

**LICA LONG TERM SOIL ACIDIFICATION MONITORING  
WHITNEY LAKES SITE - 2019**

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## EXECUTIVE SUMMARY

The Lakeland Industry and Community Association (LICA) implemented a long term Acid Deposition monitoring program in 2010 with establishment of the Moose Lake site within Moose Lake Provincial Park. A second site, the Whitney Lakes long term soil acidification monitoring site, was established in 2011, and in 2012 a third site was set up near Tucker Lake. Soil sampling and laboratory analysis of soil samples to establish baseline soil chemistry data for these sites were completed during their respective site establishment years. The intended long term monitoring interval is four years. This report presents the data from the third sampling of the Whitney Lakes site carried out in the fall of 2019 and provides comparison with the results of previous sampling events.

The LICA monitoring system follows the protocols of Alberta Environment and Parks (AEP) in their Long Term Soil Acidification Monitoring Program. Background information, site selection and results of the first sampling event are described in *LICA Long Term Soil Acidification Monitoring - Whitney Lakes Site Establishment* (Abboud and Turchenek 2012).

Soil acidification parameters are soil attributes that can be directly affected by acidic inputs, and which in turn could affect other components of the ecosystem. These attributes include pH, exchangeable base saturation, aluminum (Al) concentration in soil solution, base cation (BC) concentration in soil solution, and the ratio of BC to Al concentrations. Associated attributes are levels of carbon (C), nitrogen (N) and sulphur (S) in surface soil horizons. In particular, Total Sulphur content can increase in the LFH and surface mineral soil layers due to deposition of sulphur oxides. Carbon and N are included with S analyses because the ratios of the three elements can reveal dynamics of these nutrients over a long term.

Soil acidification parameters were examined using descriptive statistics and analysis of variance to determine variability in the data. Base saturation and pH<sub>c</sub> (pH of soil mixed with CaCl<sub>2</sub> solution) were the least variable, while BC:Al ratio and individual dissolved ions had coefficients of variation exceeding 1.0 (i.e., >100%) in some cases. Total C, N and S, as well as the ratios of these with each other, were highly variable, particularly in the upper mineral layers.

There were some differences in acidification parameters between sub-sites (East and West) and among the three sampling years (2011, 2015 and 2019). These differences are attributed to variability both within and between sub-sites. Total Carbon, which reflects the amount of organic matter in the soil, is highest in the LFH layer and in the upper mineral soil layers. Differences in other parameters such as cation exchange capacity, base cations, BC:Al ratio, Total Nitrogen and Total Sulphur follow the Total Carbon differences because of the adsorptive capacity of organic matter for cations, and because Total Sulphur and Total Nitrogen are generally in organic form in the soil. Data inferences among the three sampling events are considered to pertain primarily to natural variability of the soil properties. Decreases of about 0.2 pH units in 0-2 and 2-5 cm layers and decreases in BC:Al ratio in the 5-10 and 10-15 cm layers between 2011 and 2019 are possible exceptions.

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## 1.0 INTRODUCTION

The Lakeland Industry and Community Association (LICA) implemented a long term Acid Deposition monitoring program in 2010 with establishment of the Moose Lake site within Moose Lake Provincial Park. A second site, the Whitney Lakes long term soil acidification monitoring site, was established in 2011. Soil sampling and laboratory analysis of soil samples to establish baseline soil chemistry data for the site were completed at that time. The long term monitoring was established to re-sample soils at four year intervals. This report presents the data from the third sampling event carried out in fall of 2019.

Background information and site selection are described in *Long Term Soil Acidification Monitoring in the LICA Study Area* (Abboud and Turchenek 2011). Establishment of the Whitney Lakes site and results of the first sampling event are presented in *LICA Long Term Soil Acidification Monitoring - Whitney Lakes Site Establishment* (Abboud and Turchenek 2012); results of the second sampling event are presented in *LICA Long Term Soil Acidification Monitoring, Whitney Lakes Site - 2015* (Abboud and Turchenek 2016). The LICA monitoring system follows the protocols of Alberta Environment and Parks (AEP) in their Long Term Soil Acidification Monitoring Program (Roberts et al. 1989, Abboud et al, 2012). This program consists of eight monitoring sites established in the 1980s throughout the Province of Alberta. One of these sites is located within the LICA study area, thus providing a historical monitoring basis for the LICA program. One other site was established near Tucker Lake, northeast on the Town of Bonnyville, in addition to the monitoring sites established at Moose Lake and Whitney lakes in 2011 and 2012.

Each monitoring site consists of two sub-sites; these are referred to as the West and East sub-sites at the Whitney Lakes monitoring site. Each sub-site is delineated by a 24 m by 24 m square area that is further subdivided into plots and subplots for replication purposes. At each of the sub-sites (i.e., East and West), twelve replicates are taken of eight soil layers (LFH and 0-2, 2-5, 5-10, 10-15, 15-30, 30-45 and 45-60 cm layers. The report of Abboud and Turchenek (2011) should be consulted for further details of the monitoring protocol. Details of sampling methods and laboratory analysis are also provided in the report of the 2011 sampling event (Abboud and Turchenek 2012).

All soil chemical parameters (see Section 2.2) were measured for all replicates and all layers in the initial monitoring event in 2010. The purpose was to establish the baseline for the entire depth of sampling. In the current sampling event, and in subsequent years, only the LFH, 0-2, 2-5, 5-10, and 10-15 cm depth samples will be analyzed. This is done in part to reduce the analytical costs associated with monitoring. In addition, it has been shown that any effects to date have occurred only in the surface soils layers in the AEP long term monitoring program (Abboud et al. 2012). Consequently, the long term aspect of monitoring entails determination of the acid chemistry of surface soil layers to 15 cm depth. All samples are archived and will be available for laboratory analysis in the future, should results indicate that changes are occurring potentially to depths greater than 15 cm.

## 2.0 METHODS

### 2.1 SOIL SAMPLING

Soil sampling was carried out as described in Section 4.2.2 of the 2011 soil monitoring report (Abboud and Turchenek (2012)).

### 2.2 LABORATORY ANALYSES

Soil analyses were completed at the Soil Laboratory of the Northern Forestry Centre in Edmonton, Alberta. Samples submitted to the laboratory from the field were kept frozen if they could not be immediately processed. Sample processing consisted of drying at about 30°C and then passing them through a 2 mm sieve. Methods are as described in the 2011 soil monitoring report (Abboud and Turchenek (2012)), and method references are repeated below in Table 1.

**Table 1. Analytical Methods Applied in Soil Analysis**

Parameter	Method	Notes
pH (CaCl <sub>2</sub> )	Method 3.11 in McKeague (1978)	The soil-to-solution ratio for litter (LFH) material is 1:4 and for mineral soil is 1:2. Solution is 0.1 M CaCl <sub>2</sub> . Measurement is with a combination pH electrode.
Electrical Conductivity	Method 4.13 in McKeague (1978)	The EC and pH were measured in the saturated paste extract of a soil sample.
Soluble Ions	Method 3.21 in McKeague (1978)	By the saturated paste method and ICP-OES analysis of the extract for Na, K, Ca, Mg, Al, Fe, Mn and S.
Cation Exchange Capacity - Unbuffered	Method 18.2 in Carter and Gregorich (2008)	By unbuffered 0.1 M BaCl <sub>2</sub> extraction, and calculation of CEC as sum of exchangeable cations.
Exchangeable Cations	Method 18.2 in Carter and Gregorich (2008)	By ICP-OES analysis for Ca, Mg, Na, K, Fe, Mn, and Al in the unbuffered BaCl <sub>2</sub> extract from CEC analysis.
Total Carbon, Nitrogen, and Sulphur	Method 3.611 in McKeague (1978)	Combustion method using a LECO TruSpec CN Carbon/Nitrogen Analyzer (LECO, 2006).

### 2.3 STATISTICS

Basic statistics (i.e., mean, standard deviation and coefficient of variability) were calculated for the acidification indicators and their input variables. Coefficient of variation (CV) refers to the standard deviation divided by the mean. Analysis of variance (ANOVA) was performed on the main soil acidification variables, namely pH, base saturation, and base cation:aluminum (BC:Al) ratio, as well as some of the input variables. A two-factor ANOVA using MS Excel<sup>®</sup> was carried out in order to examine the differences between the two sub-sites (East and West) and the three sampling years (2011, 2015 and 2019). Tukey's test (Steel and Torrie 1980, 1960) was subsequently carried out on these attributes in order to determine whether differences in the data were statistically significant ( $\alpha=0.05$  level of confidence). The statistics were based on the 12 replicates from each sub-site.

## **3.0 RESULTS**

### **3.1 SOIL ACIDIFICATION PARAMETERS**

Soil acidification parameters are soil attributes that can be directly affected by acidic inputs, and which in turn could affect other components of the ecosystem. These attributes include pH, exchangeable base saturation, aluminum (Al) concentration in soil solution, base cation (BC) concentration in soil solution, and the ratio of BC to Al concentrations. A detailed discussion of these is presented in the 2011 LICA soil monitoring report (Abboud and Turchenek 2011). Of the attributes, research has demonstrated effects on vegetation mainly with respect to base saturation percentage and base cation to aluminum ratio (Ulrich et al., 1984; Sverdrup and Warfvinge, 1993). Decreases in either of these attributes can occur with addition of acidic or acidifying substances to the soil. Likewise, pH is expected to decrease. Associated attributes are levels of carbon (C), nitrogen (N) and sulphur (S) in surface soil horizons. In particular, Total Sulphur content can increase in the LFH and surface mineral soil layers due to deposition of sulphur oxides. Carbon and nitrogen are included in the analyses because the ratios of the three elements can reveal dynamics of these nutrients over a long term.

### **3.2 SOIL MONITORING RESULTS**

Soil samples from the East and West Whitney lakes sub-sites were analyzed for various soil parameters, as described above. The complete data are provided in Appendices A and B. Data in Appendix A are presented with simple statistics for each soil attribute according to soil layer and soil sub-site. Appendix B presents a listing of lab and field numbers and the analysis associated with each sample.

Tables 2, 3 and 4 summarize the data for the main acidification indicators and the main parameters from which they were calculated. These tables also include basic descriptive statistics and the results of the two factor ANOVA with Tukey's Honest Significant Difference (HSD) extension to the ANOVA results. The following examines some aspects of the data.

#### **3.2.1 pH<sub>c</sub>**

The data show no significant differences in pH<sub>c</sub> (pH of soil mixed with CaCl<sub>2</sub> solution) in soil layers among the years 2011, 2015 and 2019, except in the 0-2 cm layer where 2019 values are about 0.2 units lower in 2019 and 2015 as compared to 2011 (Table 2). Variability is low, with coefficients of variation (CV) being 0.09 or lower.

#### **3.2.2 Base Saturation**

Base saturation is a key acidification indicator defined as the proportion of exchangeable base cations (K, Na, Ca and Mg) to the cation exchange capacity (Table 2). Significant differences occur in the 5-10 cm and 10-15 cm layers, and both increases and decreases occur among the sampling years. Coefficients of variation range from 0.04 to 0.12 among the layers and sampling years.

**Table 2. Soil pH, Base Saturation, Cation Exchange Capacity and Exchangeable Bases - Whitney Lakes Site - 2011, 2015 and 2019**

<b>pHc</b>		<b>LFH</b>				<b>0-2 (cm)</b>				<b>2-5 (cm)</b>				<b>5-10 (cm)</b>				<b>10-15 (cm)</b>			
<b>Year</b>	<b>Sub-site</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>
2011	West	4.42	ab	0.10	0.02	4.83	ab	0.25	0.05	4.94	a	0.21	0.04	4.81	a	0.22	0.05	4.76	a	0.18	0.04
2015	West	4.31	a	0.15	0.03	4.71	ab	0.31	0.06	4.90	a	0.20	0.04	4.88	a	0.25	0.05	4.87	a	0.26	0.05
2019	West	4.20	a	0.16	0.04	4.65	a	0.31	0.07	4.77	a	0.23	0.05	4.84	a	0.26	0.05	4.78	a	0.38	0.08
2011	East	4.62	b	0.29	0.06	5.09	b	0.44	0.09	5.14	a	0.40	0.08	5.07	a	0.46	0.09	4.99	a	0.43	0.09
2015	East	4.41	ab	0.22	0.05	4.86	ab	0.40	0.08	4.91	a	0.36	0.07	4.89	a	0.33	0.07	4.92	a	0.31	0.06
2019	East	4.34	a	0.16	0.04	4.88	ab	0.29	0.06	4.85	a	0.37	0.08	4.81	a	0.35	0.07	4.82	a	0.36	0.08
<b>Base Saturation</b>						<b>0-2 (cm)</b>				<b>2-5 (cm)</b>				<b>5-10 (cm)</b>				<b>10-15 (cm)</b>			
<b>Year</b>	<b>Sub-site</b>					<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>
2011	West					0.90	a	0.05	0.05	0.90	a	0.07	0.07	0.88	a	0.05	0.06	0.87	a	0.05	0.06
2015	West					0.91	a	0.06	0.07	0.94	a	0.05	0.05	0.94	ab	0.03	0.03	0.95	ab	0.05	0.05
2019	West					0.89	a	0.07	0.08	0.91	a	0.06	0.07	0.93	ab	0.05	0.06	0.92	ab	0.10	0.10
2011	East					0.94	a	0.04	0.04	0.94	a	0.06	0.07	0.90	ab	0.10	0.12	0.89	ab	0.09	0.10
2015	East					0.93	a	0.05	0.05	0.95	a	0.05	0.05	0.96	b	0.04	0.04	0.97	b	0.03	0.03
2019	East					0.95	a	0.04	0.05	0.93	a	0.06	0.06	0.93	ab	0.06	0.06	0.93	ab	0.07	0.07
<b>Cation Exchange Capacity (cmol/kg)</b>						<b>0-2 (cm)</b>				<b>2-5 (cm)</b>				<b>5-10 (cm)</b>				<b>10-15 (cm)</b>			
<b>Year</b>	<b>Sub-site</b>					<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>
2011	West					4.85	a	0.92	0.19	4.25	a	1.25	0.29	2.48	a	0.68	0.27	1.72	a	0.21	0.12
2015	West					5.15	ab	1.78	0.35	4.80	ab	1.11	0.23	2.81	a	0.80	0.29	1.86	a	0.36	0.19
2019	West					5.27	ab	1.43	0.27	5.24	ab	0.61	0.12	3.41	a	0.85	0.25	1.97	a	0.30	0.16
2011	East					8.72	c	2.65	0.30	5.92	b	1.36	0.23	3.16	a	1.10	0.35	2.03	a	0.52	0.26
2015	East					6.29	abc	3.20	0.51	5.20	ab	1.13	0.22	3.03	a	1.30	0.43	2.11	a	0.60	0.28
2019	East					7.98	bc	3.73	0.47	4.52	ab	1.55	0.34	2.55	a	0.73	0.28	2.12	a	0.47	0.22
<b>Sum of Bases (cmol/kg)</b>						<b>0-2 (cm)</b>				<b>2-5 (cm)</b>				<b>5-10 (cm)</b>				<b>10-15 (cm)</b>			
<b>Year</b>	<b>Sub-site</b>					<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>
2011	West					4.36	a	0.90	0.21	3.87	a	1.33	0.34	2.19	a	0.66	0.30	1.50	a	0.23	0.15
2015	West					4.71	ab	1.69	0.36	4.52	ab	1.18	0.26	2.66	a	0.83	0.31	1.76	a	0.36	0.21
2019	West					4.70	ab	1.41	0.30	4.78	ab	0.72	0.15	3.20	a	0.89	0.28	1.82	a	0.38	0.21
2011	East					8.30	c	2.76	0.33	5.59	b	1.45	0.26	2.91	a	1.13	0.39	1.84	a	0.59	0.32
2015	East					5.94	abc	3.16	0.53	4.94	ab	1.18	0.24	2.93	a	1.31	0.45	2.05	a	0.60	0.29
2019	East					7.62	bc	3.76	0.49	4.25	ab	1.60	0.38	2.39	a	0.76	0.32	1.98	a	0.48	0.24

Abbreviations: SD—standard deviation CV – coefficient of variation

Sig - significance: a, b, ab, c, bc – significance indicators; means followed by the same letter do not differ significantly from one another at P=0.05 (Tukey's test).

**Table 3. Water Soluble Ions and Base Cation:Aluminum Ratios at the Whitney Lakes Site – 2011, 2015 and 2019**

<b>BC:Al Ratio</b>		<b>0-2 (cm)</b>				<b>2-5 (cm)</b>				<b>5-10 (cm)</b>				<b>10-15 (cm)</b>			
<b>Year</b>	<b>Sub-site</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>
2011	<b>West</b>	7.96	a	3.27	0.41	6.91	a	3.14	0.45	5.09	ab	3.25	0.64	3.53	ab	1.40	0.40
2015	<b>West</b>	11.93	a	4.03	0.34	13.59	a	9.13	0.67	11.97	b	12.35	1.03	4.03	ab	3.32	0.82
2019	<b>West</b>	6.33	a	2.55	0.40	6.20	a	3.61	0.58	3.29	ab	1.53	0.47	1.18	a	0.51	0.44
2011	<b>East</b>	21.22	a	18.22	0.86	24.55	a	31.87	1.30	11.33	ab	7.18	0.63	6.53	b	3.74	0.57
2015	<b>East</b>	24.41	a	31.50	1.29	16.58	a	16.71	1.01	7.14	ab	4.70	0.66	5.30	ab	6.76	1.28
2019	<b>East</b>	15.16	a	7.45	0.49	10.45	a	15.97	1.53	4.09	a	7.03	1.72	1.44	a	0.88	0.61
<b>K (mmol/L)</b>																	
<b>Year</b>	<b>Sub-site</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>
2011	<b>West</b>	0.44	a	0.22	0.49	0.25	a	0.10	0.41	0.17	a	0.04	0.46	0.10	a	0.03	0.27
2015	<b>West</b>	0.38	a	0.17	0.45	0.24	a	0.10	0.41	0.15	a	0.05	0.30	0.10	a	0.05	0.52
2019	<b>West</b>	0.49	a	0.16	0.33	0.35	a	0.12	0.33	0.23	a	0.09	0.99	0.15	a	0.07	0.50
2011	<b>East</b>	0.50	a	0.25	0.50	0.25	a	0.16	0.63	0.75	a	1.87	2.51	0.11	a	0.07	0.64
2015	<b>East</b>	0.50	a	0.15	0.31	0.34	a	0.14	0.43	0.39	a	0.68	1.73	0.14	a	0.10	0.72
2019	<b>East</b>	0.41	a	0.25	0.61	0.27	a	0.17	0.65	0.37	a	0.63	1.69	0.15	a	0.07	0.46
<b>Ca (mmol/L)</b>																	
<b>Year</b>	<b>Sub-site</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>
2011	<b>West</b>	0.87	a	0.23	0.26	0.69	a	0.19	0.27	0.48	a	0.11	1.17	0.33	a	0.07	0.22
2015	<b>West</b>	1.03	ab	0.57	0.55	0.84	ab	0.32	0.39	0.59	a	0.23	1.38	0.34	a	0.11	0.32
2019	<b>West</b>	0.94	ab	0.16	0.17	0.84	ab	0.11	0.13	0.64	a	0.12	1.23	0.37	ab	0.09	0.25
2011	<b>East</b>	1.19	ab	0.29	0.24	0.84	ab	0.24	0.29	0.59	a	0.17	0.29	0.41	ab	0.15	0.36
2015	<b>East</b>	1.33	b	0.55	0.41	1.03	b	0.38	0.37	0.68	a	0.23	0.34	0.51	b	0.20	0.40
2019	<b>East</b>	0.93	ab	0.26	0.28	0.74	ab	0.28	0.38	0.53	a	0.22	0.42	0.42	ab	0.14	0.35



**Table 3. Water Soluble Ions and Base Cation:Aluminum Ratios at the Whitney Lakes Site – 2011, 2015 and 2019 (Concluded)**

<b>Mg (mmol/L)</b>																	
<b>Year</b>	<b>Sub-site</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>
2011	<b>West</b>	0.29	a	0.08	0.26	0.23	a	0.06	0.27	0.17	a	0.03	0.36	0.11	a	0.03	0.23
2015	<b>West</b>	0.32	a	0.16	0.51	0.25	a	0.09	0.38	0.17	a	0.06	0.36	0.11	a	0.03	0.30
2019	<b>West</b>	0.31	a	0.07	0.24	0.25	a	0.04	0.16	0.18	a	0.04	0.37	0.13	a	0.02	0.15
2011	<b>East</b>	0.40	a	0.13	0.33	0.28	a	0.08	0.30	0.19	a	0.09	0.45	0.13	a	0.05	0.41
2015	<b>East</b>	0.42	a	0.11	0.25	0.32	a	0.12	0.38	0.21	a	0.08	0.38	0.16	a	0.07	0.44
2019	<b>East</b>	0.31	a	0.11	0.37	0.24	a	0.11	0.46	0.18	a	0.07	0.40	0.15	a	0.05	0.32
<b>Al (mmol/L)</b>																	
<b>Year</b>	<b>Sub-site</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>
2011	<b>West</b>	0.23	bc	0.12	0.50	0.20	ab	0.09	0.44	0.32	abc	0.41	4.22	0.21	a	0.20	0.93
2015	<b>West</b>	0.15	ab	0.07	0.47	0.12	a	0.05	0.39	0.12	ab	0.06	0.33	0.21	a	0.12	0.58
2019	<b>West</b>	0.30	c	0.10	0.35	0.27	b	0.09	0.32	0.35	bc	0.10	1.05	0.61	b	0.19	0.31
2011	<b>East</b>	0.14	ab	0.07	0.48	0.10	a	0.05	0.52	0.10	a	0.05	0.43	0.11	a	0.03	0.30
2015	<b>East</b>	0.13	a	0.04	0.31	0.13	a	0.04	0.32	0.20	ab	0.09	0.48	0.27	a	0.13	0.47
2019	<b>East</b>	0.13	a	0.07	0.54	0.25	a	0.14	0.56	0.44	c	0.20	0.45	0.59	b	0.20	0.34

Abbreviations: K, Ca, Mg, Al – water soluble cations BC:Al – ratio of (K+Ca+Mg) concentration to Al concentration Mean – average of 12 replicates in each sub-site  
 SD–standard deviation CV – coefficient of variation

Sig - significance: a, b, ab, c, bc – significance indicators; means followed by the same letter do not differ significantly from one another at P=0.05 (Tukey's test).

**Table 4. Total Soil Carbon, Nitrogen and Sulphur at the Whitney Lakes Site – 2011, 2015 and 2019**

Total Carbon (%)		LFH (cm)				0-2 (cm)				2-5 (cm)				5-10 (cm)				10-15 (cm)			
Year	Sub-site	Mean	Sig	SD	CV	Mean	Sig	SD	CV	Mean	Sig	SD	CV	Mean	Sig	SD	CV	Mean	Sig	SD	CV
2011	West	35.93	c	8.40	0.23	2.34	a	0.76	0.32	1.44	a	0.42	0.29	0.67	a	0.27	0.41	0.28	a	0.06	0.22
2015	West	30.23	abc	8.86	0.29	2.53	a	0.92	0.37	1.59	a	0.33	0.21	0.72	a	0.26	0.37	0.27	a	0.11	0.42
2019	West	35.57	bc	6.07	0.17	2.43	a	0.78	0.38	1.55	a	0.46	0.30	0.84	a	0.30	0.36	0.31	a	0.09	0.29
2011	East	30.61	abc	8.03	0.26	3.31	a	0.96	0.29	1.72	a	0.49	0.29	0.79	a	0.49	0.62	0.31	a	0.09	0.28
2015	East	21.76	a	7.04	0.32	3.60	a	1.79	0.50	1.57	a	0.61	0.39	0.56	a	0.15	0.27	0.29	a	0.09	0.30
2019	East	27.13	abc	9.03	0.33	3.46	a	1.62	0.51	1.48	a	0.52	0.35	0.64	a	0.26	0.40	0.35	a	0.09	0.26
Total Nitrogen (%)																					
Year	Sub-site	Mean	Sig	SD	CV	Mean	Sig	SD	CV	Mean	Sig	SD	CV	Mean	Sig	SD	CV	Mean	Sig	SD	CV
2011	West	0.959	c	0.216	0.23	0.054	a	0.027	0.50	0.026	a	0.013	0.48	0.007	a	0.003	0.46	0.005	a	0.000	0.00
2015	West	0.897	abc	0.258	0.29	0.085	ab	0.027	0.32	0.053	b	0.014	0.26	0.023	bc	0.011	0.48	0.007	a	0.006	0.77
2019	West	0.928	b	0.184	0.20	0.081	ab	0.031	0.39	0.062	b	0.020	0.32	0.032	c	0.012	0.37	0.014	b	0.006	0.43
2011	East	0.860	abc	0.210	0.24	0.105	ab	0.036	0.34	0.045	ab	0.016	0.36	0.013	ab	0.010	0.80	0.005	a	0.000	0.00
2015	East	0.650	a	0.218	0.34	0.140	b	0.077	0.55	0.059	b	0.027	0.45	0.014	ab	0.006	0.39	0.006	a	0.002	0.27
2019	East	0.705	abc	0.194	0.28	0.130	b	0.058	0.45	0.066	b	0.021	0.32	0.031	c	0.010	0.33	0.020	c	0.005	0.25
Total Sulphur (%)																					
Year	Sub-site	Mean	Sig	SD	CV	Mean	Sig	SD	CV	Mean	Sig	SD	CV	Mean	Sig	SD	CV	Mean	Sig	SD	CV
2011	West	0.100	c	0.019	0.19	0.009	a	0.003	0.31	0.006	a	0.002	0.29	0.004	a	0.002	0.42	0.003	a	0.001	0.27
2015	West	0.081	abc	0.022	0.26	0.008	a	0.002	0.29	0.005	a	0.002	0.45	0.003	a	0.002	0.64	0.002	a	0.001	0.47
2019	West	0.095	c	0.018	0.19	0.009	a	0.003	0.36	0.006	a	0.002	0.43	0.003	a	0.001	0.38	0.002	a	0.001	0.41
2011	East	0.095	bc	0.022	0.24	0.012	a	0.004	0.34	0.007	a	0.001	0.17	0.004	a	0.001	0.24	0.003	a	0.001	0.26
2015	East	0.062	a	0.017	0.27	0.013	a	0.004	0.35	0.005	a	0.003	0.56	0.003	a	0.002	0.49	0.002	a	0.001	0.35
2019	East	0.070	ab	0.022	0.32	0.013	a	0.005	0.43	0.005	a	0.002	0.33	0.003	a	0.001	0.27	0.002	a	0.001	0.30
C:N Ratio																					
Year	Sub-site	Mean	Sig	SD	CV	Mean	Sig	SD	CV	Mean	Sig	SD	CV	Mean	Sig	SD	CV	Mean	Sig	SD	CV
2011	West	37.55	a	3.90	0.10	48.48	b	15.6	0.32	61.63	c	19.23	0.31	103.66	c	34.27	0.33	55.44	bc	12.38	0.22
2015	West	33.82	a	2.01	0.06	29.29	a	3.21	0.11	30.27	ab	2.97	0.10	32.49	a	7.72	0.24	40.96	b	12.44	0.30
2019	West	38.67	a	3.28	0.08	26.05	a	4.05	0.16	25.50	a	3.07	0.12	26.55	a	4.34	0.16	24.21	a	7.02	0.29
2011	East	35.62	a	4.54	0.13	32.10	a	3.97	0.12	39.18	b	6.33	0.16	72.08	b	25.01	0.35	62.58	c	17.56	0.28
2015	East	33.69	a	3.32	0.10	25.96	a	2.65	0.10	27.22	a	3.10	0.11	42.20	a	10.66	0.25	50.69	bc	15.37	0.30
2019	East	38.18	a	5.10	0.13	24.15	a	2.85	0.12	22.34	a	1.89	0.08	20.51	a	4.30	0.21	17.93	a	6.22	0.35

**Table 4. Total Soil Carbon, Nitrogen and Sulphur at the Whitney Lakes Site – 2011, 2015 and 2019 (Concluded)**

<b>C:S Ratio</b>																					
<b>Year</b>	<b>Sub-site</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>
2011	West	357	ab	51.3	0.14	271	a	102.8	0.38	267	a	62.9	0.24	214	ab	118.4	0.55	109	a	44.9	0.41
2015	West	370	ab	35.3	0.10	309	a	76.0	0.25	508	a	608.5	1.20	371	b	275.9	0.74	187	a	114.2	0.61
2019	West	376	ab	43.2	0.11	253	a	82.7	0.33	303	a	119.6	0.39	275	ab	30.8	0.11	212	a	146.3	0.69
2011	East	324	a	52.2	0.16	287	a	85.3	0.30	265	a	62.6	0.24	188	a	77.3	0.41	133	a	61.9	0.47
2015	East	348	ab	49.3	0.14	283	a	82.8	0.29	427	a	343.2	0.80	236	ab	173.1	0.74	134	a	58.4	0.43
2019	East	390	b	75.8	0.19	253	a	53.3	0.21	285	a	77.7	0.27	192	a	56.3	0.29	192	a	102.4	0.53
<b>N:S Ratio</b>																					
<b>Year</b>	<b>Sub-site</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>	<b>Mean</b>	<b>Sig</b>	<b>SD</b>	<b>CV</b>
2011	West	9.52	ab	1.23	0.13	6.06	a	2.84	0.47	4.54	a	1.23	0.27	2.11	a	1.07	0.51	1.94	a	0.51	0.26
2015	West	10.94	c	0.83	0.08	10.55	b	2.39	0.23	16.70	b	19.72	1.18	11.47	c	8.08	0.70	5.47	ab	5.71	1.04
2019	West	10.23	bc	0.81	0.08	9.84	b	3.33	0.34	12.02	ab	4.73	0.39	10.62	bc	2.01	0.19	9.67	bc	7.25	0.75
2011	East	9.08	a	0.65	0.07	9.09	ab	2.95	0.32	6.83	ab	1.50	0.22	2.98	a	1.65	0.55	2.05	a	0.49	0.24
2015	East	10.34	bc	1.02	0.10	10.95	b	3.16	0.29	15.40	ab	11.22	0.73	5.98	ab	4.64	0.78	2.81	a	1.31	0.47
2019	East	9.71	ab	0.80	0.08	10.43	b	1.49	0.14	12.67	ab	2.69	0.21	9.54	bc	2.57	0.27	11.17	c	5.56	0.50

Abbreviations: C – Total Carbon; S – Total Sulphur; N – Total Nitrogen average of 12 replicates in each sub-site

SD–standard deviation CV – coefficient of variation

Sig - significance: a, b, ab, c, bc – significance indicators; means followed by the same letter do not differ significantly from one another at P=0.05 (Tukey's test).

### **3.2.3 Cation Exchange Capacity (CEC) and Sum of Exchangeable Bases**

Both parameters are variable, with CV ranging from 0.12 to 0.51 for CEC, and 0.15 to 0.53 for sum of bases (Table 2). The main differences occur between sites, where both CEC and sum of bases are higher in the 0-2 cm and 2-5 cm layers of the East site as compared to the West site. This is consistent among the three sampling years.

### **3.2.4 Base Cation to Aluminum Ratio (BC:Al) and Water Soluble Ions**

The BC:Al ratios are quite variable as indicated by CV values ranging from 0.34 up to 1.72 among the all soil layers and years (Table 3). Water soluble ions are likewise quite variable, with soluble Al having the widest CV range at 0.12 to 4.22 among all the layers, sites and years of sampling. The means of Al values among sites and years range from 0.10 to 0.61 mmol/L. The CV values of the other elements in the BC:Al calculations are: K - 0.27 to 2.51; Ca - 0.17 to 0.38, and; Mg - 0.15 to 0.51. The degree in variability in these water soluble ions results in likewise highly variable ratios of base cations to aluminum.

Differences among BC:Al ratios are not significant in the upper two layers. Values tend to be lower in the lower two (5-10 and 10-15 cm) soil layers in 2019 as compared to the previous sampling years.

Higher BC:Al ratios in the 0-2 cm and 2-5 cm layers, as compared to lower layers, are a consequence of the higher base cation contents (K, Ca and Mg), which are associated with the higher organic carbon levels in the surface layers. The organic C reflects the amount of organic matter in the soil. With increasing organic matter content, there is increasing capacity to adsorb and retain exchangeable cations. The organic matter also decomposes slowly, releasing nutrients including base cations, thus leading to relatively higher concentrations in the surface soil layers.

### **3.2.5 Total Carbon (TC)**

The LFH layer is included in the analysis of TC, TN and TS because of potential for accumulation of these over time. Total C has relatively high variability, with CVs ranging from 0.17 to 0.62 among the sampling years and layers (Table 4). High C contents are typical of LFH (informally referred to as litter or duff) layers in forest soils. Relatively higher C in the 0-2 cm and 2-5 cm mineral layers reflects the influence of the litter layer, whereby particulate or soluble C mixes or leaches from the LFH into the upper mineral soil. Differences in C contents are not statistically significant in the mineral soil layers, and CVs are relatively high, ranging from 0.17 to 0.42 among all mineral layers and sampling years.

### **3.2.6 Total Nitrogen (TN) and Total Sulphur (TS)**

TN and TS contents are low in the mineral soil layers, and they display variability similar to that for TC (Table 4). As for TC, the levels in the mineral soil layers are highest in the 0-2 cm layer and then diminish with depth. TS is an important monitoring parameter, as sulphur can accumulate in the LFH layer and thus reflect the amount of deposition at a site; however, no definite trends of change over time can be seen in the data.

### **3.2.7 C:N, C:S and N:S Ratios**

Of these ratios, C:S is of interest for the same reasons as indicated for TS above. If TS increases in the soil surface layers, it is expected that C:S would decrease. Similar observations apply to the C:N ratios. Some values are relatively high, particularly the 2011 ratios for the West sub-site as compared to the East sub-site. Values such as these are attributed to variability in site-specific conditions. The C:S ratios are high due to the considerably larger fraction of C in organic matter as compared to S. There is variability in these ratios; while differences among the mean values are significant, definite trends of increase or decrease are not apparent.

## **4.0 CONCLUSION**

Soil acidification parameters were examined using descriptive statistics and analysis of variance to determine variability in the data. Base saturation and pH<sub>c</sub> were the least variable, while BC:Al ratio had CVs up to 1.72 (i.e., 172%), with individual dissolved ions also exceeding 1.0 (i.e., >100%) in some cases. Total C, N and S were also examined, with ratios of TC and TN to TS calculated to observe possible trends in S accumulation over the long term. Levels of each of these were quite variable, particularly in the upper mineral layers.

Differences in acidification parameters between sub-sites (East and West) and among the three sampling years (2011, 2015 and 2019) are generally attributable to natural variability. TC, TN and TS contents are highest in the LFH layer and in upper mineral soil layers (0-2 cm and 2-5 cm). The TC reflects the amount of organic matter in the soil. Differences in other parameters such as cation exchange capacity, base cations, BC:Al ratio, TN and TS follow the TC differences because of the adsorptive capacity of organic matter for cations, and because TS and TN are generally in organic form in the soil.

Data inferences based on the 2011, 2015 and 2019 sampling events pertain mostly to natural variability of the soil properties. Three sampling events have been completed over an eight year period, but no definite trends in acidification indicators can be discerned. Decreases of about 0.2 pH units in 0-2 and 2-5 cm layers and decreases in BC:Al ratio in the 5-10 and 10-15 cm layers between 2011 and 2019 are possible exceptions.

## 5.0 REFERENCES

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**APPENDIX A**

**DATA AND BASIC STATISTICS**

**WHITNEY LAKES SOIL MONITORING SITE - 2019**

**Appendix Table A1. pHc, Cation Exchange Capacity and Exchangeable Ions - 2019 Data and Descriptive Statistics**

Plot	Subplot/ Layer	pHc	Na	K	Ca	Mg	Al	Fe	Mn	TEC	Bases	Base Saturation
West	A3/0-2	4.6	0.056	0.165	2.67	0.423	0.147	<0.001	0.267	3.72	3.31	0.89
West	B3/0-2	5.1	0.057	0.219	3.24	0.530	0.026	<0.001	0.159	4.24	4.05	0.96
West	C3/0-2	4.9	0.055	0.150	4.30	0.502	0.068	<0.001	0.246	5.32	5.00	0.94
West	D3/0-2	5.1	0.056	0.153	7.24	0.774	0.012	<0.001	0.199	8.43	8.22	0.97
West	E3/0-2	4.4	0.058	0.158	4.15	0.492	0.434	0.001	0.527	5.82	4.86	0.83
West	F3/0-2	4.8	0.053	0.118	2.60	0.389	0.060	<0.001	0.154	3.37	3.16	0.94
West	G3/0-2	4.5	0.057	0.236	4.18	0.583	0.275	<0.001	0.482	5.81	5.06	0.87
West	H3/0-2	4.7	0.056	0.179	4.23	0.671	0.099	<0.001	0.256	5.49	5.13	0.94
West	I3/0-2	4.4	0.058	0.235	4.58	0.655	0.259	<0.001	0.465	6.25	5.52	0.88
West	J3/0-2	4.5	0.057	0.128	2.56	0.379	0.471	0.018	0.622	4.24	3.13	0.74
West	K3/0-2	4.8	0.056	0.187	2.92	0.541	0.081	<0.001	0.293	4.08	3.71	0.91
West	L3/0-2	4.1	0.017	0.157	4.47	0.652	0.504	<0.001	0.668	6.47	5.30	0.82
	Mean	4.7	0.053	0.174	3.93	0.549	0.203	<0.001	0.362	5.27	4.70	0.89
	SD	0.3	0.011	0.039	1.30	0.122	0.181		0.182	1.43	1.41	0.07
	CV #	0.07	0.22	0.22	0.33	0.22	0.89		0.50	0.27	0.30	0.08
East	A3/0-2	5.0	0.016	0.125	3.76	0.559	0.057	<0.001	0.159	4.67	4.46	0.95
East	B3/0-2	4.3	0.011	0.122	3.61	0.465	0.480	<0.001	0.392	5.08	4.21	0.83
East	C3/0-2	5.1	0.014	0.295	12.8	1.35	0.008	<0.001	0.258	14.75	14.49	0.98
East	D3/0-2	5.2	0.012	0.281	12.0	1.32	0.017	<0.001	0.274	13.89	13.59	0.98
East	E3/0-2	4.5	0.010	0.155	4.19	0.687	0.232	0.001	0.299	5.57	5.04	0.90
East	F3/0-2	4.7	0.008	0.097	6.04	0.666	0.206	<0.001	0.239	7.25	6.81	0.94
East	G3/0-2	4.9	0.024	0.221	4.47	0.712	0.045	<0.001	0.289	5.76	5.43	0.94
East	H3/0-2	5.1	0.009	0.335	6.14	1.12	0.028	<0.001	0.187	7.82	7.60	0.97
East	I3/0-2	5.3	0.013	0.155	2.72	0.436	0.001	<0.001	0.063	3.39	3.33	0.98
East	J3/0-2	4.8	0.005	0.214	9.18	1.11	0.039	<0.001	0.353	10.90	10.51	0.96
East	K3/0-2	4.7	0.002	0.143	4.68	0.730	0.103	<0.001	0.237	5.90	5.56	0.94
East	L3/0-2	4.9	0.013	0.078	9.38	0.979	0.029	<0.001	0.267	10.75	10.45	0.97
	Mean	4.9	0.011	0.185	6.58	0.845	0.104	<0.001	0.251	7.98	7.62	0.95
	Std Dev	0.3	0.006	0.083	3.42	0.321	0.140		0.087	3.73	3.76	0.04
	CV #	0.06	0.49	0.45	0.52	0.38	1.35		0.35	0.47	0.49	0.05

# Value of CV (St Dev/Mean) differs from calculations using Std Dev and Mean in this table because they are taken from the database calculations where data have additional decimal places.



Appendix Table A1. pHc, Cation Exchange Capacity and Exchangeable Ions - 2019 Data and Descriptive Statistics (continued)

Plot	Subplot/ Layer	pHc	Na	K	Ca	Mg	Al	Fe	Mn	TEC	Bases	Base Saturation
		(cmol/kg)										
West	A3/2-5	4.9	0.059	0.164	4.85	0.572	0.083	<0.001	0.205	5.93	5.64	0.95
West	B3/2-5	5.0	0.058	0.247	4.09	0.607	0.053	<0.001	0.189	5.25	5.00	0.95
West	C3/2-5	4.7	0.058	0.104	3.18	0.411	0.165	<0.001	0.167	4.08	3.75	0.92
West	D3/2-5	5.1	0.057	0.142	4.33	0.517	0.026	<0.001	0.127	5.20	5.04	0.97
West	E3/2-5	4.5	0.076	0.120	2.83	0.411	0.346	<0.001	0.363	4.15	3.44	0.83
West	F3/2-5	4.7	0.060	0.117	4.78	0.528	0.146	<0.001	0.235	5.87	5.49	0.94
West	G3/2-5	5.1	0.055	0.158	4.91	0.593	0.023	<0.001	0.153	5.89	5.72	0.97
West	H3/2-5	4.5	0.057	0.181	3.71	0.580	0.219	<0.001	0.193	4.94	4.53	0.92
West	I3/2-5	4.8	0.033	0.180	4.42	0.562	0.109	<0.001	0.196	5.50	5.20	0.94
West	J3/2-5	4.7	0.060	0.122	3.56	0.446	0.484	0.016	0.699	5.39	4.19	0.78
West	K3/2-5	4.8	0.063	0.121	4.00	0.582	0.116	<0.001	0.254	5.14	4.77	0.93
West	L3/2-5	4.4	0.015	0.132	4.02	0.463	0.510	<0.001	0.366	5.51	4.63	0.84
	Mean	4.8	0.054	0.149	4.06	0.523	0.190	<0.001	0.262	5.24	4.78	0.91
	Std Dev	0.2	0.015	0.040	0.65	0.072	0.169		0.157	0.61	0.72	0.06
	CV	0.05	0.29	0.27	0.16	0.14	0.89		0.60	0.12	0.15	0.07
East	A3/2-5	4.8	0.010	0.124	3.36	0.523	0.104	<0.001	0.132	4.26	4.02	0.94
East	B3/2-5	4.4	0.026	0.093	2.47	0.300	0.484	<0.001	0.208	3.58	2.89	0.81
East	C3/2-5	5.0	0.014	0.143	5.89	0.696	0.051	<0.001	0.157	6.95	6.74	0.97
East	D3/2-5	5.5	0.020	0.081	3.80	0.384	<0.001 *	<0.001	0.060	4.35	4.29	0.99
East	E3/2-5	4.4	0.007	0.131	2.26	0.464	0.305	0.001	0.175	3.34	2.86	0.86
East	F3/2-5	4.8	0.005	0.077	3.04	0.389	0.112	<0.001	0.084	3.71	3.52	0.95
East	G3/2-5	5.1	0.010	0.186	5.64	0.744	0.037	<0.001	0.179	6.80	6.58	0.97
East	H3/2-5	5.1	0.008	0.266	4.26	0.789	0.031	<0.001	0.159	5.51	5.32	0.97
East	I3/2-5	5.4	0.006	0.205	4.98	0.732	0.005	<0.001	0.064	5.99	5.92	0.99
East	J3/2-5	4.7	0.012	0.036	1.36	0.175	0.020	<0.001	0.050	1.66	1.59	0.96
East	K3/2-5	4.6	0.004	0.079	2.77	0.435	0.151	<0.001	0.148	3.59	3.29	0.92
East	L3/2-5	4.5	0.007	0.047	3.52	0.446	0.339	<0.001	0.168	4.53	4.02	0.89
	Mean	4.9	0.011	0.122	3.61	0.507	0.149	<0.001	0.132	4.52	4.25	0.93
	Std Dev	0.4	0.006	0.069	1.38	0.194	0.158		0.054	1.55	1.60	0.06
	CV	0.08	0.59	0.56	0.38	0.38	1.06		0.41	0.34	0.38	0.06

**Appendix Table A1. pHc, Cation Exchange Capacity and Exchangeable Ions - 2019 Data and Descriptive Statistics (continued)**

Plot	Subplot/ Layer	pHc	Na	K	Ca	Mg	Al	Fe	Mn	TEC	Bases	Base Saturation
		(cmol/kg)										
West	A3/5-10	4.7	0.057	0.084	2.03	0.248	0.106	<0.001	0.100	2.63	2.42	0.92
West	B3/5-10	5.0	0.059	0.175	2.40	0.381	0.032	<0.001	0.093	3.14	3.02	0.96
West	C3/5-10	4.6	0.059	0.058	1.90	0.304	0.187	<0.001	0.108	2.62	2.32	0.89
West	D3/5-10	4.8	0.058	0.180	2.47	0.360	0.072	<0.001	0.085	3.22	3.06	0.95
West	E3/5-10	4.3	0.072	0.093	1.42	0.299	0.366	0.001	0.176	2.43	1.89	0.78
West	F3/5-10	4.8	0.058	0.086	3.43	0.373	0.077	<0.001	0.147	4.17	3.95	0.95
West	G3/5-10	5.3	0.057	0.104	2.64	0.382	0.008	<0.001	0.046	3.24	3.18	0.98
West	H3/5-10	4.9	0.057	0.196	3.45	0.578	0.049	<0.001	0.098	4.43	4.28	0.97
West	I3/5-10	4.9	0.057	0.107	2.06	0.347	0.033	<0.001	0.081	2.68	2.57	0.96
West	J3/5-10	5.2	0.062	0.105	4.41	0.429	0.045	<0.001	0.147	5.19	5.00	0.96
West	K3/5-10	4.8	0.064	0.078	2.53	0.407	0.084	<0.001	0.149	3.32	3.08	0.93
West	L3/5-10	4.8	0.014	0.101	3.21	0.309	0.096	<0.001	0.126	3.86	3.64	0.94
	Mean	4.8	0.056	0.114	2.66	0.368	0.096	<0.001	0.113	3.41	3.20	0.93
	Std Dev	0.3	0.014	0.044	0.83	0.084	0.097		0.037	0.85	0.89	0.05
	CV	0.05	0.25	0.39	0.31	0.23	1.01		0.33	0.25	0.28	0.06
East	A3/5-10	4.6	0.009	0.100	1.95	0.342	0.143	<0.001	0.075	2.62	2.40	0.92
East	B3/5-10	4.4	0.013	0.066	1.63	0.229	0.291	<0.001	0.098	2.33	1.94	0.83
East	C3/5-10	5.0	0.012	0.086	2.69	0.474	0.040	<0.001	0.062	3.37	3.27	0.97
East	D3/5-10	5.4	0.016	0.038	1.10	0.119	<0.001	<0.001	0.018	1.29	1.27	0.99
East	E3/5-10	4.3	0.006	0.101	1.20	0.317	0.299	<0.001	0.079	2.00	1.63	0.81
East	F3/5-10	4.9	0.006	0.069	1.85	0.282	0.042	<0.001	0.026	2.27	2.20	0.97
East	G3/5-10	4.8	0.008	0.129	2.28	0.338	0.100	<0.001	0.087	2.94	2.76	0.94
East	H3/5-10	5.0	0.006	0.182	1.93	0.449	0.034	<0.001	0.051	2.65	2.56	0.97
East	I3/5-10	5.4	0.007	0.135	3.53	0.493	0.001	<0.001	0.037	4.20	4.16	0.99
East	J3/5-10	4.7	0.004	0.070	1.93	0.355	0.079	<0.001	0.053	2.49	2.36	0.95
East	K3/5-10	4.7	0.005	0.050	1.76	0.248	0.077	<0.001	0.063	2.20	2.06	0.94
East	L3/5-10	4.5	0.007	0.045	1.79	0.204	0.141	<0.001	0.061	2.25	2.05	0.91
	Mean	4.8	0.008	0.089	1.97	0.321	0.113	<0.001	0.059	2.55	2.39	0.93
	Std Dev	0.4	0.004	0.043	0.65	0.113	0.100		0.024	0.73	0.76	0.06
	CV	0.07	0.44	0.48	0.33	0.35	0.88		0.40	0.28	0.32	0.06

**Appendix Table A1. pHc, Cation Exchange Capacity and Exchangeable Ions - 2019 Data and Descriptive Statistics (concluded)**

Plot	Subplot/ Layer	pHc	Na	K	Ca	Mg	Al	Fe	Mn	TEC	Bases	Base Saturation
West	A3/10-15	4.9	0.058	0.061	1.37	0.208	0.047	<0.001	0.032	1.77	1.69	0.96
West	B3/10-15	4.8	0.058	0.130	1.45	0.270	0.037	<0.001	0.038	1.98	1.91	0.96
West	C3/10-15	4.4	0.058	0.048	1.23	0.241	0.307	<0.001	0.079	1.96	1.57	0.80
West	D3/10-15	4.7	0.059	0.088	1.33	0.218	0.067	<0.001	0.031	1.79	1.69	0.95
West	E3/10-15	4.0	0.064	0.086	0.773	0.232	0.530	0.008	0.032	1.73	1.16	0.67
West	F3/10-15	4.7	0.056	0.057	1.56	0.213	0.048	<0.001	0.052	1.99	1.89	0.95
West	G3/10-15	5.2	0.055	0.079	1.55	0.292	0.007	<0.001	0.011	2.00	1.98	0.99
West	H3/10-15	4.4	0.057	0.157	1.14	0.309	0.200	<0.001	0.050	1.91	1.66	0.87
West	I3/10-15	5.3	0.055	0.070	1.45	0.259	0.006	<0.001	0.011	1.85	1.83	0.99
West	J3/10-15	5.2	0.062	0.063	2.33	0.304	0.012	<0.001	0.045	2.82	2.76	0.98
West	K3/10-15	4.8	0.012	0.028	1.31	0.213	0.034	<0.001	0.028	1.63	1.57	0.96
West	L3/10-15	5.0	0.011	0.057	1.82	0.213	0.030	<0.001	0.036	2.17	2.10	0.97
	Mean	4.8	0.050	0.077	1.44	0.248	0.110	0.001	0.037	1.97	1.82	0.92
	Std Dev	0.4	0.018	0.036	0.38	0.038	0.160		0.018	0.30	0.38	0.10
	CV	0.08	0.36	0.46	0.26	0.15	1.45		0.49	0.16	0.21	0.10
East	A3/10-15	4.7	0.009	0.089	1.67	0.287	0.090	<0.001	0.034	2.18	2.06	0.94
East	B3/10-15	4.4	0.013	0.061	1.64	0.270	0.269	<0.001	0.048	2.30	1.99	0.86
East	C3/10-15	5.1	0.017	0.074	2.26	0.480	0.026	<0.001	0.030	2.88	2.83	0.98
East	D3/10-15	5.4	0.012	0.056	1.16	0.165	<0.001	<0.001	0.014	1.41	1.39	0.99
East	E3/10-15	4.2	0.007	0.090	0.933	0.302	0.349	<0.001	0.058	1.74	1.33	0.77
East	F3/10-15	5.1	0.005	0.075	1.69	0.296	0.018	<0.001	0.015	2.10	2.07	0.98
East	G3/10-15	4.8	0.010	0.075	1.05	0.207	0.054	<0.001	0.015	1.41	1.34	0.95
East	H3/10-15	4.9	0.009	0.162	1.43	0.371	0.045	<0.001	0.023	2.04	1.97	0.97
East	I3/10-15	5.3	0.006	0.112	2.28	0.327	0.003	<0.001	0.033	2.76	2.73	0.99
East	J3/10-15	4.8	0.004	0.060	1.66	0.336	0.062	<0.001	0.035	2.15	2.06	0.95
East	K3/10-15	4.8	0.004	0.050	1.59	0.205	0.042	<0.001	0.032	1.92	1.85	0.96
East	L3/10-15	4.4	0.008	0.038	1.93	0.226	0.231	<0.001	0.094	2.52	2.20	0.87
	Mean	4.8	0.009	0.078	1.61	0.290	0.108	<0.001	0.036	2.12	1.98	0.93
	Std Dev	0.4	0.004	0.033	0.43	0.086	0.118		0.022	0.47	0.48	0.07
	CV	0.08	0.45	0.42	0.26	0.30	1.09		0.63	0.22	0.24	0.07

**Appendix Table A2. Water Soluble Ions and Base Cation:Aluminum Ratio – 2019 Data and Descriptive Statistics**

Sub-Site	Subplot/ Layer	Sat'n	pH	E.C.	Na	K	Ca	Mg	Al	Fe	Mn	S	BC:Al Ratio
		(%)	(Ext.)	(dS/m)	(mg/L)								
West	A3/0-2	43.6	5.2	0.23	1.17	19.7	29.7	6.03	8.38	5.14	3.73	5.81	4.8
West	B3/0-2	44.4	5.7	0.27	1.33	25.0	39.2	8.02	9.11	5.80	2.56	6.99	5.8
West	C3/0-2	46.8	5.5	0.24	0.965	14.6	37.6	5.99	6.37	3.86	2.74	5.64	6.6
West	D3/0-2	54.0	5.7	0.23	0.85	12.8	37.0	5.96	3.09	1.76	1.45	4.93	13.1
West	E3/0-2	58.4	4.9	0.27	1.68	16.2	35.9	6.05	9.05	6.50	6.38	8.72	4.6
West	F3/0-2	44.8	5.5	0.17	0.690	10.4	26.1	4.91	8.25	4.70	1.98	4.21	3.7
West	G3/0-2	56.8	4.9	0.34	1.37	26.3	44.7	8.90	9.35	6.27	8.07	9.75	6.2
West	H3/0-2	52.8	5.3	0.23	1.15	14.1	29.7	6.39	6.70	3.83	2.25	6.68	5.5
West	I3/0-2	58.4	4.9	0.35	1.30	32.2	42.8	9.40	8.64	6.85	6.94	12.2	7.1
West	J3/0-2	42.0	5.0	0.35	2.34	18.7	43.5	9.10	15.3	9.32	18.0	10.3	3.4
West	K3/0-2	47.2	5.3	0.33	1.66	22.1	45.1	10.2	7.05	5.11	8.37	8.77	8.1
West	L3/0-2	63.2	4.7	0.32	2.16	17.5	39.8	8.80	6.93	4.87	8.36	10.8	7.0
	Mean	51.0	5.2	0.28	1.39	19.1	37.6	7.48	8.18	5.33	5.91	7.90	6.3
	Std Dev	7.1	0.3	0.06	0.50	6.32	6.3	1.76	2.83	1.87	4.66	2.55	2.5
	CV #	0.14	0.06	0.21	0.36	0.33	0.17	0.24	0.35	0.35	0.79	0.32	0.40
East	A3/0-2	52.8	5.6	0.26	1.51	14.2	35.6	7.78	4.35	2.44	2.30	6.44	9.8
East	B3/0-2	62.8	4.9	0.19	1.02	9.22	26.5	4.72	5.57	3.47	3.084	6.35	5.3
East	C3/0-2	83.6	5.7	0.38	1.51	28.0	55.9	9.40	2.96	2.00	2.02	9.30	22.8
East	D3/0-2	64.8	5.9	0.24	1.58	14.3	34.0	6.21	2.43	1.29	0.983	5.25	16.3
East	E3/0-2	51.6	5.0	0.33	2.15	15.7	49.4	10.8	7.35	5.71	5.47	9.73	7.6
East	F3/0-2	50.8	5.3	0.16	1.18	3.69	23.4	3.61	1.16	0.763	0.98	5.22	19.2
East	G3/0-2	53.2	5.5	0.27	1.15	19.6	35.0	7.96	3.86	2.35	2.67	6.47	11.9
East	H3/0-2	55.6	5.7	0.38	1.80	37.7	49.0	13.6	5.97	4.03	2.69	9.74	12.4
East	I3/0-2	46.4	6.0	0.23	1.63	17.7	30.6	6.07	1.19	0.865	0.941	4.77	33.3
East	J3/0-2	78.4	5.4	0.29	1.37	17.5	40.0	7.76	3.37	2.24	2.28	7.60	14.1
East	K3/0-2	54.0	5.4	0.19	0.938	9.47	25.9	5.40	2.29	1.57	1.78	5.10	13.1
East	L3/0-2	80.4	5.5	0.25	1.53	4.03	44.2	6.64	2.47	1.69	1.72	7.07	16.2
	Mean	61.2	5.5	0.26	1.44	15.9	37.5	7.50	3.58	2.37	2.25	6.92	15.2
	Std Dev	12.9	0.3	0.07	0.34	9.64	10.4	2.76	1.93	1.43	1.24	1.82	7.5
	CV#	0.21	0.06	0.26	0.24	0.61	0.28	0.37	0.54	0.60	0.55	0.26	0.49

# Value of CV (St Dev/Mean) differs from calculations using Std Dev and Mean in this table because they are taken from the database calculations where data have additional decimal places.

**Appendix Table A2. Water Soluble Ions and Base Cation:Aluminum Ratio – 2019 Data and Descriptive Statistics (continued)**

Sub-Site	Subplot/ Layer	Sat'n	pH	E.C.	Na	K	Ca	Mg	Al	Fe	Mn	S	BC:Al Ratio
		(%)	(Ext.)	(dS/m)	(mg/L)								
West	A3/2-5	44.4	5.5	0.26	1.61	17.7	37.2	6.52	6.78	3.78	2.65	6.70	6.6
West	B3/2-5	42.8	5.6	0.26	1.55	21.1	34.9	6.85	7.29	4.03	2.29	6.40	6.3
West	C3/2-5	43.2	5.3	0.23	1.74	12.4	33.2	5.65	8.95	5.08	2.72	5.91	4.2
West	D3/2-5	43.6	5.8	0.19	1.24	11.2	28.2	4.79	5.38	2.94	1.15	3.63	6.0
West	E3/2-5	43.6	5.1	0.21	1.80	9.70	28.8	5.33	10.0	6.43	5.09	7.02	3.2
West	F3/2-5	50.0	5.3	0.22	1.62	10.8	33.5	5.41	7.84	4.46	2.26	5.70	4.6
West	G3/2-5	43.6	5.8	0.21	1.28	10.0	33.4	5.34	2.07	1.11	1.64	4.56	17.1
West	H3/2-5	50.0	5.1	0.22	1.14	16.8	26.4	5.82	8.70	5.01	2.23	5.90	4.1
West	I3/2-5	48.8	5.4	0.28	1.60	22.0	37.9	7.01	7.03	4.46	2.72	9.80	6.9
West	J3/2-5	41.2	5.2	0.31	2.37	12.6	41.7	8.37	11.1	5.64	13.8	9.56	4.2
West	K3/2-5	45.2	5.4	0.24	2.19	8.42	35.4	6.60	6.49	3.71	3.82	6.25	5.7
West	L3/2-5	50.4	5.0	0.25	2.67	13.0	33.9	5.58	6.61	3.99	4.73	8.45	5.7
	Mean	45.6	5.4	0.24	1.73	13.8	33.7	6.11	7.35	4.22	3.76	6.66	6.2
	Std Dev	3.3	0.3	0.03	0.46	4.52	4.3	0.99	2.32	1.36	3.37	1.85	3.6
	CV	0.07	0.05	0.14	0.27	0.33	0.13	0.16	0.32	0.32	0.90	0.28	0.58
East	A3/2-5	44.8	5.4	0.20	1.37	9.15	30.6	6.24	6.38	3.59	1.77	4.66	5.3
East	B3/2-5	44.8	5.0	0.13	1.08	5.78	17.6	2.96	10.3	6.04	1.87	3.92	1.9
East	C3/2-5	50.2	5.6	0.24	1.63	9.71	37.0	6.18	4.60	2.73	1.40	6.90	8.4
East	D3/2-5	51.2	6.2	0.36	1.95	13.0	52.5	8.90	0.915	0.375	1.79	5.22	59.3
East	E3/2-5	42.0	5.0	0.22	1.59	14.3	27.5	6.61	10.8	7.28	3.71	6.27	3.3
East	F3/2-5	41.2	5.6	0.12	1.00	4.04	18.2	3.08	8.71	5.15	0.688	2.80	2.1
East	G3/2-5	50.2	5.7	0.25	1.52	13.5	32.7	6.65	2.67	1.40	1.45	5.93	14.5
East	H3/2-5	46.8	5.6	0.35	2.39	28.7	45.7	12.4	6.31	4.13	2.85	9.35	10.2
East	I3/2-5	41.6	6.3	0.19	1.58	9.53	27.9	5.06	2.56	1.61	0.56	3.57	12.1
East	J3/2-5	48.0	5.4	0.18	1.23	8.63	26.7	4.99	6.74	4.16	1.45	5.11	4.4
East	K3/2-5	42.0	5.4	0.14	1.15	5.89	18.3	3.68	7.70	4.67	1.41	4.11	2.7
East	L3/2-5	39.2	5.2	0.12	1.32	3.07	19.8	3.55	14.0	8.75	1.33	3.51	1.4
	Mean	45.2	5.5	0.21	1.48	10.4	29.5	5.86	6.81	4.16	1.69	5.11	10.5
	Std Dev	4.1	0.4	0.08	0.39	6.80	11.1	2.71	3.81	2.46	0.86	1.81	16.0
	CV	0.09	0.07	0.38	0.27	0.65	0.38	0.46	0.56	0.59	0.51	0.35	1.53

**Appendix Table A2. Water Soluble Ions and Base Cation:Aluminum Ratio – 2019 Data and Descriptive Statistics (continued)**

Sub-Site	Subplot/ Layer	Sat'n	pH	E.C.	Na	K	Ca	Mg	Al	Fe	Mn	S	BC:Al Ratio
		(%)	(Ext.)	(dS/m)	(mg/L)								
West	A3/5-10	37.2	5.2	0.18	2.13	9.92	27.7	4.25	11.3	6.40	2.25	4.50	2.7
West	B3/5-10	38.0	5.6	0.23	2.00	14.6	29.0	5.28	4.94	2.64	1.93	5.03	7.2
West	C3/5-10	38.4	5.2	0.13	1.54	5.21	19.3	3.81	12.8	6.94	1.61	3.15	1.6
West	D3/5-10	38.4	5.5	0.15	0.965	13.1	19.5	3.35	8.56	4.92	0.970	2.64	3.0
West	E3/5-10	38.0	4.9	0.19	1.89	8.17	25.2	5.40	10.8	6.49	4.61	6.56	2.6
West	F3/5-10	41.6	5.5	0.14	1.45	4.86	23.3	3.41	8.77	4.57	1.20	3.58	2.6
West	G3/5-10	37.2	6.0	0.14	1.16	6.13	21.8	3.74	9.81	5.30	0.743	2.60	2.4
West	H3/5-10	39.6	5.5	0.19	1.33	15.1	26.8	5.92	14.5	8.13	1.22	4.45	2.4
West	I3/5-10	39.2	5.5	0.17	1.40	9.67	24.4	4.96	11.0	5.91	1.68	4.55	2.6
West	J3/5-10	43.2	5.8	0.21	1.99	6.17	36.6	4.71	6.35	3.47	1.78	6.16	5.4
West	K3/5-10	37.2	5.4	0.18	2.15	5.10	26.5	4.62	7.88	4.36	2.24	3.80	3.4
West	L3/5-10	40.0	5.5	0.19	2.66	8.69	27.9	3.52	7.82	4.16	1.85	4.69	3.7
	Mean	39.0	5.5	0.17	1.72	8.89	25.7	4.41	9.54	5.27	1.84	4.31	3.3
	Std Dev	1.9	0.3	0.03	0.49	3.70	4.7	0.86	2.71	1.57	0.99	1.25	1.5
	CV	0.05	0.05	0.17	0.29	0.42	0.18	0.20	0.28	0.30	0.54	0.29	0.47
East	A3/5-10	37.2	5.3	0.14	1.45	6.99	19.4	4.07	9.53	5.51	1.12	3.30	2.4
East	B3/5-10	36.8	5.1	0.11	1.49	4.86	14.3	2.80	16.8	9.18	1.38	2.61	1.0
East	C3/5-10	37.2	5.8	0.15	1.78	5.42	23.9	4.70	11.7	6.75	0.916	3.89	2.1
East	D3/5-10	38.4	6.4	0.28	1.82	7.74	42.5	6.76	1.59	0.826	2.20	3.62	26.1
East	E3/5-10	37.6	4.9	0.15	1.38	9.64	16.1	4.36	11.6	7.22	1.84	3.93	1.9
East	F3/5-10	37.2	5.7	0.10	1.03	4.59	15.5	3.06	15.9	9.31	0.494	2.05	1.1
East	G3/5-10	39.2	5.4	0.16	1.47	8.47	20.9	3.86	5.62	3.18	1.06	3.54	4.3
East	H3/5-10	38.0	5.6	0.23	2.06	17.7	32.4	8.34	11.9	7.94	1.90	5.80	3.6
East	I3/5-10	39.2	6.2	0.18	1.57	7.92	26.6	4.67	8.05	4.74	0.578	2.90	3.5
East	J3/5-10	38.0	5.5	0.11	0.985	5.30	16.0	3.64	15.2	9.14	0.919	2.66	1.2
East	K3/5-10	38.0	5.5	0.10	1.19	4.57	13.9	2.64	12.7	7.67	0.878	2.54	1.2
East	L3/5-10	37.2	5.4	0.08	1.20	3.72	13.0	2.64	21.5	12.6	0.749	1.97	0.7
	Mean	37.8	5.6	0.15	1.45	7.24	21.2	4.30	11.84	7.01	1.17	3.23	4.1
	Std Dev	0.8	0.4	0.06	0.32	3.77	8.9	1.72	5.31	3.13	0.55	1.05	7.0
	CV	0.02	0.08	0.39	0.22	0.52	0.42	0.40	0.45	0.45	0.47	0.32	1.72

**Appendix Table A2. Water Soluble Ions and Base Cation:Aluminum Ratio – 2019 Data and Descriptive Statistics (concluded)**

Sub-Site	Subplot/ Layer	Sat'n	pH	E.C.	Na	K	Ca	Mg	Al	Fe	Mn	S	BC:Al Ratio
		(%)	(Ext.)	(dS/m)	(mg/L)								
West	A3/10-15	36.4	5.4	0.11	1.60	5.90	17.0	3.20	18.3	9.38	0.701	2.18	1.0
West	B3/10-15	38.0	5.4	0.14	1.70	12.2	18.5	4.06	16.7	8.86	0.900	2.95	1.5
West	C3/10-15	37.2	5.0	0.08	1.39	3.20	9.74	2.60	14.4	7.87	0.892	2.10	0.8
West	D3/10-15	36.4	5.5	0.07	1.02	5.46	10.6	2.57	19.3	9.88	0.449	1.43	0.7
West	E3/10-15	37.6	4.6	0.14	2.35	7.31	13.8	3.59	7.97	4.22	0.929	5.40	2.3
West	F3/10-15	36.8	5.5	0.10	1.66	4.57	15.2	2.77	16.0	8.59	0.721	2.21	1.0
West	G3/10-15	36.8	5.9	0.07	0.965	4.45	11.7	3.21	25.2	12.9	0.213	1.14	0.6
West	H3/10-15	36.8	5.0	0.10	1.11	10.5	10.3	3.20	17.9	9.23	0.661	2.68	1.0
West	I3/10-15	36.8	6.0	0.09	1.22	4.63	14.7	3.47	24.3	11.7	0.28	1.44	0.7
West	J3/10-15	37.8	5.9	0.13	1.63	3.75	20.8	3.30	11.8	6.26	0.718	3.32	1.7
West	K3/10-15	36.8	5.5	0.10	1.67	2.54	14.6	2.70	13.3	7.37	0.516	1.82	1.1
West	L3/10-15	36.8	5.7	0.13	2.35	4.90	19.7	2.76	12.2	6.46	0.775	2.65	1.6
	Mean	37.0	5.4	0.10	1.55	5.78	14.7	3.12	16.45	8.56	0.65	2.44	1.2
	Std Dev	0.5	0.4	0.02	0.46	2.90	3.7	0.46	5.03	2.38	0.24	1.14	0.5
	CV	0.01	0.08	0.24	0.29	0.50	0.25	0.15	0.31	0.28	0.37	0.47	0.44
East	A3/10-15	36.4	5.4	0.12	1.29	5.87	16.2	3.21	11.1	6.64	0.541	2.35	1.7
East	B3/10-15	36.4	5.0	0.09	1.49	4.67	12.9	2.96	20.7	11.2	0.653	2.09	0.7
East	C3/10-15	36.4	6.0	0.11	1.57	4.54	18.5	4.58	20.9	11.3	0.467	2.34	1.0
East	D3/10-15	36.8	6.1	0.17	1.38	6.47	27.7	4.38	8.57	4.96	1.03	2.71	3.3
East	E3/10-15	36.8	4.9	0.11	1.61	6.84	10.5	3.12	10.4	6.17	1.04	2.88	1.5
East	F3/10-15	36.8	5.8	0.08	0.904	4.89	13.0	3.46	25.8	14.8	0.345	1.45	0.6
East	G3/10-15	37.2	5.5	0.10	1.61	5.68	12.3	3.02	17.3	9.45	0.396	1.83	0.9
East	H3/10-15	36.8	5.5	0.20	2.69	14.0	25.7	6.80	13.5	8.55	0.796	7.22	2.6
East	I3/10-15	37.2	6.1	0.15	1.61	6.91	23.2	3.77	9.88	6.05	0.585	2.52	2.5
East	J3/10-15	36.8	5.6	0.09	1.03	4.44	12.2	3.28	18.3	10.6	0.567	1.89	0.8
East	K3/10-15	37.2	5.7	0.09	1.21	3.99	13.0	2.30	14.5	8.74	0.501	2.03	1.0
East	L3/10-15	37.2	5.2	0.09	1.29	3.41	15.1	2.91	20.4	12.0	1.21	2.53	0.8
	Mean	36.8	5.6	0.12	1.47	5.98	16.7	3.65	15.95	9.21	0.68	2.65	1.4
	Std Dev	0.3	0.4	0.04	0.45	2.77	5.8	1.18	5.44	2.92	0.28	1.49	0.9
	CV	0.01	0.07	0.32	0.30	0.46	0.35	0.32	0.34	0.32	0.41	0.56	0.61

**Appendix Table A3. Total Carbon, Nitrogen and Sulphur – 2019 Data and Descriptive Statistics**

Sub-site	Subplot/ Layer	pHc *	Total C (%)	Total N (%)	Total S (%)	C:N Ratio	C:S Ratio	N:S Ratio
West	A3/LFH	3.9	41.6	1.13	0.109	37	382	10
West	B3/LFH	4.4	40.9	0.980	0.094	42	435	10
West	C3/LFH	4.5	38.6	0.966	0.114	40	339	8
West	D3/LFH	4.2	31.0	0.721	0.080	43	388	9
West	E3/LFH	4.3	25.9	0.637	0.064	41	405	10
West	F3/LFH	4.3	36.6	0.893	0.081	41	452	11
West	G3/LFH	4.0	36.6	0.920	0.090	40	407	10
West	H3/LFH	4.1	42.5	1.05	0.113	40	376	9
West	I3/LFH	4.2	35.8	1.12	0.110	32	325	10
West	J3/LFH	4.3	22.9	0.596	0.071	38	323	8
West	K3/LFH	4.2	37.6	1.05	0.105	36	358	10
West	L3/LFH	4.1	36.8	1.07	0.112	34	329	10
	Mean	4.2	35.6	0.928	0.095	39	376	10
	Std Dev	0.2	6.07	0.184	0.018	3.3	43.2	0.8
	CV	0.04	0.17	0.20	0.19	0.08	0.11	0.08
East	A3/LFH	4.5	15.7	0.443	0.042	35	374	11
East	B3/LFH	4.1	21.5	0.655	0.064	33	336	10
East	C3/LFH	4.1	40.7	0.892	0.079	46	515	11
East	D3/LFH	4.5	28.9	0.866	0.098	33	295	9
East	E3/LFH	4.4	16.5	0.457	0.044	36	375	10
East	F3/LFH	4.6	21.4	0.550	0.057	39	375	10
East	G3/LFH	4.4	23.5	0.597	0.063	39	373	9
East	H3/LFH	4.3	32.7	1.02	0.116	32	282	9
East	I3/LFH	4.3	39.4	0.855	0.080	46	493	11
East	J3/LFH	4.2	38.2	0.899	0.086	42	444	10
East	K3/LFH	4.3	29.0	0.678	0.061	43	475	11
East	L3/LFH	4.3	18.1	0.547	0.053	33	342	10
	Mean	4.3	27.1	0.705	0.070	38	390	10
	Std Dev	0.2	9.03	0.194	0.022	5.1	75.8	0.8
	CV	0.04	0.33	0.28	0.32	0.13	0.19	0.08

\* pHc data are presented for the LFH layer; pHc for all other layers are repeated here from Appendix Table A1



**Appendix Table A3. Total Carbon, Nitrogen and Sulphur – 2019 Data and Descriptive Statistics (continued)**

Sub-site	Subplot/ Layer	pHc *	Total C (%)	Total N (%)	Total S (%)	C:N Ratio	C:S Ratio	N:S Ratio
West	A3/0-2	4.6	1.63	0.076	0.007	21	233	11
West	B3/0-2	5.1	1.49	0.061	0.015	24	99	4
West	C3/0-2	4.9	2.03	0.079	0.006	26	338	13
West	D3/0-2	5.1	2.34	0.095	0.010	25	234	10
West	E3/0-2	4.4	2.63	0.102	0.007	26	376	15
West	F3/0-2	4.8	1.38	0.055	0.006	25	229	9
West	G3/0-2	4.5	2.53	0.101	0.008	25	316	13
West	H3/0-2	4.7	2.02	0.076	0.006	27	337	13
West	I3/0-2	4.4	2.38	0.083	0.011	29	216	8
West	J3/0-2	4.5	1.05	0.028	0.005	38	210	6
West	K3/0-2	4.8	1.31	0.059	0.009	22	146	7
West	L3/0-2	4.1	3.90	0.153	0.013	25	300	12
	Mean	4.7	2.06	0.081	0.009	26	253	10
	Std Dev	0.3	0.78	0.031	0.003	4.0	82.7	3.3
	CV	0.07	0.38	0.39	0.36	0.16	0.33	0.34
East	A3/0-2	5.0	1.92	0.099	0.008	19	240	12
East	B3/0-2	4.3	3.76	0.133	0.010	28	376	13
East	C3/0-2	5.1	6.99	0.269	0.025	26	280	11
East	D3/0-2	5.2	3.54	0.147	0.014	24	253	11
East	E3/0-2	4.5	2.36	0.083	0.009	28	262	9
East	F3/0-2	4.7	2.25	0.089	0.008	25	281	11
East	G3/0-2	4.9	2.15	0.097	0.010	22	215	10
East	H3/0-2	5.1	2.51	0.115	0.013	22	193	9
East	I3/0-2	5.3	1.29	0.063	0.008	21	161	8
East	J3/0-2	4.8	5.49	0.210	0.020	26	275	11
East	K3/0-2	4.7	2.64	0.110	0.010	24	264	11
East	L3/0-2	4.9	3.56	0.151	0.015	24	237	10
	Mean	4.9	3.20	0.130	0.013	24	253	10
	Std Dev	0.3	1.62	0.058	0.005	2.8	53.3	1.5
	CV	0.06	0.51	0.45	0.43	0.12	0.21	0.14

**Appendix Table A3. Total Carbon, Nitrogen and Sulphur – 2019 Data and Descriptive Statistics (continued)**

Sub-site	Subplot/ Layer	pHc *	Total C (%)	Total N (%)	Total S (%)	C:N Ratio	C:S Ratio	N:S Ratio
West	A3/2-5	4.9	1.71	0.062	0.003	28	570	21
West	B3/2-5	5.0	1.50	0.059	0.005	25	300	12
West	C3/2-5	4.7	1.19	0.054	0.003	22	397	18
West	D3/2-5	5.1	1.50	0.070	0.006	21	250	12
West	E3/2-5	4.5	1.23	0.048	0.004	26	308	12
West	F3/2-5	4.7	1.89	0.084	0.006	23	314	14
West	G3/2-5	5.1	1.50	0.057	0.010	26	150	6
West	H3/2-5	4.5	1.72	0.062	0.008	28	215	8
West	I3/2-5	4.8	1.75	0.073	0.010	24	175	7
West	J3/2-5	4.7	0.887	0.027	0.003	33	296	9
West	K3/2-5	4.8	1.11	0.044	0.005	25	222	9
West	L3/2-5	4.4	2.67	0.106	0.006	25	445	18
	Mean	4.8	1.55	0.062	0.006	25	303	12
	Std Dev	0.2	0.46	0.020	0.002	3.1	120	4.7
	CV	0.05	0.30	0.32	0.43	0.12	0.39	0.39
East	A3/2-5	4.8	1.25	0.055	0.005	23	250	11
East	B3/2-5	4.4	1.45	0.059	0.003	25	483	20
East	C3/2-5	5.0	2.06	0.091	0.009	23	229	10
East	D3/2-5	5.5	2.54	0.108	0.008	24	318	14
East	E3/2-5	4.4	0.996	0.046	0.004	22	249	12
East	F3/2-5	4.8	0.965	0.042	0.003	23	322	14
East	G3/2-5	5.1	1.98	0.091	0.006	22	330	15
East	H3/2-5	5.1	1.46	0.066	0.005	22	292	13
East	I3/2-5	5.4	1.04	0.050	0.005	21	208	10
East	J3/2-5	4.7	1.88	0.073	0.006	26	313	12
East	K3/2-5	4.6	1.17	0.057	0.005	21	233	11
East	L3/2-5	4.5	0.991	0.053	0.005	19	198	11
	Mean	4.9	1.48	0.066	0.005	22	285	13
	Std Dev	0.4	0.52	0.021	0.002	1.9	77.7	2.7
	CV	0.08	0.35	0.32	0.33	0.08	0.27	0.21

**Appendix Table A3. Total Carbon, Nitrogen and Sulphur – 2019 Data and Descriptive Statistics (continued)**

Sub-site	Subplot/ Layer	pHc *	Total C (%)	Total N (%)	Total S (%)	C:N Ratio	C:S Ratio	N:S Ratio
West	A3/5-10	4.7	0.684	0.025	0.002	27	342	13
West	B3/5-10	5.0	0.754	0.024	0.003	31	251	8
West	C3/5-10	4.6	0.584	0.029	0.002	20	292	15
West	D3/5-10	4.8	0.797	0.033	0.003	24	266	11
West	E3/5-10	4.3	0.527	0.018	0.002	29	264	9
West	F3/5-10	4.8	1.01	0.039	0.004	26	253	10
West	G3/5-10	5.3	0.582	0.022	0.002	26	291	11
West	H3/5-10	4.9	1.09	0.045	0.004	24	273	11
West	I3/5-10	4.9	0.584	0.025	0.002	23	292	13
West	J3/5-10	5.2	1.53	0.049	0.005	31	305	10
West	K3/5-10	4.8	0.755	0.022	0.003	34	252	7
West	L3/5-10	4.8	1.13	0.054	0.005	21	226	11
	Mean	4.8	0.835	0.032	0.003	27	275	11
	Std Dev	0.3	0.299	0.012	0.001	4.3	30.8	2.0
	CV	0.05	0.36	0.37	0.38	0.16	0.11	0.19
East	A3/5-10	4.6	0.623	0.027	0.004	23	156	7
East	B3/5-10	4.4	0.733	0.029	0.003	25	244	10
East	C3/5-10	5.0	0.654	0.039	0.004	17	164	10
East	D3/5-10	5.4	1.34	0.051	0.004	26	335	13
East	E3/5-10	4.3	0.428	0.021	0.003	20	143	7
East	F3/5-10	4.9	0.370	0.026	0.002	14	185	13
East	G3/5-10	4.8	0.803	0.041	0.005	20	161	8
East	H3/5-10	5.0	0.545	0.031	0.004	18	136	8
East	I3/5-10	5.4	0.678	0.044	0.003	15	226	15
East	J3/5-10	4.7	0.512	0.027	0.003	19	171	9
East	K3/5-10	4.7	0.505	0.024	0.003	21	168	8
East	L3/5-10	4.5	0.441	0.016	0.002	28	221	8
	Mean	4.8	0.636	0.031	0.003	21	192	10
	Std Dev	0.4	0.257	0.010	0.001	4.3	56.3	2.6
	CV	0.07	0.40	0.33	0.27	0.21	0.29	0.27

**Appendix Table A3. Total Carbon, Nitrogen and Sulphur – 2019 Data and Descriptive Statistics – (concluded)**

Sub-site	Subplot/ Layer	pHc *	Total C (%)	Total N (%)	Total S (%)	C:N Ratio	C:S Ratio	N:S Ratio
West	A3/10-15	4.9	0.219	0.007	0.003	31	73	2
West	B3/10-15	4.8	0.356	0.012	0.002	30	178	6
West	C3/10-15	4.4	0.384	0.020	0.001	19	384	20
West	D3/10-15	4.7	0.350	0.016	0.003	22	117	5
West	E3/10-15	4.0	0.288	0.010	0.002	29	144	5
West	F3/10-15	4.7	0.278	0.017	0.002	16	139	9
West	G3/10-15	5.2	0.208	0.010	0.003	21	69	3
West	H3/10-15	4.4	0.310	0.012	0.001	26	310	12
West	I3/10-15	5.3	0.187	0.005	0.002	37	94	3
West	J3/10-15	5.2	0.496	0.025	0.001	20	496	25
West	K3/10-15	4.8	0.403	0.015	0.001	27	403	15
West	L3/10-15	5.0	0.278	0.022	0.002	13	139	11
	Mean	4.8	0.313	0.014	0.002	24	212	10
	Std Dev	0.4	0.090	0.006	0.001	7.0	146	7.2
	CV	0.08	0.29	0.43	0.41	0.29	0.69	0.75
East	A3/10-15	4.7	0.264	0.018	0.002	15	132	9
East	B3/10-15	4.4	0.465	0.014	0.002	33	233	7
East	C3/10-15	5.1	0.352	0.020	0.002	18	176	10
East	D3/10-15	5.4	0.374	0.020	0.002	19	187	10
East	E3/10-15	4.2	0.317	0.019	0.003	17	106	6
East	F3/10-15	5.1	0.229	0.022	0.002	10	115	11
East	G3/10-15	4.8	0.216	0.015	0.001	14	216	15
East	H3/10-15	4.9	0.417	0.017	0.002	25	209	9
East	I3/10-15	5.3	0.491	0.027	0.001	18	491	27
East	J3/10-15	4.8	0.312	0.015	0.002	21	156	8
East	K3/10-15	4.8	0.283	0.026	0.002	11	142	13
East	L3/10-15	4.4	0.436	0.029	0.003	15	145	10
	Mean	4.8	0.346	0.020	0.002	18	192	11
	Std Dev	0.4	0.092	0.005	0.001	6.2	102	5.6
	CV	0.08	0.26	0.25	0.30	0.35	0.53	0.50

**APPENDIX B**

**SAMPLE IDENTIFICATION**

**WHITNEY LAKES SOIL MONITORING SITE - 2019**

**Table B1. Lab Report - Sample Identification**

**Project: Permanent Site -Acid Deposition -Whitney Lake**

**Project Leader: Salim Abboud; Project Contact: Larry Turchenek**

**Date Received: Oct. 7, 2019**

Date Sampled	Site	Plot	Field Id.	Lab I.D. (2019)	pH (CaCl <sub>2</sub> )	C.E.C. (BaCl <sub>2</sub> )	Total Carbon	Total Nitrogen	Total Sulfur	Sat.Paste (pH,E.C.,Sat'n, Ca,Mg,Na,K,Al,Fe,Mn,S)
Oct. 7, 2019	Whitney Lake	West	A3/LFH	361	1		1	1	1	
	Whitney Lake	West	A3/0-2	362	1	1	1	1	1	1
	Whitney Lake	West	A3/2-5	363	1	1	1	1	1	1
	Whitney Lake	West	A3/5-10	364	1	1	1	1	1	1
	Whitney Lake	West	A3/10-15	365	1	1	1	1	1	1
	Whitney Lake	West	A3/15-30	366						
	Whitney Lake	West	A3/30-45	367						
	Whitney Lake	West	A3/45-60	368						
	Whitney Lake	West	B3/LFH	369	1		1	1	1	
	Whitney Lake	West	B3/0-2	370	1	1	1	1	1	1
	Whitney Lake	West	B3/2-5	371	1	1	1	1	1	1
	Whitney Lake	West	B3/5-10	372	1	1	1	1	1	1
	Whitney Lake	West	B3/10-15	373	1	1	1	1	1	1
	Whitney Lake	West	B3/15-30	374						
	Whitney Lake	West	B3/30-45	375						
	Whitney Lake	West	B3/45-60	376						
	Whitney Lake	West	C3/LFH	377	1		1	1	1	
	Whitney Lake	West	C3/0-2	378	1	1	1	1	1	1
	Whitney Lake	West	C3/2-5	379	1	1	1	1	1	1
	Whitney Lake	West	C3/5-10	380	1	1	1	1	1	1
	Whitney Lake	West	C3/10-15	381	1	1	1	1	1	1
	Whitney Lake	West	C3/15-30	382						
	Whitney Lake	West	C3/30-45	383						
	Whitney Lake	West	C3/45-60	384						
	Whitney Lake	West	D3/LFH	385	1		1	1	1	
	Whitney Lake	West	D3/0-2	386	1	1	1	1	1	1
	Whitney Lake	West	D3/2-5	387	1	1	1	1	1	1
	Whitney Lake	West	D3/5-10	388	1	1	1	1	1	1
	Whitney Lake	West	D3/10-15	389	1	1	1	1	1	1
	Whitney Lake	West	D3/15-30	390						
	Whitney Lake	West	D3/30-45	391						
	Whitney Lake	West	D3/45-60	392						
	Whitney Lake	West	E3/LFH	393	1		1	1	1	

Date Sampled	Site	Plot	Field Id.	Lab I.D. (2019)	pH (CaCl <sub>2</sub> )	C.E.C. (BaCl <sub>2</sub> )	Total Carbon	Total Nitrogen	Total Sulfur	Sat.Paste (pH,E.C.,Sat'n, Ca,Mg,Na,K,Al,Fe,Mn,S)
Oct. 7, 2019	Whitney Lake	West	E3/0-2	394	1	1	1	1	1	1
	Whitney Lake	West	E3/2-5	395	1	1	1	1	1	1
	Whitney Lake	West	E3/5-10	396	1	1	1	1	1	1
	Whitney Lake	West	E3/10-15	397	1	1	1	1	1	1
	Whitney Lake	West	E3/15-30	398						
	Whitney Lake	West	E3/30-45	399						
	Whitney Lake	West	E3/45-60	400						
	Whitney Lake	West	F3/LFH	401	1		1	1	1	
	Whitney Lake	West	F3/0-2	402	1	1	1	1	1	1
	Whitney Lake	West	F3/2-5	403	1	1	1	1	1	1
	Whitney Lake	West	F3/5-10	404	1	1	1	1	1	1
	Whitney Lake	West	F3/10-15	405	1	1	1	1	1	1
	Whitney Lake	West	F3/15-30	406						
	Whitney Lake	West	F3/30-45	407						
	Whitney Lake	West	F3/45-60	408						
	Whitney Lake	West	G3/LFH	409	1		1	1	1	
	Whitney Lake	West	G3/0-2	410	1	1	1	1	1	1
	Whitney Lake	West	G3/2-5	411	1	1	1	1	1	1
	Whitney Lake	West	G3/5-10	412	1	1	1	1	1	1
	Whitney Lake	West	G3/10-15	413	1	1	1	1	1	1
	Whitney Lake	West	G3/15-30	414						
	Whitney Lake	West	G3/30-45	415						
	Whitney Lake	West	G3/45-60	416						
	Whitney Lake	West	H3/LFH	417	1		1	1	1	
	Whitney Lake	West	H3/0-2	418	1	1	1	1	1	1
	Whitney Lake	West	H3/2-5	419	1	1	1	1	1	1
	Whitney Lake	West	H3/5-10	420	1	1	1	1	1	1
	Whitney Lake	West	H3/10-15	421	1	1	1	1	1	1
	Whitney Lake	West	H3/15-30	422						
	Whitney Lake	West	H3/30-45	423						
	Whitney Lake	West	H3/45-60	424						
	Whitney Lake	West	I3/LFH	425	1		1	1	1	
	Whitney Lake	West	I3/0-2	426	1	1	1	1	1	1
	Whitney Lake	West	I3/2-5	427	1	1	1	1	1	1
	Whitney Lake	West	I3/5-10	428	1	1	1	1	1	1
	Whitney Lake	West	I3/10-15	429	1	1	1	1	1	1
	Whitney Lake	West	I3/15-30	430						
	Whitney Lake	West	I3/30-45	431						
	Whitney Lake	West	I3/45-60	432						
	Whitney Lake	West	J3/LFH	433	1		1	1	1	
	Whitney Lake	West	J3/0-2	434	1	1	1	1	1	1

Date Sampled	Site	Plot	Field Id.	Lab I.D. (2019)	pH (CaCl <sub>2</sub> )	C.E.C. (BaCl <sub>2</sub> )	Total Carbon	Total Nitrogen	Total Sulfur	Sat.Paste (pH,E.C.,Sat'n, Ca,Mg,Na,K,Al,Fe,Mn,S)
Oct. 7, 2019	Whitney Lake	West	J3/2-5	435	1	1	1	1	1	1
	Whitney Lake	West	J3/5-10	436	1	1	1	1	1	1
	Whitney Lake	West	J3/10-15	437	1	1	1	1	1	1
	Whitney Lake	West	J3/15-30	438						
	Whitney Lake	West	J3/30-45	439						
	Whitney Lake	West	J3/45-60	440						
	Whitney Lake	West	K3/LFH	441	1		1	1	1	
	Whitney Lake	West	K3/0-2	442	1	1	1	1	1	1
	Whitney Lake	West	K3/2-5	443	1	1	1	1	1	1
	Whitney Lake	West	K3/5-10	444	1	1	1	1	1	1
	Whitney Lake	West	K3/10-15	445	1	1	1	1	1	1
	Whitney Lake	West	K3/15-30	446						
	Whitney Lake	West	K3/30-45	447						
	Whitney Lake	West	K3/45-60	448						
	Whitney Lake	West	L3/LFH	449	1		1	1	1	
	Whitney Lake	West	L3/0-2	450	1	1	1	1	1	1
	Whitney Lake	West	L3/2-5	451	1	1	1	1	1	1
	Whitney Lake	West	L3/5-10	452	1	1	1	1	1	1
	Whitney Lake	West	L3/10-15	453	1	1	1	1	1	1
	Whitney Lake	West	L3/15-30	454						
	Whitney Lake	West	L3/30-45	455						
	Whitney Lake	West	L3/45-60	456						
	Whitney Lake	East	A3/LFH	457	1		1	1	1	
	Whitney Lake	East	A3/0-2	458	1	1	1	1	1	1
	Whitney Lake	East	A3/2-5	459	1	1	1	1	1	1
	Whitney Lake	East	A3/5-10	460	1	1	1	1	1	1
	Whitney Lake	East	A3/10-15	461	1	1	1	1	1	1
	Whitney Lake	East	A3/15-30	462						
	Whitney Lake	East	A3/30-45	463						
	Whitney Lake	East	A3/45-60	464						
	Whitney Lake	East	B3/LFH	465	1		1	1	1	
	Whitney Lake	East	B3/0-2	466	1	1	1	1	1	1
	Whitney Lake	East	B3/2-5	467	1	1	1	1	1	1
	Whitney Lake	East	B3/5-10	468	1	1	1	1	1	1
	Whitney Lake	East	B3/10-15	469	1	1	1	1	1	1
	Whitney Lake	East	B3/15-30	470						
	Whitney Lake	East	B3/30-45	471						
	Whitney Lake	East	B3/45-60	472						
	Whitney Lake	East	C3/LFH	473	1		1	1	1	
	Whitney Lake	East	C3/0-2	474	1	1	1	1	1	1
	Whitney Lake	East	C3/2-5	475	1	1	1	1	1	1



Date Sampled	Site	Plot	Field Id.	Lab I.D. (2019)	pH (CaCl <sub>2</sub> )	C.E.C. (BaCl <sub>2</sub> )	Total Carbon	Total Nitrogen	Total Sulfur	Sat.Paste (pH,E.C.,Sat'n, Ca,Mg,Na,K,Al,Fe,Mn,S)
Oct. 7, 2019	Whitney Lake	East	C3/5-10	476	1	1	1	1	1	1
	Whitney Lake	East	C3/10-15	477	1	1	1	1	1	1
	Whitney Lake	East	C3/15-30	478						
	Whitney Lake	East	C3/30-45	479						
	Whitney Lake	East	C3/45-60	480						
	Whitney Lake	East	D3/LFH	481	1		1	1	1	
	Whitney Lake	East	D3/0-2	482	1	1	1	1	1	1
	Whitney Lake	East	D3/2-5	483	1	1	1	1	1	1
	Whitney Lake	East	D3/5-10	484	1	1	1	1	1	1
	Whitney Lake	East	D3/10-15	485	1	1	1	1	1	1
	Whitney Lake	East	D3/15-30	486						
	Whitney Lake	East	D3/30-45	487						
	Whitney Lake	East	D3/45-60	488						
	Whitney Lake	East	E3/LFH	489	1		1	1	1	
	Whitney Lake	East	E3/0-2	490	1	1	1	1	1	1
	Whitney Lake	East	E3/2-5	491	1	1	1	1	1	1
	Whitney Lake	East	E3/5-10	492	1	1	1	1	1	1
	Whitney Lake	East	E3/10-15	493	1	1	1	1	1	1
	Whitney Lake	East	E3/15-30	494						
	Whitney Lake	East	E3/30-45	495						
	Whitney Lake	East	E3/45-60	496						
	Whitney Lake	East	F3/LFH	497	1		1	1	1	
	Whitney Lake	East	F3/0-2	498	1	1	1	1	1	1
	Whitney Lake	East	F3/2-5	499	1	1	1	1	1	1
	Whitney Lake	East	F3/5-10	500	1	1	1	1	1	1
	Whitney Lake	East	F3/10-15	501	1	1	1	1	1	1
	Whitney Lake	East	F3/15-30	502						
	Whitney Lake	East	F3/30-45	503						
	Whitney Lake	East	F3/45-60	504						
	Whitney Lake	East	G3/LFH	505	1		1	1	1	
	Whitney Lake	East	G3/0-2	506	1	1	1	1	1	1
	Whitney Lake	East	G3/2-5	507	1	1	1	1	1	1
	Whitney Lake	East	G3/5-10	508	1	1	1	1	1	1
	Whitney Lake	East	G3/10-15	509	1	1	1	1	1	1
	Whitney Lake	East	G3/15-30	510						
	Whitney Lake	East	G3/30-45	511						
	Whitney Lake	East	G3/45-60	512						
	Whitney Lake	East	H3/LFH	513	1		1	1	1	
	Whitney Lake	East	H3/0-2	514	1	1	1	1	1	1
	Whitney Lake	East	H3/2-5	515	1	1	1	1	1	1
	Whitney Lake	East	H3/5-10	516	1	1	1	1	1	1

Date Sampled	Site	Plot	Field Id.	Lab I.D. (2019)	pH (CaCl <sub>2</sub> )	C.E.C. (BaCl <sub>2</sub> )	Total Carbon	Total Nitrogen	Total Sulfur	Sat.Paste (pH,E.C.,Sat'n, Ca,Mg,Na,K,Al,Fe,Mn,S)
Oct. 7, 2019	Whitney Lake	East	H3/10-15	517	1	1	1	1	1	1
	Whitney Lake	East	H3/15-30	518						
	Whitney Lake	East	H3/30-45	519						
	Whitney Lake	East	H3/45-60	520						
	Whitney Lake	East	I3/LFH	521	1		1	1	1	
	Whitney Lake	East	I3/0-2	522	1	1	1	1	1	1
	Whitney Lake	East	I3/2-5	523	1	1	1	1	1	1
	Whitney Lake	East	I3/5-10	524	1	1	1	1	1	1
	Whitney Lake	East	I3/10-15	525	1	1	1	1	1	1
	Whitney Lake	East	I3/15-30	526						
	Whitney Lake	East	I3/30-45	527						
	Whitney Lake	East	I3/45-60	528						
	Whitney Lake	East	J3/LFH	529	1		1	1	1	
	Whitney Lake	East	J3/0-2	530	1	1	1	1	1	1
	Whitney Lake	East	J3/2-5	531	1	1	1	1	1	1
	Whitney Lake	East	J3/5-10	532	1	1	1	1	1	1
	Whitney Lake	East	J3/10-15	533	1	1	1	1	1	1
	Whitney Lake	East	J3/15-30	534						
	Whitney Lake	East	J3/30-45	535						
	Whitney Lake	East	J3/45-60	536						
	Whitney Lake	East	K3/LFH	537	1		1	1	1	
	Whitney Lake	East	K3/0-2	538	1	1	1	1	1	1
	Whitney Lake	East	K3/2-5	539	1	1	1	1	1	1
	Whitney Lake	East	K3/5-10	540	1	1	1	1	1	1
	Whitney Lake	East	K3/10-15	541	1	1	1	1	1	1
	Whitney Lake	East	K3/15-30	542						
	Whitney Lake	East	K3/30-45	543						
	Whitney Lake	East	K3/45-60	544						
	Whitney Lake	East	L3/LFH	545	1		1	1	1	
	Whitney Lake	East	L3/0-2	546	1	1	1	1	1	1
	Whitney Lake	East	L3/2-5	547	1	1	1	1	1	1
	Whitney Lake	East	L3/5-10	548	1	1	1	1	1	1
	Whitney Lake	East	L3/10-15	549	1	1	1	1	1	1
	Whitney Lake	East	L3/15-30	550						
	Whitney Lake	East	L3/30-45	551						
	Whitney Lake	East	L3/45-60	552						
				Total Ana=	120	96	120	120	120	96