Appendix J

Correspondence with the Ministry of the Environment

CAMBIUM ENVIRONMENTAL

Address:
P.O. Box 325
Unit 2, 2085 Whittington Dr.
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K9J 6X4

Telephone:
(705) 742.7900
(866) 217.7900

Facsimile:
(705) 742.7907

www.cambium-env.com

May 17, 2007

Ontario Ministry of the Environment
2430 Don Reid Drive
Ottawa, Ontario
K1H 1E1

Attn: Mr. Marc-Etienne LeSieur
Senior Environmental Officer

Re: Recognition of Approved Site Capacity
Ruby Road Waste Disposal Site, Township of Bonnechere Valley, Renfrew County
Cambium Ref. No. 07-1219-001

Dear Mr. LeSieur:

As you may be aware, the Township of Bonnechere Valley (Township) initiated an individual Environmental Assessment (EA) to develop a long-term Waste Management Strategic Plan (WMSP) to manage waste generated within the Municipality over a 25-year planning period, to the year 2032. Cambium Environmental Inc. (Cambium) has been retained by the Township to assist in the development of this WMSP. The Township formally commenced the EA process in December 2006 and held a preliminary Public Consultation Event on January 27th in Eganville, Ontario. A Terms of Reference document was also prepared, but has not yet been submitted to the Ministry of the Environment (MOE) for formal approval.

Recently, Ontario Regulation 101/07 came into effect under the Environmental Assessment Act (EAA), which outlines the environmental screening process for waste projects. The Township is reviewing the implications of this new regulation with respect to the options for long term management of waste. It is the Township's understanding that this regulation is directed partially at small, rural waste disposal sites and select waste projects are deemed exempt from Part II of the EAA if the environmental screening process is completed.

In order to determine applicability of Ontario Regulation 101/07 it is necessary to know the approved capacity of the select waste disposal site(s). When considering the Township's waste disposal sites, the Ruby Road waste disposal site has been identified as a waste disposal site of interest. However, the theoretical maximum available capacity (TMAC) for the site cannot be explicitly determined from the Provisional Certificate of Approval. A site capacity study was completed for the site by the Greer Galloway Group Inc., dated July 21, 1999 (attached). This capacity study was cited in the "Ruby Road Waste Disposal Site, Site Closure and Waste Transfer Facility Operations Plan" prepared by Jp2g Consultants, dated August 2002. The capacity study had indicated that the TMAC for the site is 47,650 m^3.

However, it is noted that if the Township wishes to recognize the complete TMAC at the Ruby Road waste disposal site, additional lands would be required to provide sufficient buffer (30 metres) around the waste disposal area.

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May 17, 2007

The Township is requesting confirmation from the MOE that the approved capacity for the Ruby Road waste disposal site is 47,650 m^3 as stated in the 1999 site capacity study, provided that the Township owns the necessary lands for buffer. Upon confirmation of the approved capacity, the Township is also seeking confirmation that the site capacity could be expanded by no more than 100,000 m^3 without being subject to Part II of the EAA as per Section 13 of Ontario Regulation 101/07 when adhering to the environmental screening process.

If you have any questions regarding this submission, please do not hesitate to contact Mr. Bryan Martin at the Township of Bonnechere Valley at (613) 628-3101 extension 222 or the undersigned at (705) 742-7900 extension 202. We look forward to your response.

Best regards,

Cambium Environmental Inc.

John Desbiens, P.Eng.
President

JPD/cmw

Attachments
Copies: *Mr. Bryan Martin, Township of Bonnechere Valley*
Mr. Paul Heeney, MOE EAAB Project Coordination Section

Z:\Projects\1200 to 1399\07-1219-001 - TBV Environmental Screening\Correspondence\2007-05-17 Ltr to MOE - Ruby Road.doc

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October 31, 2007

Ontario Ministry of the Environment
Environmental Assessment and Approvals Branch
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

Attn: Ms. Agatha Garcia-Wright
Director (Acting)

Re: Application for Amendment to Provisional Certificate of Approval A411501
Ruby Road Waste Disposal Site, Township of Bonnechere Valley
Cambium Ref No. 07-1219-001

Dear Ms. Garcia-Wright:

On behalf of the Township of Bonnechere Valley (Township), Cambium Environmental Inc. (Cambium) is pleased to provide an application for an amendment to Provisional Certificate of Approval (PC of A) A411501 for the Ruby Road waste disposal site. The application fee in the amount of $100 made payable to the Minister of Finance is also enclosed. A copy of the application (exclusive of fee) was sent to the MOE Ottawa District Office. Cambium did conduct a pre-consultation with the Ministry of the Environment regarding this matter and has prepared this correspondence accordingly.

Background

The Ruby Road waste disposal site is located at 2213 Ruby Road, on Part Lot 27, Concession 9, in the geographic Township of South Algona, in the amalgamated Township of Bonnechere Valley, in the County of Renfrew. The site is accessed by Ruby Road approximately 10 kilometres east of the Village of Killaloe.

The site consists of an approved fill area of 0.5 hectares and as of December 31, 2003, is currently closed to landfilling operations. The site currently operates as a waste transfer station.

Approved Capacity

Based on a review of the PC of A for the site (A411501; November 5, 2003), it has been noted that no explicit approved capacity is referenced in the PC of A. However, item 2 referenced in Schedule A of the PC of A is the report entitled *Ruby Road Waste Disposal Site, Site Closure and Waste Transfer Facility Operations Plan* (Jp2g Consultants Inc., August 2002). The Jp2g report cites a capacity study for the site dated July 21, 1999 by the Greer Galloway Group Inc. (GGG, July 1999) and has been attached for reference. The information and data from the 1999 capacity study report was used in the preparation of the 2002 site closure documentation.

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October 31, 2007

The 1999 capacity study calculated a theoretical maximum approved capacity (TMAC) of 47,650 cubic metres (m^3).

The Township is initiating the Environmental Screening Process (ESP) for the expansion of the Ruby Road waste disposal site as per Ontario Regulation 101/07 under the Environmental Assessment Act. However, in order to conduct the ESP for the Ruby Road waste disposal site capacity expansion, it is necessary to establish the TMAC value. Therefore, Cambium respectfully requests that the Ministry of the Environment include the TMAC of 47,650 m^3 in the PC of A for the site as determined in the 1999 capacity study.

The addition of the TMAC in the PC of A represents an administrative change necessary to allow the Township to conduct the ESP as described above. The Ruby Road wasted disposal site will remain closed to landfilling, and the Township will not emplace any additional waste at the Ruby Road waste disposal site unless future approvals are granted following the successful ESP and Environmental Protection Act requirements have been completed. Should the ESP be successful, the Township will apply to the Ministry of the Environment for a comprehensive Certificate of Approval for the Ruby Road waste disposal site.

Cambium thanks you in advance for your attention to this matter. If you have any questions regarding this submission, please contact Mr. Bryan Martin at the Township of Bonnechere Valley at (613) 628-3101 extension 222 or the undersigned at (705) 742-7900 extension 202.

Best regards,

Cambium Environmental Inc.

John Desbiens, P.Eng.
President

JPD/cmt

Encl.
Copies: *Mr. Marc-Etienne LeSieur, MOE Ottawa District Office*
Mr. Bryan Martin, Township of Bonnechere Valley

Z:\Projects\1200 to 1399\07-1219-001 - TBV Environmental Screening\Correspondence\2007-10-31 LTR Ruby Road WDS PCofA Amend to Include TMAC.docx

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November 15, 2007

Ontario Ministry of the Environment
Environmental Assessment and Approvals Branch
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

Attn: Ms. Agatha Garcia-Wright
Director (Acting)

Re: Application for Amendment to Provisional Certificate of Approval A411501
Ruby Road Waste Disposal Site, Township of Bonnechere Valley
MOE Ref No. 3653-78KJX4
Cambium Ref No. 07-1219-001

Dear Ms. Garcia-Wright:

Further to the application submitted dated October 31, 2007, Cambium Environmental Inc. (Cambium) is pleased to provide the following items to accompany the application:

- Site Capacity Study, Ruby Road Landfill (The Greer Galloway Group Inc., July 21, 1999).
- Site Closure and Waste Transfer Facility Operations Plan, Ruby Road Waste Disposal Site (Jp2g Consultants Inc., August 2002).

A complete copy of the application and supporting documentation has been sent to the MOE Ottawa District Office.

If you have any questions regarding this submission, please contact Mr. Bryan Martin at the Township of Bonnechere Valley at (613) 628-3101 extension 222 or the undersigned at (705) 742-7900 extension 202.

Best regards,

Cambium Environmental Inc.

John Desbiens, P.Eng.
President

JPD/cmt

Encl.
Copies: Mr. Bryan Martin, Township of Bonnechere Valley

Z:\Projects\1200 to 1399\07-1219-001 - TBV Environmental Screening\Correspondence\2007-11-15 LTR Ruby Road WDS PCofA Amend - Attachments.docx

FAX

Cambium Environmental Inc.
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Peterborough, Ontario, K9J 6X4
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To: Mr. Nafiseh Pourhassani, P.Eng.
MOE Environmental Assessment and Approvals Branch

Fax: (416) 314-8452

From: Christine Teixeira

Date: December 21, 2007

Copies:

Total pgs: 3 (including this sheet)

Re: **Addition of Explicit Approved Capacity**
Ruby Road Waste Disposal Site
MOE Reference No. 3653-78KJX4
Cambium Reference No. 07-1219-001

Hi Mr. Pourhassani:

In response to your correspondence dated December 6, 2007 regarding the amendment to the Ruby Road Waste Disposal Site Certificate of Approval (MOE Reference No. 3653-78KJX4) to include an explicit approved capacity value, please find attached a letter from the original author of the 1999 Greer Galloway Group Site Capacity Study, Mr. Kevin Mooder currently of Jp2g Consultants Inc.

As indicated in the attached correspondence, the site was a former gravel pit which had subsequently received waste while operating using the trench method and modified area method. It was assumed that a 3 to 4 metre trench depth had occurred (as limited by the excavation equipment) and a 3 to 4 metre lift was being developed to match the original ground elevation of the site, for a total depth of waste of approximately 7.0 metres.

Regards,

Ontario

Ministry of the Environment | Ministère de l'Environnement

AMENDMENT TO PROVISIONAL CERTIFICATE OF APPROVAL
WASTE DISPOSAL SITE
NUMBER A411501
Notice No. 3
Issue Date: January 17, 2008

The Corporation of the Township of Bonnechere Valley
49 Bonnechere St E
Post Office Box, No. 100
Eganville, Ontario, K0J 1T0

Site Location: Ruby Road Waste Transfer Site
Lot 27, Concession 9, South Algona Twp.
Bonnechere Valley Municipality, County of Renfrew

You are hereby notified that I have amended Provisional Certificate of Approval No. A411501 issued on September 16, 1974, and amended on December 18, 2002 and November 5, 2003 for a 0.5 hectare waste disposal site (landfill and transfer station) , as follows:

In accordance with Application for a Provisional Certificate of Approval for a Waste Disposal Site, dated October 31, 2007, and the following supporting documentation:

1. Letters dated November 15, 2007 and October 31, 2007 from Cambium Environmental
2. Letter dated July 21, 1999, from The Greer Galloway Group Inc. RE: Ruby Road Landfill Site Capacity Study
3. Letter dated December 18, 2007 from Jp2g Consultants Inc to the Township of Bonnechere Valley, Regarding explanation of depth used for capacity calculation

the following condition is added to the Certificate:

37. a) The maximum theoretical approved capacity of the Site using the 1993 Ministry Landfill Capacity Determination protocol, is calculated to be 47,650 cubic meters which includes daily cover, interim cover and waste.

b) The landfill site shall not be re-opned to utilize the remaining capacity unless the Corporation of the Township of Bonnechere Valley submites to the ministry a complete application and supporting documentation for the Director's approval.

The reason for this amendment to the Certificate of Approval is as follows:

1. The reason for this amendment is to include the maximum theoretical capacity for this site as a condition.

This Notice shall constitute part of the approval issued under Provisional Certificate of Approval No. A411501 dated September 16, 1974 and subsequent amendments.

In accordance with Section 139 of the Environmental Protection Act, R.S.O. 1990, Chapter E-19, as amended, you may by written notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 142 of the Environmental Protection Act, provides that the Notice requiring the hearing shall state:

1. The portions of the approval or each term or condition in the approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The Certificate of Approval number;
6. The date of the Certificate of Approval;
7. The name of the Director;
8. The municipality within which the waste disposal site is located;

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*
Environmental Review Tribunal
2300 Yonge St., Suite 1700
P.O. Box 2382
Toronto, Ontario
M4P 1E4

AND

The Director
Section 39, *Environmental Protection Act*
Ministry of the Environment
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

* **Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 314-4600, Fax: (416) 314-4506 or www.ert.gov.on.ca**

The above noted waste disposal site is approved under Section 39 of the Environmental Protection Act.

DATED AT TORONTO this 17th day of January, 2008

THIS NOTICE WAS MAILED
ON Jan. 18, 2008
N.P
(Signed)

Tesfaye Gebrezghi, P.Eng.
Director
Section 39, *Environmental Protection Act*

NP/
c: District Manager, MOE Ottawa
John Desbiens, Cambium Environmental Inc. ✓

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January 6, 2008

Ontario Ministry of the Environment, Kingston Regional Office
Box 22032
1259 Gardiners Road
Kingston, Ontario, K7M 8S5

Attn: Alida Mitton
Environmental Planner

Re: Request for Comments from the MOE Regarding Efforts to Date
Township of Bonnechere Valley Environmental Screening Process
Cambium Reference: 07-1219-001

Dear Ms. Mitton,

As you are aware, the Township of Bonnechere Valley (Township) is engaged in an Environmental Screening Process (ESP) to determine the feasibility of a capacity expansion at the Ruby Road Waste Disposal Site (the Site) as a long-term (25-year) solution that will best meet the needs of the municipality with respect to the management of municipal solid waste generated within its boundaries. Cambium Environmental Inc. (Cambium) has been retained by the Township to assist in the ESP in accordance with the Ontario Regulation 101/07 under the Environmental Assessment Act (EAA)).

The environmental effects have been studied extensively and have incorporated the following investigations:

- Initial Environmental Impact Study
- Supplementary Environmental Impact Studies
- Stage I and II Archaeological Assessment
- Traffic Impact Study
- Hydrogeological Assessment
- Aesthetics Study
- Noise Impact Assessment

A precautionary approach was utilized with appropriate safety factors incorporated into each of the studies. In doing so, Cambium is confident that reasonable and cautious scenarios were considered when assessing the potential effects that would result in an expansion of the Site. In summary, the work conducted resulted in a determination of the Site being a feasible option to provide for additional waste disposal capacity within the Township of Bonnechere Valley.

A Conceptual Design and Operations plan has been developed and it is proposed to expand the existing Site up to 100,000 m^3 over 25 years to accept non-hazardous solid waste only. This will require 2.5 ha of waste disposal area within a 6.8 ha buffered operational area on a 32.8 ha property. Waste will continue to be accepted at the current transfer station (waste receiving area)

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and transferred to the active face by municipal staff for disposal. Mitigation measures have been developed to control biological factors such as bears, potential surface water and groundwater impacts, litter, and the admission of acceptable wastes.

A Public Liaison Committee consisting of two members of Council, one member of Township staff, and eight members of the public was formed to act on behalf of public interest and regular meetings were held to facilitate communication with the public.

The Township hosted a total of three (3) Public Consultation Events throughout the ESP process and received public feedback during the process. Presentations, flyers, handouts, questionnaires, and question and comment periods supplied the interested public with informative details pertaining to the project and provided the Township feedback about the concerns of the nearby residents. Interested parties, including the Ministry of Aboriginal Affairs and the Department of Indian and Northern Affairs have also been included in correspondence in reference to the project and have been informed about specific details throughout the duration of the project.

Information regarding the Township of Bonnechere Valley ESP is available on the Township's web site: http://www.bonnecherevalleytwp.com/environment/environmental.html. Cambium can be reached by phone, toll-free at 1 (866) 217-7900, by fax at (705) 742-7907, or by email at info@cambium-env.com.

Cambium is currently preparing the ESP report in draft for review by the Township and when the necessary revisions have been made, the report will be posted for review by the public and interested parties for a period of 60 days.

The Township encourages the Ministry of the Environment to provide comments and guidance with respect to the above mentioned processes that have occurred and whether any further information is required in order to finalize the Environmental Screening Process.

On behalf of the Township, thank you for your time and assistance to ensure that all the necessary details are provided to complete this project.

Best regards,

Cambium Environmental Inc.

John Desbiens, P.Eng.
Senior Project Manager

JPD/slb

Copies: Mr. Bryan Martin, CAO, Township of Bonnechere Valley

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Mitton, Alida (ENE)

From: Tony Pearson [tony.pearson@sympatico.ca]
Sent: June 18, 2009 9:57 AM
To: Mitton, Alida (ENE)
Subject: Continuing hydro-geologic concerns about proposed Ruby landfill

Attachments: dump watershed.pdf; Map 1.pdf

dump atershed.pdf (903 K

Map 1.pdf (488 KB)

After your conversation with him, John Coe asked me to summarize our continuing concerns about the hydro-geology associated with the proposed new landfill site on Ruby Road in Bonnechere Valley Township, in light of the environmental screening review now coming to a conclusion. Our main concerns:

1. Although the latest Cambium hydro-geologic study states that there is no possibility of any of the leachate plume leaving the boundaries of the dumpsite, we note that this appears to contradict a previous Cambium report. In its 2007 annual monitoring report on the closed dump right beside the proposed new landfill area, Cambium stated that a leachate plume continues to be generated beneath the waste mound, although it has been closed for over half a decade - and more important, that the groundwater flow under the old dump "was interpreted to be to the north-east, with a component flowing to the north in the overburden" - i.e., toward streams that lead into Golden Lake.

2. Although we were originally told that there was no serious aquifer under the area of the proposed dump, we are now informed that there is a very large aquifer - but that it is so slow-moving as to create no danger of any material falling down into it ever going anywhere.

3. We believe there is reason to question this alleged non-movement of the aquifer, given the presence of several ponds 'downhill' from the proposed dump - ponds which remain full on a year-round basis (and in a couple of cases, not even freezing over during the winter). This strongly suggests that they are fed from the aquifer under the proposed landfill. I attach John's map of these ponds, which also shows their relationship to streams which ultimately flow into Golden Lake.

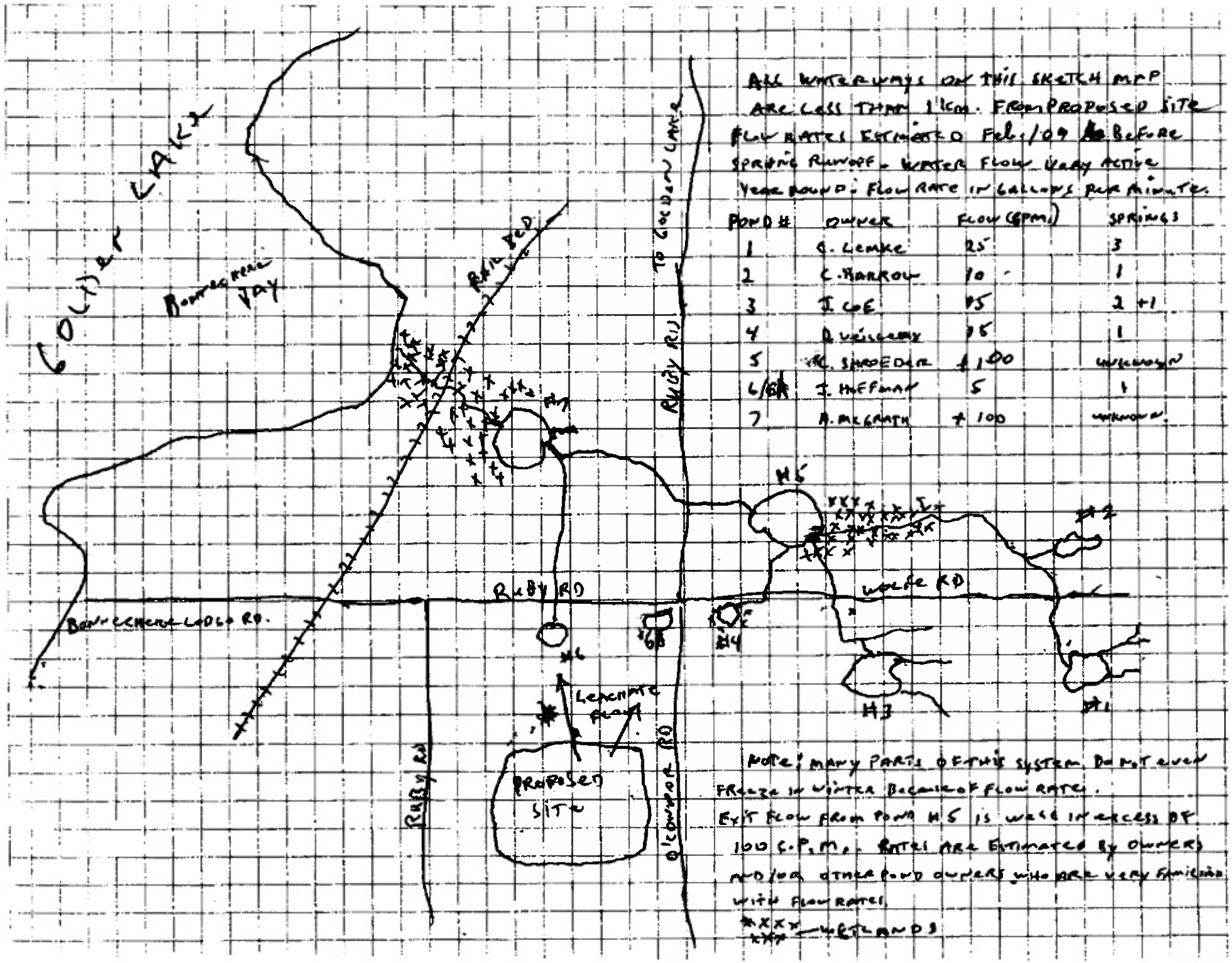
4. I attach another map, showing the acknowledged watershed connections in the area of the dump. You will note the connection to John's map of the ponds - the ponds ultimately connect to the known streams which flow into Golden Lake.

5. Of course, if the aquifer in fact doesn't move, then all may be well. However, we note that in their hydro-geologic study for the environmental screening report, Cambium drilled only three new test wells. They used these, together with the four

wells which monitor the closed dump (which had previously indicated a leachate plume flowing to the north-east), to arrive at their finding that the aquifer was for all intents and purposes immobile. We wonder if this represents enough wells to make such a finding.

6. We could note that there is extensive spring surface run-off down the hill on which the new landfill would be dug. Run-off also occurs after heavy rainfall. This run-off connects to a stream which flows into Golden Lake. However, measures can certainly be taken to contain run-off. (It should be noted though that the 2007 Cambium monitoring report on the closed Ruby dump stated that attenuation of the leachate plume "varies both seasonally and annually as a result of varying precipitation amounts", indicating some rainfall impact on groundwater as well as surface water).

Thank you for your attention and consideration.



ALL WATERWAYS ON THIS SKETCH MAP ARE LESS THAN 1 KM. FROM PROPOSED SITE

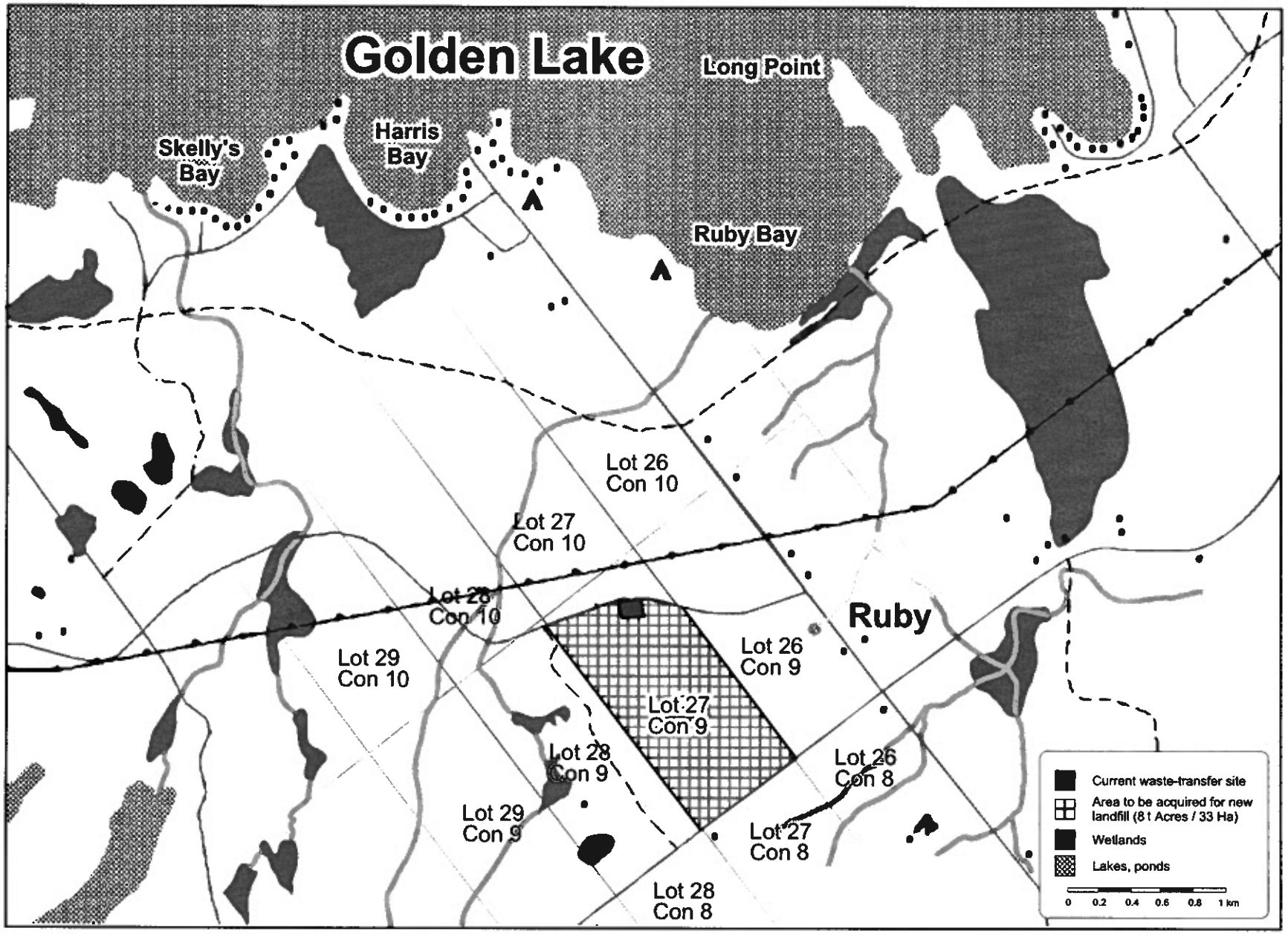
FLOW RATES ESTIMATED FEB./09 BEFORE SPRING RUNOFF. WATER FLOW VERY ACTIVE YEAR ROUND. FLOW RATE IN GALLONS PER MINUTE.

POND #	OWNER	FLOW (GPM)	SPRINGS
1	G. LEMKE	25	3
2	C. HARROW	10	1
3	T. COE	15	2 +1
4	D. VEILLEUX	15	1
5	RC. SHREDER	+100	UNKNOWN
6/6A	J. MCFINNY	5	1
7	A. MCGRATH	+100	UNKNOWN

NOTE: MANY PARTS OF THIS SYSTEM DO NOT EVER FREEZE IN WINTER BECAUSE OF FLOW RATES.

EXIT FLOW FROM POND H5 IS WELL IN EXCESS OF 100 G.P.M.. RATES ARE ESTIMATED BY OWNERS AND/OR OTHER POND OWNERS WHO ARE VERY FAMILIAR WITH FLOW RATES.

XXXX ← WETLANDS


Golden Lake
Long Point
Skelly's Bay
Harris Bay
Ruby Bay
Lot 26 Con 10
Lot 27 Con 10
Lot 28 Con 10
Lot 29 Con 10
Ruby
Lot 26 Con 9
Lot 27 Con 9
Lot 28 Con 9
Lot 29 Con 9
Lot 26 Con 8
Lot 27 Con 8
Lot 28 Con 8
Current waste-transfer site
Area to be acquired for new landfill (8 t Acres / 33 Ha)
Wetlands
Lakes, ponds
0 0.2 0.4 0.6 0.8 1 km

Ministry of the Environment

P.O. Box 22032
Kingston, Ontario
K7M 8S5
613/549-4000 or 1-800/267-0974
Fax: 613/548-6908

Ministère de l'Environnement

C.P. 22032
Kingston (Ontario)
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613/549-4000 ou 1-800/267-0974
Fax: 613/548-6908

Ontario

M E M O R A N D U M

June 29, 2009

TO: Marc-Etienne Lesieur
Senior Environmental Officer
Ottawa District Office
Eastern Region

FROM: Shawn Kinney
Hydrogeologist
Water Resources Unit
Technical Support Section
Eastern Region

RE: Ruby Road Waste Disposal Site A411501
Lot 27, Concession 9, Geographic Township of South Algona
2006 and 2008 Annual Monitoring Report and Groundwater Modelling Report

---

I have reviewed the hydrogeologic aspects of the following documents entitled:

- *"Numerical Hydrogeological Modeling Report for Expansion Feasibility of the Ruby Road Waste Disposal Site"* Cambium Environmental Inc., January 15, 2009

- *"2008 Annual Report, Ruby Road Waste Disposal Site"* Cambium Environmental Inc., March 26, 2009

- Logs of boreholes MW4-08, MW5-08 & MW6-08 provided in electronic form by Cambium Environmental Inc. June 4, 2009.

Additionally, I toured the site on 3 June 2009. I submit the following comments for your consideration.

Summary

1. I cannot confirm that the provided numerical model emulates existing site conditions well enough to serve as a predictive tool at this time. I have identified a number of factors with this memo which, in combination, may account for substantial differences observed between simulated and actual site conditions.

2. The existing waste disposal site is closed. Guideline B-9 currently applies. The leachate plume from the existing fill area extends off-site, but there are no identified down-gradient receivers within 500 metres. The site owners should develop an action plan to ensure that off-site leachate migration will not interfere with potential future downgradient users of groundwater supplies.

3. The primary pathway for leachate migration at the existing site is downward through approximately 25 metres of unsaturated sand and gravel, then horizontally to the north-northeast via a relatively thin saturated zone overlying Precambrian bedrock.

4. Surface water receivers are located approximately 150 metres west of the proposed new fill area. I am unable to advise you about potential risks to shallow groundwater or surface water in the vicinity of the proposed fill area given the information provided.

5. The monitoring and reporting frequency at the existing site should be maintained. The proposed smaller list of analytical parameters is acceptable with the addition of hardness.

Certificate of Approval

The Ministry amended Certificate of Approval A411501 in November 2003. The Certificate closed the Ruby Road Waste Disposal Site to waste disposal effective December 31, 2003.

The site is licensed within part of Lot 27, Concession 9, South Algona Township. The site now operates as a 0.5 ha waste transfer facility. Former landfill activities were a combination of trench and area fill methods.

The site owners are assessing the feasibility of an area south of the existing site as a potential additional fill area.

Geology

Borehole information is available for three locations at the existing former waste disposal site. Additionally, three newer boreholes were constructed during May 2008 around the proposed new fill area. Figure A at the end of this memo depicts the location of these boreholes.

Overburden

Ontario Geological Survey Map P3125 depicts the site overburden unit as "g*ravel, gravely sand, sand, silt, minor clay and till"*. The borehole data suggest that overburden within the eastern half of the property is over 25 metres thick. Overburden within the western half of the property is approximately 10 metres thick.

Bedrock

Precambrian metamorphic rock underlies the overburden. Ontario Geological Survey Map 2459 (Pembroke) depicts at least two dissimilar types of bedrock beneath the site. Figure A, attached, includes the relevant section of this map. The companion OGS Map 2460 (Cobden) provides a detailed legend describing the bedrock underlying the site as follows:

- Unit 5a: *"Medium- to coarse-grained, gneissic arkose and subarkose"*
- Unit 10e: *"Medium- to coarse-grained gneissic, siliceous marble"*

Marble is a relatively well known carbonate rock type. To define the other geological terms, "arkose" is feldspar-rich metamorphic rock derived from sandstone. "Gneissic" denotes a banded texture imposed by metamorphic processes and "siliceous" means containing abundant silica.

Hydrogeologic Conditions

Hydraulic Conductivity

Section 5.2.1, page 4 of the numerical modelling report states that a hydraulic conductivity value of 0.001 $m^3/m^2/s$ was uniformly assumed for on-site overburden. The value is derived from published literature and is within the highest range of coarse sand. This value has not been validated by hydraulic testing.

The MW5-08 borehole log depicts this well's screen/sand pack as being completed approximately 75% in overburden and 25% in fractured bedrock. Although not ideal, information from this well is the closest analogue to overburden hydraulic conductivity testing that I currently possess. The tested hydraulic conductivity of monitor MW5-08 was 0.0000076 $m^3/m^2/s$. This is 130 times less than the above-noted overburden value selected from the literature.

In the absence of other validating test results, I do not assume that the literature-based 0.001 $m^3/m^2/s$ value represents the actual hydraulic conductivity of overburden at this site.

Table 2, page 4 of the numerical modelling report presents bedrock hydraulic conductivity test results from the bedrock monitoring wells MW4-08 and MW6-08. I note the following:

- MW4-08: 0.00000043 $m^3/m^2/s$. This is within the lower normal range for fractured metamorphic rock.
- MW6-08: 0.000012 $m^3/m^2/s$. This is 28 times more permeable than MW4-08.

The consultants applied an average hydraulic conductivity value of 0.0000067 $m^3/m^2/s$ to the entire bedrock aquifer. However, I cannot discount the possibility that arkose, marble and the boundary zones between them have dissimilar hydrogeologic properties. I question whether any uniform hydraulic conductivity value appropriately emulates the existing site conditions.

Hydraulic Gradient

Table 3, page 5 of the numerical modelling report indicates a water level decrease of almost 16 metres between monitor MW6-08 and MW5-08, located approximately 200 metres to the west. This infers a westward horizontal hydraulic gradient of approximately 0.075 m/m. Figure 5 of the numerical modelling report depicts a simulated westward hydraulic gradient of 0.05 m/m.

The simulated water level decrease is approximately 1.5 times less than what was actually observed at this location. The relationship between hydraulic gradient and groundwater flow velocity is linear. Consequently, groundwater flow and leachate migration velocities simulated by the numerical model could be 1.5 times less than actual flows at the site.

I propose possible causes of the discrepancy in the "Numerical Groundwater Modelling" section, below.

Background Water Quality

Section 4.1.2, page 5 of the 2008 monitoring report designates BH-2 as the background monitoring well. I concur with this assessment. Table 4 of the monitoring report provides historical water quality data for this well.

I examined the median water quality reported for the 5 most recent sampling events. Median background quality for reported parameters conformed to provincial drinking water criteria with the following exceptions:

- Manganese: 0.278 mg/l. This is 5.6 times greater than the 0.05 mg/l drinking water criterion.
- Iron: 0.79 mg/l. This is 2.6 times greater than the 0.3 mg/l drinking water criterion.
- Hardness: 223 mg/l. This is 2.2 times greater than the 100 mg/l drinking water criterion. .

Leachate Water Quality

Monitors BH-1 and BR-1 are located at the north eastern corner of the property boundary and former fill area. These monitors were most recently sampled during April and July of 2008. I have examined the analytical results for these sampling dates as presented in Table 4 of the 2008 monitoring report.

Concentrations of several parameters are elevated compared to upgradient groundwater. I note that the following parameters exceeded provincial drinking water criteria.

- Hardness: 610 mg/l to 625 mg/l. This is 2.7 times greater than the 223 mg/l median background value at monitor BH-2 and more than 6 times greater than the 100 mg/l drinking water criterion.
- Total Dissolved Solids: 814 mg/l. This is 1.6 times greater than the 500 mg/l drinking water criterion.

Section 4.1.3, page 6 of the 2008 monitoring report states that these are leachate effects.

Downgradient Water Quality

The Ruby Road facility does not have a downgradient monitoring network beyond monitors BH-1 and BR-1. I cannot advise you regarding downgradient groundwater quality. The most recent monitoring data suggest that leachate has migrated off-site. Full delineation of leachate impacts will require additional down-gradient monitoring wells.

GW / SW Interaction

Ontario Base Map 10 18 3150 50400 depicts a wetland located approximately 150 metres west and down-hill of the proposed new fill area. The wetland surface appears to be 4 to 6 metres lower than ground surface at the proposed new fill area and only 2 metres lower than the ground surface at monitoring well MW4-08.

Unless the above-noted wetlands are perched upon impermeable material, shallow groundwater almost certainly interacts with surface water near the proposed new fill area. The nearest monitor, MW4-08, is screened in bedrock 18 metres below ground surface and does not provide information on this matter.

I cannot advise you about shallow aquifer conditions in the vicinity of the proposed fill area with the information provided. The consultant should address this with a supplementary evaluation of overburden hydrogeology in the vicinity of the proposed waste footprint.

Guideline B-7

The existing site is closed to waste disposal. Guideline B-9 (Water Quality Interference) applies under the existing regulatory framework. The most recent monitoring data indicate that the leachate plume has migrated off-site. Some leachate related parameters exceed provincial drinking water criteria.

There do not appear to be any groundwater users within 500 metres down-gradient of the existing site at this time. The site owners should develop an action plan to ensure that the leachate plume will not interfere with potential future downgradient users of groundwater supplies.

Groundwater Monitoring Program and Reporting

The existing twice annual monitoring and reporting frequencies should be maintained until groundwater quality at the property boundary consistently conforms to the drinking water criteria or background levels.

Table 2 of the 2008 report summarizes the proposed analytical parameter list. The proposed list conforms to Column 2 (indicator parameters) of Schedule 5 of the 1998 Landfill Standards Guideline. The proposed list is acceptable provide that hardness is added. Hardness must be included, as it is one of the parameters identified in excess concentrations at the property boundary.

Numerical Groundwater Modelling

I cannot confirm that the model in its current form emulates existing site conditions well enough to serve as a predictive tool. I have identified a number of factors which, in combination, may account for substantial differences observed between simulated and actual site conditions. I note the following:

- The numerical simulation assumed that bedrock and its associated properties such as hydrogeologic conductivity are uniform throughout the model domain. Published geological maps do not support this assumption.

- The water levels assigned to the western boundary of the model domain (210 metres to 215 metres above sea level) appear to be 3 to 4 metres greater than corresponding land and surface water elevations depicted by the Ontario Base Map.

- The 160 metre fixed groundwater level assigned to the eastern boundary of the model domain appears to be unsupported by field data. The surface elevation of Golden Lake as depicted on the Ontario Base Map as 169 metres above sea level. Additionally, water well record #5505401 reports a static groundwater level on the order of 177 metres above sea level located approximately 700 metres east of the proposed fill area. The model-simulated water level at this location is approximately 7 metres lower than the measured water level.

- The high hydraulic conductivity value uniformly applied to the overburden at this site is based on values in published literature rather than site-specific information. To my

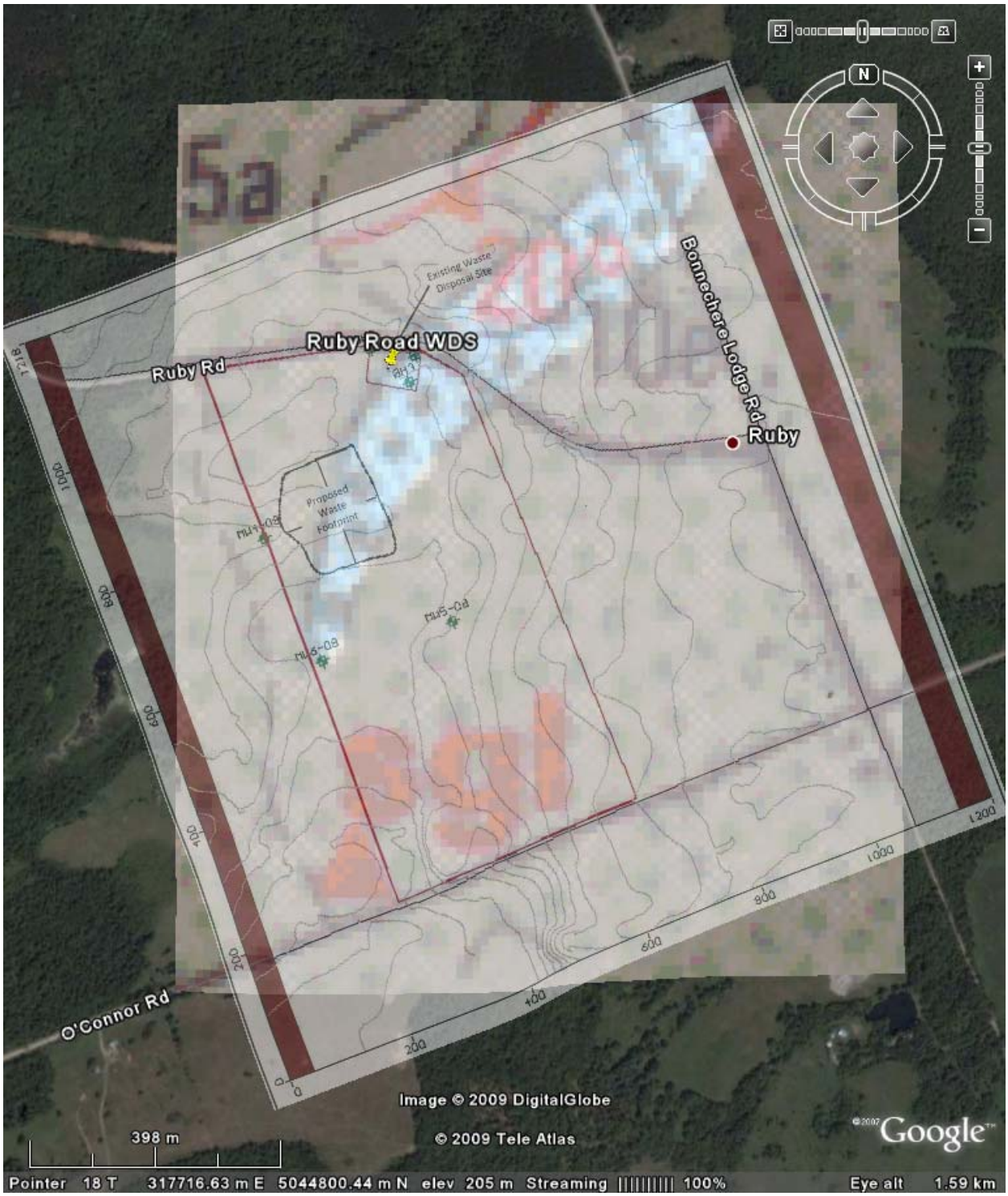
knowledge, the hydraulic conductivity of overburden materials in the vicinity of the proposed waste footprint has not been verified by testing. Considerable uncertainty exists regarding this parameter.

Shawn Kinney, P.Geo
SK/gl

c: Paul Kehoe (Ottawa District)
Peter Taylor (Water Resources Unit)
Laurel Grills (Surface Water)
GW 03-03 BOVA Ruby Road WDS A411501 Lot 27, Con 9 South Algona Twp
SK #8044-78QRVR, 8431-7E7NJH

Figure A: Existing Road Waste Disposal Area (indicated by pushpin). Excerpt of Ontario Geological Survey Map 2459 and the rotated Numerical Model domain are overlaid. Bedrock Unit 10e (light blue) = marble. Unit 5a (dark grey) = arkose.

Sources: Google Earth (2009), Ontario Geological Survey (1982), Cambium Environmental (2009)



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July 30, 2009

Ministry of the Environment
Water Resources Unit, Technical Support Section, Eastern Region
PO Box 22032
Kingston, Ontario, K7M 8S5

Attn: Mr. Shawn Kinney, P. Geo.
Hydrogeologist

Re: Groundwater Modelling Report Review - Ruby Road Waste Disposal Site A411501
Lot 27, Concession 9, Geographic Township of South AlgonaCambium Reference No. 1219-001

Dear Mr. Kinney,

Cambium Environmental Inc. (Cambium), on behalf of the Township of Bonnechere Valley (Township), has prepared the following response to your review of the *Numerical Hydrogeological Modelling Report for Expansion Feasibility of the Ruby Road Waste Disposal Site* (Cambium 2009) provided in correspondence dated June 29, 2009.

Cambium has reviewed the comments and recommendations provided in the correspondence and offers the following responses herein. Additional comments with respect to the review of the *2008 Annual Monitoring Report, Ruby Road Waste Disposal Site* (Cambium 2009) and operations of the existing closed waste disposal site will follow under a separate cover. For ease of reference, the original review comment or recommendation is provided in bold followed by the Cambium response.

HYDROGEOLOGIC CONDITIONS

HYDRAULIC CONDUCTIVITY

Section 5.2.1, page 4 of the numerical modelling report states that a hydraulic conductivity value of 0.001 $m^3/m^2/s$ was uniformly assumed for on-site overburden. The value is derived from published literature and is within the highest range of coarse sand. This value has not been validated by hydraulic testing.

The MW5-08 borehole log depicts this well's screen/sand pack as being completed approximately 75% in overburden and 25% in fractured bedrock. Although not ideal, information from this well is the closest analogue to overburden hydraulic conductivity testing that I currently possess. The tested hydraulic conductivity of monitor MW5-08 was 0.0000076 $m^3/m^2/s$. This is 130 times less than the above-noted overburden value selected from the literature.

In the absence of other validating test results, I do not assume that the literature-based 0.001 $m^3/m^2/s$ value represents the actual hydraulic conductivity of overburden at this site.

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July 30, 2009

As described in Section 6.2.1 (Constant Concentration), the contaminant transport model was used to simulate a constant concentration applied to the top of the water table. The water table elevation was determined to be in the bedrock or just above the bedrock, as recognized in the Summary section of your review comments, point number 3. Considering these factors, the hydraulic conductivity assigned to the overburden will not influence the outcome of the model.

In addition, although available geology maps indicate the site overburden unit is gravel, gravely sand, sand, silt, minor clay and till; the observations made by Cambium staff during drilling indicated that the overburden material at the site consists mainly of medium sand with some gravel and very few fines. This information was used when assigning the hydraulic conductivity of the overburden. The on-site tests conducted at the two (2) bedrock wells and one (1) overburden/bedrock interface well could not be used to determine the hydraulic conductivity of the sand and gravel material. Consequently, a conservative value of 0.001 $m^3/m^2/s$ was selected to ensure the model was precautionary.

In order to address the comments of the reviewer, consideration will be given to revising the overburden hydraulic conductivity value. The effect of a change to this value on the model outcome will be examined through sensitivity analysis. Should this analysis determine that the variation of this parameter is a significant aspect in the model, Cambium proposes to complete slug tests at the three (3) monitoring wells located at the existing closed waste disposal site in order to determine a representative overburden hydraulic conductivity value for the model.

Table 2, page 4 of the numerical modelling report presents bedrock hydraulic conductivity test results from the bedrock monitoring wells MW4-08 and MW6-08. I note the following:

- ***MW4-08: 0.00000043 $m^3/m^2/s$. This is within the lower normal range for fractured metamorphic rock.***
- ***MW6-08: 0.000012 $m^3/m^2/s$. This is 28 times more permeable than MW4-08.***

The consultants applied an average hydraulic conductivity value of 0.0000067 $m^3/m^2/s$ to the entire bedrock aquifer. However, I cannot discount the possibility that arkose, marble and the boundary zones between them have dissimilar hydrogeologic properties. I question whether any uniform hydraulic conductivity value appropriately emulates the existing site conditions.

It is likely that the bedrock is not uniform; however, the model bedrock hydraulic conductivity was assumed to be uniform to avoid the creation of an unnecessarily complicated model that would not be supported by the available information. Using the new four (4) well locations to delineate distinct bedrock units would be difficult to support with confidence. The risk associated with influencing the direction of groundwater flow in the model by applying more permeable areas of hydraulic conductivity in the bedrock such that the model becomes less representative was greater than if a uniform value were to be used. In the event the marble unit is not the width,

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direction or area as shown on the OGS map, the model will be in error and potentially significant error.

Consulting the on-site borehole logs, as well as seven (7) water well records from adjacent properties, five (5) of which are bedrock water wells, the bedrock encountered has consistently been granite, opposed to arkose or marble. Specifically, the three (3) wells drilled in 2008 in the vicinity of the proposed waste site were identified as granite on the borehole logs. In reviewing the pictures of the core samples (attached) it can be observed the bedrock is actually a granitic gneiss. There was a three (3) metre section of bedrock in monitoring well MW6-04 that was observed to be of a darker mineralization that also exhibited possible seems of a light green marble. This varying stratigraphy may be representative of the marble unit shown on the OGS Map.

Cambium has also consulted the OGS Earth software and obtained information regarding bedrock geology from this mapping based in Google Earth. This mapping (refer to attached Figure 1) indicated the entire site, existing and expansion areas, are of unit 51 which is described as the following:

TECTONITE UNIT

tectonites, straight gneisses, porphyroclastic gneisses, unsubdivided gneisses in major deformation zones, mylonites, protomylonites

PROTEROZOIC, NEO-TO MESOPROTEROZOIC (0.57 to 1.6 Ga), Grenville

The property immediately to the north of the site was identified as unit 41 which is described as the following:

MIGMATITIC ROCKS AND GNEISSES OF UNCERTAIN PROTOLITH

commonly layered biotite gneisses and migmatites; locally includes quartzofeldspathic gneisses, orthogneisses, paragneisses

PROTEROZOIC, NEO-TO MESOPROTEROZOIC (0.57 to 1.6 Ga), Grenville, Central Gneiss Belt

Lastly, the property to the west was identified as unit 54a which is described as the following:

OTTAWA GP.; SIMCOE GP.; SHADOW LAKE FM.

Limestone, dolostone, shale, arkose, sandstone

Ottawa Gp.; Simcoe Gp.; Shadow Lake Fm

PHANEROZOIC, PALEOZOIC, ORDOVICIA, MIDDLE ORDOVICIAN

These descriptions support the granitic gneiss observed in the three (3) boreholes drilled in 2008.

Regardless, in an effort to better represent site bedrock conditions which have not been clearly delineated with the current monitoring well network alone, two (2) hydraulic conductivities will be used when revising the model. The hydraulic conductivity observed at monitoring well MW4-08 will be assigned to the majority of the site, while the more permeable conductivity observed at monitoring well MW6-08 will be used for the marble unit indicated on OGS Map 2459. It is noted

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that the delineation of these two (2) areas may be adjusted through model development to better simulate the information provided in borehole logs and well records.

HYDRAULIC GRADIENT

Table 3, page 5 of the numerical modelling report indicates a water level decrease of almost 16 metres between monitor MW6-08 and MW5-08, located approximately 200 metres to the west. This infers a westward horizontal hydraulic gradient of approximately 0.075 m/m. Figure 5 of the numerical modelling report depicts a simulated westward hydraulic gradient of 0.05 m/m.

The simulated water level decrease is approximately 1.5 times less than what was actually observed at this location. The relationship between hydraulic gradient and groundwater flow velocity is linear. Consequently, groundwater flow and leachate migration velocities simulated by the numerical model could be 1.5 times less than actual flows at the site.

Acknowledged. This will be revised to reflect the field observed hydraulic gradient.

GW/SW INTERACTION

Ontario Base Map 10 18 3150 50400 depicts a wetland located approximately 150 metres west and down-hill of the proposed new fill area. The wetland surface appears to be 4 to 6 metres lower than ground surface at the proposed new fill area and only 2 metres lower than the ground surface at monitoring well MW4-08.

Unless the above-noted wetlands are perched upon impermeable material, shallow groundwater almost certainly interacts with surface water near the proposed new fill area. The nearest monitor, MW4-08, is screened in bedrock 18 metres below ground surface and does not provide information on this matter.

Please note, the bedrock observed at monitoring well MW4-08 is approximately 11.5 metres below grade opposed to the 18 metres indicated (see attached borehole log).

During the installation of monitoring well MW4-08 in May 2008, no overburden groundwater was encountered. This suggests that there is no overburden aquifer at this location. Following installation, the groundwater level has been observed to extend into the overburden, likely due to the pressure head of the competent bedrock found at this location; nonetheless, is observed to be approximately 9 metres below grade.

Furthermore, the wetland area shown on OBM 10 18 3150 50400 located approximately 150 metres west of the site has been observed to be ephemeral and often is not observed. The *Supplemental Studies for Natural Environment Features of Ruby Road Waste Disposal Site* (Snider's Ecological Services 2008) identified this ponded area as a shrub swamp that is intermittently wet. The surface elevation at monitoring well MW4-08 is approximately 209 metres

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above sea level (masl) and the elevation at the low lying area is approximately 207.5 masl. Based on these observations, it has been assumed this low lying area is perched and is not connected to the groundwater aquifer observed at monitoring well MW4-08 given that the groundwater aquifer is likely a minimum of five (5) to seven (7) metres below grade at the low lying area.

I cannot advise you about shallow aquifer conditions in the vicinity of the proposed fill area with the information provided. The consultant should address this with a supplementary evaluation of overburden hydrogeology in the vicinity of the proposed waste footprint.

A review of surrounding water well records and on-site borehole logs indicates the bedrock slopes in a northeast direction (see attached Figure 2). The following surrounding water well records were used to make this determination: 5514913, 5505401, 5508988, and 5505743. Water well records 5052514 and 5502513 were also consulted; however, they are constructed in the overburden.

Based on the fact that the water table is either strictly in the bedrock (monitors MW4-08, MW6-08) or a thin layer located on the bedrock surface (monitors MW5-08, BR-1), it is expected that any shallow overburden groundwater flow would follow the contours of the bedrock, which suggests the shallow overburden flow would travel to the northeast, similar to the groundwater aquifer currently mapped. The water well records were used to estimate the regional groundwater flow direction. This information confirmed the general regional groundwater flow direction to the northeast and is also included on Figure 2.

NUMERICAL GROUNDWATER MODELLING

I cannot confirm that the model in its current form emulates existing site conditions well enough to serve as a predictive tool. I have identified a number of factors which, in combination, may account for substantial differences observed between simulated and actual site conditions. I note the following:

- ***The numerical simulation assumed that bedrock and its associated properties such as hydrogeologic conductivity are uniform throughout the model domain. Published geological maps do not support this assumption.***

Addressed previously in this response.

- ***The water levels assigned to the western boundary of the model domain (210 metres to 215 metres above sea level) appear to be 3 to 4 metres greater than corresponding land and surface water elevations depicted by the Ontario Base Map.***
- ***The 160 metre fixed groundwater level assigned to the eastern boundary of the model domain appears to be unsupported by field data. The surface elevation of Golden Lake***

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as depicted on the Ontario Base Map as 169 metres above sea level. Additionally, water well record #5505401 reports a static groundwater level on the order of 177 metres above sea level located approximately 700 metres east of the proposed fill area. The model-simulated water level at this location is approximately 7 metres lower than the measured water level.

Acknowledged. These boundary conditions were assigned as the model was trying to best represent the local site conditions and areas immediately adjacent to the northeast of the site (downgradient). The model was calibrated using the four (4) on-site bedrock monitors and sufficient calibration was reached as discussed in Section 5.6 of the modelling report (Cambium 2009). The revised model will consider the regional groundwater flow conditions; therefore, these boundary conditions will be revised.

It is proposed a hypothetical flow model as defined by the *USGS Guidelines for Evaluating Ground-Water Flow Models* (Reilly and Harbaugh 2004) will be developed; meaning that the model will be designed to understand the basic operation of a regional groundwater system with limited available data and no calibration. Most model parameters will be sourced from literature and mapping; however, the site specific data, where available, will be used to determine which values will be used.

- ***The high hydraulic conductivity value uniformly applied to the overburden at this site is based on values in published literature rather than site-specific information. To my knowledge, the hydraulic conductivity of overburden materials in the vicinity of the proposed waste footprint has not been verified by testing. Considerable uncertainty exists regarding this parameter.***

Address previously in this response.

CLOSING

If you require further information or clarification, please contact the undersigned at 705-742-7900.

Best regards,

Cambium Environmental Inc.

Stephanie Reeder, A.Sc.T.
Project Specialist

John Desbiens, P.Eng.
President

JPD/snr
Encl: Bedrock Core Photographs, Borehole Logs, Figure 1 and Figure 2

\\srvsbs\data\Projects\1200 to 1299\07-1219-001 - TBV Environmental Screening\Correspondence\2009-07-21 LTR Ruby Road Response to TSS review of HydroGeo.docx

Photo 1 Monitoring Well MW4-06 Bedrock Core

Photo 2 Monitoring Well MW5-06 Bedrock Core

Photo 3 Monitoring Well MW6-08 Bedrock Core

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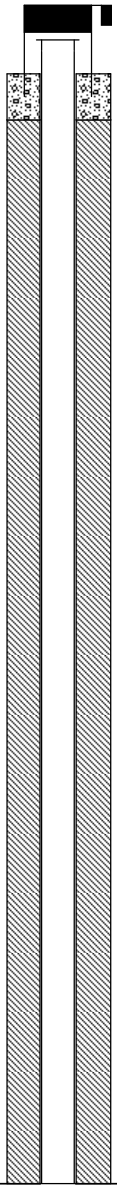
Log of Borehole: MW4-08

Project No.: 1219-001 ***UTM:*** 10 18 317340 5044902

Project Name: Ruby Road WDS Environmental Screening

Client: Township of Bonnechere Valley ***Logged By:*** S. Reeder

Location: West Property Line ***Project Manager:*** C. Teixeira

SUBSURFACE PROFILE			SAMPLE					
Depth (ft / m)	Symbol	Description	Number	Type	% Recovery	SPT (n)/RQD (%)	Well Installation	Remarks
-3 / -1		Ground Surface						Well instrumented with waterra, footvalve and lock.
1		***Silty Sand*** Red brown silty sand, dry	1	SS	-	-		Steel lockable casing, cemented
3		***Silty Sand*** Red brown silty sand, trace gravel, dry	2	SS	63	5		
5			3	SS	58	11		
7 / 2		***Silty Sand*** Brown silty sand, dry	4	SS	71	14		
9								
11			5	SS	54	11		
13 / 4		***Silty Sand*** Brown silty sand, occasional clay seam, dry	6	SS	67	9		
15			7	SS	46	14		
17		***Silty Sand*** Grey silty fine sand, dry						
19			8	SS	75	15		
21 / 6		***Sand and Gravel*** Coarse gravel (granite) and sand	9	SS	50	75		
23		***Sand and Gravel*** Inferred sand and gravel, some boulders (> 15 cm diameter)						Bentonite
25								
27 / 8								
29								
31								
33 / 10								
35								
37								
39 / 12		***Granite Bedrock*** Very fractured granite bedrock	10	HQ	100	94		
41								
43			11	HQ	100	72		
45 / 14								
47								

Drilled By: George Downing Estate Drilling ***Input By:*** SNR

Drill Method: Hollow Stem Auger/HQ Core ***Checked By:*** CMT

Drill Date: May 5, 2008 ***Sheet:*** 1 of 2

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Log of Borehole: MW4-08

Project No.: 1219-001 ***UTM:*** 10 18 317340 5044902

Project Name: Ruby Road WDS Environmental Screening

Client: Township of Bonnechere Valley ***Logged By:*** S. Reeder

Location: West Property Line ***Project Manager:*** C. Teixeira

SUBSURFACE PROFILE			SAMPLE					
Depth	Symbol	Description	Number	Type	% Recovery	SPT (n)/RQD (%)	Well Installation	Remarks
49 51 53 55 57 59 61 63 65 67 69 71 73 75 77 79 81 83 85 87 89 91 93 95 97 (16, 18, 20, 22, 24, 26, 28)		***Granite Bedrock*** Very competent granite bedrock. Vertical fracture from 15.0 to 15.5 metres. No fractures from 15.8 to 19.7 metres. Fractures at: - 19.7 metres - 21.3 metres - 21.6 metres - 22.4 metres - 22.6 metres	12	HQ	100	65		
			13	HQ	100	100		
			14	HQ	100	100		
			15	HQ	100	100		
			16	HQ	98	98		Silica Sand 0.038 m x 1.5 m screen
			17	HQ	100	97		
		End of Borehole						

Drilled By: George Downing Estate Drilling ***Input By:*** SNR

Drill Method: Hollow Stem Auger/HQ Core ***Checked By:*** CMT

Drill Date: May 5, 2008 ***Sheet:*** 2 of 2

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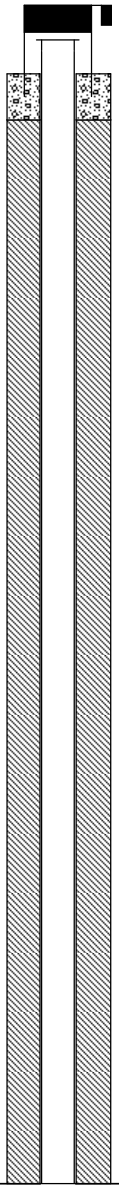
Log of Borehole: MW5-08

Project No.: 1219-001 ***UTM:*** 10 18 317638 5044766

Project Name: Ruby Road WDS Environmental Screening

Client: Township of Bonnechere Valley ***Logged By:*** S. Bachynski

Location: East Property Line ***Project Manager:*** C. Teixeira

SUBSURFACE PROFILE			SAMPLE					
Depth (ft / m)	Symbol	Description	Number	Type	% Recovery	SPT (n)/RQD (%)	Well Installation	Remarks
-3 / -1		Ground Surface						Well instrumented with waterra, footvalve and lock.
1 / 0		***Silty Sand*** Dark brown silty sand, trace organics, dry	1	SS	71	8		Steel lockable casing, cemented
5 / 2		***Clay*** Dark brown clay, dry	2	SS	58	35		
7 / 2		***Layered Silty Sand and Sand and Gravel*** Brown silty sand, trace organics layered with fine to medium sand, some fine gravel, dry	3	SS	46	21		
11 / 3			4	SS	50	16		
13 / 4		***Sand and Gravel*** Brown medium sand with gravel, occasional silty fine sand layer from 3.8 to 4.3 metres, dry	5	SS	54	23		
15 / 4			6	SS	58	18		
19 / 6		***Sand and Gravel*** Layered fine to medium sands with medium to coarse gravel, dry	7	SS	38	28		
21 / 6			8	SS	17	28		
25 / 8			9	SS	33	21		Bentonite
31 / 9			10	SS	71	17		
33 / 10		***Sand and Gravel*** Inferred sand and gravel, some boulders (> 0.2 metres)						
39 / 12								
45 / 14								

Drilled By: George Downing Estate Drilling ***Input By:*** SNR

Drill Method: Hollow Stem Auger/HQ Core ***Checked By:*** CMT

Drill Date: May 7, 2008 ***Sheet:*** 1 of 2

Cambium Environmental Inc.
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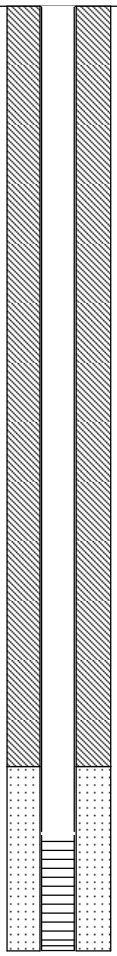
Log of Borehole: MW5-08

Project No.: 1219-001 ***UTM:*** 10 18 317638 5044766

Project Name: Ruby Road WDS Environmental Screening

Client: Township of Bonnechere Valley ***Logged By:*** S. Bachynski

Location: East Property Line ***Project Manager:*** C. Teixeira

SUBSURFACE PROFILE			SAMPLE					
Depth	Symbol	Description	Number	Type	% Recovery	SPT (n)/RQD (%)	Well Installation	Remarks
49								
51								
53 16								
55								
57								
59 18								
61								
63								
65 20								
67								Silica Sand
69								
71								
73 22								
75								
77								
79 24								
81								
83								
85 26		***Granite Bedrock***	11	HQ	100	32		0.038 m x 1.5 m screen
87		Fracutred granite bedrock						
89		End of Borehole						
91 28								
93								
95								
97								

Drilled By: George Downing Estate Drilling ***Input By:*** SNR

Drill Method: Hollow Stem Auger/HQ Core ***Checked By:*** CMT

Drill Date: May 7, 2008 ***Sheet:*** 2 of 2

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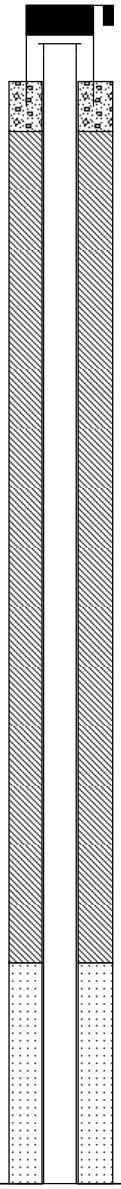
Log of Borehole: MW6-08

Project No.: 1219-001 ***UTM:*** 10 18 317431 5044709

Project Name: Ruby Road WDS Environmental Screening

Client: Township of Bonnechere Valley ***Logged By:*** S. Bachynski

Location: West Property Line ***Project Manager:*** C. Teixeira

SUBSURFACE PROFILE			SAMPLE					
Depth (ft / m)	Symbol	Description	Number	Type	% Recovery	SPT (n)/RQD (%)	Well Installation	Remarks
-3 / -1		Ground Surface						Well instrumented with waterra, footvalve and lock.
1		***Silty Sand*** Dark brown silty sand, trace organics, dry	1	SS	-	-		Steel lockable casing, cemented
3			2	SS	100	50+		
5 / 2		***Silty Sand layered with Sand*** Brown silty sand, layered with grey-brown sand, dry	3	SS	71	14		
7			4	SS	67	13		
9								
11			5	SS	71	11		
13 / 4		***Sand*** Grey-brown sand, dry	6	SS	67	16		
15								
17		***Sand*** Grey-brown sand, trace gravel, dry	7	SS	58	15		
19 / 6		***Silty Sand layered with Sand*** Brown silty sand layered with sand, dry	8	SS	63	18		
21								
23		***Sand and Gravel*** Inferred sand and gravel, some cobbles and boulders (> 0.2 metres)						
25 / 8			9	SS	42	45		Bentonite
27		Auger refusal at 8.6 metres.						
29		***Granite Bedrock*** Fracutred granite bedrock	10	HQ	56	33		
31			11	HQ	100	50		
33 / 10								
35			12	HQ	100	78		
37								
39 / 12			13	HQ	100	89		
41								

Drilled By: George Downing Estate Drilling ***Input By:*** SNR

Drill Method: Hollow Stem Auger/HQ Core ***Checked By:*** CMT

Drill Date: May 8, 2008 ***Sheet:*** 1 of 2

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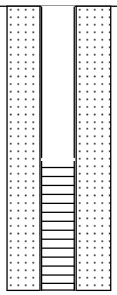
Log of Borehole: MW6-08

Project No.: 1219-001 ***UTM:*** 10 18 317431 5044709

Project Name: Ruby Road WDS Environmental Screening

Client: Township of Bonnechere Valley ***Logged By:*** S. Bachynski

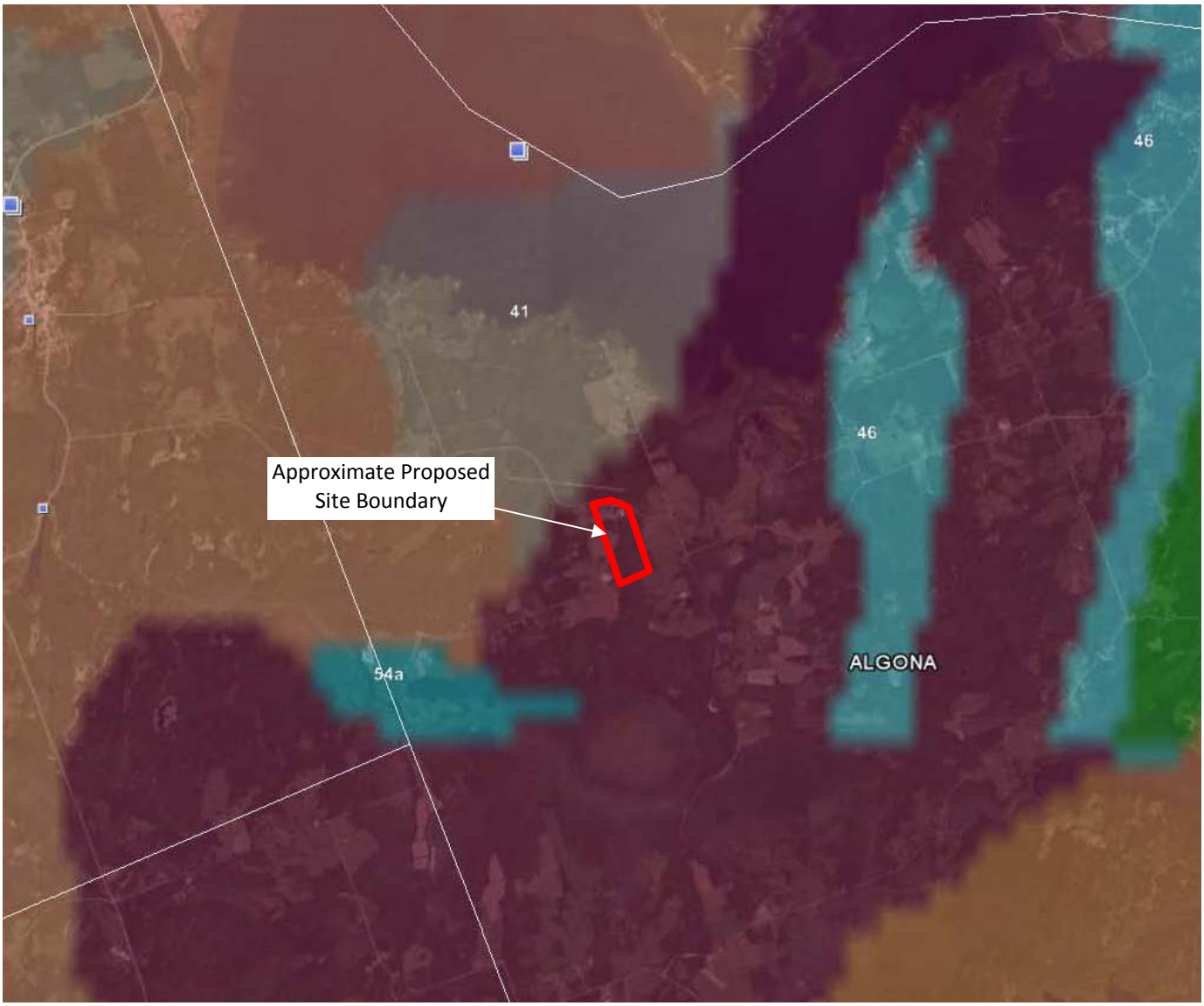
Location: West Property Line ***Project Manager:*** C. Teixeira

SUBSURFACE PROFILE			SAMPLE					
Depth	Symbol	Description	Number	Type	% Recovery	SPT (n)/RQD (%)	Well Installation	Remarks
44								Silica Sand
46 – 14			14	HQ	100	79		
48								0.038 m x 1.5 m screen
50			15	HQ	100	89		
52 – 16		End of Borehole						
54								
56								
58								
60 – 18								
62								
64								
66 – 20								
68								
70								
72 – 22								
74								
76								
78 – 24								
80								
82								
84								
86 – 26								

Drilled By: George Downing Estate Drilling ***Input By:*** SNR

Drill Method: Hollow Stem Auger/HQ Core ***Checked By:*** CMT

Drill Date: May 8, 2008 ***Sheet:*** 2 of 2



Source: OGS Earth, accessed July 21, 2009

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Created by:	Project No.:
SNR	1219-001
Checked by:	Scale:
JPD	NTS
Date:	
July 2009	

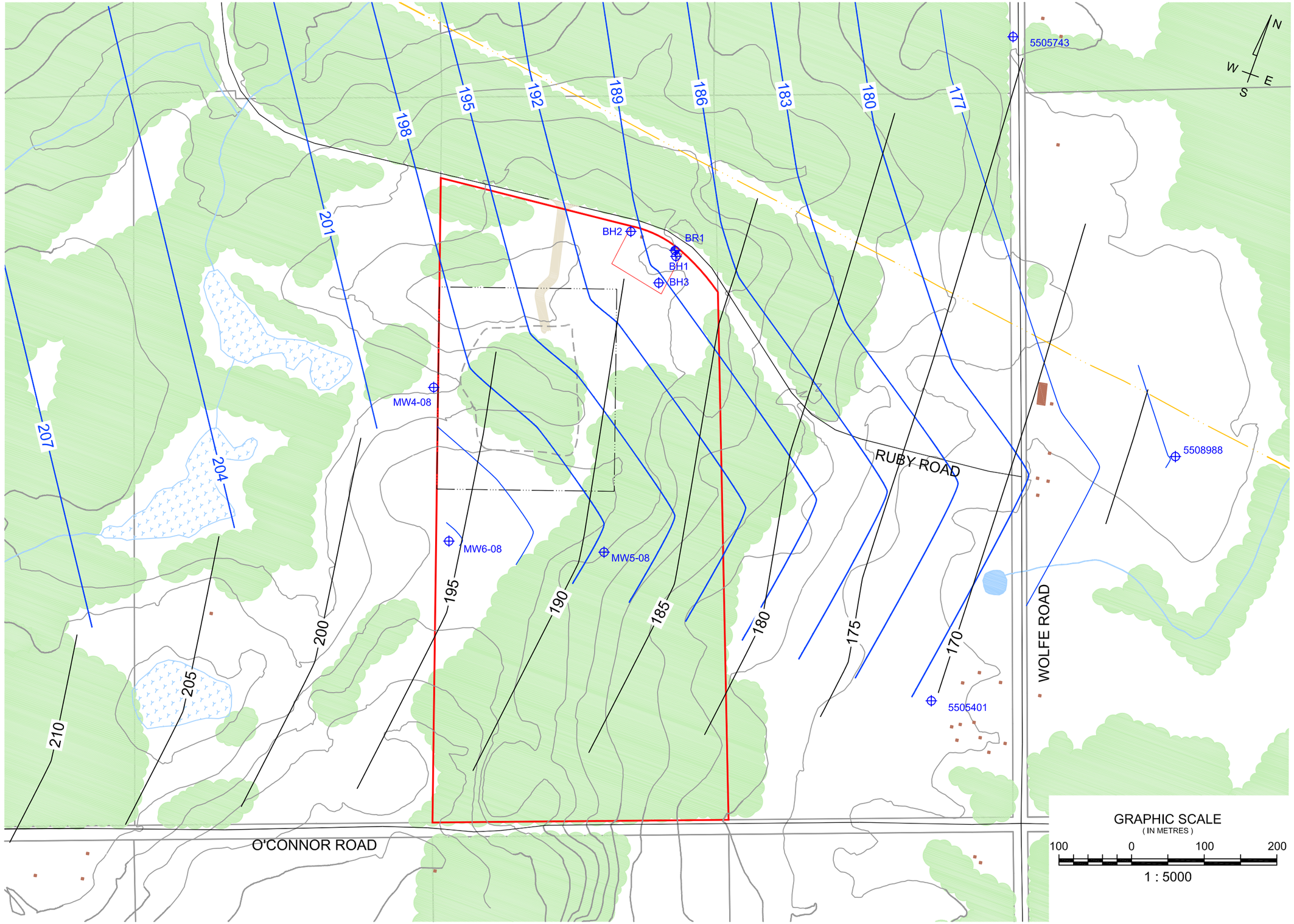
OGS Earth Excerpt

Ruby Road Waste Disposal Site
Township of Bonnechere Valley

Figure No: **1**

RUBY ROAD
WASTE DISPOSAL SITE

Township of Bonnechere Valley
County of Renfrew



GRAPHIC SCALE
(IN METRES)

100 0 100 200

1 : 5000

LEGEND

- BR1 — Groundwater Monitoring Well Location
- Proposed Property Boundary (32.8 ha.)
- Existing Property Boundary (0.5 ha.)
- Proposed Operational Buffer (6.8 ha.)
- Proposed Limit of Waste (2.5 ha.)
- Proposed Entrance (185 m x 12 m)
- Regional Groundwater Flow Direction
- Regional Bedrock Surface

Notes:
1. Survey completed by Cambium Environmental Inc. May 29, 2008.
2. Groundwater and bedrock elevations obtained from Water Well Records provided by the Ministry of the Environment.
3. Distances on this plan are in metres and can be converted to feet by dividing by 3.048.

Benchmarks:
1. Nail and washer in southeast corner of pressure treated wood base of Quonset hut. Elevation 100.477 m.

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REGIONAL GROUNDWATER AND BEDROCK CONTOURS

Drawn By:	Checked By:	Scale:
SNR	JPD	HORZ: 1:5000
Date: July 2009		VERT: N/A
Revision Date:		Figure: 2
Project No.: 1219-001		

August 26, 2009

Cambium Environmental Inc.
P.O. Box 325
2085 Whittington Drive, Unit 2
Peterborough, Ontario
K9J 6X4

Attention: Sadie L. Bachynski

Dear Ms Bachynski:

Re: Township of Bonnechere Valley
Ruby Road Waste Disposal Site
Environmental Screening Process

The Township of Bonnechere Valley is undertaking the Environmental Screening Process (ESP) to determine the feasibility of an expansion to the capacity of the Ruby Road Waste Disposal Site. I offer the following comments in keeping with the MOE document: "Guide to Environmental Assessment Requirements for Waste Management Projects".

Notice of Commencement of a Screening

The notices contained all relevant information in accordance with the Environmental Screening Process for Waste Management Projects.

Identify Problem or Opportunity and Provide Project Description

The Township is proposing an expansion to the Ruby Road waste disposal site in order to provide a 25 year solution to its long term waste needs. Current estimates of capacity indicate approximately 4 years of life remaining. The proposed expansion is for an increase of up to 100,000 cubic metres of capacity and is expected to be approximately 2.5 ha in size within a 6.8 ha buffered operational area on a 32.8 ha property.

Screening Criteria Checklist

The screening criteria checklist, Schedule I of the Guide, has not been completed.

Describe the Potential Environmental Effects, Concerns and/or Issues to be Addressed

This has not been done.

Consult with Interested Persons, including Aboriginal Communities and Government Agencies to identify Any Issues or Concerns

A Public Liaison Committee has been formed to act on behalf of public interest and regular meetings are held to facilitate communication with the public. The Township has hosted public consultation events and interested parties, including Aboriginal Communities have been consulted.

Conduct Studies and Assessment of Potential Environmental Effects

The Township's consultant has conducted a number of studies and the MOE has reviewed the Noise Impact Assessment and the Hydrogeological Assessment.

Noise Study

MOE staff from our Air & Noise Unit, Environmental Assessment & Approvals Branch have reviewed the noise report entitled "Noise Impact Assessment for Expansion Feasibility of the Ruby Road Waste Disposal Site" prepared by Cambium Environmental Inc. dated October 27, 2008.

The report states that the landfill will only utilize construction equipment and/or motorized conveyances. The applicable criteria was determined correctly based on provisions in the Ministry's Landfill Standard Guideline and the analysis was correctly based on procedures detailed in Ministry Publication NPC-233 and ISO-9613-2.

The report concludes that the noise impact due to the operation of the proposed undertaking, at the nearest noise sensitive receptors, are below the applicable Ministry noise limits. MOE agrees with this conclusion and has no objection to the acceptance of the EA from a noise perspective provided the undertaking is conducted as detailed in the report.

Groundwater

I have provided you with comments from our Water Resources Unit resulting from the review of the hydrogeological information you provided in support of the proposed expansion of the Ruby Road waste disposal site. You have indicated that you are incorporating the review comments into the final report and I trust that the groundwater concerns will be addressed.

I am attaching comments provided by Mr. Pearson and Mr. Coe regarding their concerns about the hydrogeology of the area and other concerns in case you do not have them.

Surface Water

The impact on any surface waters in the vicinity of the proposed expanded waste disposal site needs to be addressed.

Develop Impact Management and Mitigation Measures

This requires the proponent to develop and describe impact management measures related to the potential negative environmental effects identified by the screening criteria checklist. Monitoring requirements should also be identified if necessary. This has not been completed.

Consult with all Interested Parties to Identify Issues/Concerns

The proponent is required to review all steps of the ESP up to this point through consultation with the ministry, interested persons, Aboriginal communities and government agencies. A notice is required related to this consultation on a website. Please refer to the guidance document for more details.

Significant Net Effects and Resolution of Concerns, Conduct Additional Studies and Assessment of Effects and Mitigation Measures, Prepare Environmental Screening Report

Please refer to the guidance document.

Publish Notice of Completion of Environmental Screening Report

This is issued by the proponent when all previous steps have been completed. Technical issues should be resolved prior to the issuance of the Notice of Completion and preferably prior to the preparation of the final Environmental Screening Report. The final step is the issuance of a **Statement of Completion to the Ministry.**

This concludes my comments on the Environmental Screening Process for this project to date. If you have any questions concerning these comments, please contact me at 613-540-6861.

Yours truly,

Alida Mitton
Environmental Planner
Technical Support Section
Eastern Region
/am
bc Marc-Etienne Lesieur
file

Ministry of the Environment

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Ministère de l'Environnement

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Ontario

November 19, 2009

Cambium Environmental Inc.
PO Box 325
2085 Whittington Drive, Unit 2
Peterborough, Ontario
K9J 6X4

Attention: Sadie L. Bachynski

Dear Ms Bachynski:

Re: Township of Bonnechere Valley
Ruby Road Waste Disposal Site
Environmental Screening Process

The Township of Bonnechere Valley is undertaking the Environmental Screening Process (ESP) to determine the feasibility of an expansion to the capacity of the Ruby Road waste disposal site. Further to my letter of August 26, 2009, I offer the following additional hydrogeological comments.

Our Groundwater staff reviewed the report "Groundwater Modelling Report Review – Ruby Road Waste Disposal Site A411501, Lot 27, Concession 9, Geographic Township of South Algona" prepared by Cambium Environmental Inc. dated July 30, 2009.

The ministry is in agreement with the consultants' proposal to perform hydraulic tests at 3 overburden monitoring wells at the existing closed site to determine representative overburden hydraulic conductivity values. Hydraulic conductivity values derived from site-specific tests are more representative and defensible than literature based approximations.

Cambium has proposed to assign separate hydraulic conductivity values to the two different bedrock types underlying the site as depicted in Ontario Geological Survey Map 2459. The hydraulic conductivity values will be based on site-specific well tests. The consultants expect that the delineation of these areas may be adjusted to conform to available borehole logs and well records. The Ministry of the Environment (MOE) agrees with this approach.

To address the ministry's previous comments regarding hydraulic gradient, the consultants propose to revise the model such that simulated hydraulic gradients more closely emulate hydraulic gradients observed in the field. This is considered satisfactory to address our concerns.

Additional information was provided by the consultants indicating that groundwater was not encountered in the overburden at borehole MW4-08. This borehole is located approximately 150 metres east of the wetland as depicted on Ontario Base Map 10 18 3150 50400. MOE notes that the consultants have concluded that this wetland is not connected to the overburden aquifer.

This ministry previously recommended that a supplementary evaluation of shallow aquifer hydrogeologic conditions in the vicinity of the proposed fill area be undertaken. This still has not been completed and must be addressed.

The model boundary conditions are proposed to be revised to consider observed regional conditions. MOE agrees with the revisions which promote conformity of the model to observable conditions.

This concludes my comments on the additional hydrogeological information that was submitted in support of the Environmental Screening Process for this project. If you have any questions concerning these comments, please contact me at (613) 540-6861.

Yours truly,

A. Mitton

Alida Mitton
Environmental Planner
Technical Support Section
Eastern Region
AM/sh

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Ontario

M E M O R A N D U M

01 April 2010

TO: Alida Mitton
Environmental Planner
Technical Support Section
Eastern Region

FROM: Shawn Kinney
Hydrogeologist
Water Resources Unit
Technical Support Section
Eastern Region

RE: Ruby Road Waste Disposal Site, A411501
Lot 27, Concession 9, Geographic Township of South Algona
Draft Groundwater Modelling Report

I have reviewed the hydrogeologic aspects of the following document entitled:

- *"DRAFT Numerical Hydrogeological Modelling Report for Expansion Feasibility of the Ruby Road Waste Disposal Site"* Cambium Environmental Inc., December 22, 2009.

I submit the following comments for your consideration.

Summary

1. The most recent version of the numerical model is well constrained by known physical features associated with the site, such as topography and surface water bodies.

2. The document reports that at least two bedrock types, specifically marble and gneiss exist beneath the site. This is supported by an interpretation of borehole data and Ontario Geological Survey Map 2459, entitled "Pembroke, Precambrian Geology, Scale 1:100,000".

3. The consultants have tested the hydraulic conductivity of overburden and bedrock at the site. The results indicate that marble bedrock reportedly encountered at borehole MW6-08 is on the order of 25 times more conductive than gneiss bedrock reportedly encountered at borehole MW4-08.

4. The consultants have assigned a higher conductivity value to a zone in the model domain to reflect the hydraulic test results. Figure 3 of the report depicts this zone.

5. I note that the area of the model domain corresponding to the MW6-8 location is assigned a hydraulic conductivity value that is 25 times less than the field-measured value. The higher conductivity zone depicted in Figure 3 would more closely conform to field observations if it were adjusted approximately 300 metres westward.

6. The above-noted adjustment would likely raise the bedrock hydraulic conductivity values beneath the simulated fill area by a factor of 25. This would considerably increase the migration rate and extent of the simulated chloride plume. I do not believe that such an amended model would predict Guideline B-7 compliance within the existing property boundaries.

7. Based upon the information provided, I cannot conclude that the proposed waste disposal site will maintain long-term compliance with Reasonable Use Guideline B-7 solely through natural attenuation. The site owners should contemplate an enlarged Contaminant Attenuation Zone or engineered leachate management options.

Shawn Kinney, P.Geo
SK/gl

c: Paul Kehoe (Ottawa District)
Peter Taylor (Water Resources Unit)
Laurel Grills (Surface Water)
GW 03-03 BOVA Ruby Road WDS A411501 Lot 27, Con 9 South Algona Twp
SK #6808-7YZMJD

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September 22, 2010

Ontario Ministry of the Environment
Water Resources Unit, Technical Support Section, Eastern Region
P.O. Box 22032
Kingston, Ontario, K7M 8S5

Attn: Mr. Shawn Kinney, P. Geo.
Hydrogeologist

Re: Response to Review Comments and Finalization of Groundwater Modelling Report
Ruby Road Waste Disposal Site (A411501)
Cambium Reference No. 1219-001

Dear Mr. Kinney,

Cambium Environmental Inc. (Cambium), on behalf of the Township of Bonnechere Valley (Township), has prepared the following response to your most recent review of the *Numerical Hydrogeological Modelling Report for Expansion Feasibility of the Ruby Road Waste Disposal Site* (Report) prepared by (Cambium and dated May 6, 2010) provided in correspondence dated August 5, 2010.

Cambium has reviewed the comments and recommendations provided in the above noted correspondence, has prepared the responses herein, and has addressed these aspects in the final Report. For ease of reference, the original review comment or recommendation is provided in bold followed by the Cambium response.

SUMMARY

1. ***The most recent version of the numerical model domain conforms well to known physical features associated with the site, such as topography and surface water bodies.***

   Acknowledged; as noted in Modelling Reports (January 2009, December 2009, and May 2010). Cambium has calibrated the model to reflect the localized hydrogeologic conditions and within the regional hydrologic environment.

2. ***Hydraulic conductivity values in the most recent model conform to field measured values at the locations where these properties were measured.***

   Acknowledged; as noted in Modelling Reports (January 2009, December 2009, and May 2010). Cambium has used measured values of hydraulic conductivity determined from field tests at the observation wells on the subject property.

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3. ***Groundwater pressure gradients provide insights into likely groundwater flow direction. Figure 7 of the document depicts the groundwater pressure distribution calculated by the model. The model predicts eastward groundwater flow from the proposed fill area towards the eastern property boundary.***

   The groundwater flow in the area of the proposed waste disposal site was consistently reported to be towards the east in the previous versions of the Modelling Report (January 2009, December 2009, and May 2010). It is also noted that the hydraulic gradients have been determined to vary from north to south on the subject property. For example, the hydraulic gradient in the north end of the property within the proposed waste disposal area and the notional attenuation zone ranges from 0.05 to 0.03 respectively; whereas the gradient values in the south end of the property range from 0.07 to 0.03 when moving from west to east.

4. ***This calculated eastern groundwater flow conforms to the eastward flow direction inferred by on-site groundwater elevations measured in April 2010 at monitors BH1, BH2, BH3, MW5-08, and MW7-09. These monitors provide water level data within the notional contaminant attenuation zone between the proposed fill area and the eastern property boundary.***

   Acknowledged, as noted in Modelling Reports (January 2009, December 2009, and May 2010). However, it important to recognize that the groundwater elevations from *all* of the monitors on-site (including MW4-08 and MW6-08), in conjunction with the regional hydraulic features (Golden Lake and offsite wells), are used to develop the calibrated pressure distribution model depicted in Figure 7.

5. ***The April 2010 groundwater elevation for monitors BH1, BH2, BH3, MW5-08, and MW7-09 indicate an eastward groundwater pressure gradient on the order of 0.07 metres per metre within the notional attenuation zone.***

   The complete groundwater pressure distribution model, as depicted in Figure 7, shows the hydraulic gradient of 0.07 metres per metre to exist between the wells south of the proposed waste area and not in the contaminant attenuation zone. A horizontal hydraulic gradient of approximately 0.05 metres per metre exists through the proposed footprint and reduces to a horizontal hydraulic gradient of approximately 0.03 metre per metre to the east of the proposed footprint in the contaminant attenuation zone. Refer to the attached Figure 1 Groundwater Configuration April 2010, as completed in AutoCAD.

6. ***The water pressure gradients depicted in Figure 7 of the report show that the model's prediction of leachate transport is predicted upon a pressure gradient on the order of 0.03 metres per metre within the notional attenuation zone. This model value is 43% of the value derived from observed water levels at the site.***

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The hydraulic gradient of 0.07 exists between the wells *south of* the proposed waste area (i.e. between the on-site installed monitors MW5-08 and MW6-08), as shown by the groundwater elevations, calculated in AutoCAD, and concurred by the model. This gradient cannot continue to be 0.07 in the natural attenuation zone (i.e. east of the proposed waste boundary), as the groundwater elevations will not calibrate with surrounding features, such as Golden Lake and the information obtained from the water wells located east of the Site. The elevations of Golden Lake and the water wells located east of the Site were specifically used at the request of the MOE in comments dated November 19, 2009 to develop a more regional model.

As discussed in Section 6.3 of the Report, the values used for calibration of the model included not only the on-site monitoring wells, but also the surrounding water wells and Golden Lake. Using these known elevations and the known hydraulic conductivity values as obtained from field observations, the *calibrated flow model* was developed. Based on this information and the adequate calibration of the model, a gradient of 0.03 is to be expected in the natural attenuation zone.

7. ***Doubling the groundwater pressure gradient in a porous material has the effect of doubling the groundwater flow velocity. Assuming all other model settings are kept constant, a 0.07 metre per metre hydraulic gradient would significantly increase the groundwater flow velocity within the model domain. This would extend the plume father eastward than what is depicted in Figure 8 of the report. The potential exists that such a model would actually predict non-compliance with Guideline B-7 criteria.***

   As indicated above, the localized hydraulic gradient of 0.07 exists between the wells *south of* the proposed waste area (i.e. between the on-site installed monitoring wells), and the localized hydraulic gradient of 0.05 exists within the proposed waste area, as shown by the groundwater elevations and concurred by the model. With respect to the natural attenuation zone (i.e. east of the proposed waste boundary), the gradient must decrease to 0.03 in this area as the groundwater elevations would not calibrate with surrounding regional features, such as Golden Lake and the information obtained from the water wells located east of the Site.

8. ***The informed judgement of the modeller determines what hydraulic conductivity values are assigned to large areas of the model where no direct measurements are available. The model predictions are sensitive to those choices. The report does not quantify how variations in the hydraulic conductivity values affect the predicted extent of plume migration as depicted in Figure 8 of the report.***

   As indicated in Section 7.5 of the Report, the hydraulic conductivity had not been changed as part of the sensitivity analysis, since this parameter was the only parameter determined from actual field tests and was therefore considered to be the basis for the model. The MOE

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indicated in comments dated November 19, 2009 that "hydraulic conductivity values derived from site-specific tests are more representative and defensible than literature based approximations." Therefore, since site-specific values for hydraulic conductivity were obtained through slug tests, these values were confidently used in the model. In order to address the reviewers concerns about value variation effects, sensitivity analysis has been completed on the hydraulic conductivity and included in the final report in Section 8.3, the results of which do not affect the results and conclusions of the Report.

9. ***In order to maintain the groundwater flow velocity used to derive Figure 8, hydraulic conductivity values downgradient of the proposed fill area would need to be significantly reduced to counter-balance the effects of a pressure gradient which matched the observed site conditions. Such an adjustment would likely require a hydraulic conductivity value that is significantly less than any value measured at the site.***

   As described in Section 6.2.1 of the Report, through examination of the hydraulic conductivities determined through slug tests and the associated cross-sections, it can be observed that the Site geological materials are variable in nature and homogeneous values cannot be used to accurately represent the Site conditions.

   As indicated on Figures 2 and 3 of the Report, a hydraulic conductivity of 2.62×10^{-6} m/s was used in the area of the proposed waste footprint. The hydraulic conductivity decreases towards the east to 3.11×10^{-7} m/s in the area of the natural attenuation zone. The hydraulic conductivities assigned to the calibrated model are representative of the observed Site conditions.

10. ***Based on these factors, I cannot conclude that a numerical model of this site that fully and accurately simulated known field conditions would predict long-term compliance with Reasonable Use Guideline B-7 solely through natural attenuation.***

    As indicated in Section 9.0 of the Report, based on the calibrated flow and hypothetical transport models, it can be concluded that groundwater regime at the Site will adequately attenuate the leachate infiltration from the proposed expanded waste disposal area. The contaminant plumes simulated with a precautionary model thus far (all drafts, with all varying revisions) have indicated that the plume concentrations at the property boundary will be less than the RUC value. It is believed the actual contaminant plume will manifest concentrations less than those modeled and much less than the Reasonable Use Concept when it reaches the property line.

    As part of the monitoring program at the Site, additional wells will be required between the proposed waste area and the downgradient property boundary to assess the quality of the

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leachate migrating from the waste area. Should concentrations exceed the Reasonable Use Concept limits at the property boundary, remedial measures would be implemented.

Although details of the considered remedial measures will be included in the Design and Operations Plan for the expanded landfill with respect to the required groundwater monitoring program and associated contingency plans, brief details have been added to the final report in Section 10.0.

11. ***To safeguard against leachate impacts that are more widespread than those predicted by the model, the site owners must demonstrate that they can acquire legal care and control of an expanded subsurface contaminant attenuation zone to the east of the existing property boundary.***

    In the event that exceedances of the Reasonable Use Concept limits are confirmed at the downgradient property boundary, remedial measures to limit the off-site migration of leachate-impacted groundwater may include, but not be limited to:

    - Acquisition of additional pasture lands to extend the natural attenuation zone.
    - Application of a low permeability cover material to reduce infiltration through the waste fill areas that have reached final contours.
    - Installation of a leachate collection system consisting of purge wells and/or collection pipes located at the periphery of the operational area.

12. ***If an enlarged contaminant attenuation zone cannot be acquired, the site owners must demonstrate that they can institute effective engineered leachate management measures within the existing property boundary.***

    As indicated above, if additional land cannot be obtained for natural attenuation, engineered measures (i.e. leachate collection, low permeability cover material, etc.) will be required to ensure that the Site is in compliance with the Reasonable Use Concept.

13. ***I note that there are currently no leachate monitoring wells located within the notional contaminant attenuation zone between the proposed fill area and the eastern property boundary. This must be addressed.***

    Waste is not currently being placed in the proposed waste area; therefore, additional wells are not necessary at this time. Should this Site be approved for expansion as proposed, additional monitoring wells will be required downgradient of the proposed waste area to characterize the quality of the groundwater migrating downgradient of the Site.

CAMBIUM ENVIRONMENTAL

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September 22, 2010

CLOSING

If you require further information or clarification, please contact the undersigned at 705-742-7900.

Best regards,

Cambium Environmental Inc.

ORIGINAL SIGNED BY

Stephanie Reeder, C.E.T., Dipl.
Environmental Specialist

ORIGINAL SIGNED BY

John Desbiens, P.Eng.
President

JPD/cmt

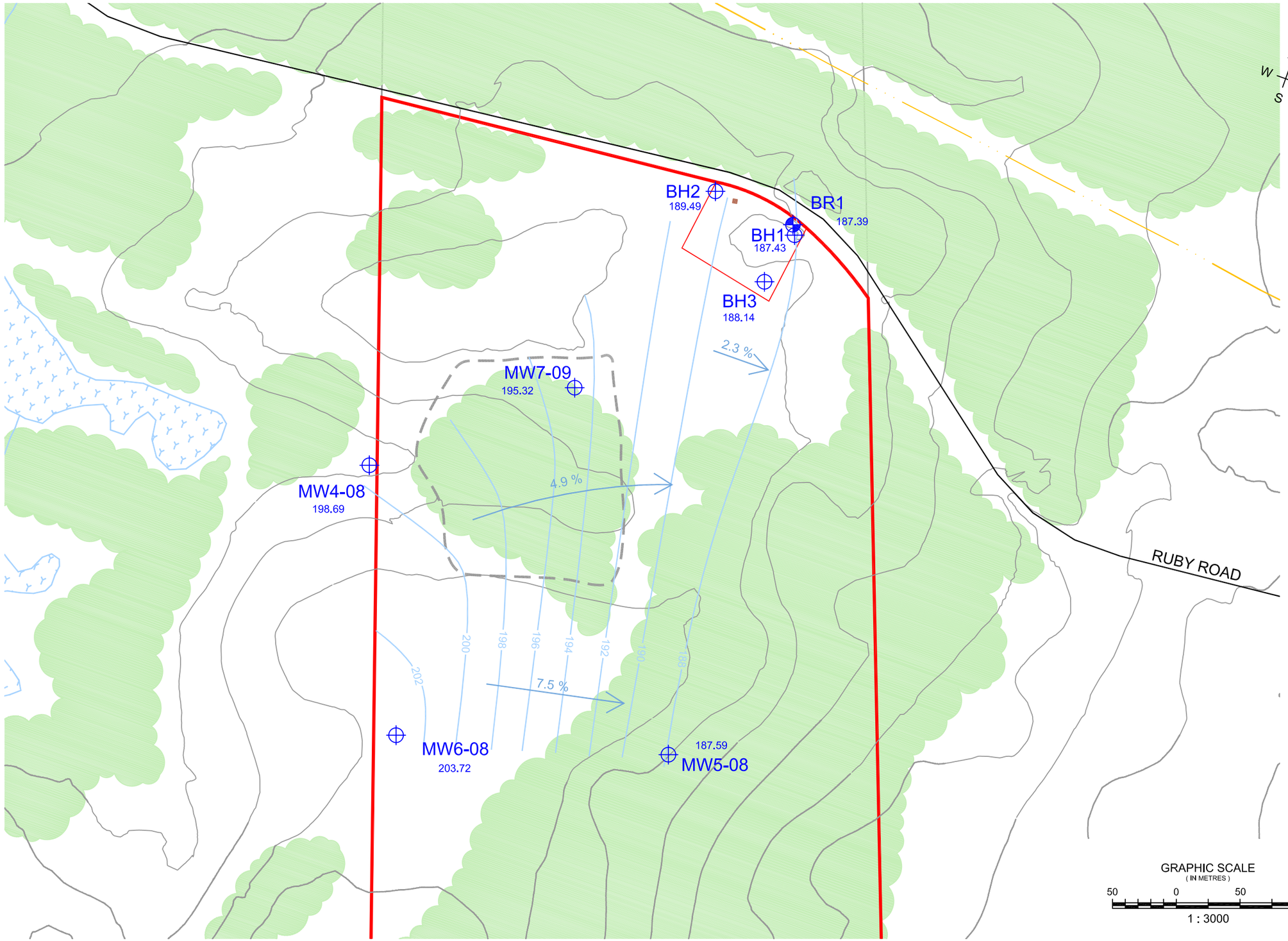
Encl. *Figure 1 Groundwater Configuration April 2010*

Numerical Hydrogeological Modelling Report for Expansion Feasibility of the Ruby Road Waste Disposal Site, Cambium Environmental, September 20, 2010

Z:\Projects\1200 to 1299\07-1219-001 - TBV Environmental Screening\Correspondence\2010-09-20 LTR Ruby Road Response to TSS review of HydroGeo.docx

RUBY ROAD
WASTE DISPOSAL SITE

Township of Bonnechere Valley
County of Renfrew



GRAPHIC SCALE
(IN METRES)

50 0 50 100

1 : 3000

LEGEND

BH-1 ⊕	Groundwater Monitoring Well Location
94.56	Groundwater Elevation April 2010
	Groundwater Contour April 2010
	Proposed Property Boundary
	Proposed Waste Footprint
	Existing Property Boundary
	Groundwater Flow Direction
2.3 %	Horizontal Hydraulic Gradient

Notes:
1. Survey completed by Cambium Environmental Inc. May 29, 2008.
2. Distances on this plan are in metres and can be converted to feet by dividing by 3.048.

Benchmarks:
1. Nail and washer in southeast corner of pressure treated wood base of Quonset hut. Elevation 100.477 m.

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GROUNDWATER CONFIGURATION: APRIL 2010

Drawn By: SNR	Checked By: JPD	Scale: HORZ: 1:3000 VERT: N/A
Date: August 2010		
Revision Date:		Figure: 1
Project No.: 1219-001		

Ministry of the Environment

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December 8, 2010

Cambium Environmental Inc.
PO Box 325
2085 Whittington Drive, Unit 2
Peterborough, Ontario
K9J 6X4

Attention: Sadie L. Bachynski

Dear Ms. Bachynski:

Re: Township of Bonnechere Valley
Ruby Road Waste Disposal Site
Environmental Screening Process

Ministry staff have reviewed the hydrogeological report entitled: Numerical Hydrogeological Modelling Report for Expansion Feasibility of the Ruby Road Waste Disposal Site, prepared by your firm and dated September 20, 2010.

Our hydrogeologist expressed concern over the unverified properties of the proposed contaminant attenuation zone (CAZ) east of the theoretical fill area. Also requested was consideration of the possibility that actual leachate plume behaviour may differ from that predicted by the model.

If leachate impacts become more widespread than predicted by the model, then mitigative measures will be necessary. The ministry requested in an email confirmation that the mitigative measures suggested in the report (CAZ enlargement, low permeability covers, leachate collection) are affordable and possible by the municipality.

Confirmation was provided by your firm in an email dated November 25, 2010. Information was also provided indicating that the contingency measures recommended in the report would be included in the Design and Operations Report as part of the Certificate of Approval amendment.

The ministry is satisfied with this approach and with the hydrogeological investigation completed to date to demonstrate the feasibility of the expansion of the Ruby Road waste disposal site. The Township can proceed with completing the Environmental Screening Process.

If you have any questions concerning these comments, please call me at 613-540-6861 or email me at alida.mitton@ontario.ca.

Yours truly,

Alida Mitton
Divisional Program Specialist
Program Services Section
Eastern Region
AM/gl

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M E M O R A N D U M

28 July 2011

TO: Vicky Mitchell
Environmental Planner
Technical Support Section
Eastern Region

FROM: Shawn Kinney
Hydrogeologist
Water Resources Unit
Technical Support Section
Eastern Region

RE: Ruby Road Waste Disposal Site A411501
Lot 27, Concession 9, Geographic Township of South Algona
Environmental Screening Report

I have reviewed the hydrogeologic aspects of the following documents entitled:

- *Independent Review of Hydrogeological issues Pertaining to the Proposed Ruby Road landfill near Golden Lake, Ontario" Wilf* Ruland 18 February 2011.
- *"Golden Lake Property Owners Association gets "second opinion" on proposed Ruby Road Landfill"* Golden Lake Property Owners Association, 21 February 2011.
- *"Meeting Report submitted by John Gulland"* 16 March 2011.
- *"Dear Editor"* Letter from Wilf Ruland (undated, post-23 March 2011).
- *"Subject: Proposed Ruby Road Landfill – Bonnechere Valley Township"* e-mail from John Gulland (Golden Lake Property Owners Association) to Alida Mitton (MOE), 28 April 2011, 9:12 AM.
- *"Environmental Screening Report: Ruby Road Waste Disposal Site Capacity Expansion"* Cambium Environmental Inc. June 1 2011.

Questions regarding the protection of potential surface water receivers should be referred to the Surface Water Group for comment. Based upon the information provided for review, I submit the following comments for your consideration.

Summary

- The MOE's Eastern Region Technical Support Section does not endorse landfill expansion applications for sites with existing off-site leachate contamination issues.

- I do not agree that the provided groundwater model reasonably emulates the physical hydrogeology of the site. As such, I am not confident that the model's predictions of leachate plume migration are reliable.

- The provided model does not prove that this site is a feasible location for a naturally attenuating landfill within the proposed property boundaries. The potential exists for actual leachate plume migration to exceed the modelling study's predictions.

- An appropriately sized Contaminant Attenuation Zone will likely require legal care and control of subsurface areas in Lot 26 and Lot 27, Concession 9, Township of South Algona.

Discussion

<u>Leachate Plume at Existing Site</u>

A landfill site has an irrevocable impact which lasts for years beyond its active use. A naturally attenuating landfill site cannot be "turned off" as a source of contaminants as a conventional machine can. Damage to aquifer quality is unlikely to be quickly or easily reversed.

The proponents maintain that the proposed fill area is not a new landfill, but is instead an expansion of the existing closed waste disposal site / transfer station regulated by Certificate of Approval #A411501.

The existing closed landfill site emits a leachate plume which has migrated off-site. Leachate parameters reportedly exceed Ontario Drinking Water Objectives and Standards at the existing property boundary. The full off-site extent of the existing leachate plume has not been delineated.

The MOE's Eastern Region Technical Support Section does not endorse Certificate of Approval applications to expand landfill sites which are causing off-site leachate impacts. This should be contemplated during the environmental screening process.

Groundwater Modeling Study

I do not agree that the provided groundwater model accurately emulates the physical hydrogeology of the site. It follows that I am not confident that the model's predictions of leachate plume migration are reliable.

Little factual basis exists to substantiate a conclusion that landfill leachate impacts from the proposed landfill site would be confined to Lot 27, Concession 9, of the Township of South Algona. The potential exists for actual leachate plume migration to exceed that which was predicted by the provided modelling study.

Eventual leachate impacts to aquifers located in adjacent Lot 26, Concession 9, can be expected if the naturally attenuating landfill site becomes operational as proposed. This can be addressed as follows:

- Obtain legal care and control of a subsurface Contaminant Attenuation Zone, or CAZ, in Lots 26 and 27, Concession 9, Township of South Algona.

- The CAZ property or easement must have sufficient dimensions to contain the full extent of landfill leachate contamination from both the existing and the proposed fill areas to the satisfaction of the Ministry during the contaminating lifespan of both sites.

- The existence of the CAZ must be legally registered on the titles of the included properties. This is necessary for the protection of future land owners in the event of any change of ownership of CAZ lands.

It has been my experience that the process of retroactive CAZ enlargement at non-compliant landfill sites is frequently prone to delay. The most often cited causes of such delays include insufficient funds, failure of negotiations with adjoining landowners or unwillingness to expropriate the necessary lands / easements. On occasion, such circumstances result in the closure of landfill sites sooner than the operators had anticipated.

For this reason, I strongly recommend that the CAZ requirements at this site be satisfied prior to consideration of any landfill expansion approval. I doubt the feasibility of an expanded naturally attenuating landfill site at this location if this fundamental requirement cannot be addressed.

Discrepancy between Measured and Simulated Bedrock Hydraulic Conductivity, "K"

I have re-examined the appended numerical modelling study produced by Cambium Environmental and dated 20 September 2010. During this re-examination, I noted a subtle discrepancy in the document that I did not identify during my earlier review.

Appendix B of the Numerical Modelling report provides well response test results for a borehole designated as BH4-08, now designated MW4-08. The test yielded a hydraulic conductivity, or "K" value of 4.84 $*10^{-6}$ m/s. This value is consistent with the typical mid range of values for fractured metamorphic rocks.

In contrast to the well test results, Table 2, page 9 of the Numerical Modelling Report presents a K value of $4.84*10^{-7}$ m/s for monitor MW4-08. The legends provided in Figures 2 and 3 of the Numerical Modelling Report similarly state a $4.84*10^{-7}$ m/s value representing competent bedrock within the model domain. The consultant has advised me that the $4.84*10^{-7}$ K value was indeed applied to the model.

The one-digit discrepancy in the exponent means that the K value used to represent competent bedrock throughout the model is 10 times less than what was measured at MW4-08.

This discrepancy in the K value has profound implications for the model. Previous analyses by the consultant show that the model's groundwater contaminant transport calculations are particularly sensitive to changes in the K value.

The mathematical calculations performed within each cell of the MODFLOW model rely on the results of calculations in all other adjoining cells. As such, the widespread application of the lesser bedrock K value undoubtedly affects groundwater flow calculations throughout the model domain. This diminishes the model's reliability as a predictive tool.

Subsurface Conditions Downgradient of Proposed Fill Area

The composition of downgradient overburden and bedrock simulated in the model domain are conjecture. No boreholes or monitoring wells exist which substantiate the thickness and type of subsurface materials comprising the notional CAZ.

Similarly, no hydraulic test results exist to substantiate the K value of overburden and bedrock materials downgradient of the fill area. The assigned values appear to represent the minimum K values measured in well tests conducted elsewhere at the site.

I do not assume that the downgradient conditions depicted in Figure 2 and Figure 3 of the Numerical Modelling Report exist. I discussed this issue in my previous memo dated 24 November 2010.

Model Recharge Values

"Recharge" refers to the amount of precipitation which eventually reaches the water table. I have reexamined the water recharge values used in the model in light of commentary provided by Mr. Wilf Ruland on behalf of the Golden Lake Property Owners Association.

Section 8.2, page 28 of the Numerical Modelling Report states that predicted plume travel distance may be sensitive to the recharge term used in the model. In fact, Chart 2, page 22 of the report indicates that a 40 % increase in the recharge value almost doubles the calculated plume concentration at the proposed property boundary.

Section 6.1.2, page 7 of the Numerical Modelling Report states that an initially recharge value of 175 mm/year was obtained from the United States Geological Survey report entitled *"Report 2005-5284 Estimation of Shallow Ground-Water Recharge in the Great Lakes Basin"*.

The USGS estimate appears to reflect the average recharge value of the entire Bonnechere River watershed based upon stream water balance calculations. I have consulted the following secondary reference for comparison purposes:

- Parkin, G.W., Wagner-Riddle, C., Fallow, D.J. and Brown, D.M. (1999) *"Estimated Seasonal and Annual Water Surplus in Ontario"* Canadian Water Resources Journal, Vol 24, No.4, pp 277-292.

Table 3 of Parkin et al. (1999) provides a 30 year average recharge value of 201 mm/year (with considerable annual variability) for the eastern Ontario climatic zone. The calculations reportedly used soil K values within the range of those reported for the proposed Ruby Road site.

Evidently, two dissimilar published calculation methods yielded somewhat similar groundwater recharge values. Based on this, I conclude that an assumed recharge value in the range of 175-200 mm/year is reasonable for this site.

The consultant reduced the 175 mm/year USGS value by half to 87.5 mm/year during simulations of contaminant transport. This was reportedly done to produce a closer match between the model's simulated groundwater levels and observed groundwater levels.

The 87.5 mm/year recharge rate suggests that almost 90% of annual precipitation does not reach the aquifer. On its face, this assumption is logically problematic given the predominantly sandy and un-vegetated nature of this site. I do not assume that the 87.5 mm/year recharge value used in the model is realistic.

I suspect that a 50% reduction in the USGS published recharge value was mathematically necessary to balance the reduced groundwater flow rates calculated by the model. The reduced flow rates are an expected consequence of the bedrock K discrepancy and minimum overburden K values discussed above.

<u>Conclusions</u>

Based on the information provided, I submit the following conclusions:

- The Technical Support Section does not endorse landfill site expansion applications for sites which do not comply with Reasonable Use Guideline B-7.

- The validity of the bedrock hydraulic conductivity value used in the model is doubtful.

- The hydraulic conductivity of the bedrock and overburden downgradient of the fill area remains a matter of conjecture.

- The water recharge values applied to the model are implausible

- The actual extent of landfill leachate impacts will likely be greater than what has been predicted by the model.

- The provided model does not prove that this site is a feasible location for a naturally attenuating landfill within the proposed property boundaries.

- An appropriately sized Contaminant Attenuation Zone will likely require legal care and control of subsurface areas in Lot 26 and Lot 27, Concession 9, Township of South Algona.

Shawn Kinney, P.Geo.
SK/gl

c: Lance Larkin (Ottawa District)
Laurel Grills (Surface Water)
File GW-03-03, BOVA Ruby Road WDS (A411501)
SK #3360-8GWS6X

e.c. Tara MacDonald (Ottawa District – electronic copy)
Peter Taylor (Water Resources Unit – electronic copy)

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M E M O R A N D U M

October 18, 2011

TO: Vicki Mitchell
Environmental Assessment Coordinator
Technical Support Section
Eastern Region

FROM: Laurel Grills
Surface Water Evaluator
Technical Support Section
Eastern Region

RE: Environmental Screening Report:
Ruby Road Waste Disposal Site Capacity Expansion
The Corporation of the Township of Bonnechere Valley

I have reviewed the Environmental Screening Report, dated June 1, 2011 for the Ruby Road Waste Disposal Site (WDS) and provide the following comments, relative to surface water impact concerns, for your consideration.

Background

The Ruby Road landfill operates under Provisional Certificate of Approval No. A411501. The site was closed to landfill activities as of December 31, 2003 and currently operates as a waste transfer station. Based on the remaining capacity of approximately five years for waste management in the Township, the Township is in need of developing a long term plan to address their solid waste management needs. The purpose of this Environmental Screening Process is *to determine the feasibility of a capacity expansion at the Ruby Road WDS as a long-term (25 year) solution that will best address the need to manage the municipal solid waste generated within the Township boundaries.*

Site Description

The Ruby Road landfill is located at 2213 Ruby Road, on Part of Lot 27, Concession 9 within the geographic Township of South Algona. The existing site has an approved fill area of 0.5 hectares with an approved theoretical capacity of 47,650 cubic metres. The Capacity Study estimated an existing waste volume onsite of 17,000 cubic metres. There is a remaining fill capacity at the current site of 30,650 cubic metres. The Township is seeking approval to reopen

the existing landfill to make use of the remaining capacity (30,650 cubic metres) and to expand the landfill to a new area to the southwest for *a total waste disposal capacity increase of between 40,000 and 100,000 cubic metres*. The proposed expansion is to the southwest of the existing site into an area that was a sand and gravel pit. The expansion represents a significant increase in volume.

There are no apparent surface water features outlined on the 1:50,000 topographic map of the area. However, I conducted a site inspection on June 3, 2009. A tributary exists west of the site. It drains into Golden Lake which is located approximately one kilometre downstream. There was moderate flow in the tributary on the day of my inspection.

According to the report, the Ministry of Natural Resources (MNR) indicated that many of the watercourses flowing to Golden Lake are cold water fish habitats. It is not apparent from the site visit whether the watercourse to the west is an intermittent watercourse. It is possible that the watercourse is permanent and may represent cold water fish habitat. The MNR indicated that the watercourse to the west and north although mapped as intermittent had the potential of being permanent. The Snider's Ecological Services report, included in the Screening Report, concluded the watercourses west of the proposed expansion area were intermittent and seasonal and did not contain any fish and are not considered to be important fish habitat. According to Cambium, the other identified potential watercourses within 1 kilometre were intermittent watercourses.

The proposed expansion area boundary is approximately 75 metres to a surface water feature. This low lying area is located directly downgradient from the proposed expansion area. Leachate generated from the existing landfill is characterized by elevated alkalinity, TDS, hardness and nitrates. Iron and manganese are elevated and are considered naturally occurring. The concern is for leachate contaminated groundwater, generated from the proposed expansion area, to discharge to this low lying area into the small wetland and into the tributary of Golden Lake.

Surface Water Monitoring Program

To date, no surface water quality monitoring has been undertaken at this site. The nearest surface water feature (to the existing landfill) is a small low lying wetland located approximately 300 metres southwest of the existing fill area. The proposed expansion area is approximately 75 metres to this surface water feature. This low lying area is located directly downgradient from the proposed expansion area.

Conclusions and Recommendations

The proposed expansion area is located slightly south and west of the current landfill. According to the Screening Report, mitigative measures will be implemented to control surface drainage movement away from surface water bodies. The placement of the waste mound expansion will

be strategically positioned on the site and would be properly sloped when the fill material is placed, in order to minimize excessive surface water runoff. The surface drainage system will include a storm drainage system to manage runoff during storm events. Runoff will be directed towards several catchment areas. Surface drainage from the site is expected to be easily mitigated due to the highly permeable nature of the soils on-site.

The proposed expansion area boundary is approximately 75 metres to a surface water feature located west and south west of the proposed area. This low lying swamp is located directly downgradient from the proposed expansion area. The consultant outlined profile views of the proposed site in the report. However, these profiles were in relation to nearby residents. There was no profile outlined facing west or southwest from the proposed fill area.

The proposed expansion area is located on a local topographic high. The soil is characterized as a gravely sandy loam with coarse gravel and good drainage. Precipitation percolates through the ground from hills and discharges into adjacent valleys. *The main flow is, more or less, from high ground to low* (G.C. Milligan, 1977). A contour map for the area shows the centre of the proposed expansion area at 215 metres above sea level, the western most boundary of the proposed area drops off to 210 metres above sea level and then the low lying swamp. The concern is for leachate contaminated groundwater, generated from the proposed expansion area, to discharge to this low lying area into the small wetland and into the unnamed tributary of Golden Lake.

I defer to the groundwater reviewer for the determination whether groundwater from this proposed area discharges to the low lying area directly to the west of the proposed expansion site. According to Mr. Shawn Kinney, Hydrogeologist, MOE in his recent technical memo dated July 28, 2011, he states: *I do not agree that the provided groundwater model reasonably emulates the physical hydrogeology of the site. As such, I am not confident that the model's predictions of the leachate plume migration are reliable. The potential exists for actual leachate plume migration to exceed that which was predicted by the provided modelling study.*

According to the Environmental Screening Report, *due to the lack of surface water on the Site and in the proximate surrounding area, surface water quality in the general vicinity of the Site is indeterminable.* This statement requires clarification.

In summary:

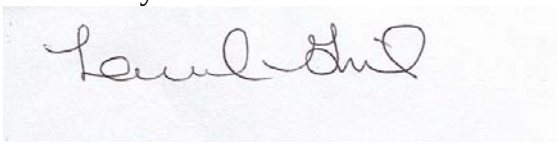
1) The proposed expansion volume is considerably larger than the existing approved volume (up to 52,350 cubic metres).

2) Soils in this location are characterized as a gravely sandy loam with coarse gravel. The expansion is designed as a natural attenuation site in an area of highly porous soils.

3) The proposed expansion area is located further west of the existing site closer to a surface water feature considered by MNR as likely to be permanent in nature. Springs are known to feed this stream which discharges to a cold water lake. *Similar streams in the area contain cold water regimes* (Correspondence J. Gaweda, District Planner, MNR, October 13, 2011).

4) Until the groundwater movement/direction from the proposed expansion area is fully determined, I must err on the side of caution and maintain there is a potential risk that leachate contaminated groundwater from the expansion area could potentially discharge to the low lying swamp area which discharges to the unnamed tributary of Golden Lake. I therefore do not support an expansion of the Ruby Road landfill into the currently proposed section of the property.

If you have any questions or comments regarding the above, I would be pleased to discuss them with you.



Laurel Grills
LG/sh

c: File SW-05-04 (Township of Bonnechere Valley)
Shawn Kinney
Lance Larkin, Ottawa District Office
Tara MacDonald, Ottawa District Office
LG

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M E M O R A N D U M

April 26, 2012

TO: V. Mitchell
Environmental Assessment Coordinator
Technical Support Section
Eastern Region

FROM: K. Stephenson
Hydrogeologist
Technical Support Section
Eastern Region

RE: Ruby Road Waste Disposal Site
Certificate of Approval A411501
Lot 27, Concession 9, Geographic Township of South Algona
Environmental Screening Report

Purpose

I have reviewed the letter entitled "Response to MOE Comments in 2011 dated July 28, October 18 and November 15, Environmental Screening of Capacity Expansion at Ruby Road Waste Disposal Site, Cambium Reference: 1219-001" dated January 19, 2012 and completed by Cambium Environmental (Cambium) on behalf of the Corporation of the Township of Bonnechere Valley (Township).

I reviewed the letter to provide technical comments on groundwater issues related to the proposed expansion of the Ruby Road Waste Disposal Site. I also completed a general file review including a review of the Environmental Screening Report (dated June 1, 2011), the numerical modeling work completed to predict groundwater impacts and previous correspondence between Cambium and MOE (Mr. Shawn Kinney) regarding groundwater issues.

Background

The Township is engaged in the Environmental Screening process to support a proposed expansion of their Ruby Road Landfill site. The expansion would occur in a new footprint area with an expected waste volume of 100,000 cubic metres. The proposed site would operate as a natural attenuation landfill. The boundaries of the proposed waste fill area are located 30 metres

from the western site boundary, approximately 200 metres from the eastern site boundary, 150 to 200 metres from the northern site boundary and greater than 500 metres from the southern property boundary. The general hydrogeological conceptual model for the site is groundwater / leachate migration downwards through overburden and then horizontal flow to the north / northeast within a saturated zone at the overburden / Precambrian bedrock interface or in the upper fractured bedrock. In order to assess potential groundwater impacts, Cambium has conducted groundwater flow and contaminant transport modeling using numerical methods (computer codes MODFLOW and RT3D).

There is currently a closed waste disposal site on the property where the expansion would occur. The existing waste fill area has an estimated volume of 17,000 cubic metres. The existing site does not comply with MOE Guideline B-7 however as a closed site it has been accepted by the Ministry that Guideline B-9 applies to the closed site. It is understood that the closed site conforms to Guideline B-9 (i.e. there is currently no offsite well interference resulting from landfill leachate impacts).

The following main technical groundwater issues have been raised related to the proposed expansion:

1. The groundwater modeling undertaken to support site expansion is not reliable and may not accurately predict future compliance with Guideline B-7 (issues related to model input parameters including hydraulic conductivity and recharge); and

2. groundwater flow direction may not be completely understood at the site and there is potential groundwater flow to the west and towards a nearby wetland feature.

There is also a policy issue that has been raised related to the fact that the existing site does not currently comply with Guideline B-7. It is a general policy that the MOE groundwater unit does not support site expansion where there is existing non-compliance with Guideline B-7. The Township has taken initial steps to address this issue (described further below).

Discussion

There have been several exchanges of information between the MOE groundwater unit and Cambium related to the ability of the model to simulate real conditions at the site and predict future conditions. Cambium has indicated that model input parameters are highly conservative and as such model output should overestimate potential groundwater impacts. Cambium has also completed some sensitivity analysis to reduce the uncertainty associated with model output. In general, there is always significant uncertainty associated with a groundwater model usually related to the hydrogeological conceptual model or various assumptions associated with input parameters (parameters measured based on field work or otherwise assumed / estimated, e.g. hydraulic conductivity and recharge). It is important to ensure that the conceptual model is correct and that the full range of potential conditions at a site are considered as part of the modeling work in order to predict potential impacts using a precautionary approach.

Based on my review, I am uncertain that the hydrogeological conceptual model includes all possible contaminant migration pathways away from the proposed landfill area. It appears to me that there is potential for groundwater flow and contaminant migration from the proposed landfill towards the western property boundary which has not been included in the conceptual model (flow and contaminant transport to the east / north east is part of the current conceptual model). The western bound of the proposed waste fill area is approximately 30 metres from the western property boundary. The waste fill area appears to be located on / near a local topographic and bedrock high area which may promote groundwater flow and contaminant transport in multiple directions away from the fill area (refer to Figures 4 and 9 of the Environmental Screening Report). I am not certain that flow to the west would result in impacts to surface water features located west of the site however, given the limited buffer zone between the waste fill area and the western property boundary, any contaminant transport to the west would likely result in problems with Guideline B-7 compliance. I am not confident that that monitoring well MW4-08 by itself is adequate to define flow conditions west of the site. Additional investigation (monitoring well installation) is needed to determine the direction(s) of groundwater flow away from the proposed waste fill area. This information should then be used to determine all potential contaminant transport pathways.

The MOE groundwater unit has previously requested additional investigation from the proposed Contaminant Attenuation Zone (CAZ) downgradient of the site (refer to memorandum from Mr. Shawn Kinney dated July 28, 2011). This investigation would improve the certainty related to field measurements and model inputs (e.g. hydraulic conductivity). As it currently stands, the numerical modeling indicates that the B-7 limit will be met for chloride at a location approximately 10 metres from the downgradient property boundary. This does not leave significant room for error. As such, any information which can improve confidence in model input parameters is worthwhile.

Cambium has used chloride as the key landfill leachate contaminant in the numerical model. The numerical model assumes a chloride source (leachate) concentration of 300 mg/L applied across the proposed waste fill area. Cambium based this value on information from other sites in the Township. I am concerned that this value may not be representative of potential chloride strength in leachate. The MOE Landfill Standards Guideline (regulatory requirements for this guideline described in Ontario Regulation 232/98) indicates that leachate strength in chloride should fall within the range of 1500 mg/L to 2500 mg/L for design purposes. Other information suggests that these values may be high for a smaller site such as the proposed Ruby Road site. For example, a paper entitled “A Method for Predicting Chloride Concentrations in Leachate at Natural Attenuation Landfills in the Precambrian Shield Regions of Ontario, Canada” (Gehrels and Puumala, 2000) provides a calculation for estimating peak chloride concentration for the purposes of risk assessment. This calculation relates chloride concentration with waste volume based on a statistical analysis of leachate strength at numerous sites. For a waste volume of 100,000 cubic metres, the calculation estimates a source chloride concentration of 561 mg/L. Cambium should consider this information and revise (increase) the source chloride concentration in order to more fully assess potential impacts from the proposed expansion.

It appears that Cambium has applied a transient contaminant transport modeling approach to determine potential impacts to groundwater from the proposed expansion (the model has not been run to steady state conditions but rather results are provided at various time steps). It appears that the model has been run for 20 years at which point Cambium indicates that "breakthrough" occurs. Referring to page 30 of the modeling report dated September 20, 2010, Cambium indicates that "the breakthrough time for the expanded footprint is approximately 20 years; therefore the concentrations would be expected to increase minimally beyond the 20 year time period". The term "breakthrough" as it relates to contaminant transport usually describes the time that the leading edge of the plume reaches a certain location / distance from the source. A breakthrough curve then describes the changes in concentration of a particular contaminant over time following initial breakthrough. It appears that the Cambium model stops at 20 years and does not appropriately consider the contaminating lifespan of the landfill. If contaminant breakthrough at the property boundary occurs at 20 years then I would expect contaminant concentrations to increase for some time (to a maximum value) following initial contaminant breakthrough. Cambium should develop a contaminating lifespan estimate and then run the model for an appropriate time to determine estimated maximum concentration at the property boundary. This maximum value should then be compared to the Guideline B-7 limit. The Environmental Screening report indicates that the expected landfilling period is approximately 25 years so it is not clear why the model is only run out to the 20 year time period. Waste volume / contaminant mass is not discussed in the modeling report but the waste footprint is indicated to be 2.5 hectares on Figure 4.

The Township has recognized that they must address non-compliance with Guideline B-7 at the existing Ruby Road site prior to expansion of the site. The Township / Cambium has estimated that the northern portion of Lots 27 and 26, Concession 9 would be adequate to comply with Guideline B-7 (refer to Cambium letter dated January 19, 2012). Delineation of groundwater impacts should be completed in order to confirm the required extent of an expanded Contaminant Attenuation Zone.

I have reviewed borehole logs for the site and I need further information / clarification on the construction of borehole MW7-09. This monitoring well has been indicated by Cambium to be a bedrock well (refer to Table 2 of the January 19, 2012 letter) however the log shows that the borehole terminated at the bedrock surface and as such would not monitor the bedrock zone.

In their letter of January 19, 2012, Cambium has indicated that Lot 26, Concession 9 is not required to support site expansion. This issue should be revisited once the issues identified in this memorandum have been addressed.

Conclusions and Recommendations

I offer the following conclusions and recommendations, for your consideration:

1. Additional investigation (monitoring well installation) is needed to determine the direction(s) of flow away from the proposed waste fill area.

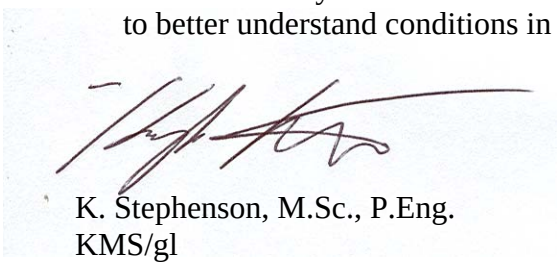
2. The MOE groundwater unit has previously requested additional investigation from the proposed Contaminant Attenuation Zone (CAZ) downgradient of the site (refer to memorandum dated July 28, 2011. This investigation would improve the certainty related to field measurements and model inputs (e.g. hydraulic conductivity). Additional monitoring wells should be installed to characterize the proposed CAZ area.

3. Cambium should revise the source chloride concentration used in the numerical model as discussed above.

4. Cambium should develop a contaminating lifespan estimate and then run the model for an appropriate time to determine estimated maximum concentration at the property boundary.

5. The Township has recognized that they must address non-compliance with Guideline B-7 at the existing Ruby Road site prior to expansion of the site. The Township / Cambium has estimated that the northern portion of Lots 27 and 26, Concession 9 would be adequate to comply with Guideline B-7 (refer to Cambium letter dated January 19, 2012). Delineation of groundwater impacts should be completed in order to confirm the required extent of an expanded Contaminant Attenuation Zone.

6. I have based my review on a review of available documents but I would like to visit the site to better understand conditions in the area.



K. Stephenson, M.Sc., P.Eng.
KMS/gl

c: L. Larkin
L. Grills
T. MacDonald
F. Crossley/File GW 03-03 BOVA, Ruby Road WDS (A411501)
KMS/IDS #4682-8QNLTX

References:

Gehrels, J. and Puumala, M. “A Method for Predicting Chloride Concentrations in Leachate at Natural Attenuation Landfills in the Precambrian Shield Regions of Ontario, Canada” *Ground Water Monitoring & Remediation*, Volume 20, Issue 3, pages 169–176, August 2000; published online: February 22, 2007.

Ministry of the Environment

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Ontario

M E M O R A N D U M

30 April 2012

TO: Vicki Mitchell
Environmental Assessment Coordinator
Technical Support Section
Eastern Region

FROM: Laurel Rudd
Surface Water Evaluator
Technical Support Section
Eastern Region

RE: Ruby Road Waste Disposal Site Capacity Expansion
The Corporation of the Township of Bonnechere Valley

I have reviewed the letter entitled "Response to MOE Comments in 2011 dated July 28, October 15 and November 15, Environmental Screening of Capacity Expansion at Ruby Road Waste Disposal Site, Cambium Reference: 1219-001" dated January 19, 2012 and completed by Cambium Environmental (Cambium) on behalf of the Corporation of the Township of Bonnechere Valley (Township). I provide the following comments, relative to surface water impact concerns, for your consideration.

Background

The Ruby Road landfill operates under Provisional Certificate of Approval No. A411501. The site was closed to landfill activities as of December 31, 2003 and currently operates as a waste transfer station. The Township is engaged in the Environmental Screening process *to determine the feasibility of a capacity expansion at the Ruby Road WDS as a long-term (25 year) solution that will best address the need to manage the municipal solid waste generated within the Township boundaries*. To date, no surface water quality monitoring has been undertaken at this site, either for the existing or in support of the proposed expansion.

Site Description

The Ruby Road landfill is located at 2213 Ruby Road, on Part of Lot 27, Concession 9 within the Geographic Township of South Algona. The Township is seeking approval to reopen the existing landfill to make use of the remaining capacity (30,650 cubic metres) and to expand the landfill to a new area to the southwest for *a total waste disposal capacity increase of between 40,000 and 100,000 cubic metres*. The proposed expansion is to the southwest of the existing site into an area that was formally a sand and gravel pit.

There are no apparent surface water features outlined on the 1:50,000 topographic map of the area. However, I conducted a site inspection on June 3, 2009. A tributary exists west of the site. It drains into Golden Lake which is located approximately one kilometre downstream. There was moderate flow in the tributary on the day of my inspection.

According to the Environmental Screening Report, the Ministry of Natural Resources (MNR) indicated that many of the watercourses flowing to Golden Lake are cold water fish habitat. It is not apparent from the site visit whether the watercourse to the west is an intermittent watercourse. It is possible that the watercourse is permanent and may represent cold water fish habitat. The MNR indicated that the watercourse to the west and north, although mapped as intermittent, had the potential of being permanent. The Snider's Ecological Services report, included in the Screening Report, concluded the watercourses west of the proposed expansion area were intermittent and seasonal and did not contain any fish and are not considered to be important fish habitat. According to the Environmental Screening Report, the other identified potential watercourses within 1 kilometre were intermittent watercourses.

The proposed expansion area boundary is approximately 75 metres to a surface water feature. The feature represents a low lying swamp located directly downgradient from the proposed expansion area. The concern is for leachate contaminated groundwater, generated from the proposed expansion area, to discharge to this low lying area which empties into the tributary of Golden Lake.

Conclusions and Recommendations

Outlined in the January 19, 2012 letter, Cambium states that the *MOE TSS surface water reviewer will defer to the Ministry of Natural Resources to review and comment on the technical reports prepared to date relating to an unnamed water feature located on the property west of the proposed landfill expansion (TSS Meeting, 2011).* For clarification, the Ministry of the Environment (MOE) relies on the MNR for the fisheries management designations (warm water versus cold water habitat). MOE is responsible for areas of water quality and water quantity. Therefore, any relevant studies pertaining specifically to fish habitat, wetland designation and species at risk should be forwarded to the MNR and any relevant studies pertaining to water quality and quantity should be forwarded to the MOE.

The proposed expansion area is located south-west of the current landfill. Soils in the area are expected to be highly permeable. The proposed expansion fill area boundary is approximately 75 metres to a surface water feature located south of the proposed area. This low lying swamp is located directly downgradient from the proposed expansion area. The proposed expansion area is located on a local topographic high. The soil is characterized as a gravely sandy loam with coarse gravel and good drainage. Precipitation percolates through the ground from hills and discharges into adjacent valleys. *The main flow is, more or less, from high ground to low,* (G.C. Milligan, 1977).

A contour map for the area shows the center of the proposed expansion area at 215 metres above sea level, the western most boundary of the proposed area drops off to 210 metres above sea level and then the low lying swamp. The concern is for leachate contaminated groundwater, generated from the proposed expansion area, to discharge to this low lying swamp which empties into the small wetland and the unnamed tributary of Golden Lake.

According to Mr. Kyle Stephenson, Hydrogeologist, MOE in his recent technical memo dated April 26, 2012, he states, *I am uncertain that the hydrogeological conceptual model includes all possible contaminant migration pathways away from the proposed landfill area. It appears to me that there is a potential for groundwater flow and contaminant migration from the proposed landfill towards the western property boundary which has not been included in the conceptual model. Additional investigation (monitoring well installation) is needed to determine the direction(s) of flow away from the proposed waste fill area.* Until the groundwater flow conditions west of the site are adequately delineated, I must error on the side of caution and maintain there is a potential risk that leachate contaminated groundwater from the expansion area could potentially discharge to the low lying swamp area which discharges to the unnamed tributary of Golden Lake.

If you have any questions or comments regarding the above, I would be pleased to discuss them with you.

Laurel Rudd

Laurel Rudd
LR/sh

c: File SW-05-04 (Township of Bonnechere Valley)
Lance Larkin, Ottawa District Office
Tara MacDonald, Ottawa District Office
LR

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Environmental Assessment and Approvals Branch

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Ontario

MEMORANDUM

June 20, 2012

To: Kyle Stephenson, Hydrogeologist
Technical Support Section - Groundwater
Eastern Region

From: Dale Gable, P.Eng.
Senior Review Engineer – Team 1
Approval Services Section
Environmental Approvals Branch

Re: Rudy Road Waste Disposal Site

At the request of Eastern Region, I was asked to review the letter report entitled "Constant Chloride Concentrations – Hydrogeologic Modeling Environmental Screening of Capacity Expansion at Ruby Road Waste Disposal Site" prepared by Cambium Environmental and dated May 31, 2012. The letter report provides a rationale for the use of a lower initial chloride concentration in the modeling of the proposed expansion compared to the initial chlorides concentrations levels provided in the Landfill Standards Guideline. Based on my review I am providing the following comment:

1. Cambium provided an overview of their study on small eastern Ontario landfills of similar size and waste nature. The overview does not indicate whether or not the site's that were reviewed are currently active or whether the sites are closed. The concern with using sites that are active is that the chloride concentrations may not have reached their maximum levels.

   Therefore, the values provided may not be indicative of peak chloride concentrations. As a result, it would be difficult to accept the rationale provided without clarification on the information.

2. Cambium did not indicate whether the samples were collected from leachate monitors or from groundwater monitors surrounding the site. It is important to use leachate monitors to ensure the initial concentrations are representative of leachate.

   As a result, it would be difficult to accept the rationale provided without clarification.

3. The proposed waste density as indicated on page 3 of the letter report is considered to be at the low end of the spectrum. Cambium should provide their rationale for using waste density. It the EAB's recommendation that a higher waste density.

4. Cambium provided a second rationale for using a chloride concentration other than the values provided in the Landfill Standards Guideline. The rationale used the rationale provided in a paper prepared by Jim Gehrels and Mark Pummala (2000) that addresses predicting chloride concentrations in landfills in Northern Ontario. Cambium is assuming that the site characteristics of the Ruby Road Landfill Site are similar in nature to small landfill sites in northern Ontario.

5. For site specific design, Regulation 232/98 and the Landfill Standards Guideline does allow for alternative initial concentrations be used in the design of a site for a site located in a geographic area where more representative leachate data is available. The approach taken with this Site is consistent with sites located in northern Ontario. Therefore the approach is considered to be acceptable.

   The ministry's Technical Support Section and District Office should confirm that the site characteristics and properties are consistent with the intent of the paper prepared by Jim Gehrels and Mark Puumala. For example, the paper addressed sites having permeable soils with hydraulic conductivities ranging from 4×10^{-7} to $2X10^{-4}$. Cambium should provide a table listing all the characteristics from the paper and compare those to actual site conditions to ensure they fall within the range for each item. If the Township can show the Rudy Road Landfill Site is similar in nature to the type of sites that the paper was intended to address, then the approach should be considered acceptable.

6. Utilizing this rationale, Cambium estimated that the peak chloride concentration would be 590 mg/L.

7. The Township will need to ensure a ministry approved groundwater and leachate monitoring program will be in place to ensure the Site can be monitoring to determine compliance with Guideline B-7. It is recommended that a leachate monitoring well be installed in the waste to ensure leachate concentrations can be monitored.

8. It is recommended that should the Township complete the Environmental Screening Process that as part of the Environmental Protection Act approval submission they provide a trigger mechanism and contingency plan to monitor the chloride concentrations. The contingency plan will need to address any off-site impacts due to higher than predicted chloride concentrations in the leachate

9. In the event, chloride concentration levels in the leachate are higher than predicted, the Township should model the leachate plume using the initial chloride values stated in Landfill Standard Guidelines and prepare necessary contingency plans to ensure there are no off-site impacts.

If you require any further comments, please contact me at (416) 314-5138 or dale.gable@ontario.ca.

Dale Gable
Senior Review Engineer
Approval Services Unit – Team 1
Environment Approvals Branch
Ministry of the Environment

Ministry of the Environment

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Ontario

MEMORANDUM

October 10, 2012

TO: V. Mitchell
Environmental Assessment Coordinator
Technical Support Section
Eastern Region

FROM: K. Stephenson
Hydrogeologist
Technical Support Section
Eastern Region

RE: Ruby Road Waste Disposal Site
Proposed Expansion / Environmental Screening
Certificate of Approval A411501
Lot 27, Concession 9, Geographic Township of South Algona

Purpose

I previously reviewed groundwater information related to the expansion of the Ruby Road Waste Disposal Site. Based on that review, I provided the following recommendations (refer to memorandum dated April 26, 2012):

1. Additional investigation (monitoring well installation) is needed to determine the direction(s) of flow away from the proposed waste fill area.

2. The MOE groundwater unit has previously requested additional investigation from the proposed Contaminant Attenuation Zone (CAZ) downgradient of the site (refer to memorandum dated July 28, 2011). This investigation would improve the certainty related to field measurements and model inputs (e.g. hydraulic conductivity). Additional monitoring wells should be installed to characterize conditions in the proposed CAZ area.

3. Cambium should revise the source chloride concentration used in the numerical model.

4. Cambium should develop a contaminating lifespan estimate and then run the model for an appropriate time to determine estimated maximum concentration at the property boundary.

5. The Township has recognized that they must address non-compliance with Guideline B-7 at the existing Ruby Road site prior to expansion of the site. The Township / Cambium has estimated that the northern portion of Lots 27 and 26, Concession 9 would be adequate to comply with Guideline B-7 (refer to Cambium letter dated January 19, 2012). Delineation of groundwater impacts should be completed in order to confirm the required extent of an expanded Contaminant Attenuation Zone.

6. I have based my review on a review of available documents but I would like to visit the site to better understand conditions in the area.

Additional work has been completed by the Township / Cambium to respond to the first five items above and this is documented in the report entitled "Numerical Hydrogeological Modeling Report for Expansion Feasibility of the Ruby Road Waste Disposal Site" completed by Cambium on behalf of the Township and dated September 7, 2012. I have also had an opportunity to visit the site.

The purpose of this review is to provide comments on additional investigation and assessment completed by the Township / Cambium. I have summarized my overall conclusions and recommendations relating to the proposed waste disposal site expansion at the end of this memorandum for your consideration.

Additional Groundwater Investigation and Assessment

In order to address point 1 above, additional monitoring wells were installed at the site. Monitoring wells MW9 and MW10 were installed to the northwest and west of the proposed expansion area and groundwater levels were measured in order to further evaluate groundwater flow direction in the area surrounding the proposed new waste footprint. Initial results indicate groundwater flow towards the east / northeast generally consistent with past interpretation of groundwater flow direction.

Monitoring well MW11 was installed to address point 2 above and hydraulic conductivity was assessed using hydraulic testing at the well (slug tests). The monitoring well was installed in the bedrock unit and hydraulic conductivity was calculated to be 5.91×10^{-6} m/s within the range calculated at other bedrock wells.

In order to address point 3, Cambium increased the chloride concentration to 590 mg/L following guidance from previous work at sites with similar conditions to the Ruby Road site. This increased chloride concentration resulted in a larger simulated groundwater plume requiring additional CAZ land to maintain compliance with Guideline B-7.

To address point 4, Cambium has completed a contaminating lifespan calculation and run the model for an extended period of time in order to adequately assess potential impacts. Additional guidance was provided by MOE Environmental Approvals Branch related to the contaminating lifespan calculation.

To address point 5, the Township / Cambium has identified an expanded proposed CAZ on Figure 12 of the groundwater modeling report dated September 7, 2012. It is understood that the Township / Cambium expects that this CAZ should address non-compliance with Guideline B-7 at the existing site and will be adequate to maintain site compliance with Guideline B-7 if the proposed site is approved.

Discussion

There have been several exchanges of information between the MOE Groundwater Unit and Cambium related to the ability of the numerical model to simulate real conditions at the site and predict future conditions. Cambium has indicated that model input parameters are highly conservative and as such model output should overestimate potential groundwater impacts. Cambium has also completed some sensitivity analysis to reduce the uncertainty associated with model output. In general, there is always significant uncertainty associated with a groundwater model usually related to the hydrogeological conceptual model and / or various assumptions associated with model input parameters (parameters measured based on field work or otherwise assumed / estimated, e.g. groundwater levels, hydraulic conductivity, source concentrations and recharge). Although some model input is based on field testing and the model is calibrated to available field observations, the predictive model does not typically provide a unique result. Therefore, it is important to ensure that the conceptual model is correct and that a range of potential conditions at a site are considered as part of the modeling work in order to predict potential impacts using a precautionary approach. The hydrogeological conceptual model must be correct to form the basis of a useful numerical model. The conceptual model is also used to guide the groundwater monitoring program so that all potential contaminant transport pathways are appropriately monitored.

In order to further develop the conceptual model, Cambium has completed additional work to further investigate the groundwater flow direction away from the proposed expansion area. This work included installation of additional monitoring wells to the northwest and west of the site. The majority of boreholes at the site have shown no significant water bearing unit above the interface zone between overburden and bedrock (borehole drilling generally shows "dry" material in boreholes above the interface zone). The unsaturated zone is typically thick and is comprised of silty sand with occasional clay seams underlain by sand and gravel. In some cases, drilling has extended into bedrock before groundwater has been encountered. These observations indicate that overburden at the site is well drained down to the interface zone where the main pathway for groundwater flow (and contaminant transport) is expected to occur. The exception to this pattern occurs at recently installed monitoring wells MW10 and MW9. At these wells thicker saturated zones in overburden are observed above the main assumed contaminant transport pathway (the overburden bedrock interface). Despite the thicker saturated zone in overburden observed at these wells, initial water levels indicate northeasterly / easterly groundwater flow consistent with the established conceptual model for the site. Based on additional investigation, the interpreted groundwater flow direction does not indicate groundwater flow from the area of the proposed expansion towards the western property boundary. The investigation indicates that the western

property boundary will not be hydraulically downgradient of the proposed waste fill area and therefore impacts to the wetlands located west of the site are not expected. Additional water level measurement at all site monitoring wells should be undertaken to confirm initial results.

The Township / Cambium has indicated that an expanded CAZ to the east / northeast of the site would be adequate to address both Guideline B-7 exceedences at the existing site and maintain compliance with Guideline B-7 for the expanded site. The CAZ area has been expanded (from the initial proposal) to include land on both lots 27 and 26, Concession 9 as shown on Figure 12 of the modeling report. This proposed CAZ area provides for approximately 600 metres between the proposed / expanded waste fill area and the hydraulically downgradient CAZ boundary. The proposed CAZ provides for approximately 450 metres between the waste fill area at the existing site and the hydraulically downgradient CAZ boundary. This expanded CAZ area is expected to be adequate to maintain compliance with Guideline B-7 for the existing and expanded sites based on the information provided. If site expansion is approved, installation of additional monitoring wells and ongoing monitoring would be necessary to ensure that compliance with Guideline B-7 is maintained during operation of the site.

Given the uncertainty with respect to groundwater modeling discussed above and the proposal to rely on natural attenuation at this site, I recommend a phased development / adaptive management approach with detailed groundwater monitoring to assess phased development of the site. Detailed groundwater monitoring will provide an opportunity to confirm the results of the investigation and predictive modeling on an ongoing basis.

This approach should consider the following:

- the initial phases of the waste disposal site should be located in the eastern portion of the proposed waste footprint allowing monitoring in all directions away from the new fill area while maximizing buffer areas between waste and the nearest property boundaries;

- observations from site monitoring wells should be compared to predictive modeling to ensure that contaminant migration is acceptable and in general agreement with predictions as part of regular annual monitoring / reporting;

- the need for additional wells closer to the initial waste fill area should be evaluated so that model predictions can be assessed in a reasonable time frame following phased development of the site;

- if observations confirm model predictions then further development can proceed however, if observations are unexpected and any problem is identified following incremental development of the site, then the site design may need to be modified; and,

- monitoring wells should be constructed as multilevel monitoring wells with intervals at the interface zone and in overburden at locations where significant groundwater is encountered in the overburden unit.

Within the Environmental Screening Report, the Township / Cambium has indicated that additional wells would be installed if the expansion is approved and that a revised groundwater trigger mechanism and contingency plan would be developed and submitted for MOE review. I am in agreement with this approach and I recommend that additional wells should be considered along the boundaries of the proposed CAZ.

I also recommend that the proposed setback between the waste fill area and the western property boundary be further assessed. The Township / Cambium have recommended a 30 metre setback however a greater setback distance may be preferred to ensure that any leachate mounding and / or drainage effects can be controlled inside the Township owned property. The Township should consider modifying the waste fill footprint to allow for 50 metre or 100 metre setback from the western property boundary.

Conclusions and Recommendations

I recommend that an additional round of groundwater level measurements is completed at all site monitoring wells to confirm water levels measured at recently installed monitoring wells and to confirm the overall conceptual model. If water levels confirm the current conceptual model and understanding of groundwater flow direction, I can accept the hydrogeological investigation undertaken at the Environmental Screening stage of the expansion proposal. Water levels should be measured and an updated interpretation of groundwater flow direction should be submitted for review. Once this information is submitted, I will provide further comment on the expansion proposal.

I recommend that the other items raised in the previous section are addressed if the proposal is approved. If the proposal is approved, these items should be incorporated within the Environmental Compliance Approval for the site.

The Township should update the Environmental Screening Report to include the updated information contained in the report entitled "Numerical Hydrogeological Modeling Report for Expansion Feasibility of the Ruby Road Waste Disposal Site" completed by Cambium and dated September 7, 2012. This will provide an opportunity for the public to review and comment on this information.

K. Stephenson, M.Sc., P.Eng.
KMS/FC/gl

ec: E. Tieu
L. Grills
T. MacDonald
D. Gable - Senior Review Engineer, Approvals Services Unit, Environmental Approval Services Section, Environmental Approvals Branch, Ministry of the Environment, 2 St. Clair Avenue West, Floor 12A, Toronto, Ontario, M4V 1L5

c: F. Crossley/File GW 03-03 BOVA, Ruby Road WDS (A411501)
KMS/IDS #6315-8UXRLW

Karen Mann

From: John Desbiens
Sent: Monday, June 04, 2007 7:35 AM
To: Karen Mann
Cc: Christine Wolf
Subject: FW: 07-1219-001 : Ruby Road Waste Disposal Site Capacity Clarification for Reg. 101/07 Purposes

To file

From: Lesieur, Marc-Etienne (ENE) [mailto:Marc.Lesieur@ontario.ca]
Sent: Friday, June 01, 2007 3:46 PM
To: John Desbiens
Cc: Bryan Martin; Heeney, Paul (ENE); Mitchell, Vicki (ENE)
Subject: RE: 07-1219-001 : Ruby Road Waste Disposal Site Capacity Clarification for Reg. 101/07 Purposes

Hi John,

At your request I have conducted a preliminary review of the Ruby Road Waste Disposal Site file to determine whether the site approved capacity is the theoretical maximum available capacity (TMAC) of 47,650 m3 as indicated in your letter and the letter report dated July 21, 1999 submitted by The Greer Galloway Group Inc to the Township of South Algona (amalgamated to the Bonnechere Valley Township).

At this point in time, I cannot provide a confirmation that the site approved capacity is related to the TMAC of 47,650 m3. In my opinion, there are several items that require clarifications prior to confirming the site approved capacity. I suggest that further discussions be held between the MOE and the Township to confirm the site approved capacity.

With respect to the applicability of O.Reg 101/07 and other Acts and Regulations, I can convey that I am waiting for a number of my colleagues to provide me with information which I regret is not available at this time. I will however strive to have a Ministry position in a reasonable timeframe, keeping in mind that O.Reg 101/07 is relatively recent and requires careful consideration based on site specific issues.

Sincerely,

Marc-Etienne LeSieur
Senior Environmental Officer
Ontario Ministry of the Environment
Ottawa District Office
2430 Don Reid Drive
Ottawa, ON, K1H 1E1
tel: 613-521-3450 ext. 229
fax: 613-521-5437
Toll free: 1-800-860-2195

From: John Desbiens [mailto:john.desbiens@cambium-env.com]
Sent: May 18, 2007 3:26 PM

To: Lesieur, Marc-Etienne (ENE)
Cc: Bryan Martin; Heeney, Paul (ENE)
Subject: 07-1219-001 : Ruby Road Waste Disposal Site Capacity Clarification for Reg. 101/07 Purposes

Hello Marc,
Please refer to the attached correspondence and documentation. Should you have any questions, please don't hesitate to contact me.
Enjoy the long weekend.

Kind regards,

John Desbiens, P.Eng.

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Karen Mann

From: Christine Teixeira
Sent: Friday, December 21, 2007 10:48 AM
To: nafiseh.pourhassani@ontario.ca
Cc: Bryan Martin (bryanm@eganville.com); John Desbiens; Karen Mann
Subject: 07-1219-001 Ruby Road Waste Disposal Site Capacity Determination
Attachments: 2006013D - Bryan Martin Letter Dec 18 07.pdf

Hi Mr. Pourhassani:

In response to your correspondence dated December 6, 2007 regarding the amendment to the Ruby Road Waste Disposal Site Certificate of Approval (MOE Reference No. 3653-78KJX4) to include an explicit approved capacity value, please find attached a letter from the original author of the 1999 Greer Galloway Group Site Capacity Study, Mr. Kevin Mooder currently of Jp2g Consultants Inc.

As indicated in the attached correspondence, the site was a former gravel pit which had subsequently received waste while operating using the trench method and modified area method. It was assumed that a 3 to 4 metre trench depth had occurred (as limited by the excavation equipment) and a 3 to 4 metre lift was being developed to match the original ground elevation of the site, for a total depth of waste of approximately 7.0 metres.

If you have any questions concerning this email, please contact me.

Regards,

Christine Teixeira (Wolf), B.A.Sc., EIT
Project Specialist

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christine.teixeira@cambium-env.com

Please note that my email address has recently changed to christine.teixeira@cambium-env.com. Please update your contact list accordingly.

Karen Mann

From: Christine Teixeira
Sent: Monday, January 07, 2008 11:38 AM
To: John Desbiens
Cc: David Bucholtz; Karen Mann
Subject: FW: 07-1219-001 Ruby Road Waste Disposal Site Capacity Determination

John:

Below is a draft C of A for Ruby Road recognizing the TMAC, which is good news for the ESP, we can increase the capacity up to 100,000 m^3 above this TMAC. I had a look at it and I have no proposed changes. Please review and let me know if you have any suggested changes and then we can back to the MOE.

If you have any questions concerning this email, please contact me.

Regards,

Christine Teixeira (Wolf), B.A.Sc., EIT
Project Specialist
Cambium Environmental Inc.

Please note that my email address has recently changed to christine.teixeira@cambium-env.com. Please update your contact list accordingly.

From: Pourhassani, Nafiseh (ENE) [mailto:Nafiseh.Pourhassani@ontario.ca]
Sent: January 7, 2008 10:16 AM
To: Christine Teixeira
Subject: RE: 07-1219-001 Ruby Road Waste Disposal Site Capacity Determination

Hi Christine,

Copied below you will find a draft amendment for Ruby Rd landfill. Could you please review with appropriate staff and let me know as soon as possible if there are any comments.

Regards,

Nafiseh Pourhassani, P. Eng.
Senior Review Engineer
Waste Unit
Environmental Assessment and Approvals Branch
Ministry of the Environment
2 St. Clair Ave West, 12th floor
Toronto, ON, M4V 1L5
T. 416-314-7029
F. 416-314-7166

The Corporation of the Township of Bonnechere Valley
49 Bonnechere St E
Post Office Box, No. 100
Eganville, Ontario, K0J 1T0

Site Location: Ruby Road Waste Transfer Site
Lot 27, Concession 9, South Algona Twp.
Bonnechere Valley Municipality, County of Renfrew

You are hereby notified that I have amended Provisional Certificate of Approval No. A411501 issued on September 16, 1974, and amended on December 18, 2002 and November 5, 2003 for a 0.5 hectare waste disposal site (landfill and transfer station), as follows:

In accordance with Application for a Provisional Certificate of Approval for a Waste Disposal Site, dated October 31, 2007, and the following supporting documentation:

1. Letters dated November 15, 2007 and October 31, 2007 from Cambium Environmental
2. Letter dated July 21, 1999, from The Greer Galloway Group Inc. RE: Ruby Road Landfill Site Capacity Study
3. Letter dated December 18, 2007 from Jp2g Consultants Inc to the Township of Bonnechere Valley, Regarding explanation of depth used for capacity calculation

the following condition is added to the Certificate:

37. a) The maximum theoretical approved capacity of the Site using the 1993 Ministry Landfill Capacity Determination protocol, is calculated to be 47,650 cubic meters which includes daily cover, interim cover and waste.

b) The Site was closed in accordance with the November 5, 2003 Certificate, prior to the maximum theoretical approved capacity being completely utilized. Reopening and utilization of the remainder of the capacity will require a complete application and supporting documentation for Director's approval.

The reason for this amendment to the Certificate of Approval is as follows:

1. The reason for this amendment is to include the maximum theoretical capacity for this site as a condition.

This Notice shall constitute part of the approval issued under Provisional Certificate of Approval No. A411501 dated September 16, 1974 and subsequent amendments.

In accordance with Section 139 of the Environmental Protection Act, R.S.O. 1990, Chapter E-19, as amended, you may by written notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 142 of the Environmental Protection Act, provides that the Notice requiring the hearing shall state:

1. The portions of the approval or each term or condition in the approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to <u>each</u> portion appealed.

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The Certificate of Approval number;
6. The date of the Certificate of Approval;
7. The name of the Director;
8. The municipality within which the waste disposal site is located;

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*****
Environmental Review Tribunal
2300 Yonge St., Suite 1700
P.O. Box 2382
Toronto, Ontario
M4P 1E4

<u>AND</u>

The Director
Section 39, *Environmental Protection Act*
Ministry of the Environment
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

*** Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 314-4600, Fax: (416) 314-4506 or www.ert.gov.on.ca**

The above noted waste disposal site is approved under Section 39 of the Environmental Protection Act.

DATED AT TORONTO this .....

Signature
....., P.Eng.
Director
Section .....

NP/
c: District Manager, MOE Ottawa
John Desbiens, Cambium Environmental Inc.

Karen Mann

From: Christine Teixeira
Sent: Monday, January 07, 2008 12:06 PM
To: Pourhassani, Nafiseh (ENE)
Cc: Karen Mann
Subject: RE: 07-1219-001 Ruby Road Waste Disposal Site Capacity Determination

Hi Nafiseh:

We have reviewed the draft PC of A for the Ruby Road waste disposal site you sent this morning and we have no proposed changes.

If you have any questions concerning this email, please contact me.

Regards,

Christine Teixeira (Wolf), B.A.Sc., EIT
Project Specialist
Cambium Environmental Inc.

Please note that my email address has recently changed to christine.teixeira@cambium-env.com. Please update your contact list accordingly.

From: Pourhassani, Nafiseh (ENE) [mailto:Nafiseh.Pourhassani@ontario.ca]
Sent: January 7, 2008 10:16 AM
To: Christine Teixeira
Subject: RE: 07-1219-001 Ruby Road Waste Disposal Site Capacity Determination

Hi Christine,

Copied below you will find a draft amendment for Ruby Rd landfill. Could you please review with appropriate staff and let me know as soon as possible if there are any comments.

Regards,

Nafiseh Pourhassani, P. Eng.
Senior Review Engineer
Waste Unit
Environmental Assessment and Approvals Branch
Ministry of the Environment
2 St. Clair Ave West, 12th floor
Toronto, ON, M4V 1L5
T. 416-314-7029
F. 416-314-7166

Ontario

Ministry of the Environment **Ministère de l'Environnement**

AMENDMENT TO PROVISIONAL CERTIFICATE OF APPROVAL
WASTE DISPOSAL SITE

The Corporation of the Township of Bonnechere Valley
49 Bonnechere St E
Post Office Box, No. 100
Eganville, Ontario, K0J 1T0

Site Location: Ruby Road Waste Transfer Site
Lot 27, Concession 9, South Algona Twp.
Bonnechere Valley Municipality, County of Renfrew

You are hereby notified that I have amended Provisional Certificate of Approval No. A411501 issued on September 16, 1974, and amended on December 18, 2002 and November 5, 2003 for a 0.5 hectare waste disposal site (landfill and transfer station), as follows:

In accordance with Application for a Provisional Certificate of Approval for a Waste Disposal Site, dated October 31, 2007, and the following supporting documentation:

1. Letters dated November 15, 2007 and October 31, 2007 from Cambium Environmental
2. Letter dated July 21, 1999, from The Greer Galloway Group Inc. RE: Ruby Road Landfill Site Capacity Study
3. Letter dated December 18, 2007 from Jp2g Consultants Inc to the Township of Bonnechere Valley, Regarding explanation of depth used for capacity calculation

the following condition is added to the Certificate:

37. a) The maximum theoretical approved capacity of the Site using the 1993 Ministry Landfill Capacity Determination protocol, is calculated to be 47,650 cubic meters which includes daily cover, interim cover and waste.

b) The Site was closed in accordance with the November 5, 2003 Certificate, prior to the maximum theoretical approved capacity being completely utilized. Reopening and utilization of the remainder of the capacity will require a complete application and supporting documentation for Director's approval.

The reason for this amendment to the Certificate of Approval is as follows:

1. The reason for this amendment is to include the maximum theoretical capacity for this site as a condition.

This Notice shall constitute part of the approval issued under Provisional Certificate of Approval No. A411501 dated September 16, 1974 and subsequent amendments.

In accordance with Section 139 of the Environmental Protection Act, R.S.O. 1990, Chapter E-19, as amended, you may by written notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 142 of the Environmental Protection Act, provides that the Notice requiring the hearing shall state:

1. The portions of the approval or each term or condition in the approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;

5. The Certificate of Approval number;
6. The date of the Certificate of Approval;
7. The name of the Director;
8. The municipality within which the waste disposal site is located;

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*****
Environmental Review Tribunal
2300 Yonge St., Suite 1700
P.O. Box 2382
Toronto, Ontario
M4P 1E4

AND

The Director
Section 39, *Environmental Protection Act*
Ministry of the Environment
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

*** Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 314-4600, Fax: (416) 314-4506 or www.ert.gov.on.ca**

The above noted waste disposal site is approved under Section 39 of the Environmental Protection Act.

DATED AT TORONTO this .....

Signature
....., P.Eng.
Director
Section .....

NP/
c: District Manager, MOE Ottawa
John Desbiens, Cambium Environmental Inc.

Karen Mann

From: Lesieur, Marc-Etienne (ENE) <Marc.Lesieur@ontario.ca>
Sent: Wednesday, January 23, 2008 3:15 PM
To: Sadie Bachynski
Cc: Christine Teixeira; John Desbiens; Karen Mann; Wilcox, Beth (ENE); Kehoe, Paul (ENE)
Subject: RE: 07-1219-001 Township of Bonnechere Valley request for information from MOE

Good day,

As per your request we are arranging for the entire ministry file to be scanned and provided to you, except the reports identified below.

Hope this will be of benefit to your study.

Marc-Etienne LeSieur
Senior Environmental Officer
Ontario Ministry of the Environment
Ottawa District Office
2430 Don Reid Drive
Ottawa, ON, K1H 1E1
tel: 613-521-3450 ext. 229
fax: 613-521-5437
Toll free: 1-800-860-2195

From: Sadie Bachynski [mailto:sadie_bachynski@cambium-env.com]
Sent: January 9, 2008 1:26 PM
To: Lesieur, Marc-Etienne (ENE)
Cc: Christine Teixeira; John Desbiens; Karen Mann
Subject: 07-1219-001 Township of Bonnechere Valley request for information from MOE

Dear Mr. LeSieur:

As you may be aware, the Township of Bonnechere Valley (Township) has initiated the Environmental Screening Process (ESP) in accordance with Ontario Regulation 101/07 under the *Environmental Assessment Act* (EAA). This regulation is directed partially at small, rural waste disposal sites and select waste projects are deemed exempt from Part II of the EAA if the environmental screening process is completed. The ESP is intended to determine the feasibility of a capacity expansion at the Ruby Road waste disposal site as a long-term (25-year) solution that will best meet the needs of the municipality with respect to the management of municipal solid waste generated within its boundaries.

The Ruby Road waste disposal site is located at 2213 Ruby Road, Lot 27, Concession 9, in the geographic Township of South Algona, in the amalgamated Township of Bonnechere Valley, in the county of Renfrew.

At this time Cambium retains copies of the following documentation from the MOE with respect to the site in query:

- Certificate of Approval A411501, prepared by the Ministry of the Environment, September 16, 1974, amended December 18, 2002 and November 5, 2003

- Bonnechere Valley Waste Management Study, presented by Bryce G. Bell, May 2000 Site Closure and Waste Transfer Facility Operations Plan, Prepared by Jp2g Consultants Inc., August 2002
- Non-Hazardous Waste Transfer Processing Inspection Report, prepared by Ministry of the Environment, Ottawa District Office, May 28, 2004
- Ruby Road Waste Disposal Site, Township of Bonnechere Valley, 2003 Annual Report, prepared by Jp2g Consultants Inc, March 2004
- 2004 Annual Report, Ruby Road Waste Disposal Site, prepared by SGS Lakefield Research Limited, March 28,2005
- 2005 Annual Report, Ruby Road Waste Disposal Site, prepared by SGS Lakefield Research Limited, March 27,2006
- 2006 Annual Report, Ruby Road Waste Disposal Site, prepared by Cambium Environmental Inc., April 24,2007

Cambium requests any further information the MOE Ottawa District Office feels may be pertinent to the background data collection for this project.

The Township of Bonnechere Valley (Township) and Cambium sincerely appreciate you cooperation in this matter.

If you have any questions regarding this submission, please do not hesitate to contact me at (705)742-7900 ext 213.

Regards,

Sadie Bachynski, B.A.Sc.
Junior Project Specialist

Cambium Environmental Inc.
PO Box 325, 2085 Whittington Drive, Unit 2
Peterborough, Ontario K9J 6X4
T. 705.742.7900 ext.213
866.217.7900
F. 705.742.7907
M. 705.768.7030
E. sadie.bachynski@cambium-env.com

Stephanie Reeder

From: John Desbiens
Sent: Wednesday, November 16, 2011 8:37 AM
To: Cambium File (file@cambium-env.com)
Cc: Andrea Zavitz Coppins; Stephanie Reeder (kayakburleigh@gmail.com); 'Dave Bucholtz'
Subject: FW: Ruby Road Waste Disposal Site - Draft Environmental Screening Report (1219-001)
Attachments: Ruby Road sw.pdf

Best regards,

John P. Desbiens, P.Eng., President
Cambium Environmental Inc.

From: Mitchell, Vicki (ENE) [mailto:Vicki.Mitchell@ontario.ca]
Sent: November-15-11 3:15 PM
To: John Desbiens; Bryan Martin
Cc: Larkin, Lance (ENE); Grills, Laurel (ENE); Gable, Dale (ENE); MacDonald, Tara (ENE); Burns, Steve (ENE); Taylor, Peter (ENE)
Subject: Ruby Road Waste Disposal Site - Draft Environmental Screening Report

Hello John and Bryan,

Eastern Region staff have some additional comments on the draft Environmental Screening Report. We recommend that these comments be addressed during the environmental assessment process for the project.

I have attached the comments from Laurel Grills, Surface Water Evaluator. The attached comments will need to be addressed as part of the environmental assessment process. Ms Grills comments include support for the further determination of groundwater movement and direction, and concerns that there is potential risk that leachate contaminated groundwater from the expansion area could potentially discharge to the low lying swamp area which discharges to the unnamed tributary of Golden Lake. Ms Grills also comments that the proposed expansion area is closer to a surface water feature considered by MNR as likely permanent in nature. Please refer to the attached memorandum for the complete comments.

The report indicates that the existing and proposed landfill areas are included within a 33 hectare lot. The Township would like to use the remainder of the 47,650 m3 theoretical capacity for the existing, closed landfill area, and proposes a new waste disposal area within the 33 ha lot. The waste disposal site is proposed in the Report to be a natural attenuation site. The Report (p. 4) indicates that the surrounding lands are available for purchase of a Contaminant Attenuation Zone (CAZ), and that "the Township has the ability to acquire the 33 ha property surrounding the existing WDS". From this description, it appears that the 33 hectare lot within the "proposed property boundary" (shown on figures 5, 6 and 8) does not currently belong to the Township. The figures do not show the contaminant attenuation zone, or the boundary of the property currently owned by the Township. After MOE's comments on the hydrogeologic aspects of the

proposed project have been addressed to the satisfaction of our Water Resources staff, and an appropriately sized CAZ has been proposed, the figures in the ESR should be changed to show the lands owned by the Township, the proposed CAZ, and privately owned lands, in addition to the proposed waste disposal site property boundary. Note that the MOE hydrogeologist commented on the draft ESR and related reports, and indicated that an appropriately sized CAZ will likely require legal care and control of subsurface areas in Lot 26 and 27, Concession 9, former Township of South Algoma.

The information on Aboriginal consultation appears to be incomplete. For example, Appendix I does not appear to include a response from the Ministry of Aboriginal Affairs, any record of consultation with the Algonquins of Ontario consultation office, and no response from the Algonquins of Pikwàkanagàn First Nation. In the middle of Appendix I there is a list of aboriginal communities and agencies contacted, but the actual letters and emails are not always included. It would be helpful to expand this list into a table indicating dates and methods of contact (letter, email, phone call, meeting) and summary of contact (issues raised). Page 21 of the Report states that Chief Kirby Whiteduck and the consultant for the Algonquins of Eastern Ontario were to be kept informed of project developments, and that they have been involved throughout the consultation process. However, the letters in appendix I only show letters and emails to the Algonquins of Pikwàkanagàn, the most recent contact being in 2008. We recommend that this information be updated.

These comments are in addition to my July 29, 2011 email and the attached comments from Shawn Kinney.

As we had discussed previously, if you would like to discuss MOE's technical comments further, please contact this office or the Ottawa District office. We would be happy to meet or teleconference with you at your convenience.

Vicki Mitchell
Environmental Assessment Coordinator
Ministry of the Environment, Eastern Region

1259 Gardiners Road, P.O. Box 22032,
Kingston, ON K7M 8S5

(613) 540-6852

Sarah Ford

From: Stephenson, Kyle (ENE) <Kyle.Stephenson@ontario.ca>
Sent: Friday, May 11, 2012 10:30 AM
To: Stephanie Reeder; John Desbiens; Mitchell, Vicki (ENE); Bryan Martin; Taylor, Peter (ENE); Kevin Warner; Tieu, Emily (ENE)
Subject: FW: Ruby Road Landfill
Attachments: 001867589.pdf

Hello Bryan and John

I have had a chance to speak with our landfill approvals engineer, Mr. Dale Gable regarding the approach that we discussed on Wednesday for determining chloride levels in leachate for design / risk assessment purposes.

Dale has indicated to me that there is flexibility to deviate from the 1500 – 2500 mg/L chloride design level specified in Ontario Regulation 232/98 based on site specific information. Dale indicated that an appropriate level of supporting information is required in order to approve an alternate design level.

I suggest that you put together a brief letter with information to support the 561 mg/L chloride level that we discussed on Wednesday. I recommend that you include the previous rationale for using 300 mg/L, the calculation based on the paper that I discussed in my recent memorandum resulting in a chloride concentration of 561 mg/L (paper is attached) and any other information that is relevant to support deviation from the 1500 – 2500 mg/L range specified in the regulation (I know that you included some of this information in your recent memo dated May 8, 2012).

If you send this document to me, I will forward the information to Mr. Gable for his review. Mr. Gable indicated that he would be able to review this information quickly and provide comments back. Assuming that the 561 mg/L chloride level is accepted for design / risk assessment purposes, you could then move forward with further modeling and site characterization as we discussed. Based on my discussions with Mr. Gable, I recommend that a constant chloride concentration be applied at the landfill footprint (this has already been done in previous modeling) so that a precautionary approach is maintained.

Mr. Gable also indicated that the waste density calculation in your contaminating lifespan calculation is too low (you specified 300 kg/m3 in your May 8, 2012 letter). A range of between 650 kg/m3 and 900 kg/m3 is more realistic with 650 kg/m3 representing only minimally compacted waste. This calculation should be corrected but this would not be included as part of the modeling given that the more precautionary approach discussed above (constant concentration) will be applied in the model.

Please let me know if you have any questions or concerns.

Regards,

Kyle Stephenson P.Eng.
Hydrogeologist
Ministry of the Environment - Eastern Region
1259 Gardiners Road, Kingston ON K7P 3J6
Tel. 613 540-6877
Fax 613 548-6908
Cell 613 561-9506

Sarah Ford

From: Stephenson, Kyle (ENE) <Kyle.Stephenson@ontario.ca>
Sent: Thursday, August 09, 2012 3:31 PM
To: Stephanie Reeder; Kevin Warner; Mitchell, Vicki (ENE)
Cc: Taylor, Peter (ENE); bryanm@eganville.com; Tieu, Emily (ENE)
Subject: Ruby Road Landfill expansion
Attachments: fks-vlm-Ruby Road WDS April 18 2012.pdf

Hello Kevin and Stephanie

I have had a chance to review the updated numerical modeling report that you provided (dated July 27, 2012) and I have come up with a few preliminary questions / recommendations. I would like to hear from you on these points before I finalize my review. I also have a few questions regarding groundwater flow direction (new wells) and other recommendations in my last memo (attached). I think that you have worked to address all of the comments in my memo, I would just like to clarify the points below before I provide final comments.

1. The cross sections shown on Figure 5 of the report appear to combine water levels from deep bedrock below a confining zone (e.g. MW4-08) with those from the shallow bedrock / interface zone (e.g. BR1) to show the water table elevation. Given that these are two separate hydrostratigraphic units, they should be treated separately. I would like to see water levels from the main expected contaminant pathway (the shallow bedrock / interface zone) contoured and shown on a figure in the report using all available information (including new wells). This can be used to more easily compare with simulated water levels shown on Figure 7 of the report. Water level contouring was shown on Figure 9 of the EA report however I would like to see this updated based on information from all available wells (including the new wells). It would also be helpful to show contours for the elevation of the bedrock surface based on drilling at the site.

2. I would like clarification on the well installation methodology at the site. With the deep overburden / bedrock interface zone as the expected primary contaminant migration pathway, wells at the site have been installed in overburden above the bedrock, below the overburden in shallow bedrock only and also straddling the overburden / bedrock zone. I would like rationale for the differing well construction at the site and a proposed methodology for future well installation.

3. The hydraulic conductivity (k) distribution used in the model is shown on Figures 2 and 3 of the report. The k distribution is variable based on the variability of measured k in site monitoring wells. I am wondering why it appears that the fractured bedrock zone is not continuous in the model (usually this zone is assumed to occur in the upper weathered portion of bedrock). Also, Figure 2 shows an irregular bedrock surface elevation – I am wondering why overburden and bedrock have been simulated in the same model layer and not assigned to separate model layers (this is the approach that I have typically seen in the past). I am also wondering if the k distribution is responsible for the two “lobes” observed in the higher concentration area of the simulated plume on Figure 8.

4. Hydraulic conductivity values for some wells shown in Table 2 appear to be an average of values obtained from various interpretation methods (e.g. MW 11). The approach for developing the values presented in Table 2 should be provided. This is important because some of the curve fitting is not ideal (e.g. Hvorslev analysis for the test at MW11 – “slug out” test) so I would like to know how hydraulic conductivity values used in the model were determined.

5. The discussion on contaminant breakthrough provided on page 30 of the report is not clear to me. There is an indication that breakthrough at the proposed CAZ will not occur. Also it is stated that the maximum concentration at the CAZ boundary will be 115 mg/L at 36 years and that concentrations will only increase minimally beyond 36 years. This is not clear to me because I expect that there would be some contaminant breakthrough at the property boundary. Also, concentrations should not increase beyond the peak concentration. If you could plot the contaminant breakthrough over time (the breakthrough curve) at the property boundary this may provide clarification. I suspect that these issues may be related to the fact that a constant concentration is applied in the model however; additional clarification is required.

6. A figure in the report (potentially Figure 8) should show the boundaries of the proposed CAZ land.

7. Table 5 indicates that the distance from the base of fill at the proposed site to the water table is 8 metres – this seems low based on conditions shown on borehole logs and should be modified.

Also, I have asked Dale to take another look at the contaminating lifespan calculation and I hope to hear back from him on this soon. I think he may give Kevin a call to discuss this calculation further.

Please give me a call if you would like to discuss these points further (I am out of the office tomorrow but back next week). I don't think that these issues should be too difficult to address however I would like to get your input before I finish up.

Thank-you

Kyle Stephenson
Hydrogeologist
Ministry of the Environment - Eastern Region
1259 Gardiners Road, Kingston ON K7P 3J6
Tel. 613 540-6877
Fax 613 548-6908
Cell 613 561-9506

Stephanie Reeder

From: Mitchell, Vicki (ENE) <Vicki.Mitchell@ontario.ca>
Sent: Wednesday, November 14, 2012 9:00 AM
To: Stephanie Reeder
Cc: Kevin Warner; John Desbiens; Bryan Martin; Tieu, Emily (ENE); Gable, Dale (ENE); Rudd, Laurel (ENE); Dagg-Foster, Gillian (ENE); Taylor, Peter (ENE); MacDonald, Tara (ENE); Stephenson, Kyle (ENE)
Subject: FW: Ruby Road Landfill - Environmental Screening
Attachments: Ruby Road WDS - MOE Groundwater Comments Oct 2012.PDF

Hi Stephanie,

Thank you for your October 18, 2012 response. Please refer to Kyle Stephenson's comments in the email below.

MOE staff are satisfied with the hydrogeological investigation undertaken at the Environmental Screening stage. Please ensure that the Environmental Screening Report is updated to include all of the information provided to MOE for review, before the ESR is finalized and made available for public and government agency review.

When the ESR has been finalized, please send one hard copy of the ESR and appendices to the Kingston office (to the attention of Vicki Mitchell) and one hard copy of ESR and appendices to the Ottawa District office (to the attention of Emily Tieu). In addition, please send a copy on CD to both the Kingston and Ottawa offices. We look forward to reviewing the final ESR and providing comments. Copies of the ESR should be sent as soon as they are available, before or at the start of the final public comment period. In addition, please send me a copy of the Notice of Completion, and information on where the notice was published an on which dates.

Please note that Kyle raised additional recommendations in his October 10, 2012 memorandum that should be addressed at the Environmental Compliance Approval stage.

Vicki Mitchell
Environmental Assessment Coordinator
MOE Eastern Region
(613) 540-6852
1259 Gardiners Road
P.0. Box 22032, Kingston, K7M 8S5

From: Stephenson, Kyle (ENE)
Sent: November 13, 2012 4:05 PM
To: Mitchell, Vicki (ENE)
Cc: Taylor, Peter (ENE); Dagg-Foster, Gillian (ENE); Tieu, Emily (ENE)
Subject: Ruby Road Landfill - Environmental Screening

Hello Vicki

I have reviewed the letter from Cambium Environmental dated October 18, 2012 regarding additional water level measurements collected at the Ruby Road Landfill site in the Township of Bonnechere Valley.

As you know, I had requested one additional round of water level measurements in order to confirm the conceptual hydrogeological model for the site that has been proposed in relation to site expansion assessment under the Environmental Screening process (refer to my memorandum to you dated October 10, 2012 - attached).

I am satisfied that the additional round of water levels presented in the October 18th letter has confirmed the conceptual model and I can accept the hydrogeological investigation undertaken at the Environmental Screening stage.

Please note that I had raised additional recommendations in my October 10, 2012 memorandum that should be addressed if the expansion is approved. I also recommended that the Environmental Screening Report be updated and provided for public review and comment.

Please let me know if I can provide anything further.

Regards,

Kyle Stephenson
Hydrogeologist
Ministry of the Environment - Eastern Region
1259 Gardiners Road, Kingston ON K7P 3J6
Tel. 613 540-6877
Fax 613 548-6908
Cell 613 561-9506