October 10, 2017

DILLON CONSULTING

1558 Willson Place
Winnipeg, Manitoba
Canada
R3T 0Y4
Telephone
204.453.2301
Fax
204.452.4412

Manitoba Sustainable Development
Unit B – 284 Reimer Avenue
Steinbach, MB
R5G 0R5

Attention: Curt Bueckert
Environment Officer, Steinbach

Local Urban District of Landmark – Lagoon Desludging

Dear Mr. Bueckert:

The Local Urban District of Landmark (LUD) lagoon has significant buildup of sludge solids at and around the truck dump spillway in Cell #3 (primary cell). Due to the accumulation of solids and the presence of other organic matter in the lagoon (wood chips, straw, etc.), the ability for sludge to be distributed within the lagoon is limited. Dillon Consulting Limited (Dillon) has been retained by the R.M. of Taché (RM) to develop this short-term sludge management plan enclosed herein. We propose that an estimated 6,000 m^3 to be removed and landfilled, in Fall 2017. If you have any comments, questions or concerns, please do not hesitate to contact the undersigned.

Sincerely,

DILLON CONSULTING LIMITED

Indra Kalinovich, Ph.D., C.Chem.
Associate

IKK:jef

Attachment(s): Figure 1 & 2
Photograph 1 & 2
Laboratory COA and Analytical Results

cc: Robert Boswick, Manitoba Sustainable Development
Christine Hutlet, Rural Municipality of Taché
Pete Skjaerlund, Rural Municipality of Taché

Our file: 16-3207

Options for Sludge

Options discussed with the Rural Municipality of Taché (RM) for short-term sludge management at the Landmark lagoon have included:

1. Land application;
2. Landfilling; and,
3. Spreading the sludge within the lagoon cell to reduce the accumulation at the truck dump spillway.

Land application (considered beneficial reuse) of the sludge is the preferred option by Manitoba Sustainable Development (MSD). However, landfilling the sludge may be considered acceptable if the sludge is unsuitable for land application or suitable land is relatively unavailable. Spreading or pushing the sludge out further into the cell is a short-term measure that will not address the issue of accumulated sludge in the cell, but rather delay the need to do so.

Dillon has submitted multiple samples of the sludge solids from the lagoon to Maxxam Analytics laboratory for analysis. Dillon was able to roughly characterize the sludge based on this sampling and analysis and the summary characteristics of the sludge are shown in Table 1 below. The results of this analysis are attached in Appendix A.

TABLE 1: LAGOON SLUDGE CHARACTERISTICS

Parameter	Average Concentration [ppm]	Max Cumulative Conc. In Soil [ppm]
Arsenic	2.75	12
Cadmium	0.585	1.4
Chromium	43.5	64
Copper	145	63
Lead	8.4	70
Nickel	24	50
Zinc	400	200
Mercury	0.079	6.6

Parameter	Average Concentration [ppm]	Max Cumulative Conc. In Soil [ppm]
Acid ext. P	5600	-
Ammonia-N	270	-
Nitrate	0	-
TKN	12140	-
Total Organic N	11750	-
Total Solids	34.25%	-
Volatile Solids	57.1%	-

The metals, nutrients, and physical parameters of the sludge that are typically of concern to MSD and the maximum allowable cumulative concentrations of metals in soil are presented in Table 1. It can be seen that although there are elevated levels of the metals of concern in the sludge, they are not orders of magnitude greater than the allowable concentrations in soil. Concentrations of nitrogen and phosphorus are elevated and represent a potentially rich source of nutrients to crops if the sludge is land applied. Finally, total solids percentage indicates that the sampled sludge has a relatively low moisture content as compared to typical municipal sludge. This is considered to be attributed in part to the coarse textured nature of the sludge solids. Sludge solids are comprised of not only municipal wastewater, but also from several hog washing and truck washing facilities within the municipality, that contribute greater quantities of sand and gravel-sized particles to the sludge. These larger particles are concentrated near the Landmark lagoon spillway. More recent analyses (including leachable metals to evaluate landfilling suitability), demonstrate a total solids content ranging from 89 to 93%.

In conjunction with the chemical parameters of the sludge, the volume of the sludge must be estimated to determine how land is required to apply the sludge at a rate that is typically accepted by MSD. Using design drawings, site observations, and information from the lagoon operators, it was estimated that there are approximately 6,000 cubic metres of sludge in Zone A of the lagoon (see Figure 1, attached).

Land Application

Land application is considered a beneficial reuse of an available resource, and is therefore CWS's preferred option for short-term lagoon sludge management. The Landmark lagoon is located within a reasonable distance of large areas of agricultural land, making land application a reasonable option to consider.

The land requirement for this option was estimated based on the sludge analysis results and estimations of disposal field soil quality which was in turn based on generalized soil maps of the area. Three scenarios were considered:

1. Metals limiting application rates;
2. Phosphorus limiting application rates; and,
3. Nitrogen limiting application rates.

In the *metals limiting scenario*, the known concentrations of the metals in the sludge combined with assumed existing soil concentrations of metals (based on generalized soil maps) were used to calculate the maximum dose of sludge (in kg/ha) that would be allowed without exceeding the allowable cumulative concentration of any constituent metal of concern in the receiving soil. This rate was found to be 315,000 kg sludge/ha, which corresponds to a land requirement of approximately 7 ha (not including buffer zones).

In the *phosphorus limiting scenario*, it was assumed that the receiving soil had a moderate to low existing phosphorus concentration (< 120 ppm TP) and that alfalfa would be cropped on the land following sludge application. These assumptions led to an application rate of approximately 65,700 kg sludge/ha which corresponds to a land requirement of approximately 30 ha (not including buffer zones). However, it should be noted that if a different crop is grown on the land in the following season (with a lower P uptake rate) or if the existing total phosphorus concentration in the soil is greater than 120 ppm, the land requirement could double or triple compared to the current estimate.

Finally, in the *nitrogen limiting scenario*, it was assumed that the receiving soil had a low residual nitrate concentration and that the sludge would be applied to land by direct injection, limiting nitrogen losses to the atmosphere. This scenario also assumed alfalfa would be grown on the land in the season following sludge application. Based on these assumptions, a land area of approximately 28 ha will be

required for sludge application. Again, it should be noted that this value does not include buffer zones. If there are crops other than alfalfa grown on the land, or if the available land has a medium to high residual nitrate concentration in the soil, the land requirements for sludge application will increase significantly.
The land area requirements for the three scenarios described above are presented in Table 2.

TABLE 2: APPROXIMATE LAND REQUIREMENTS PER LIMITING SCENARIO

Limiting Scenario	Estimated Land Requirement
Metals	7 ha. (17 acres)
Phosphorus	30 ha. (74 acres)
Nitrogen	28 ha. (69 acres)

Based on this preliminary analysis it appears that phosphorus concentration in the sludge will limit the land application rate and that, given the listed assumptions, a land area of approximately 30 hectares will be needed to manage the lagoon sludge by land application in accordance with current regulations.

Dillon met with the Rural Municipality of Taché to discuss available lands for nearby land application. Figure 2 was drafted based on those discussions, which clearly identifies that there is not enough land nearby that is available for land application.

Landfill

The RM may pursue landfilling of the lagoon sludge as a viable option if sludge testing *indicates that the sludge is unsuitable for land application, or if there is not a sufficient amount of suitable land in the vicinity of the lagoon to warrant land application*.

We contend that the proposed sludge solids meet both of the above exemptions:

- The quantity of sand and gravel present in the sludge near the spillway do not provide beneficial reuse (see Photographs 1 and 2).
- There is not a sufficient amount of suitable land in the vicinity of the lagoon to warrant land application – land application of animals waste is active throughout the Municipality, and much of the available nearby land is already being used for land application by the local agricultural industry (calculations above, and Figure 2).

Sludge samples taken in November 2015 (Table 1) indicate the sludge has a total solids ratio of over 30% which indicates a reasonably dewatered material and allows the sludge to be classified as solid waste as per Waste Disposal Ground Regulation 150/91. At 30% solids, most sludge like materials can be handled, hauled, and placed without additional dewatering. Subsequent analysis has shown this value to increase to 89 - 93%, with 42-46% moisture content in samples obtained from Zone A. Based on these results, the following desludging and landfilling plan should be employed by:

1. In Fall 2017, excavate and haul the top layer of sufficiently dry sludge to the RM landfill. Excavation could be accomplished with appropriate machinery such as a "long-stick" excavator;
2. Remove remaining sludge from lagoon cell by dredging or "long-stick" excavator and pile on internal berm for dewatering over the winter months; and,
3. Once sufficient dewatering has occurred, remove sludge from berm and haul to landfill.

Based on the low volatile solids measured, the case may be made to use the sludge as daily or intermediate cover material at the landfill. Alternatively, if the sludge is not sufficiently stabilized, it could be co-composted with organic waste such as wood chips at the landfill site, provided a suitable (and licensed) composting pad is available. Following this process the co-composted sludge may be suitable for daily/intermediate cover at the landfill.

A significant portion of the sludge in the lagoon cell (Zone A, potentially Zone B) is very high in grit/gravel and will therefore be unsuitable for land application. We also expect that the portion of sludge furthest out from the lagoon may be suitable for land application (as has been shown from our existing analysis). Therefore, Dillon recommends a combined approach where, based on the additional sludge testing, a portion of the sludge is removed for land application while the remainder of less beneficial material would be landfilled. Sludge in Zone A (estimated 6,000 m^3) will be removed and landfilled, in Fall 2017.

RURAL MUNICIPALITY OF TACHE, MANITOBA

SLUDGE REMOVAL FROM LANDMARK LAGOON

SITE PLAN AND SAMPLING LOCATIONS

FIGURE 1

Site Location

2016 Sample

0.5 m Sludge

0.75 m Sludge

1.5 m Sludge

DILLON CONSULTING

MAP DRAWING INFORMATION:
DATA PROVIDED BY MLI

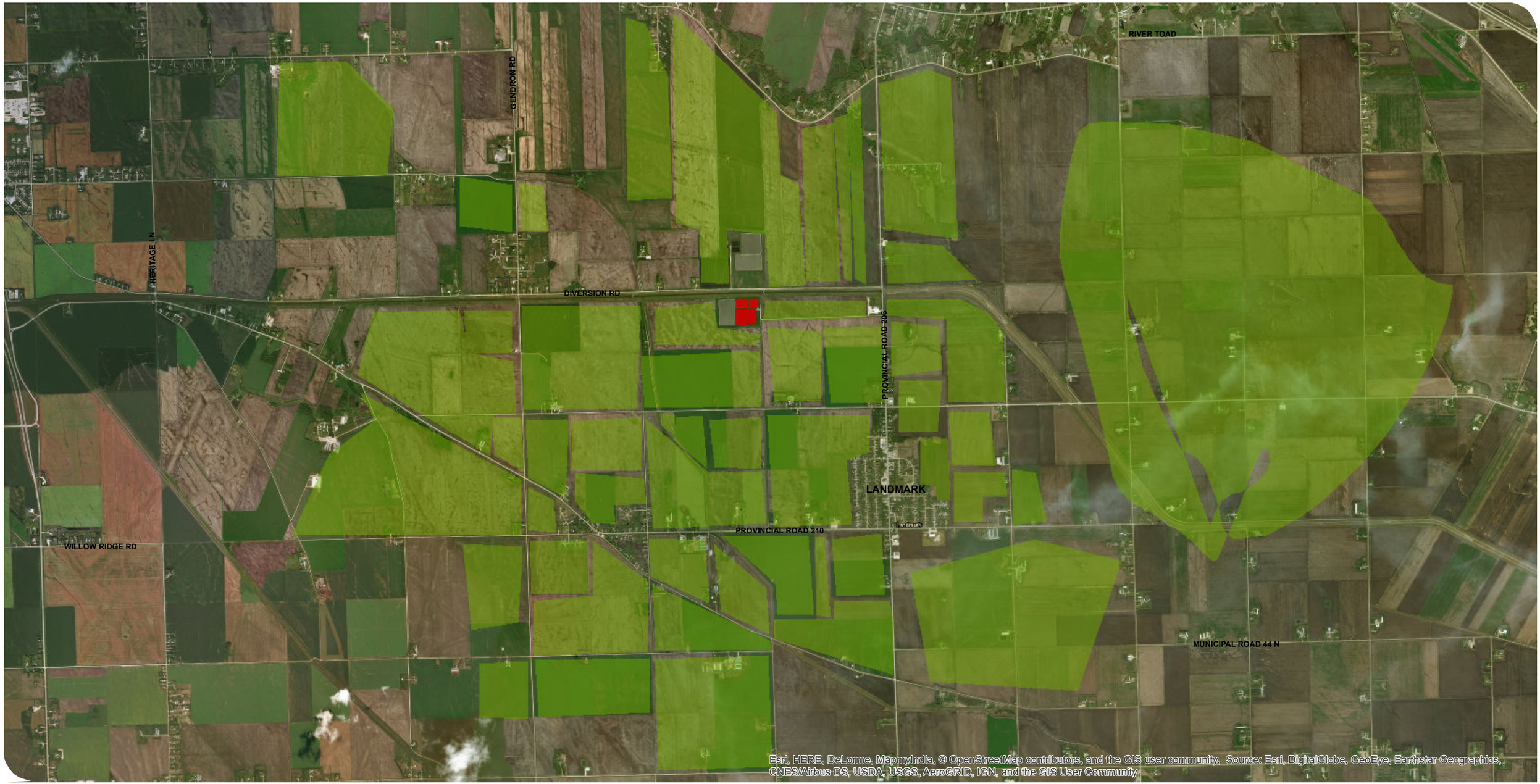
MAP CREATED BY: TLA
MAP CHECKED BY: IK
MAP PROJECTION: NAD 1983 UTM Zone 14N

0 25 50 100 150 Meters

N W E S

PROJECT: 16-3407 STATUS: DRAFT DATE: 9/11/2017

Document Path: G:\GIS\163407 - Landmark Lagoon Expansion\GIS Data\MXD\Figure 1 Site Plan and Figure Location.mxd



RURAL MUNICIPALITY OF TACHE, MANITOBA

SLUDGE REMOVAL FROM LANDMARK LAGOON

LAND PARCELS KNOWN TO BE UNAVAILABLE FOR LAND APPLICATION OF SLUDGE

FIGURE 2

Landmark Lagoon

Land Parcels Known to be Unavailable for Land Application of Sludge

DILLON CONSULTING

MAP DRAWING INFORMATION:
DATA PROVIDED BY MLI

MAP CREATED BY: TLA
MAP CHECKED BY: IK
MAP PROJECTION: NAD 1983 UTM Zone 14N

0 0.35 0.7 1.4 2.1 Kilometers

N W E S

PROJECT: 16-3407 STATUS: DRAFT DATE: 9/11/2017

Document Path: G:\GIS\163407 - Landmark Lagoon Expansion\GIS Data\MXD\Figure 2 Land Parcels Known to be Unavailable for Land Application of Sludge.mxd

Looking out onto Spillway

Looking out onto Lagoon from Spillway

DILLON CONSULTING	SITE PHOTOGRAPHS	PROJECT NO. 16-3207
May 2017	**Landmark Lagoon - RM of Tache**	PHOTO NO. 1,2

Your C.O.C. #: na

Attention:Ash Raichura

Dillon Consulting Limited
1558 WILLSON PLACE
Winnipeg, MB
CANADA R3T 0Y4

Report Date: 2015/11/16
Report #: R3768330
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B5M3470
Received: 2015/10/31, 09:50

Sample Matrix: SOLID
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Conductivity	2	N/A	2015/11/06	CAM SOP-00414	OMOE E3138 v2 m
Strong Acid Leachable Metals by ICPMS	2	2015/11/06	2015/11/06	CAM SOP-00447	EPA 6020A m
Moisture	2	N/A	2015/11/04	CAM SOP-00445	Carter 2nd ed 51.2 m
Ammonia-N	2	2015/11/05	2015/11/07	CAM SOP-00441	Carter, SS&A
Nitrate (NO3) and Nitrite (NO2) in Soil	2	N/A	2015/11/09	CAM SOP-00440	SM 22 4500-NO3I/NO2B
Organic Nitrogen in Soil	2	N/A	2015/11/13		
pH CaCl2 EXTRACT	2	2015/11/06	2015/11/06	CAM SOP-00413	EPA 9045 D m
Total Kjeldahl Nitrogen - Soil	2	2015/11/11	2015/11/13	CAM SOP-00454	EPA 351.2 m
Total Solids	2	N/A	2015/11/05	CAM SOP-00428	SM 22 2540 G m
Volatile Solids	2	N/A	2015/11/05	CAM SOP-00428	SM 22 2540 G m

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Sara Singh, B.Sc, Senior Project Manager
Email: sarasingh@maxxam.ca
Phone# (905)817-5730

==========

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B5M3470
Report Date: 2015/11/16

Dillon Consulting Limited
Sampler Initials: WT

RESULTS OF ANALYSES OF SOLID

Maxxam ID		BGP780	BGP781		
Sampling Date		2015/10/29	2015/10/29		
COC Number		na	na		
	UNITS	**SAMPLE #1 (BIOSOLID)**	**SAMPLE #2 (BIOSOLID)**	**RDL**	**QC Batch**
Calculated Parameters					
Total Organic Nitrogen	mg/kg	16000	7500	0.1	4255745
Inorganics					
Total Ammonia-N	ug/g	473	67	20	4259628
Conductivity	umho/cm	4040	2940	2	4261903
Moisture	%	70	61	1.0	4258303
Available (CaCl2) pH	pH	6.98	6.77	N/A	4260285
Total Solids	%	29.6	38.9	0.1	4260335
Total Kjeldahl Nitrogen	ug/g	16700	7580	100	4267519
Volatile Solids	%	66.4	47.8	0.2	4260370
Nitrite (N)	ug/g	<0.5	<0.5	0.5	4261470
Nitrate (N)	ug/g	<2	<2	2	4261470
Nitrate + Nitrite (N)	ug/g	<3	<3	3	4261470

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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Maxxam Job #: B5M3470
Report Date: 2015/11/16

Dillon Consulting Limited
Sampler Initials: WT

ELEMENTS BY ATOMIC SPECTROSCOPY (SOLID)

Maxxam ID		BGP780	BGP781		
Sampling Date		2015/10/29	2015/10/29		
COC Number		na	na		
	UNITS	**SAMPLE #1 (BIOSOLID)**	**SAMPLE #2 (BIOSOLID)**	**RDL**	**QC Batch**
Metals					
Acid Extractable Aluminum (Al)	ug/g	4200	3100	50	4261727
Acid Extractable Antimony (Sb)	ug/g	1.1	0.73	0.20	4261727
Acid Extractable Arsenic (As)	ug/g	3.2	2.3	1.0	4261727
Acid Extractable Barium (Ba)	ug/g	84	89	0.50	4261727
Acid Extractable Beryllium (Be)	ug/g	<0.20	<0.20	0.20	4261727
Acid Extractable Bismuth (Bi)	ug/g	5.4	2.5	1.0	4261727
Acid Extractable Boron (B)	ug/g	12	10	5.0	4261727
Acid Extractable Cadmium (Cd)	ug/g	0.50	0.67	0.10	4261727
Acid Extractable Calcium (Ca)	ug/g	42000	66000	50	4261727
Acid Extractable Chromium (Cr)	ug/g	32	55	1.0	4261727
Acid Extractable Cobalt (Co)	ug/g	2.9	2.3	0.10	4261727
Acid Extractable Copper (Cu)	ug/g	160	130	0.50	4261727
Acid Extractable Iron (Fe)	ug/g	19000	18000	50	4261727
Acid Extractable Lead (Pb)	ug/g	8.9	7.9	1.0	4261727
Acid Extractable Magnesium (Mg)	ug/g	13000	26000	50	4261727
Acid Extractable Manganese (Mn)	ug/g	160	220	1.0	4261727
Acid Extractable Molybdenum (Mo)	ug/g	4.2	3.1	0.50	4261727
Acid Extractable Nickel (Ni)	ug/g	26	22	0.50	4261727
Acid Extractable Phosphorus (P)	ug/g	4700	6500	50	4261727
Acid Extractable Potassium (K)	ug/g	1200	810	200	4261727
Acid Extractable Selenium (Se)	ug/g	1.4	0.64	0.50	4261727
Acid Extractable Silver (Ag)	ug/g	0.24	<0.20	0.20	4261727
Acid Extractable Sodium (Na)	ug/g	1500	910	50	4261727
Acid Extractable Strontium (Sr)	ug/g	61	63	1.0	4261727
Acid Extractable Thallium (Tl)	ug/g	0.083	0.15	0.050	4261727
Acid Extractable Tin (Sn)	ug/g	7.0	<5.0	5.0	4261727
Acid Extractable Uranium (U)	ug/g	1.7	1.6	0.050	4261727
Acid Extractable Vanadium (V)	ug/g	14	14	5.0	4261727
Acid Extractable Zinc (Zn)	ug/g	440	360	5.0	4261727
Acid Extractable Mercury (Hg)	ug/g	0.095	0.063	0.050	4261727

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B5M3470
Report Date: 2015/11/16

Dillon Consulting Limited
Sampler Initials: WT

GENERAL COMMENTS

Sample BGP780-01 : Conductivity Analysis: Sample entirely absorbed the extraction fluid when the prescribed 1:2 ratio was used. Due to the absorbent nature of the sample, the sample/fluid ratio was changed to 1:4.

Sample BGP781-01 : Conductivity Analysis: Sample entirely absorbed the extraction fluid when the prescribed 1:2 ratio was used. Due to the absorbent nature of the sample, the sample/fluid ratio was changed to 1:4.

Results relate only to the items tested.

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Maxxam Job #: B5M3470
Report Date: 2015/11/16

QUALITY ASSURANCE REPORT

Dillon Consulting Limited
Sampler Initials: WT

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
4258303	Moisture	2015/11/04							1.7	20		
4259628	Total Ammonia-N	2015/11/07	108	75 - 125	112	80 - 120	<20	ug/g	NC	35		
4260285	Available (CaCl2) pH	2015/11/06			99	97 - 103			0.47	N/A		
4260335	Total Solids	2015/11/05					<0.1	%	13	35		
4260370	Volatile Solids	2015/11/05					<0.2	%	6.9	35		
4261470	Nitrate (N)	2015/11/09	103	75 - 125	98	75 - 125	<2	ug/g	NC	25	NA	75 - 125
4261470	Nitrate + Nitrite (N)	2015/11/09	106	75 - 125	99	75 - 125	<3	ug/g	NC	25	86	75 - 125
4261470	Nitrite (N)	2015/11/09	NC	75 - 125	104	75 - 125	<0.5	ug/g	NC	25		
4261727	Acid Extractable Aluminum (Al)	2015/11/06	NC	75 - 125	106	80 - 120	<50	ug/g				
4261727	Acid Extractable Antimony (Sb)	2015/11/06	96	75 - 125	97	80 - 120	<0.20	ug/g	NC	30		
4261727	Acid Extractable Arsenic (As)	2015/11/06	101	75 - 125	102	80 - 120	<1.0	ug/g	NC	30		
4261727	Acid Extractable Barium (Ba)	2015/11/06	NC	75 - 125	103	80 - 120	<0.50	ug/g	1.0	30		
4261727	Acid Extractable Beryllium (Be)	2015/11/06	101	75 - 125	99	80 - 120	<0.20	ug/g	NC	30		
4261727	Acid Extractable Bismuth (Bi)	2015/11/06	97	75 - 125	97	80 - 120	<1.0	ug/g				
4261727	Acid Extractable Boron (B)	2015/11/06	94	75 - 125	94	80 - 120	<5.0	ug/g	NC	30		
4261727	Acid Extractable Cadmium (Cd)	2015/11/06	103	75 - 125	101	80 - 120	<0.10	ug/g	NC	30		
4261727	Acid Extractable Calcium (Ca)	2015/11/06	NC	75 - 125	109	80 - 120	<50	ug/g				
4261727	Acid Extractable Chromium (Cr)	2015/11/06	99	75 - 125	101	80 - 120	<1.0	ug/g	0.57	30		
4261727	Acid Extractable Cobalt (Co)	2015/11/06	99	75 - 125	101	80 - 120	<0.10	ug/g	5.9	30		
4261727	Acid Extractable Copper (Cu)	2015/11/06	NC	75 - 125	100	80 - 120	<0.50	ug/g	0.95	30		
4261727	Acid Extractable Iron (Fe)	2015/11/06	NC	75 - 125	105	80 - 120	<50	ug/g				
4261727	Acid Extractable Lead (Pb)	2015/11/06	99	75 - 125	97	80 - 120	<1.0	ug/g	0.57	30		
4261727	Acid Extractable Magnesium (Mg)	2015/11/06	NC	75 - 125	114	80 - 120	<50	ug/g				
4261727	Acid Extractable Manganese (Mn)	2015/11/06	NC	75 - 125	99	80 - 120	<1.0	ug/g				
4261727	Acid Extractable Mercury (Hg)	2015/11/06	113	75 - 125	106	80 - 120	<0.050	ug/g	NC	30		
4261727	Acid Extractable Molybdenum (Mo)	2015/11/06	103	75 - 125	100	80 - 120	<0.50	ug/g	NC	30		
4261727	Acid Extractable Nickel (Ni)	2015/11/06	99	75 - 125	101	80 - 120	<0.50	ug/g	0.91	30		
4261727	Acid Extractable Phosphorus (P)	2015/11/06	NC	75 - 125	104	80 - 120	<50	ug/g				
4261727	Acid Extractable Potassium (K)	2015/11/06	NC	75 - 125	112	80 - 120	<200	ug/g				
4261727	Acid Extractable Selenium (Se)	2015/11/06	101	75 - 125	103	80 - 120	<0.50	ug/g	NC	30		
4261727	Acid Extractable Silver (Ag)	2015/11/06	101	75 - 125	99	80 - 120	<0.20	ug/g	NC	30		
4261727	Acid Extractable Sodium (Na)	2015/11/06	NC	75 - 125	103	80 - 120	<50	ug/g				

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
4261727	Acid Extractable Strontium (Sr)	2015/11/06	NC	75 - 125	102	80 - 120	<1.0	ug/g				
4261727	Acid Extractable Thallium (Tl)	2015/11/06	98	75 - 125	97	80 - 120	<0.050	ug/g	NC	30		
4261727	Acid Extractable Tin (Sn)	2015/11/06	105	75 - 125	101	80 - 120	<5.0	ug/g				
4261727	Acid Extractable Uranium (U)	2015/11/06	92	75 - 125	90	80 - 120	<0.050	ug/g	2.2	30		
4261727	Acid Extractable Vanadium (V)	2015/11/06	NC	75 - 125	96	80 - 120	<5.0	ug/g	NC	30		
4261727	Acid Extractable Zinc (Zn)	2015/11/06	NC	75 - 125	97	80 - 120	<5.0	ug/g	2.5	30		
4261903	Conductivity	2015/11/06			100	90 - 110	<2	umho/cm	0.35	10		
4267519	Total Kjeldahl Nitrogen	2015/11/13	73 (1)	80 - 120	97	80 - 120	<10	ug/g	0.66	40	100	80 - 120

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than 2x that of the native sample concentration).

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

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Maxxam Job #: B5M3470
Report Date: 2015/11/16

Dillon Consulting Limited
Sampler Initials: WT

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Brad Newman, Scientific Specialist

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Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Your Project #: 16-3207
Site#: LANDMARK LAGOON
Site Location: LANDMARK, MB
Your C.O.C. #: N015489

Attention:Indra Kalinovich

DILLON CONSULTING LTD.
1558 Willson Place
Winnipeg, MB
CANADA R3T 0Y4

Report Date: 2016/11/10
Report #: R2299066
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B697828
Received: 2016/11/02, 08:00

Sample Matrix: Soil
Samples Received: 6

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Conductivity (Soluble) (1)	6	2016/11/08	2016/11/09	BBY6SOP-00029	SM 22 2510 B
Metals - TCLP (1)	6	2016/11/10	2016/11/10	BBY7SOP-00005,	EPA 1311, 6020bR2 m
Moisture (1)	6	2016/11/04	2016/11/04	BBY8SOP-00017	BCMOE BCLM Dec2000 m
Ammonia-N (Available) (1)	6	2016/11/07	2016/11/07	BBY6SOP-00009	SM 22 4500-NH3- G m
Nitrate+Nitrite (N) (Available) (1)	6	N/A	2016/11/08	BBY6SOP-00010	SM 22 4500-NO3- I m
Phosphorus (Available by ICP) (2)	6	2016/11/07	2016/11/07	CAL SOP-00152 / AB SOP-00042	EPA 200.7 CFR 2012 m
TCLP pH Measurements (1)	6	N/A	2016/11/10	BBY7SOP-00005	EPA 1311 R1992
Saturated Paste (1)	6	2016/11/08	2016/11/08	BBY6SOP-00030	Carter 2nd 15.2.1 m
Total Kjeldahl Nitrogen - Soil (2)	6	2016/11/07	2016/11/08	AB SOP-00008	EPA 351.1 R1978 m
Total Solids (Fixed and Volatile) (1)	6	2016/11/09	2016/11/09	BBY6SOP-00050	SM 22 2540 G
Total Organic Nitrogen Soil Subcontract (3)	6	N/A	2016/11/09		

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods. Results relate to samples tested.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

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Your Project #: 16-3207
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CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B697828
Received: 2016/11/02, 08:00

(1) This test was performed by Maxxam Vancouver
(2) This test was performed by Maxxam Calgary Environmental
(3) This test was performed by Maxxam Ontario (from Winnipeg)

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Amanda Hung, B.Sc., Project Manager
Email: AHung@maxxam.ca
Phone# (204)772-7276 Ext:2215

==========

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Maxxam Job #: B697828
Report Date: 2016/11/10

DILLON CONSULTING LTD.
Client Project #: 16-3207
Site Location: LANDMARK, MB
Sampler Initials: NB

RESULTS OF CHEMICAL ANALYSES OF SOIL

Maxxam ID		PY0284		PY0397		PY0398	PY0398		
Sampling Date		2016/11/01 10:30		2016/11/01 10:40		2016/11/01 10:50	2016/11/01 10:50		
COC Number		N015489		N015489		N015489	N015489		
	UNITS	**SAMPLE-16-3**	**RDL**	**SAMPLE-16-4**	**RDL**	**SAMPLE-16-5**	**SAMPLE-16-5 Lab-Dup**	**RDL**	**QC Batch**
Parameter									
Subcontract Parameter	N/A	ATTACHED	N/A	ATTACHED	N/A	ATTACHED		N/A	8466477
Misc. Inorganics									
Total Solids (Fixed)	%	90.2	0.10	89.0	0.10	93.1	92.8	0.10	8465179
Total Solids (Volatile)	%	9.81	0.10	11.0	0.10	6.93	7.21	0.10	8465179
Nutrients									
Available (KCl) Ammonia (N)	mg/kg	707 (1)	5.0	30.4	0.50	196 (1)	199	5.0	8462304
Nitrate plus Nitrite (N)	ug/g	<2.0	2.0	<2.0	2.0	<2.0	<2.0	2.0	8463995
Available (NH4F) Phosphorus (P)	mg/kg	100	1.0	30	1.0	2.3		1.0	8462034
Total Kjeldahl Nitrogen	mg/kg	3800 (1)	200	5800 (1)	250	1100 (1)		50	8461916
Soluble Parameters									
Soluble Conductivity	uS/cm	3550	1.0	5230	1.0	1000		1.0	8463438
Saturation %	%	120	1.0	101	1.0	98.2		1.0	8463423

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

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Maxxam Job #: B697828
Report Date: 2016/11/10

DILLON CONSULTING LTD.
Client Project #: 16-3207
Site Location: LANDMARK, MB
Sampler Initials: NB

RESULTS OF CHEMICAL ANALYSES OF SOIL

Maxxam ID		PY0399		PY0400		PY0401		
Sampling Date		2016/11/01 11:00		2016/11/01 11:10		2016/11/01		
COC Number		N015489		N015489		N015489		
	UNITS	**SAMPLE-16-6**	**RDL**	**SAMPLE-16-7**	**RDL**	**FD1**	**RDL**	**QC Batch**
Parameter								
Subcontract Parameter	N/A	ATTACHED	N/A	ATTACHED	N/A	ATTACHED	N/A	8466477
Misc. Inorganics								
Total Solids (Fixed)	%	88.8	0.10	93.6	0.10	92.1	0.10	8465179
Total Solids (Volatile)	%	11.2	0.10	6.38	0.10	7.91	0.10	8465179
Nutrients								
Available (KCl) Ammonia (N)	mg/kg	493 (1)	5.0	386 (1)	5.0	481 (1)	5.0	8462304
Nitrate plus Nitrite (N)	ug/g	<2.0	2.0	<2.0	2.0	<2.0	2.0	8463995
Available (NH4F) Phosphorus (P)	mg/kg	1.5	1.0	<1.0	1.0	140	1.0	8462034
Total Kjeldahl Nitrogen	mg/kg	4200 (1)	200	1900 (1)	100	4800 (1)	200	8461916
Soluble Parameters								
Soluble Conductivity	uS/cm	2990	1.0	3170	1.0	3440	1.0	8463438
Saturation %	%	170	1.0	91.0	1.0	118	1.0	8463423

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

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Maxxam Job #: B697828
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DILLON CONSULTING LTD.
Client Project #: 16-3207
Site Location: LANDMARK, MB
Sampler Initials: NB

PHYSICAL TESTING (SOIL)

Maxxam ID		PY0284	PY0397	PY0398	PY0399	PY0399	PY0400		
Sampling Date		2016/11/01 10:30	2016/11/01 10:40	2016/11/01 10:50	2016/11/01 11:00	2016/11/01 11:00	2016/11/01 11:10		
COC Number		N015489	N015489	N015489	N015489	N015489	N015489		
	UNITS	**SAMPLE-16-3**	**SAMPLE-16-4**	**SAMPLE-16-5**	**SAMPLE-16-6**	**SAMPLE-16-6 Lab-Dup**	**SAMPLE-16-7**	**RDL**	**QC Batch**
Physical Properties									
Moisture	%	46	42	45	50	60	45	0.30	8459624

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate

Maxxam ID		PY0401		
Sampling Date		2016/11/01		
COC Number		N015489		
	UNITS	**FD1**	**RDL**	**QC Batch**
Physical Properties				
Moisture	%	45	0.30	8459624

RDL = Reportable Detection Limit

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Maxxam Job #: B697828
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DILLON CONSULTING LTD.
Client Project #: 16-3207
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Sampler Initials: NB

ELEMENTS BY ATOMIC SPECTROSCOPY (SOIL)

Maxxam ID		PY0284	PY0397	PY0398	PY0399	PY0400	PY0401		
Sampling Date		2016/11/01 10:30	2016/11/01 10:40	2016/11/01 10:50	2016/11/01 11:00	2016/11/01 11:10	2016/11/01		
COC Number		N015489	N015489	N015489	N015489	N015489	N015489		
	UNITS	**SAMPLE-16-3**	**SAMPLE-16-4**	**SAMPLE-16-5**	**SAMPLE-16-6**	**SAMPLE-16-7**	**FD1**	**RDL**	**QC Batch**
TCLP Extraction Procedure									
Initial pH of Sample	pH	8.63	8.38	8.99	9.02	8.99	8.48	N/A	8466092
LEACHATE Antimony (Sb)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	8467725
pH after HCl	pH	2.01	2.60	1.51	2.51	1.69	1.81	N/A	8466092
LEACHATE Arsenic (As)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	8467725
Final pH of Leachate	pH	5.94	6.07	5.86	6.09	6.15	6.02	N/A	8466092
LEACHATE Barium (Ba)	mg/L	<0.10	0.15	0.97	0.92	0.80	<0.10	0.10	8467725
pH of Leaching Fluid	pH	4.94	4.94	4.94	4.94	4.94	4.94	N/A	8466092
LEACHATE Beryllium (Be)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	8467725
LEACHATE Boron (B)	mg/L	0.13	0.17	0.14	0.10	<0.10	0.11	0.10	8467725
LEACHATE Cadmium (Cd)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	8467725
LEACHATE Chromium (Cr)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	8467725
LEACHATE Cobalt (Co)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	8467725
LEACHATE Copper (Cu)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	8467725
LEACHATE Iron (Fe)	mg/L	1.46	4.60	0.78	1.68	1.12	3.06	0.50	8467725
LEACHATE Lead (Pb)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	8467725
LEACHATE Mercury (Hg)	mg/L	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0020	8467725
LEACHATE Molybdenum (Mo)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	8467725
LEACHATE Nickel (Ni)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	8467725
LEACHATE Selenium (Se)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	8467725
LEACHATE Silver (Ag)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	8467725
LEACHATE Thallium (Tl)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	8467725
LEACHATE Uranium (U)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	8467725
LEACHATE Vanadium (V)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	8467725
LEACHATE Zinc (Zn)	mg/L	<0.10	0.22	<0.10	<0.10	<0.10	0.16	0.10	8467725
LEACHATE Zirconium (Zr)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	8467725

RDL = Reportable Detection Limit
N/A = Not Applicable

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Maxxam Job #: B697828
Report Date: 2016/11/10

DILLON CONSULTING LTD.
Client Project #: 16-3207
Site Location: LANDMARK, MB
Sampler Initials: NB

GENERAL COMMENTS

Samples analyzed past recommended hold time for Solids analysis.

Results relate only to the items tested.

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Client Project #: 16-3207
Site Location: LANDMARK, MB
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QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8459624	CG5	Method Blank	Moisture	2016/11/05	<0.30		%	
8459624	CG5	RPD [PY0399-02]	Moisture	2016/11/05	18		%	20
8461916	MB5	Matrix Spike	Total Kjeldahl Nitrogen	2016/11/08		NC	%	75 - 125
8461916	MB5	QC Standard	Total Kjeldahl Nitrogen	2016/11/07		103	%	75 - 125
8461916	MB5	Spiked Blank	Total Kjeldahl Nitrogen	2016/11/08		111	%	75 - 125
8461916	MB5	Method Blank	Total Kjeldahl Nitrogen	2016/11/07	<10		mg/kg	
8461916	MB5	RPD	Total Kjeldahl Nitrogen	2016/11/08	0.73		%	35
8462034	PL	Spiked Blank	Available (NH4F) Phosphorus (P)	2016/11/07		88	%	80 - 120
8462034	PL	Method Blank	Available (NH4F) Phosphorus (P)	2016/11/07	<1.0		mg/kg	
8462034	PL	RPD	Available (NH4F) Phosphorus (P)	2016/11/07	NC		%	35
8462304	CK	Matrix Spike [PY0398-01]	Available (KCl) Ammonia (N)	2016/11/07		NC	%	75 - 125
8462304	CK	Spiked Blank	Available (KCl) Ammonia (N)	2016/11/07		101	%	75 - 125
8462304	CK	Method Blank	Available (KCl) Ammonia (N)	2016/11/07	<0.50		mg/kg	
8462304	CK	RPD [PY0398-01]	Available (KCl) Ammonia (N)	2016/11/07	1.9		%	30
8463423	JGD	QC Standard	Saturation %	2016/11/08		111	%	75 - 125
8463423	JGD	Method Blank	Saturation %	2016/11/08	<1.0		%	
8463423	JGD	RPD	Saturation %	2016/11/08	0.010		%	30
8463438	MM3	Spiked Blank	Soluble Conductivity	2016/11/09		94	%	80 - 120
8463438	MM3	Method Blank	Soluble Conductivity	2016/11/09	<1.0		uS/cm	
8463438	MM3	RPD	Soluble Conductivity	2016/11/09	0		%	35
8463995	IW1	Matrix Spike [PY0398-01]	Nitrate plus Nitrite (N)	2016/11/08		95	%	70 - 130
8463995	IW1	Spiked Blank	Nitrate plus Nitrite (N)	2016/11/08		101	%	70 - 130
8463995	IW1	Method Blank	Nitrate plus Nitrite (N)	2016/11/08	<2.0		ug/g	
8463995	IW1	RPD [PY0398-01]	Nitrate plus Nitrite (N)	2016/11/08	NC		%	30
8465179	JGD	Method Blank	Total Solids (Fixed)	2016/11/09	<0.10		%	
			Total Solids (Volatile)	2016/11/09	<0.10		%	
8465179	JGD	RPD [PY0398-03]	Total Solids (Fixed)	2016/11/09	0.30		%	20
			Total Solids (Volatile)	2016/11/09	4.0		%	20
8466092	WZ1	Method Blank	Initial pH of Sample	2016/11/10	4.94		pH	
			Final pH of Leachate	2016/11/10	4.94		pH	
			pH of Leaching Fluid	2016/11/10	4.94		pH	
8466092	WZ1	RPD	Initial pH of Sample	2016/11/10	1.4		%	N/A
			Final pH of Leachate	2016/11/10	0.21		%	N/A
			pH of Leaching Fluid	2016/11/10	0		%	N/A
8467725	JC8	Matrix Spike	LEACHATE Arsenic (As)	2016/11/10		97	%	75 - 125
			LEACHATE Beryllium (Be)	2016/11/10		100	%	75 - 125
			LEACHATE Cadmium (Cd)	2016/11/10		108	%	75 - 125
			LEACHATE Chromium (Cr)	2016/11/10		NC	%	75 - 125
			LEACHATE Cobalt (Co)	2016/11/10		95	%	75 - 125
			LEACHATE Copper (Cu)	2016/11/10		96	%	75 - 125
			LEACHATE Lead (Pb)	2016/11/10		97	%	75 - 125
			LEACHATE Nickel (Ni)	2016/11/10		96	%	75 - 125
			LEACHATE Selenium (Se)	2016/11/10		103	%	75 - 125
			LEACHATE Uranium (U)	2016/11/10		100	%	75 - 125
			LEACHATE Vanadium (V)	2016/11/10		101	%	75 - 125
			LEACHATE Zinc (Zn)	2016/11/10		NC	%	75 - 125
8467725	JC8	Spiked Blank	LEACHATE Arsenic (As)	2016/11/10		97	%	75 - 125
			LEACHATE Beryllium (Be)	2016/11/10		102	%	75 - 125
			LEACHATE Cadmium (Cd)	2016/11/10		106	%	75 - 125
			LEACHATE Chromium (Cr)	2016/11/10		95	%	75 - 125
			LEACHATE Cobalt (Co)	2016/11/10		94	%	75 - 125
			LEACHATE Copper (Cu)	2016/11/10		95	%	75 - 125

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Client Project #: 16-3207
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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			LEACHATE Lead (Pb)	2016/11/10		92	%	75 - 125
			LEACHATE Nickel (Ni)	2016/11/10		96	%	75 - 125
			LEACHATE Selenium (Se)	2016/11/10		101	%	75 - 125
			LEACHATE Uranium (U)	2016/11/10		94	%	75 - 125
			LEACHATE Vanadium (V)	2016/11/10		100	%	75 - 125
			LEACHATE Zinc (Zn)	2016/11/10		101	%	75 - 125
8467725	JC8	Method Blank	LEACHATE Antimony (Sb)	2016/11/10	<0.10		mg/L	
			LEACHATE Arsenic (As)	2016/11/10	<0.10		mg/L	
			LEACHATE Barium (Ba)	2016/11/10	<0.10		mg/L	
			LEACHATE Beryllium (Be)	2016/11/10	<0.10		mg/L	
			LEACHATE Boron (B)	2016/11/10	<0.10		mg/L	
			LEACHATE Cadmium (Cd)	2016/11/10	<0.10		mg/L	
			LEACHATE Chromium (Cr)	2016/11/10	<0.10		mg/L	
			LEACHATE Cobalt (Co)	2016/11/10	<0.10		mg/L	
			LEACHATE Copper (Cu)	2016/11/10	<0.10		mg/L	
			LEACHATE Iron (Fe)	2016/11/10	<0.50		mg/L	
			LEACHATE Lead (Pb)	2016/11/10	<0.10		mg/L	
			LEACHATE Mercury (Hg)	2016/11/10	<0.0020		mg/L	
			LEACHATE Molybdenum (Mo)	2016/11/10	<0.10		mg/L	
			LEACHATE Nickel (Ni)	2016/11/10	<0.10		mg/L	
			LEACHATE Selenium (Se)	2016/11/10	<0.10		mg/L	
			LEACHATE Silver (Ag)	2016/11/10	<0.10		mg/L	
			LEACHATE Thallium (Tl)	2016/11/10	<0.10		mg/L	
			LEACHATE Uranium (U)	2016/11/10	<0.10		mg/L	
			LEACHATE Vanadium (V)	2016/11/10	<0.10		mg/L	
			LEACHATE Zinc (Zn)	2016/11/10	<0.10		mg/L	
			LEACHATE Zirconium (Zr)	2016/11/10	<0.10		mg/L	
8467725	JC8	RPD	LEACHATE Antimony (Sb)	2016/11/10	NC		%	35
			LEACHATE Arsenic (As)	2016/11/10	NC		%	35
			LEACHATE Barium (Ba)	2016/11/10	NC		%	35
			LEACHATE Beryllium (Be)	2016/11/10	NC		%	35
			LEACHATE Boron (B)	2016/11/10	NC		%	35
			LEACHATE Cadmium (Cd)	2016/11/10	NC		%	35
			LEACHATE Chromium (Cr)	2016/11/10	1.6		%	35
			LEACHATE Cobalt (Co)	2016/11/10	NC		%	35
			LEACHATE Copper (Cu)	2016/11/10	NC		%	35
			LEACHATE Iron (Fe)	2016/11/10	1.3		%	35
			LEACHATE Lead (Pb)	2016/11/10	NC		%	35
			LEACHATE Mercury (Hg)	2016/11/10	NC		%	35
			LEACHATE Molybdenum (Mo)	2016/11/10	NC		%	35
			LEACHATE Nickel (Ni)	2016/11/10	NC		%	35
			LEACHATE Selenium (Se)	2016/11/10	NC		%	35
			LEACHATE Silver (Ag)	2016/11/10	NC		%	35
			LEACHATE Thallium (Tl)	2016/11/10	NC		%	35
			LEACHATE Uranium (U)	2016/11/10	NC		%	35
			LEACHATE Vanadium (V)	2016/11/10	NC		%	35
			LEACHATE Zinc (Zn)	2016/11/10	1.6		%	35

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Sampler Initials: NB

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			LEACHATE Zirconium (Zr)	2016/11/10	NC		%	35

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than 2x that of the native sample concentration).

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

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NOTIFICATION LOG

No Reportable Regulation Exceedences Noted.

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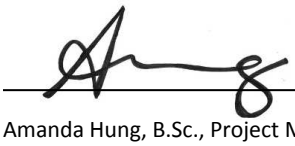
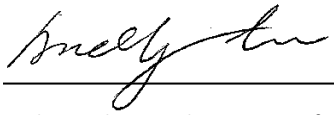
VALIDATION SIGNATURE PAGE

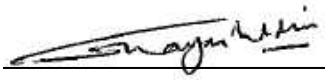
The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Amanda Hung, B.Sc., Project Manager



Andy Lu, Ph.D., P.Chem., Scientific Specialist



Ghayasuddin Khan, M.Sc., P.Chem., QP, Scientific Specialist, Inorganics

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Phone: 204-772-7276 Fax: 204-772-2386 Toll Free: (866) 800-6208

CHAIN OF CUSTODY RECORD

Page 1 of 1

INVOICE INFORMATION	REPORT INFORMATION (if different from invoice)	PROJECT INFORMATION	MAXXAM JOB NUMBER
Company Name: Dillon Consulting.	Company Name: Same as invoice.	Quotation #:	B697828
Contact Name: Indra Kalinovich.	Contact Name:	P.O. #:	CHAIN OF CUSTODY #
Address: 1558 Willson Pl Winnipeg, MB	Address:	Project #: 16-3207.	N 015489
Phone: 204-453-2301 Fax:	Phone: Fax:	Project Name: Landmark Lagoon	
Email: ~~nbeaupre@dillo~~ /Kalinovich@dillon.ca	Email:	Location: Landmark, MB	
		Sampled By: Nanci Beaupré	

REGULATORY REQUIREMENTS SERVICE REQUESTED:

- ☐ CCME
- ☐ DRINKING WATER
- ☐ Other:

Special Instructions:

SAMPLES MUST BE KEPT COOL (<10°C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM.

ANALYSIS REQUESTED (Please be specific)

TURNAROUND TIME (TAT) REQUIRED

PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS.

Regular (Standard) TAT:
☒ 5 to 7 Working Days

Rush TAT:
☐ 1 day ☐ 2 days ☐ 3 days

DATE Required:

TATs for certain tests are > 5 days. Please contact your Project Manager for details

	Lab Use	Sample Identification	Date Sampled	Time Sampled	Matrix (GW, SW, Soil etc)	Drinking Water? (Y / N)	Coliforms: (Method) Total / Fecal / MF / MPN / E. coli / QT	Dissolved Metals: Field Filtered?	Field Acidified?	Total Metal: Field Acidified?	BTEX / F1	F2 - F4	PCB	Biochemical Oxygen Demand	Conductivity/Moisture (copies)	Strong Acid Leachable Metals	Total Ammonia	Nitrate+Nitrite	Organic Nitrogen in Soil	TKN / Total Solids / Volatile Solids	Total Phosphorus (ICP)			HOLD - DO NOT ANALYZE	# of Cont.	COMMENTS
1	PY0284	Sample-16-3	Nov1/16	1030	Soil										X	X	X	X	X	X	X				
2	PY0397	Sample-16-4	Nov1/16	1040	Soil										X	X	X	X	X	X	X				
3	98	Sample-16-5	Nov1/16	1050	Soil										X	X	X	X	X	X	X				
4	99	Sample-16-6	Nov1/16	1100	Soil										X	X	X	X	X	X	X				
5	PY0400	Sample-16-7	Nov1/16	1110	Soil										X	X	X	X	X	X	X				
6	01	FD1	Nov1/16	—	Soil										X	X	X	X	X	X	X				
7																									
8																									
9																									
10																									
11																									
12																									

RELINQUISHED BY (Signature/Print)	RECEIVED BY (Signature/Print)	Date	Time	RECEIVED ON ICE	Laboratory Use Only
NBeaupre / Nanci Beaupré	Coupland / LAURA COUPLAND	~~2016/11/01~~ 16/10/32	08:00	Y ☑ N ☐	Temperature (°C) on Receipt: 6.4, 3.2, 3.2
		2016/11/02			

Unless otherwise agreed to in writing, work submitted on this Chain of Custody is subject to Maxxam's standard Terms and Conditions.
Signing of this Chain of Custody document is acknowledgment and acceptance of our terms which are available for viewing at www.maxxam.ca/terms

***MANDATORY SECTIONS IN GREY MUST BE FILLED OUT. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.**