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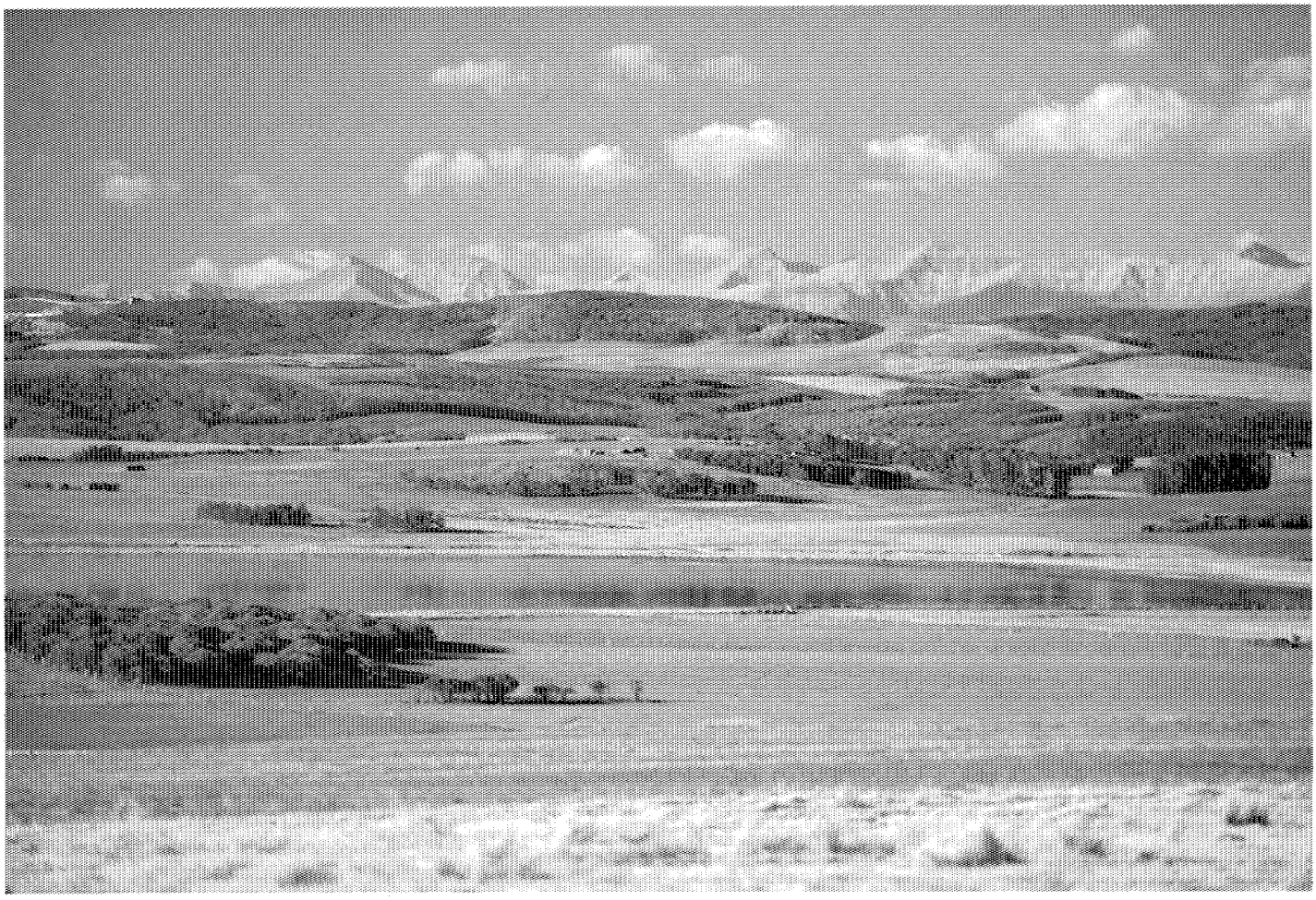
Soil sensitivity to acid deposition

and the potential of soils and geology in Alberta to reduce the acidity of acidic inputs

N. Holowaychuk and R.J. Fessenden



ALBERTA RESEARCH COUNCIL

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Soil sensitivity to acidic inputs, Alberta ..... in pocket
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Abstract

The objective of this project was to prepare maps of the province of Alberta, suitable for presentation at a scale of 1:2 000 000, showing the distribution of soils relative to their sensitivity to acid deposition and the distribution of soils and geology relative to their potential to reduce the acidity of atmospheric deposition. This project was Alberta's contribution to a Western Canada Long Range Transport of Air Pollution (LRTAP) Committee effort to prepare such maps for the four western provinces, the Yukon, and the Northwest Territories in a coordinated and collaborative fashion.

When this project was initiated, no soils base map was available for the province of Alberta that was suitable for interpreting the sensitivity of soils to acid deposition or their potential to reduce the acidity of atmospheric deposition. Descriptive information was assembled and synthesized for mineral soils and peatland systems throughout the province. Approximately 350 discrete map units were delineated; these were consolidated into 215 distinct map unit types. The quality and detail of the soils information that was available for the southern half of the province and the Peace River area, and the National Parks in the Rocky Mountains, was quite good. However, the information that was available for the far north and the northeastern areas of the province, and the eastern slopes, was more general. In particular, there was a paucity of information for Organic and Organic Cryosol soils, except in a few localized areas.

The sensitivity of mineral soils to acid deposition was interpreted according to criteria that were developed cooperatively by the western Canada participants. The sensitivity of three soil processes—sensitivity to base loss, sensitivity to acidification, and sensitivity to the solubilization of aluminum—were rated separately for each map unit. These were then combined into an overall sensitivity rating. Soils that were considered to have low base reserves, as evidenced by low cation exchange capacity and low pH, were rated as highly sensitive to acid deposition. Those soils that were considered to have high base reserves, as evidenced by a high cation exchange capacity and high pH, were rated as being of low sensitivity to acid deposition.

A provisional set of criteria was developed for Organic and Organic Cryosol soils. Three peatland system categories were recognized: eutrophic, mesotrophic, and oligotrophic. They were defined on the basis of pH and base cation content of the organic matrix-ambient water systems. Eutrophic peatland systems, such as those with slightly acid to mildly alkaline reaction and relatively high base cation content, are considered to be of low sensitivity. Mesotrophic peatland systems, considered to be the predominant kind in Alberta, have low to intermediate pH and base cation content and are rated as being of high sensitivity. Oligotrophic peatland systems, those with the lowest pH and base cation content, are considered to be of low sensitivity because they are well buffered in the extremely to very strongly acid range by aluminum and humic acid buffering systems.

Expressed as a percentage of the total area of the province, soils of high sensitivity occupy 22.7 percent, soils of medium sensitivity occupy 30.6 percent, and soils of low sensitivity occupy 44.4 percent. The major groups of soils in the high sensitivity category are the mesotrophic peatlands and Dystric Brunisols, both of which are primarily located in the northeastern region of the province. The major groups of soil placed in the medium sensitivity category are the various subgroups of the Gray Luvisolic great group. These soils have very extensive distribution in the central and eastern slopes regions of the province. The largest group of soils in the low sensitivity category comprises the Chernozems, located in the southern and central regions of the province.

All map units were also rated for their potential to reduce the acidity of atmospheric deposition. The criteria that were used for mineral soils were developed jointly by the western Canada participants and were based on criteria developed in eastern Canada. They are based on combinations of soil depth, exchangeable base content, bedrock type, parent material type, and soil drainage class. Criteria for Organic soils were not developed by the LRTAP committee. Provisional criteria were developed for Alberta and used in this project.

Expressed as a percentage of the total area of the province, soils (and associated geology) with high potential to reduce acidity occupy 64.4 percent, soils with medium potential, 21.8 percent, and soils with low potential, 11.3 percent. Most of the southern half of the province and the Peace River region are occupied by soils with a high potential to reduce acidity. Soils with medium potential are located predominantly in the north central, northeastern, and eastern slopes regions, and to some extent in the Rocky Mountains. Soils with low potential are located in the far north, the northeastern regions of the province, and the northern Rocky Mountains, and are associated with oligotrophic peatland systems and coarse-textured, acid, Dystric Brunisol soils. Eutrophic peatland systems are considered to have a high potential to reduce acidity, mesotrophic peatland systems have a medium potential, and oligotrophic systems, a low potential.

Introduction

In December 1982, the Western Canada Long Range Transport of Air Pollution (LRTAP) Committee initiated a project to prepare acid sensitivity maps of the four western provinces, the Yukon, and the Northwest Territories. It was intended that the proposed maps would show the expected sensitivity of soils to acid deposition and the potential of soils and surficial geological materials to reduce the acidity of atmospheric deposition. A task group chaired by Dr. J.H. Wiens of the British Columbia Ministry of the Environment was established to implement this project. The task group held three meetings—the first in Victoria during June 1983, the second in Edmonton during September 1984, and the third, a conference call, during September 1985. The purpose of these meetings was to develop a common approach to map preparation and common criteria for interpreting soils information. In addition to these formal meetings, several informal discussions were held between various members of the task force. An effort was made not only to develop consistent rating criteria, but to resolve differences in interpretations at the adjoining boundaries with provinces and territories.

This report represents the results of Alberta's contribution to the Western LRTAP project. It must be stressed that the rating criteria used to prepare these maps were drawn heavily from principles of soil

chemistry, geology, and hydrology, as well as soil fertility and plant nutrition. Supporting investigations to confirm actual changes in soils and geology due to acidic precipitation are limited, as are studies of effects on a wide variety of plant species due to these changes. The maps and reports were prepared by the Alberta Research Council under contract to Alberta Environment.

Soils base map

Data compilation

When this project was initiated, existing base maps of the Province of Alberta were unsuitable for interpreting soil sensitivity to acid deposition or the potential of soil to reduce the acidity of atmospheric deposition. Consequently, the first tasks were to prepare a suitable soils base map and to assemble pertinent descriptive information that could be used to interpret individual map units.

Alberta was divided into four regions (figure 1) from which soils information could be obtained—the agricultural areas (region A), the northern forest (region B), the mountain parks (region C), and mountains and foothills (region D).

Information was derived from published or printed sources and from Alberta Research Council file information to delineate map units in these regions and to characterize broad soils groupings. Direct sources included previous surveys and other types of soil resource inventories that included taxonomic classification of soils and pertinent data on their properties. Where such information was lacking or limited, it was inferred from surficial materials, geology, physiography, and/or topography maps, and supplemented by information extrapolated from contiguous or comparable areas that had been surveyed. Although data were gathered from several sources at different scales, all available information was eventually reduced to a scale of 1:2 000 000 for final map presentation.

Information for region A was obtained from reconnaissance soil survey reports prepared by Agriculture Canada and the Alberta Research Council. These reports contain information on the areal distribution of various soils, and field descriptions and laboratory-derived data for the more important soils. Because the soils information for region A has been entered into a computerized data base (Patterson and Peterson, 1984), it was possible to generate computer printout maps at a scale of 1:1 000 000 that displayed the taxonomic class and the textural family class of the dominant soil in each quarter township. Such maps served as the basis for delineating individual map units. Concurrent examination of the soil survey maps made it possible to identify the soil series of the dominant and associated soils. This facilitated extraction, organization, and systematic compilation of pertinent data that are usually recorded for each soil series.

Information for region B was gathered from exploratory soil survey reports compiled by the Alberta Research Council (Lindsay et al., 1957-1964). Because of the lower intensity of those surveys, map units in region B are larger and are likely to encompass a greater variety of soils than are units in region A. Although soil series were not designated in the exploratory soil surveys, the acquired information was ample to at least permit the taxonomic classification of the more extensively distributed mineral soils and to characterize their basic properties. However, only general information was available in these reports for organic soils.

Detailed soils information, similar to that for region A, was available for the Alberta Oil Sands Environmental Research Program area (Turchenek and Lindsay, 1982). Therefore, this area constitutes a special unit within region B (AOSERP in figure 1).

Soils information for region C was derived from the

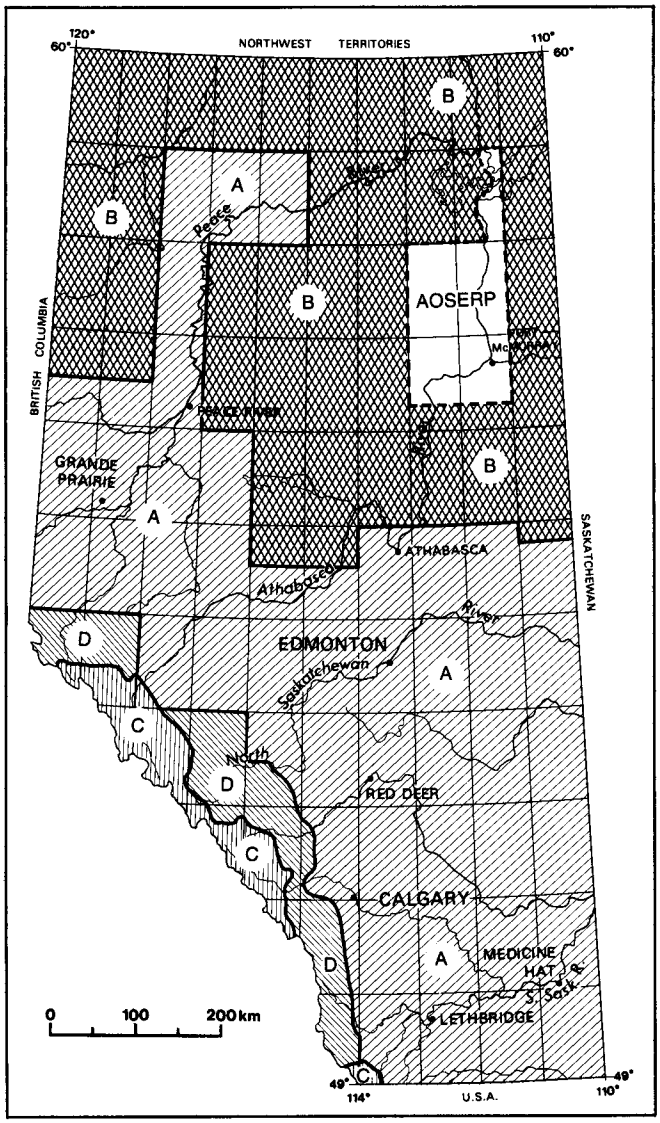


Figure 1. Soil inventory information source regions.

Ecological (Biophysical) Land Classification of Banff and Jasper National Parks (Holland and Coen, 1982) and the Soil Survey of Waterton Lakes National Park (Coen and Holland, 1976). Because both of these surveys involved large-scale mapping and the collection of considerable data on the properties of the soils, they contained good information on the definition, delineation, and characterization of map units.

Region D (figure 1) comprises parts of the Rocky Mountains outside the national parks as well as the southern and south-central portions of the foothills, as outlined by Pettapiece (1986). In this region, the soils information is varied, general, and in places, inferred or extrapolated from scanty data. Accordingly, the classification of soils and the delineation and characterization of map units are likely to be tenuous in some places.

The definition and delineation of map units in the mountains north of Jasper Park was based on information derived from Alberta Energy and Natural Resources (AENR) Physical Land Classification maps, a report by Ferguson (1980), surficial materials maps by Bayrock and Reimchen (1974-1975), and a geology map by Green (1970). The characterization of map units was based largely on extrapolation of information from Holland and Coen (1982) for Jasper Park, and Twardy and Corns (1980) for the Wapiti map sheet. Similar sources of information on surficial materials and geology, and the extrapolated information from Holland and Coen (1982), were used for the mountainous areas south of Banff National Park. A study by Jeffrey et al. (1968) contained additional information for a small portion of the southern Rocky Mountains area.

Comparable sources of information were used for defining, delineating, and characterizing map units in the foothills portion of Region D. Useful information was found in the AENR Physical Land Classification maps and reports by Karpuk and Levinsohn (1980), Kocaoglu (1983), Kocaoglu and Sauchyn (1980), and Tedder (1980) and the Alberta Institute of Pedology report by Pettapiece (1971). Data for the Hinton-Edson soil survey report (Dumanski et al., 1972) were used for extrapolations. An ongoing soil survey in the Cardston area (Brierley, 1985) resulted in information for the extreme southern part of the foothills. In addition, soil surveys of three small areas, about 10 km^2 each, in the central and southern foothills by one of the authors (N.H.), provided information on the classification of the soils, and data regarding their properties in the areas surveyed. Surficial materials maps (Bayrock and Reimchen, 1974-1975) and bedrock geology maps (Green, 1970) were also used to infer the distribution and properties of soils.

Map unit descriptions

The soils map depicts the areal distribution of the various kinds of soils occurring in the province. Each map unit encompasses an area in which a certain kind of soil is dominant. Usually, however, other kinds of soils are included in each map unit, some constituting more than 20 percent of the area. In such cases, the most extensive of the minor soils is considered to be a subdominant component of the map unit. Other kinds of soils, although of minor extent, may collectively contribute appreciably to the qualities of the map unit.

The dominant and, if included in the map unit, the subdominant soils and the non-soil materials, were characterized individually as to their attributes and properties (appendix B). For each map unit, the first line of data is for the dominant soil, and the second line, if shown, applies to the subdominant soil. Information about soil properties was recorded separately for the surface and subsurface layers to show the variation through the soil profile. The characteristics of the dominant and the subdominant soils that served as the bases for establishing the map units include taxonomic class (C.S.S.C., 1978), reaction (pH), and, for mineral soils, their texture and the kind and quality of the parent material (appendix A) or the substrate on which the soils occur. Of these attributes, the taxonomic class and the texture family class are implicit in the map unit symbols. Also implicit are the rock material types for those map units in which non-soil components are dominant.

Unless otherwise indicated, mineral soils are considered to be deep; that is, the combined thickness of the surface and subsurface layers in fine earth materials is 100 cm or greater. In cases where contrasting layers such as bedrock occur within 100 cm of the surface, this condition is indicated in the table by symbols or abbreviations defined in appendix A. All other symbols and abbreviations that appear in the table are likewise explained or defined in appendix A.

Map unit symbols

A three-part symbol—consisting of a capital letter followed, in most cases, by two integers—is usually used for identifying each map unit. The capital letter indicates the taxonomic classification of the dominant soil, or the non-soil material, in the map unit (appendix A). Excepting organic soils, the first number following the capital letter indicates the texture family class of the soil.

The second number is sometimes used to differentiate map units that have a similar classification and texture of the dominant soil, but differ in other attributes, such as reaction (pH) of the dominant soil, kinds of associated soils, and differences in parent materials. For example, both map units B11 and B12 have dominant soils that are Dark Brown Chernozems with a clayey soil texture family class. However, the materials in map unit B11 are weakly to moderately calcareous and weakly to moderately saline, whereas the materials in map unit B12 are only weakly calcareous and weakly saline.

For some map units, the three-part symbol is followed by a hyphenated number. This symbol identifies individual map units that may differ to some extent in their array of component soils, but on the basis of their predominant soils all are included in the same map unit type.

Soil sensitivity to acid deposition

Mineral soils

The criteria for rating the sensitivity of mineral soils to acid deposition were developed by representatives from British Columbia, Alberta, Saskatchewan, Manitoba, the Yukon, and the Northwest Territories between June 1983 and September 1985. No similar criteria had been developed previously in Eastern Canada although the general approach was adapted from preliminary work done there. The rating system was based on the recognition of 16 categories defined on the basis of cation exchange capacity and pH (table 1). For each category, the sensitivity of three soil chemical processes—sensitivity to base loss, sensitivity to acidification, and sensitivity to the solubilization of toxic elements such as aluminum—were rated separately and then combined as an overall sensitivity rating. Each sensitivity rating was based on an interpretation of the characteristics and properties of only the surface layer of the soil (approximately 20 cm deep) as this layer has a dominant role in plant growth. The soil sensitivity map therefore portrays the distribution of soil susceptibility to internal chemical changes that could affect forest and agricultural productivity.

The assigned rating of the map unit shown on the interpretive map represents the rating of the dominant soil only.

For the purposes of this project, all soils were assumed to be non-sulfate adsorbing. Soils in northern glaciated regions of North America are relatively low in the hydrous oxide minerals largely responsible for sulfate adsorption.

Sensitivity to base loss

Base loss refers to the loss of basic cations—primarily Ca^{2+}, Mg^{2+}, and K^{+}—from the surface layers of the soil. Base loss is caused by the displacement of such cations by acidic cations such as H^{+} and the leaching of the displaced cations by water moving through the profile. The displacing efficiency of H^{+} is greatest in soils of high pH and high percent base saturation (Wiklander, 1980).

Percent base saturation refers to the percentage of the total cation content of a soil that basic cations constitute (Brady, 1984). There is a good general relationship between percent base saturation and pH, although the specific relationship may differ between different kinds of soil (Mehlich, 1942). In general, base saturation is about 80 percent or greater in soils with pH values greater than 6.0 in the surface layers of mineral soils in Alberta. In strongly acid soils (pH < 5.6) and extremely acid soils (pH < 4.6), base saturation decreases more or less gradually from about 70 percent to about 10 percent.

In soils with pH values above 5.5, and especially above 6.0, base saturation is high, but conditions are conducive to appreciable loss of bases due to the high efficiency of H^{+} to replace exchangeable bases (Wiklander, 1980) and the inherent prevalence of bicarbonate anions that facilitate their leaching (Gasser, 1973). Below pH 5.5, there is a reduction in the efficiency of acid cations to release exchangeable bases, and, with the inherent lower base saturation, some mobilization of bases still occurs but at a decreased rate. Mobilized bases in these acid conditions are leached primarily by sulfate and nitrate anions (Abrahamsen, 1984). Such ions are most often associated with acid deposition.

Sensitivity to base loss has been interpreted in at least two different ways. The first approach has been to equate high absolute base loss with high sensitivity and low absolute base loss with low sensitivity. The second approach (Cowell et al., 1981) has been to focus on relative base loss—that is, absolute base loss as a proportion of the total base reserve. In this approach, a high relative base loss is equated with high sensitivity, and a low relative base loss with low sensitivity.

The two approaches to determining base loss sensitivity lead to dramatically different interpretations. Using the first approach, soils of high percent base saturation (pH > 6.0) are considered to be highly sensitive to base loss because they are projected to experience high absolute base loss when subjected to a given amount of acid deposition, whereas soils of low percent base saturation are considered to be of low sensitivity because the absolute base loss is predicted to be lower, given the same amount of acid deposition. Using the second approach, soils of low percent base saturation (low pH) are considered to be highly sensitive because, while the absolute base loss is low, the relative base loss is high (Mollitor and Raynal, 1982). On the other hand, soils of high percent base saturation are considered to be of low sensitivity because, while the absolute base loss is high, the relative base loss is low. The latter approach has been adopted in developing criteria in this report because the relative base loss is more important than absolute base loss in terms of the potential effect of acid deposition on the availability of

Table 1. Criteria for rating the sensitivity of mineral soils to acidic inputs.

CEC*	pH	Sensitivity to:			Overall Sensitivity
		Base loss	Acidification	Al Solubilization	
<6	<4.6	H	L	H	H
	4.6-5.0	H	L	H	H
	5.1-5.5	H	M	H	H
	5.6-6.0	H	H	M	H
	6.1-6.5	H	H	L	H
	>6.5	L	L	L	L
6-15	<4.6	H	L	H	H
	4.6-5.0	M	L	H	M
	5.1-5.5	M	L-M	M	M
	5.6-6.0	M	L-M	L-M	M
	>6.0	L	L	L	L
>15	<4.6	H	L	H	H
	4.6-5.0	M	L	H	M
	5.1-5.5	M	L	M	M
	5.6-6.0	L	L-M	L-M	L
	>6.0	L	L	L	L

* Cation exchange capacity, in cmol(+)kg^{-1}.

Ca, Mg, and K to plants, and therefore on plant productivity (or soil fertility).

Cation exchange capacity has a modifying influence on the interpretation of sensitivity to base loss (table 1). For any given percent base saturation, the total base reserve increases as cation exchange capacity increases. Therefore, cation exchange capacity, taken together with pH, provides a basis for estimating the total base reserves in a soil (Wang and Coote, 1981). For example, in soils with a low cation exchange capacity (<6.0 cmol(+)kg^{-1}), the total base reserves will be relatively small even though base saturation may be quite high. Consequently, all soils of low cation exchange capacity and pH <6.5 are rated as highly sensitive to base loss.

Sensitivity to acidification

Sensitivity to acidification is a measure of the change (decrease) in pH that a soil would likely experience relative to a given addition of acid. It is inversely related to buffering capacity. Bache (1980) defines buffering capacity as the amount of acid or base required to change the pH of the soil by one unit. Soils with a low buffering capacity have a high sensitivity to acidification, and conversely, soils with a high buffering capacity have a low sensitivity to acidification.

Bache (1980) considers cation exchange capacity as the main factor that determines the buffering capacity of soils. Cation exchange capacity is directly related to the mineral (clay) and organic (organic matter) colloid content of the soil. Therefore, soils that are high in clay and/or organic matter will tend to have a high cation exchange capacity, a high buffering capacity, and a low sensitivity to acidification. Conversely, soils that are low in clay and/or organic matter (for example, sands, loamy sands) tend to have a low cation exchange capacity, a low buffering capacity, and a high sensitivity to acidification.

The nature and magnitude of the buffering system in soil varies with soil pH (Thomas and Hargrove, 1984). Generally, soils that have a pH of 6.5 or greater tend to be well buffered by a carbonate-bicarbonate buffering system. Acid soils, with a pH of 3.5 to 5.5, also tend to be well buffered because of hydrolysis reactions of aluminum. All other things being equal, soils in the pH range of 5.0 to 6.5 tend to be less well buffered than more acid or alkaline soils. In this pH range, aluminol groups on the clay minerals, and some functional groups on organic colloids, provide some buffering capacity but are not as effective as either the aluminum- or carbonate-based buffer systems.

The criteria for assessing sensitivity to acidification reflect the aforementioned considerations. Thus, soils that are most sensitive to acidification are those with low cation exchange capacity and a pH of 5.5 to 6.5. Soils with a pH greater than 6.5, or less than 5.0, have a low sensitivity, whereas soils with moderate to high cation exchange capacity and a pH of 5.5 to 6.0 have medium to low sensitivity.

Alberta soils are young in a geological sense and, therefore, have a relatively high content of weatherable soil minerals. Mineral weathering acts to counteract acidification (Bache, 1983). This factor has also been taken into consideration in assigning sensitivity ratings to acidification and base loss.

Sensitivity to solubilization of aluminum

The solubilization of toxic elements, especially aluminum, is one of the soil chemical processes that is considered in estimating soil sensitivity (table 1). The rate of solubilization, which is considered to be almost nonexistent in neutral and slightly acid soils, shows a gradual increase from pH 6.0 to about pH 5.5. In this pH range, sufficient aluminum is solubilized to be toxic to sensitive plant species (Hoyt et al., 1974; Penney et al., 1977). Below pH 5.5, the rate of solubilization shows a progressively more marked increase (Abrahamsen, 1984; McKenzie and Nyborg, 1984). Even the more tolerant plant species are affected in the pH 5.5 to 5.0 range, and it is postulated that some mobilized aluminum may appear in the soil solution effluent. Considerably more solubilized aluminum is likely to be generated in soils of pH 5.0 or lower (Abrahamsen, 1984); thus, effluent waters from such soils may contain sufficient solubilized aluminum to be deleterious to aquatic ecosystems.

Overall sensitivity

If two or more of the sensitivity ratings of the soil chemical processes were high, the overall sensitivity rating was judged to be high. In cases where only one of the ratings was high and the others were moderate or low, or where none were rated as high but two or more were considered medium, the overall sensitivity was rated as medium. Where all of the ratings were low, or low to medium, an overall rating of low was assigned.

Soils that had a high overall sensitivity rating were all those with a pH of 4.6 or lower, and soils with a low cation exchange capacity and a pH of 6.5 or lower. Soils that were assigned an overall sensitivity rating of medium were those soils with a cation exchange capacity in excess of 6 cmol(+)kg^{-1} and a pH of 4.6 to 5.5, and those with a pH range of 5.6 to 6.0 and cation exchange capacity between 6 and 15 cmol(+)kg^{-1}. All other soils were given a low rating.

Peatland systems

Considerable attention has been directed to recognizing and assessing the effects of acid deposition on terrestrial and aquatic ecosystems. In contrast, as Gorham et al. (1984) have emphasized, very little research has been done regarding the sensitivity of peatlands, which are transitional between those two systems. Because of this lack of information, no specific acid sensitivity criteria for peatlands were defined by the LRTAP committee. However, because large areas of the northern half of Alberta are occupied by Organic kinds of soils, it was felt that, in this report, at least a preliminary attempt should be made to evaluate their sensitivity to acid deposition.

Soil map units

A total of 30 map units in which Organic or Organic Cryosol (permafrost) soils are the dominant components were established. Of these, 5 are designated

oligotrophic, 23 mesotrophic, and 2 eutrophic. This relatively large number of map units was delineated to identify the different kinds of associated mineral substrate materials and the kinds of associated subdominant mineral soils. With additional and more extensive investigation, these latter components could possibly serve as clues to the general hydrochemistry of the contiguous peatland systems.

All map units were established on the basis of information obtained by reconnaissance (region A, figure 1) or exploratory (region B, figure 1) soil surveys. The information obtained on kind and distribution of soils in region B is very general, especially with regard to peatland systems. Those map units in region B that show mesotrophic peatland systems as the dominant components are also likely to include appreciable and varying proportions of oligotrophic and eutrophic peatland systems. For almost all map units, only very general descriptions of the peatland systems were available, and for the majority, no data were available on chemical properties. The peatland system designations assigned to these map units were premised on such general information, supplemented by specific data in the few, localized areas where intensive investigations had been conducted. The properties recorded for each map unit (appendix B) were then assumed according to the assigned designation and general information (table 2).

Because of the paucity of soil survey information, and because of the assumptions that had to be made, the map unit designations and the subsequent interpretations should be considered as provisional. There is a definite need for more-detailed soil survey information and for research into the impacts of acid deposition on peatland systems in Alberta.

General description

Organic and Organic Cryosol soils are derived from the accumulation of detrital vegetation (mosses, sedges, grasses, trees, and shrubs) in poorly drained habitats. Accumulation depths of such peatland deposits may range from less than a metre to several metres. There are commonly several vertical differences in the characteristics of peatland systems. As Ingram (1978) indicates, the upper (surface) layer, which may be as much as 50 cm deep, contains a fluctuating water table, is more porous, has high hydraulic conductivity, is subject to periodic or intermittent aeration, and has a proliferation of plant roots. Below this layer, the soil is more consistently water logged, anaerobic, and has lower hydraulic conductivity. There is also considerable variation in the depth to the mineral substrate materials, which are commonly within a metre of the surface.

Considered on a volume instead of weight basis, organic soils in the undrained state are about 10 percent organic matter, and 90 percent ambient water,* and should be thought of as organic matrix-ambient water systems. Because of their constitution and hydrology, these soils are transitional between terrestrial and aquatic ecosystems. Some of their ambient water comes directly from precipitation, but a considerable proportion is additional water from run-off or groundwater influx. Because of the different sources of water, the addition of dissolved minerals into these soils differs widely in quality and quantity.

The approach that we have taken is to identify three categories of peatland systems, based on a synthesis of the limited chemical data that were available. These categories are based on the chemical properties of their Organic and Organic Cryosol soils and associated pool waters. They are designated as peatland systems, with emphasis that they be considered as organic matrix-ambient water systems.

* Ambient water refers to the water of the pores and voids within the framework of organic material, while pool water is the open water in the peatland micro depressions.

Table 2. Some properties of Alberta peatland systems and their associated waters.

		organic soils				pool water	
Peatland system	**Layer**	**Depth (cm)**	**pH**	**Exchangeable bases (cmol(+)L^{-1})**	**% base saturation**	**pH**	**$Ca^{2+} + Mg^{2+}$ (cmol(+)L^{-1})**
eutrophic	surface	0 - 40	6.0 - 8.0	8 - 10	70 - 100	6.5 - 8.0	2 - 5
	subsurface	40 - 120	6.0 - 7.5	10 - 18	65 - 100		
	below subsurface	>120	6.0 - 7.5	10 - 18	65 - 100		
mesotrophic	surface	0 - 40	4.5 - 6.0	2 - 8	25 - 70	5.0 - 6.5	0.5 - 2
	subsurface	40 - 120	5.0 - 6.5	4 - 12	30 - 70		
	below subsurface	>120	5.5 - 6.5	6 - 15	40 - 75		
oligotrophic - organic soils	surface	0 - 40	3.5 - 5.5	0 - 2	10 - 25	3.5 - 5.5	>0.5
	subsurface	40 - 120	3.5 - 5.5	2 - 6	15 - 40		
	below subsurface	>120	4.5 - 6.0	4 - 12	25 - 70		
- organic cryosol	surface	0 - 40	3.5 - 5.5	0 - 6	5 - 50	3.5 - 5.0	<0.5
	subsurface	40 - 80	3.5 - 5.5	0 - 7	5 - 60		
	below subsurface (perm. frozen)	>80	4.5 - 6.0	2 - 12	15 - 90		

Note: The following bulk density values used for weight-volume conversions are based on data reported by Turchenek and Lindsay (1982) and Turchenek et al. (1984):
0.07 $mg \cdot m^{-3}$ - surface layer in all systems and all layers of Organic Cryosol soils
0.12 $mg \cdot m^{-3}$ - subsurface and below surface layers of all Organic soils.

Data for the three peatland systems (table 2) were derived from Horton et al. (1979), Karlin and Bliss (1984), Moore (1985), Slack et al. (1980), Turchenek et al. (1984), Turchenek and Lindsay (1982), Vitt et al. (1975), Walmsley and Lavkulich (1973), and a number of soil survey reports for the west-central, east-central, and Peace River regions of Alberta. The data for the pool water are assumed to be indicative of the chemical properties of the ambient water. There is some overlap in the pH and base cation data that had been reported for the mesotrophic and oligotrophic peatland systems (table 2). A considerable proportion of the oligotrophic peatlands are ombrotrophic. These peatland system designations were adapted from Jeglum (1973) and Stanek and Worley (1983). Most of the oligotrophic peatland systems shown on the maps consist of Organic Cryosol soils.

Sensitivity to acidic inputs

The three individual sensitivity ratings and the overall sensitivity rating for Alberta peatland systems (table 3) are based on the pH and base cation content of the ambient waters, and the pH, cation exchange capacity and percent base saturation of the surface layer organic matrix. The relationships between base cation content and alkalinity for Saskatchewan lake waters (Liaw, 1982) and Alberta peatland waters (Turchenek et al., 1984), and the relationship between alkalinity, pH, and buffering properties for bog and fen waters (Gorham et al., 1984) were considered when defining sensitivity criteria. It should be stressed again that this scheme is based on meagre data and several assumptions; therefore, it should be considered to be provisional.

Sensitivity of eutrophic systems

It is inferred from the data (table 2) that the high pH and the relatively high base cation content of the pool water is indicative of the capacity of the system to sustain a high level of bicarbonate buffering, and that acidification and relative base loss will be minimal. Because of the high pH, aluminum solubilization will likewise be negligible. It is also postulated that the base cation concentration of the water will not decrease substantially, due to equilibration with the considerable base reserve in the organic matrix and the influx of base-charged minerotrophic waters from soil surface runoff and groundwater sources. Thus, the sensitivity of each process is rated as low, as is the overall sensitivity.

Sensitivity of mesotrophic systems

The base cation content of the ambient water in this system ranges from moderately low to moderately high, and the pH from about 4.5 to about 6.5 (table 2). Base saturation of the organic matrix surface layer ranges from very low to medium. The base content of the ambient water is indicative of moderately high to low bicarbonate content, hence moderately high to low buffering capacity. An addition of strong acid will rapidly deplete the buffering in the low range of alkalinity, and with further additions, progressively reduce the buffering capacity remaining, but with only minimal change in pH where some of the original bicarbonate buffering remains (Gorham et al., 1984). Under these conditions, the base loss would be high and acidification moderate. In situations where the original bicarbonate content is below the moderately high level, both acidification and base loss rates would be high and aluminum solubilization medium to high. This condition is considered to be the more common in most of the mesotrophic peatland systems in Alberta. Some replenishment of the base cations can be expected by influx of minerotrophic water and a modest amount from the exchange base reserve of the organic matrix. However, mesotrophic systems in Alberta are rated as highly sensitive to base loss and acidification. Sensitivity to aluminum solubilization is rated as medium. Overall, the sensitivity of mesotrophic systems to acid deposition is considered to be high.

Sensitivity of oligotrophic systems

Oligotrophic systems are extremely to very strongly or strongly acidic, with very meagre amounts of base cations in the ambient water. Base saturation of the organic matrix is very low to low in the surface layer (table 2). The very low pH and very low base cation content of the ambient water indicates that there is very little or no bicarbonate buffering. Rather, these systems are buffered in the extremely to very strongly acid range by aluminum and humic acid systems, as discussed by Johannesen (1980) and Braekke (1981). Additions of acid would, therefore, cause little, if any, change in pH.

Clymo (1984) postulated that any bases present in the acid deposition would exchange with H^+ from any organic acids derived from the growth of sphagnum moss, and that this would increase the total acidity. Braekke (1981) also indicated that base cations are strongly fixed by humic acids. Supporting data, indicating retention of calcium in the surface layer of ombrotrophic (oligotrophic) peat, was reported by Damman (1978). Such indications led to the provisional conclusion in this report that sensitivity to base loss is also low in these systems. However, if sources of aluminum are available—such as mineral dust or associated mineral soil or rock materials—sensitivity to aluminum solubilization would be high, due to the extremely acid condition. Overall, the sensitivity of oligotrophic systems to acid deposition is considered to be low.

Table 3. Sensitivity of Alberta peatland systems to acidic inputs.

Peatland system	Sensitivity to:			Overall sensitivity
	Base loss	Acidification	Al Solubilization	
eutrophic	L	L	L	L
mesotrophic	H	H	M	H
oligotrophic	L	L	H	L

Distribution of Alberta soils relative to their sensitivity to acid inputs

Expressed as a percentage of the total area of the province, soils of high sensitivity occupy 22.7%, soils of medium sensitivity occupy 30.4%, and soils of low sensitivity occupy 44.4% (table 4). The remainder of the

Table 4. Distribution of Alberta soils relative to their sensitivity to acidic inputs.

Map unit symbol	Soil	Area (% of province)			
		High sensitivity	Medium sensitivity	Low sensitivity	Total
A	Brown Chernozem	0.8	-	4.3	5.1
B	Dark Brown Chernozem	0.8	-	5.3	6.1
C	Black Chernozem	-	-	9.1	9.1
D	Dark Gray Chernozem	-	-	1.0	1.0
E	Dark Gray Luvisol	-	-	1.4	1.4
F,G	Orthic Gray Luvisol	1.0	18.7	0.1	19.8
H	Brunisolic Gray Luvisol Podzolic Gray Luvisol	0.3	5.0	0.1	5.4
J	Solonetzic Gray Luvisol	-	2.9	1.2	4.1
K	Solonetz	-	2.1	2.9	5.0
L	Solod	-	-	1.6	1.6
M	Dystric Brunisol	3.1	1.0	-	4.1
N	Eutric Brunisol	1.1	0.3	3.0	4.4
O	Organic	13.4	-	2.3	15.7
OC	Organic-cryosol	-	-	6.6	6.6
P	Podzol	0.1	-	-	0.1
R	Rock, Rough Broken	2.0	0.2	1.6	3.8
T	Gleysol	0.1	0.2	2.8	3.1
U	Regosol	-	-	1.1	1.1
Total		22.7	30.4	44.4	97.5*

* Water bodies account for about 2.5% of the provincial area.

province is occupied primarily by water bodies.

The major groups of soils constituting the high sensitivity category (map 1) are the mesotrophic peatlands located in the northern and northeastern portions of the province, the Dystric Brunisols located in the northeastern portion of the province, and the areas of noncarbonate rocks in the mountains and granite type rocks in the Precambrian Shield area. The remaining areas of highly sensitive soils are scattered throughout the province and mainly comprise the coarser-textured members of the Chernozemic, Luvisolic, and Brunisolic Orders. As discussed previously, both the area estimate and the rating for the mesotrophic peatland system included some assumptions and must be considered to be tentative. However, both the area estimate and the rating for the Dystric Brunisol soils are based upon more certain information. An additional cause of concern for these soils is that they occur extensively in an area where oil sands development is taking place.

The major groups of soils placed in the medium sensitivity category are the Orthic Gray Luvisols and the Brunisolic and Podzolic Gray Luvisols. These soils have a very extensive distribution in the central and eastern slopes regions of the province and, taken together, constitute almost one-quarter of the area of the province. There are also large areas of Solonetz and Solonetzic Gray Luvisol soils that are classed as being of medium sensitivity.

Soils of the Chernozemic Order—the most productive agricultural soils in the southern and central regions of the province—and the Black and Dark Gray Solod soils in the Peace River area are primarily rated as being of low sensitivity. The oligotrophic and eutrophic peatland systems are also placed in this category of low sensitivity.

Potential of soils and geology to reduce the acidity of incoming acid deposition

The rating of the potential to reduce acidity refers to the degree of capability of the soil, and particularly subsoil materials, to reduce the acidity of acid deposition before its possible entry into an aquatic ecosystem as leachate or effluent.

All the dominant and subdominant soil and non-soil components of the map units were rated for their potential to reduce the acidity of atmospheric deposition. The criteria (table 5) were based on guidelines developed for eastern Canada (Working Group 1, 1983) that were adopted by the western Canada participants (Wiens, 1983). In Alberta, additional criteria were developed to rate map units dominated by Organic and Organic Cryosol soils.

Criteria for mineral soils

The rating of map units dominated by mineral materials was based on combinations of soil depth, exchangeable base content of soils, bedrock type (appendix A), parent material type (appendix A), and soil drainage class. For example, deep soils with an exchangeable

Table 5. Criteria for potential of Alberta soils and geology to neutralize acidic inputs.

Potential to neutralize	Soil depth (cm)	Exchangeable bases (cmol(+)kg^{-1})	Bedrock type*	Surficial material type*
high	all depths	calcareous	all types	all types
	<25	all ranges	I	A
	25 - 100	>15	I, II, V	A
	25 - 100	6 - 15	I, II	A
	25 - 100	<6	I	A
	>100	>15	all types	all types
	>100	6 - 15	I	A
	Poorly drained soils	all ranges	all types	all types
	Eutrophic peatlands	-	-	-
medium	<25	all ranges	II, III	-
	25 - 100	6 - 15	II, III	B, C
	25 - 100	<6	II, III	B
	>100	6 - 15	II, III, IV	B, C, D
	>100	<6	I	A
	Mesotrophic peatlands	-	-	-
low	<25	all ranges	IV	-
	25 - 100	<6	IV	C, D
	>100	<6	II, III, IV	C, D
	Oligotrophic peatlands	-	-	-

* Appendix A.

base concentration of greater than 15 cmol(+)kg^{-1} were all rated as having a high potential to reduce acidity regardless of the parent material type or bedrock type. However, where the soil was shallower than 100 cm or where the exchangeable base concentration was less than 15 cmol(+)kg^{-1}, types of parent material and bedrock type were also considered in the rating. Generally, parent material types and bedrock types were categorized relative to their carbonate content and texture. Calcareous parent materials and bedrock were given a high rating. Also, clayey and fine loamy materials were considered to be more effective in reducing the acidity of atmospheric deposition than sandy materials. Poorly drained soils of the Gleysolic Order were rated as having a high potential.

Criteria for peatland systems

The ability of peatland systems to reduce the acidity of atmospheric deposition was inferred from chemical characteristics—specifically pH and base cation concentration—of the different types of systems. For example, eutrophic peatland systems have a high pH and a relatively high concentration of base cations, reflecting a sustained influx of base-charged minerotrophic waters. The potential of such systems to neutralize acidity is probably high. Mesotrophic systems have an intermediate pH and base cation concentration in the surface layer, but become less acidic with depth. It is expected that incident acidity will acidify the surface layer water, but that the effluent will be moderated to a varying degree by influx from the lower layers, resulting in a medium potential to reduce the acidity. The surface layer water of oligotrophic systems is extremely to strongly acid, and little if any moderating influence from the lower layers is likely to occur, especially in Organic Cryosol soils where such layers are perennially frozen. A low potential to reduce acidity is, therefore, predicted for these systems.

Specific ratings

Approximately two-thirds (64.4%) of the total area of the province is occupied by soils and geological materials rated as having a high potential to reduce the acidity of atmospheric deposition (table 6). A further 21.8 percent of the area of the province is rated as having a medium potential, and only 11.3 percent is rated as having a low potential.

A very large portion of the Plains region, with the exception of the area covered by some Organic and Organic Cryosol map units, is rated as having a high potential to reduce acidity (map 2 in pocket). According to Green (1970), this physiographic region is underlain by Mesozoic and some Tertiary clastic sedimentary bedrock (Rock types II, III and V; appendix A). More importantly, however, weakly or moderately calcareous morainal deposits from continental glaciations and associated glaciolacustrine, lacustrine, and glaciofluvial sediments overlie the bedrock and are the source of soil parent materials (Type A; appendix A) over a very large proportion of the Plains region. Within this large region, however, there are localized occurrences of glaciofluvial or aeolian sands that have low base contents. These parent materials may or may not be calcareous. Such areas were given a medium or low rating.

The foothills region is underlain by Mesozoic, and to some extent, Tertiary clastic sedimentary bedrock (Rock types II and III). This region has been covered by Cordilleran glaciations of different vintages (Boydell, 1972; Roed, 1968). The surviving morainal deposits are generally stony but differ in extent, thickness, and carbonate content. Some of these deposits appear to be sporadically weakly calcareous (Dumanski et al., 1972,

Table 6. Potential of Alberta soils and geology to reduce the acidity of acid deposition.

Map units	Soils	Area (% of province)			
		Low potential	Medium potential	High potential	Total
A, B, C, D	Chernozem	-	1.6	19.8	21.4
E, F, G, H, J	Luvisol	0.3	3.1	27.3	30.7
K	Solonetz	-	-	4.9	4.9
L	Solod	-	-	1.6	1.6
M, N, P	Brunisol, Podzol	3.3	2.1	3.2	8.6
O, OC	Organic, Organic Cryosol	6.6	13.4	2.3	22.3
R	Non-soil	1.1	1.6	1.1	3.8
T	Gleysol	-	-	3.1	3.1
U	Regosol	-	-	1.1	1.1
Total		11.3	21.8	64.4	97.5*

* Water bodies account for about 2.5% of the provincial area.

Twardy and Corns, 1980) and in places shallow or mixed with colluvium. Apparently, bedrock-derived materials have contributed appreciably to the surficial materials. On the basis of the properties of the soils and surficial materials, the acidity-reducing potential in this area was estimated to be moderate. From the vicinity of the Bow River and to the south, the glacial deposits appear to be more consistently calcareous, and the acidity-reducing potential is estimated to be high.

Ubiquitous glaciations apparently occurred, and some are still active in places in the Rocky Mountains region. The resulting deposits are strongly influenced by the bedrock provenance, which varies from extremely calcareous to noncalcareous. The acidity-reducing potential is rated to be high in areas of carbonate rock materials and the related Eutric Brunisol map units (N62, N63, N65, N66, N91, and N92), derived from the calcareous morainal or colluvial materials. It is estimated to be medium in areas of noncalcareous clastic sedimentary rocks and rock materials of map units R29 and R39, and low in the Dystric Brunisol soils on the associated morainal and colluvial materials outlined by map units M91 and M92.

Granite or granite type rocks (Rock type IV) and associated extremely to very strongly acid sandy Dystric Brunisol soils prevail in the shield area of northeastern Alberta. Their acidity-reducing potential is rated as low.

A comparison of map 1 with map 2 (pocket) shows that a greater area of Alberta has a high to moderate soil sensitivity rating than a low to moderate potential to reduce acidity. A high rating for soil sensitivity does not necessarily translate into a low potential to neutralize acid deposition, because different components of the soil were used to determine ratings for these two maps. Sensitive topsoil materials were often underlain by calcareous subsoil materials throughout the southern, central, and northwestern portions of the province.

References

Abrahamsen, G. (1984): The effects of acidic deposition on forest soil and vegetation. Phil. Trans. R. Soc., Lond. B305, 369-382.

Bache, B.W. (1980): The acidification of soils. *In:* Hutchinson, T.C. and M. Havas (eds.) Effects of acid precipitation on terrestrial ecosystems. NATO Conference Series, Volume 4. New York: Plenum Press, pp. 183-202.

Bache, B.W. (1983): The implications of rock weathering for acid neutralization. *In:* Ecological effects of acid deposition. Stockholm's National Swedish Environmental Protection Board. pp. 175-187.

Bayrock, L.A. and T.H.F. Reimchen. (1974-1975): Surficial geology: Alberta Foothills and Rocky Mountains. Bayrock and Reimchen Surficial Geology Ltd. Prep. for Alberta Environment and Alberta Research Council. (Maps).

Boydell, A.N. (1972): Multiple glaciations in the Foothills, Rocky Mountain House area, Alberta. Ph.D. Thesis, University of Calgary. 128 pages.

Brady, N.C. (1984): The nature and properties of soils, 9th ed. New York: Macmillan Publishing Company. 750 pages.

Braekke, F.H. (1981): Hydrochemistry in low-pH-soils of South Norway. I. Peat and soil water quality. (Hydrokjemi for jordarter med lav pH p: Svrlandet. 1. Torv.- og jordvannskvalitet). Medd. Nor. inst. skogforsk. 36(11): 1-32.

Brierley, A. (1985): Pedologist; Agriculture Canada, Edmonton (personal communication).

C.S.S.C. (1978): Canada Soil Survey Committee. Subcommittee on Soil Classification. 1978. The Canadian system of soil classification. Canada Department of Agriculture, Publication 1646. Ottawa: Supply and Services Canada. 164 pages.

Clymo, R.S. (1984): Sphagnum-dominated peat bog: a naturally acid ecosystem. Phil. Trans. R. Soc. Lond. B305, 487-499.

Coen, G.M. and W.D. Holland (1976): Soils of Waterton Lakes National Park. Can. For. Serv. Inf. Rep. NOR-X-65, Alberta Institute of Pedology S-73-33. 116 pages.

Cowell, D.W., A.E. Lucas and C.D.A. Rubec (1981): The development of an ecological sensitivity rating for acid precipitation impact assessment. Working Paper No. 10. Lands Directorate, Environment Canada, Ottawa. 42 pages.

Damman, A.W.H. (1978): Distribution and movement of elements in ombrotrophic peat bogs. Oikos 30: 480-495.

Dumanski, J., T.M. Macyk, C.F. Veauvy, and J.D. Lindsay (1972): Soil survey and land evaluation of the Hinton-Edson area, Alberta. Alberta Soil Survey Report Number 31. Alberta Research Council, Edmonton. 119 pages.

Ferguson, N.B. (1980): Physical land classification of the Willmore-Kakwa regional recreation plan study area. Land Classification Section Resource Inventory and Appraisal Report T/12-No. 5. Alberta Energy and Natural Resources. Resource Evaluation and Planning, Edmonton, Alberta. 58 pages.

Gasser, J.K.R. (1973): An assessment of the importance of some factors causing losses of lime from agricultural soils. Experimental Husbandry 25: 86-95.

Gorham, E., S.E. Bayley, and D.W. Schindler (1984): Ecological effects of acid deposition upon peatlands: A neglected field of "Acid-Rain" research. Canadian Journal of Fisheries and Aquatic Sciences 41: 1256-1268.

Green, R. (1970): Geological map of Alberta. Alberta Research Council Map 35.

Holland, W.D. and G.M. Coen (eds.) (1982): Ecological land classification of Banff and Jasper: Vol. II Soil & Vegt. Resources. Alta. Inst. Ped. Publ. No. 55-82-44, 540 pages.

Horton, D.G., D.H. Vitt, and N.G. Slack (1979): Habitats of circumboreal-subarctic sphagna: I. A quantitative analysis and review of species in the Caribou Mountains, northern Alberta. Can. J. Bot. 57: 2283-2317.

Hoyt, P.B., M. Nyborg and D.C. Penney (1974): Farming acid soils in Alberta and northeastern British Columbia. Can. Dept. Agric. Publ. 1521.

Ingram, H.A.P. (1978): Soil layers in mires: Function and terminology. J. Soil Sci. 29: 224-227.

Jeffrey, W.W., L.A. Bayrock, L.E. Lutwick, and J.F. Dormaar (1968): Land-vegetation typology in the Upper Oldman River Basin, Alberta. Ministry of Forestry and Rural Development, Ottawa. Forestry Branch Departmental Publication No. 1202. 45 pages.

Jeglum, J.K. (1973): Boreal forest wetlands near Candle Lake, Saskatchewan: II, Relationships of vegetational variation to major environmental gradients. Musk-Ox 12:32-48.

Johannesen, M. (1980): Aluminum, a buffer in acidic waters? *In:* Drablos, D. and A. Tollan, (eds.) Proceedings of an international conference on ecological impact of acid precipitation. 1980 March 11-14 Sandefjord, Norway. SNSF Project P.O. Box 61, 1432 As-NHL Norway, pp. 222-223.

Karlin, E.F. and L.C. Bliss (1984): Variation in substrate chemistry along microtopographical and water-chemistry gradients in peatlands. Can. J. Bot. 62: 142-153.

Karpuk, E.W. and A.G. Levinsohn (1980): Physical land classification of the Livingstone-Porcupine study area. Land Classification Section Report

T/12-No.10. Alberta Energy and Natural Resources. Resource Evaluation and Planning, Edmonton, Alberta. 54 pages.

Kocaoglu, S.S. (1983): Physical land classification of the Rocky-North Saskatchewan Area. Land Classification Section, Resource Inventory and Appraisal. Alberta Energy and Natural Resources, Resource Evaluation and Planning. Edmonton, Alberta. 39 pages.

Kocaoglu, S.S. and D.J. Sauchyn (1980): Physical land classification of the Brazeau-Pembina Study area. Land Classification Section, Resource Inventory and Appraisal. ENR Report #147. Alberta Energy and Natural Resources, Resource Evaluation and Planning. Edmonton, Alberta. 39 pages.

Liaw, W.K. (1982): Chemical sensitivity of Northern Saskatchewan waters to acidification. *In:* Preproceedings Acid forming emissions in Alberta and their ecological effects. 1982 March 9-12; Edmonton, Alberta: pg. 262 (Abstract).

Lindsay, J.D., P.K. Heringa, S. Pawluk, W. Odynsky, A. Wynnyk (1957-1964): Exploratory soil survey of Alberta; map sheets 84C, 84-B, 84-A, 74-D, 84-D, 84-E, 84-F, 84-G, 84-J, 84-K, 84-L, 84-M, 84-N, 84-O, 84-P, 84-I, 84-H, 74-M, 74-L, 74-E, 73-L, 83-O, 83-P, 73-M, 83-L, 83-K, 83-F and 83-J. Preliminary Soil Survey, Reports 58-1, 59-1, 60-1, 61-1, 62-1, 63-1, 64-1 and 64-2. Alberta Research Council, Edmonton.

McKenzie, R.C. and M. Nyborg (1984): Influence of subsoil acidity on root development and crop growth in soils of Alberta and northeastern British Columbia. Can. J. Soil Sci: 64:681-697.

Mehlich, A. (1942): Base unsaturation and pH in relation to soil type. Soil Sci. Soc. Am. Proc. (1941) 6:150-156.

Mollitor, A.V. and D.J. Raynal (1982): Acid precipitation and ionic movements in Adirondack Forest soils. Soil Sci. Soc. Am. J. 46:137-141.

Moore, T.R. (1985): The spectrophotometric determination of dissolved organic carbon in peat waters. Soil Sci. Soc. Am. J. 49:1590-1592.

Patterson, G.T. and G.K. Peterson (1984): Soil inventory database for management and planning (SIDMAP). Database contents and potential applications. Agriculture Canada and Alberta Agriculture internal document. 20 pages.

Penney, D.C., M. Nyborg, P.B. Hoyt, W.A. Rice, B. Siemens, and D.H. Laverty (1977): An assessment of the soil acidity problem in Alberta and northeastern British Columbia. Can. J. Soil Sci. 57:157-164.

Pettapiece, W.W. (1971): Land classification and soils in the Rocky Mountains of Alberta along the North Saskatchewan River Valley. Alberta Institute of Pedology, University of Alberta, 5-71-31.

Pettapiece, W.W. (1986): Physiographic subdivisions of Alberta (map), Agriculture Canada. 1986 Faculty of Extension, University of Alberta.

Roed, M.A. (1968): Surficial geology of the Edson-Hinton area, Alberta. Unpublished Ph.D. Thesis, University of Alberta, Edmonton.

Slack, N.G., D.H. Vitt and D.C. Horton (1980): Vegetation gradients of minerotrophically rich fens in western Alberta. Can. J. Bot. 58: 330-350.

Stanek, W. and I. Worley (1983): A terminology of virgin peat and peatlands. *In:* Fuchsman, C.H. and S.A. Spigarelli, (eds.) International symposium on peat utilization, 1983 October 10-13; Bemidji, Minnesota; pp. 75-102.

Tedder, W.S. (1980): Physical land classification of the Ghost River study area. Land Classification Section Report T/12-No. 11. Alberta Energy and Natural Resources, Resource Evaluation and Planning. Edmonton, Alberta. 69 pages.

Thomas, G.W. and W.L. Hargrove (1984): The chemistry of soil acidity. *In:* Adams, F., (ed.) Soil acidity and liming. American Society of Agronomy, Inc., Crop Science Society of America, Inc., and Soil Science Society of America, Inc., Madison, Wisconsin. pp. 3-56.

Turchenek, L.W. and J.D. Lindsay (1982): Soils inventory of the Alberta Oil Sands Environmental Research Program Study Area. AOSERP Report 122. Prep. for the Alberta Oil Sands Environmental Research Program by Alberta Research Council. Edmonton, Alberta. 240 pages.

Turchenek, L.W., D.E.B. Storr, C.L. Palylyk, and P.H. Crown (1984): Peatlands inventory pilot project. Prep. for Resource Evaluation Branch, Research Evaluation and Planning Division, Alberta Energy and Natural Resources. Edmonton, Alberta. 230 pages.

Twardy, A.G. and I.G.W. Corns (1980): Soil survey and interpretation of the Wapiti Map area, Alberta. Bulletin 39. Alberta Research Council, Edmonton. 134 pages.

Vitt, D.H., P. Achuff, and R.E. Andrus (1975): The vegetation and chemical properties of patterned fens in the Swan Hills, north central Alberta. Can. J. Bot. 53: 2776-2795.

Walmsley, M.E. and L.M. Lavkulich (1973): In situ measurement of dissolved materials as an indicator of organic terrain type. Can. J. Soil Sci. 53:231-236.

Wang, C. and D.R. Coote (1981): Sensitivity classification of agricultural land to long-term acid precipitation in Eastern Canada. Land Resource Research Institute Contribution No. 98. Ottawa: Research Branch, Agriculture Canada. 9 pages.

Wiens, J.H. (1983): Soils and geology mapping in western Canada. Report on the Victoria, British Columbia meeting July 27, 28, 1983. Prepared by J.H. Wiens on behalf of the Task Group on Soil

and Geology Sensitivity Mapping for the western Canada LRTAP Technical Committee.

Wiklander, L. (1980): Interactions between cations and anions influencing adsorption and leaching. *In:* Hutchinson, T.C. and M. Havas, (eds.) Effects of acid precipitation on terrestrial ecosystems. NATO Conference Series, Volume 4. New York Plenum Press, pp. 239-254.

Working Group 1. (1983): United States-Canada Memorandum of intent on transboundary air pollution. Impact Assessment, Final Report. Canada Department of Environment, Ottawa.

Appendix A. Abbreviations and symbols.

Taxonomic classes

Letter in map unit symbol	Abbreviation for taxonomic class	Soil
A	B	Brown Chernozem
	SZB	Solonetzic Brown Chernozem
B	DB	Dark Brown Chernozem
	SZDB	Solonetzic Dark Brown Chernozem
C	BL	Black Chernozem
	SZBL	Solonetzic Black Chernozem
D	DG	Dark Gray Chernozem
E	DGL	Dark Gray Luvisol
F,G	OGL	Orthic Gray Luvisol
H	BRGL	Brunisolic Gray Luvisol and Podzolic Gray Luvisol
J	SZGL	Solonetzic Gray Luvisol
K	BSS	Brown Solonetz and Solodized Solonetz
	DBSS	Dark Brown Solonetz and Solodized Solonetz
	BLSS	Black Solonetz and Solodized Solonetz
	DGSS	Dark Gray Solonetz and Solodized Solonetz
	GSS	Gray Solonetz and Solodized Solonetz
L	BSO	Brown Solod
	DBSO	Dark Brown Solod
	DGSO	Dark Gray Solod
	BLSO	Black Solod
	SODG	Solodic Dark Gray Chernozem
M	DYB	Dystric Brunisol
N	EB	Eutric Brunisol
O	ORG	Organic
OC	OC	Organic Cryosol
P	P	Podzol
R1	R1	Nonsoil. Carbonate rock and rock materials
R2	R2	Nonsoil. Intermingled carbonate and clastic sedimentary rock and rock materials
R3	R3	Nonsoil. Clastic sedimentary rock and rock materials
R4	R4	Nonsoil. Granite and Granite type rock
R5	R5	Rough Broken Land -Mapped only in the Plains section of the province.
T	G	Gleysol
U	R	Regosol
Y	None	Icefields and practically barren glacial materials

The taxonomic classes that may be of the Order, Great Group or Subgroup categories and the texture family classes follow the criteria defined by C.S.S.C. (1978). The taxonomic class and the texture family class of the dominant soil are represented in the map unit symbol by a capital letter and the first number following the capital letter, respectively. The taxonomic class and the texture family class of the subdominant soil are not represented in the map unit symbol. Additional explanation of the three-digit symbol is given in the legend of the maps.

Texture family class and soil texture classes

Classes of soil texture as used in the report follow the criteria defined in C.S.S.C. (1978). Classes of texture based on the fine earth (< 2 mm) fraction of the soil are used to characterize the texture of the soil of the surface (0 to 20 cm) layer. The texture family classes, which consist of some groupings of the textural classes mentioned above and include the coarse fragments in the soil, are used to indicate the texture of the taxonomic class of the map unit. In addition, these groupings are used to describe the texture of the subsoil and the material below the subsoil.

Texture family classes

SDY	Sandy family	Includes sands and loamy sands
COL	Coarse loamy	Includes sandy loams, light loams and some coarse silt loams
FNL	Fine loamy	Includes loams, light clay loams
CLY	Clayey	Soils with clay content above 35 percent
CSK	Clayey Skeletal	Clayey with coarse fragment content above 35 percent
LSK	Loamy Skeletal	Loamy with coarse fragment content above 35 percent
SSK	Sandy Skeletal	Sandy with coarse fragment content above 35 percent

Soil texture family class in the map unit symbols

The first number following the capital letter in the symbol indicates the texture family class of the dominant soil as follows:

1	clayey class
2, 3, 4	fine loamy class
5, 6	coarse loamy class
7, 8	sandy class
9	sandy skeletal, loamy skeletal, or clayey skeletal class

Kind and chemical properties of the mineral surficial materials on which the soil occurs

Kind

CL	Colluvial materials
EO	Eolian materials
FL	Fluvial materials
FN	Fluviolacustrine materials
GF	Glaciofluvial materials
GL	Glaciolacustrine materials
LC	Lacustrine materials
LT	Lacustro till materials

MR Morainal materials
RS Residual materials

Carbonate content

NC Noncalcareous
WC Weakly calcareous - carbonate content less than 6 percent
MC Moderately calcareous - carbonate content 6 to 12 percent
SC Strongly calcareous - carbonate content 12 to 40 percent
EC Extremely calcareous - carbonate content over 40 percent

Salinity

NS Non saline
WS Weakly saline - relative term
MS Moderately saline - relative term
SS Strongly saline - relative term

Contrasting substrate if within 100 cm

Rock types

I. Carbonate rock (limestone, dolomite) or calcareous clastic sedimentary rocks: shales, siltstone, sandstone. High buffering capacity.
II. Intermingled carbonate rocks (limestone, dolomite) and clastic sedimentary rocks that are more commonly fine or medium grained: shale, siltstone, some sandstone. Some of the clastic sedimentary rocks are slightly acid to mildly alkaline in reaction and may include sporadic calcareous strata. Moderately high buffering capacity.
III. Clastic sedimentary rocks: shale, siltstone sandstone. More commonly fine or medium grained. In frequent calcareous strata. Medium buffering capacity.
IV. Granite or granite type rocks. Low buffering capacity.
V. Largely alkaline clastic sedimentary rocks: some of which may be saline to some extent: shale, siltstone sandstone. High buffering capacity.

Prevalence in the map unit

* Minor to subdominant
** Dominant

Kind and thickness of organic layer on the surface of mineral soils

L Organic horizon consisting of fresh or slightly altered accumulation of plant detrital material
F Organic horizon consisting of partly decomposed accumulation of plant detrital material
H Organic horizon consisting of considerably decomposed accumulation of plant detrital materials

The thickness of these organic horizons is usually shown collectively. In cases where the thickness of the H horizon exceeds about 10 cm, it may be shown separately.

Pt Peat. Where the peat horizon is more than 15 cm and less than 60 cm, it is shown as a surface horizon. In this report, the degrees of decomposition are not indicated. If present, this organic horizon is commonly found on poorly drained soils such as the Gleysol soils.

Surface soil and subsoil

Horizon nomenclature

Horizon nomenclature in mineral soil follows C.S.S.C. (1978). In Organic and Organic Cryosol soils, the materials at the three depths (surface, subsurface, and below subsurface) are designated as Pt (Peat) or Ptz (Peat, permanently frozen).

Texture

Abbreviations representing the texture classes based on the fine earth fraction refer to the averaged soil texture of the surface layer (0 - 20 cm).

SD	Sand	Includes sands and loamy sands
SL	Sandy loam	
LM	Loam	Includes loams and silt loam
CL	Clay loam	Includes clay loam, silty clay loam
CY	Clay	

Organic matter content

L	Low	<2.0 percent organic carbon content
M	Medium	2.0 - 3.5 percent organic carbon content
H	High	>3.5 percent organic carbon content

Soil reaction (pH) classes

These were measured in soil-water mixes.

EA	Extremely acid	pH <4.6
VSA	Very strongly acid	pH 4.6 to 5.0
SA	Strongly acid	pH 5.1 to 5.5
MA	Medium acid	pH 5.6 to 6.0
SLA	Slightly acid	pH 6.1 to 6.5
N	Neutral	pH 6.6 to 7.3
MLK	Mildly alkaline	pH 7.4 to 7.8
MRK	Moderately alkaline	pH 7.9 to 8.4

Cation exchange capacity

Cation exchange capacity (CEC) was determined by the neutral, normal, ammonium acetate method. It is expressed as cmol(+)kg^{-1} for mineral soils and as cmol(+)L^{-1} for Organic and Organic Cryosol soils. Where data were lacking, their magnitudes are shown as ranges of values (see below), inferred or extrapolated from areas having similar soils for which data were available.

L	Low	<6 cmol(+)kg^{-1}
M	Medium	6 - 15 cmol(+)kg^{-1}
H	High	15 - 25 cmol(+)kg^{-1}
VH	Very High	>25 cmol(+)kg^{-1}

Exchangeable bases

The above discussion for cation exchange capacity applies equally here. Where data were lacking, values were inferred from areas having similar soils, and ex-

Appendix A. (continued)

pressed as ranges of values as follows:

L	Low	>6 cmol(+)kg^{-1}
M	Medium	6 to 15 cmol(+)kg^{-1}
H	High	15 to 25 cmol(+)kg^{-1}
VH	Very High	>25 cmol(+)kg^{-1}

Percent base saturation
Where data were available they are shown. Where they were not, they were inferred and are expressed as ranges of values according to the following list:

EL	Extremely low	<10 percent
VL	Very low	<25 percent
L	Low	25 to 49 percent
M	Medium	50 to 74 percent
H	High	75 to 89 percent
VH	Very High	90 to 100 percent

Thickness of subsoil
The subsoil thickness shown represents the thickness of a horizon that constitutes the subsoil or the combined thickness of the horizons included in the subsoil. Where two or more horizons are included in the subsoil, the physical and chemical properties of the more dominant horizon are shown as properties of the subsoil. Where a contrasting substratum layer, such as bedrock, occurs within 100 cm of the soil surface, the depth from the surface soil to the contrasting layer represents the subsoil.

Material below the subsoil
Horizon nomenclature
Horizon nomenclature follows the C.S.S.C. (1978). The Roman numeral II prefix identifies B or C horizons in fine earth materials that differ from those of the subsoil in mode of origin.

Contrasting layers
This refers to contrasting layers of bedrock that occur within 100 cm of the surface and are subjacent to the mineral fine earth soil. Layers are defined according to their rock type. The symbol D represents the contrasting layer while the lower case letters identify it as to rock type as defined under contrasting substrate.

Drc	I	Carbonate rocks: limestone, dolomite
Drs	II, III, V	Clastic sedimentary rocks: shale, siltstone, sandstone
Drg	IV	Granite and granite type rocks

Surficial material types

A	Carbonate bearing materials of all textures
B	Noncarbonate bearing or sporadically weakly calcareous materials of clayey texture family class
C	Noncarbonate bearing or sporadically weakly calcareous materials of fine loamy texture family class
D	Noncarbonate bearing, coarse loamy, sandy, or sandy skeletal materials

Soil depth

Deep soils:	Soils in fine earth materials at least 100 cm deep.
Shallow soils: (Also shallow phase soils)	Soils in fine earth materials 25 cm or more but less than 100 cm deep. Contrasting substrata occur within 100 cm of the surface. Contrasting substrata consist of weakly consolidated or soft rock types that commonly are fine or medium grained.
Very shallow soil:	Soils in fine earth material less than 25 cm deep over contrasting substrata of consolidated rock. These soils are included with areas mapped as practically barren rock or rock materials: R1, R2, R3 and R4.
Lithic soils: (Also lithic phase soils)	Similar to shallow soils but the contrasting substrata consists of consolidated rock.

Appendix B. Descriptive properties of map units.

Map Unit	Kind of Soil(s)		Kind and Properties of Surficial Materials					Soil Properties by Horizons or Layers																			Soil Sensitivity to:				
									Surface Soil (MIN - 0-20cm)(ORG - 0-40cm)						Subsoil							Below Subsoil									
	Taxonomic Class	Soil Texture Family Class	Kind	Texture Family Class	Reaction (pH) or Carbonate Content	Salinity	Contrasting Substrate if within 100 cm	Organic Surface Layer (kind, thickness)	Kind of horizon(s) or layer(s)	Texture	Organic Matter Content	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Total Thickness (cm)	Texture Family Class	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Texture Family Class or Rock Type	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Loss of Bases	Acidification	Aluminum Solubilization	Overall Soil Sensitivity	Potential to Neutralize Acidity
A11	B	CLY	GL	CLY	MC	NS			Ah-Bm	CL	L	N-MLK	H	H	100	Bm	10-50	CLY	MLK	VH	VH	100	C	CLY	MC		L	L	L	L	H
A21	B	FNL	MR,FN	FNL	MC	NS			Ah-Bm	LM	L	N-MLK	15-25	15-25	100	Bm	0-30	FNL	MLK	15-25	15-25	100	Ck	FNL	MC		L	L	L	L	H
A22	SZB	FNL	MR	FNL	MC	NS			Ah-Ae	LM	L	SLA-N	12-22	10-22	80-100	Bntj	0-20	FNL	MLK	15-30	15-30	100	Ck	FNL	MC		L	L	L	L	H
	B	FNL	MR	FNL	MC	NS			Ah-Bm	LM	L	N-MLK	15-25	15-25	100	Bm	0-30	FNL	MLK	15-25	15-25	100	Ck	FNL	MC		L	L	L	L	H
A31	B	FNL	MR	FNL	MC	NS			Ah-Bm	LM	L	N-MLK	15-25	15-25	100	Bm	0-30	FNL	MLK	15-25	15-25	100	Ck	FNL	MC		L	L	L	L	H
	BSS	FNL	MR	FNL	WC-MC	MS			Ah-Ae	LM	L	SLA	12-15	6-15	50-100	Bnt	0-20	FNL	MLK	20-30	20-30	100	Ck	FNL	WC-MC		L	L	L	L	H
A32	SZB	FNL	MR	FNL	MC	WS-MS			Ah-Ae, AB	LM	L	SLA-N	12-22	10-22	80-100	Bntj	0-20	FNL	MLK	15-20	15-20	100	Ck	FNL	MC		L	L	L	L	H
	BSS	FNL	MR	FNL	MC	MS			Ah-Ae	LM	L	SLA	12-15	6-15	50-100	Bnt	0-20	FNL	MLK	20-30	20-30	100	Ck	FNL	MC		L	L	L	L	H
A61	B	COL	GF	COL	WC-MC	NS			Ah	SL-SD	L	SLA-N	7-15	6-15	90-100	Bm	10-50	COL	N-MLK	6-10	6-10	100	Ck	COL-SDY	WC		L	L	L	L	H
A71	B	SDY	EO GF	SDY	WC-MC	MS			Ah-Cl	SD	L	SLA-N	3-7	3-7	80-100	C2	80	SDY	SLA-MLK	3-6	3-6	90-100	Ck	SDY	WC-MC		H	H	L	H	M
B11	DB	CLY	LC	CLY	WC-MC	NS-MS			Ah-Bm	CY	M-H	N-SLA	25-35	25-35	100	Bm	10-30	CLY	N-MLK	25-30	25-30	100	Ck	CLY	WC-MC		L	L	L	L	H
B12	DB	CLY	GL	CLY	WC	NS			Ah-Bm	CL-LM	M	N-MLK	25-35	25-35	100	Bm	10-30	CLY	N-MLK	25-30	25-30	100	Ck	CLY	WC		L	L	L	L	H
B21	DB	FNL	MR-FN	FNL	WC-MC	NS			Ah-Bm	LM	M	N-SLA	20-30	18-30	90-100	Bm	10-30	FNL	N-MLK	18-28	18-28	100	Ck	FNL	WC-MC		L	L	L	L	H
B22	DB	FNL	MR	FNL	MC	NS-WS			Ah-Bm	LM	M	N-MLK	20-30	20-30	100	Bm	10-30	FNL	N-MLK	18-28	18-28	100	Ck	FNL	MC		L	L	L	L	H
B23	DB	FNL	MR-FN	FNL	MC	NS			Ah-Bm	LM	M	N-MLK	20-30	20-30	100	Bm	10-30	FNL	N-MLK	18-28	18-28	100	Ck	FNL	MC		L	L	L	L	H
B31	DB	FNL	MR-GL	FNL-CLY	MC-WC	NS			Ah-Bm	LM	M-H	SLA-N	20-30	16-30	80-100	Bm	10-30	FNL-CLY	N-MLK	18-30	18-30	100	Ck	FNL-CLY	MC-WC		L	L	L	L	H
B32	DB	FNL	MR	FNL	MC	NS-WS			Ah-Bm	LM	M	SLA-N	18-28	15-28	75-100	Bm	10-30	FNL	N	15-25	15-25	100	Ck	FNL	MC		L	L	L	L	H
	DBSS	FNL	MR	FNL	WC-MC	MS			Ah-Ae	LM	L-M	MA	15-20	10-15	60-75	Bnt	10-20	FNL	MLK	20-25	20-25	100	Ck	FNL	WC-MC		L	L-M	L-M	L	H
B33	DB	FNL	MR	FNL	MC	NS			Ah-Bm	LM	M	SLA	18-28	12-28	70-100	Bm	10-30	FNL	N-MLK	15-25	15-25	100	Ck	FNL	MC		L	L	L	L	H

Appendix B. (continued)

Map Unit	Kind of Soil(s)		Kind and Properties of Surficial Materials					Soil Properties by Horizons or Layers																				Soil Sensitivity to:				
									Surface Soil (MIN - 0-20cm)(ORG - 0-40cm)						Subsoil							Below Subsoil										
	Taxonomic Class	Soil Texture Family Class	Kind	Texture Family Class	Reaction (pH) or Carbonate Content	Salinity	Contrasting Substrate if within 100 cm	Organic Surface Layer (kind, thickness)	Kind of horizon(s) or layer(s)	Texture	Organic Matter Content	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Total Thickness (cm)	Texture Family Class	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Texture Family Class or Rock Type	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Loss of Bases	Acidification	Aluminum Solubilization	Overall Soil Sensitivity	Potential to Neutralize Acidity
B34	DB	FNL	MR	FNL	MC	NS			Ah-Bm	LM	M	N-SLA	18-28	15-25	80-100	Bm	10-40	FNL	N-MLK	15-25	15-25	100	Ck	FNL	MC		L	L	L	L	H
	DB	SDY-COL	EO,GF	SDY-COL	WC-NC	NS			Ah	SD-SL	L-M	SLA-N	6-15	6-15	100	Bm	20-60	SDY-COL	N-MLK	4-12	4-12	100	Ck	SDY-COL	WC-MC		L	L	L	L	H
B51	DB	COL	GF	COL	MC	NS			Ah	SL	M	SLA	12-15	10-12	80-90	Bm	20-50	COL	N-MLK	8-12	8-12	100	Ck	COL	MC		L	L	L	L	H
	DBSO	CLY	GL	CLY	MC	WS			Ah-Ae	LM	M	MA	18-25	14-18	70-80	Bnt	10-30	CLY	MLK	20-30	20-30	100	Ck	CLY	MC		L	L-M	L-M	L	H
B52	DB	COL	GF	COL-SDY	WC-MC	NS			Ah	SL	M	SLA-N	10-15	10-15	100	Bm	20-50	COL	N-MLK	6-10	6-10	100	Ck	COL-SDY	WC-MC		L	L	L	L	H
B71	DB	SDY	EO,GF	SDY	WC	NS			Ah Bm	SD	L	SLA-N	3-6	3-6	80-100	Bm-BC	50-80	SDY	N-MLK	2-5	2-5	100	Ck	SDY	WC		H	H	L	H	M
C11	BL	CLY-FNL	GL,FN	CLY-FNL	MC	NS			Ah	CY-LM	H	SLA-N	30-40	25-40	85-100	Bm	10-40	CLY-FNL	SLA-N	25-35	22-35	90-100	Ck	CLY-FNL	MC		L	L	L	L	H
C12	BL	CLY-FNL	GL,MR	CLY-FNL	WC-SC	NS			Ah	CY-LM	H	MA-N	35-45	27-45	75-100	Bm	20-40	CLY-FNL	SLA-N	25-40	22-40	90-100	Ck	CLY-FNL	WC-SC		L	L-M	L-M	L	H
	DGL	FNL	MR	FNL	MC	NS			Ah-Ae	LM	L-M	MA-SLA	15-20	10-15	70-80	Bt,BC	20-60	FNL-CLY	SLA-N	20-25	18-25	90-100	Ck	FNL	MC		L	L-M	L-M	L	H
C13	BL	CLY	EO	CLY	NC	NS			Ah	CL	H	SA-MA	25-35	20-27	75-85	Bt,BC	50-70	CLY	MA	20-28	15-23	75-85	IIC	CSK	SLA	H	M	L	M	M	H
C21	BL	FNL	MR,FN	FNL	MC	NS			Ah	LM	H	SLA-N	20-35	18-35	80-100	Bm	20-50	FNL	SLA-N	18-25	15-25	80-100	Ck	FNL	MC		L	L	L	L	H
C22	BL	FNL	MR	FNL	MC	WS			Ah	LM	H	SLA-N	20-30	18-25	80-100	Bm	20-50	FNL	SLA-N	18-25	15-25	80-100	Ck	FNL	MC		L	L	L	L	H
C23	BL	FNL	MR	FNL	MC	NS			Ah	LM	H	SLA-N	18-28	15-25	80-100	Bm	20-40	FNL	SLA-N	18-25	15-25	80-100	Ck	FNL	MC		L	L	L	L	H
	G	FNL-CLY	MR,LC	FNL	MC	WS			Ah	LM	M	N	H	H	H	Bg	20-50	FNL-CLY	N-MLK	H	H	VH	Ckg	FNL-CLY	MC		L	L	L	L	H
C24	BL	FNL	MR	FNL	MC	NS			Ah	LM	H	MA-N	18-25	15-25	75-100	Bm	20-30	FNL	SLA-N	18-25	15-25	80-100	Ck	FNL	MC		L	L-M	L-M	L	H
C25	BL	FNL-CLY	MR	FNL-CLY	MC	NS			Ah	LM-CL	H	MA-N	25-35	18-35	75-100	Bm	20-50	FNL-CLY	SLA-N	20-35	18-35	90-100	Ck	FNL-CLY	MC		L	L-M	L-M	L	H
C26	BL	FNL	MR	FNL	MC	NS			Ah-Bm	LM	H	SLA-N	25-35	22-35	90-100	Bm	20-40	FNL	N	20-30	20-30	100	Ck	FNL	MC		L	L	L	L	H
C27	BL	FNL	MR,FN	FNL	SC	NS			Ah-Bm	LM	H	N	25-30	25-30	100	Bm	20-30	FNL	N	18-25	18-25	100	Ck	FNL	SC		L	L	L	L	H

Map Unit	Kind of Soil(s)		Kind and Properties of Surficial Materials					Soil Properties by Horizons or Layers																			Soil Sensitivity to:				
									Surface Soil (MIN - 0-20cm)(ORG - 0-40cm)							Subsoil							Below Subsoil								
	Taxonomic Class	Soil Texture Family Class	Kind	Texture Family Class	Reaction (pH) or Carbonate Content	Salinity	Contrasting Substrate if within 100 cm	Organic Surface Layer (kind, thickness)	Kind of horizon(s) or layer(s)	Texture	Organic Matter Content	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Total Thickness (cm)	Texture Family Class	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Texture Family Class or Rock Type	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Loss of Bases	Acidification	Aluminum Solubilization	Overall Soil Sensitivity	Potential to Neutralize Acidity
C28	BL	FNL	MR	FNL	MC-SC	NS			Ah-Bm	LM	H	SLA-MLK	25-30	22-30	90- 00	Bm	20-40	FNL	N-MLK	15-25	15-25	100	Ck	FNL	MC-SC		L	L	L	L	H
	EB	FNL	MR,RS	FNL	WC-SC	NS			Ah-Ae	LM	L	SLA-N	15-20	15-20	90-100	Bm	15-40	StFNL	SLA-N	10-15	10-15	100	Ck	St-FNL	WC-SC		L	L	L	L	H
C31	BL	FNL	MR,FN	FNL	MC	NS			Ah	LM	H	SLA-N	25-35	22-35	90-100	Bm	20-50	FNL	SLA-N	15-25	14-25	90-100	Ck	FNL	MC		L	L	L	L	H
C32	BL	FNL	MR	FNL	MC	NS			Ah	LM	H	SLA-N	25-30	22-30	90-100	Bm	20-40	FNL	SLA-N	18-25	15-25	85-100	Ck	FNL	MC		L	L	L	L	H
	BLSS	FNL	MR	FNL	MC-WC	NS			Ah-Ae	LM	M-H	MA	15-25	10-15	50-70	Bnt	15-30	FNL	N-MLK	20-30	20-30	100	Ck	FNL	MC-WC		L	L-M	L-M	L	H
C33	BL	FNL	MR,FN	FNL-CLY	MC	NS			Ah	LM-CL	H	SLA-N	25-35	22-33	85-95	Bm	20-40	FNL-CLY	SLA-N	18-30	18-30	90-100	Ck	FNL-CLY	MC		L	L	L	L	H
	BLSS	FNL-CLY	MR,GL	FNL-CLY	MC-WC	WS			Ah-Ae	LM,CL	H	MA-SLA	20-30	15-20	60-75	Bnt	10-30	FNL-CLY	N-MLK	20-30	20-30	100	Ck	FNL-CLY	MC-WC		L	L-M	L-M	L	H
C34	BL	FNL	MR	FNL	MC	NS			Ah	LM	H	SLA-N	20-30	18-28	90-100	Bm	20-40	FNL	SLA-N	18-25	18-23	85-95	Ck	FNL	MC		L	L	L	L	H
C35	BL	FNL	MR	FNL	MC-WC	NS			Ah	LM	H	SLA-N	25-30	20-25	80-100	Bm	20-50	FNL	N	18-25	18-23	85-95	Ck	FNL	MC-WC		L	L	L	L	H
	BL	COL-SDY	GF,EO	COL-SDY	MC-WC	NS			Ah	SL-SD	M	SLA-N	6-15	6-15	100	Bm	20-70	COL-SDY	SLA-N	5-10	5-10	100	Ck	COL-SDY	MC-WC		L	L	L	L	H
C36	BL	FNL	MR	FNL	MC	NS			Ah-Bm	LM	H	SLA-N	25-35	22-35	90-100	Bm	20-40	FNL	N	20-30	20-30	100	Ck	FNL	MC		L	L	L	L	H
	BLSS	FNL	MR	FNL	MC	MS			Ah-Ae	LM	H	MA	20-25	10-15	50-60	Bnt	10-20	FNL	MA-MLK	25-30	22-30	90-100	Ck	FNL	MC		L	L-M	L-M	L	H
C41	BL	FNL	MR	FNL	MC	NS			Ah	LM	H	MA-N	VH	H	H-VH	Bm	20-60	FNL	MA-N	H	H	H-VH	Ck	FNL	MC		L	L-M	L-M	L	H
	DGL	FNL	MR	FNL	MC	NS			Ah-Ae	LM	L-M	MA-SLA	M-H	M	H	Bt	20-40	FNL	MA-SLA	H	H	H	Ck	FNL	MC		M	L-M	L-M	M	H
C42	BL	FNL-CLY	MR,GL	FNL-CLY	WC-SC	NS			Ah	LM-CL	H	MA-N	VH	H-VH	H-VH	Bm	20-60	FNL-CLY	MA-N	H-VH	H	H-VH	Ck	FNL-CLY	WC-SC		L	L-M	L-M	L	H
	DGL	FNL	MR	FNL	WC-SC	NS			Ah-Ae	LM	L-M	MA-SLA	M-H	M	H	Bt	20-60	FNL	MA-SLA	H	M-H	M-H	Ck	FNL	WC-SC		M	L-M	L-M	M	H

Appendix B. (continued)

Map Unit	Kind of Soil(s)		Kind and Properties of Surficial Materials					Soil Properties by Horizons or Layers																	Soil Sensitivity to:				
									Surface Soil (MIN - 0-20cm)(ORG - 0-40cm)						Subsoil						Below Subsoil								
	Taxonomic Class	Soil Texture Family Class	Kind	Texture Family Class	Reaction (pH) or Carbonate Content	Salinity	Contrasting Substrate if within 100 cm	Organic Surface Layer (kind, thickness)	Kind of horizon(s) or layer(s)	Texture	Organic Matter Content	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Total Thickness (cm)	Texture Family Class	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Texture Family Class or Rock Type	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Loss of Bases	Acidification	Aluminum Solubilization	Overall Soil Sensitivity	Potential to Neutralize Acidity
C51	BL	COL	GF	COL	MC	NS			Ah	SL	H	SLA	12-18	10-15	80-90	Bm	30-50	COL	SLA-N	<6	<6	90-100	Ck	COL-SDY	MC		L	L	L	L	H
	BLSS	FNL	MR	FNL	MC-SC	MS			Ah-Ae	LM	M-H	MA	15-25	10-15	50-70	Bnt	15-30	FNL	N-MLK	20-28	20-28	100	Ck	FNL	MC		L	L-M	L-M	L	H
C52	BL	COL	GF	COL-SSK	MC-SC	NS			Ah	SL	H	N-MRK	20-25	20-25	100	Bm	10-40	COL-SSK	MRK	-	-	-	Ck	COL-SSK	MC-SC		L	L	L	L	H
C61	BL	COL	GF	COL	MC	NS			Ah	SL	H	SLA-N	15-20	12-18	80-100	Bm	20-60	COL	N	8-12	8-12	100	Ck	COL	MC		L	L	L	L	H
C62	BL	COL-SDY	GF,EO	COL	MC	NS			Ah	SL-SD	H-M	SLA-N	10-15	9-15	90-100	Bm	20-60	COL	N	6-12	6-12	100	Ck	COL-SDY	MC		L	L	L	L	H
	BL	FNL	MR,FN	FNL	MC	NS			Ah	LM	H	SLA-N	25-35	22-35	90-100	Bm	20-40	FNL	SLA-N	18-25	15-25	90-100	Ck	FNL	MC		L	L	L	L	H
D11	DG	CLY	GL	CLY	WC	NS			Ah	CY-LM	H-M	MA-SLA	30-40	25-35	80-90	Bm	20-40	CLY	MA-SLA	30-35	25-32	85-95	Ck	CLY	WC		L	L-M	L-M	L	H
D21	DG	FNL	GF	FNL	NC-WC	NS			Ah	LM	H	MA-SLA	20-25	18-22	80-90	Bm	60-80	FNL	MA-SLA	20-25	18-22	80-90	C	FNL	SLA-N	15-20	L	L-M	L-M	L	H
	DGL	FNL-COL	GF	FNL-COL	NC-WC	NS			Ah-Ae	LM	M-L	MA	15-20	12-15	75-85	Bt	60-80	FNL	SA	15-20	12-16	75-85	C	COL-FNL	MA	12-15	L	L-M	L-M	L	M
D22	DG	FNL	GL,MR	FNL	MC	NS			Ah	LM	H	SLA	25-35	22-32	85-95	Bm	20-40	FNL	SLA-N	15-25	13-22	85-90	Ck	FNL	MC		L	L	L	L	H
	G	CLY	GL	CLY	MC	NS			Ah	CY	H	N	VH	VH	100	Bg	20-40	CLY	N	VH	VH	100	Ckg	CLY	MC		L	L	L	L	H
D23	DG	FNL	GL	FNL	MC	NS			Ah	FNL	H	SLA-N	25-35	22-32	85-95	Bm	20-40	FNL	SLA-N	18-27	15-27	85-100	Ck	FNL	MC		L	L	L	L	H
	DGL	FNL	MR	FNL	MC-WC	NS			Ah-Ae	LM	M-H	MA-SLA	18-25	15-22	80-90	Bt	20-50	FNL	MA-SLA	15-27	12-25	80-95	Ck	FNL	MC-WC		L	L-M	L-M	L	H
E11	DGL	CLY	GL	CLY	MC	WS			Ah-Ae	CL	M-H	SLA	27-33	25-30	85-95	Bt	20-30	CLY	MA	28-33	25-30	85-95	Ck	CLY	MC		L	L	L	L	H
	SZGL	CLY	GL	CLY	MC	WS			Ae-AB	CL	L	MA	10-15	8-12	75-85	Bt	20-40	CLY	SA-MA	25-33	20-28	75-90	Ck	CLY	MC		M	L-M	L-M	M	H
E12	DGL	CLY	GL	CLY	MC	WS			Ah-Ae AB	CL	M-H	SLA	27-33	25-30	85-95	Bt	20-30	CLY	MA-SLA	20-25	18-23	90-95	Ck	CLY	MC		L	L	L	L	H
	DGSO	CLY	GL,LT	CLY	MC	WS			Ah-Ae	CL	M-H	MA-SLA	25-33	18-27	70-85	Bt	15-25	CLY	SA	30-40	25-33	70-85	Ck	CLY	MC		L	L-M	L-M	L	H

Map Unit	Kind of Soil(s)		Kind and Properties of Surficial Materials					Soil Properties by Horizons or Layers																			Soil Sensitivity to:				
									Surface Soil (MIN - 0-20cm)(ORG - 0-40cm)							Subsoil							Below Subsoil							
	Taxonomic Class	Soil Texture Family Class	Kind	Texture Family Class	Reaction (pH) or Carbonate Content	Salinity	Contrasting Substrate if within 100 cm	Organic Surface Layer (kind, thickness)	Kind of horizon(s) or layer(s)	Texture	Organic Matter Content	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Total Thickness (cm)	Texture Family Class	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Texture Family Class or Rock Type	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Loss of Bases	Acidification	Aluminum Solubilization	Overall Soil Sensitivity	Potential to Neutralize Acidity
E21	DGI	FNL	MR	FNL	MC-WC	NS			Ah-Ae	LM	M	MA-SLA	15-20	14-18	85-95	Bt	20-50	FNL	MA	18-25	15-22	85-95	Ck	FNL	MC-WC		L	L-M	L-M	L	H
	OGL	FNL	MR	FNL	MC-WC	NS			Ae-AB	LM	L	MA	8-12	7-10	75-85	Bt	20-50	FNL	MA	15-25	13-20	80-90	Ck	FNL	MC-WC		M	L-M	L-M	M	H
E22	DGL	FNL	MR	FNL	MC	NS			Ah-Ae	LM	M-H	SLA-N	15-22	15-22	100	Bt	20-50	FNL	N	15-20	15-20	100	Ck	FNL	MC		L	L	L	L	H
	DG	COL	GF	COL	MC	NS			Ah	SL	M-H	SLA	15-20	12-15	70-80	Bm	30-50	COL	N	6-10	6-10	100	Ck	COL	MC		L	L	L	L	H
E32	DGL	FNL	GF	FNL	NC-WC	NS			Ah-Ae	LM	M-H	SLA	20-25	18-22	85-90	Bt	20-30	FNL	MA	18-25	15-22	80-90	C	FNL	NC-WC	H	L	L	L	L	H
	OGL	FNL	GF	FNL	NC	NS			Ae	LM	L	MA	12-15	9-12	70-80	Bt	20-30	FNL	SA-MA	20-25	15-18	65-75	C	FNL	SA	H	M	L-M	L-M	M	M
E33	DGL	FNL	FL,GL	FNL	SC-MC	NS			Ah-Ae	LM	M-H	SLA	25-30	22-27	85-95	Bt	15-25	FNL	SLA	20-25	17-22	80-90	Ck	FNL	SC-MC		L	L	L	L	H
	DGSO	CLY	LC,LT	CLY	WC	WS			Ah-Ae		M	MA-SLA	20-30	15-25	70-85	Bnt	20-40	CLY	MA-SA	30-40	22-32	75-85	Ck	CLY	WC		L	L-M	L-M	L	H
E34	DGL	FNL	MR	FNL	WC	NS			Ah-Ae	LM	M	MA-SLA	H	H	H	Bt	20-40	FNL	MA	H	H	H	Ck	FNL	WC		L	L-M	L-M	L	H
	DGSO	CLY	LC	CLY	WC	WS			Ah-Ae	LM	M	MA	H-VH	H	H	Bnt	20-40	CLY	MA-SA	VH	H	H	Ck	CLY	WC		L	L-M	L-M	L	H
E51	DGL	COL	GF	COL	MC	NS			Ah	SL	M-H	SLA-N	12-20	10-18	85-100	Bm	20-50	COL	N-MLK	8-15	8-15	100	Ck	COL	WC		L	L	L	L	H
	OGL	COL	GF	COL	MC	NS			Ae	SL	L	SLA	6-10	5-8	80-90	Bt	10-30	COL	SLA-MA	8-12	6-10	70-80	IIC	FNL	MC		L	L	L	L	H
F11	OGL	CLY	RS	CLY-FNL	NC	NS			Ae	LM	L	VSA-SA	10-12	2-3	20-25	Bt	10-30	CLY-FNL	VSA	20-25	4-5	20-25	C	CLY-FNL	MA	20	M	L	H	M	M
	OGL	FNL	MR	FNL	WC-MC	NS			Ae	LM	L	VSA-SA	10-15	6-10	60-70	Bt	30-60	FNL	VSA	18-22	10-12	55-65	Ck	FNL	WC-MC		M	L	H	M	H
F12	OGL	CLY	GL	CLY	MC	NS			Ae-AB	LM-CL	L	MA	12-15	10-12	80-90	Bt	20-40	CLY	MA-SA	30-40	20-30	60-90	Ck	CLY	MC		M	L-M	L-M	M	H
	ORG	-	GL	CLY	MC	NS			Pt	-	-	SLA	9-12	8-10	70-100	Pt	40-80	-	SLA	15-20	10-18	65-100	IICg	CLY	WC		L	L	L	L	H
F13	OGL	CLY	GL	CLY	MC-WC	NS			Ae-Bm	LM	L	MA	12-15	10-12	80-90	Bt	20-40	CLY	MA-SA	30-40	25-30	60-90	Ck	CLY	MC-WC		M	L-M	L-M	M	H
	DGL	FNL	MR	FNL	WC	NC			Ah-Ae	LM	M	MA-SLA	15-20	14-18	85-95	Bt	20-50	FNL	MA	18-27	15-22	80-90	Ck	FNL	WC		L	L-M	L-M	L	H

Appendix B. (continued)

Map Unit	Kind of Soil(s)		Kind and Properties of Surficial Materials					Soil Properties by Horizons or Layers																			Soil Sensitivity to:				
									Surface Soil (MIN - 0-20cm)(ORG - 0-40cm)							Subsoil							Below Subsoil								
	Taxonomic Class	Soil Texture Family Class	Kind	Texture Family Class	Reaction (pH) or Carbonate Content	Salinity	Contrasting Substrate if within 100 cm	Organic Surface Layer (kind, thickness)	Kind of horizon(s) or layer(s)	Texture	Organic Matter Content	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Total Thickness (cm)	Texture Family Class	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Texture Family Class or Rock Type	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Loss of Bases	Acidification	Aluminum Solubilization	Overall Soil Sensitivity	Potential to Neutralize Acidity
F21	OGL	FNL	MR	FNL	MC	NS-WS			Ae-AB	LM	L	MA	8-10	7-9	80-90	Bt	20-60	FNL	MA-SA	18-27	15-22	80-90	Ck	FNL	MC		M	L-M	L-M	M	H
	ORG	-	MR	FNL	MC	NS			Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	40-80	-	SA-SLA	15-20	4-12	30-70	IICg	FNL	MC		H	H	M	H	M
F22	OGL	FNL	MR	FNL	MC-WC	NS			Ae-AB	LM	L	MA	7-12	6-10	80-90	Bt	30-50	FNL	MA-SA	18-27	15-22	80-90	Ck	FNL	MC-WC		M	L-M	L-M	M	H
F23	OGL	FNL	MR	FNL	WC-MC	NS			Ae-AB	LM	L	MA-SLA	7-13	6-12	85-90	Bt	20-60	FNL	MA-SA	18-27	15-22	80-90	Ck	FNL	WC-MC		M	L-M	L-M	M	H
	ORG	-	MR	FNL	MC-WC	NS			Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	40-80	-	SA-SLA	15-20	4-12	30-70	IICg	FNL	MC-WC		H	H	M	H	M
F24	OGL	FNL	MR	FNL	MC-WC	NS-WS			Ae-AB	LM	L	MA	7-13	6-10	80-90	Bt	20-60	FNL	MA-SA	18-27	15-22	80-90	Ck	FNL	MC-WC		M	L-M	L-M	M	H
	DGL	FNL	MR	FNL	MC-WC	NS			Ah-Ae	LM	M	MA-SLA	15-20	14-18	85-95	Bt	20-50	FNL	MA	18-27	15-22	80-90	Ck	FNL	MC-WC		L	L-M	L-M	L	H
F25	OGL	FNL	MR,GL	FNL-CLY	WC-MC	NS			Ae	LM	L	MA-SLA	7-15	6-13	85-95	Bt	20-40	FNL-CLY	MA-SA	18-30	16-28	85-95	Ck	FNL-CLY	WC-MC		M	L-M	L-M	M	H
	G	FNL	MR	FNL	MC	NS			Aeg	LM	L	SLA	15-20	14-18	85-95	Btg	30-60	FNL	SLA	18-21	16-20	85-95	C	FNL	MC		L	L	L	L	H
F26	OGL	FNL	MR	FNL	WC	NS			Ae-AB	LM	L	MA	8-10	6-8	75-85	Bt	20-40	FNL	SA	15-20	13-17	80-90	Ck	FNL	WC		M	L-M	L-M	M	H
	ORG	-	MR	FNL	WC	NS			Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	80	-	SA-SLA	15-20	4-12	30-70	Pt	-	MA-SLA	15-20	H	H	M	H	M
F27	OGL	FNL	MR	FNL	MC-SC	NS			Ae-AB	LM	L	SLA-M	8-10	8-10	100	Bt	20-40	FNL	MA-SLA	14-16	13-15	90-100	Ck	FNL	MC-SC		L	L	L	L	H
	EEB	SDY	GF	SDY	WC	NS			Ae-Bm	SD	L	SLA	2-3	1-2	65-75	Bm	30-40	SDY	SLA	2-3	2-3	80-90	C	SDY	WC		H	H	L	H	M
F28	OGL	FNL	MR	FNL	MC	NS			Ae-AB	SL	L	MA-SLA	4-6	3-5	65-85	Bt	40-50	FNL	MA	12-15	10-13	80-90	Ck	FNL	MC		H	H	M	H	H
	ORG	-	GF-MR	FNL	NC-MC	NS			Pt	-	-	VSA-MA	9-12	2-8	60-70	Pt	40-80	-	SA-SLA	15-20	4-12	60-65	IICg	SDY-FNL	NC-MC		H	H	M	H	M
F31	OGL	FNL	MR	FNL	WC-MC	NS			Ae-AB	LM	L	SA	8-12	3-5	30-50	Bt	20-50	FNL	VSA-SA	20-25	10-15	50-75	Ck	FNL	WC-MC		M	L-M	M	M	H

Map Unit	Kind of Soil(s)		Kind and Properties of Surficial Materials					Soil Properties by Horizons or Layers																			Soil Sensitivity to:				
									Surface Soil (MIN - 0-20cm)(ORG - 0-40cm)							Subsoil							Below Subsoil								
	Taxonomic Class	Soil Texture Family Class	Kind	Texture Family Class	Reaction (pH) or Carbonate Content	Salinity	Contrasting Substrate if within 100 cm	Organic Surface Layer (kind, thickness)	Kind of horizon(s) or layer(s)	Texture	Organic Matter Content	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Total Thickness (cm)	Texture Family Class	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Texture Family Class or Rock Type	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Loss of Bases	Acidification	Aluminum Solubilization	Overall Soil Sensitivity	Potential to Neutralize Acidity
F32	OGL	FNL	MR	FNL	WC	NS			Ae-AB	LM	L	MA	M	M	H	Bt	20-50	FNL	SA	H	H	H-VH	Ck	FNL	WC		M	L-M	L-M	M	H
	G	FNL	MR	FNL	WC	NS			Ah	LM	H	SLA	H-VH	H	H-VH	Bg	20-30	FNL	N	H	H	VH	Ckg	FNL	WC		L	L	L	L	H
F33	OGL	FNL	MR	FNL	WC	NS			Ae-AB	LM	L	MA-SA	12-15	9-12	75-85	Bt	20-40	FNL	SA	20-25	15-22	70-90	Ck	FNL	WC		M	L-M	L-M	M	H
	BRGL	FNL	MR	FNL	WC	NS			AeBf	LM	L	SA-VSA	12-15	4-6	30-40	Bt	20-40	FNL	SA	22-28	15-23	70-85	Ck	FNL	WC		M	L-M	M	M	H
F34	OGL	FNL	MR	FNL	WC-NC	NS			Ae-AB	LM	L	SA	10-15	7-12	70-85	Bt	30-50	FNL	VSA	18-27	15-23	80-85	C	FNL	WC-NC	20-25	M	L-M	M	M	H
F35	OGL	FNL	MR	FNL	MC	NS			Ae-AB	LM	L	MA-SLA	12-15	10-13	80-90	Bt	10-20	FNL	MA	18-25	16-23	90-95	Ck	FNL	MC		M	L-M	L-M	M	H
	BRGL	FNL	MR	FNL	MC	NS			Bm-Ae	LM	L	N	12-15	11-14	85-95	Bt	10-20	FNL	SLA	28-35	25-35	90-100	Ck	FNL	MC		L	L	L	L	H
F36	OGL	FNL	MR	FNL	MC	NS			Ae-Bm	LM	L	MA	10-15	8-14	80-95	Bt	20-50	FNL-CLY	MA-SA	20-30	18-27	80-90	Ck	FNL	MC		M	L-M	L-M	M	H
F41	OGL	FNL	MR	FNL	MC	NS	*II, III		Ae-AB	LM	L	MA-SLA	M	M	H-VH	Bt	30-80	FNL	MA-SLA	H	H	VH	Ck	FNL	MC		M	L-M	L-M	M	H
	BL	FNL	MR	FNL	MC	NS	*II, III		Ah	LM	H	MA-N	H-VH	H-VH	H-VH	Bm	10-40	FNL	MA-N	H	H	H-VH	Ck	FNL	MC		L	L-M	L-M	L	H
F42	OGL	FNL	MR	FNL	WC-MC	NS	*II, III		Ae-AB	LM	L	MA-SA	M	M	M	Bt	10-60	FNL	SA	H	M-H	M	Ck	FNL	WC-MC		M	L-M	L-M	M	H
	BL	FNL-CLY	MR,GL	FNL-CLY	WC-SC	NS			Ah	LM-CL	H	MA-N	H-VH	H-VH	VH	Bm	10-40	FNL-	MA-N	H-VH	H-VH	H-VH	Ck	FNL-CLY	WC-SC		L	L-M	L-M	L	H
F51	OGL	COL	GF	COL-FNL	WC-MC	NS			Ae	SL	L	MA-SLA	5-6	3-4	50-75	Ae-Bt	10-30	COL	MA	8-15	6-12	70-85	IICk	FNL-CLY	MC		H	H	M	H	H
	OGL	COL	GF	COL	WC-MC	NS			Ae	SL	L	MA-SLA	5-7	3-5	50-75	Ae-Bt	10-20	COL	MA-SLA	8-15	6-12	70-85	Ck	COL	WC-MC		H	H	M	H	H
F52	OGL	COL	MR	COL	MC	NS			Ae-AB	SL	L	SLA	5-6	3-5	75-85	Bt	20-30	COL	MA-SLA	10-15	9-13	85-95	Ck	COL	MC		H	H	L	H	H
	ORG	-	MR	COL	MC	NC			Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	80	-	SA-SLA	15-20	4-12	30-70	Pt	-	MA-SLA	15-20	H	H	M	H	M

Appendix B. (continued)

Map Unit	Kind of Soil(s)		Kind and Properties of Surficial Materials					Soil Properties by Horizons or Layers																				Soil Sensitivity to:				
									Surface Soil (MIN - 0-20cm)(ORG - 0-40cm)							Subsoil							Below Subsoil								
	Taxonomic Class	Soil Texture Family Class	Kind	Texture Family Class	Reaction (pH) or Carbonate Content	Salinity	Contrasting Substrate if within 100 cm	Organic Surface Layer (kind, thickness)	Kind of horizon(s) or layer(s)	Texture	Organic Matter Content	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Total Thickness (cm)	Texture Family Class	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Texture Family Class or Rock Type	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Loss of Bases	Acidification	Aluminum Solubilization	Overall Soil Sensitivity	Potential to Neutralize Acidity
F53	OGL	COL	GF	COL	MC	NS			Ae	SD	L	SLA	5-6	4-5	80-85	Bt	40-80	COL	SLA-N	10-15	9-14	90-95	Ck	COL-SDY	MC		H	H	L	H	H
	DGL	COL	GF	COL	MC	NS			Ah	SL	M	SLA	12-15	11-14	90-95	Bt	30-40	COL	SLA-N	10-15	9-14	85-95	Ck	COL-SDY	MC		L	L	L	L	H
G11	OGL	CLY	MR	CLY-FNL	NC-WC	NS-WS			Ae-AB	LM-CL	L	SA-VSA	15-20	8-15	50-75	Bt	30-60	CLY	VSA	25-35	15-28	60-80	C	CLY-FNL	MA-SLA	20-30	M	L	H	M	H
G12	OGL	CLY	MR,RS	CLY	NC	NC			Ae-AB	CL	L	EA-VSA	15-25	2-5	15-20	Bt	15-25	CLY	EA	25-30	2-4	10-15	C	CLY	EA	15-20	H	L	H	H	L
	OC	-	MR,RS	CLY	NC	NS			Pt	-	-	EA-SA	10-15	1-6	5-50	Pt	10-40	-	EA-SA	10-15	1-7	5-60	Ptz	-	VSA-MA	10-15	L	L	H	L	L
G31	OGL	FNL	FL	FNL	MC	NS			Ae-AB	LM	L	MA-SLA	7-10	5-8	70-80	Bt	10-30	FNL	MA-SLA	15-23	14-20	85-95	Ck	FNL	MC		M	L-M	L-M	M	H
G32	OGL	FNL	MR	FNL	WC	NS			Ae-AB	LM	L	SA-MA	8-12	6-11	70-90	Bt	20-40	FNL	VSA-SA	18-27	15-23	80-85	Ck	FNL	WC		M	L-M	M	M	H
G33	OGL	FNL	MR	FNL	WC	NS			Ae-AB	LM	L	SA-MA	8-12	6-11	70-90	Bt	20-40	FNL	VSA-SA	18-27	15-23	80-85	Ck	FNL	WC		M	L-M	M	M	H
	SZGL	CLY	LT	CLY	WC	WS			Ae-AB	CL	L	SA-MA	12-20	9-15	75-90	Bt	20-30	CLY	VSA-SA	25-35	18-30	70-85	Ck	CLY	WC		M	L	M	M	H
G34	OGL	FNL	MR,CL	FNL	NC	NS			Ae-AB	LM	L	VSA	6-15	1-6	20-50	Bt	20-40	FNL	VSA-SA	15-25	4-15	25-60	C	FNL	VSA-MA	M-H	M	L	H	M	M
G35	OGL	FNL	MR	FNL	NC	NS			Ae-AB	LM	L	VSA	6-15	1-6	20-50	Bt	20-40	FNL	VSA-SA	15-25	4-15	25-60	C	FNL	VSA-SA	15-25	M	L	H	M	M
	OC	-	MR	FNL-CLY	NC	NS			Pt	-	-	EA-SA	10-15	1-6	5-50	Pt	10-40	-	VSA	10-15	1-7	5-60	Ptz	-	MA	10-15	L	L	H	L	L
G36	OGL	FNL	MR	FNL	WC	NS			Ae-AB	LM	L	MA-SLA	7-10	5-8	75-85	Bt	20-40	FNL	MA	18-27	15-25	80-90	Ck	FNL	WC		M	L-M	L-M	M	H
	SZGL	CLY	LT	CLY	WC	WS			Ae-AB	CL	L	MA	12-15	10-13	75-90	Bt	20-30	CLY	SA	25-35	20-30	80-85	Ck	CLY	WC		M	L-M	L-M	M	H

Map Unit	Kind of Soil(s)		Kind and Properties of Surficial Materials					Soil Properties by Horizons or Layers																			Soil Sensitivity to:				
									Surface Soil (MIN - 0-20cm)(ORG - 0-40cm)							Subsoil							Below Subsoil							
	Taxonomic Class	Soil Texture Family Class	Kind	Texture Family Class	Reaction (pH) or Carbonate Content	Salinity	Contrasting Substrate if within 100 cm	Organic Surface Layer (kind, thickness)	Kind of horizon(s) or layer(s)	Texture	Organic Matter Content	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Total Thickness (cm)	Texture Family Class	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Texture Family Class or Rock Type	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Loss of Bases	Acidification	Aluminum Solubilization	Overall Soil Sensitivity	Potential to Neutralize Acidity
G37	OGL-DGL	FNL-CLY	MR,LC	FNL-CLY	WC	NS			Ah,Ae AB	LM	L-M	MA-SLA	M-H	M	H	Bt	30-40	FNL-CLY	MA	H-VH	H	H	Ck	FNL-CLY	WC		M	L-M	L-M	M	H
	ORG	-	MR,LC	FNL-CLY	WC	NS			Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	80	-	SA-SLA	15-20	4-12	30-70	Pt	-	MA-SLA	15-20	H	H	M	H	M
G38	OGL	FNL	MR	FNL	NC-WC	NS			Ae-AB	LM	L	VSA-SA	12-15	5-6	40-50	Bt	30-50	FNL	VSA-SA	18-25	15-20	65-85	C	FNL	SA	15-22	M	L	H	M	H
	DYB	LSK	FL	LSK	NC	NS			Ae-Bf	SL	L	VSA	L-M	L	VL	Bf-Bm	10-20	LSK	VSA	L-M	L	VL	C	LSK	VSA	L	H	L	H	H	L
G51	OGL	COL	FL	COL	WC-MC	NS			Ae	SL	L	SLA-N	5-7	5-6	80-100	Bt	20-30	COL	N-MA	9-12	8-11	85-100	Ck	COL	WC-MC		H	H	L	H	H
G52	OGL	COL	MR	COL	NC	NS			Ae	SD	L	VSA	<6	<2	20-25	Bt	20-30	COL	SA	6-8	<4	25-50	C	COL	SA	<6	H	L	H	H	L
	ORG	-	MR,GL	COL	NC	NS			Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	80	-	SA-SLA	15-20	4-12	30-70	Pt	-	MA-SLA	15-20	H	H	M	H	M
H31	BRGL	FNL	MR	FNL	MC	NS			Ae-Bf	LM	L	VSA-SA	8-12	<3	15-25	Bt	20-40	FNL	SA-MA	15-20	8-12	50-60	Ck	FNL	MC		M	L	H	M	H
H32	BRGL	FNL	MR	FNL	WC	NS			Ae-Bf	LM	L	VSA-SA	15-20	2-4	10-20	Bt	20-50	FNL	VSA	18-27	7-12	30-50	Ck	FNL	WC		M	L	H	M	H
	OGL	FNL	MR	FNL	WC	NS			Ae-AB	LM	L	VSA-SA	12-15	6-9	40-60	Bt	20-60	FNL	VSA-SA	20-25	15-20	60-80	Ck	FNL	WC		M	L	H	M	H
H33	BRGL	FNL	MR	FNL	MC-SC	NS			Ae-Bf	LM	L	N-MLK	12-15	12-15	100	Bt	10-20	FNL	N	20-25	20-25	100	Ck	FNL	MC-SC		L	L	L	L	H
	OGL	FNL	MR	FNL	MC-SC	NS			Ae	LM	L	N	6-8	6-8	100	Bt	10-20	FNL	N	20-25	20-25	100	Ck	FNL	MC-SC		L	L	L	L	H
H34	BRGL	FNL	MR	FNL	MC-WC	NS			Ae-Bf	LM	L	MA	10-15	3-6	30-40	Bt	10-20	FNL	MA	15-25	12-20	75-85	Ck	FNL	MC-WC		M	L-M	L-M	M	H
	ORG	-	MR,GL	FNL	MC-WC	NS			Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	80	-	SA-SLA	15-20	4-12	30-70	Pt	-	MA-SLA	15-20	H	H	M	H	M
H35	BRGL	FNL	GL	FNL	WC	NS			Ae-Bf	LM	L	SA-MA	10-12	6-8	50-70	Bt	40-60	FNL	SA-MA	15-22	14-20	85-95	Ck	FNL	WC		M	L-M	M	M	H
	DYB	SDY	EO	SDY	WC	NS			Ae-Bf	SD	L	MA	<6	<2	20-40	Bm	20-50	SDY	MA	<6	<3	50-60	C	SDY	WC		H	H	M	H	M

Appendix B. (continued)

Map Unit	Kind of Soil(s)		Kind and Properties of Surficial Materials					Soil Properties by Horizons or Layers																			Soil Sensitivity to:				
									Surface Soil (MIN - 0-20cm)(ORG - 0-40cm)							Subsoil							Below Subsoil								
	Taxonomic Class	Soil Texture Family Class	Kind	Texture Family Class	Reaction (pH) or Carbonate Content	Salinity	Contrasting Substrate if within 100 cm	Organic Surface Layer (kind, thickness)	Kind of horizon(s) or layer(s)	Texture	Organic Matter Content	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Total Thickness (cm)	Texture Family Class	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Texture Family Class or Rock Type	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Loss of Bases	Acidification	Aluminum Solubilization	Overall Soil Sensitivity	Potential to Neutralize Acidity
H36	BRGL	FNL	MR,FL	FNL	MC	NS			Ae-Bf	LM	L	MA	10-15	6-10	50-70	Bt	20-50	FNL	SA-MA	18-28	15-25	80-90	Ck	FNL	MC		M	L-M	L-M	M	H
	ORG	-	MR,FL	FNL	MC	NS			Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	80	-	SA-	15-20	-	30-70	Pt	-	SA-MA		H	H	M	H	M
H37	BRGL	FNL	MR	FNL	MC	NS			Ae-Bf	LM	L	MA	10-15	6-10	50-70	Bt	20-50	FNL	SA-MA	18-28	15-25	80-90	Ck	FNL	MC		M	L-M	L-M	M	H
H38	BRGL	FNL	GL	FNL	WC	NS			Ae-Bf	LM	L	MA-SA	10-12	8-10	70-80	Bt	40-60	FNL	SA-MA	15-22	14-20	85-95	Ck	FNL	WC		M	L-M	L-M	M	H
	ORG	-	GL	FNL	WC	NS			Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	80	-	SA-SLA	15-20	4-12	30-70	Pt	-	MA-SLA	15-20	H	H	M	H	M
H41	BRGL	FNL	MR	FNL	NC-WC	NS	*III, II		Ae-Bf	LM	L	SA-MA	M	L	L	Bt	30-40	FNL	SA	H	M	M	C	FNL	NC-WC	H	M	L-M	M	M	M
	EB	FNL-COL	CL, MR	FNL-COL	NC	NS	*III, II		Ae-Bm	LM-SL	L	MA-SLA	M-H	M	H	B,C	0-80	FNL-COL	MA-SLA	M-H	M	H	Drs.	III,II			M	L-M	L-M	M	M
H42	BRGL	FNL	MR	FNL	NC-WC	NS	*III, II		Ae-Bf	LM	L	SA-MA	M	L	L	Bt	30-40	FNL	SA	H	M	M	C	FNL	NC-WC	H	M	L-M	M	M	M
	DYB	COL	CL,MR	COL-FNL	NC	NS	*III, II		Ae-Bf	SL-LM	L	SA	M	L	L	B,C	0-80	COL	SA	M	L	L-M	Drs.	III,II	NC		M	L-M	M	M	M
H43	BRGL	FNL	MR	FNL	MC-WC	NS			Ae-Bf	LM	L	SA-MA	M	M-L	L	Bt	10-20	FNL	SLA	H	H	H	Ck	FNL	MC-WC		M	L-M	M	M	H
	EB	COL	GF,FL	COL	MC-SC	NS			Ae-Bm	LM	L	N	M	M	VH	Bm	10-20	COL	MLK	M	M	VH	Ck	COL	MC-SC		L	L	L	L	H
H44	BRGL	FNL	MR	FNL	NC-WC	NS	*III, II		Ae-Bf	LM	L	MA-SA	12-15	3-6	20-40	Bt	30-40	FNL	SA	18-25	12-15	60-75	C	FNL	MA	H	M	L-M	L-M	M	M
	DYB	FNL	MR,CL	FNL	NC	NS	*III, II		Ae-Bf	LM	L	SA	M	L	L	B,C	0-80	COL	SA	M	L	L	Drs.	III,II			M	L-M	M	M	L
H45	BRGL	FNL	MR	FNL	NC-WC	NC	*II, III		Ae-Bf	LM	L	SA	M	L	L	Bt	30-40	FNL	SA	H	M	M	C	FNL	SA-MA	H	M	L-M	M	M	M
	DYB	COL	MR,CL	COL	NC	NS	*III,		Ae-Bf	LM	L	SA	M	L	L	B,C	0-80	COL	SA	M	L-M	L-M	Drs.	III,II			M	L-M	M	M	M
H46	BRGL	FNL	MR	FNL	NC-WC	NS			Ae-Bf	LM	L	SA	12-15	3-6	20-40	Bt	30-40	FNL	SA	18-25	12-15	60-75	C	FNL	MA	H	M	L-M	M	M	M
	DYB	FNL	CL,RS	FNL	NC	NS	*III II		Ae-Bf	LM	L	VSA-SA	15-25	2-4	10-20	B,C	10-80	FNL	SA	15-25	5-10	25-50	Drs.	III,II			M	L	H	M	M

Map Unit	Kind of Soil(s)		Kind and Properties of Surficial Materials					Soil Properties by Horizons or Layers																				Soil Sensitivity to:				
									Surface Soil (MIN - 0-20cm)(ORG - 0-40cm)						Subsoil							Below Subsoil									
	Taxonomic Class	Soil Texture Family Class	Kind	Texture Family Class	Reaction (pH) or Carbonate Content	Salinity	Contrasting Substrate if within 100 cm	Organic Surface Layer (kind, thickness)	Kind of horizon(s) or layer(s)	Texture	Organic Matter Content	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Total Thickness (cm)	Texture Family Class	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Texture Family Class or Rock Type	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Loss of Bases	Acidification	Aluminum Solubilization	Overall Soil Sensitivity	Potential to Neutralize Acidity
H47	BRGL	FNL	MR	FNL	MC-EC	NS			Ae-Bf	LM-SL	L	MA-SA	M	M-L	M	Bt	15-25	FNL	SLA	H	H	H	Ck	FNL	MC-EC		M	L-M	L-M	M	H
	P	COL	MR,GL	COL	NC	NS	*III		Ae-Bf	LM	L	VSA-SA	M	L	VL	Bf	0-10	COL	VSA	M	L	L-VL	C	COL	SA	M	M	L	H	M	L
H51	BRGL	COL	GL	COL	MC	NS			Ae-Bf	SD	L	SA-MA	<6	<3	50-60	Bt	10-40	COL	MA	10-12	6-9	60-80	Ck	COL-SDY	MC		H	M	H	H	H
	ORG	-	GL	COL	MC	NS			Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	80	-	SA-SLA	15-20	4-12	30-70	Pt	-	MA-SLA	15-20	H	H	M	H	M
H71	BRGL	SDY	GF	SDY	MC	NS			Bm-Ae	SD	L	SLA-MA	4-6	3-5	75-85	Bt	10-30	COL	SLA	6-10	5-9	80-90	IIBCk	FNL	MC		H	H	L	H	H
	EB	COL	GF	COL	MC	NS			Ae-Bm	SL	L	MA-SLA	6-10	4-6	60-70	Bm	20-30	COL	SLA	6-12	4-10	70-85	Ck	COL	MC		M	L-M	L-M	M	H
H91	BRGL	LSK	FL	LSK	NC	NS			Ae-Bf	LM	L	SA	8-10	3-4	30-40	Bt	20-30	LSK	SA	12-15	6-9	50-60	C	LSK	SA	12-15	M	L-M	M	M	L
	BRGL	FNL	MR	FNL	WC	NS			Ae-Bf	LM	L	SA	12-15	4-6	30-40	Bt	20-40	FNL	SA	22-28	15-20	70-85	Ck	FNL	WC		M	L-M	M	M	H
J11	SZGL	CLY	GL	CLY	MC	WS			Ae-AB	CL	L	MA	10-15	8-12	75-90	Bt	15-25	CLY	SA	25-30	20-25	75-90	Ck	CLY	MC		M	L-M	L-M	M	H
	G	CLY	GL	CLY	WC	NS		Pt	Bg	CY	L	N-SLA	30-40	28-40	90-100	Bg	20-30	CLY	SLA-N	30-40	28-40	90-100	Cg	CLY	WC		L	L	L	L	H
J13	SZGL	CLY	LT	CLY	WC	WS			Ae-AB	CL	L	MA	12-15	10-13	75-90	Bt	20-30	CLY	SA	25-35	20-30	80-85	Ck	CLY	WC		M	L-M	L-M	M	H
J14	SZGL	CLY	LT	CLY	WC	WS			Ae-AB	CL	L	MA	12-15	10-13	75-90	Bt	20-30	CLY	SA	25-35	20-30	80-85	Ck	CLY	WC		M	L-M	L-M	M	H
	ORG	-	LT	CLY	WC	WS			Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	80	-	SA-SLA	15-20	4-12	30-70	Pt	-	MA-SLA	15-20	H	H	M	H	M
J15	SZGL	CLY	GL	CLY	MC	WS			Ae-AB	CL	L	MA	10-15	8-12	75-85	Bt	20-40	CLY	SA	25-33	20-28	75-90	Ck	CLY	MC		M	L-M	L-M	M	H
	DGL	CLY	GL	CLY	MC	WS			Ah-Ae	CL	M-H	SLA	27-33	25-30	85-95	Bt	20-30	CLY	MA	28-33	25-30	85-95	Ck	CLY	MC		L	L	L	L	H
J16	SZGL	CLY	GL	CLY	WC	WS			Ae-AB	CL	L	MA-SLA	15-20	12-18	80-90	Bt	30-40	CLY	SA-MA	28-33	25-30	80-90	Ck	CLY	WC		L	L-M	L-M	L	H
	DGSO	CLY	GL	CLY	WC	WS			Ah-Ae	CL	M-H	MA-SLA	25-33	18-27	70-85	Bt	15-25	CLY	SA	30-40	25-35	70-85	Ck	CLY	WC		L	L-M	L-M	L	H

Appendix B. (continued)

Map Unit	Kind of Soil(s)		Kind and Properties of Surficial Materials					Soil Properties by Horizons or Layers																			Soil Sensitivity to:				
									Surface Soil (MIN - 0-20cm)(ORG - 0-40cm)							Subsoil							Below Subsoil							
	Taxonomic Class	Soil Texture Family Class	Kind	Texture Family Class	Reaction (pH) or Carbonate Content	Salinity	Contrasting Substrate if within 100 cm	Organic Surface Layer (kind, thickness)	Kind of horizon(s) or layer(s)	Texture	Organic Matter Content	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Total Thickness (cm)	Texture Family Class	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Texture Family Class or Rock Type	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Loss of Bases	Acidification	Aluminum Solubilization	Overall Soil Sensitivity	Potential to Neutralize Acidity
J17	SZGL	CLr	LT	CLY	WC	WS			Ae-AB	CL	L	MA-SA	15-20	9-15	60-75	Bt	20-40	CLY	VSA-SA	28-35	20-27	70-80	Ck	CLY	WC		L	L-M	L-M	L	H
J18	SZGL	CLY	LT	CLY	WC	WS			Ae-AB	LM	L	MA	10-15	6-10	60-75	Bt	20-40	CLY	SA	30-40	25-35	80-90	Ck	CLY	WC		M	L-M	L-M	M	H
	G	CLY	LT	CLY	WC	WS			Ah-Bg	CL	M-H	SLA-N	30-40	30-38	90-100	Bg	20-40	CLY	SLA-N	30-35	28-35	90-100	Ck	CLY	WC		L	L	L	L	H
J19	SZGL	CLY	LT	CLY	WC	WS			Ae-AB	LM	L	MA	10-15	6-10	60-75	Bt	20-40	CLY	SA	25-30	15-22	60-80	Ck	CLY	WC		M	L-M	L-M	M	H
	G	CLY	GL	CLY	MC	NS			Ah-Ae	CL	M	SLA	30-35	18-25	60-70	Btg	20-30	CLY	SLA-N	27-33	25-33	75-100	Ck	CLY	MC		L	L	L	L	H
K11	GSS	CLY	MR,LT	CLY	MC-WC	WS-MS			Ae-AB	LM-CL	L	MA	12-15	8-12	70-80	Bnt	15-25	CLY	SLA-N	25-30	22-30	80-100	Ck	CLY	MC-WC		M	L-M	L-M	M	H
K12	BLSS	CLY	MR,GL	CLY	MC-WC	MS			Ah-Ae	LM-CL	H	MA	25-35	15-25	60-70	Bnt	20-30	CLY	N-MLK	20-30	20-30	100	Ck	CLY	MC-WC		L	L-M	L-M	L	H
	BL	FNL	MR,GL	FNL	MC	NS			Ah	LM	H	SLA-N	20-35	18-30	80-95	Bm	20-40	FNL	SLA-N	18-25	15-25	85-100	Ck	FNL	MC		L	L	L	L	H
K13	GSS	CLY	GL	CLY	MC-WC	WS			Ae-AB	LM	L	MA-SLA	7-13	6-12	80-90	Bnt	30-50	CLY	N-MLK	20-25	20-25	100	Ck	CLY	MC-WC		M	L-M	L-M	M	H
	ORG	-	GL	CLY	MC-WC	WS			Pt	-	-	VSA	9-12	1-2	10-25	Pt	80	-	VSA-SA	15-20	15-40	2-6	Pt	-	VSA-MA	15-20	L	L	H	L	L
K14	GSS	CLY	LC	CLY	WC	MS			Ah-Ae-AB	LM	L	SA-MA	M	M	M	Bnt	10-30	CLY	SA	H	M	M	Ck	CLY	WC		M	L-M	M	M	H
	OGL	FNL	LC	FNL	WC	NS			Ae	LM	L	SLA	M	M	M	Bt	30-40	FNL	MA	VH	H	H	Ck	FNL	WC		L	L	L	L	H
K21	BSS	FNL	MR	FNL	MC-WC	MS			Ah-Ae	LM	L	MA-SLA	12-15	6-10	50-70	Bnt	0-20	FNL	MLK	20-30	20-30	100	Ck	FNL	MC-WC		M	L-M	L-M	M	H
K22	BSS	FNL	MR	FNL	MC-WC	MS			Ah-Ae	LM	L	SLA	12-15	6-10	50-70	Bnt	0-20	FNL	MLK	20-30	20-30	100	CK	FNL	MC-WC		L	L	L	L	H
	B	FNL	MR,FN	FNL	MC	NS			Ah-Bm	LM	L	SLA-MLK	15-25	15-25	100	Bm	0-30	FNL	N-MLK	15-25	15-25	100	Ck	FNL	MC		L	L	L	L	H
K31	DBSS	FNL	MR	FNL	MC-WC	MS			Ah-Ae	LM	M	MA	15-20	10-15	50-80	Bnt	15-25	FNL	N-MLK	18-27	18-27	100	Ck	FNL	MC-WC		L	L-M	L-M	L	H
K32	DBSS	FNL	MR	FNL	MC	MS			Ah-Ae	LM	M	MA-SLA	15-20	12-15	70-80	Bnt	10-30	FNL	N-MLK	15-25	15-25	100	Ck	FNL	MC		L	L-M	L-M	L	H
	DB	FNL	MR	FNL	WC	NS			Ah-Bm	LM	M-H	SLA-N	20-30	16-30	80-100	Bm	10-30	FNL	N-MLK	18-28	18-28	100	Ck	FNL	WC		L	L	L	L	H

Map Unit	Kind of Soil(s)		Kind and Properties of Surficial Materials					Soil Properties by Horizons or Layers																			Soil Sensitivity to:				
									Surface Soil (MIN - 0-20cm)(ORG - 0-40cm)						Subsoil							Below Subsoil								
	Taxonomic Class	Soil Texture Family Class	Kind	Texture Family Class	Reaction (pH) or Carbonate Content	Salinity	Contrasting Substrate if within 100 cm	Organic Surface Layer (kind, thickness)	Kind of horizon(s) or layer(s)	Texture	Organic Matter Content	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Total Thickness (cm)	Texture Family Class	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Texture Family Class or Rock Type	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Loss of Bases	Acidification	Aluminum Solubilization	Overall Soil Sensitivity	Potential to Neutralize Acidity
K41	BLSS	FNL	MR	FNL	MC-WC	WS			Ah-Ae	LM	H	MA-SLA	20-30	15-20	60-75	Bnt	10-30	FNL	N-MLK	20-30	20-30	100	Ck	FNL	MC-WC		L	L-M	L-M	L	H
	GSS	FNL	MR	FNL	MC-WC	MS			Ah,Ae AB	LM	L	SA-MA	12-15	7-10	50-70	Bnt	10-30	FNL	SA	20-30	15-20	60-75	Ck	FNL	MC-WC		M	L-M	M	M	H
K46	BLSS	FNL-CLY	MR,LC	FNL-CLY	MC-WC	MS			Ah-Ae	LM-CL	H	MA-SLA	25-35	15-25	60-75	Bnt	10-30	FNL-CLY	N-MLK	25-35	25-35	100	Ck	FNL-CLY	MC-WC		L	L-M	L-M	L	H
	BL	FNL	MR	FNL	MC	NS			Ah	LM	H	SLA-N	25-35	22-35	90-100	Bm	20-40	FNL	SLA-N	18-30	16-30	90-100	Ck	FNL	MC		L	L	L	L	H
K47	BLSS	FNL	MR	FNL	MC	MS			Ah-Ae	LM	M-H	MA	18-25	13-20	60-80	Bnt	20-30	FNL	N-MLK	20-25	20-25	100	Ck	FNL	MC		L	L-M	L-M	L	H
	SZBL	FNL	MR	FNL	MC	WS			Ah-Ae	LM	H	SLA	18-27	15-25	80-90	Bt	20-30	FNL	SLA-N	18-25	18-23	90-100	Ck	FNL	MC		L	L	L	L	H
K51	BSS	COL	GF,RS	COL	WC	WS	*V		Ah	SL	L	MA-SLA	M	M	H	Bnt-BC	20-80	COL	N	M	M	VH	Drs	V			M	L-M	L-M	M	H
	B	FNL	MR,RS	FNL	MC	WS	*V		Ah-Bm	LM	L	N-MLK	15-25	15-25	100	Bm-BC	30-80	FNL	MLK	15-25	15-25	100	Drs	V			L	L	L	L	H
K62	DBSS	COL	GF,MR	COL	MC	MS			Ah-Ae	SL	M	SA	10-15	6-10	50-70	Bnt	20-30	COL-FNL	N-MLK	15-20	15-20	100	Ck	FNL	MC		M	L-M	M	M	H
	DB	COL	GF	COL	MC-WC	NS			Ah	SL	M	MA	12-15	8-12	60-80	Bm	20-40	COL	MA	8-12	7-10	80-90	Ck	SDY-COL	MC-WC		M	L-M	L-M	M	H
K71	BSS	SDY	GF	SDY	WC	WS			Ah	SD	L	N	3-6	3-6	100	Bnt	50-70	SDY	MLK-MRK	3-6	3+	100+	Ck	SDY	WC		L	L	L	L	H
L11	BLSO	CLY	LT,GL	CLY	WC	WS			Ah-Ae	CL	H	SLA-MA	25-35	20-30	80-90	Bt	20-40	CLY	MA-SLA	25-40	20-35	80-95	Ck	CLY	WC		L	L	L	L	H
L12	BLSO	CLY	LT,GL	CLY	WC	WS			Ah-Ae	CL	H	SLA-MA	25-35	20-30	80-90	Bt	20-40	CLY	MA	25-40	20-35	80-90	Ck	CLY	WC		L	L	L	L	H
	DGSS	CLY	MR,GL	CLY	WC	WS			Ah-Ae	LM	H	MA	20-30	12-15	50-65	Bnt	15-30	CLY	SLA-N	25-35	25-32	90-100	Ck	CLY	WC		L	L-M	L-M	L	H
L13	DGSO	CLY	GL	CLY	WC	WS			Ah-Ae	LM	M-H	MA-SLA	25-33	18-27	70-85	Bt	15-25	CLY	SA	30-40	25-35	70-85	Ck	CLY	WC		L	L-M	L-M	L	H
L14	SODG	CLY	LT	CLY	WC	WS			Ah-Ae	CL	H	SLA-MA	25-35	20-30	80-90	Bt	20-40	CLY	MA	25-35	20-30	80-90	Ck	CLY	WC		L	L	L	L	H
	SZGL	CLY	LT	CLY	WC	WS			Ae-AB	CL	L	MA	10-15	8-14	75-90	Bt	20-30	CLY	SA	25-35	20-30	80-85	Ck	CLY	WC		M	L-M	L-M	M	H

Appendix B. (continued)

Map Unit	Kind of Soil(s)		Kind and Properties of Surficial Materials					Soil Properties by Horizons or Layers																				Soil Sensitivity to:				
									Surface Soil (MIN - 0-20cm)(ORG - 0-40cm)						Subsoil							Below Subsoil										
	Taxonomic Class	Soil Texture Family Class	Kind	Texture Family Class	Reaction (pH) or Carbonate Content	Salinity	Contrasting Substrate if within 100 cm	Organic Surface Layer (kind, thickness)	Kind of horizon(s) or layer(s)	Texture	Organic Matter Content	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Total Thickness (cm)	Texture Family Class	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Texture Family Class or Rock Type	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Loss of Bases	Acidification	Aluminum Solubilization	Overall Soil Sensitivity	Potential to Neutralize Acidity
L15	DGSO	CLY	LT	CLY	WC	WS			Ah-Ae	CL	M	MA	20-30	15-23	65-80	Bt	20-30	CLY	VSA-SA	30-35	21-30	70-85	Ck	CLY	WC		L	L-M	L-M	L	H
M42	DYB	FNL	CL-RS	FNL	NC	NS	*III		Ae-Bf	LM	L	VSA-SA	15-25	2-4	10-20	B,C	10-80	FNL	SA	15-25	5-10	25-50	Drs	III			M	L	H	M	M
	BRGL	FNL	MR	FNL	NC-WC	NS	*II		Ae-Bf	LM	L	SA	12-15	3-6	20-40	Bt	30-40	FNL	SA	18-25	12-15	60-75	C	FNL	MA	15-20	M	L-M	M	M	M
M71	DYB	SDY	GF	SDY	NC	NS			Ae-Bf	SD	L	EA-VSA	<6	<2	<30	B,C	20-50	SDY	VSA	<4	<2	<50	C	SDY	VSA	<4	H	L	H	H	L
M72	DYB	SDY	GF	SDY	NC	NS			Ae	SD	L	SA	<6	<2	<35	Bm-BC	20-30	SDY	MA	<4	<2	<50	C	SDY	MA	<4	H	M	H	H	L
M75	DYB	SDY	GF	SDY	NC	NS			Ae-Bf	SD	L	MA	L	L	M	Bm	30-50	SDY	MA	L	L	M	C	SDY	MA-SLA	L	H	H	M	H	L
	ORG	-	GF	SDY	NC	NS			Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	80	-	SA-SLA	15-20	4-12	30-70	Pt	-	MA-SLA	15-20	H	H	M	H	M
M76	DYB	SDY	GF,CL MR	SDY	NC	NC			Ae-Bf	SD-SL	L	MA	L	L	M	BC	30-80	SDY	MA	L	L	M	IIC	FNL	MA	H	H	H	M	H	M
	OGL	FNL	MR	FNL	NC	NS			Ae-AB	SL	L	VSA	7-10	<6	60-70	Bt	20-40	FNL	VSA-SA	20-25	15-20	70-80	C	FNL	MA	H	M	L	H	M	H
M77	DYB	SDY	GF	SDY	NC-WC	NS			Ae-AB	SD	L	MA	<4	<2	50-60	Bm	20-40	SDY	MA	<4	<2	50-60	C	SDY	MA-SLA	<4	H	H	M	H	L
	OGL	FNL	MR,GF	FNL	MC-WC	NS			Ae-AB	LM	L	MA	7-10	6-9	80-90	Bt	30-40	FNL	SA-MA	15-20	14-18	85-90	Ck	FNL	MC-WC		M	L-M	L-M	M	H
M78	DYB	SDY	GF	SDY	NC	NS			Ae-Bm	SL	L	SA	4-6	<2	<25	Bm	20-30	SDY	MA	<6	<2	30-40	C	SDY	MA	<6	H	M	H	H	L
	OC	-	GF	SDY	NC	NS			Pt	-	-	EA-SA	10-15	1-6	5-50	Pt	10-40	-	EA-SA	10-15	1-7	5-60	Ptz	-	VSA-MA	10-15	L	L	H	L	L
M81	DYB	SSK	GF	SSK	NC	NS			Bm	SD	L	SA	<4	<2	<40	Bm	20-40	SSK	SA	<4	<2	<40	C	SSK	SA-SLA	<2	H	M	H	H	L
M91	DYB	SSK	MR,CL	SSK	NC-WC	NS	*III,	LFH 5-15	Ah-Ae, Bhf	LM	M	VSA-MA	6-15	<6	<40	B,BC	10-50	SSK	SA-MA	<6	<3	<40	C	SSK	NC-WC	<6	M	L	H	M	L
	R3		PRACTICALLY BARREN CLASTIC SEDIMENTARY ROCKLAND AND ROCK MATERIALS, NONCALCAREOUS BUT IN PLACES WEAKLY CALCAREOUS, VERY SHALLOW SOILS.																					III,II			H	L	H	H	M

Map Unit	Kind of Soil(s)		Kind and Properties of Surficial Materials					Soil Properties by Horizons or Layers																			Soil Sensitivity to:				
									Surface Soil (MIN - 0-20cm)(ORG - 0-40cm)						Subsoil							Below Subsoil									
	Taxonomic Class	Soil Texture Family Class	Kind	Texture Family Class	Reaction (pH) or Carbonate Content	Salinity	Contrasting Substrate if within 100 cm	Organic Surface Layer (kind, thickness)	Kind of horizon(s) or layer(s)	Texture	Organic Matter Content	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Total Thickness (cm)	Texture Family Class	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Texture Family Class or Rock Type	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Loss of Bases	Acidification	Aluminum Solubilization	Overall Soil Sensitivity	Potential to Neutralize Acidity
M92	DYB	SSK	MR,CL	SSK	NC	NS	*III, II	LFM 5-15	Ah-Ae--Bhf	LM	M	VSA-MA	6-15	<6	<40	B,BC	10-50	SSK	SA-MA	<6	<3	<40	C	SSK	NC-WC	6	M	L	H	M	L
M93	DYB	LSK	CL,MR	LSK	NC	NS	*III, II	LFH 5-15	Ae	LM	M	VSA-SA	M	L	M-L	B	10-20	LSK	SA	M	M	M	C	LSK	MA-SLA	M	M	L	H	M	M
	EB	LSK	CL,MR		NC-WC	NS NS	*II	LFH 5-15	Ae-Bm	LM	M	SLA	M	M	M	B	10-20	LSK	SLA-N	M	M	M-H	C	LSK	SLA-MLK	M	L	L	L	L	M
N41	EB	FNL	CL MR	FNL	NC	NS	*II		Ae-Bm	LM	L	SLA	18-25	15-23	85-90	Bm,BC	10-80	FNL	SLA-N	18-27	15-25	85-95	Drs	II			L	L	L	L	H
	OGL	FNL	MR	FNL	NC-WC	NC	*II, III		Ae	LM	L	SA	9-12	<6	25-50	Bt	20-40	FNL	SA	15-25	10-15	60-70	C	FNL	SA-MA	15-25	M	L-M	M	M	M
N42	EB	FNL	CL,MR	FNL	NC-WC	NS	*II, III		Ae-Bm	LM	L	MA-SLA	M-H	M	H	Bm,BC	10-70	FNL	MA-SLA	M-H	M	H	Drs	II,III			M	L-M	L-M	M	M
	BRGL	FNL	MR	FNL	NC-WC	NS	*II		Ae-Bf	LM	L	SA-MA	M	L	L	Bt	30-40	FNL	SA	H	M	M	C	FNL	MA	H	M	L-M	M	M	M
N51	EB	COL	GF	COL	MC	NS			Ae-Bm	SL	L	SLA-N	6-12	6-10	90-100	Bm	30-40	COL	SLA-N	6-10	5-10	90-100	Ck	COL	MC		L	L	L	L	H
	OGL	COL	GF	COL	MC	NS			Ae	SD-SL	L	SLA-MA	5-7	4-5	75-90	Bt	10-30	COL	MA-SLA	8-12	6-10	75-90	Ck	COL	MC		H	H	L	H	H
N52	EB	COL	EO	COL	SC	NS			Ahk	SL	L-M	MRK	-	-	-	Bmk	10-20	SDY	MRK	-	-	-	Ck	SDY	SC		L	L	L	L	H
N62	EB	LSK	MR,CL	LSK	WC-EC	NS	*I,II	LFH 5-15	Ae-Bm	LM	M	MA-N	20-25	15-25	75-100	Bm	10-20	LSK	SLA-MLK	15-20	15-20	90-100	BCk-Ck	LSK	WC-EC		L	L-M	L-M	L	H
N63	EB	COL-FNL	MR,GF	COL-FNL	MC-EC	NS			Ae-Bm	LM	L-M	SLA-MLK	12-15	12-15	100	Bm	0-40	COL-FNL	N-MLK	10-15	10-15	100	BCk-Ck	COL-FNL	MC-EC		L	L	L	L	H
N65	EB	LSK	MR,GF	LSK	MC-EC	NS			Ae-Bm	LM	L-M	SLA-N	15-25	12-25	80-100	Btj	0-10	LSK	N	15-20	15-20	100	BCk-Ck	LSK	MC-EC		L	L	L	L	H
N66	EB	LSK	MR,GF	LSK	MC-EC	NS			Ae-Bm	LM	L-M	SLA-N	15-25	12-25	80-100	Btj	0-10	LSK	N	15-20	15-20	100	BCk-Ck	LSK	MC-EC		L	L	L	L	H
	DYB	SSK	MR	SSK	NC	NS			Ae-Bf	LM	M	VSA-MA	M	L	L	B,BC	10-50	SSK	SA-MA	L	L	L	C	SSK	NC	L	M	L	H	M	L

Appendix B. (continued)

Map Unit	Kind of Soil(s)		Kind and Properties of Surficial Materials					Soil Properties by Horizons or Layers																		Soil Sensitivity to:				
									Surface Soil (MIN - 0-20cm)(ORG - 0-40cm)							Subsoil							Below Subsoil							
	Taxonomic Class	Soil Texture Family Class	Kind	Texture Family Class	Reaction (pH) or Carbonate Content	Salinity	Contrasting Substrate if within 100 cm	Organic Surface Layer (kind, thickness)	Kind of horizon(s) or layer(s)	Texture	Organic Matter Content	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Total Thickness (cm)	Texture Family Class	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Texture Family Class or Rock Type	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Loss of Bases	Acidification	Aluminum Solubilization	Overall Soil Sensitivity	Potential to Neutralize Acidity
N71	EB	SDY	GF,EO	SDY	WC-MC	NS			Ae,Bm	SD	L	SLA	<5	<4	60-80	Bm C	80	SDY	SLA-N	<3	<3	80-100	Ck	SDY	WC-MC		H	H	L	H	M
	ORG	-	GF,EO	SDY	WC-MC	NS			Pt	-	-	SLA	9-12	8-10	70-100	Pt	40-80		SLA	15-20	10-18	65-100	IIC	SDY	WC-MC		L	L	L	L	H
N72	EB	SDY	EO	SDY	MC	NS			Bm	SD	L	N-MLK	<6	<6	100	BCk	80	SDY	MRK	-	-	-	Ck	SDY	MC		L	L	L	L	H
N73	EB	SDY	GF,EO	SDY	WC	NS			Ae,Bm	SD	L	SLA	<5	<4	60-80	Bm C	80	SDY	SLA-N	<4	<4	75-95	C	SDY	WC		H	H	L	H	M
N75	EB	SDY	GF	SDY	WC	NS			Ae,Bm	SD	L	SLA-MA	<5	<4	60-80	Bm BC	80	SDY	SLA-MA	<4	<3	60-80	C	SDY	WC		H	H	L	H	M
	DG	FNL	GL,MR	FNL	MC	NS			Ah	LM	H	SLA-N	25-35	22-32	85-95	Bm	20-40	FNL	SLA-N	15-25	13-23	85-95	Ck	FNL	MC		L	L	L	L	H
N91	EB	LSK	MR,CL	LSK	MC-EC	NS	*I	LFH 5-15	Ae Bm	LM	M	MA-N	15-25	13-25	85-100	Bm	0-20	LSK	SLA-MLK	12-20	12-20	100	BC - Ck	LSK	MC-EC		L	L-M	L-M	L	H
	R1	PRACTICALLY BARREN LARGELY CARBONATE ROCKLAND AND ROCK MATERIALS, VERY SHALLOW SOILS.																						I			L	L	L	L	H
N92	EB	LSK	MR,CL	LSK	MC-EC	NS	*I	LFH 5-15	Ae,Bm	LM	M	MA-N	15-25	13-25	85-100	Bm	0-20	LSK	SLA-MLK	12-20	12-20	100	BCk-Ck	LSK	MC-EC		L	L-M	L-M	L	H
001	ORG	-	GL	CLY	WC-MC	WS			Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	80	-	SA-SLA	15-20	4-12	30-70	Pt	-	MA-SLA	15-20	H	H	M	H	M
011	ORG	-	GL,MR	CLY	NC-WC	NS			Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	80	-	SA-SLA	15-20	4-12	30-70	Pt	-	MA-SLA	15-20	H	H	M	H	M
	OGL	CLY	MR,GL	CLY	NC-WC	NS			Ae,AB	LM-CL	L	SA	H	M	M	Bt	30-60	CLY	VSA-SA	VH	H	M	C	CLY	SA-SLA	H-VH	M	L	M	M	H
012	ORG	-	GL,MR	CLY	NC-WC	NS			Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	80	-	SA-SLA	15-20	4-12	30-70	Pt	-	MA-SLA	15-20	H	H	M	H	M
	OGL	CLY	GL,MR	CLY	NC-WC	NS			Ae,AB	LM-CL	L	SA-MA	H	M	H	Bt	20-40	CLY	SA	VH	H	M-H	C	CLY	SLA	H-VH	M	L	M	M	H
013	ORG	-	GL,MR	FNL-CLY	NC-WC	NS			Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	80	-	SA-SLA	15-20	4-12	30-70	Pt	-	MA-SLA	15-20	H	H	M	H	M
	OGL	CLY	GL,MR	FNL-CLY	NC-WC	NS			Ae,AB	CL	L	VSA	15-20	6-10	40-50	Bt	20-30	CLY	VSA	30-35	15-20	50-60	C	FNL-CLY	SLA	15-25	M	L	H	M	H
014	ORG	-	GL	CLY	WC	WS			Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	80	-	SA-SLA	15-20	4-12	30-70	Pt	-	MA-SLA	15-20	H	H	M	H	M
	G	CLY	GL	CLY	WC	WS			Ah-Aeg	LM	H	VSA-SA	H	M	M	Btg	15-30	CLY	SA	VH	H	M	Cg	CLY	WC		M	L	H	M	H

Map Unit	Kind of Soil(s)		Kind and Properties of Surficial Materials					Soil Properties by Horizons or Layers																			Soil Sensitivity to:				
									Surface Soil (MIN - 0-20cm)(ORG - 0-40cm)							Subsoil							Below Subsoil							
	Taxonomic Class	Soil Texture Family Class	Kind	Texture Family Class	Reaction (pH) or Carbonate Content	Salinity	Contrasting Substrate if within 100 cm	Organic Surface Layer (kind, thickness)	Kind of horizon(s) or layer(s)	Texture	Organic Matter Content	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Total Thickness (cm)	Texture Family Class	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Texture Family Class or Rock Type	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Loss of Bases	Acidification	Aluminum Solubilization	Overall Soil Sensitivity	Potential to Neutralize Acidity
021	ORG	-	MR	FNL-CLY	WC-MC	NS			Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	80	-	SA-SLA	15-20	4-12	30-70	Pt	-	MA-SLA	15-20	H	H	M	H	M
	OGL	FNL-CLY	MR	FNL-CLY	WC-MC	NS			Ae-AB	LM	L	MA	M-H	M	H	Bt	20-30	CLY	MA	VH	H	H	Ck	CLY	WC-MC		M	L-M	L-M	L	H
023	ORG	-	GL,MR,FL	CLY-FNL	MC	NS			Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	80	-	SA-SLA	15-20	4-12	30-70	Pt	-	MA-SLA	15-20	H	H	M	H	M
	OGL	CLY-FNL	GL,MR,FL	CLY FNL	MC	NS			Ae-AB	LM-CL	L	SLA-MA	H	M	H	Bt	20-30	CLY-FNL	MA-SLA	H-VH	H	H	Ck	CLY-FNL	MC		L	L	L	L	H
024	ORG	-	FL	FNL	MC	NS			Pt	-	-	SLA	9-12	8-10	70-100	Pt	40-80	-	SLA	15-20	10-18	65-100	IICg	FNL	MC		L	L	L	L	H
	OGL	FNL	FL	FNL	MC	NC			Ae-AB	LM	L	MA-SLA	7-10	5-8	70-80	Bt	20-40	FNL	MA-SLA	15-23	14-20	85-95	Ck	FNL	MC		M	L-M	L-M	M	H
031	ORG	-	MR,GL	FNL-CLY	WC	NS			Pt	-	-	VSA-MA	9-12	2-8	25-65	PT	80	-	SA-SLA	15-20	4-12	30-70	Pt	-	MA-SLA	15-20	H	H	M	H	M
	OGL	FNL-CLY	MR,GL	FNL-CLY	WC	NS			Ae-AB	LM	L	SA	6-12	2-6	<50	Bt	20-40	FNL-CLY	SA-MA	15-25	10-20	60-80	Ck	FNL	WC		M	L-M	M	M	H
033	ORG	-	MR	FNL	NC	NS			Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	80	-	SA-SLA	15-20	4-12	30-70	Pt	-	MA-SLA	15-20	H	H	M	H	M
	OGL	FNL	MR	FNL	NC	NS			Ae-AB	LM	L	VSA	3-7	1-3	30-50	Bt	25-40	FNL	VSA-SA	10-15	3-7	30-50	C	FNL	VSA-SA	10-15	H	L	H	H	L
034	ORG	-	GF,MR	SDY-FNL	WC	NS			Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	80	-	SA-SLA	15-20	4-12	30-70	Pt	-	MA-SLA	15-20	H	H	M	H	M
	OGL	FNL	MR GL	FNL	WC	NS			Ae-AB	LM	L	SA	M	L	L	Bt	20-40	FNL	SA-MA	H	M-H	M-H	Ck	FNL	WC		M	L-M	M	M	H
035	ORG	-	MR	FNL	WC-MC	NS			Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	80	-	SA-SLA	15-20	4-12	30-70	Pt	-	SA-MA	15-20	H	H	M	H	M
	OGL	FNL	MR	FNL	WC-MC	NS			Ae-AB	LM	L	SA-MA	M	M	M-H	Bt	20-50	FNL	SA	H	H	M-H	Ck	FNL	WC-MC		M	L-M	M	M	H
042	ORG	-	MR,GF	COL-FNL	NC	NS			Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	80	-	SA-SLA	15-20	4-12	30-70	Pt	-	MA-SLA	15-20	H	H	M	H	M
	OGL	FNL	MR,GF	COL-FNL	NC	NS			Ae-AB	SL-LM	L	VSA	<6	<2	<25	Bt	10-20	FNL	VSA	15-20	6-8	30-40	IIC	FNL	SA	15-25	H	L	H	H	M

Appendix B. (continued)

Map Unit	Kind of Soil(s)		Kind and Properties of Surficial Materials					Soil Properties by Horizons or Layers																		Soil Sensitivity to:				
									Surface Soil (MIN - 0-20cm)(ORG - 0-40cm)							Subsoil							Below Subsoil							
	Taxonomic Class	Soil Texture Family Class	Kind	Texture Family Class	Reaction (pH) or Carbonate Content	Salinity	Contrasting Substrate if within 100 cm	Organic Surface Layer (kind, thickness)	Kind of horizon(s) or layer(s)	Texture	Organic Matter Content	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Total Thickness (cm)	Texture Family Class	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Texture Family Class or Rock Type	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Loss of Bases	Acidification	Aluminum Solubilization	Overall Soil Sensitivity	Potential to Neutralize Acidity
051	ORG	-	MR,GF	COL	NC	NS			Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	80	-	SA-SLA	15-20	4-12	30-70	Pt	-	MA-SLA	15-20	H	H	M	H	M
	OGL	COL	MR	COL	NC	NS			Ae	SD	L	VSA	<6	<2	<25	Bt	20-30	COL	VSA	6-8	<4	25-50	C	COL	VSA-SA	6-8	H	L	H	H	L
052	ORG	-	GF	SDY-COL	NC-WC	NS			Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	80	-	SA-SLA	15-20	4-12	30-70	Pt	-	MA-SLA	15-20	H	H	M	H	M
	DYB	SDY	GF	SDY-COL	NC-WC	NS			Ae-Bf	SD	L	MA	L	L	M	Bm-BC	30-80	SDY	MA	L	L	M	IICk	COL	WC		H	H	M	H	M
061	ORG	-	GF,MR	SDY	NC	NS			Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	80	-	SA-SLA	15-20	4-12	30-70	Pt	-	MA-SLA	15-20	H	H	M	H	M
	DYB	SDY	GF,MR	SDY	NC	NS			Ae-Bf	SD	L	SA	<4	<2	<60	Bm	20-50	SDY	MA	<6	<5	60-80	C	SDY	MA	<6	H	M	H	H	L
062	ORG	-	GF,EO	SDY	WC-MC	NS			Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	80	-	SA-SLA	15-20	4-12	30-70	Pt	-	MA-SLA	15-20	H	H	M	H	M
	EB	SDY	GF,EO	SDY	WC-MC	NS			Ae-Bm	SD	L	MA-SLA	<6	<5	40-80	Bm	30-50	SDY	SA-SLA	<6	<5	<80	Ck	SDY	WC-MC		H	H	M	H	M
071	ORG		EO,FL,LC	SDY	MC	NS			Pt	-	-	SLA-N	9-12	8-10	70-100	Pt	80	-	SLA-N	15-20	10-18	65-100	Pt	-	N-MLK	15-20	L	L	L	L	H
	EB	SDY	EO,FL,LC	SDY	MC	NS			Bf-Bm	SDY	L	N-SLA	<7	<6	85-100	Bm-BC	30-80	SDY	N	7	6-7	90-100	Ck	SDY	MC		L	L	L	L	H
072	ORG	-	GF,EO	SDY	NC	NS			Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	80	-	SA-SLA	15-20	4-12	30-70	Pt	-	MA-SLA	15-20	H	H	M	H	M
	DYB	SDY	GF,EO	SDY	NC	NS			Ae-Bf	SDY	L	EA-VSA	<6	<2	<35	Bm	20-50	SDY	VSA	<4	<2	<50	C	SDY	VSA	<4	H	L	H	H	L
073	ORG	-	GF,MR	SDY	NC	NS			Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	80	-	SA-SLA	15-20	4-12	30-70	Pt	-	MA-SLA	15-20	H	H	M	H	M
	DYB	SDY	GF,MR	SDY	NC	NS			Ae-Bf	SD	L	SA	L	L	L	Bm	30-50	SDY	SA	L	L	L	C	SDY	SA	L	H	M	H	H	L
074	ORG	-	MR,GL	FNL	NC-WC	NS			Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	80	-	SA-SLA	15-20	4-12	30-70	Pt	-	MA-SLA	15-20	H	H	M	H	M
	G	FNL	MR,GL	FNL	NC-WC	NS		Pt	Bg	LM	L-M	MA-N	H	H	H-VH	Bg	10-20	FNL	N	H	H	VH	Cg	FNL	NC-WC		L	L	L	L	H

Map Unit	Kind of Soil(s)		Kind and Properties of Surficial Materials					Soil Properties by Horizons or Layers																					Soil Sensitivity to:				
									Surface Soil (MIN - 0-20cm)(ORG - 0-40cm)							Subsoil							Below Subsoil								
	Taxonomic Class	Soil Texture Family Class	Kind	Texture Family Class	Reaction (pH) or Carbonate Content	Salinity	Contrasting Substrate if within 100 cm	Organic Surface Layer (kind, thickness)	Kind of horizon(s) or layer(s)	Texture	Organic Matter Content	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Total Thickness (cm)	Texture Family Class	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Texture Family Class or Rock Type	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Loss of Bases	Acidification	Aluminum Solubilization	Overall Soil Sensitivity	Potential to Neutralize Acidity
075	ORG	-	EO	SDY	NC	NS			Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	80	-	SA-SLA	15-20	4-12	30-70	Pt	-	MA-SLA	15-20	H	H	M	H	M
	DYB	SDY	EO	SDY	NC	NS			Ae-Bm	SD	L	MA	<6	<2	30-40	Bm	20-60	SDY	MA	<6	<3	50-60	C	SDY	MA-SLA	<6	H	H	M	H	L
076	ORG	-	GF	SDY	NC	NS			Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	80	-	SA-SLA	15-20	4-12	30-70	Pt	-	MA-SLA	15-20	H	H	M	H	M
	DYB	SDY	GF	SDY	NC	NS			Ah-Bm	SD	L	MA	<4	<2	40-60	Bm	20-40	SDY	MA	<4	<3	50-60	C	SDY	MA-SLA	<6	H	H	M	H	L
077	ORG	-	GF,MR	SDY-FNL	NC	NS			Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	80	-	SA-SLA	15-20	4-12	30-70	Pt	-	MA-SLA	15-20	H	H	M	H	M
	DYB	SDY	GF,MR	SDY-FNL	NC	NS			Ae-Bf	SD	L	MA	L	L	M	Bm	10-20	SDY	MA	L	L	M	IIC	FNL	MA-SLA	H	H	H	M	H	M
078	ORG	-	GF,MR,GL	SDY-FNL	NC-WC	NS			Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	80	-	SA-SLA	15-20	4-12	30-70	Pt	-	MA-SLA	15-20	H	H	M	H	M
	DYB	SDY	GF,MR GL	SDY-FNL	NC-WC	NS			Ae-Bf	SD	L	MA	L	L	M	Bm-BC	30-80	SDY	MA	L	L	M	IIC	FNL	SA-SLA	H	H	H	M	H	M
OC1	OC	-	MR,RS	FNL--CLY-SDY	WC-NC	NS			Pt	-	-	EA-SA	10-15	1-6	5-50	Pt	10-40	-	EA-SA	10-15	1-7	5-60	Ptz	-	VSA-MA	10-15	L	L	H	L	L
OC2	OC	-	MR	FNL	NC	NS			Pt	-	-	EA-SA	10-15	1-6	5-50	Pt	10-40	-	VSA-SA	10-15	1-7	5-60	Ptz	-	VSA-MA	10-15	L	L	H	L	L
	OGL	FNL	MR	FNL	NC	NS			Ae-AB	LM	L	VSA	6-15	1-6	20-50	Bt	20-40	FNL	VSA-SA	15-25	4-15	25-60	C	FNL	VSA-MA	15-25	M	L	H	M	M
OC3	OC	-	MR,GL	FNL	MC	NS			Pt	-	-	EA-SA	10-15	1-6	5-50	Pt	10-40	-	VSA-SA	10-15	1-7	5-60	Ptz	-	VSA-MA	10-15	L	L	H	L	L
	OGL	FNL	MR,GL	FNL	MC	NS			Ae-AB	LM	L	MA-SLA	M	M	H	Bt	20-50	FNL	MA	H	M-H	H	Ck	FNL	MC		M	L-M	L-M	M	H
OC4	OC	-	GL	CLY	WC	NS			Pt	-	-	EA-SA	10-15	1-6	5-50	Pt	10-40	-	VSA-SA	10-15	1-7	5-60	Ptz	-	VSA-MA	10-15	L	L	H	L	L
	G	CLY	GL	CLY	WC	NS		Pt	Bg	CY	H	SLA-N	VH	VH	VH	Bg	20-40	CLY	SLA-N	VH	VH	VH	Cg	CLY	WC		L	L	L	L	H
OC5	OC	-	GL	CLY	WC	WS			Pt	-	-	EA-SA	10-15	1-6	5-50	Pt	10-40	-	VSA-SA	10-15	1-7	5-60	Ptz	-	VSA-MA	10-15	L	L	H	L	L
	SZGL	CLY	GL	CLY	WC	WS			Ae-AB	CL-L	L	SA-MA	M-H	M	H	Bt	10-30	CLY	SA	VH	H-VH	H	Ck	CLY	WC		M	L-M	M	M	H
P91	P	LSK	MR	LSK	NC	NS			Ae	SL	L	VSA	<6	<1	<20	Bf	20-35	LSK	VSA	6-10	<1	<10	C	SSk	SA	<6	H	L	H	H	L
	DYB	COL	CL,RS	COL	NC	NS	*III		Ae	LM	L	VSA	8-12	<4	<30	Bm-C	10-40	COL	SA	8-12	<6	<50	Drs	III			M	L	H	M	M

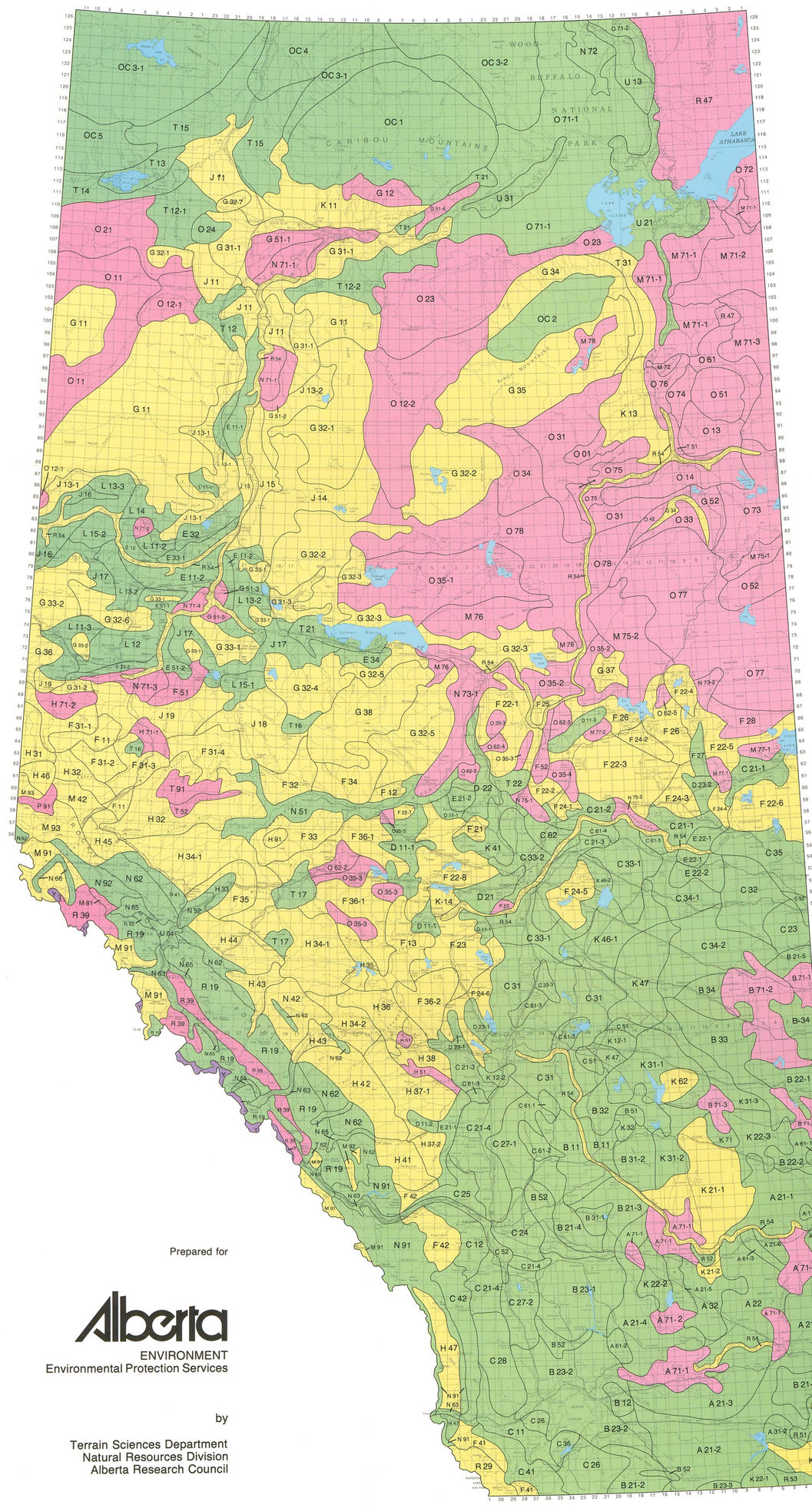
Appendix B. (continued)

Map Unit	Kind of Soil(s)		Kind and Properties of Surficial Materials					Soil Properties by Horizons or Layers																		Soil Sensitivity to:				
									Surface Soil (MIN - 0-20cm)(ORG - 0-40cm)							Subsoil							Below Subsoil							
	Taxonomic Class	Soil Texture Family Class	Kind	Texture Family Class	Reaction (pH) or Carbonate Content	Salinity	Contrasting Substrate if within 100 cm	Organic Surface Layer (kind, thickness)	Kind of horizon(s) or layer(s)	Texture	Organic Matter Content	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Total Thickness (cm)	Texture Family Class	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Texture Family Class or Rock Type	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Loss of Bases	Acidification	Aluminum Solubilization	Overall Soil Sensitivity	Potential to Neutralize Acidity
R19	R1	PRACTICALLY BARREN	LARGELY CARBONATE ROCKLAND AND ROCK MATERIALS, ROCK TYPE I. VERY SHALLOW SOILS.																										
	EB	LSK	MR,CL	LSK	MC-EC	NS	*I	LFH 5-15	Ae-Bm	LM	M	MA-MLK	15-25	13-25	85-100	Bm	0-20	LSK	N-MRK	15-20	15-20	100	BCk-Ck	LSK	MC-EC		L	L	L	L	H
																											L	L-M	L-M	M	M
R29	R2	PRACTICALLY BARREN	INTERMINGLED CARBONATE AND CLASTIC SEDIMENTARY ROCKLAND AND ROCK MATERIALS, ROCKY TYPE II. VERY SHALLOW SOILS.																								M	L-M	L-M	M	M
	P	LSK	MR,CL	LSK	NC	NS	*II		Ae-Bf	LM	M	VSA	15-25	1-2	<10	Bf	10-20	LSK	SA	15-20	1-2	<10	C	LSK	VSA-SA	<6	M	L	H	M	L
R39	R3	PRACTICALLY BARREN	CLASTIC SEDIMENTARY ROCKLAND AND ROCK MATERIALS, ROCK TYPE III. VERY SHALLOW SOILS.																								H	L	H	H	M
	DYB	SSK	MR,CL	SSK	NC-WC	NS	*III, II	LFH 5-15	Ah-Ae Bfj	LM	M	VSA-MA	6-15	<6	10-40	B,BC	10-50	SSK	SA-MA	<6	<3	<40	C	SSK	NC-WC	<6	M	L	H	M	L
R47	R4	PRACTICALLY BARREN	GRANITE AND GRANITE TYPE ROCKLAND AND ROCK MATERIALS, ROCKY TYPE IV. VERY SHALLOW SOILS.																								H	L	H	H	L
	DYB	SDY	GL,MR	SDY	NC	NS	**IV		Ae-Bf	SD	L	EA-VSA	<4	<2	<40	Bf-Bm C	20-80	SDY	VSA	<4	<2	<40	Drg	IV			H	L	H	H	L
R51	R5	ROUGH BROKEN LAND, CLASTIC SEDIMENTARY ROCKS TYPE V AND MORAINAL MATERIALS TYPE A.																									L	L	L	L	H
	B	FNL	MR	FNL	MC	WS			Ah-Bm	LM	L	N-MLK	15-25	15-25	100	Bm	0-30	FNL	MLK	15-25	15-25	100	Ck	FNL	MC		L	L	L	L	H
R52	R5	ROUGH BROKEN LAND, CLASTIC SEDIMENTARY ROCKS TYPE V AND MORAINAL AND GLACIOLACUSTRINE MATERIALS TYPE A.																									L	L	L	L	H
	BSO	FNL	MR	FNL	MC	MS			Ah-Ae	LM	L	SLA	H	H	H	Bnt	15-20	FNL	MLK	H	H	VH	Ck	FNL	MC		L	L	L	L	H
R53	R5	ROUGH BROKEN LAND, CLASTIC SEDIMENTARY ROCKS TYPE V AND MORAINAL AND GLACIOFLUVIAL MATERIALS TYPE A.																									L	L	L	L	H
	B	COL	GF,MR	COL	MC	NS	*V		Ah-Bm	SL	L	SLA-N	M	M	VH	Bm	20-50	COL	N-MLK	M	M	100	IICk	FNL	MC		L	L	L	L	H
R54		ROUGH BROKEN LAND, VARIABLE SOILS.	CLASTIC SEDIMENTARY ROCK COLLUVIAL MATERIALS TYPES II AND III AND MORAINAL AND GLACIOLACUSTRINE MATERIALS																				TYPES	B, A, AND C			M	L-M	L-M	M	M

Map Unit	Kind of Soil(s)		Kind and Properties of Surficial Materials					Soil Properties by Horizons or Layers																				Soil Sensitivity to:				
									Surface Soil (MIN - 0-20cm)(ORG - 0-40cm)							Subsoil							Below Subsoil								
	Taxonomic Class	Soil Texture Family Class	Kind	Texture Family Class	Reaction (pH) or Carbonate Content	Salinity	Contrasting Substrate if within 100 cm	Organic Surface Layer (kind, thickness)	Kind of horizon(s) or layer(s)	Texture	Organic Matter Content	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Total Thickness (cm)	Texture Family Class	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Texture Family Class or Rock Type	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Loss of Bases	Acidification	Aluminum Solubilization	Overall Soil Sensitivity	Potential to Neutralize Acidity
T11	G	CLY	GL	CLY	WC	SS			Ah-Bg	CY	L	MLK	VH	VH	100	Bg	20-30	CLY	MLK	VH	VH	100	Cg	CLY	WC		L	L	L	L	H
	B	SDY	FL	SDY	MC	NS			Ah	SD	L	SLA-N	L	L	100	Bm	20-30	SDY	MLK	L	L	100	Ck	SDY	MC		H	H	L	H	H
T12	G	CLY	GL	CLY	WC	NS		Pt	Ah-Bg	CY	H	SLA-N	30-40	28-40	90-100	Bg	20-30	CLY	N	30-40	28-40	90-100	Cg	CLY	WC		L	L	L	L	H
T13	G	CLY	GL	CLY	WC-MC	SS			Ah-Bg	CY	M	N	VH	VH	VH	Bg	20-30	CLY	MLK	VH	VH	VH	Cg	CLY	WC-MC		L	L	L	L	H
T14	G	CLY	GL	CLY	WC	WS			Ah	CL	H	SLA-N	VH	VH	VH	Bg	20-30	CLY	SLA-MLK	VH	VH	VH	C	CLY	WC		L	L	L	L	H
T15	G	CLY	GL	CLY	WC	WS		Pt	Ah-Bg	CY	H	SLA	VH	VH	VH	B	20-30	CLY	SLA-N	VH	VH	VH	C	CLY	WC		L	L	L	L	H
T16	G	FNL	MR	FNL	MC	NS		Pt	Ae-Bg	LM	H	SLA-N	H	H	H	Btg	20-40	FNL	N	20-30	18-30	90-100	Cg	FNL	MC		L	L	L	L	H
T17	G	FNL	GL	FNL	MC	NS		Pt	Ah	LM	H	N	H	H	H	Bg	10-20	FNL	N	H	H	H	Cg	FNL-CLY	MC		L	L	L	L	H
	OGL	FNL	GL	FNL	MC	NS			Ae	LM	L	SA	8-12	6-9	70-80	Bt	20-30	FNL	SLA	18-25	17-22	85-95	Ck	FNL	MC		M	L-M	M	M	H
T21	G	FNL	FL	FNL	WC	NS			Ah	LM	H	SLA-N	VH	VH	VH	Bg	20-30	FNL	SLA-N	H	H	H	Cg	FNL	WC		L	L	L	L	H
T22	G	FNL	FN	FNL	MC-WC	NS			Ah	LM	M	SLA-N	15-25	14-22	85-95	Bg	20-30	FNL	N	15-20	15-20	90-100	C	FNL	MC-WC		L	L	L	L	H
	ORG	FNL	MR	FNL	MC-WC				Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	80	-	SA-SLA	15-20	4-12	30-70	Pt	-	MA-SLA	15-20	H	H	M	H	M
T31	G	CLY	FL	CLY	NC	NS			Cg1	CY	L	SA	25-33	20-28	75-85	Cg2	20-50	CLY	SA	25-33	20-28	75-85	Cg3	CLY	SA	25-33	M	L	M	M	H
	ORG	-	FL	CLY	NC	NS			Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	80	-	SA-SLA	15-20	4-12	30-70	Pt	-	MA-SLA	15-20	H	H	M	H	M
T51	G	COL	GF,GL, MR	COL-CLY	NC,WC	NS			Aeg	SL	L	MA	<6	<2	30-40	Bg-Cg	10-30	COL	MA	<6	<3	40-50	IICg	CLY	SA	20-25	H	H	M	H	H
	ORG	-	GF,GL MR	COL-CLY	NC,WC	NS			Pt	-	-	VSA-MA	9-12	2-8	25-65	Pt	80	-	SA-SLA	15-20	4-12	30-70	Pt	-	MA-SLA	15-20	H	H	M	H	M
T52	G	COL	FL	COL	NC	NS			Aeg,Bg	LM	L	SA	L	L	M	Bg-BCg	20-50	COL	SA-MA	L	L	H	Cg	FNL	SLA	M	H	M	H	H	H
	DYB	SDY	GL	SSK	NC	NS			Ae-Bm	SD	L	SA	L	L	L	Bm	10-20	COL	SA	L	L	L	BC, C	SSK	NC	L	H	M	H	H	L

Appendix B. (continued)

Map Unit	Kind of Soil(s)		Kind and Properties of Surficial Materials					Soil Properties by Horizons or Layers																			Soil Sensitivity to:				
									Surface Soil (MIN - 0-20cm)(ORG - 0-40cm)							Subsoil							Below Subsoil								
	Taxonomic Class	Soil Texture Family Class	Kind	Texture Family Class	Reaction (pH) or Carbonate Content	Salinity	Contrasting Substrate if within 100 cm	Organic Surface Layer (kind, thickness)	Kind of horizon(s) or layer(s)	Texture	Organic Matter Content	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Total Thickness (cm)	Texture Family Class	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Exch. Bases MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Percent Base Saturation	Kind of horizon(s) or layer(s)	Texture Family Class or Rock Type	Reaction (pH) or Carbonate Content	CEC MIN-cmol(+)kg^{-1} or ORG-cmol(+)L^{-1}	Loss of Bases	Acidification	Aluminum Solubilization	Overall Soil Sensitivity	Potential to Neutralize Acidity
T62	G	FNL-COL	MR,FL	COL-FNL	WC-SC	NS		Pt	Cg1	LM	H	N	H	H	VH	Cg2	10-40	FNL	N	M	M	VH	Cg3	FNL-COL	WC-SC		L	L	L	L	H
T91	G	LSK	FL	LSK	NC	NS		L	H	-	H	EA	20-30	2-4	10-15	Ae-Bgf	10-20	LSK	VSA	10-15	<1	<5	Cg	LSK	VSA	10-15	H	L	H	H	H
	BRGL	LSK	FL	LSK	NC	NS			Ae-Bf	LM	L	EA	8-12	1-2	10-20	Bt	20-30	LSK	SA	10-15	2-4	20-30	C	LSK	VSA-SA	10-15	H	L	H	H	L
U13	R	CLY	FN	CLY	WC	SS			Ah-Cg	CY	M	SLA-N	VH	VH	VH	Cg	80	CLY	N	VH	VH	VH	Ck	CLY	WC		L	L	L	L	H
U21	R	FNL	FL	FNL	WC	NS		Pt	Ah-C	LM	L-H	MA-ML	H-VH	H-VH	H-VH	Cg	80	FNL	MA-MRK	H	H	VH	C	FNL	WC		L	L-M	L-M	L	H
U31	R	FNL	FL	FNL	WC	NS			C1	LM	L	SLA-N	H	H	VH	C2	80	FNL	N	H	H	VH	C3	FNL	WC		L	L	L	L	H
U64	R	COL	EO	COL	SC-EC	NS			Ck1	SL-LM	L	MRK	-	-	-	Ck2	80	COL	MRK	-	-	-	Ck3	COL	SC-EC		L	L	L	L	H
	EB	LSK	GF,MR	LSK	WC-EC	NS			Ae-Bm	SL-LM	L-M	SLA-N	15-25	12-22	75-95	Bm	20-30	LSK	SLA-N	15-20	14-18	75-100	Ck	LSK	WC-EC		L	L	L	L	H
Y	GLACIERS AND RECENT GLACIAL DEPOSITS.																														



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Sensitivity of Soils

The sensitivity refers to the relative degree of susceptibility of soils to change in response to effects of acidic deposition. The rated sensitivity of the dominant soil or nonsoil components represents the rating assigned to the map unit. The symbols H, M, and L (which mean high, medium and low relative categories) are used to describe the sensitivity of these components. The overall rating of sensitivity is derived from a combination of comparable ratings of the sensitivity to effects of acidic deposition on each of three soil chemistry processes: loss of bases, acidification (change in pH), and solubilization of aluminum. These ratings are based on the chemical properties: pH, cation exchange capacity and percent base saturation of the surface soil layer; depth 0-20 cm in mineral soils and 0-40 cm in Organic and Organic Cryosol soils. The latter soils are considered as organic material (peat)—associated water systems so their assigned sensitivity is based on the chemical qualities of the system. Combinations of such properties of the surface layer organic material (peat) as pH, cation exchange capacity and percent base saturation serve as indicators of these chemical qualities. For nonsoil components the buffering properties defined subsequently of the different types of rock and surficial materials served as the basis for their sensitivity ratings.

The pertinent properties of the surface layer of the dominant soil components and the kind of rock or surficial materials of the dominant nonsoil components are indicated in the tabular presentation of the map units by appropriate symbols defined subsequently.

The Map Unit Symbol

The map unit symbol is in part connotative. It consists of three digits: a capital letter followed by two numbers. The capital letter identifies the taxomic class of the dominant soil and if it is a mineral soil the first number represents its texture family class of the subsoil. The second number is used flexibly to describe other attributes for additional characterization of the map unit. As an example, in the map unit C31

C = Black Chernozem
3 = Fine loamy texture class
1 = Used flexibly. In this case it indicates that the C31 map unit includes minor areas of Black Solonetz soils.

Comparable 3 digit symbols identify the map units in which nonsoil components are dominant. Each of the latter map units are individually defined as shown subsequently.

The three-digit symbol, when followed by a hyphenated postscript number, identifies separate delineations of the sample map unit, but in which there may be minor component differenes between the delineated areas. The postscript number is not used in separate map unit delineations where the delineated areas are similar in their components.

More detailed individual descriptions of the map units are given in N. Holowaychuk, 1986. Supplement to: The sensitivity of Alberta soils to acidic inputs and the potential of soils and geology to reduce acidity of incoming acidic deposition. Alberta Research Council, Terrain Sciences Department Open File Report 86-1, 70 pages.

Taxonomic classes of the dominant soils in map units:

A Brown Chernozem or Solonetzic Brown
B Dark Brown Chernozem or Solonetzic Dark Brown
C Black Chernozem
D Dark Gray Chernozem
E Dark Gray Luvisol
F,G Orthic Gray Luvisol*
H Brunisolic Gray Luvisol and Podzolic Gray Luvisol
J Solonetzic Gray Luvisol
K Brown, Dark Brown, Black, and Gray Solonetz and Solodized Solonetz
L Black and Dark Gray Solod and Solodic Dark Gray Chernozem
M Dystric Brunisol
N Eutric Brunisol
O Organic
OC Organic Cryosol (these are Organic soils that are permanently frozen within 50 to 80 cm of the surface).
P Podzol
T Gleysol
U Regosol

Map units in which nonsoil components are dominant:

R19 Dominantly carbonate rockland and rock materials with some very shallow soils, <25 cm deep. Rock Type I.
R29 Dominantly Intermingled carbonate and clastic sedimentary rockland and rock materials with some very shallow soils, <25 cm deep. Rock Type II.
R39 Dominantly clastic sedimentary rockland and rock materials with some very shallow soils, <25 cm deep. Rock Type III.
R47 Dominantly granite and granite type rockland and rock materials with some very shallow soils, <25 cm deep. Rock Type IV.
R51 Rough Broken Land. Rock Type V and A surficial materials with inclusions of Brown fine loamy soils.
R52 Rough Broken Land. Rock Type V and A surficial materials with inclusions of Brown clayey soils.
R53 Rough Broken Land. Rock Type V and A surficial materials with inclusions of Brown coarse loamy soils.
R54 Rough Broken Land. Rock Type II and B and A surficial materials with variable soils common.
Y Icefields and practically barren glacial materials.

Texture family classes

It is emphasized that the texture family classes identified by the first number in the map unit symbol apply to the subsoil portion of the mineral soils and not to the texture of the surface layer. These classes, as used in soil taxonomy, refer to the grain size distribution of whole soil material (fine earth material and larger grain size particles) whereas texture classes commonly used in describing soils are based on the proportionate contents of sand, silt and clay fractions in the fine earth (< 2 mm) material. Brief definitions of the texture family classes, their identifying numbers as shown in the map unit symbol and their abbreviations as shown in the table are given.*

1 Clayey class — clay content of material 35 percent or more.
2,3,4 Fine loamy class — clay content of material 18-35 percent.
5,6 Coarse loamy class — clay content of material < 18 percent.
7,8 Sandy class — material consists of 70 or more percent of sand.
9 Clayey, loamy and sandy skeletal classes — clayey, loamy or sandy classes with 35 or more percent of rock fragments or pebbles.

Rock and rock material types

I Carbonate (limestone, dolomite) rock or rock materials or calcareous clastic sedimentary rock or rock materials (shale, siltstone, sandstone). High buffering properties.
II Intermingled carbonate rock and noncalcareous clastic sedimentary rock and rock materials. Moderately high buffering properties.
III Clastic sedimentary rock and rock materials, infrequent calcareous strata may be present. Moderate buffering properties.
IV Granite and granite type rock and rock materials. Low buffering properties.
V Alkaline clastic sedimentary rock and rock materials. High buffering properties.

Surface material types

A Calcareous or mildly alkaline and saline materials. All texture classes. High buffering properties.
B Noncarbonate bearing clayey or sporadically weakly calcareous clayey and fine loamy materials. Moderately high buffering properties.
C Largely noncarbonate bearing but in places may be very sporadically weakly calcareous fine loamy materials. Moderate buffering properties.
D Noncarbonate bearing coarse loamy, sandy, and sandy skeletal class materials. Low buffering properties.

Definitions of Symbols in the Tabular Presentation

Soil texture or type of rock or surficial material

The texture classes defined are like those that are commonly used to describe soil texture. These classes are based on the proportionate contents of the sand, silt, and clay fractions of the fine earth (< 2 mm) soil material.

SD sand or loamy sand
SL sandy loam
LM loam or silt loam
CL clay loam or silty clay loam
CY clay

Pt Peat

The soil texture property is not applicable to Organic or Organic Cryosol soils and the symbol Pt indicating peat is shown instead. For nonsoil components the types of rock or surficial materials defined previously are shown instead of texture by appropriate symbols defined previously.

Organic matter content: expressed as percent organic carbon content

L Low — <2.0
M Medium — 2.0 - 3.5
H High — >3.5

Soil reaction (pH)

EA Extremely acid — pH <4.6
VSA Very strongly acid — pH 4.6 to 5.0
SA Strongly acid — pH 5.1 to 5.5
MA Medium acid — pH 5.5 to 6.0
SLA Slightly acid — pH 6.1 to 6.5
N Neutral — pH 6.6 to 7.3
MLK Mildly alkaline — pH 7.4 to 7.8
MRK Moderately alkaline — pH 7.9 to 8.4

CEC (cation exchange capacity) expressed in cmol (centimoles) per kilogram of mineral soil or per litre of Organic or Organic Cryosol soils

L Low — <6 cmol
M Medium — 6 - 15 cmol
H High — 15 - 25 cmol
VH Very High — >25 cmol

Percent base saturation:

EL Extremely low — < 10
VL Very low — 10 to 24
L Low — 25 to 49
M Medium — 50 to 74
H High — 75 to 89
VH Very High — 90 to 100

*In several cases two or three numbers were used for the same texture family class in order to provide a larger number of capital letters- first number combinations necessitated by the large number of unique map units. Similarly, two capital letters, F and G, were required for the Orthic Gray Luvisol taxonomic class.

Properties of the Surface Layer of the Dominant Soil or the Types of Rocks or Surficial Materials in the Dominant Nonsoil Map Unit Components and their Rated Sensitivity

Low Sensitivity

Map unit symbol	Texture class of soil or type of rock or surficial material	Organic matter content	pH	Cation exchange capacity	Percent base saturation	Sensitivity to: Base loss	Acidification	Aluminum solubilization	Overall sensitivity
A11	CL	L	N-MLK	H	VH	L	L	L	L
A21	LM	L	N-MLK	H	VH	L	L	L	L
A22	LM	L	SLA-N	H	H-VH	L	L	L	L
A31	LM	L	N-MLK	H	VH	L	L	L	L
A32	LM	L	SLA-N	H	H-VH	L	L	L	L
A61	SL-SD	L	SLA-N	M	VH	L	L	L	L
B11	CY	M-H	N-SLA	VH	VH	L	L	L	L
B12	CL-LM	M	N-MLK	VH	VH	L	L	L	L
B21	LM	M	N-SLA	H-VH	VH	L	L	L	L
B22	LM	M	N-SLA	H-VH	VH	L	L	L	L
B23	LM	M	N-MLK	H-VH	H-VH	L	L	L	L
B31	LM	M-H	SLA-N	H-VH	H-VH	L	L	L	L
B32	LM	M	SLA-N	H-VH	H-VH	L	L	L	L
B33	LM	M	SLA	H-VH	H-VH	L	L	L	L
B34	LM	M	N-SLA	H-VH	H-VH	L	L	L	L
B51	SL	M	SLA	M	H	L	L	L	L
B52	SL	M	SLA-N	M	VH	L	L	L	L
C11	CY-LM	M	SLA-N	M	VH	L	L	L	L
C12	CY-LM	H	MA-N	VH	H-VH	L	L-M	L-M	L
C21	LM	H	SLA-N	H-VH	H-VH	L	L	L	L
C22	LM	H	SLA-N	H-VH	H-VH	L	L	L	L
C23	LM	H	SLA-N	H	H-VH	L	L	L	L
C24	LM	H	MA-N	H	H-VH	L	L-M	L-M	L
C25	LM-CL	H	MA-N	VH	H-VH	L	L-M	L-M	L
C26	LM	H	SLA-N	VH	VH	L	L	L	L
C27	LM	H	N	VH	VH	L	L	L	L
C28	LM	H	SLA-MLK	VH	VH	L	L	L	L
C31	LM	H	SLA-N	VH	VH	L	L	L	L
C32	LM	H	SLA-N	VH	VH	L	L	L	L
C33	LM-CL	H	SLA-N	VH	H-VH	L	L	L	L
C34	LM	H	SLA-N	H-VH	VH	L	L	L	L
C35	LM	H	SLA-N	VH	H-VH	L	L	L	L
C36	LM	H	SLA-N	VH	VH	L	L	L	L
C41	LM	H	MA-N	VH	H-VH	L	L-M	L-M	L
C42	LM-CL	H	MA-N	VH	H-VH	L	L-M	L-M	L
C51	SL	H	SLA	M-H	H	L	L	L	L
C52	SL	H	N-MRK	H	VH	L	L	L	L
C61	SL	H	SLA-N	H	H-VH	L	L	L	L
C62	SL-SD	H-M	SLA-N	M	VH	L	L	L	L
D11	CY-LM	H-M	MA-SLA	VH	H	L	L-M	L-M	L
D21	LM	H	MA-SLA	H	H	L	L-M	L-M	L
D22	LM	H	SLA	VH	H-VH	L	L	L	L
D23	LM	H	SLA-N	VH	H-VH	L	L	L	L
E11	CL	M-H	SLA	VH	H-VH	L	L	L	L
E12	CL	M-H	SLA	VH	H-VH	L	L	L	L
E21	LM	M	MA-SLA	H	H-VH	L	L-M	L-M	L
E22	LM	M-H	SLA-N	H	VH	L	L	L	L
E32	LM	M-H	SLA	H	H	L	L	L	L
E33	LM	M-H	SLA	VH	H-VH	L	L	L	L
E34	LM	M	MA-SLA	H	H	L	L-M	L-M	L
E51	SL	M-H	SLA-N	M-H	H-VH	L	L	L	L
F27	LM	L	SLA-N	M	VH	L	L	L	L
H33	LM	L	N-MLK	M	VH	L	L	L	L
J16	CL	L	MA-SLA	H	H	L	L-M	L-M	L
J17	CL	L	MA-SA	H	M	L	L-M	L-M	L
K12	LM-CL	H	MA	VH	M	L	L-M	L-M	L
K22	LM	L	SLA	M	M	L	L	L	L
K31	LM	M	MA	H	M-H	L	L-M	L-M	L
K32	LM	M	MA-SLA	H	M-H	L	L-M	L-M	L
K41	LM	H	MA-SLA	H-VH	M	L	L-M	L-M	L
K46	LM-CL	H	MA-SLA	VH	M	L	L-M	L-M	L
K47	LM	M-H	MA	H	M-H	L	L-M	L-M	L
K71	SD	L	N	L	VH	L	L	L	L
L11	CL	H	SLA-MA	VH	H	L	L	L	L
L12	CL	H	SLA-MA	VH	H	L	L	L	L
L13	LM	M-H	MA-SLA	VH	M-H	L	L-M	L-M	L
L14	CL	H	SLA-MA	VH	H	L	L	L	L
L15	CL	M	MA	H-VH	M-H	L	L-M	L-M	L
N41	LM	L	SLA	H	H	L	L	L	L
N51	SL	L	SLA-N	M	VH	L	L	L	L
N52	SL	L-M	MRK	-	-	L	L	L	L
N62	LM	M	MA-N	H	H-VH	L	L-M	L-M	L
N63	LM	L-M	SLA-MLK	M	VH	L	L	L	L
N65	LM	L-M	SLA-N	H	H-VH	L	L	L	L
N66	LM	L-M	SLA-N	H	H-VH	L	L	L	L
N72	SD	L	N-MLK	L	VH	L	L	L	L
N91	LM	M	MA-N	H	H-VH	L	L-M	L-M	L
N92	LM	M	MA-N	H	H-VH	L	L-M	L-M	L
O24	Pt	-	SLA	M	H-VH	L	L	L	L
O71	Pt	-	SLA	M	H-VH	L	L	L	L
OC1	Pt	-	EA-SA	M	EL-L	L	L	H	L
OC2	Pt	-	EA-SA	M	EL-L	L	L	H	L
OC3	Pt	-	EA-SA	M	EL-L	L	L	H	L
OC4	Pt	-	EA-SA	M	EL-L	L	L	H	L
OC5	Pt	-	EA-SA	M	EL-L	L	L	H	L
R19	I	-	-	-	-	L	L	L	L
R51	V	-	-	-	-	L	L	L	L
R52	V	-	-	-	-	L	L	L	L
R53	V	-	-	-	-	L	L	L	L
T11	CY	L	MLK	VH	VH	L	L	L	L
T12	CY	H	SLA-N	VH	VH	L	L	L	L
T13	CY	M	N	VH	VH	L	L	L	L
T14	CL	H	SLA-N	VH	VH	L	L	L	L
T15	CY	H	SLA	VH	VH	L	L	L	L
T16	LM	H	SLA-N	H	H	L	L	L	L
T17	LM	H	N	H	H	L	L	L	L
T21	LM	H	SLA-N	VH	VH	L	L	L	L
T22	LM	M	SLA-N	H	H-VH	L	L	L	L
T62	LM	H	N	H	H	L	L	L	L
U13	CY	M	SLA-N	VH	VH	L	L	L	L
U21	LM	L-H	MA-MLK	H-VH	H-VH	L	L-M	L-M	L
U31	LM	L	SLA-N	H	VH	L	L	L	L
U64	SL	L	MRK	-	-	L	L	L	L

Medium Sensitivity

Map unit symbol	Texture class of soil or type of rock or surficial material	Organic matter content	pH	Cation exchange capacity	Percent base saturation	Sensitivity to: Base loss	Acidification	Aluminum solubilization	Overall sensitivity
C13	CL	H	SA-MA	VH	H	M	L	M	M
F11	LM	L	VSA-SA	M	VL	M	L	H	M
F12	LM-CL	L	MA	M	H	M	L-M	L-M	M
F13	LM	L	MA	M	H	M	L-M	L-M	M
F21	LM	L	MA	M	H	M	L-M	L-M	M
F22	LM	L	MA	M	H	M	L-M	L-M	M
F23	LM	L	MA-SLA	M	H	M	L-M	L-M	M
F24	LM	L	MA	M	H	M	L-M	L-M	M
F25	LM	L	MA-SLA	M	H-VH	M	L-M	L-M	M
F26	LM	L	MA	M	H	M	L-M	L-M	M
F31	LM	L	SA	M	L	M	L-M	M	M
F32	LM	L	MA	M	H	M	L-M	L-M	M
F33	LM	L	MA-SA	M	H	M	L-M	L-M	M
F34	LM	L	SA	M	M-H	M	L-M	M	M
F35	LM	L	MA-SLA	M	H	M	L-M	L-M	M
F36	LM	L	MA	M	H-VH	M	L-M	L-M	M
F41	LM	L	MA-SLA	M	H-VH	M	L-M	L-M	M
F42	LM	L	MA-SA	M	M	M	L-M	L-M	M
G11	LM-CL	L	SA-VSA	H	M	M	L	H	M
G31	LM	L	MA-SLA	M	M-H	M	L-M	L-M	M
G32	LM	L	SA-MA	M	M-H	M	L-M	M	M
G33	LM	L	SA-MA	M	M-H	M	L-M	M	M
G34	L-M	L	VSA	M	VL-L	M	L	H	M
G35	LM	L	VSA	M	VL-L	M	L	H	M
G36	LM	L	MASLA	M	H	M	L-M	L-M	M
G37	LM	L-M	MA-SLA	M-H	H	M	L-M	L-M	M
G38	LM	L	VSA-SA	M	L	M	L	H	M
H31	LM	L	VSA-SA	M	VL-L	M	L	H	M
H32	LM	L	VSA-SA	H	VL	M	L	H	M
H34	LM	L	MA	M	L	M	L-M	L-M	M
H35	LM	L	SA-MA	M	M	M	L-M	M	M
H36	LM	L	MA	M	M	M	L-M	L-M	M
H37	LM	L	MA	M	M	M	L-M	L-M	M
H38	LM	L	MA-SA	M	M-H	M	L-M	L-M	M
H41	LM	L	SA-MA	M	L	M	L-M	M	M
H42	LM	L	SA-MA	M	L	M	L-M	M	M

Properties of the Surface Layer of the Dominant Soil or the Types of Rocks or Surficial Materials in the Dominant Nonsoil Map Unit Components and their Rated Sensitivity

Medium Sensitivity

Map unit symbol	Texture class of soil or type of rock or surficial material	Organic matter content	pH	Cation exchange capacity	Percent base saturation	Sensitivity to: Base loss	Acidification	Aluminum solubilization	Overall sensitivity
H43	LM	L	SA-MA	M	L	M	L-M	M	M
H44	LM	L	MA-SA	M	L	M	L-M	L-M	M
H45	LM	L	SA	M	L	M	L-M	M	M
H46	LM	L	SA	M	L	M	L-M	M	M
H47	LM-SL	L	MA-SA	M	M	M	L-M	L-M	M
H91	LM	L	SA	M	L	M	L-M	M	M
J11	CL	L	MA	M	H	M	L-M	L-M	M
J13	CL	L	MA	M	H	M	L-M	L-M	M
J14	CL	L	MA	M	H	M	L-M	L-M	M
J15	CL	L	MA	M	H	M	L-M	L-M	M
J18	LM	L	MA	M	M	M	L-M	L-M	M
J19	LM	M-H	SLA-N	H	H-VH	M	L-M	L-M	M
K11	LM-CL	L	MA	M	M-H	M	L-M	L-M	M
K13	LM	L	MA-SLA	M	H	M	L-M	L-M	M
K14	LM	L	SA-MA	M	M	M	K-M	M	M
K21	LM	L	MA-SLA	M	M	M	L-M	L-M	M
K51	SL	L	MA-SLA	M	H	M	L-M	L-M	M
K62	SL	M	SA	M	M	M	L-M	M	M
M42	LM	L	VSA-SA	H	VL	M	L	H	M
M91	LM	M	VSA-MA	M	L	M	L	H	M
M92	LM	M	VSA-MA	M	L	M	L	H	M
M93	LM	M	VSA-SA	M	M-L	M	L	H	M
N42	LM	L	MA-SLA	M-H	H	M	L-M	L-M	M
R29	II	-	-	-	-	M	L-M	L-M	M
R54	II	-	-	-	-	M	L-M	L-M	M
T31	CY	L	SA	VH	H	M	L	M	M

High Sensitivity

Map unit symbol	Texture class of soil or type of rock or surficial material	Organic matter content	pH	Cation exchange capacity	Percent base saturation	Sensitivity to: Base loss	Acidification	Aluminum solubilization	Overall sensitivity
A71	SD	L	SLA-N	L	H-VH	H	H	L	H
B71	SD	L	SLA-N	L	H-VH	H	H	L	H
F28	SL	L	MA-SLA	L	M-H	H	H	M	H
F51	SL	L	MA-SLA	L	M	H	H	M	H
F52	SL	L	SLA	L	H	H	H	L	H
F53	SD	L	SLA	L	H	H	H	L	H
G12	CL	L	EA-VSA	H	VL	H	L	H	H
G51	SL	L	SLA-N	L	H-VH	H	H	L	H
G52	SD	L	VSA	L	VL	H	L	H	H
H51	SD	L	SA-MA	L	M	H	M	H	H
H71	SD	L	SLA-MA	L	H	H	H	L	H
M71	SD	L	EA-VSA	L	VL	H	L	H	H
M72	SD	L	SA	L	VL-L	H	M	H	H
M75	SD	L	MA	L	M	H	H	M	H
M76	SD-SL	L	MA	L	M	H	H	M	H
M77	SD	L	MA	L	M	H	H	M	H
M78	SL	L	SA	L	VL	H	M	H	H
M81	SD	L	SA	L	L	H	M	H	H
N71	SD	L	SLA	L	M-H	H	H	L	H
N73	SD	L	SLA	L	M-H	H	H	L	H
N75	SD	L	SLA-MA	L	M-H	H	H	L	H
O01	Pt	-	VSA-MA	M	L-M	H	H	M	H
O11	Pt	-	VSA-MA	M	L-M	H	H	M	H
O12	Pt	-	VSA-MA	M	L-M	H	H	M	H
O13	Pt	-	VSA-MA	M	L-M	H	H	M	H
O14	Pt	-	VSA-MA	M	L-M	H	H	M	H
O21	Pt	-	VSA-MA	M	L-M	H	H	M	H
O23	Pt	-	VSA-MA	M	L-M	H	H	M	H
O31	Pt	-	VSA-MA	M	L-M	H	H	M	H
O33	Pt	-	VSA-MA	M	L-M	H	H	M	H
O34	Pt	-	VSA-MA	M	L-M	H	H	M	H
O35	Pt	-	VSA-MA	M	L-M	H	H	M	H
O42	Pt	-	VSA-MA	M	L-M	H	H	M	H
O51	Pt	-	VSA-MA	M	L-M	H	H	M	H
O52	Pt	-	VSA-MA	M	L-M	H	H	M	H
O62	Pt	-	VSA-MA	M	L-M	H	H	M	H
O75	Pt	-	VSA-MA	M	L-M	H	H	M	H
O76	Pt	-	VSA-MA	M	L-M	H	H	M	H
O77	Pt	-	VSA-MA	M	L-M	H	H	M	H
P91	SL	L	VSA	L	VL	H	L	H	H
R39	III	-	-	-	-	H	L	H	H
R47	IV	-	-	-	-	H	L	H	H
T51	SL	L	MA	L	L	H	H	M	H
T52	LM	L	SA	L	M	H	M	H	H
T91	-	H	EA	H-VH	VL	H	L	H	H

Lakes

Glaciers

Scale 1:2,000,000 (main map)

40 0 40 80 120 160 Kilometres
20 0 20 40 60 80 100 Miles

Soil Sensitivity to Acidic Inputs, Alberta

Map No. 1

N. Holowaychuk and R.J. Fessenden

Map to accompany Earth Sciences Report 86-1
The sensitivity of Alberta soils to acidic inputs and the potential of soils and geology to reduce acidity of incoming deposition.
Published 1986

Cartography by Alberta Research Council, Graphics Services, J.K. Matthie

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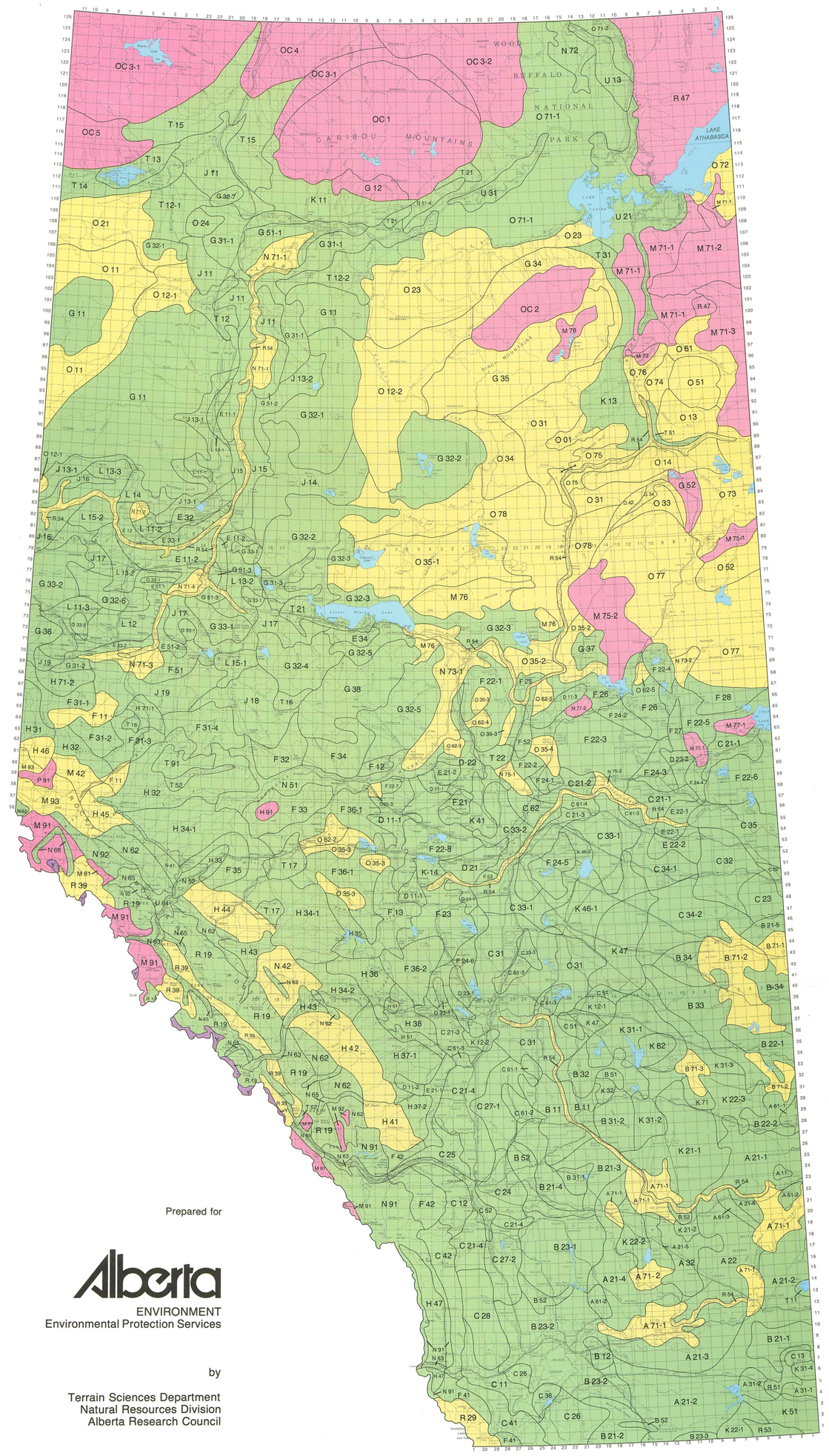

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Potential to Reduce Acidity

The rating of the potential to reduce acidity refers to the degree of capability of the map unit component to reduce the incident acid deposition acidity before its possible entry into an aquatic ecosystem as leachate or effluent. The high, medium and low rating of this potential (shown by corresponding symbols H, M, and L) of the dominant soil or nonsoil component represent the rating assigned to a map unit. Such attributes as depth, content of exchangeable bases, kind of substrate material and the drainage class of soils determine this potential of the soil components. All poorly drained mineral soils are rated as having high potential. The relative magnitude of the buffering properties of the types of rock or surficial materials defined below determine the rating of the nonsoil components. For map units in which Organic and Organic Cryosol soils are dominant the rating is based on the combined chemical qualities of the organic material (peat) and associated water. A combination of such properties of the surface layer (0-40 mm deep) of these soils as pH, cation exchange capacity, percent base saturation, and content of exchangeable bases serve as an indicator of these chemical qualities of the organic material-water system.

The attributes and properties of the dominant soil or nonsoil component of each map unit that are pertinent to the rating of this potential are defined and shown by appropriate symbols in the tabular presentation of the map units.

The Map Unit Symbol

The map unit symbol is in part connotative. It consists of three digits: a capital letter followed by two numbers. The capital letter identifies the taxomic class of the dominant soil and if it is a mineral soil the first number represents its texture family class of the subsoil. The second number is used flexibly to describe other attributes for additional characterization of the map unit. As an example, in the map unit C31

C = Black Chernozem
3 = Fine loamy texture class
1 = Used flexibly. In this case it indicates that the C31 map unit includes minor areas of Black Solonetz soils.

Comparable 3 digit symbols identify the map units in which nonsoil components are dominant. Each of the latter map units are individually defined as shown subsequently.

The three-digit symbol, when followed by a hyphenated postscript number, identifies separate dilineations of the same map unit, but in which there may be minor component differences between the delineated areas. The postscript number is not used in separate map unit delineations where the delineated areas are similar in their components.

More detailed individual descriptions and characterization of the map units are given in N. Holowaychuk, 1986. Supplement to: The sensitivity of Alberta soils to acidic inputs and the potential of soils and geology to reduce acidity of incoming acidic deposition. Alberta Research Council, Terrain Sciences Department Open File Report 86-1.

Taxonomic classes of the dominant soils in map units:

A Brown Chernozem or Solonetzic Brown
B Dark Brown Chernozem or Solonetzic Dark Brown
C Black Chernozem
D Dark Gray Chernozem
E Dark Gray Luvisol
F,G Orthic Gray Luvisol*
H Brunisolic Gray Luvisol and Podzolic Gray Luvisol
J Solonetzic Gray Luvisol
K Brown, Dark Brown, Black, and Gray Solonetz and Solodized Solonetz
L Black and Dark Gray Solod and Solodic Dark Gray Chernozem
M Dystric Brunisol
N Eutric Brunisol
O Organic
OC Organic Cryosol (these are Organic soils that are permanently frozen within 50 to 80 cm of the surface).
P Podzol
T Gleysol
U Regosol

Map units in which nonsoil components are dominant:

R19 Dominantly carbonate rockland and rock materials with some very shallow soils, <25 cm deep. Rock Type I.
R29 Dominantly Intermingled carbonate and clastic sedimentary rockland and rock materials with some very shallow soils, <25 cm deep. Rock Type II.
R39 Dominantly clastic sedimentary rockland and rock materials with some very shallow soils, <25 cm deep. Rock Type III.
R47 Dominantly granite and granite type rockland and rock materials with some very shallow soils, <25 cm deep. Rock Type IV.
R51 Rough Broken Land. Rock Type V and A surficial materials with inclusions of Brown fine loamy soils.
R52 Rough Broken Land. Rock Type V and A surficial materials with inclusions of Brown clayey soils.
R53 Rough Broken Land. Rock Type V and A surficial materials with inclusions of Brown coarse loamy soils.
R54 Rough Broken Land. Rock Type II and B and A surficial materials with variable soils common.
Y Icefields and practically barren glacial materials.

Texture family classes

It is emphasized that the texture family classes identified by the first number in the map unit symbol applies to the subsoil portion of the mineral soils and not to the texture of the surface layer. These classes, as used in soil taxonomy, refer to the grain size distribution of whole soil material (fine earth material and larger grain size particles) whereas texture classes commonly used in describing soils are based on the proportionate contents of sand, silt and clay fractions in the fine earth (<2 mm) material. Brief definitions of the texture family classes, their identifying numbers as shown in the map unit symbol and their abbreviations as shown in the tabular presentation are given.*

1 CLY Clayey class — clay content of material 35 percent or more.
2,3,4 FNL Fine loamy class — clay content of material 18-35 percent.
5,6 COL Coarse loamy class — clay content of material <18 percent.
7,8 SDY Sandy class — material contains 70 or more percent of sand.
9 CSK Clayey skeletal class — clayey class with 35 or more percent by volume of rock fragments or pebbles.
9 LSK Loamy skeletal class — loamy class with 35 or more percent by volume of rock fragments or pebbles.
9 SSK Sandy skeletal class — sandy class with 35 or more percent of rock fragments or pebbles.

Rock and rock material types

I Carbonate (limestone, dolomite) rock or rock materials or calcareous clastic sedimentary rock or rock materials (shale, siltstone, sandstone). High buffering properties.
II Intermingled carbonate rock and noncalcareous clastic sedimentary rock and rock materials. Moderately high buffering properties.
III Clastic sedimentary rock and rock materials, infrequent calcareous strata may be present. Moderate buffering properties.
IV Granite and granite type rock and rock materials. Low buffering properties.
VI Alkaline clastic sedimentary rock and rock materials. High buffering properties.

Surficial material types

A Calcareous or mildly alkaline and saline materials. All texture classes. High buffering properties.
B Noncarbonate bearing clayey or sporadically weakly calcareous clayey and fine loamy materials. Moderately high buffering properties.
C Largely noncarbonate bearing but in places may be very sporadically weakly calcareous fine loamy materials. Moderate buffering properties.
D Noncarbonate bearing coarse loamy, sandy, and sandy skeletal class materials. Low buffering properties.

Definitions of Symbols in the Tabular Presentation

Kind of soil or nonsoil components

This is implicit in the map unit symbol but in the tabular presentation it is identified as follows:
Mineral soils — appropriate texture family class symbol defined previously.
Organic or Organic Cryosol soils. Peat symbols.
Pt — Peat
Pt_Z — Peat, permanently frozen.
Nonsoil — Rock type. Appropriate symbols defined previously.
Nonsoil — Surficial material type. Appropriate symbols defined previously.

Soil drainage class

Soil drainage class refers to the relative annual patterns of conditions of wetness common to mineral soils.
W. — Well and rapidly drained class
Soil is rarely water saturated or saturated infrequently for short periods of time.
M. — Moderately well drained class
Soil is water saturated for small but significant periods of time.
P. — Poorly drained class
Soil is water saturated for appreciable or prolonged periods of time.

Soil depth class

D — Deep soils
Soil profile and underlying fine earth material at least 100 cm deep.
SH — Shallow soils
Soil profile and underlying fine earth material 25 to 99 cm deep over rock or rock materials.

Chemical properties of component soils

The classes of the following four chemical properties represent averaged values for the soil depth in mineral soils or the surface layer (0-40 cm depth) in Organic and Organic Cryosol soils.

CEC (cation exchange capacity) expressed in cmol (centimoles) per kilogram of mineral soil or per litre of Organic or Organic Cryosol soil.
L Low — <6 cmol
M Medium — 6 - 15 cmol
H High — 15 - 25 cmol
VH Very High — >25 cmol

Soil reaction (pH)
EA Extremely acid — pH <4.6
VSA Very strongly acid — pH 4.6 to 5.0
SA Strongly acid — pH 5.1 to 5.5
MA Medium acid — pH 5.5 to 6.0
SLA Slightly acid — pH 6.1 to 6.5
N Neutral — pH 6.6 to 7.3
MLK Mildly alkaline — pH 7.4 to 7.8
MRK Moderately alkaline — pH 7.9 to 8.4

Percent base saturation:
EL Extremely low — <10
VL Very low — 10 to 24
L Low — 25 to 49
M Medium — 50 to 74
H High — 75 to 89
VH Very High — 90 to 100

Sum of exchangeable bases (Ca, Mg, K, Na), expressed in cmol (centimoles) per kilogram of mineral soil or per litre of Organic or Organic Cryosol soil.
L Low — <6 cmol
M Medium — 6 - 15 cmol
H High — 15 - 25 cmol
VH Very High — >25 cmol

Kind of substrate

The kind of substrate refers to the type of rock or surficial materials defined previously that underlie the soils. In Organic and Organic Cryosol soils the substrate shown underlies the peat material which may range from less than 100 cm to several metres in depth. Appropriate symbols defined previously identify the type of rock or surficial material.

*In several cases two or three numbers were used for the same texture family class in order to provide a larger number of capital letters-first number combinations necessitated by the large number of unique map units. Similarly, two capital letters, F and G, were required for the Orthic Gray Luvisol taxonomic class.

Attributes and Properties of Dominant Soil and Nonsoil Map Unit Components and the Rating of Potential to Reduce Acidity

High Potential

Map unit symbol	Kind of dominant soil or nonsoil component	Soil drainage class	Soil depth	Cation exchange capacity	Soil Reaction (pH)	Percent base saturation	Sum of exchange bases	Kind of substrate under soil	Rating of potential to reduce acidity
A11	CLY	W	D	VH	MLK	VH	VH	A	H
A21	FNL	W	D	H	MLK	VH	H	A	H
A22	FNL	W	D	H	MLK	VH	H	A	H
A31	FNL	W	D	H	MLK	VH	H	A	H
A32	FNL	W	D	H	MLK	VH	H	A	H
A61	COL	W	D	M	MLK	VH	M	A	H
B11	CLY	W	D	VH	N-MLK	VH	VH	A	H
B12	CLY	W	D	VH	N-MLK	VH	VH	A	H
B21	FNL	W	D	H-VH	N-MLK	VH	H-VH	A	H
B22	FNL	W	D	H-VH	N-MLK	VH	H-VH	A	H
B23	FNL	W	D	H-VH	N-MLK	VH	H-VH	A	H
B31	FNL	W	D	H-VH	N-MLK	VH	H-VH	A	H
B32	FNL	W	D	H	N	VH	H	A	H
B33	FNL	W	D	H	N	VH	H	A	H
B34	FNL	W	D	H	N	H-VH	H	A	H
B51	COL	W	D	M	N	H-VH	M	A	H
B52	COL	W	D	M	N	VH	M	A	H
C11	CLY	W	D	VH	SLA-N	VH	VH	A	H
C12	CLY	W	D	VH	SLA-N	VH	VH	A	H
C13	CLY	W	D	H-VH	MA	H	H	A	H
C21	FNL	W	D	H-VH	SLA-N	H-VH	H-VH	A	H
C22	FNL	W	D	H-VH	SLA-N	H-VH	H	A	H
C23	FNL	W	D	H	SLA-N	H-VH	H	A	H
C24	FNL	W	D	H	SLA-N	H-VH	H	A	H
C25	FNL	W	D	VH	SLA-N	H-VH	H-VH	A	H
C26	FNL	W	D	H-VH	N	VH	H-VH	A	H
C27	FNL	W	D	H-VH	N	VH	H-VH	A	H
C28	FNL	W	D	H-VH	N-MLK	VH	H-VH	A	H
C31	FNL	W	D	H-VH	SLA-N	VH	H-VH	A	H
C32	FNL	W	D	H-VH	SLA-N	VH	H-VH	A	H
C33	FNL	W	D	H-VH	SLA-N	VH	H-VH	A	H
C34	FNL	W	D	H	SLA-N	VH	H	A	H
C35	FNL	W	D	H-VH	SLA-N	H-VH	H	A	H
C36	FNL	W	D	H-VH	SLA-N	VH	H-VH	A	H
C41	FNL	W	D	H-VH	MA-N	H-VH	H	A	H
C42	FNL	W	D	H-VH	MA-N	H-VH	H-VH	A	H
C51	COL	W	D	M	SLA-N	H-VH	M	A	H
C52	COL	W	D	-	MRK	-	-	A	H
C61	COL	W	D	M-H	SLA-N	VH	M-H	A	H
C62	COL	W	D	M	SLA-N	VH	M	A	H
D11	CLY	W	D	VH	MA-SLA	H	VH	A	H
D21	FNL	W	D	H	MA-SLA	H	H	A	H
D22	FNL	W	D	H-VH	SLA	H	H	A	H
D23	FNL	W	D	H-VH	SLA-N	H-VH	H-VH	A	H
E11	CLY	W	D	VH	MA-SLA	H-VH	VH	A	H
E12	CLY	W	D	H-VH	MA-SLA	H-VH	H-VH	A	H
E21	FNL	W	D	H	MA	H-VH	H	A	H
E22	FNL	W	D	H	N	VH	H	A	H
E32	FNL	W	D	H	MA-SLA	H	H	B	H
E33	FNL	W	D	H-VH	SLA	H	H	A	H
E34	FNL	W	D	H	MA	H	H	A	H
E51	COL	W	D	M	N	VH	M	A	H
F12	CLY	W	D	H-VH	MA	H	H	A	H
F13	CLY	W	D	H-VH	MA	H	H	A	H
F21	FNL	W	D	M-H	MA	H	M-H	A	H
F22	FNL	W	D	M-H	MA	H	M-H	A	H
F23	FNL	W	D	M-H	MA	H	M-H	A	H
F24	FNL	W	D	M-H	MA	H	M-H	A	H
F25	FNL	W	D	H	MA	H-VH	H	A	H
F26	FNL	W	D	M	SA-MA	H	M	A	H
F27	FNL	W	D	M	SLA	VH	M	A	H
F28	FNL	W	D	M	MA	M-H	M	A	H
F31	FNL	W	D	H	SA	M	M	A	H
F32	FNL	W	D	M-H	MA-SA	H	M-H	A	H
F33	FNL	W	D	H	SA	H	M-H	A	H
F34	FNL	W	D	H	SA-VSA	H	H	B	H
F35	FNL	W	D	H	MA	H-VH	H	A	H
F36	FNL	W	D	H	MA	H-VH	H	A	H
F41	FNL	W	D	H	MA-SLA	H-VH	H	A	H
F42	FNL	W	D	H	SA	M	M-H	A	H
F51	COL	W	D	M	MA	M-H	M	A	H
F52	COL	W	D	M	MA-SLA	H-VH	H	A	H
F53	COL	W	D	M	SLA-N	H-VH	M	A	H
G11	CLY	W	D	H-VH	SA-VSA	M-H	H	B	H
G31	FNL	W	D	M-H	MA-SLA	H-VH	M-H	A	H
G32	FNL	W	D	H	SA	H	M-H	A	H
G33	FNL	W	D	H	SA	H	H	A	H
G36	FNL	W	D	H	MA	H	H	A	H
G37	FNL	W	D	H	MA	H	M-H	A	H
G38	FNL	W	D	H	VSA-SA	H	H	B	H
G51	COL	W	D	M	SLA	H-VH	M	A	H
H31	FNL	W	D	M	SA	M	M	A	H
H32	FNL	W	D	H	VSA	L	M	A	H
H33	FNL	W	D	M-H	N	VH	M-H	A	H
H34	FNL	W	D	M-H	MA	M-H	M-H	A	H
H35	FNL	W	D	M-H	SA-MA	M-H	M-H	A	H
H36	FNL	W	D	H	MA-SA	M-H	M-H	A	H
H37	FNL	W	D	H	MA-SA	M-H	M-H	A	H
H38	FNL	W	D	M-H	MA-SA	H	M-H	A	H
H43	FNL	W	D	M-H	MA-SLA	M-H	M-H	A	H
H47	FNL	W	D	M-H	MA-SLA	M-H	M-H	A	H
H51	COL	W	D	M	MA-SA	M-H	M	A	H
H71	SDY	W	SH	L	SLA	L	L	A	H
J11	CLY	M	D	H-VH	SA-MA	H	H	A	H
J13	CLY	M	D	H-VH	SA-MA	H	H	A	H
J14	CLY	M	D	H-VH	SA-MA	H	H	A	H
J15	CLY	M	D	H-VH	SA-MA	H	H	A	H
J16	CLY	M	D	VH	MA	H	H-VH	A	H
J17	CLY	M	D	VH	SA	M-H	H	A	H
J18	CLY	M	D	H-VH	SA-MA	M-H	H	A	H
J19	CLY	M	D	H	SA-MA	M-H	M-H	A	H
K11	CLY	M	D	H	SLA	H-VH	H	A	H
K12	CLY	M	D	H-VH	N	VH	H-VH	A	H
K13	CLY	M	D	H	N	VH	H	A	H
K14	CLY	M	D	H	SA	M	M	A	H
K21	FNL	W	D	H	MLK	VH	H	A	H
K22	FNL	W	D	H	MLK	VH	H	A	H
K31	FNL	W	D	H	N	VH	H	A	H
K32	FNL	W	D	H	N	VH	H	A	H
K41	FNL	M	D	H-VH	N	H	H	A	H
K46	FNL	M	D	VH	N	H	H-VH	A	H
K47	FNL	W	D	H	N	H	H	A	H
K51	COL	W	D	M	N	H-VH	M	A	H
K62	COL	W	D	M	N	VH	M	A	H
K71	SDY	W	D	L	MRK	VH	L	A	H
L11	CLY	M	D	VH	MA-SLA	H	H-VH	A	H
L12	CLY	M	D	VH	MA-SLA	H	H-VH	A	H
L13	CLY	M	D	VH	MA-SA	M-H	H-VH	A	H
L14	CLY	M	D	VH	MA	H	H-VH	A	H
L15	CLY	M	D	VH	SA	M-H	H	A	H
N41	FNL	W	SH	H	SLA	H	H	II	H
N51	COL	W	D	M	SLA-N	VH	M	A	H
N52	COL	W	D	-	MRK	-	-	A	H
N62	LSK	W	D	H	SLA-MLK	VH	H	A	H
N63	COL	W	D	M	N-MLK	VH	M	A	H
N65	LSK	W	D	H	N	VH	H	A	H
N66	LSK	W	D	H	N	VH	H	A	H
N72	SDY	W	D	-	MRK	-	-	A	H
N91	LSK	W	D	H	SLA-MLK	VH	H	A	H
N92	LSK	W	D	H	SLA-MLK	VH	H	A	H
O24	Pt	-	-	M-H	SLA	M-VH	M	A	H
O71	Pt	-	-	M-H	SLA-N	M-VH	M	A	H
R19	I,A	-	-	-	-	-	-	-	H
R51	V,A	-	-	-	-	-	-	-	H
R52	V,A	-	-	-	-	-	-	-	H
R53	V,A	-	-	-	-	-	-	-	H
T11	CLY	P	D	VH	MLK	VH	VH	A	H
T12	CLY	P	D	VH	N	VH	VH	A	H
T13	CLY	P	D	VH	N	VH	VH	A	H
T14	CLY	P	D	VH	N	VH	VH	A	H
T15	CLY	P	D	VH	SLA-N	VH	VH	A	H
T16	FNL	P	D	H-VH	SLA-N	H-VH	H-VH	A	H
T17	FNL	P	D	H	N	H	H	A	H
T21	FNL	P	D	H-VH	SLA-N	H-VH	H	A	H
T22	FNL	P	D	H	N	VH	H	A	H
T31	CLY	P	D	VH	SA	H	H-VH	C	H
T51	COL	P	D	L	MA	L	L	B	H
T52	COL	P	D	L	SA-MA	M-H	L	C	H
T62	FNL	P	D	H-M	N	VH	H-M	A	H
T91	LSK	P	D	M	VSA	VL	L	D	H
U13	CLY	M	D	VH	N	VH	VH	A	H
U21	FNL	M	D	H-VH	MA-MRK	VH	H	A	H
U31	FNL	M	D	H	N	VH	H	A	H
U64	COL	W	D	-	MRK	-	-	A	H

Attributes and Properties of Dominant Soil and Nonsoil Map Unit Components and the Rating of Potential to Reduce Acidity

Medium Potential

Map unit symbol	Kind of dominant soil or nonsoil component	Soil drainage class	Soil depth	Cation exchange capacity	Soil Reaction (pH)	Percent base saturation	Sum of exchange bases	Kind of substrate under soil	Rating of potential to reduce acidity
A71	SDY	W	D	L	N	VH	L	A	M
B71	SDY	W	D	L	N	VH	L	A	M
F11	CLY	M	SH	M-H	VSA	VL	L	B,III	M
G34	FNL	W	D	M-H	VSA	L-M	M-L	C	M
G35	FNL	W	D	M-H	VSA	L-M	M-L	C	M
H41	FNL	W	D	M-H	SA	M	M	B,III	M
H42	FNL	W	D	M-H	SA	M	M	B,III	M
H44	FNL	W	D	M-H	SA	M	M	B,III	M
H45	FNL	W	D	M-H	SA	M	M	B,III	M
H46	FNL	W	D	M-H	SA	M	M	B,III	M
M42	FNL	W	D	H	SA	L	M-L	III,B	M
M76	SDY	W	SH	L	MA	M	L	B,C	M
M93	LSK	W	D	M	SA	M	M	III,B	M
N42	FNL	W	D	M-H	MA-SLA	M-H	M	B	M
N71	SDY	W	D	L	SLA-N	H-VH	L	A	M
N73	SDY	W	D	L	SLA-N	H	L	A	M
N75	SDY	W	D	L	SLA-MA	M-H	L	A,D	M
001	Pt	-	-	M	VSA-MA	L-M	L-M	A	M
011	Pt	-	-	M	VSA-MA	L-M	L-M	B	M
012	Pt	-	-	M	VSA-MA	L-M	L-M	B	M
013	Pt	-	-	M	VSA-MA	L-M	L-M	B	M
014	Pt	-	-	M	VSA-MA	L-M	L-M	A	M
021	Pt	-	-	M	VSA-MA	L-M	L-M	A	M
023	Pt	-	-	M	VSA-MA	L-M	L-M	A	M
031	Pt	-	-	M	VSA-MA	L-M	L-M	A	M
033	Pt	-	-	M	VSA-MA	L-M	L-M	C	M
034	Pt	-	-	M	VSA-MA	L-M	L-M	A	M
035	Pt	-	-	M	VSA-MA	L-M	L-M	A	M
042	Pt	-	-	M	VSA-MA	L-M	L-M	C	M
051	Pt	-	-	M	VSA-MA	L-M	L-M	D	M
052	Pt	-	-	M	VSA-MA	L-M	L-M	A	M
061	Pt	-	-	M	VSA-MA	L-M	L-M	D	M
062	Pt	-	-	M	VSA-MA	L-M	L-M	A	M
072	Pt	-	-	M	VSA-MA	L-M	L-M	D	M
073	Pt	-	-	M	VSA-MA	L-M	L-M	D	M
074	Pt	-	-	M	VSA-MA	L-M	L-M	B	M
075	Pt	-	-	M	VSA-MA	L-M	L-M	D	M
076	Pt	-	-	M	VSA-MA	L-M	L-M	D	M
077	Pt	-	-	M	VSA-MA	L-M	L-M	D,C	M
078	Pt	-	-	M	VSA-MA	L-M	L-M	D,C	M
R29	II,B	-	-	-	-	-	-	-	M
R39	III,C	-	-	-	-	-	-	-	M
R54	II,B ,A	-	-	-	-	-	-	-	M

Low Potential

Map unit symbol	Kind of dominant soil or nonsoil component	Soil drainage class	Soil depth	Cation exchange capacity	Soil Reaction (pH)	Percent base saturation	Sum of exchange bases	Kind of substrate under soil	Rating of potential to reduce acidity
G12	CLY	W	D	M-H	EA	VL	L	C	L
G52	COL	W	D	L	SA	L	L	D	L
H91	LSK	W	D	M	SA	L-M	L	D	L
M71	SDY	W	D	L	EA	L	L	D	L
M72	SDY	W	D	L	SA-MA	L	L	D	L
M75	SDY	W	D	L	MA	M	L	D	L
M77	SDY	W	D	L	MA	M	L	D,A	L
M78	SDY	W	D	L	SA-MA	L	L	D	L
M81	SSK	W	D	L	SA	L	L	D	L
M91	SSK	W	D	M-L	SA-MA	L	L	D	L
M92	SSK	W	D	M-L	SA-MA	L	L	D	L
P91	LSK	W	D	M-L	VSA	VL	L	D	L
R47	IV	-	-	-	-	-	-	-	L
OC1	$Pt\text{-}Pt_Z$	-	-	M	EA-SA	EL-L	L	B,C	L
OC2	$Pt\text{-}Pt_Z$	-	-	M	EA-SA	EL-L	L	C	L
OC3	$Pt\text{-}Pt_Z$	-	-	M	EA-SA	EL-L	L	A	L
OC4	$Pt\text{-}Pt_Z$	-	-	M	EA-SA	EL-L	L	A	L
OC5	$Pt\text{-}Pt_Z$	-	-	M	EA-SA	EL-L	L	A	L

Lakes

Glaciers

Scale 1:2 000 000 (Main map)

40 0 40 80 120 160 Kilometres
20 0 20 40 60 80 100 Miles

Potential of Soil and Geology to Reduce Acidity of Incoming Acidic Deposition, Alberta

Map No. 2

N. Holowaychuk and R.J. Fessenden

Map to accompany Earth Sciences Report 86-1
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