MEMORANDUM

DATE: 21 February 2020
TO: Chris Prucha, Bill McDonough and Jim Forney, Waste Management (WM)
CC:
FROM: Madeleine Corriveau & François Richard, BluMetric Environmental Inc.
PROJECT NO: 200172-03
SUBJECT: Leachate Release Groundwater Sampling Results, Waste Management Richmond Landfill, Town of Greater Napanee

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This memorandum has been prepared to report on sampling requested by MECP Provincial Officer David Arnott (email dated January 30, 2020). The requested sampling was in addition to the sampling required by Item No. 3 of Provincial Officer's Order (POO) 3623-BL33DW issued on January 23, 2020 and amended on January 27, 2020. Results from the sampling required in the POO were reported to MECP on February 17, 2020.

The additional sampling requested by MECP was for:

- Groundwater samples from monitoring wells M60-1, M60-2, M60-3, M60-4, M128-2 and M134-2 for analysis of Tables 3 and 4 from the latest Environmental Monitoring Program (EMP) for the Site[1].

Sampling was completed on January 31, 2020. No sample was collected from monitoring well M134-2 because it was frozen. Samples were analyzed for the parameters set out in EMP Tables 3 and 4.

RESULTS

Monitoring well locations are shown on Figure 1 and sampling results are summarized in Table 1.

1,4-dioxane, the primary leachate indicator for the site, was less than the reportable detection limit of 0.001 mg/L for all monitoring wells sampled as part of this investigation.

[1] *Environmental Monitoring Plan, WM Richmond Landfill, Town of Greater Napanee, Ontario, rev. No.05*, prepared by BluMetric Environmental Inc., dated April 2016

Elevated mineralization was observed in monitoring wells M60-1, M60-2, M60-3 and M128-2. These are consistent with historical results at these locations where available (provided as Attachment 1) and other monitoring wells installed in the intermediate bedrock flow zone in some areas of the Site. Elevated concentrations of some constituents (e.g., chloride, sodium, conductivity and total dissolved solids), as well as the presence of BTEX constituents (benzene, toluene, ethylbenzene and xylenes), are indicative of naturally poor groundwater quality associated with connate water found in low permeability bedrock.

CONCLUSIONS & RECOMMENDATIONS

Results from the sampling event conducted on January 31, 2020 indicate no adverse impact to groundwater as a result of the leachate release that occurred on January 14, 2020 to the west of the North Lagoon.

Weekly surface water sampling at location S3 has been initiated by WM. Sampling location S3 is located in Marysville Creek near the downstream property boundary. Samples are being analyzed for the list of surface water parameters from the Environmental Monitoring Plan (EMP Table 8)[1]. Results from this sampling location represent surface water quality leaving the site. It is recommended that weekly sampling continue for a total period of 6 weeks at which point the need to continue weekly sampling will be re-evaluated and discussed with MECP.

It is recommended that each of the five monitoring wells sampled as part of this investigation, as well as monitoring well M134-2, be sampled for the same suite of parameters during the next routine monitoring event (typically scheduled for April) to verify that there are no impacts associated with the leachate release.

Table 1: Groundwater Quality Results (January 31, 2020)

Reading Name	Units	Sam Date	M60-1	M60-2	M60-3	M60-4	M128-2
General/Inorganic Parameters							
Alkalinity	mg/L	2020-01-31	220	340	360	310	390
Ammonia	mg/L	2020-01-31	0.89	0.66	0.52	< 0.15	< 0.15
Boron	mg/L	2020-01-31	0.83	0.28	0.36	< 0.02	1.7
Calcium	mg/L	2020-01-31	64	73	29	110	30
Chloride	mg/L	2020-01-31	230	280	330	9.6	33
Conductivity	µS/cm	2020-01-31	1600	1800	1900	640	1200
Dissolved Organic Carbon	mg/L	2020-01-31	2.2	1.7	1.8	1.5	4.4
Iron	mg/L	2020-01-31	< 0.1	0.25	< 0.1	< 0.1	0.2
Magnesium	mg/L	2020-01-31	14	34	22	14	31
Manganese	mg/L	2020-01-31	0.029	0.16	0.019	< 0.002	0.02
Nitrate	mg/L	2020-01-31	< 0.1	< 0.1	1.61	4.64	0.86
Nitrite	mg/L	2020-01-31	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Potassium	mg/L	2020-01-31	12	8.6	11	0.31	10
Sodium	mg/L	2020-01-31	240	230	200	2.1	190
Sulphate	mg/L	2020-01-31	180	100	34	3.9	180
Total Dissolved Solids	mg/L	2020-01-31	855	905	935	355	725
Volatile Organic Compounds (VOCs)							
1,1,1,2-Tetrachloroethane	mg/L	2020-01-31	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
1,1,1-Trichloroethane	mg/L	2020-01-31	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
1,1,2,2-Tetrachloroethane	mg/L	2020-01-31	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
1,1,2-Trichloroethane	mg/L	2020-01-31	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
1,1-Dichloroethane	mg/L	2020-01-31	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
1,1-Dichloroethylene	mg/L	2020-01-31	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
1,2-Dichlorobenzene (o)	mg/L	2020-01-31	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
1,2-Dichloroethane	mg/L	2020-01-31	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
1,3,5-Trimethylbenzene	mg/L	2020-01-31	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
1,3-Dichlorobenzene (m)	mg/L	2020-01-31	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
1,4-Dichlorobenzene (p)	mg/L	2020-01-31	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
1,4-Dioxane	mg/L	2020-01-31	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Benzene	mg/L	2020-01-31	0.008	0.0041	0.004	< 0.0001	< 0.0001
Chlorobenzene	mg/L	2020-01-31	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Chloroethane	mg/L	2020-01-31	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Chloromethane	mg/L	2020-01-31	< 0.001	< 0.001	< 0.001	< 0.0005	< 0.0005
Cis-1,2-Dichloroethylene	mg/L	2020-01-31	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Dichloromethane	mg/L	2020-01-31	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Ethylbenzene	mg/L	2020-01-31	< 0.0001	0.00016	0.00026	< 0.0001	< 0.0001
m+p-Xylene	mg/L	2020-01-31	0.00034	< 0.0001	0.0015	< 0.0001	< 0.0001
o-Xylene	mg/L	2020-01-31	0.00021	0.00012	0.00064	< 0.0001	< 0.0001
Styrene	mg/L	2020-01-31	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Tetrachloroethylene	mg/L	2020-01-31	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Toluene	mg/L	2020-01-31	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Total Xylenes	mg/L	2020-01-31	0.00054	0.00012	0.0021	< 0.0001	< 0.0001
Trans-1,2-dichloroethylene	mg/L	2020-01-31	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Trichloroethylene	mg/L	2020-01-31	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Vinyl Chloride	mg/L	2020-01-31	< 0.0002	0.00022	< 0.0002	< 0.0002	< 0.0002

CLOSING

We trust the above is satisfactory at this time. If you have any questions or need further information please do not hesitate to contact the undersigned.

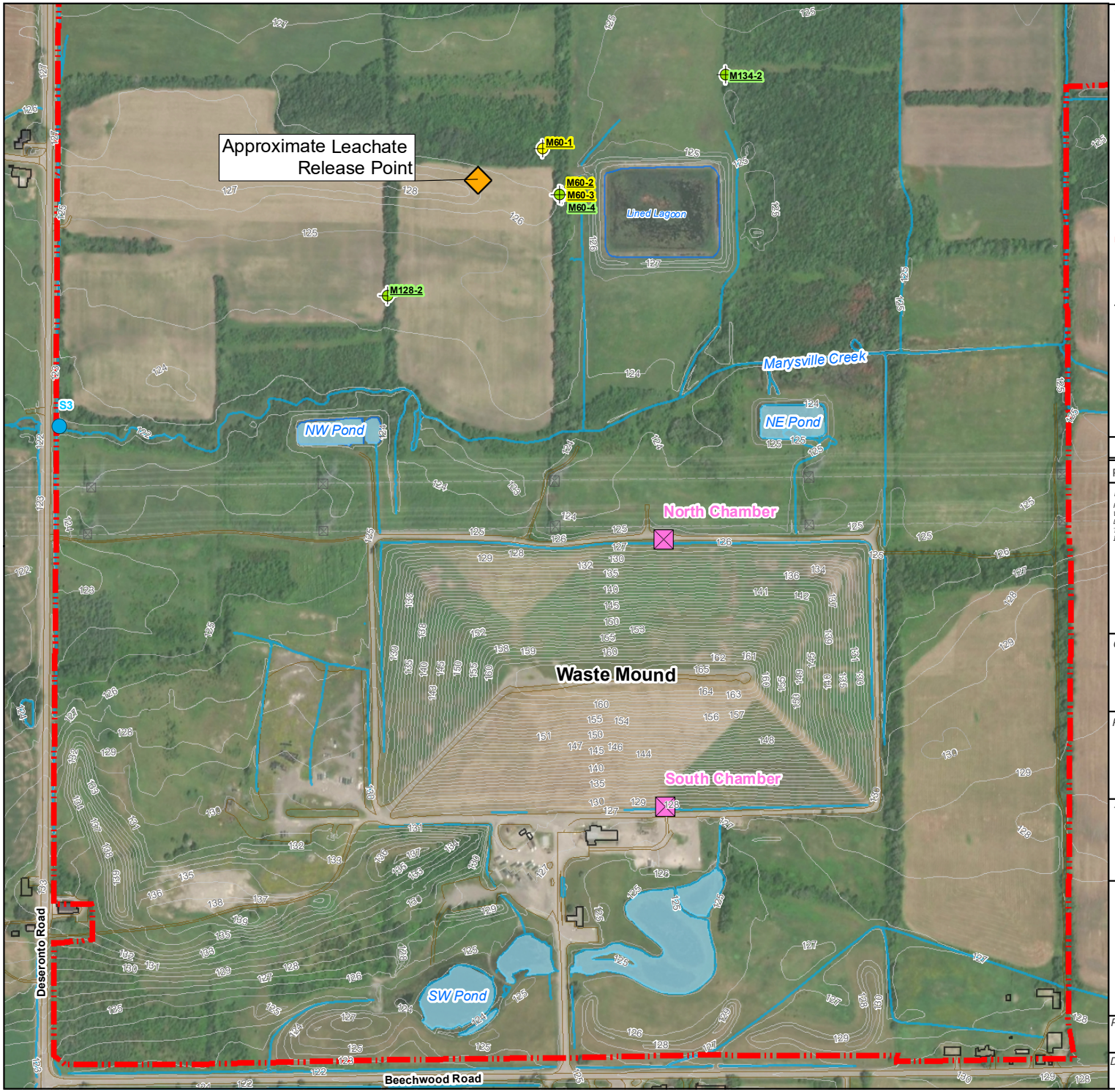
Respectfully submitted,
BluMetric Environmental Inc.

Francois Richard, Ph.D. P.Geo.
Senior Hydrogeologist

Madeleine Corriveau, M.Sc., P.Geo
Senior Geoscientist

Encl.
Figure 1: Site Plan and Sampling Locations
Attachment 1: Historical Groundwater Chemistry Results

FIGURE



LEGEND

- Surface Water Sample
- **Single Wells**
- Active Shallow Monitoring Well
- Active Intermediate Monitoring Well
- Release Point
- Leachate Monitoring Locations
- Property Boundary
- Waterbody
- Building
- Hydro Tower
- Road
- Watercourse
- Overhead Power Line
- Waterbody
- **Topographic Contours (1 masl)**
- Major Contour
- Minor Contour

REV.	DESCRIPTION	YY/MM/DD	BY	CHK
1				

REFERENCES

0 50 100 200 Meters

1:6,300

CLIENT

WASTE MANAGEMENT

PROJECT

WASTE MANAGEMENT RICHMOND LANDFILL LEACHATE RELEASE INVESTIGATION

TITLE

SITE PLAN AND MONITORING LOCATIONS

BluMetric™ Environmental

The Tower - The Woolen Mill,
4 Cataraqui St.,
Kingston, Ontario, K7K 1Z7
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Web: http://www.blumetric.ca

PROJECT #	DATE
200172-03	February 18, 2020

DRAWN	CHECKED	FIG NO.	REV
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ATTACHMENT 1

Historical Groundwater Quality Results

Historical Groundwater Chemistry Results at M60-1, M60-2, M60-3 and M60-4

			M60-1				M60-2				M60-3		M60-4			
Reading Name	**Reading Group**	**Units**	**25-Jun-98**	**3-Dec-99**	**26-Nov-09**	**31-Jan-20**	**24-Jun-98**	**1-Jul-98**	**3-Dec-99**	**31-Jan-20**	**24-Jun-98**	**31-Jan-20**	**24-Jun-98**	**1-Jul-98**	**3-Dec-99**	**31-Jan-20**
General and Inorganic Parameters																
Alkalinity	chem - general	mg/L	171	101	132	220	260		287	340	259	360	239		288	310
Ammonia	chem - ions	mg/L	3.1	7.3	1.33	0.89	0.46		0.71	0.66	0.26	0.52	0.23		0.16	< 0.15
Boron	chem - metals	mg/L			0.99	0.83				0.28		0.36				< 0.02
Calcium	chem - metals	mg/L	125	10	13	64		80	80	73	99	29		126	114	110
Chloride	chem - ions	mg/L	61	141	180	230	46		127	280	31	330	4		6	9.6
Conductivity	chem - general	µS/cm	1390	1280	1280	1600	916		1580	1800	801	1900	516		618	640
Dissolved Organic Carbon	chem - ions	mg/L		45.4	10.3	2.2			14.2	1.7		1.8			1.1	1.5
Iron	chem - metals	mg/L	0.08	0.05	< 0.1	< 0.1		0.07	ND	0.25	0.2	< 0.1		0.58	ND	< 0.1
Magnesium	chem - metals	mg/L	1	1	4	14		19	29	34	20	22		18	17	14
Manganese	chem - metals	mg/L			0.003	0.029				0.16		0.019				< 0.002
Nitrate	chem - ions	mg/L	0.28	ND	0.4	< 0.1	1.4		ND	< 0.1	1.36	1.61	4.11		6.41	4.64
Nitrite	chem - ions	mg/L	ND	ND	0.34	< 0.01	ND		ND	< 0.01	0.8	< 0.01	ND		ND	< 0.01
Potassium	chem - metals	mg/L	38	57	17	12		5	9	8.6	6	11		2	ND	0.31
Sodium	chem - metals	mg/L	97	197	230	240		101	240	230	53	200		29	7	2.1
Sulphate	chem - ions	mg/L	247	241	210	180	153		332	100	121	34	17		19	3.9
Total Dissolved Solids	chem - general	mg/L			804	855				905		935				355
Volatile Organic Compounds (VOCs)																
1,1,1,2-Tetrachloroethane	chem - VOCs	mg/L				< 0.0002				< 0.0002		< 0.0002				< 0.0002
1,1,1-Trichloroethane	chem - VOCs	mg/L			< 0.0001	< 0.0001				< 0.0001		< 0.0001				< 0.0001
1,1,2,2-Tetrachloroethane	chem - VOCs	mg/L				< 0.0002				< 0.0002		< 0.0002				< 0.0002
1,1,2-Trichloroethane	chem - VOCs	mg/L				< 0.0002				< 0.0002		< 0.0002				< 0.0002
1,1-Dichloroethane	chem - VOCs	mg/L			< 0.0001	< 0.0001				< 0.0001		< 0.0001				< 0.0001
1,1-Dichloroethylene	chem - VOCs	mg/L			< 0.0001	< 0.0001				< 0.0001		< 0.0001				< 0.0001
1,2-Dichlorobenzene (o)	chem - VOCs	mg/L				< 0.0002				< 0.0002		< 0.0002				< 0.0002
1,2-Dichloroethane	chem - VOCs	mg/L				< 0.0002				< 0.0002		< 0.0002				< 0.0002
1,3,5-Trimethylbenzene	chem - VOCs	mg/L				< 0.0002				< 0.0002		< 0.0002				< 0.0002
1,3-Dichlorobenzene (m)	chem - VOCs	mg/L				< 0.0002				< 0.0002		< 0.0002				< 0.0002
1,4-Dichlorobenzene (p)	chem - VOCs	mg/L			< 0.0002	< 0.0002				< 0.0002		< 0.0002				< 0.0002
1,4-Dioxane	chem - VOCs	mg/L				< 0.001				< 0.001		< 0.001				< 0.001
Benzene	chem - VOCs	mg/L	0.0043	ND	0.0017	0.008	ND		ND	0.0041	ND	0.004	ND		ND	< 0.0001
Chlorobenzene	chem - VOCs	mg/L				< 0.0001				< 0.0001		< 0.0001				< 0.0001
Chloroethane	chem - VOCs	mg/L				< 0.005				< 0.005		< 0.005				< 0.005
Chloromethane	chem - VOCs	mg/L				< 0.001				< 0.001		< 0.001				< 0.0005
Cis-1,2-Dichloroethylene	chem - VOCs	mg/L				< 0.0001				< 0.0001		< 0.0001				< 0.0001
Dichloromethane	chem - VOCs	mg/L				< 0.0005				< 0.0005		< 0.0005				< 0.0005
Ethylbenzene	chem - VOCs	mg/L	ND	ND	< 0.0001	< 0.0001	ND		ND	0.00016	ND	0.00026	ND		ND	< 0.0001
m+p-Xylene	chem - VOCs	mg/L	0.0036	ND	0.0004	0.00034	ND		ND	< 0.0001	ND	0.0015	ND		ND	< 0.0001
o-Xylene	chem - VOCs	mg/L	0.0012	ND	< 0.0001	0.00021	ND		ND	0.00012	ND	0.00064	ND		ND	< 0.0001
Styrene	chem - VOCs	mg/L				< 0.0002				< 0.0002		< 0.0002				< 0.0002
Tetrachloroethylene	chem - VOCs	mg/L			< 0.0001	< 0.0001				< 0.0001		< 0.0001				< 0.0001
Toluene	chem - VOCs	mg/L	0.0413	0.003	0.0021	< 0.0002	ND		ND	< 0.0002	ND	< 0.0002	0.0013		ND	< 0.0002
Total Xylenes	chem - VOCs	mg/L			0.0004	0.00054				0.00012		0.0021				< 0.0001
Trans-1,2-dichloroethylene	chem - VOCs	mg/L				< 0.0001				< 0.0001		< 0.0001				< 0.0001
Trichloroethylene	chem - VOCs	mg/L				< 0.0001				< 0.0001		< 0.0001				< 0.0001
Vinyl Chloride	chem - VOCs	mg/L				< 0.0002				0.00022		< 0.0002				< 0.0002

ND: Below Laboratory Reporting Limit