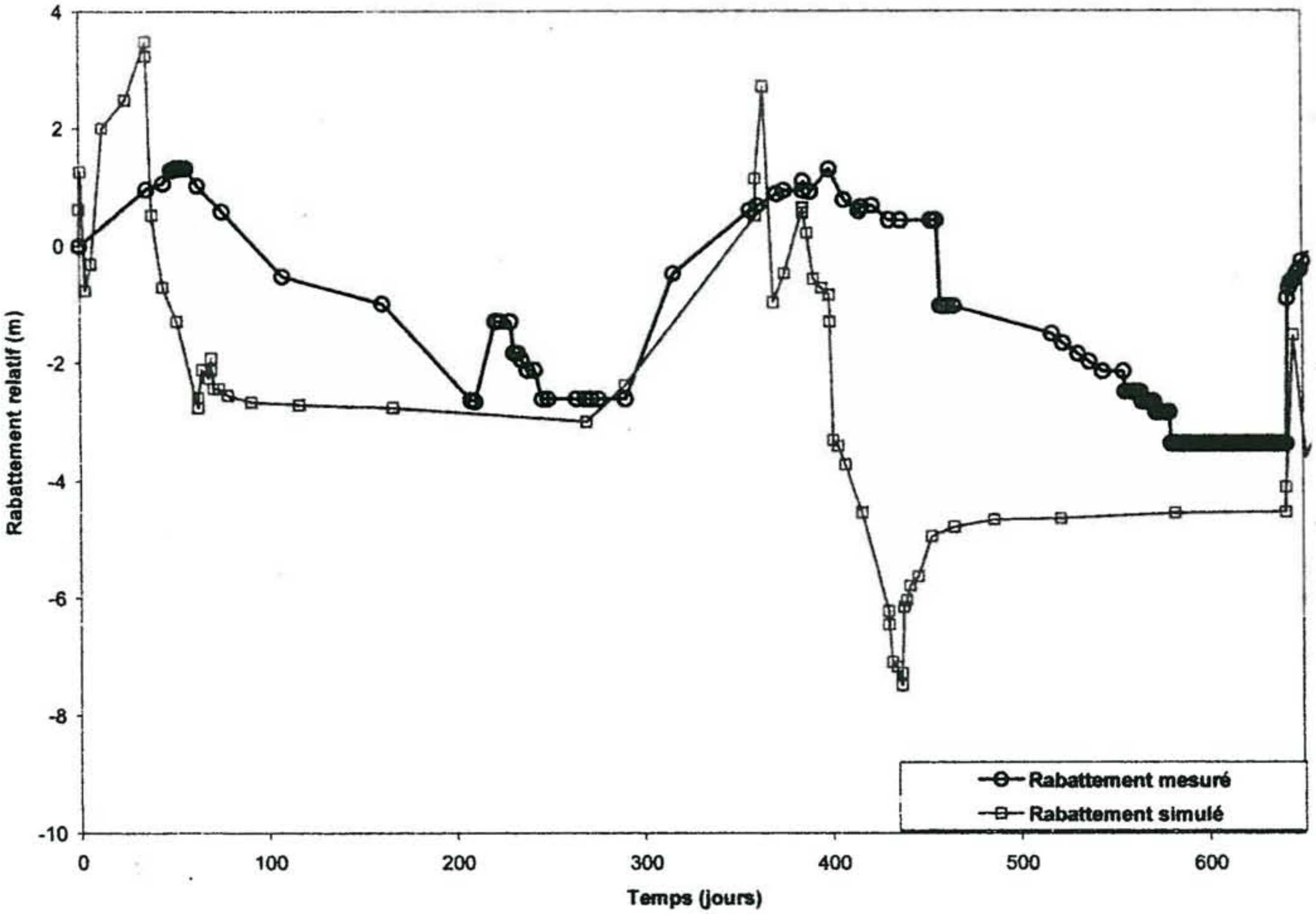
- Evaluate the drainage rate at different periods of mine operation;
- Evaluate the size and extent of the drawdown in the rock and overburden;

The simulations were initially conducted taking into account the hydraulic parameters calibrated for the simulated piezometric conditions. The hydraulic properties obtained from calibration in the permanent regime with the intent of simulating the drainage rates in 1979, were retained as a basis for the predictive simulations.

A variant, including a higher hydraulic conductivity, was simulated to evaluate a range of results corresponding to a sensitivity analysis of the model.

The dewatering of the mine was simulated according to the proposed Osisko mining sequence within the pit.

It is important to note that several hypotheses and simplifications were used. Therefore, the following sections must be considered as a tool in planning and managing the underground water program.



- 4 avril 2006: départ pompe no.1 et no.2 (jour 36)
- 1[er] mai 2006: arrêt pompe no.2 (jour 63)
- 14 décembre 2006: arrêt pompe no.1 (jour 290)
- 19 mars 2007: départ pompe no.1 (jour 385)
- 2 avril 2007: départ pompe no.2 (jour 399)
- 10 mai 2007: arrêt pompe no.2 (jour 437)
- 30 novembre 2007: arrêt pompe no.1 (jour 641)

CONFIDENTIEL

Golder Associés

CLIENT: OSISKO			PROJET: EVALUATION DU DÉBIT D'EXHAURE ET DES IMPACTS POTENTIELS SUR LES NIVEAUX DES EAUX SOUTERRAINES, OSISKO EXPLORATION, MALARTIC, QUÉBEC, CANADA	
DESSINÉ PAR: A.B..	DATE: 25 juin 2008		TITRE: Graphique du rabattement simulé et observé au puits de la mine Est Malartic – 2006-2007	
VÉRIFIÉ PAR: N.D.	DATE: 25 juin 2008			
ECHELLE: Not to scale		A4	PROJET No: 07-1221-0028	FIGURE No: 20

20.0 Simulation Scenarios

The calibration of the model must consider pumping in the East Malartic shaft in 2006 and 2007, and the dewatering of the underground mine in 1979.

Two sets of hydraulic parameters were identified for the predictive simulations of drainage flow rates and the impact of the drawdown in that area of the open pit.

The underground mines were assigned the equivalent volume of their opening but limited to runoff exiting the model.

The open pit was simulated by means of limit conditions as an exit flux from the model. These conditions were set up around the proposed open pit for 3 scenarios — year 3, year 8 and year 15 of the operation.

Two pumping scenarios of underground openings were used:

Scenario A — to maintain the water level 50 metres below the base of the pit.

Scenario B — Complete dewatering of the underground over the 15-year life of the pit.

21.0 Results of the Predictive Simulations

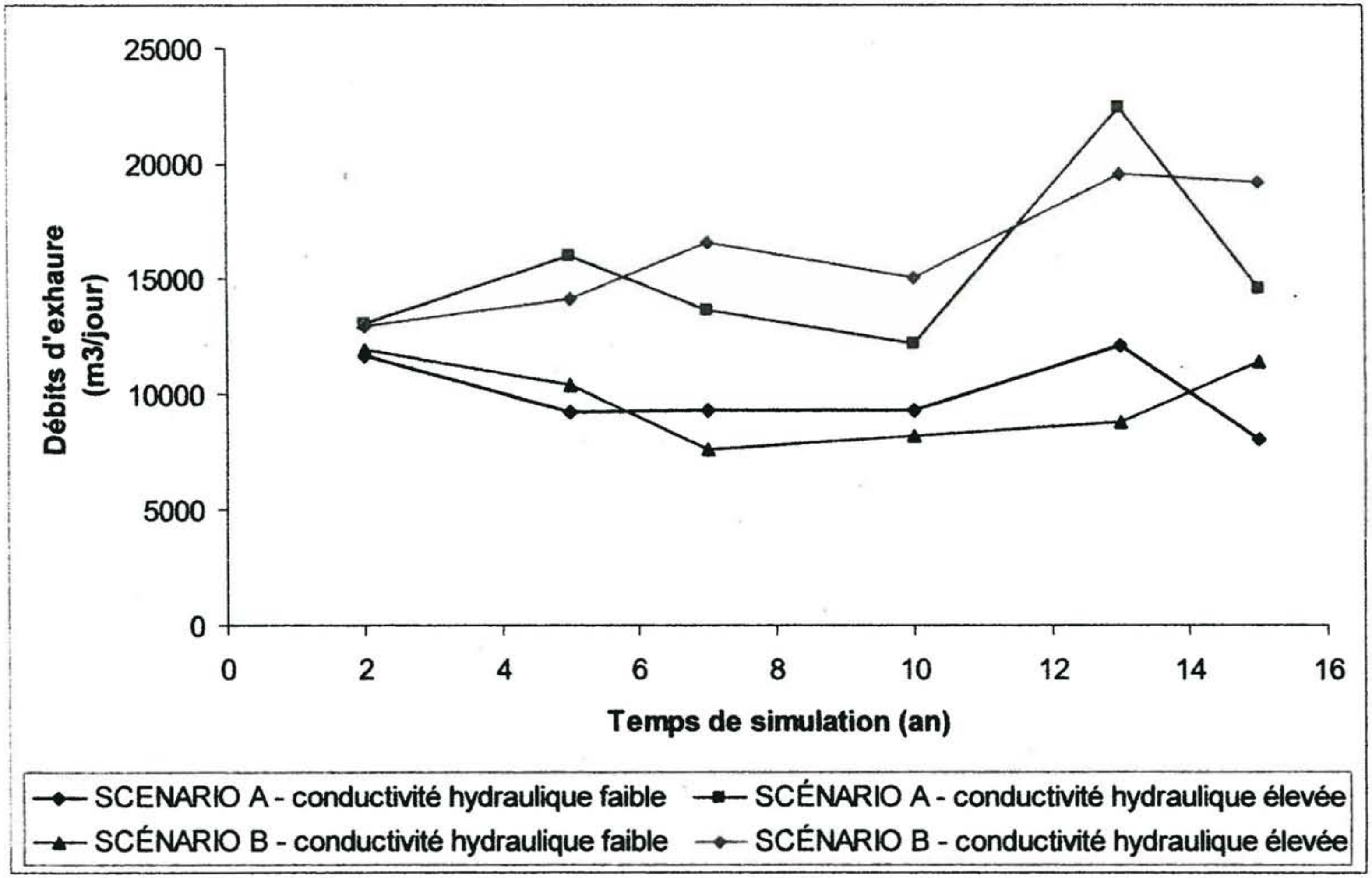
21.1 Drainage Rate

Table 13 (Golder – included on page 9) and Figure 21 (Golder – included on page 9a) show the estimated drainage rate values for the simulation. The total rate includes infiltration into the pit and underground and dewatering of the underground. It does not include runoff, direct precipitation and evaporation. The minimum rate simulated is 7,300m^3/day and the maximum is 22,500m^3/day.

Tableau 13

Débits d'exhaures estimés selon les différents scénarios de simulations prédictives

Scénarios simulés	Période (an) / Débits estimés (m^3/j)					
	2	5	7	10	13	15
Scénario A faible perméabilité	11 600	9300	9300	9400	12 100	8100
Scénario A forte perméabilité	13 000	16 000	13 600	12 200	22 500	14 600
Scénario B faible perméabilité	12 000	10 400	7700	8200	8800	11 400
Scénario B forte perméabilité	13 000	14 200	16 600	15 100	19 600	19 200



CONFIDENTIEL

Golder Associés	CLIENT: OSISKO		PROJET: ÉVALUATION DU DÉBIT D'EXHAURE ET DES IMPACTS POTENTIELS SUR LES NIVEAUX DES EAUX SOUTERRAINES, OSISKO EXPLORATION, MALARTIC, QUÉBEC, CANADA
	DESSINÉ PAR: A.B..	DATE: 25 juin 2008	TITRE: **Graphique des valeurs de débits d'exhaure estimés selon les différents scénarios de simulations prédictive**
	VÉRIFIÉ PAR: N.D.	DATE: 25 juin 2008	
	ÉCHELLE: Not to scale	A4	PROJET No: 07-1221-0028 — FIGURE No: 21

9a

21.2 Drawdowns

Figures 22 – 29 of the Golder report show the drawdown after 10 and 15 years of operation of the proposed open pit mine according to Scenarios A and B and for the two sets of hydraulic parameters.

The significant drawdown was set at 3 metres. This is shown as well as a drawdown of 10 metres or more – the most critical zone.

The drawdown maps indicate that potential significant drawdown extends to considerable distances to the south and lesser distances to the north. The maps also indicate that certain wells of the SIH are located in the interior of potential significant drawdown zones all around the proposed pit.

The existing wells of the town of Malartic are very close to or in the interior of potential significant drawdown. Finally, the town of Malartic is included in the drawdown zone of more than 10 metres. This zone includes areas of overburden soils characterized by fine soils or by the pressure on surface mine supports.

Reduced moisture content in the fine soils will likely be associated with settlement of the ground surface and its ramifications.

22.0 Conclusions and Recommendations — Golder Report

22.1 Conclusions

The principal hypotheses of the numerical modelling were intended to conservatively establish available drainage capacities, water balance and the extent of the potential drawdown cone in the study area.

Various scenarios were simulated in order to study the extent and sensitivity of the model under different hydraulic parameters and to identify conservative results.

Conclusions from observations and measurement of hydrogeological conditions and the results of the predictive numerical simulations are as follows:

- The hydraulic conductivity of the bedrock diminishes with depth;
- The piezometric data suggests that the underground mines are interconnected in their upper portions;

— The archival plans of Canadian Malartic, Sladen, Barnat and East Malartic mines indicate an interconnection to a depth of about 300 metres;

— Differences in the water levels in the East Malartic, Sladen and Barnat shafts suggest that the elevations in some reference points are erroneous. They should be resurveyed using the same reference system.

— Various tests indicate a range of hydraulic conductivity for the surface rock (0-100m) of $2x10^{-5}$m/sec to $3x10^{-6}$m/sec. This may be partly influenced by collapse of upper pillars;

— The simulated drainage capacities coming from the dewatering of the underground mines and the proposed open pit are estimated to be between 7700 and 22,500m^3/day. The maximum flows are less probable. For analysis and design purposes the values judged to be plausible are 7700 – 10,000m^3/day;

— The potential significant drawdown zone (>3m) extends to a distance of 5Km to the south and 3Km to the north of the open pit. In both cases the town of Malartic will be affected;

— The investigation reveals the capacity of the wells for the town of Malartic in the eskers to the north will experience reduced volume during low water periods of late summer and winter;

— The fine soils (clays) in the area of the town will consolidate due to drawdown. The amount will vary with the thickness of the clay;

— Golder state the rapid drainage of the rock could cause instability in certain surface pillars in the area of substantial drawdown. Note that the strength of rock generally increases as the moisture content reduces. Stability would then be increased. However, if there were weak fault zones with clay infill the shrinkage of the clay could reduce stability of the pillars.

— For some simulation scenarios the size of the drawdown zone could increase to the west. A sensitivity analysis could assess this potential.

22.2 General Recommendations

— A contingency plan relative to the water supply for the town of Malartic should be developed. This could include:

a) An artificial recharge project in the esker from surface water;

b) Maintain the dike of the reserve lake in order to maintain a reserve of water close to the town;

c) Develop water supply from rain water courses in the region;

d) Develop additional wells in the esker area;

— Develop a program of monitoring water levels in the eskers near the existing wells;

— The domestic wells are in a significant drawdown zone. A contingency plan to develop deep domestic wells or supply water by trucking could be considered;

— Develop an inventory of domestic wells, supplementary to the SIH data and Genvar in the near future;

— Develop a program of monitoring wells in the potential major drawdown areas to follow the development of drawdown and compare it to Golder estimates;

— Inventory the areas showing significant thickness of sensitive clay in the major drawdown zones in relation to existing structures;

— Inventory areas of shallow pillars and evaluate potential instability;

— Carry out a techno-feasibility study for deep pumpage from the underground mine areas;

— Develop and update the water balance of the site on an ongoing basis;

— Continue to monitor flow in all relevant water courses, particularly during low-flow periods.

23.0 <u>Limitations (Golder Report)</u>

This report is for the exclusive use of Osisko or its agents. It is site specific.

This report was formulated based on an interpretation of site conditions and the foreseen future use of the site, rules and environmental criteria and accepted professional practice of the present time.

There may be unforeseeable conditions that differ from those presently interpreted. If future information develops which could change present interpretations Golder Associates should be advised.

Engineering models are subject to the accuracy of the input information. If future information varies from that based in the model the model must be revisited. The conclusions based on the model are useful to compare different scenarios.
The volume of water in the mines depends on the geometry of the openings. Volumes are estimated based on historic information and plans. The volumes could be less if the openings are partially plugged and do not permit water to drain from certain openings. The volume of water recoverable is dependent on the interconnection of the mine openings and locations of the pumps.

24.0 Conclusions and Recommendations – (C.O. Brawner)

This groundwater, water supply and water balance report has developed comments and recommendations based on complex site conditions which required the use of detailed modelling and many assumptions.

Because of this complexity it will be essential for Osisko to develop a major program of field monitoring to update the water balance conditions preferably on a monthly basis. Should unexpected or unfavourable anomalies develop it will be desirable to have early warning so that corrective measures can be developed as soon as possible.

Typical monitoring programs to include are:

- Development of a program to monitor groundwater levels
    a) Within the town of Malartic
    b) Near all Malartic water wells and domestic wells
    c) Within the area where drawdown will exceed 3 metres and specifically where the drawdown is estimated to exceed 10 metres
- Development of a grid system of settlement hubs. These hubs should be seated below the depth of frost penetration so that frost heave does not influence measurements
- Development of water monitoring stations on all significant creeks and rivers. Develop alarm levels for flood flow and low flow
- Update the water balance frequently
- Develop vibration and air pressure monitors at appropriate locations in and around the town to control potential blasting damage

The report by Golder Associates is comprehensive and addresses the Terms of Reference outlined by Osisko. Simulations and assumptions are extensive. These are well defined and, in my opinion, reasonable. A field monitoring program by Osisko is essential to test the simulations.

The Golder report meets the required Engineering Standard of Practice.

Typical additional details to include in the monitoring are listed below.

- Ground settlements in the town of Malartic may be differential depending on the thickness of clay. Establish permanent elevation survey hubs with the base below the depth of frost. Check sewer elevations to assess continued gravity flow. Some sewer lines may settle more than others, even to the point of flowing in the opposite direction;

- As the pit deepens monitor the potential for floor heave;

- Inspect and maintain shaft walls and assess conditions to maintain pumps;

- Periodically test water chemistry in wells and water sources;

- Monitor water levels in shafts, wells and drill-holes to update the drawdown cone;

- Maintain a plan of <u>all</u> domestic wells in the drawdown zone;

- Monitor all blasts from the open pit for peak particle velocity (ppv) and air blast pressure;

- Establish a local weather station;

- Monitor water levels and water chemistry in all shafts and wells;

- Locate and record details of all significant seepage from the open pit walls. In winter monitor ice glaciation;

- Check elevations of wells, shafts, settlement hubs etc. Use the same reference system.

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