

September 21, 2016

BY ELECTRONIC FILING

Alberta Energy Regulator
Suite 1000, 250-5th Street SW
Calgary, Alberta T2P 0R4

Attention: Dr. Fikre Debela
Science Specialist, Land Conservation and Reclamation –
Closure and Liability Branch

Dear Dr. Debela

Re: Pembina Pipeline Corporation
Fox Creek to Namao Pipeline Expansion Project
Approval 356633-00-00 – Clause 3.1.2
Supplemental Soil Survey Report

The attached soil survey prepared by Golder Associates is submitted to AER in fulfillment of Clause 3.1.2 of Approval 356633-00-00 under the *Environmental Protection and Enhancement Act*.

The AEPEA Approval states:

3.1.2. The approval holder shall complete pre-construction soil surveys on Grassroots lands and submit them to the Director and receive written authorization from the Director, prior to commencing construction.

The attached report describes the soil survey and recommendation that was prepared by Golder Associates for the construction through the outstanding Grassroots parcels.

The soils report describes the sample sites and soil units encountered. The soil units identified are consistent with those found elsewhere on the Fox to Namao Pipeline Expansion Project (the "Project") and described in the soils report submitted with the Conservation and Reclamation Application for the Project in September 2014. The approach for soil stripping will be two lift materials handling using the method described in the approved Environmental Protection Plan for the Project.

Pembina is preparing to commence construction in this area as soon as possible. The late summer rains delayed construction in some areas, weather conditions are now favourable to complete topsoil handling activities on the Project.

Upon completion of your review and approval of this soils report Pembina will commence construction in these areas.

Pembina Pipeline Corporation.
4000, 585 – 8th Avenue S.W., Calgary, Alberta Canada T2P 1G1
Telephone: (403) 231-7500 Fax: (403) 237-0254



If you have any questions or concerns about the information, please contact me at (403) 231-3157 or pmiles@pembina.com.

Regards,

Peter Miles
Supervisor, Regulatory Affairs

Enclosure

cc: Kevin Evans, Consultant, Environment-Pembina Pipeline Corporation
Balmeet Toor, Supervisor, Environment-Pembina Pipeline Corporation

DATE September 21, 2016**PROJECT No.** 1659251**TO** Balmeet Toor - Supervisor, Environment and Peter Miles - Supervisor, Regulatory Affairs
Pembina Pipeline Corporation**CC** Kevin Evans and Joanna Fedoruk**FROM** Tyler Phillips and Dave Kerr**EMAIL** Tyler_Phillips@golder.com**RE: ADDITIONAL SOIL SURVEY AND SAMPLING ON THE FOX CREEK TO NAMAJO EXPANSION
PROJECT FOR PEMBINA PIPELINES.**

Introduction

An additional soil survey was conducted along the Fox Creek to Namao Junction Expansion Pipeline Project (F2N) (Environmental Protection and Enhancement Act number 001-00356633) for Pembina Pipelines Corporation (Pembina). The data collected supplements the *Fox Creek to Namao Junction Expansion Pipeline Project Conservation and Reclamation Report* (Boreal 2014). The soil survey collected additional soils information on September 9 and 14, 2016. The following quarter sections were surveyed along the Right of Way:

- SW 19-56-2 W5M;
- SE 24-56-3 W5M; and
- SW 20-56-2 W5M.

Methods

Soils were inspected at ten locations in the three quarter- sections. A hand auger was used to inspect soils to a depth of 120 cm. Soil samples were collected for nine out of the ten inspections. Inspection locations and soil map units are presented in Figure 1.

Samples were collected in the upper subsoil (~20 to 50 cm) and lower subsoil (~50 to 120 cm). Samples were analysed for electrical conductivity (EC) and sodium absorption ratio (SAR), along with other soil chemistry parameters and are presented in Appendix 1, Table 1. Soil chemistry results are provided in Appendix 2.

Soil Handling Procedures

All soils surveyed for this supplemental report were previously encountered and described in detail within the *Fox Creek to Namao Junction Expansion Pipeline Project Conservation and Reclamation Report* (Boreal 2014). A brief summary of soil physical descriptors encountered in the field are provided in Appendix 1 Table 2. Soil handling procedures were determined using Table 7 - Criteria for evaluating suitability of subsoil material in the Plains Region published in *Soil Quality Relative to Disturbance and Reclamation* (Alberta Agriculture, 1987) and *Guidelines for Alternative Soil handling Procedures During Pipeline Construction* (APESC 1996). Soil series specific handling techniques described in the *Fox Creek to Namao Junction Expansion Pipeline Project Conservation and Reclamation Report* (Boreal 2014) were applied to the soils encountered during this survey if similar chemical and physical conditions were encountered in the field.



Soils with upper or lower subsoil EC or SAR rated as unsuitable without the presence of a Bnt horizon will be handled using a three lift technique as described in Section 8.1.25 of the *Fox Creek to Namao Junction Expansion Pipeline Project C&R – Part B: Environmental Protection Plan White Area– Revision 3* (EPP) (Boreal 2015).

Soils with upper and lower subsoil with EC or SAR rated poor to good will be handled using a two lift technique.

All soils encountered with the exception of the Thorsby soil series contained upper and lower subsoil rated poor to good and did not possess a Bnt horizon. These soils will be salvaged with a two lift handling technique. The Thorsby soil series contained unsuitable lower subsoil as a result of having >12 SAR. However, since the EC measurements were rated good and a Bnt horizon with firm to very firm consistency was observed, a two lift soil handling technique will be used for this soil series as well. This technique is consistent with recommendations described in the *Guidelines for Alternative Soil handling Procedures During Pipeline Construction* (APESC 1996) and is consistent with current soil handling practices when Thorsby is encountered in other areas of the F2N, described in *Fox Creek to Namao Junction Expansion Pipeline Project Conservation and Reclamation Report* (Boreal 2014). Soil handling and topsoil thickness range in relation to their soil series map unit are presented in Figure 1.

Summary

Interpretation of the data gathered from the soil survey and accompanying soil chemistry results have identified the lower subsoil of the Thorsby (TBY) soil map units as being unsuitable for reclamation due to high (>12) SAR. However, due to the presence of a Bnt upper subsoil horizon with unsuitable firm to very firm consistence and good EC reclamation suitability rating, no three lift soil handling techniques will be used.

Closure

We trust the above meets your present requirements. If you have any questions or require additional details, please contact the undersigned.

GOLDER ASSOCIATES LTD.



Tyler Phillips, M.Sc., P.Ag.
Soil Scientist

Dave Kerr, M.Sc., P.Ag.
Project Director

TP/DK/fjm

References

- Alberta Agriculture. 1987. Soil quality criteria relative to disturbance and reclamation. Prepared by the Soil Quality Criteria Working Group, Soil Reclamation Subcommittee, Alberta Soils Advisory Committee, Alberta Agriculture. Edmonton AB.
- Alberta Pipeline Environmental Steering Committee (APESC). 1996. Guidelines for Alternate Soil Handling Procedures During Pipeline Construction. Prepared for Soil Handling Sub-Committee of The APESC. Prepared by W.W. Pettapiece and M.W. Dell. June, 1996.
- The Boreal Group Inc. (Boreal). 2014. Fox Creek to Namao Junction Expansion Pipeline Project Conservation and Reclamation Report. Prepared for Pembina Pipelines Inc. September 2014. 64pp + Appendices.
- Boreal. 2015. Fox Creek to Namao Junction Expansion Pipeline Project C&R – Part B: Environmental Protection Plan White Area– Revision 3. Prepared for Pembina Pipelines Inc. August 2015. 135pp + Appendices.

APPENDIX 1

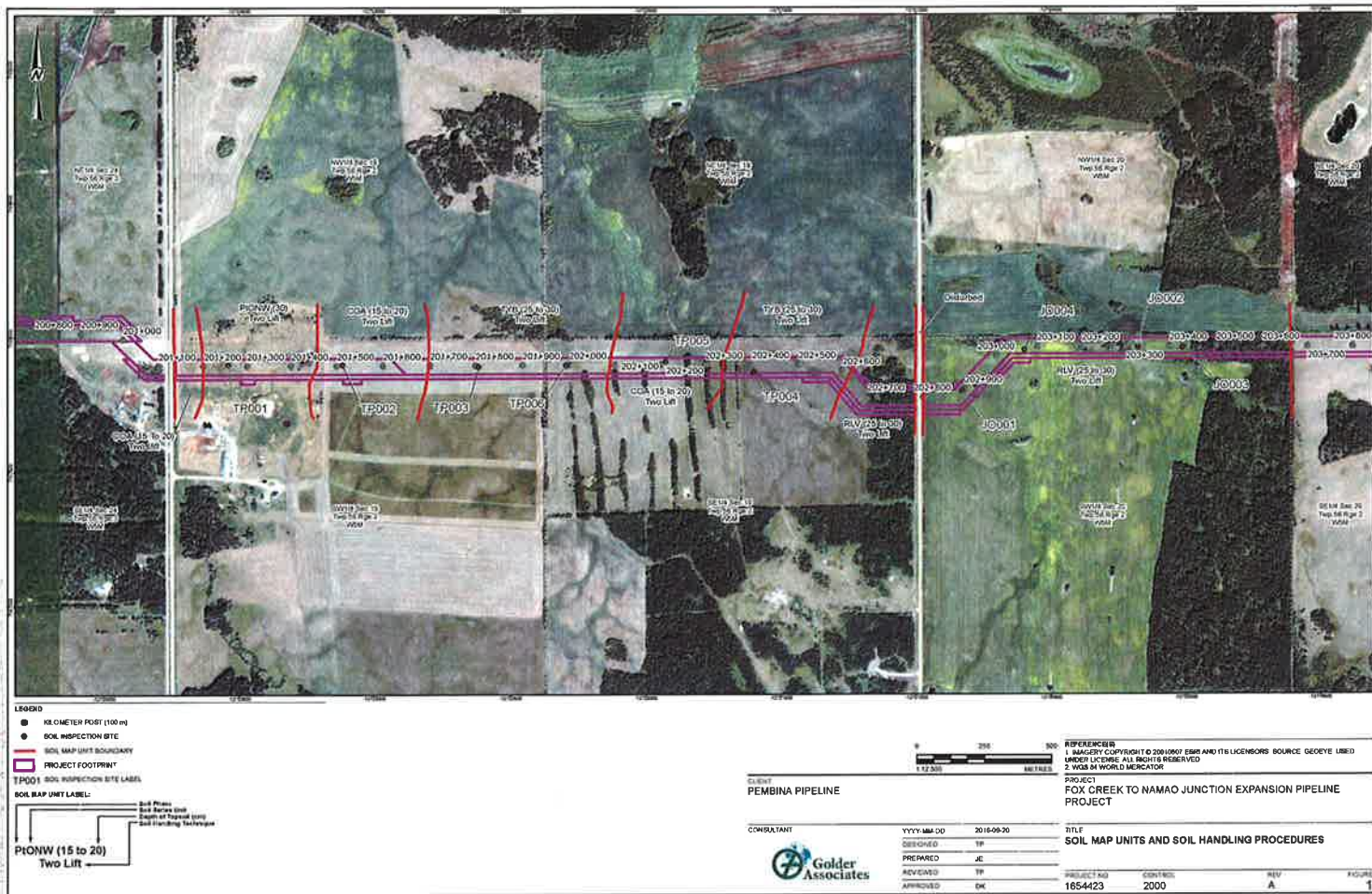
Tables and Figure

Table 1: Supplementary Soil Chemical and Reclamation Suitability Rating

Soil Inspection Site	Soil Series Name (Abbreviation)	Sample Depth [cm]	EC [dS/M]	SAR	Reclamation Suitability Rating and Limitations
TP001	Peaty Onoway (ptONW)	20 to 50	0.78	9.54	Good (EC), Poor (SAR)
		50 to 100	0.79	9.51	Good (EC), Poor (SAR)
TP002	Cooking Lake (COA)	20 to 50	0.79	9.59	Good (EC), Poor (SAR)
		50 to 100	0.68	9.75	Good (EC), Poor (SAR)
TP004	Thorsby (TYB)	20 to 50	0.90	9.46	Good (EC), Poor (SAR)
		50 to 100	2.11	13.2	Good (EC), Unsuitable (SAR)
TP005	Cooking Lake (COA)	20 to 50	0.17	0.78	Good (EC), Poor (SAR)
		50 to 100	0.11	0.86	Good (EC), Poor (SAR)
TP006	Thorsby (TYB)	20 to 50	0.74	7.64	Good (EC), Poor (SAR)
		50 to 100	2.70	12.8	Good (EC), Unsuitable (SAR)
JO_001	Rolly View (RLV)	20 to 50	0.22	1.70	Good (EC), Good (SAR)
50 to 100		0.32	2.33	Good (EC), Good (SAR)	
JO_002		20 to 50	1.08	1.96	Good (EC), Good (SAR)
		50 to 100	0.97	2.32	Good (EC), Good (SAR)
JO_003		20 to 50	0.29	0.30	Good (EC), Good (SAR)
		50 to 100	0.35	0.30	Good (EC), Good (SAR)
JO_004		20 to 50	0.12	0.64	Good (EC), Good (SAR)
		50 to 100	0.14	0.73	Good (EC), Good (SAR)

Table 2: Soil Inspection Summary

Soil Inspection Site	Soil Series	Classification	Parent Material	Topsoil Thickness [cm]	Dominant Texture (Topsoil / Subsoil)	Drainage
TP001	ptONW	Orthic Humic Gleysol	Till	30	Clay Loam / Clay	Imperfect
TP002	COA	Orthic Grey Luvisol		15	Loam / Clay Loam	Moderately Well
TP003	TYB	Dark Grey Solodized Solonetz		25	Loam / Clay	
TP004	TYB			20	Loam / Clay	
TP005	COA	Orthic Grey Luvisol		20	Loam / Clay Loam	
TP006	TYB	Dark Grey Solodized Solonetz		30	Loam / Clay	
JO_001	RLV	Orthic Dark Grey Chernozem		20	Loam / Clay	
JO_002				25	Loam / Clay	
JO_003				20	Loam / Clay	
JO_004				30	Loam / Clay	



APPENDIX 2

Soil Chemistry Results

CLIENT NAME: PEMBINA PIPELINES
4000, 585 - 8TH AVENUE SW
CALGARY, AB T2P1G1
(403) 838-8388

ATTENTION TO: Accounts Payable

PROJECT: 1659250 / SW-20-056-02W5M

AGAT WORK ORDER: 16E136223

SOIL ANALYSIS REVIEWED BY: Melinda Guay, Technical Reviewer

DATE REPORTED: Sep 11, 2016

PAGES (INCLUDING COVER): 7

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (780) 395-2525

***NOTES**

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories (V1)

Member of: Association of Professional Engineers, Geologists and Geophysicists
of Alberta (APEGGA)
Western Enviro-Agricultural Laboratory Association (WEALA)
Environmental Services Association of Alberta (ESAA)

Page 1 of 7

AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation.

Results relate only to the items tested and to all the items tested
All reportable information as specified by ISO 17025:2005 is available from AGAT Laboratories upon request



Certificate of Analysis

AGAT WORK ORDER: 16E136223

PROJECT: 1659250 / SW-20-056-02W5M

6310 ROPER ROAD
EDMONTON, ALBERTA
CANADA T6B 3P9
TEL (780)395-2525
FAX (780)462-2490
<http://www.agatllabs.com>

CLIENT NAME: PEMBINA PIPELINES

ATTENTION TO: Accounts Payable

SAMPLING SITE:

SAMPLED BY:

Soil Analysis - Salinity (AB Tier 1 - pH Calcium Chloride)

DATE RECEIVED: 2016-09-10

DATE REPORTED: 2016-09-11

		J0_001_50		J0_001_100		J0_002_50		J0_002_100		J0_003_50		J0_003_100		J0_004_50		J0_004_100	
		SW-20-056-		SW-20-056-		SW-20-056-		SW-20-056-		SW-20-056-		SW-20-056-		SW-20-056-		SW-20-056-	
SAMPLE DESCRIPTION:		02W5M		02W5M		02W5M		02W5M		02W5M		02W5M		02W5M		02W5M	
SAMPLE TYPE:		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil	
DATE SAMPLED:		9/9/2016		9/9/2016		9/9/2016		9/9/2016		9/9/2016		9/9/2016		9/9/2016		9/9/2016	
Parameter	Unit	G / S	RDL	7836643	7836644	7836645	7836646	7836647	7836648	7836649	7836650						
pH (CaCl2 Extraction)	pH Units		N/A	7.35	7.27	7.32	7.63	7.70	7.52	6.44	5.69						
Electrical Conductivity (Sat. Paste)	dS/m		0.05	0.22	0.32	1.08	0.97	0.29	0.35	0.12	0.14						
Sodium Adsorption Ratio	N/A			1.70	2.33	1.96	2.32	0.30	0.30	0.64	0.73						
Saturation Percentage	%		1	52	58	66	65	55	56	45	45						
Chloride, Soluble	mg/L		5	6	6	<5	14	<5	<5	<5	<5						
Calcium, Soluble	mg/L		1	14	18	114	87	38	48	10	11						
Potassium, Soluble	mg/L		2	<2	<2	<2	<2	<2	<2	<2	<2						
Magnesium, Soluble	mg/L		1	4	7	32	26	10	12	3	2						
Sodium, Soluble	mg/L		2	28	46	92	96	8	9	9	10						
Sulfate, Soluble	mg/L		2	28	27	529	472	26	24	22	20						
Theoretical Gypsum Requirement	tonnes/ha		N/A	0	0	0	0	0	0	0	0						
Calcium, Soluble (meq/L)	meq/L		0.05	0.70	0.90	5.69	4.34	1.90	2.40	0.50	0.55						
Calcium, Soluble (mg/kg)	mg/kg		1	7	10	75	57	21	27	5	5						
Chloride, Soluble (meq/L)	meq/L		0.06	0.17	0.17	<0.06	0.39	<0.06	<0.06	<0.06	<0.06						
Chloride, Soluble (mg/kg)	mg/kg		2	3	3	<2	9	<2	<2	<2	<2						
Magnesium, Soluble (meq/L)	meq/L		0.08	0.33	0.58	2.63	2.14	0.82	0.99	0.25	0.16						
Magnesium, Soluble (mg/kg)	mg/kg		1	2	4	21	17	6	7	1	<1						
Potassium, Soluble (meq/L)	meq/L		0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05						
Potassium, Soluble (mg/kg)	mg/kg		2	<2	<2	<2	<2	<2	<2	<2	<2						
Sodium, Soluble (meq/L)	meq/L		0.09	1.22	2.00	4.00	4.18	0.35	0.39	0.39	0.43						
Sodium, Soluble (mg/kg)	mg/kg		2	15	27	61	62	4	5	4	5						
Sulfur (as Sulfate), Soluble (meq/L)	meq/L		0.04	0.58	0.56	11.0	9.83	0.54	0.50	0.46	0.42						
Sulfur (as Sulfate), Soluble (mg/kg)	mg/kg		2	15	16	349	307	14	13	10	9						

Certified By:



Certificate of Analysis

AGAT WORK ORDER: 16E136223

PROJECT: 1659250 / SW-20-056-02W5M

6310 ROPER ROAD
EDMONTON, ALBERTA
CANADA T6B 3P9
TEL (780)395-2525
FAX (780)462-2490
<http://www.agatlabs.com>

CLIENT NAME: PEMBINA PIPELINES

SAMPLING SITE:

ATTENTION TO: Accounts Payable

SAMPLED BY:

Soil Analysis - Salinity (AB Tier 1 - pH Calcium Chloride)

DATE RECEIVED: 2016-09-10

DATE REPORTED: 2016-09-11

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

7836643-7836650 If sodium results in mg/L are less than detection, SAR is non-calculable and is reported as 0.

Sodium Adsorption Ratio is a calculated parameter. The calculated value is the ratio of the sodium concentration in mmol/L over the square rooted sum of the calcium and magnesium concentrations in mmol/L.

Theoretical Gypsum Requirement is a calculated parameter. The calculation is from "A Comparison of Methods for Gypsum Requirement of Brine-Contaminated Soils", Canadian Journal of Soil Science, 1998.

Certified By:

Quality Assurance

CLIENT NAME: PEMBINA PIPELINES
PROJECT: 1659250 / SW-20-056-02W5M
SAMPLING SITE:

AGAT WORK ORDER: 16E136223
ATTENTION TO: Accounts Payable
SAMPLED BY:

Soil Analysis															
RPT Date:			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Soil Analysis - Salinity (AB Tier 1 - pH Calcium Chloride)

pH (CaCl ₂ Extraction)	255	7836643	7.35	7.25	1.4%	N/A	102%	90%	110%						
Electrical Conductivity (Sat. Paste)	255	7836643	0.22	0.23	NA	< 0.05	94%	90%	110%						
Saturation Percentage	255	7836643	52	51	1.9%	< 1	106%	80%	120%						
Chloride, Soluble	1664	7836643	6	11	NA	< 5	96%	80%	120%						
Calcium, Soluble	255	7835580	40	43	7.2%	< 1	95%	80%	120%				102%	80%	120%
Potassium, Soluble	255	7835580	2	2	NA	< 2	95%	80%	120%				95%	80%	120%
Magnesium, Soluble	255	7835580	15	15	0.0%	< 1	95%	80%	120%				93%	80%	120%
Sodium, Soluble	255	7835580	7	7	NA	< 2	94%	80%	120%				92%	80%	120%
Sulfate, Soluble	255	7835580	34	35	2.9%	< 2	103%	80%	120%				111%	80%	120%

Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated
If Matrix spike value is NA, the spiked analyte concentration was lower than that of the matrix contribution.

Certified By: _____



Method Summary

CLIENT NAME: PEMBINA PIPELINES
PROJECT: 1659250 / SW-20-056-02W5M
SAMPLING SITE:

AGAT WORK ORDER: 16E136223
ATTENTION TO: Accounts Payable
SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
pH (CaCl ₂ Extraction)	INOR-171-6207	SHEPPARD 2007; HENDERSHOT 2008	PH METER
Electrical Conductivity (Sat. Paste)	INO-171-6206	SHEPPARD 2007; MILLER 2007	CONDUCTIVITY METER
Sodium Adsorption Ratio	INOR-171-6201 & INOR-171-6002	McKeague 3.26	CALCULATION
Saturation Percentage	SOIL 0140; SOIL 0110; SOIL 0120	MILLER 2007; SHEPPARD 2007	GRAVIMETRIC
Chloride, Soluble	INOR-171-6200	Carter & Gregorich 2007; SM 4500E	COLORIMETER
Calcium, Soluble	INOR-171-6201	CARTER & GREGORICH 2007, SM 3120B	ICP/OES
Potassium, Soluble	INOR-171-6201	CARTER & GREGORICH 2007, SM 3120B	ICP/OES
Magnesium, Soluble	INOR-171-6201	CARTER & GREGORICH 2007, SM 3120B	ICP/OES
Sodium, Soluble	INOR-171-6201	CARTER & GREGORICH 2007, SM 3120B	ICP/OES
Sulfate, Soluble	INOR-171-6201 & INOR-171-6002	SHEPPARD 2007; EATON 2005; MILLER 2007, SM 3120B	ICP/OES
Theoretical Gypsum Requirement	SOIL 0260	USDA HDBK 60, 22D	N/A



AGAT Laboratories

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Edmonton, Alberta T6B 3P9
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webearth.agatlabs.com

Laboratory Use Only

Arrival Temperature: 7/8
AGAT Job Number: 16E136223

Date and Time: 16 SEP 10 11:41

Chain of Custody Record

Report Information		Report Information		Report Format														
Company: <u>GOLDER ASSOCIATES</u>	1. Name: <u>Jesse O'Meara</u>	Single Sample per Page		Turnaround Time Required (TAT) Regular TAT <input type="checkbox"/> 5 to 7 business days Rush TAT <input checked="" type="checkbox"/> Less than 24 hours <input checked="" type="checkbox"/> 24 to 48 hours <input type="checkbox"/> 48 to 72 hours Date Required: _____														
Contact: <u>JESSE O'MEARA</u>	Email: <u>jomeara@golder.com</u>	Multiple Samples per Page																
Address: <u>16820 107 Ave</u> <u>Edmonton, AB T5P 4C3</u>	2. Name: <u>Tyler Phillips</u> Email: <u>Tphillips@golder.com</u>																	
Phone: <u>780 531 0302</u> Fax: _____	3. Name: _____			<small>RUSH TAT REQUESTS UPON SELECTING A RUSH TAT, THE CLIENT ACCEPTS THAT A RUSH SURCHARGE WILL BE ADDED TO THE INVOICE. SEE BACK FOR SURCHARGE.</small>														
LSD: <u>SW 20-56-2 W5</u>	Email: _____																	
Client Project #: <u>1659250</u>																		
Requirements (Selection may impact detection limits)																		
<input type="checkbox"/> CCME <input type="checkbox"/> AB Tier 1 <input type="checkbox"/> BC CSR																		
<input type="checkbox"/> Agricultural <input type="checkbox"/> Industrial <input type="checkbox"/> Residential/Park <input type="checkbox"/> Commercial <input type="checkbox"/> Drinking Water <input type="checkbox"/> FWAL																		
<input type="checkbox"/> Other <input type="checkbox"/> D50 (Drilling) <input type="checkbox"/> SPIGEC																		
Invoice To <input type="checkbox"/> Same Yes <input type="checkbox"/> No																		
Company: <u>Pembina</u>																		
Contact: _____																		
Address: _____																		
Phone: _____ Fax: _____																		
PO/A/E#: <u>4500092816</u>																		
LABORATORY USE (LAB ID #)	SAMPLE IDENTIFICATION	SAMPLE MATRIX	DATE/TIME SAMPLED	COMMENTS - SITE SAMPLE INFO. SAMPLE CONTAINMENT	# OF CONTAINERS	Detailed Soil Salinity (Saturated Paste)	CCME BTEX/F1-F4	Soil Metals <input type="checkbox"/> HWS-B <input type="checkbox"/> Cr ⁶ <input type="checkbox"/> Hg <input type="checkbox"/> Cu ⁶	Water Metals <input type="checkbox"/> Dissolved <input type="checkbox"/> Total <input type="checkbox"/> Hg <input type="checkbox"/> Cu ⁶	Routine Water Potability	AB Class 2 Landfill	BC Landfill	D50 Detailed Soil Salinity (As Received)	Microtox	BTEX/VP/EPH <input type="checkbox"/> LEPH/HEPH <input type="checkbox"/> Basic Salinity	HOLD FOR 60 DAYS	PRESERVED (Y/N)	CONTAMINATED/HAZARDOUS (Y/N)
J0-001-50	6643	SOIL	2016/09/09		1													
J0-001-100	644	SOIL	"		1													
J0-002-50	645	SOIL	"		1													
J0-002-100	646	SOIL	"		1													
J0-003-50	647	SOIL	"		1													
J0-003-100	648	SOIL	"		1													
J0-004-50	649	SOIL	"		1													
J0-004-100	650	SOIL	"		1													
ALL SAMPLES ACCOUNTED FOR																		
Signature: <u>Jesse O'Meara</u>		Date/Time: <u>Sept 10/2016 11:41</u>		Signature: <u>Jason Trasmont</u>		Date/Time: <u>16 Sept. 16 11:41</u>		Pink Copy - Client		Yellow Copy - AGAT		White Copy - AGAT		Page _____ of _____		Nº: AB 008748		



AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM

RECEIVING BASICS - Shipping

Company/Consultant: Golder Associates
Courier: Drop off Prepaid Collect
Waybill# 7c
Branch ☒ EDM GP FN FM RD VAN LYD FSJ EST Other: _____
If multiple sites were submitted at once: Yes ☒ No
Custody Seal Intact: Yes No ☒ NA
TAT: <24hr ☒ 24-48hr 48-72hr Reg Other _____
Cooler Quantity: 0

TIME SENSITIVE ISSUES - Shipping

ALREADY EXCEEDED HOLD TIME? Yes ☒ No
Inorganic Tests (Please Circle): Mibi, BOD, Nitrate/Nitrite, Turbidity, Microtox, Ortho PO4, Tedlar Bag, Residual Chlorine, Chlorophyll*, Chloroamines*
Earliest Expiry: 7/2
Hydrocarbons: Earliest Expiry 7/2

SAMPLE INTEGRITY - Shipping

Hazardous Samples: YES ☒ NO Precaution Taken: _____
Legal Samples: Yes ☒ No
International Samples: Yes ☒ No
Tape Sealed: Yes ☒ No
Coolant Used: Icepack Bagged Ice Free Ice Free Water ☒ None

Temperature (Bottles/Jars only) ☒ N/A if only Soil Bags Received

FROZEN (Please Circle if samples received Frozen)

1 (Bottle/Jar) _____ °C 2 (Bottle/Jar) _____ °C
3 (Bottle/Jar) _____ °C 4 (Bottle/Jar) _____ °C
5 (Bottle/Jar) _____ °C 6 (Bottle/Jar) _____ °C
7 (Bottle/Jar) _____ °C 8 (Bottle/Jar) _____ °C
9 (Bottle/Jar) _____ °C 10 (Bottle/Jar) _____ °C

(If more than 10 coolers are received use another sheet of paper and attach)

LOGISTICS USE ONLY

Workorder No: 16F130223
Samples Damaged: Yes ☒ No If YES why?
No Bubble Wrap Frozen Courier
Other: _____
Account Project Manager: _____ have they been notified of the above issues: Yes No
Whom spoken to: _____ Date/Time: _____
CPM Initial _____
General Comments: _____

* Subcontracted Analysis (See CPM)

CLIENT NAME: PEMBINA PIPELINES
4000, 585 - 8TH AVENUE SW
CALGARY, AB T2P1G1
(403) 838-8388

ATTENTION TO: Accounts Payable

PROJECT: Pembina 1659251

AGAT WORK ORDER: 16E137802

SOIL ANALYSIS REVIEWED BY: Ngoc (Ruby) Vu, Lab Technician

DATE REPORTED: Sep 15, 2016

PAGES (INCLUDING COVER): 7

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (780) 395-2525

NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.



Certificate of Analysis

AGAT WORK ORDER: 16E137802

PROJECT: Pembina 1659251

6310 ROPER ROAD
EDMONTON, ALBERTA
CANADA T6B 3P9
TEL (780)395-2525
FAX (780)462-2490
<http://www.agallabs.com>

CLIENT NAME: PEMBINA PIPELINES

ATTENTION TO: Accounts Payable

SAMPLING SITE:

SAMPLED BY:

Soil Analysis - Salinity (AB Tier 1 - pH Calcium Chloride)										
DATE RECEIVED: 2016-09-15					DATE REPORTED: 2016-09-15					
SAMPLE DESCRIPTION:		03770	03771	03769	03768	03775	03767	03773	03772	
SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	
DATE SAMPLED:		9/14/2016	9/14/2016	9/14/2016	9/14/2016	9/14/2016	9/14/2016	9/14/2016	9/14/2016	
G / S RDL		7846428	7846430	7846431	7846432	7846433	7846434	7846435	7846436	
Parameter	Unit									
pH (CaCl ₂ Extraction)	pH Units	N/A	7.30	7.31	7.18	7.28	7.36	7.63	5.89	5.62
Electrical Conductivity (Sat. Paste)	dS/m	0.05	0.78	0.79	0.79	0.68	0.90	2.11	0.17	0.11
Sodium Adsorption Ratio	N/A		9.54	9.51	9.59	9.75	9.46	13.2	0.78	0.86
Saturation Percentage	%	1	72	149	77	91	104	97	57	61
Chloride, Soluble	mg/L	5	8	8	9	10	9	5	<5	<5
Calcium, Soluble	mg/L	1	15	12	15	10	18	47	16	9
Potassium, Soluble	mg/L	2	<2	<2	<2	4	<2	4	<2	<2
Magnesium, Soluble	mg/L	1	4	4	5	3	5	16	3	2
Sodium, Soluble	mg/L	2	161	149	168	137	176	411	13	11
Sulfate, Soluble	mg/L	2	203	266	99	190	297	1030	21	19
Theoretical Gypsum Requirement	tonnes/ha	N/A	0.111	0.196	0.131	0.107	0.188	1.52	0	0
Calcium, Soluble (meq/L)	meq/L	0.05	0.75	0.60	0.75	0.50	0.90	2.35	0.80	0.45
Calcium, Soluble (mg/kg)	mg/kg	1	11	18	12	9	19	46	9	5
Chloride, Soluble (meq/L)	meq/L	0.06	0.23	0.23	0.25	0.28	0.25	0.14	<0.06	<0.06
Chloride, Soluble (mg/kg)	mg/kg	2	6	12	7	9	9	5	<2	<2
Magnesium, Soluble (meq/L)	meq/L	0.08	0.33	0.33	0.41	0.25	0.41	1.32	0.25	0.16
Magnesium, Soluble (mg/kg)	mg/kg	1	3	6	4	3	5	16	2	1
Potassium, Soluble (meq/L)	meq/L	0.05	<0.05	<0.05	<0.05	0.10	<0.05	0.10	<0.05	<0.05
Potassium, Soluble (mg/kg)	mg/kg	2	<2	<2	<2	4	<2	4	<2	<2
Sodium, Soluble (meq/L)	meq/L	0.09	7.00	6.48	7.31	5.96	7.66	17.9	0.57	0.48
Sodium, Soluble (mg/kg)	mg/kg	2	116	222	129	125	183	399	7	7
Sulfur (as Sulfate), Soluble (meq/L)	meq/L	0.04	4.23	5.54	2.06	3.96	6.18	21.4	0.44	0.40
Sulfur (as Sulfate), Soluble (mg/kg)	mg/kg	2	146	396	76	173	309	999	12	12

Certified By:



Certificate of Analysis

AGAT WORK ORDER: 16E137802

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CLIENT NAME: PEMBINA PIPELINES

ATTENTION TO: Accounts Payable

SAMPLING SITE:

SAMPLED BY:

Soil Analysis - Salinity (AB Tier 1 - pH Calcium Chloride)

DATE RECEIVED: 2016-09-15

DATE REPORTED: 2016-09-15

		SAMPLE DESCRIPTION:		03776		03774
		SAMPLE TYPE:		Soil		Soil
		DATE SAMPLED:		9/14/2016		9/14/2016
Parameter	Unit	G / S	RDL	RDL		
			7846437			7846438
pH (CaCl2 Extraction)	pH Units		N/A	5.26	N/A	6.72
Electrical Conductivity (Sat. Paste)	dS/m		0.05	0.74	0.05	2.70
Sodium Adsorption Ratio	N/A			7.64		12.8
Saturation Percentage	%		1	61	1	99
Chloride, Soluble	mg/L		5	9	5	<5
Calcium, Soluble	mg/L		1	17	1	80
Potassium, Soluble	mg/L		2	<2	2	2
Magnesium, Soluble	mg/L		1	3	1	26
Sodium, Soluble	mg/L		2	130	2	517
Sulfate, Soluble	mg/L		2	324	4	1360
Theoretical Gypsum Requirement	tonnes/ha		N/A	0.0213	N/A	2.41
Calcium, Soluble (meq/L)	meq/L		0.05	0.85	0.05	3.99
Calcium, Soluble (mg/kg)	mg/kg		1	10	1	79
Chloride, Soluble (meq/L)	meq/L		0.06	0.25	0.06	<0.06
Chloride, Soluble (mg/kg)	mg/kg		2	5	2	<2
Magnesium, Soluble (meq/L)	meq/L		0.08	0.25	0.08	2.14
Magnesium, Soluble (mg/kg)	mg/kg		1	2	1	26
Potassium, Soluble (meq/L)	meq/L		0.05	<0.05	0.05	0.05
Potassium, Soluble (mg/kg)	mg/kg		2	<2	2	2
Sodium, Soluble (meq/L)	meq/L		0.09	5.65	0.09	22.5
Sodium, Soluble (mg/kg)	mg/kg		2	79	2	512
Sulfur (as Sulfate), Soluble (meq/L)	meq/L		0.04	6.75	0.04	28.3
Sulfur (as Sulfate), Soluble (mg/kg)	mg/kg		2	198	2	1350

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

7846428-7846438 If sodium results in mg/L are less than detection, SAR is non-calculable and is reported as 0.

Sodium Adsorption Ratio is a calculated parameter. The calculated value is the ratio of the sodium concentration in mmol/L over the square rooted sum of the calcium and magnesium concentrations in mmol/L.

Theoretical Gypsum Requirement is a calculated parameter. The calculation is from "A Comparison of Methods for Gypsum Requirement of Brine-Contaminated Soils", Canadian Journal of Soil Science, 1998.

Certified By: 

Quality Assurance

CLIENT NAME: PEMBINA PIPELINES

PROJECT: Pembina 1659251

SAMPLING SITE:

AGAT WORK ORDER: 16E137802

ATTENTION TO: Accounts Payable

SAMPLED BY:

Soil Analysis															
RPT Date:			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Soil Analysis - Salinity (AB Tier 1 - pH Calcium Chloride)

pH (CaCl ₂ Extraction)	259	7845114	6.48	6.50	0.3%	N/A	100%	90%	110%						
Electrical Conductivity (Sat. Paste)	259	7845114	0.34	0.35	4.0%	< 0.05	93%	90%	110%						
Saturation Percentage	259	7845114	59	58	1.7%	< 1	113%	80%	120%						
Chloride, Soluble	1668	7845114	23	25	NA	< 5	101%	80%	120%						
Calcium, Soluble	259	7845114	48	49	2.1%	< 1	90%	80%	120%				92%	80%	120%
Potassium, Soluble	259	7845114	<2	<2	NA	< 2	85%	80%	120%				101%	80%	120%
Magnesium, Soluble	259	7845114	11	11	0.0%	< 1	88%	80%	120%				101%	80%	120%
Sodium, Soluble	259	7845114	7	8	NA	< 2	85%	80%	120%				97%	80%	120%
Sulfate, Soluble	259	7845114	37	44	17.3%	< 2	95%	80%	120%				107%	80%	120%

Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated

If Matrix spike value is NA, the spiked analyte concentration was lower than that of the matrix contribution.

Certified By:



Method Summary

CLIENT NAME: PEMBINA PIPELINES

PROJECT: Pembina 1659251

SAMPLING SITE:

AGAT WORK ORDER: 16E137802

ATTENTION TO: Accounts Payable

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
pH (CaCl ₂ Extraction)	INOR-171-6207	SHEPPARD 2007; HENDERSHOT 2008	PH METER
Electrical Conductivity (Sat. Paste)	INO-171-6206	SHEPPARD 2007; MILLER 2007	CONDUCTIVITY METER
Sodium Adsorption Ratio	INOR-171-6201 & INOR-171-6002	McKeague 3.26	CALCULATION
Saturation Percentage	SOIL 0140; SOIL 0110; SOIL 0120	MILLER 2007; SHEPPARD 2007	GRAVIMETRIC
Chloride, Soluble	INOR-171-6200	Carter & Gregorich 2007; SM 4500E	COLORIMETER
Calcium, Soluble	INOR-171-6201	CARTER & GREGORICH 2007, SM 3120B	ICP/OES
Potassium, Soluble	INOR-171-6201	CARTER & GREGORICH 2007, SM 3120B	ICP/OES
Magnesium, Soluble	INOR-171-6201	CARTER & GREGORICH 2007, SM 3120B	ICP/OES
Sodium, Soluble	INOR-171-6201	CARTER & GREGORICH 2007, SM 3120B	ICP/OES
Sulfate, Soluble	INOR-171-6201 & INOR-171-6002	SHEPPARD 2007; EATON 2005; MILLER 2007, SM 3120B	ICP/OES
Theoretical Gypsum Requirement	SOIL 0260	USDA HDBK 60, 22D	N/A



AGAT Laboratories

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Edmonton, Alberta T6B 3P9
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Laboratory Use Only

Arrival Temperature:
AGAT Job Number: **16E137802**

Date and Time:
16 SEP 15 09:22

Chain of Custody Record

Report Information

Company: Golden Associates LTD
Contact: Tyler Phillips
Address: 102, 2535 3rd Ave SE
Calgary AB
Phone: 403 279 1458 Fax: 1654351
LSD: 1654351
Client Project #: Pembina 475000-1216

Report Information

1. Name: Tyler Phillips
Email: tyler_phillips@golden.com
2. Name: _____
Email: _____
3. Name: _____
Email: _____

Report Format

☐ Single Sample per Page
☒ Multiple Samples per Page

Turnaround Time Required (TAT)

Regular TAT ☐ 5 to 7 business days
Rush TAT ☒ Less than 24 hours
☐ 24 to 48 hours
☐ 48 to 72 hours

RUSH TAT REQUESTS
UPON SELECTING A
RUSH TAT, THE CLIENT
ACCEPTS THAT A
RUSH SURCHARGE
WILL BE ADDED
TO THE INVOICE.
SEE BACK FOR
SURCHARGE.

Date Required: ASAP

Invoice To Same Yes ☐ / No ☐

Company: Pembina
Contact: _____
Address: _____
Phone: _____ Fax: _____
PO/A/E#: 4500092816

Requirements (Selection may impact detection limits)

☐ CCME ☐ AB Tier 1 ☐ BC CSR
☐ Agricultural ☐ Agricultural ☐ AW
☐ Industrial ☐ Industrial ☐ IW
☐ Residential/Park ☐ Residential/Park ☐ LW
☐ Commercial ☐ Commercial ☐ DW
☐ Drinking Water ☐ Natural Area
☐ FWAL ☐ AB Surface Water
☐ Other ☐ SPIGEC
☐ D50 (Drilling)

LABORATORY USE (LAB ID #)	SAMPLE IDENTIFICATION	SAMPLE MATRIX	DATE/TIME SAMPLED	COMMENTS - SITE SAMPLE INFO. SAMPLE CONTAINMENT	# OF CONTAINERS	Detailed Soil Salinity (Saturated Paste)	CCME BTEX/F1-F4	Soil Metals <input type="checkbox"/> HWSB <input type="checkbox"/> Cu <input type="checkbox"/> Hg	Water Metals <input type="checkbox"/> Dissolved <input type="checkbox"/> Total <input type="checkbox"/> Hg <input type="checkbox"/> Cu <input type="checkbox"/> Pb	Routine Water Potability	AB Class 2 Landfill	BC Landfill	D50 Detailed Soil Salinity (As Received)	Microtox	BTEX/VPH/EPH <input type="checkbox"/> LEPH/HEPH <input type="checkbox"/>	Basic Salinity	HOLD FOR 60 DAYS	PRESERVED (Y/N)	CONTAMINATED/HAZARDOUS (Y/N)
7846428	03770	Soil	Sept 14/2015																
430	03771																		
431	03769																		
432	03768																		
433	03775																		
434	03767																		
435	03773																		
436	03772																		
437	03776																		
438	03774																		

Samples Relinquished By (Print Name and Sign): <u>Tyler Phillips</u>	Date/Time: <u>Sept 14/2015</u>	Samples Received By (Print Name and Sign): <u>A. Benoit</u>	Date/Time: <u>Sept 14/2015</u>	Pink Copy - Client Yellow Copy - AGAT White Copy - AGAT	Page ____ of ____ N°: AB 008927
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AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM

RECEIVING BASICS - Shipping

Company/Consultant: Gowen
 Courier: D-U Prepaid Collect
 Waybill# _____
 Branch ☒ EDM ☐ GP ☐ FN ☐ FM ☐ RD ☐ VAN ☐ LYD ☐ FSJ ☐ EST Other: _____
 If multiple sites were submitted at once: Yes ☐ No ☒
 Custody Seal Intact: Yes ☐ No ☒ NA
 TAT: ☒ <24hr ☐ 24-48hr ☐ 48-72hr Reg Other _____
 Cooler Quantity: 5

TIME SENSITIVE ISSUES - Shipping

ALREADY EXCEEDED HOLD TIME? Yes ☐ No ☒
 Inorganic Tests (Please Circle): Mibi, BOD, Nitrate/Nitrite, Turbidity, Microtox, Ortho PO4, Tedlar Bag, Residual Chlorine, Chlorophyll*, Chloroamines*
 Earliest Expiry: _____
 Hydrocarbons: Earliest Expiry _____

SAMPLE INTEGRITY - Shipping

Hazardous Samples: YES ☐ NO ☒ Precaution Taken: _____
 Legal Samples: Yes ☐ No ☒
 International Samples: Yes ☐ No ☒
 Tape Sealed: Yes ☐ No ☒
 Coolant Used: Icepack ☐ Bagged Ice ☐ Free Ice ☐ Free Water ☐ None ☒

Temperature (Bottles/Jars only) ☒ N/A ☐ if only Soil Bags Received

FROZEN (Please Circle if samples received Frozen)

1 (Bottle/Jar) _____ + _____ = _____ °C 2 (Bottle/Jar) _____ + _____ = _____ °C
 3 (Bottle/Jar) _____ + _____ = _____ °C 4 (Bottle/Jar) _____ + _____ = _____ °C
 5 (Bottle/Jar) _____ + _____ = _____ °C 6 (Bottle/Jar) _____ + _____ = _____ °C
 7 (Bottle/Jar) _____ + _____ = _____ °C 8 (Bottle/Jar) _____ + _____ = _____ °C
 9 (Bottle/Jar) _____ + _____ = _____ °C 10 (Bottle/Jar) _____ + _____ = _____ °C

(If more than 10 coolers are received use another sheet of paper and attach)

LOGISTICS USE ONLY

Workorder No: 16E137802
 Samples Damaged: Yes ☐ No ☒ If YES why?
 No Bubble Wrap Frozen Courier
 Other: _____
 Account Project Manager: _____ have they been notified of the above issues: Yes ☐ No ☒
 Whom spoken to: _____ Date/Time: _____
 CPM Initial _____
 General Comments: _____

* Subcontracted Analysis (See CPM)