M•L 3861

March 25, 2008

AC Ltd. Box 607 Okotoks, Alberta T1F 1A7

Attention:

Mr. Brian McCaughan

Dear Sir:

Subject:

Preliminary Geotechnical Evaluation 55 Acres Residential Development Lac St. Anne County, Alberta

This letter report serves to present the results of the preliminary geotechnical evaluation, particle size analysis and near surface groundwater testing completed by McIntosh•Lalani Engineering Ltd. (M•L) at the above noted site. The site is located on Lot B, Plan 4722TR within the N.E. ¼ of Section 30-54-15-W5M and is heavily treed and undulating with cut lines running throughout the property and a high pressure gas line running northwest to southeast across the site.

Nine (9) subsurface investigation boreholes were drilled on January 23 and January 24, 2008 using a solid stem auger drill rig contracted from Mobile Augers and Research Ltd. of Calgary, Alberta. The nine (9) boreholes were drilled to depths ranging from 3.0 to 9.1 metres below the existing ground surface. Bulk samples of soil were obtained from the drill cutting and returned to the laboratory for testing. In addition, Standard Penetration Testing (SPT) was conducted on select boreholes to aid in classifying the soil strengths. Slotted PVC standpipes were installed in all of the boreholes to allow for future monitoring of groundwater levels. The borehole locations were selected by M•L and the approximate locations of the boreholes are presented in the attached Figure No. 1. Laboratory tests including natural moisture contents, soluble sulphate concentrations and hydrometer tests were conducted on select soil samples recovered from the boreholes. The laboratory test results are presented on the attached borehole logs and elsewhere in the text of this letter.

It is M•L's understanding that this project includes the development of the 55 acres into country residential lots. The project will consist of some site grading and the construction of new roadways and individual lot specific spectic tile fields. This preliminary geotechnical evaluation serves for the purpose of design and subdivision approval. Prior to subdivision construction a complete geotechnical evaluation and percolation testing program should be completed to fully assess site conditions prior to final design. All recommendations given within this letter should be confirmed prior to subdivision construction upon completion of a complete geotechnical evaluation.

A surficial layer of topsoil was encountered in all nine (9) boreholes and ranged in thickness from 50 to 600 mm. The topsoil thicknesses are known only at discrete borehole locations and as such should not be used for tendering purposes. Beneath the topsoil interbedded layers of silts, sands and silty clays were encountered which extended beyond the maximum depth of 9.1 metres below the existing ground surface to which the boreholes were drilled. These silts, sands and silty clays were generally compact/stiff, damp, low plastic, medium grain, brown or grey in colour and contained traces of sand, gravel, clay, silt and cobbles. At the time this report was prepared, information on subsurface stratigraphy was available only at discrete borehole locations. Conditions were extrapolated and interpolated form the borehole locations to develop recommendations. Adequate monitoring should be provided during construction to check that these assumptions are reasonable.

Upon completion of drilling, all boreholes remained dry. Groundwater levels were obtained on February 5, 2008 and at that time groundwater levels ranged from 2.1 to dry to 9.1 metres below the existing ground surface.

Based on the results of the preliminary geotechnical investigation, conventional strip and spread footings may be used for residential structures within this development. The footings within native soils or on "general engineered" fill should be designed for a soil bearing capacity of 100 kPa. Bearing certificates should be prepared for all footings placed in fill by a qualified geotechnical engineers. Footings within heated structures should be founded at a depth of 1.4 metres below grade and for unheated structures at a depth of 2.1 metres below grade to protect against the effect of frost heaving.

Preliminary testing for soluble sulphate content has revealed sulphate levels of 0.014 percent, which indicates a negligible risk of sulphate attack on exposed concrete. Based upon this result Type GU (Normal Portland) cement with a maximum w/cm ratio of 0.5 and air entrainment of 4-7 percent by volume (based on 14-20 mm aggregate) may be used for this development. This results should be confirmed by further soluble sulphate testing upon completion of a complete geotechnical evaluation.

The composition and consistency of the site soils are such that conventional hydraulic excavators should be suitable to remove the soils. Due to groundwater levels, excavations may encounter groundwater infiltration and require dewatering. Sumps equipped with submersible pumps is considered a feasible method of dewatering and should effectively control the groundwater infiltration. Some cuts and fills may be required within this development. All organic topsoil and

vegetation should be removed from areas to be filled. The backfill should be "general engineered" fill placed in uniform lifts compacted to a minimum of 98 percent of Standard Proctor Density at a moisture content in the range of optimum to 3 percent above optimum.

M•L has completed a preliminary groundwater monitoring program on site. The groundwater levels range from 2.1 to dry to 9.1 metres below ground surface. A subsurface weeping tile subdrain system placed around the perimeter of all residential housing foundations is required as the measured groundwater level is within 2.1 metres of lowest top of footing. The weeping tile should be placed at the elevation of the underside of the footing. M•L should review the weeping tile requirements and final site grades prior to final design.

To determine the viability of septic tile field across the site, particle size analyses were conducted on select samples recovered from the boreholes. These particle size analyses were conducted rather than percolation testing due to frost conditions exceeding deeper than 45 cm below the ground surface. Four of the five hydrometer tests returned acceptable results with a maximum of 55 percent sand and a maximum of 19 percent clay while the fifth hydrometer conducted on Sample No. 1-1 from Borehole No. 1 returned a result of 82 percent sand and 11 percent clay indicating that percolation testing must be conducted in the vicinity of Borehole No. 1 after the frost has left the ground. The Alberta Environmental Protection's (AEP) guidelines for an acceptable range for soil particle size is a maximum of 70 percent sand and 35 percent clay. The result of the testing within the boreholes indicate that the particle size across the majority of the site is within the AEP's acceptable range for conventional septic field development purposes. This should be confirmed by percolation testing across the site once the frost has left the ground. All particle size analyses were conducted according to ASTM D-422, Standard Test Method for Particles - Size Analysis of Soils. The results of the hydrometer testing can be found on the borehole logs attached.

The AEP guidelines define a high groundwater table as any where the water table is within 1.8 metres of the ground surface during the frost free period up until the end of August, and within 2.4 metres of the ground surface during the remainder of the year. The water level was measured on February 5, 2008 and in eight of the nine boreholes was recorded to be dry at a depth of 3.0 metres below the existing ground level. The remaining borehole, Borehole No. 8, recorded a groundwater level of 2.1 metres below the existing ground surface. Based upon the borehole information, this groundwater reading is believed to be due to perched water located on or near the surface of the silty clay. This is believed to be a localized condition were water is perched on the silty clay and not a regional condition. This should be confirmed by more extensive groundwater monitoring conducted during a complete geotechnical evaluation. The groundwater readings are presented in the attached borehole logs.

Recommendations presented herein are based on a preliminary geotechnical evaluation of the findings in nine boreholes. This report has been prepared in accordance with generally accepted soil and foundation engineering practices. No warranty is expressed or implied.

We trust the enclosed meets with your present requirements. Should you have questions please contact our office.

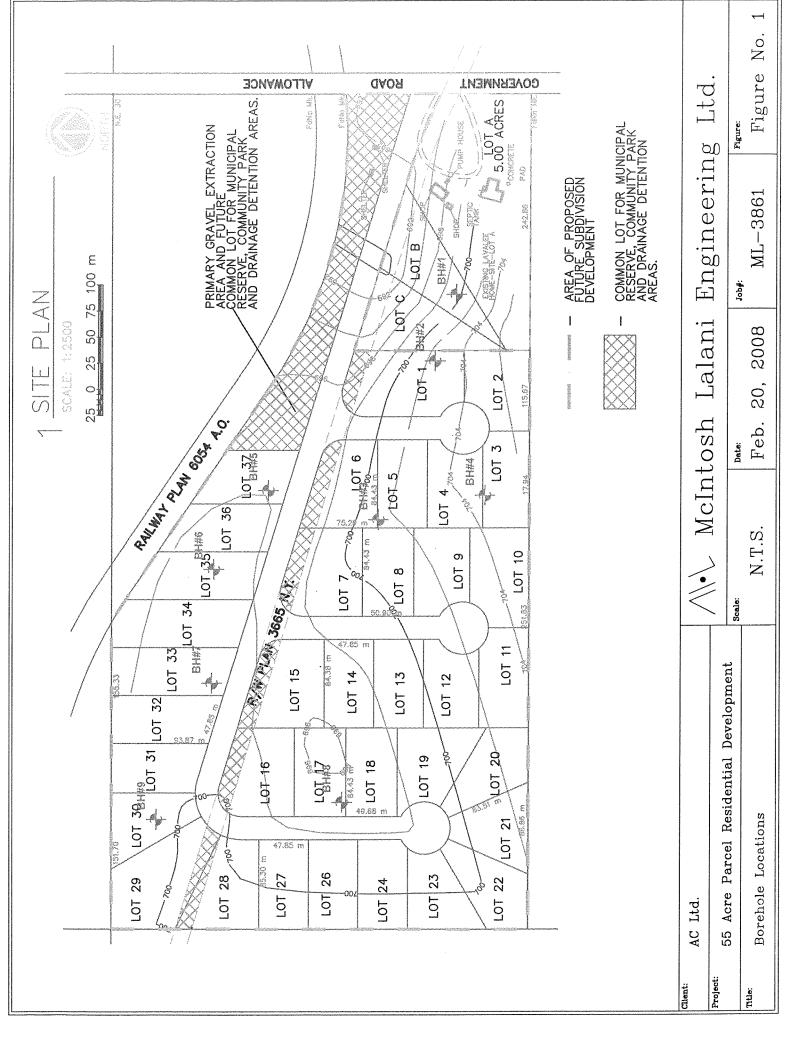
Respectfully submitted,

McIntosh • Lalani Engineering Ltd.

Nicholas R. Payne, E.I.T

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Marty D. Ward, P.Eng. Senior Project Engineer



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۷		-some gravel and cobbles, very stiff.		9-3				15.4									[804]	<sub>s</sub> ] = 0.014%		
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#### STANDARD TEST METHOD FOR PARTICLE SIZE

(Test Method ASTM D422)

PROJECT:

**55 ACRE PARCEL** 

CLIENT:

AC LTD.

PROJECT NO.:

ML-3861

LOCATION:

BH 1-1

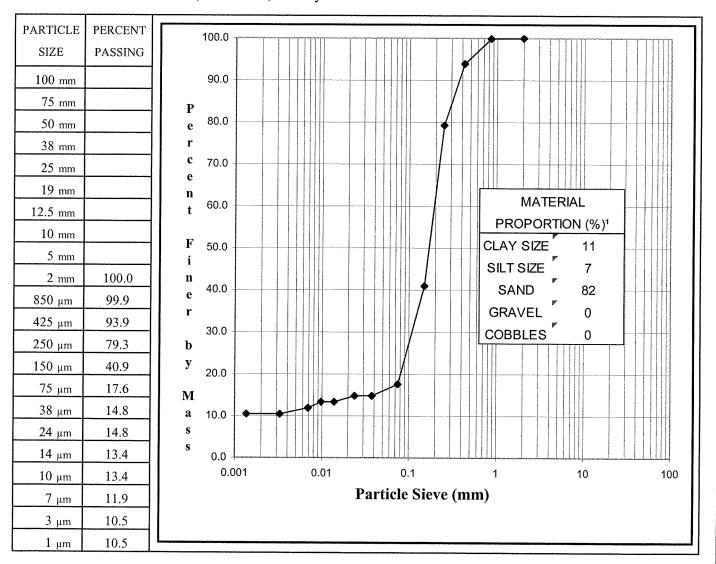
SAMPLE NO.:

11147

DEPTH:

DESCRIPTION:

Sand, Trace Silt, & Clay



Reviewed by: Mathematical Charge

P.Eng.

Note 1: Classified by the Modified Unified Soil Classification System

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#### STANDARD TEST METHOD FOR PARTICLE SIZE

(Test Method ASTM D422)

PROJECT: 55 ACRE PARCEL

CLIENT: AC LTD.
PROJECT NO.: ML-3861
LOCATION: BH 3-1
SAMPLE NO.: 11147

DEPTH:

DESCRIPTION: SILT, Some Sand & Clay

PARTICLE	PERCENT	100	20						
SIZE	PASSING					ر ا			
100 mm		90	0.0						
75 mm		P							
50 mm		e 80	0.0			1			
38 mm		r							dan and a dan a da
25 mm		e 70	0.0		<b>             </b>				
19 mm		n						7.7.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1	<u> </u>
12.5 mm		t 60	0.0		/		MATE		
10 mm		F 50	0.0				PROPORT		_
5 mm		i	J.U		/		CLAY SIZE	19	V (villadouprop)
2 mm	100.0	n 40	0.0				SILT SIZE	50	
850 μm	99.6	e r	,.o		7		SAND	31	
425 μm	97.9	30	0.0				GRAVEL	0	
250 μm	93.9	b					COBBLES	0	
150 μm	81.4	y 20	0.0	<b>K</b>					
75 μm	69.5	M							
34 μm	43.9	a 10	0.0						
22 μm	39.6	S							
13 μm	36.7	<b>s</b> 0	0.0						
9 μm	33.8		0.001	0.01		.1	1	10	100
7 μm	29.4				Particle	Sieve (	(mm)		
3 μm	22.1								
1 μm	17.8	<u> </u>							

Reviewed by:

P.Eng

Note 1: Classified by the Modified Unified Soil Classification System

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#### STANDARD TEST METHOD FOR PARTICLE SIZE

(Test Method ASTM D422)

PROJECT:

55 ACRE PARCEL

CLIENT:

AC LTD.

PROJECT NO.:

ML-3861

LOCATION:

BH 6-1

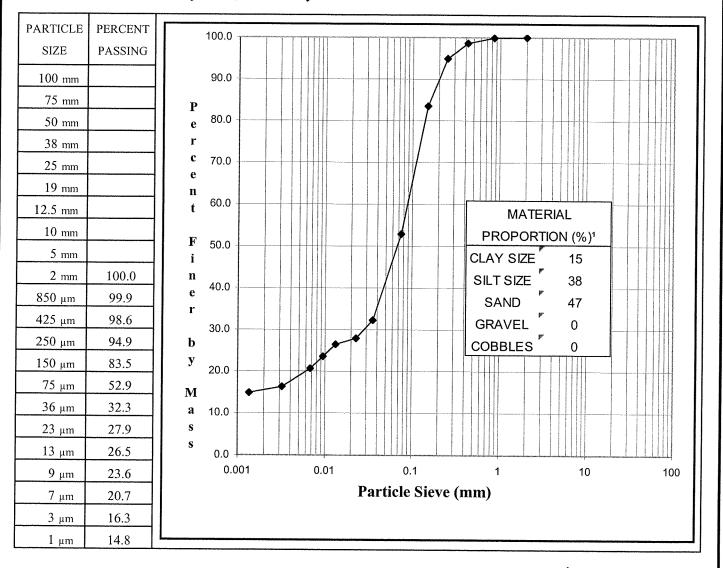
SAMPLE NO.:

11147

DEPTH:

DESCRIPTION:

Silty Sand, Some Clay



Reviewed by: Matheway

P.Eng.

Note 1: Classified by the Modified Unified Soil Classification System

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#### STANDARD TEST METHOD FOR PARTICLE SIZE

(Test Method ASTM D422)

PROJECT:

**55 ACRE PARCEL** 

CLIENT:

AC LTD.

PROJECT NO.:

ML-3861

LOCATION:

BH 8-1

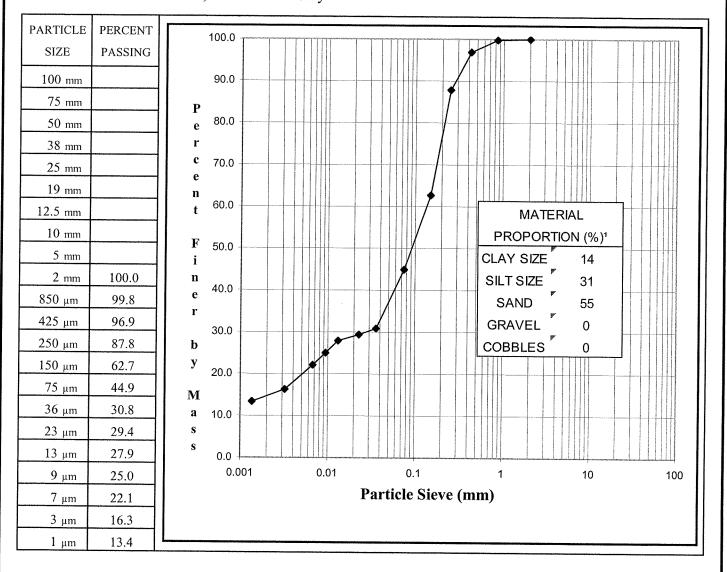
SAMPLE NO.:

11147

DEPTH:

DESCRIPTION:

Sand, Some Silt & Clay



Reviewed by:

P Fna

Note 1: Classified by the Modified Unified Soil Classification System

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#### STANDARD TEST METHOD FOR PARTICLE SIZE

(Test Method ASTM D422)

PROJECT: **55 ACRE PARCEL** 

CLIENT: AC LTD. PROJECT NO.: ML-3861 LOCATION: BH 9-1 SAMPLE NO.: 11147

DEPTH:

DESCRIPTION: Sand, Some Silt & Clay

PARTICLE SIZE	PERCENT PASSING	100.0		
100 mm		90.0		
75 mm		P		
50 mm		e 80.0		A COLUMN TO THE
38 mm		r		***************************************
25 mm		e 70.0		
19 mm		n		a.u.
12.5 mm		t 60.0	<del></del>	***************************************
10 mm		F 50.0 PROPORTION (9		
5 mm		i PROPORTION (9		
2 mm	100.0	n CLAY SIZE 14 e 40.0 SILT SIZE 31		
850 μm	98.7	r SAND 55	1	
425 μm	93.7	30.0 CPAVEL F		
250 μm	86.7	b GRAVEL 0 COBBLES 0		
150 μm	76.7 68.8	20.0		
75 μm 33 μm	55.6	M		
21 μm	52.7	a 10.0 s		
12 μm	49.8	s <sub>0.0</sub>		
9 μm	43.9	0.001 0.01 1	10	100
6 μm	41.0	Particle Sieve (mm)		
3 μm	35.2			
1 μm	27.9			

Reviewed by: Mass Ward P.Eng.

Note 1: Classified by the Modified Unified Soil Classification System

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