LAND RESOURCE SURVEY

BIGSTONE INDIAN RESERVE

No. 166 B, C and D

Pedology Consultants 1982

LAND RESOURCE SURVEY
OF
BIGSTONE INDIAN RESERVES
#166B, #166C AND #166D

PREPARED FOR
Indian and Northern Affairs
Alberta Region
September 1982

PREPARED BY
K. J. Bessie, B.Sc., A.I.T.
A. G. Twardy, M.Sc., P.Ag.
A. L. Reid, B.Sc., P.Ag.

TABLE OF CONTENTS

TABLE OF CONTENTS, Continued . . .

LIST OF MAPS

TABLE OF CONTENTS, Continued . . .

1.0 INTRODUCTION

This Land Resource Survey is a continuation of the series conducted in 1980 and 1981 covering Alexander, Alexis, Beaver Ranch, Chipewyan, Clearwater River, Driftpile, Gregoire Lake, Sucker Creek, Wabamun and Bigstone #166A Indian Reserves, located throughout Northern Alberta (Figure 1).

The main objectives of these surveys were:

- to map soils of the entire Reserves at a semi-detailed level
- to map selected Core Areas at a detailed level*
- to interpret the soil information for settlement and agricultural uses
- to prepare, in addition to the Soil Maps, other maps showing
  - Present Land Use
  - Agricultural Capability
  - Settlement Suitability
  - Potential Land Use

A report which generally contains three main sections has been prepared for each of the Reserves. A "GENERAL" section is common to all reports and describes the role of soil investigations in planning, the mapping approach, the soil interpretation procedures. Then comes a "RESERVE" section that contains a description of the geographical setting and three sections, Reserve #166B, Reserve #166C, and Reserve #166D, which describes the key soils and discusses the prepared maps for each Reserve. The "APPENDICES" contain: brief descriptions of sites inspected and profile descriptions of key soils within each Reserve; guidelines used in rating the lands for different uses; definitions of soil symbols and textural, drainage, topographic and stoniness classes and a glossary of technical terms.

* Note: There were no core areas selected for Bigstone Indian Reserves #166B, #166C, and #166D.

GENERAL

2.0 GENERAL DESCRIPTION OF MAPPING PROGRAM

2.1 THE ROLE OF LAND RESOURCE SURVEYS IN DEVELOPMENT PLANNING

The soil resources of an area are one of the most important elements of the natural resource base, influencing both rural and urban development. Soil is the natural medium for the growth of plants; its properties and life serve to stabilize wastes and purify water; and it serves as a foundation for buildings, roads, playgrounds and all other man-made land-based structures. Knowledge of the soil resource and its ability to sustain development contribute to reducing development costs and help to avoid misuse of land. Such problems as malfunctioning septic tank sewage disposal systems, flood damages, footing and foundation failures, soil erosion, and stream and groundwater contamination are usually very costly to correct and may create grave personal hardships in comparison to the relatively simple steps required to avoid them. To assist in preventing misuse of the soil resource base, a comprehensive regional planning program is needed to examine how land and soils are presently used and how they can be used and managed better. A first requirement in regional planning is having a land resource survey which provides definitive data about the geographic location of various kinds of soils; about the physical, chemical and biological properties of these soils; and about the ability of these soils to support various kinds of rural and urban land uses.

For planning application, the following soils investigations are necessary to permit initial assessment on a uniform, areawide basis of:

- the engineering properties of soils as an aid in locating residential, commercial, agricultural and recreational developments.
- the biological properties of soils, including both agricultural and nonagricultural soil-plant relationships as an aid in establishing distribution patterns for permanent agricultural and recreational greenbelts and open spaces.

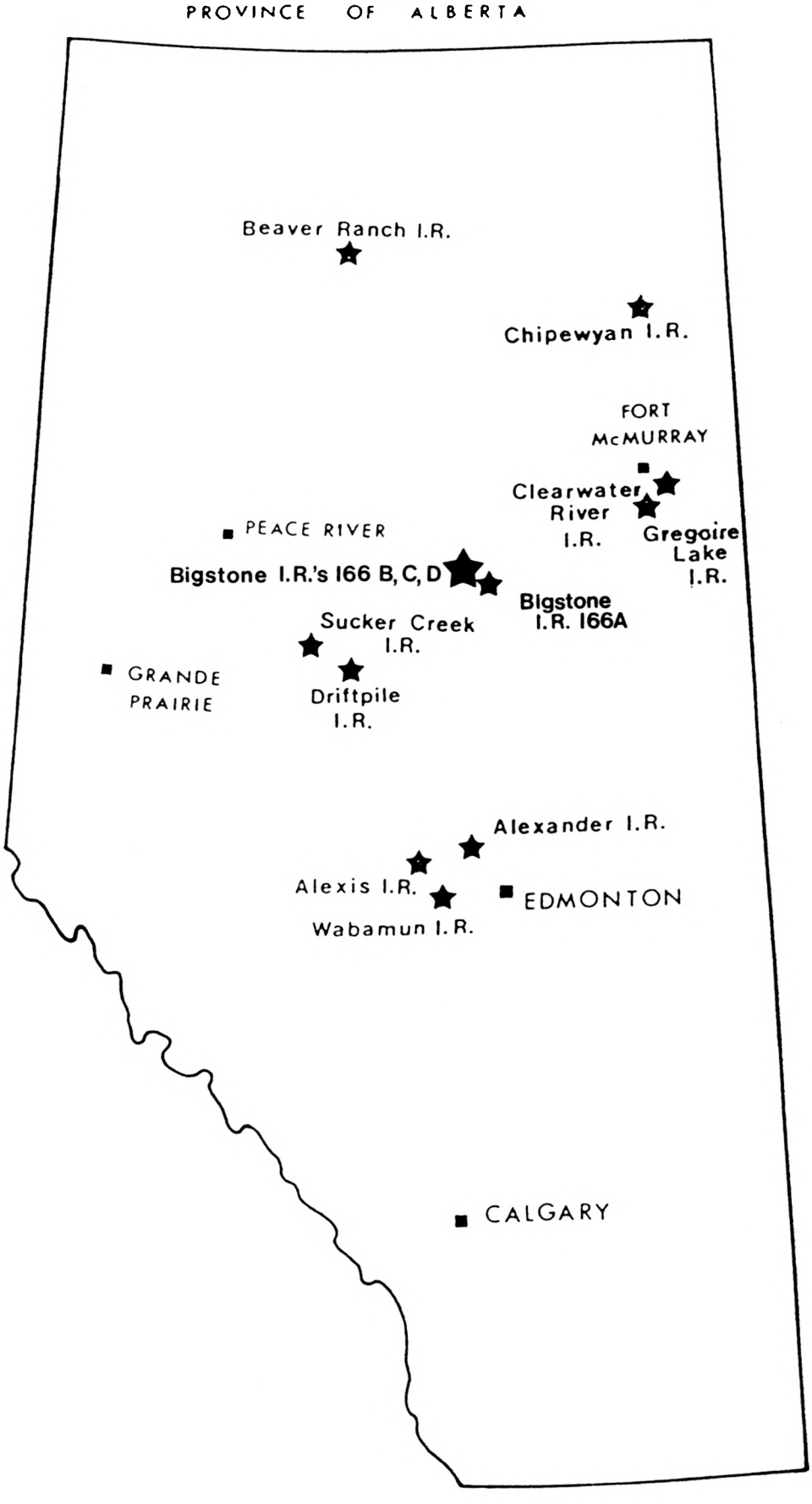


Figure 1. Locations of Indian Reserves.

- the suitability and limitations of soils for specific settlement applications, such as on-site sewage disposal facilities, foundations for buildings, road location, recreational facilities, and sewage lagoons and embankments as an aid in the planning and design of specific development proposals and in the application of such land-use plan implementation devices as zoning.
- the location of potential sources of sand, gravel, and other soil-related mineral resources.

Such an areawide soil resource survey is not intended to, and does not, eliminate the need for on-site engineering foundation investigations or the laboratory testing of soils in connection with the final design and construction of specific engineering works. Such an areawide study is intended to provide the means of predicting the suitability of land areas for various land uses and public works facilities and thereby to permit, during the planning stages, the adjustment of regional development patterns, broadly considered, to one important element of the natural resource base.

2.2 PREVIOUS STUDIES

Reconnaissance soil survey reports and maps published at a scale of 1:126,720 (1 inch to 2 miles) or 1:190,080 (1 inch to 3 miles) and Soil Capability for Agriculture, Canada Land Inventory Maps at a scale of 1:250,000 cover most Reserves. Both these sources of information have been used earlier, without more detailed field examination, to prepare one volume outlining the general agricultural capability and potential for crop production of all Indian Reserves in Alberta (Takyi and Pluth). Reconnaissance geological, surficial geology and hydrogeological studies have been published for most areas. All these provide valuable background information and they are suitable for land use planning at a broad level.

Other key sources of information include climatic data published by Environment Canada, and various publications, bulletins, pamphlets, etc. about farming prepared by the Provincial and Federal Departments of Agriculture.

In 1979, 1980 and 1981, Pedology Consultants conducted semi-detailed surveys of seven entire Indian Reserves, and detailed surveys of Core Areas of these seven plus six other Reserves. These reports contain soil maps as well as interpretive maps showing agricultural capability and soil suitability for a number of settlement uses. The semi-detailed survey of Bigstone Indian Reserves #166B, #166C, and #166D is a continuation of the same series.

2.3 MAPPING SYSTEMS

2.3.1 Soil Mapping

Soils are natural materials that differ greatly in properties from one location to the next and even within the same area. The purpose of soil survey is to identify, describe and delineate soil patterns in the landscape and to present the information to the user.

The soil surveyor makes point observations of soils and extrapolates the information to areas with the aid of aerial photographs and by using principles of pedology, geomorphology, surficial geology, hydrology, hydrogeology and vegetation pattern indicators. Soil map units are distinguished on the basis of prominent soil features including textures, depths, and kinds of soil parent materials, topography, soil moisture conditions, and soil profile development. Since soils change gradually from one type to another, soil units are described as having a certain range of properties and the attributes recognized in separating soil areas are those considered important for the intended kinds of intensities of land uses.

The soil have been classified and described according to standards established by the Canada Soil Survey Committee (1978). The two levels of mapping are employed and these are described briefly as follows:

1. Semi-detailed mapping of entire Reserves:

   - field mapping scale is 1:20,000 (maps may be reduced for presentation)
   - inspection density ranges from about 8 inspections per square mile on uplands to 2 inspections per square mile in lowlying wet areas
   - map units are given numerical symbols (e.g. 1, 2, 3, etc.) and they are described in the Legend
   - map units generally comprise two or more important soil types designated in the Legend as dominant, significant, and inclusions, representing more than 40% of a unit, 10 to 40%, and less than 10%, respectively
   - sampling density is sparse with only key soil parent materials being sampled for laboratory analysis

2. Detailed mapping of selected Core Areas:

   - field mapping scale is 1:5,000 (same scale used in presentation)
   - field inspection density is a minimum of 40 inspections to a depth of 1 metre or more per square mile
   - a limited number of 2 to 3 metre holes have been augered to measure water table levels
   - map units are identified by numbers and letters (e.g. 1a, 2a, 2b, 3a, etc.) and they are described in the Legend
   - map units generally comprise one dominant soil type but occasionally they have associated similar soils of significant extent or of minor occurrence
   - key parent materials have been sampled for laboratory analyses

The location of the sampling sites is presented on the Soil Maps, profiles are described in the Appendix, and the results of the analyses are tabulated in the report. Analyses have been conducted on the parent mateial samples tabulated in the report according to ASTM standards (ASTM, 1970) and include:

1. Soil Reaction (pH) which provides a measure of hydrogen ion activity, and gives an indication of nutrient availability and soluble carbonate content.
2. Soluble Sulphate which provides a measure of potential concrete corrosion hazard is analyzed where saline soils occur.
3. Particle Size Analysis (Hydrometer method) which provides soil texture information and is related to water holding capacity, erodibility, porosity, and bulk density.
4. Sieve Analysis and Atterberg Limits which characterize the engineering properties of the soils.

2.3.2 Present Land Use Mapping

Aerial photographs have been interpreted, and field checks made during the soil survey to determine categories of present land use for all the Reserves. These categories are displayed on the Present Land Use Map accompanying this report and include one or more of the following:

Hay Field (HF) - These are areas that have been cleared and are used for forage production.

Forested and Rough Pasture (F) - These are areas of forested land where no improvements have been made.

Bogs (B) - These are poorly drained, frequently ponded areas containing organic soils. Vegetation consists mainly of black spruce, birch, willow, sedges and mosses.

Delta (D) - This is a poorly drained, frequently ponded area between North and South Wabasca Lakes. It contains Gleysolic and Regosolic soils and willow, sedge and grass vegetation.

Settlement (S) - These are areas that have been cleared of forest cover and are predominantly occupied by residences.

As well as the above land uses, sand pits, open water, sloughs, and trails have been noted on the Present Land Use Map.

The Present Land Use Map is intended as a base to monitor the progression of agricultural and other development projects. By superimposing the capability and suitability maps, areas can be selected with potential for development.

2.4 INTERPRETIVE CLASSIFICATION SYSTEMS

2.4.1 The Soils Input

Growing public awareness of the need for a conservation ethic, increased demand and higher prices for land, and land use conflicts have necessitated rapid development and refinement of land use planning skills. It is very important that in making decisions concerning land use, land suitability information should carry its weight along with political, economic and social factors that are often the major, if not the only, considerations.

For Soil Maps and their associated descriptions of the soils to be most useful, they must be appropriately interpreted and generalized. Two primary steps in technical application of soil survey are:

1. Interpretation of the individual soil types for the desired uses.

   Example: Consider a well drained Orthic Gray Luvisol developed on clay loam till occurring on undulating topography.

   This soil can be assigned definite ratings depending on the specifications (as outlined in Appendix A) required for the desired uses (housing, road location, etc.)

2. Interpretation of map units for the desired uses.

   Example: Consider a map unit which contains dominantly well drained Orthic Gray Luvisols in the uplands and significant extents of poorly drained Orthic Humic Gleysols in depressions, all developed on till with gently rolling topography.

   These two main soil types can be assigned separate ratings which are considerably different; however, for planning purposes one overall rating is often desirable. In such instances, one or more limitation given to a map unit may apply to the different soils occurring within that map unit. The overall rating either coincides with the rating of the dominant soil or it may be downgraded one class if a clearly inferior soil occupies a significant portion of the unit.

It is extremely important that the user of interpretive maps appreciate the significance of the two steps previously outlined. In detailed mapping a great effort is made to separate different soil types, in terms of suitability for desired uses, thus making interpretation generally straightforward. When a soil has characteristics which are borderline between two classes the final rating is determined by judgement.

In semi-detailed and more general mapping, contrasting soil types are often necessarily combined in one map unit. The land use planner or other users must therefore deal with land patterns rather than with individual soils. This is why semi-detailed and more general maps are suited only to "conceptual planning". Design and implementation require detailed mapping as a prerequisite. With this information it is possible to fit land uses to the capabilities of the soil in the most efficient and least destructive manner.

2.4.2 Agricultural Capability Classification

The soils are rated for agricultural capability according to the Canada Land Inventory guidelines (Canada Land Inventory, 1972). In this system, the mineral soils are grouped into seven classes according to their limitations for agricultural use. The first three classes are capable of sustained production of common cultivated crops; the fourth class is considered marginal; the fifth is capable of use for improved pasture and hay production; the sixth is capable of use for unimproved pasture; and the seventh class has no capability or potential for agricultural use.

The classes, the broadest category in the system, are an assessment of the degree or intensity of limitation. For example, a Class 4 soil has limitations which are more severe than a Class 3 soil. The second category, the subclass, describes the kind of limitation responsible for the class designation. Thus, when used together, the class and subclass provide information about the degree and kind of limitation. This information is useful for land use planning, and for determining conservation and management requirements for groups of farms when mapping is at a semi-detailed level.

The seven classes are broadly defined as follows:

Class 1 - these soils have no significant limitations to use for crops.

Class 2 - these soils have moderate limitations that restrict the range of crops or require moderate conservation practices.

Class 3 - these soils have moderately severe limitations that restrict the range of crops or require special conservation practices.

Class 4 - these soils have severe limitations that restrict the range of crops that can be grown or require special conservation practices to overcome, or both.

Class 5 - these soils have very severe limitations that restrict their capability to producing perennial forage crops and improvement practices are feasible.

Class 6 - these soils are capable only of producing perennial forage crops and improvement practices are not feasible.

Class 7 - these soils or land types have no capability for arable culture or permanent pasture.

Organic - Organic soils are not rated in the Soil Capability for Agriculture System, but they have severe limitations and are considered equivalent to Class 6.

It must be emphasized that soils within a capability class are similar only with respect to the degree or intensity of limitation, and not the kind of limitation. Each class includes many different kinds of soils, and many of the soils within any one class may require different management practices.

The subclass is a grouping of soils with the same kind of limitation. Seven different kinds of limitations are recognized as a result of adverse climate, soil, or landscape characteristics. The limiting effects of the climate are considered first since they affect the initial capability class or degree of limitation on a broad sub-regional basis. Next the soil and landscape limitations are considered.

The limitations, due to unfavorable soil and landscape characteristics, are:

C - adverse climate

D - adverse soil structure

F - low natural fertility

I - inundation (flooding) by streams

M - low available moisture holding capacity

S - a combination of two or more of the subclasses

T - adverse topography because of steepness or pattern of slopes

W - excessive soil moisture

Subclass C: adverse climate

This limitation applies to soil areas where the length of the frost-free period or the shortage of degree days are the major limitations to agriculture.

Subclass D: undesirable soil structure and/or low permeability

Often soils with eluviated (leached) surface horizons and illuviated (clay enriched) subsurface horizons exhibit structural limitations. The degree or intensity of limitation depends largely on the degree of development of these horizons, although the nature of the parent material (texture) provides some modifying effects.

The structure of eluvial horizons is quite unstable, and when cultivated, these horizons tend to pulverize easily. Eluvial horizons, such as the surface horizons of the Gray Luvisolic soils which are low in organic matter content, are the least stable. When wet, these soils tend to flow and "puddle" and are very susceptible to erosion even on gently rolling topography. On drying, these soils are subject to crusting, which tends to inhibit seedling emergence and tillering, and may restrict soil aeration.

The illuvial horizons or subsoil of some soils also present structural limitations that are restrictive to internal drainage and root penetration. These horizons occur in Luvisolic and Solonetzic soils of Alberta. The very compact nature of these horizons restrict root development and penetration, and when near the surface, makes maintenance of good tilth difficult. Root and moisture penetration is severely restricted resulting in a shallow root zone.

Subclass F: low natural fertility

Occasionally the natural fertility of soils is low due to one or more of these conditions: lack of available nutrients, high acidity or alkalinity, low exchange capacity, high levels of calcium carbonate or presence of toxic compounds.

Subclass I: inundation by streams or rivers

This limitation applies to soils subject to inundation (flooding) by streams or rivers, but not to depressional areas subject to ponding. The degree of limitation depends on the frequency of inundation.

Subclass M: low available moisture holding capacity

The available moisture holding capacity of soils is primarily evaluated on the basis of texture. That is, as the amount of clay decreases (sand and silt increases), the moisture holding capacity decreases and the degree of limitation increases. Also, the degree of limitation becomes more severe as climatic moisture decreases, and as the organic matter content of the surface horizon decreases.

Subclass T: adverse topography, both steepness of slopes and pattern

This subclass applies to areas where topography is considered to be a limitation to agricultural use. Assessment of this limitation includes evaluation of the hazards imparted to cultivation by the degree of slope as well as those due to irregularity of field patterns and lack of soil unifor-

mity as a result of complex landform patterns. For example, areas of hummocky terrain with numerous knolls and poorly drained depressions have cumulative limitations which not only affect the ease of cultivation because of steep slopes, but also increase the difficulty of management (seeding and harvesting). The degree or intensity of limitation increases with the slope angle as well as the complexity of the landscape pattern. Generally, long simple slopes are not as restricting to agricultural use as are complex slopes of comparable degree.

Subclass W: excessive moisture

This subclass limitation applies to soils where excess moisture is a limitation, but does not include wetness due to inundation. Excessive moisture may be the result of poor soil drainage, a high water table, seepage, or the collection of run-off from surrounding areas. The degree of limitation is dependent on the duration of the period that these soils remain wet as it affects the timing of cultivation, seeding and harvesting.

2.4.3 Soil Interpretations for Settlements

Soil is the oldest and most used construction material. Information regarding the behavior of soils is of vital importance when selecting and planning new developments to avoid costly errors. The prime function of soil survey interpretations for engineering use is one of providing information on soil character and behavior as an adequate and reliable basis of design and construction (Aandahl). The interpretations can be very useful in predicting performance and identifying problem areas when planning new developments such as roads, airports, residential areas, commercial areas, and parks. The information provided by soil surveys is not intended to be site specific, nor does it serve as a substitute for on-site investigations. The intent is to provide a basis for area planning, to identify problem areas, to reduce the amount of further investigations, and to minimize costs. The interpretations are evaluations of performance, and not recommendations for use.

These interpretations are based on the Guide for Interpreting Engineering Uses of Soils published by United States Department of Agriculture, Soil Conservation Service (1972), and those used by Coen et al. (1976). These evaluations consider such soil properties as: texture, which affects the stability and bearing strength for roads and foundations, shrink-swell potential, risk of frost heave, and the rate of infiltration and internal drainage; soil moisture conditions, which affect the location of buildings, roads, and services; and soluble salt content, which affects concrete foundation construction. Several terms used to describe soil such as texture, structure and consistence differ in meaning between pedology and engineering. The pedological definitions are used in this report, many of which are in the Glossary (Appendix C).

The Soil Map Units recognized in each Reserve and Core Area are grouped into three categories according to their constraints or suitabilities for settlement uses. The categories are:

Low Constraints (Highly Suitable) - These are lands which generally have favorable soil, topographic and drainage conditions for most settlement uses. There are few problems expected since there are few potentially troublesome conditions identified.

Moderate Constraints (Moderately Suitable) - These are lands which have some favorble and some troublesome conditions, largely determined by soil, drainage and topographic conditions. With careful planning, design and management and possibly higher costs, the problems can be overcome.

Severe Constraints (Marginally Suitable to Unsuitable) - These are lands which generally have few favorable conditions and many troublesome conditions. The most common problems are due to wetness (poor drainage, high water tables or flooding), to rugged topography, or to the presence of organic soils. Costs of overcoming these problems, even with careful planning, design and good management, will generally make the proposed use questionable.

In this study, all Soil Map Units are evaluated, in table form, with respect to degree (Low, Moderate, Severe) and kind (flooding, low permeability, excessive slope, etc.) of constraint for various single purpose settlement uses (housing, septic tank field location, road location, etc.).

Settlement Suitability represents the combined evaluation of several single purpose uses which have similar requirements in terms of soils, topographic and drainage conditions. The single purpose uses include housing (with and without basements), subgrade conditions, septic tank field location, road location, and recreational uses (camping and picnic areas, and hiking trails). Key items affecting the different uses are outlined in Table 1 in the form of a checklist. Detailed guidelines for assessing soils for the specific uses are given in Appendix B.

The Settlement Suitability Map shows areas of Low, Moderate and Severe degrees of constraints, as well as the corresponding kinds of constraints, e.g. wetness (W), inundation (I), topography (T), etc.

Evaluations of soils for location for sewage lagoons and as a source of sand and gravel, are given separately in the Legend since requirements for these purposes are considerably different from requirements for the other settlement uses.

Also, the soils are rated as good (G), fair (F), poor (P), or unsuitable (U), sources of sand and gravel.

Table 1. Checklist for Assessing Soil Constraints for Settlement Uses.

This checklist indicates which soil and landscape characteristics are considered in evaluating soils for important settlement uses.

The reader is referred to Appendix B for detailed guidelines used in determining degrees of constraints for each use.

Key Items Affecting Use	Settlement Uses				
	Single Family Dwellings	Septic Tank Absorption Fields	Road and Parking Lot Location	Road Subgrade Material	Recreation Uses
Flooding	X	X	X		X
Soil Drainage	X	X	X	X	X
Water Table Depth	X	X			X
Slope	X	X	X	X	X
Volume Change Potential	X		X		
Unified Soil Group	X		X	X	X
AASHO Group Index			X	X	
Permeability		X			X
Frost Heave Potential	X		X		
Depth to Consolidated Bedrock	X	X	X		
Sulphate Content	X				

RESERVES

3.0 DESCRIPTION OF THE BIGSTONE INDIAN RESERVES #166B, C, AND D

Location and Extent

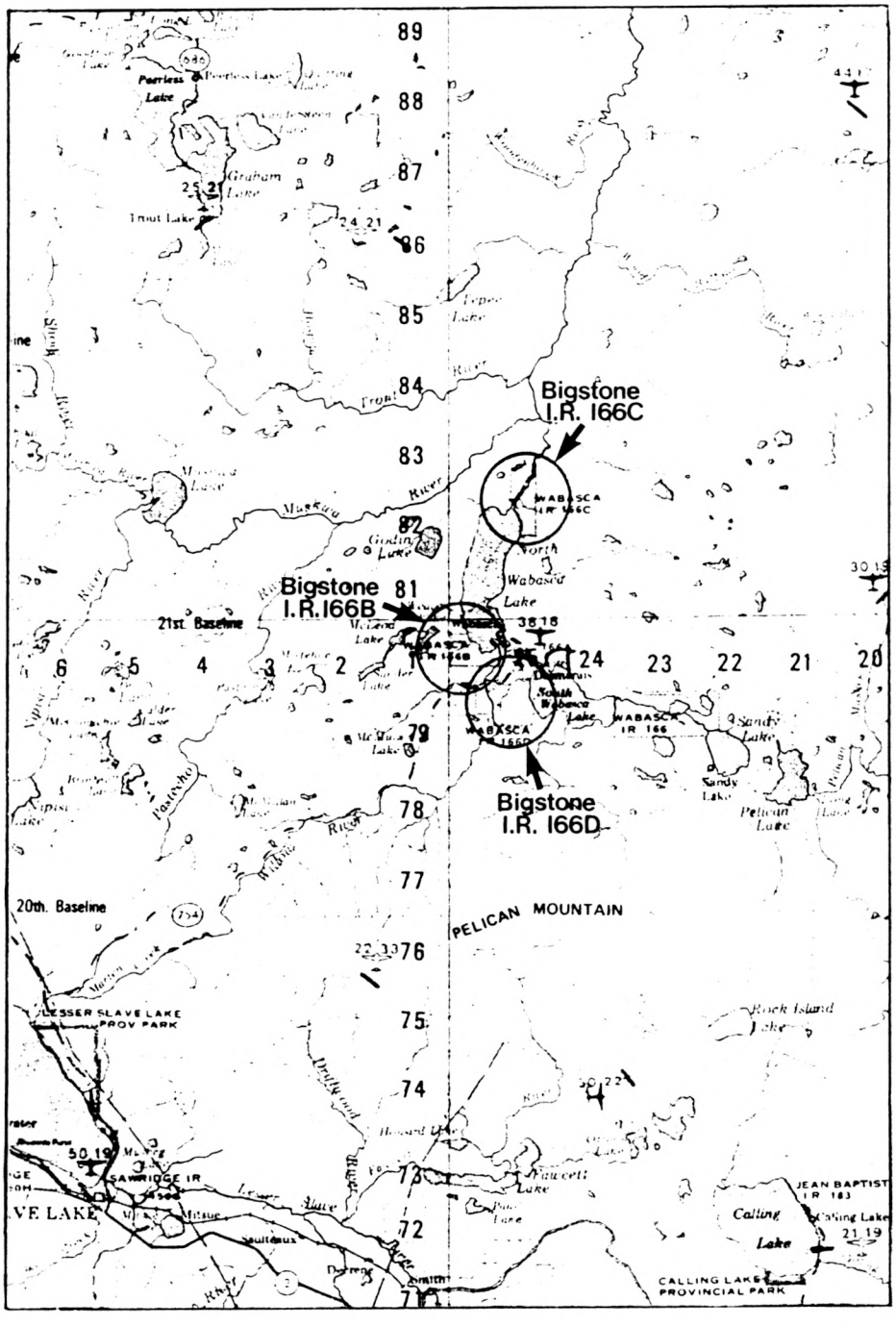
The Bigstone Indian Reserves #166B, C, and D are located about 130 kilometres (80 miles) northeast of Slave Lake, Alberta. They cover approximately 2,400 hectares (5,920 acres), 2,920 hectares (7,200 acres), and 5,980 hectares (14,780 hectares) respectively. Reserves #166B and #166C are located along North Wabasca Lake. Reserve #166C, the furthest north, is within Township 25, Ranges 82 and 83, and #166B is within Township 26, Range 80. Reserve #166D is along South Wabasca Lake within Townships 79 and 80, Range 25. All of the Bigstone Reserves are west of the 4th Meridian.

Physiography and Drainage

The landscape ranges from level to moderately rolling. The majority of the soils are developed on either glaciolacustrine deposits or organic deposits (bogs and fens) over glaciolacustrine deposits. Other soil parent materials that occur within the study areas are: glaciofluvial deposits, till, lacustrine deposits, fluvial- lacustrine deposits, and recent fluvial deposits.

Differences in soil characteristics, drainage, and local topography resulted in the separation of sixteen principal soil map units plus five minor miscellaneous units; stream channels, sand pits, sloughs, open water, and escarpments. These are all described in more detail in Sections 5.2, 6.2 and 7.2.

Elevations within the Reserves range from 545 m (1,790 ft) to 565 m (1,850 ft) above sea level.



Location Map of Bigstone Indian Reserves 166B, C, and D

The surface drainage of the Reserves is towards the north, heading eventually to the Arctic Ocean. Reserve #166D is drained primarily into North Wabasca Lake by Willow River, although some minor streams drain into South Wabasca Lake. Reserve #166B is also drained into North Wabasca Lake by small streams. Wabasca River drains north out of North Wabasca Lake through Reserve #166C.

Geology

The La Biche Formation of Upper and Lower Cretaceous age underlies the entire study area. This formation consists of marine dark gray shale and silty shale with ironstone partings and concretions.

Climate

The climate of the area is continental, characterized by relatively warm summers and cold winters. Climate recording stations within or near the study area indicate the annual precipitation to be approximately 470 mm (18.5 inches) (Environment Canada, 1975). Of this amount, about 60 percent falls during the growing season from May to August (Table 3). The rainfall peak is reached in July, the period of maximum vegetative growth.

The mean annual temperature in the area is approximately 3 degrees Centigrade. January is the coldest month with a mean of -18 degrees Centigrade; July is the warmest month with a mean temperature of 16 degrees Centigrade (Table 2).

Table 2. Mean Daily Temperatures (1941-1970)*

Station	Elevation (m)	J	F	M	A	M	J	J	A	S	O	N	D	Frost-Free Period Days-Date /1	Degrees Days (5) /2
Slave Lake	586	-17.7	-14.1	-7.1	2.4	9.1	13.1	15.7	14.1	9.2	3.4	-5.8	-13.9	82; 6/7-8/29	1,210.3
Wabasca	-	-18.6	-14.4	-8.2	2.0	9.7	14.3	16.9	15.3	9.7	4.1	-6.4	-13.9	-	-

/1 Average Based on 1941-1970 period of record
/2 Degree days greater than 5 C

Table 3. Monthly and Annual Precipitation Data (1941-1970)*

Station	Elevation (m)	Precipitation (mm) May	June	July	Aug.	Sept.	May-Sept.	Annual
Slave Lake	586	45.2	67.8	79.5	65.5	44.2	30.2	472.6

* Environment Canada, 1975

Vegetation

The study area lies within the Moist Mixedwood Subregion of the Boreal Mixedwood Ecoregion (Strong and Leggat, 1979). The dominant tree species are aspen, black spruce and white spruce.

The understory vegetation is diverse and consists of such species as reed grass, wild rye, dogwood and willows.

Throughout the Reserves, there are many peaty wet depressions that vary in size from a few hectares to several hectares. Two distinct vegetation communities exist on these depressions: sedge fens support sedge, slough grasses, willow, dwarf birch, and alder; moss bogs support black spruce, tamarack, Labrador tea, sphagnum and plume mosses.

4.0 METHODS

A semi-detailed soil survey was conducted on the Bigstone Indian Reserves #166B, #166C and #166D. The soils were inspected at 52, 78 and 125 sites, respectively (see Appendix A). Ten samples of representative parent materials were obtained for laboratory analysis. The Soil Maps are presented on uncontrolled air photo mosaics (1976 photos) at a scale of 1:20,000 (back pocket).

5.0 BIGSTONE INDIAN RESERVE #166B

5.1 PRESENT LAND USE

A Present Land Use Map (page 25) was mapped at 1:20,000 and reduced to page size (1:50,000). The background, a photo mosaic, enables one to see the roads, lakes and streams. The Legend for this map lists the main types of land use encountered and the Explanation of Legend below describes the units in more detail.

Explanation of Legend

Settled Lands (S) - These are areas that have been cleared of forest cover and are predominantly occupied by residences.

Forested and Rough Pasture (F) - These are areas of forested land where no improvements have been made.

Bogs (B) - These are poorly drained, frequently ponded areas containing Gleysolic and Organic soils. Vegetation consists mainly of black spruce, birch, willow, sedges and mosses.

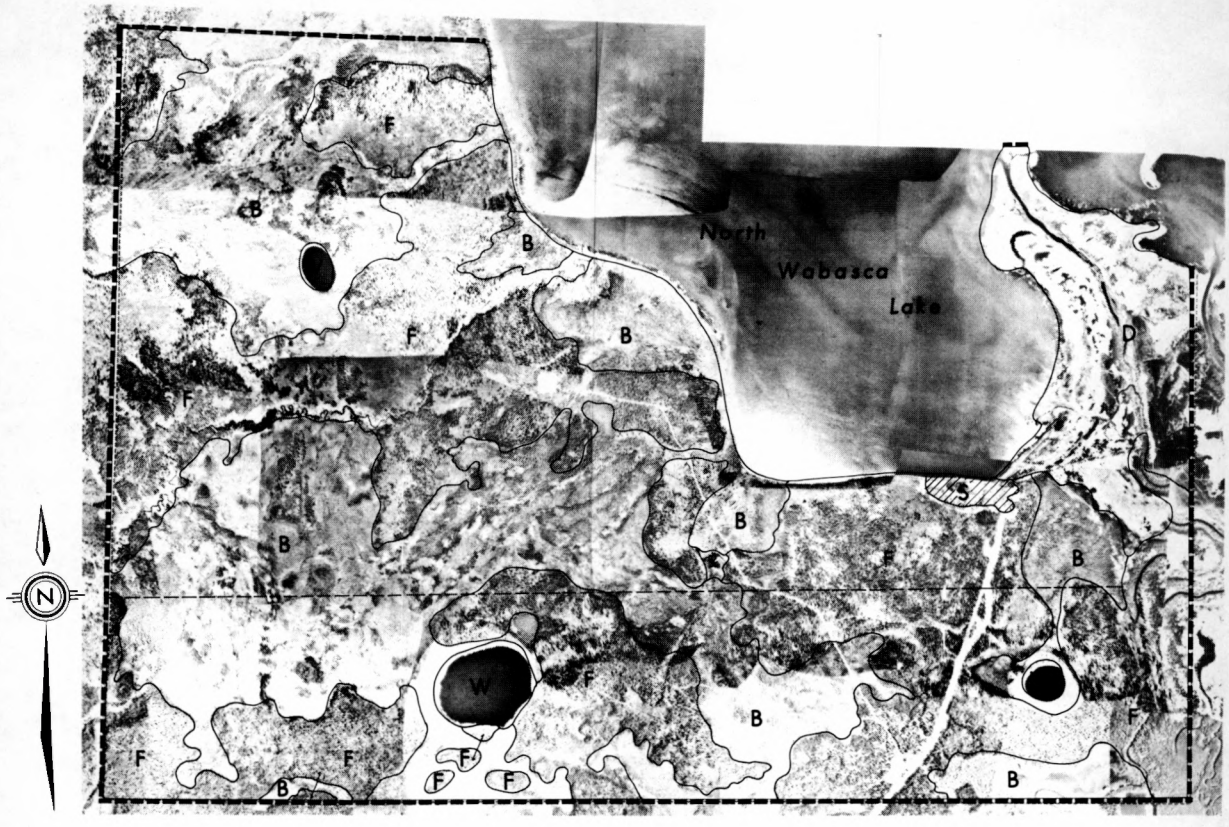
Delta (D) - These are poorly drained, frequently ponded areas located near North and South Wabasca Lakes that contain Gleysolic and Regosolic soils. Vegetation consists mainly of willow, sedges and mosses.

Water (W) - This symbol indicates open bodies of water.

Slough (*) - These are poorly drained, frequently ponded areas that support mainly sedge vegetation.

-------- - Cutlines and trails.

PRESENT LAND USE
BIGSTONE INDIAN RESERVE No. 166 B



SCALE
1 : 50,000
0 200 1000 2000
metres

LEGEND

S - SETTLED LAND
F - FORESTED
B - BOG
D - DELTA
W - OPEN WATER
- SLOUGH
- - - - CUTLINES AND TRAILS

PREPARED FOR
INDIAN AND NORTHERN AFFAIRS ALBERTA
BY

Pedology Consultants

5.2 SOILS

In accordance with standard procedures (CSSS, 1978), important soil characteristics including parent material, texture, drainage and surface stoniness along with landscape features such as topography (slope expression and pattern), have been recognized.

Field Investigations revealed the presence of six major soil forming parent materials in Reserve #166B that have been separated into nine map units due to differences in soils, topography and drainage. The soil map units plus three miscellaneous map units, stream channels, slough and open water, are described below. Detailed profile descriptions of some of the dominant soils are provided in Appendix A.

Soils on Glaciofluvial Deposits

Sandy to silty clay loam, non-stony to very stony glaciofluvial deposits. The sandier material tends to occur on ridged, moderately rolling topography whereas the silty material occurs on gently undulating to undulating topography. The sands are rapidly permeable, have a low shrink-swell potential, a low frost heave potential and are classified as SM according to the Unified Classification. The finer textured deposits are moderately permeable, have a low to medium shrink-swell potential, a medium frost heave potential and are classified as CL according to the Unified Classification. Sulfate content is negligible in both the sandy and finer textured deposits.

Differentiating characteristics of the map units on glaciofluvial material are:

Map Unit	Dominant Soil Subgroup*	Dominant Texture	Drainage	Slope
1	Eluviated Eutric Brunisols	LS-S	rapidly	10-15%
2	Orthic Gray Luvisols	FSL-SiCL	well-rapidly	0-5%

Soils on Till Deposits

Loam to clay loam, slightly to moderately stony till deposits occurring on gently rolling topography. The till material is ML or CL according to the Unified Classification. It is moderately permeable and has a medium shrink-swell potential and frost heave potential. Sulfate content is negligible and should pose no problem to concrete.

Only one map unit on till material was recognized. It has the following distinguishing features:

Map Unit	Dominant Soil Subgroup	Dominant Texture	Drainage	Slope
3	Orthic Gray Luvisols	L-CL	moderately well	6-9%

Soils on Glaciolacustrine Deposits

A large portion of Bigstone Indian Reserve #166B is comprised of soils developed on silty clay to heavy clay, non-stony glaciolacustrine deposits. Topography is characteristically level to undulating and depressional. The glaciolacustrine sediments have slow permeabilities, high shrink-swell potential, and medium frost heave potential. They are rated as CH in the Unified System, as HC in the USDA System and A-7-6(20) in the AASHO Classification System. Sulfate content is sufficient in places to cause a positive attack on concrete, unless corrective measures are taken.

Distinguishing characteristics of the glaciolacustrine map units are:

Map Unit	Dominant Soil Subgroup	Dominant Texture	Drainage	Slope
4	Orthic Gray Luvisols	SiC-C	moderately well	0-5%
5	Gleyed Gray Luvisols	SiC-C	imperfectly	0-5%
7	Peaty Orthic Gleysols	SiC-C	very poorly	0-2%

Soils on Fluvial-Lacustrine Deposits

These are non-stony, silty clay deposits on depressional to gently undulating land which originated from the combined actions of moving water and ponded water after glaciation. These materials are subject to flooding during the spring snow-melt and are affected by a high groundwater table. They are classified as CH by the Unified Classification, have a slow permeability, a high shrink-swell potential and a medium frost heave potential. Sulfates are negligible.

In Reserve #166B, one map unit on this parent material is recognized. It has the following characteristics:

Map Unit	Dominant Soil Subgroup	Dominant Texture	Drainage	Slope
12	Rego Gleysols	SiC	very poorly	0-2%

Soils on Recent Fluvial Deposits

Non-stony, stratified, silt loam and fine sandy loam recently deposited fluvial materials occurring on nearly level to undulating topography. These areas are subject to flooding during the spring snow-melt and after heavy rains and are affected by a seasonally high water table. They are rapidly to moderately permeable, have a low to medium shrink-swell and frost heave potential and are classified as SM to CL in the Unified Classification System.

The one map unit is characterized as follows:

Map Unit	Dominant Soil Subgroup	Dominant Texture	Drainage	Slope
13	Gleyed Regosols	SiL-FSL	imperfectly	0-5%

Soils on Organic Deposits

A large portion of the area contains very poorly drained depressional and gently sloping areas with accumulations of 0.5 to 1.2 m or more of moss and sedge peat overlying silty clay to clay glaciolacustrine material. The peat is usually moderately decomposed but in some cases, where the topography is gently sloping the peat is well decomposed.

All Organic soils are grouped into one map unit which has the following features:

Map Unit	Dominant Soil Subgroup	Texture	Drainage	Slope
16	Terric and Typic Mesisols	-	very poorly	0-2%

Miscellaneous Units and Symbols

Stream Channels (SC)

This unit includes the banks, meander scars and channels of streams. The banks are commonly steep, and the valley bottom is affected by seasonal flooding, making these areas unsuitable for most uses. A natural vegetative cover should be maintained to minimize soil and geological erosion.

Sloughs (⁂)

Areas which consist predominantly of sedge and have water tables at or near the surface.

Open Water (Ō)

Bodies of water with little or no surface vegetation.

5.3 LABORATORY ANALYSIS

Laboratory analyses were conducted on representative glaciolacustrine and glaciofluvial samples collected in the Reserve. The results are described in Table 4 (B-11, B-37, B-51). This information is used to aid in characterizing the soil materials and in making soil interpretations.

TABLE 4. Laboratory Test Data and Classification of Selected Soils within the Bigstone Indian Reserves 166B, 166C and 166D.

SOIL MAP UNIT	INSP.* SITE#	DEPTH (cm)	pH (H_2O)	EC	% SO_4	% Passing Sieve #4	#10	#40	#200	% Smaller than #270 (0.05mm)	0.002mm	Atterberg Limits Liquid Limit	Plasticity Index (PI)
1	C-43	70-100	6.7	1.3	-	87	81	41	17	16	8	NL	NP
2	B-11	60-100	5.7	0.2	-	100	99	94	32	27	14	22	9
2	D-52	80-100	4.7	0.3	-	100	100	100	98	92	26	34	19
3	C-63	70-100	4.8	0.2	-	100	99	94	69	61	32	29	8
4	B-37	60- 90	4.5	3.0	0.153	100	100	100	98	92	74	83	54
4	B-37	90-120	6.9	6.2	0.502	-	-	-	-	-	-	-	-
4	B-51	70-100	7.2	2.5	0.139	100	100	100	98	94	70	65	40
5	C-25	80-110	6.9	1.4	-	100	100	98	84	76	62	58	37
5	D-7	80-100	6.0	0.2	-	100	100	100	98	92	74	55	29
9	D-33	80-100	6.4	0.4	-	100	100	99	98	88	38	59	34

SOIL MAP UNIT	INSP.* SITE#	DEPTH (cm)	SAT. %	CLASSIFICATION UNIFIED	AASHO	USDA	PERMEABILITY (1)	SHRINK-SWELL POTENTIAL (2)	FROST HEAVE POTENTIAL (3)
1	C-43	70-100	17	SM	A-1-b(0)	LS	R	L	L
2	B-11	60-100	26	SM	A-4(1)	SL	R	L	L
2	D-52	80-100	42	CL	A-6(16)	SiL	M	L-M	M
3	C-63	70-100	37	CL-ML	A-4(7)	CL	M	L-M	M-H
4	B-37	60- 90	78	CH	A-7-6(20)	HC	S	H	M
4	B-37	90-120	73	-	-	-	S	H	M
4	B-51	70-100	74	CH	A-7-6(20)	HC	S	H	M
5	C-25	80-110	63	CH	A-7-6(20)	HC	S	H	M
5	D-7	80-100	71	CH	A-7-6(19)	HC	S	H	M
9	D-33	80-100	73	CH	A-7-6(20)	SiCL	S	H	M

(1) Permeability Classes

S - Slow; less than 0.5 cm/hr
M - Moderate; 0.5 to 1.5 cm/hr
R - Rapid; more than 1.5 cm/hr

(2) Shrink-Swell Potential

L - Low
M - Medium
H - High

(3)+ Frost Heave Potential

L - Low; F1 & F2 frost groups
M - Medium; F3 frost group
H - High; F4 frost group

+ from U.S. Army Corps of Engineers, 1962.

* The letter before the numerical digit indicates Reserve number;
ex B = 166B Reserve
C = 166C Reserve
D = 166D Reserve

5.4 AGRICULTURAL CAPABILITY

Soil capability for agriculture is displayed on the Agricultural Capability Map, Bigstone Indian Reserve #166B (page 33) and in Table 5.

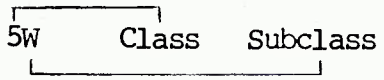
The Reserve lies within Agro-Climatic Zone 3H. Limitations such as undesirable soil structure (D), inundation (I), excessive wetness (W), moisture deficiency problems (M), adverse topography (T), and the presence of Organic soils (O), further limit the agricultural capability to as low as Class 7.

Table 5. Agricultural Capability Ratings of the Bigstone Indian Reserve #166B.

Capability Class	Subclass	Map Unit
4	4D	2, 3, 4
	4^{D}_{W}	5
5	5W	6
	5^{I}_{W}	13
6	6W	7, 12,
	6^{M}_{T}	1
	6^{I}_{W}	SC
7	7W	12, O
O	O	16

EXPLANATION OF AGRICULTURAL CAPABILITY MAP LEGEND

NOTATION:



AGRICULTURE CAPABILITY CLASSES

Class 4 - these soils have severe limitations that restrict the range of crops that can be grown or require special conservation practices to overcome or both.

Class 5 - these soils have very severe limitations that restrict their capability to producing perennial forage crops and improvement practices are not feasible.

Class 6 - these soils are capable only of producing perennial forage crops and improvement practices are not feasible.

Class 7 - these soils or land types have no capability for arable culture or permanent pasture.

O - Organic soils not rated for agriculture.

SOIL CAPABILITY SUBCLASSES

Soil Limitations:

Subclass D - undesirable soil structure and/or slow permeability

Subclass M - low moisture holding capacity

Landscape Limitations:

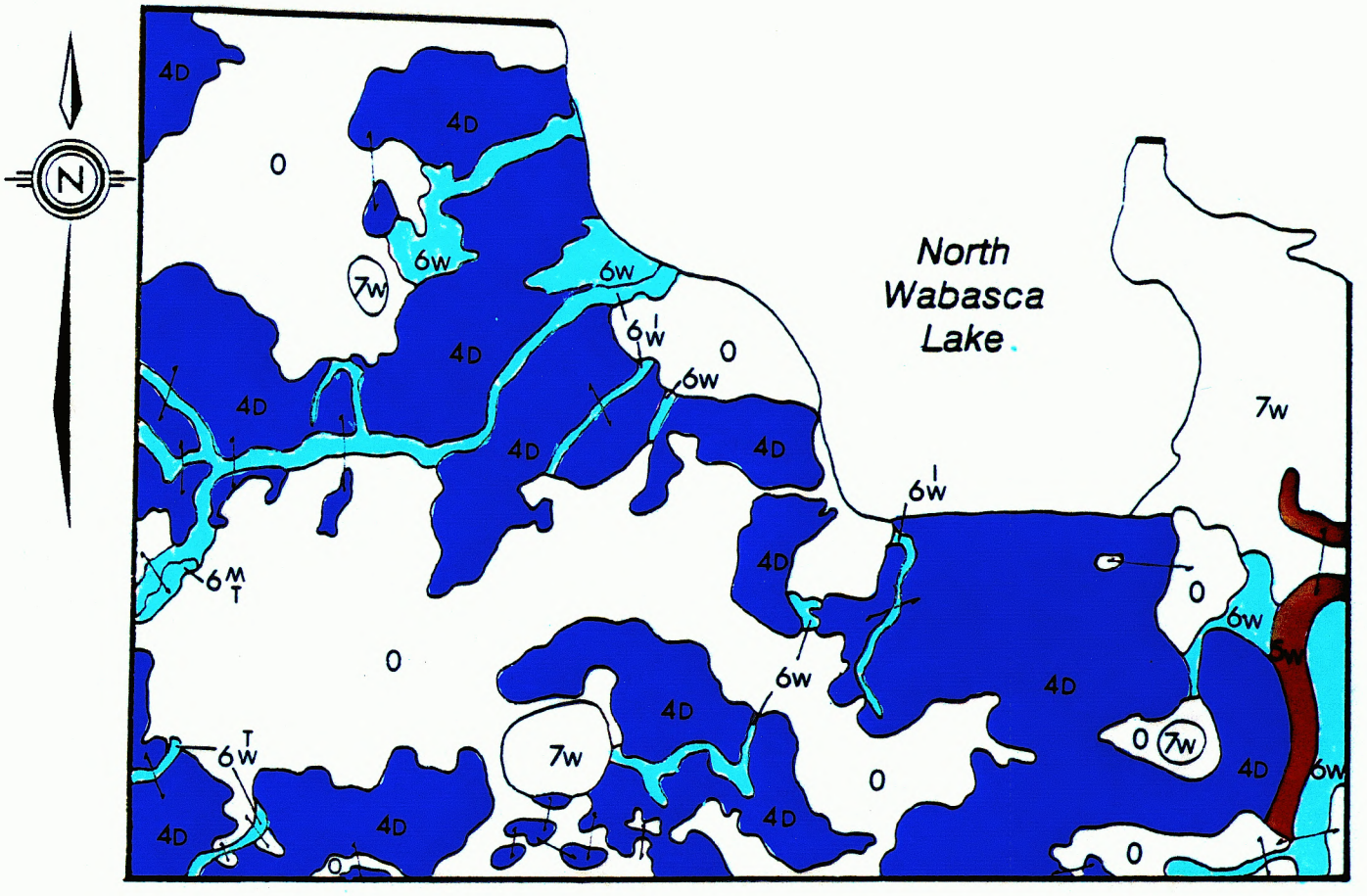
Subclass I - inundation (flooding)

Subclass T - adverse topography, both steepness and pattern

Subclass W - excessive moisture

AGRICULTURAL CAPABILITY

BIGSTONE INDIAN RESERVE No. 166B



LENCO DRAFTING

SCALE: 1:50,000

LEGEND:

- Class 4
- Class 5
- Class 6
- Classes 7 & 0

(see page 32)

PREPARED FOR
INDIAN AND NORTHERN AFFAIRS ALBERTA
BY

Pedology Consultants

5.5 SETTLEMENT SUITABILITY

The settlement uses considered in evaluating Settlement Suitability are: single family dwellings (with and without basements), septic tank absorption fields, road and parking lot location, road subgrade material, and recreation uses. In addition, constraints for sewage lagoons and suitability as a source of sand and gravel are assessed since requirements for these uses differ from those for settlement suitability. Ratings of all Soil Map Units for all the above uses are given in Table 6.

Areas of Low, Moderate and Severe constraints as well as kind of constraints are displayed on the Settlement Suitability Map, page 38.

Low Constraints - Soil Map Units 1, 2 and 3

The areas of low constraints to settlement occur on moderately well to rapidly drained glaciofluvial deposits and moderately well drained till deposits.

The topography varies from gently undulating (Map Unit 2) to moderately rolling (Map Unit 1). The till deposits (Map Unit 3) occur on gently rolling topography.

Although the land occurring in these map units is generally favorable for development, some site specific problems may be encountered and these should be considered prior to construction. For example, the rapidly drained glaciofluvial deposits are unsuitable for sewage lagoons because of rapid permeability and steep topography (refer to Table 6).

Moderate Constraints - Soil Map Units 4 and 5

The constraints to settlement for these map units include a high shrink-swell potential and possible concrete corrosion. Careful site selection and proper design taking into account these constraints should enable successful development of these lands. Development costs will likely be higher than in areas of Low Constraints.

TABLE 6. Degrees and Kinds of Constraints for Various Settlement Uses of all Map Units Occurring in the Bigstone Indian Reserves No. 166B, 166C, 166D.

SOIL MAP UNIT	SINGLE FAMILY DWELLINGS		SEPTIC TANK ABSORPTION FIELDS	SEWAGE LAGOONS	ROAD AND PARKING LOT LOCATION	SOURCE OF ROAD SUBGRADE MATERIAL	SOURCE OF SAND AND GRAVEL	RECREATION		
	WITH BASEMENTS	WITHOUT BASEMENTS						CAMP-GROUNDS	PICNIC AREAS	HIKING TRAILS
1	L-M3	L-M3	L-M3	S9,3	L-M3	G	G	M3,5	M3,5	L-M5
o 2	L-M22	L-M22	L-M10	M10	L-M22	G-F	U	L	L	L
3	L-M22	L-M22	L-M10	L-M3	L-M22	F	U	L	L	L
4	M13,23	M13,23	M-S11	L	M-S13	P	U	M6,11	M6,11	M6,11
5	M13,2,23	M13,23	S11,2	L	M-S13,2	P	U	M2,6,11	M2,6,11	M2,6,11
+ 6	S2,13	S2,13	S2,11	S2	S2,13	P	U	S2	S2	S2
7	S2,20	S2,20	S2,11	S2,20	S2,20	P	U	S2,20	S2,20	S2,20
+x 8	M13,2	M13	S11,2	L	M-S13,2	P	U	M2,6,11	M2,6,11	M2,6,11
+o 9	M13	M13	M-S11	L	M-S13	P	U	M6,11	M6,11	M6,11
+o 10	M13,2	M13	S11,2	L	M-S13,2	P	U	M2,6,11	M2,6,11	M2,6,11
+o 11	S2,13	S2,13	S2,11	S2	S2,13	P	U	S2	S2	S2
o 12	S1,2,20	S1,2,20	S2,11,12	S1,2,20	S1,2,20	U	U	S1,2,20	S1,2,20	S1,2,20
13	S1,2	S1,2	S1,2,12	S1,2,10	S1,2	F-P	P	S1,2	S1,2	S1,2
+x 14	L	L	S9,12	S9,12	L	G	G	M5	M5	M5
+x 15	S2,20	S2,20	S2,12	S2,9,20	S2,20	U	P	S2,20	S2,20	S2,20
16	S2,19	S2,19	S2,19	S2,19	S2,19	U	U	S2,19	S2,19	S2,19
SC	S1,2	S1,2	S1,2,12	S1,2,10	S1,2	P	U	S1,2	S1,2	S1,2

DEGREE OF CONSTRAINT:

L - Low
M - Moderate
S - Severe

SUITABILITY AS SOURCES:

G - Good P - Poor
F - Fair U - Unsuitable

KINDS OF CONSTRAINTS:

1: Flooding hazard (overflow)
2: Seasonally high groundwater table or surface ponding
3: Excessive slope
5: Sandy surface texture
6: Slippery or sticky when wet
9: Rapid permeability
10: Moderate permeability
11: Slow permeability
12: Groundwater contamination hazard
13: High shrink-swell potential
19: Organic soil
20: Organic surface layer 15-50 cm thick
22: Moderate shrink-swell potential
23: Possible concrete corrosion hazard (soluble sulfate)

+ Soil Map Unit does not occur in Reserve #166B
o Soil Map Unit does not occur in Reserve #166C
x Soil Map Unit does not occur in Reserve #166D

Severe Constraints - Soil Map Units 7, 12, 13, 16
and Stream Channels (SC)

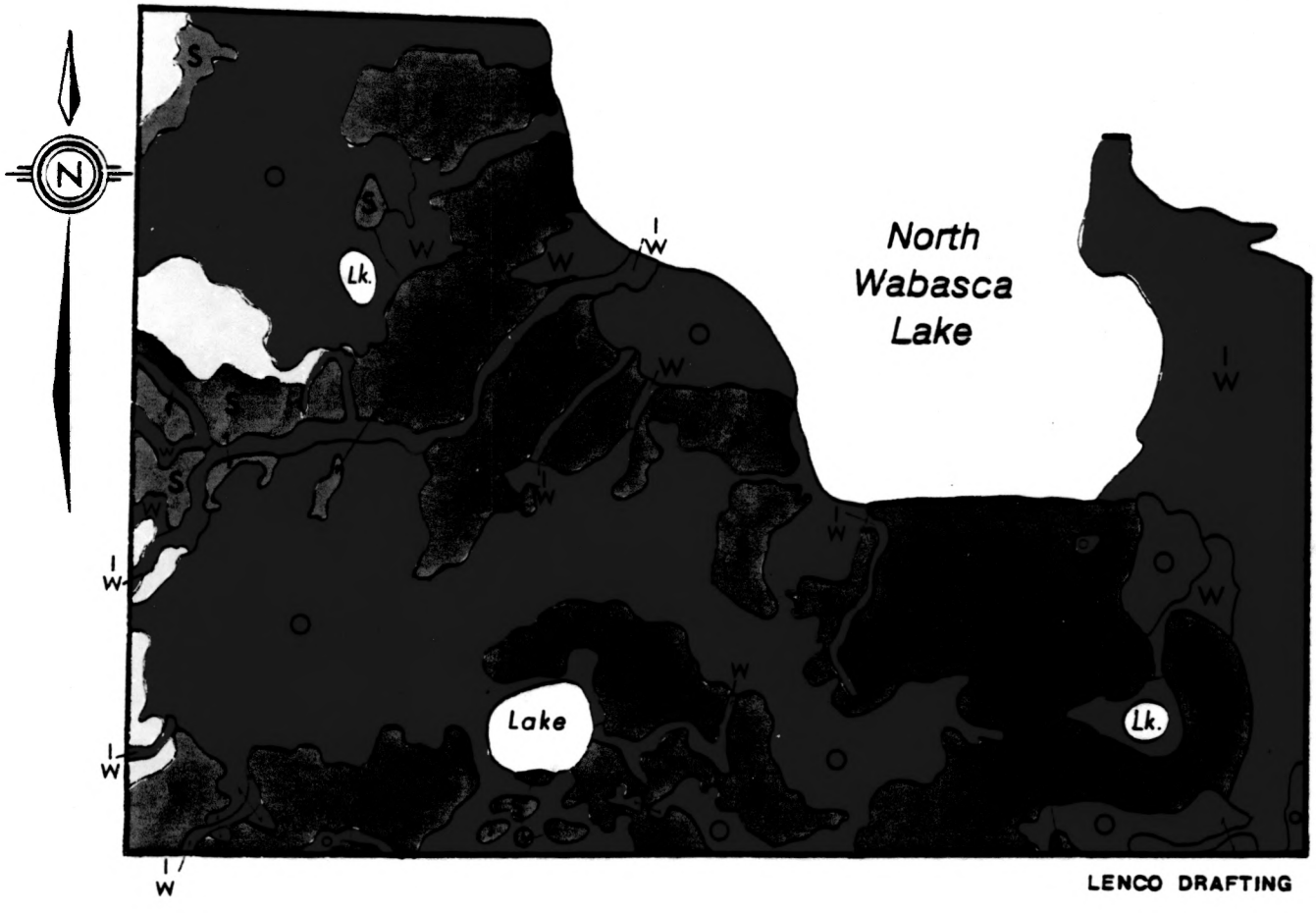
Lands in this group are unsuitable for development for one or more reasons. All of them suffer from excessive wetness. Some have a high shrink-swell potential (Units 6 and 7) or a flooding hazard (Units 12 and 13). The stream channel unit has steep banks as well as flood-prone valley bottoms. Also included in this group are the Organic soils (Unit 16).

SETTLEMENT SUITABILITY

	Soil Interpretations				Soil Characteristics and Qualities									
	SETTLEMENT USES	SERVICE LAGOONS	SOURCE OF SAND & GRAVEL	HAZARDS	SOIL MAP UNIT	LANDFORM	PERMEABILITY	WATER TABLE DEPTH	SOIL DRAINAGE CLASS	TOPOGRAPHY (SLOPES)	UNIFIED TEXTURE	SHRINK-SWELL POTENTIAL	FROST HEAVE POTENTIAL
LOW CONSTRAINTS	Favorable Conditions: rapidly to moderately well drained soils, deep water tables Potentially Troublesome Conditions: rapid permeability, sandy surface texture, slope in Unit 1, moderate shrink-swell	severe (permeability)	good	topography and sandy surface texture	1	- sandy glaciofluvial - ridged and moderately rolling	rapid	2 m	rapidly	10-15%	SM	low	low
		moderate (permeability)	unsuitable	moderate shrink-swell	2	- sandy to clayey glaciofluvial - gently undulating to undulating	moderate	2 m	well-moderately well	0-5%	SM-CL	low-medium	low-medium
		low constraints	unsuitable	moderate shrink-swell	3	- loamy to clayey till - gently rolling	moderate	2 m	moderately well	6-9%	CL	medium	medium
		severe (permeability & pollution)	good	sandy surface texture and pollution	14	- sandy recent beach deposits - level to gently undulating	rapid	1-1.5 m	rapidly	0-2%	SW	low	low
MODERATE CONSTRAINTS	Favorable Conditions: moderately well to imperfectly drained soils, water tables below 1.5 m, undulating topography Potentially Troublesome Conditions: high shrink-swell, slow permeability, concrete corrosion hazard in Units 4 and 5, susceptible to occasional flooding in Units 9 and 10	low constraints	unsuitable	high shrink-swell and concrete corrosion	4	- clayey glaciolacustrine - level to undulating	slow	2 m	moderately well	0-5%	CH	high	medium
		low constraints	unsuitable		5		slow	1.5-2 m	imperfectly		CH	high	medium
		low constraints	unsuitable	high shrink-swell	8	- clayey lacustrine - level to gently undulating	slow	1.5-2 m	imperfectly	0-2%	CH	high	medium
		low constraints	unsuitable	high shrink-swell and occasional flooding	9	- silty to clayey fluvial/ lacustrine - level to gently undulating	slow	2 m	moderately well	0-2%	CH	high	medium
		low constraints	unsuitable		10		slow	1.5-2 m	imperfectly		CH	high	medium
SEVERE CONSTRAINTS	Troublesome Conditions: high water table, poor drainage, high shrink-swell	severe (wetness)	unsuitable	wetness and high shrink-swell	6	- clayey glaciolacustrine - depressional to gently undulating	slow	0.5-1 m	poorly	0-2%	CH	high	medium
		severe (wetness)	unsuitable		7		slow	0-0.5 m	very poorly		CH	high	medium
	Troublesome Conditions: high water table, poor drainage, occasional flooding, high shrink-swell	severe (wetness)	unsuitable	wetness, high shrink-swell and occasional flooding	11	- silty to clayey fluvial/ lacustrine - depressional to gently undulating	slow	0.5-1 m	poorly	0-2%	CH	high	medium
		severe (wetness)	unsuitable		12		slow	0-0.5 m	very poorly		CH	high	medium
	Troublesome Conditions: wetness, flooding, pollution	severe (wetness and flooding)	poor	wetness and flooding	13	- silty to sandy recent fluvial - level to undulating	rapid-moderate	1-1.5 m	imperfectly	0-5%	SM-CL	low-medium	low-medium
	Troublesome Conditions: high water table, surface peat, poor drainage, rapid permeability, pollution	severe (wetness & permeability)	poor	wetness	15	- peat overlying sandy recent beach - depressional to gently undulating	rapid	0-0.5 m	very poorly	0-2%	SM	low	low
	Troublesome Conditions: high water table, very poor drainage, deep peat	severe (organic soils)	unsuitable	wetness and depth of peat	16	- peat fens and bogs - depressional to gently sloping	-	0-0.5 m	very poorly	0-2%	—	-	-
	Troublesome Conditions: flooding, erosion	severe (wetness and flooding)	unsuitable	flooding and erosion	SC	- Stream Channel and small fluvial plain	-	0-1 m	imperfectly to very poorly	30%	—	-	-

SETTLEMENT SUITABILITY

BIGSTONE INDIAN RESERVE No. 166B



LENCO DRAFTING

SCALE: 1:50,000

LEGEND:

- Low Constraints
- Moderate Constraints
- Severe Constraints

TYPE OF CONSTRAINTS

- I - INUNDATION FLOODING
- O - ORGANIC MATERIALS
- S - UNFAVORABLE SOIL CHARACTERISTICS - SLOW PERMEABILITY, HIGH SHRINK/SWELL
- T - TOPOGRAPHY
- W - WETNESS - POOR SOIL DRAINAGE, SHALLOW WATER TABLE

PREPARED FOR
INDIAN AND NORTHERN AFFAIRS ALBERTA
BY

Pedology Consultants

5.6 POTENTIAL LAND USE

The various settlement uses and agricultural capability have been considered together in preparing a Potential Land Use Map (page 40). It shows three distinctive Areas in terms of development opportunities as outlined below.

Area A - Soil Map Units 1, 2, 3, 4 and 5

This area is the best for settlement and agriculture in the Reserve. Unit 1 has low constraints to settlement and Units 2, 3, 4 and 5 have low to moderate constraints for settlement. Units 2, 3, 4 and 5 have a marginal Agricultural Capability rating (Class 4). Unit 1 is included in Area 1, even though it has a Class 6 Agricultural Capability rating, because it is the land with the least constraints to settlement and also only occurs in small areas adjacent to Class 4 agricultural land.

Area B - Soil Map Units 6 and 13

These lands have severe constraints for settlement due to wetness and periodic flooding. They have a Class 5 agricultural capability rating and are suitable for limited forage crop production with potential flooding hazard and wetness limitations.

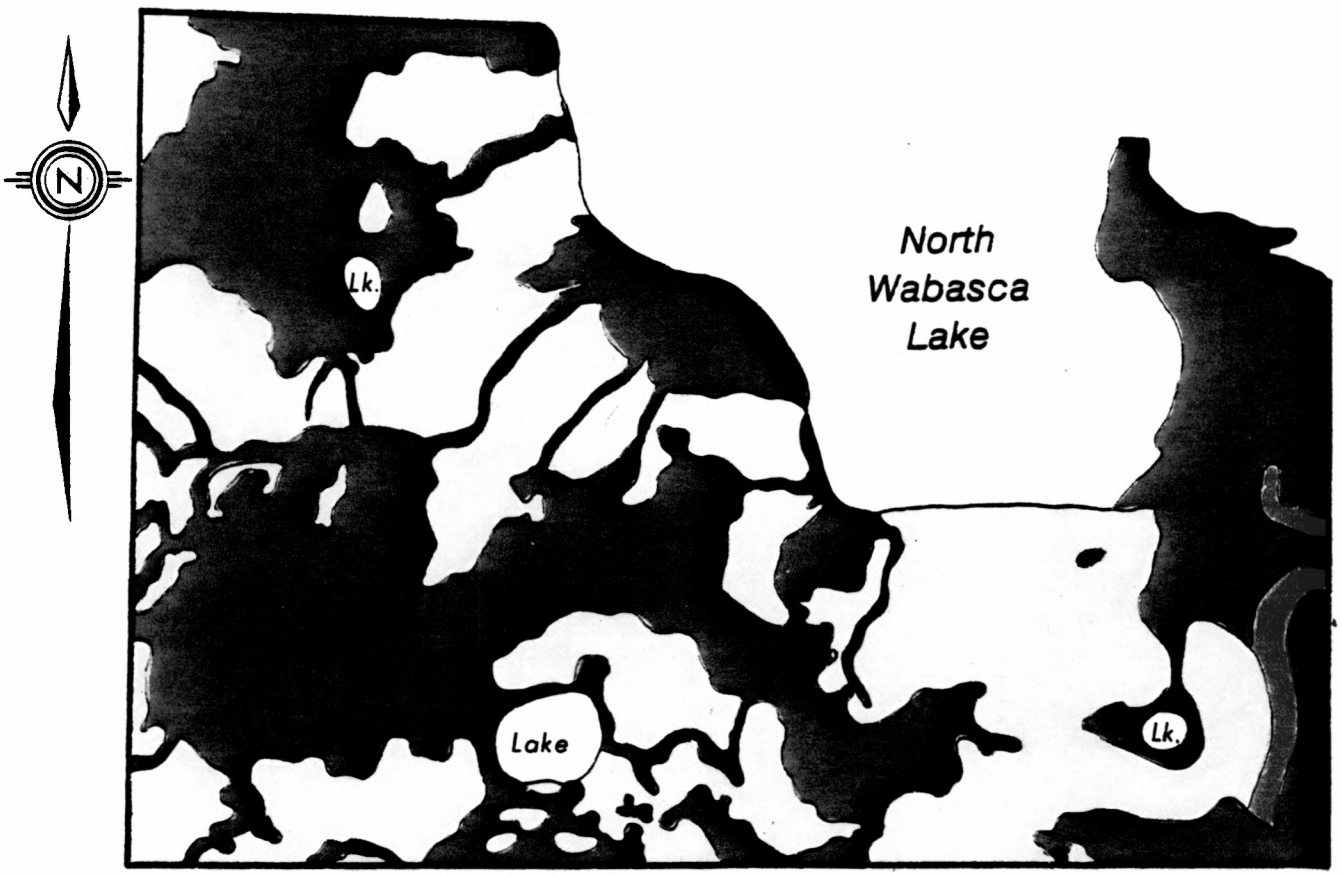
Area C - Soil Map Units 7, 12, 16, SC and ✱

These lands are generally unsuitable for all uses considered because of excessive wetness or flooding hazards (Unit SC). Constraints to settlement are severe and Agricultural Capability ratings are Class 6 or 7. Also included in this group are the Organic soils (Soil Unit 16).

POTENTIAL LAND USE

BIGSTONE INDIAN RESERVE

No. 166 B



LENCO DRAFTING

LEGEND:

SCALE: 1:50,000

Area A

Area B

Area C

(see page 39)

PREPARED FOR
INDIAN AND NORTHERN AFFAIRS ALBERTA
BY

Pedology Consultants

5.7 SUMMARY OF RESERVE #166B

. Present Land Use - A Present Land Use Map, at a scale of 1:20,000, has been prepared, based on photo interpretation and field checking during the soil survey.

Almost all of the Reserve is in its native forest and wetland vegetation. A limited amount of clearing has taken place around settlements.

. Semi-Detailed Soil Survey - Soils were inspected at 52 sites. Nine principal soil map units and 3 miscellaneous map units were recognized in the area. These are described in the text and legend. The soil map is presented on an aerial photo mosaic at a scale of 1:20,000 (back pocket).

. Parent Materials - Six parent materials were recognized in the area. Important soil types found on mineral materials include: Orthic Gray Luvisols, Solonetzic Gray Luvisols, Gleyed Gray Luvisols, Gleysols, peaty Gleysols and Regosols. Terric and Typic Mesisols are dominant where organic deposits have accumulated.

The majority of the Reserve is occupied by very poorly drained Organic soils and by moderately well to imperfectly drained Luvisolic soils developed on glaciolacustrine deposits.

. Agricultural Capability - An Agricultural Capability Map has been prepared at a scale of 1:50,000.

The well to imperfectly drained Luvisolic soils are marginally suitable for cultivated crops. Limitations of unfavorable climate (C) and slow permeability (D) restrict their agricultural capability to Class 4.

The fluvial-lacustrine floodplains are rated as Class 5. These areas are suitable only for improved pasture or forage crops.

The lowlands containing Organic soils Gleysols and streams are generally unsuitable for agriculture.

. Settlement Suitability - Soil interpretations or estimates of soil performance have been made using field and laboratory data, published guidelines and information from other soil surveys. The soil interpretations for settlement suitability include: constraints to family dwellings, road location, septic tank absorption fields, recreation, sewage lagoon location, and sources of sand, gravel and subgrade materials.

The ratings for specific uses have been considered jointly in preparing a Settlement Suitability Map. For each map area, favorable and potentially troublesome conditions are given, emphasizing topography, drainage, wetness, soil physical properties and erosion hazard.

Very few areas of low constraint to settlement occur in the Reserve.

Sizeable areas with moderate constraints to settlement are found throughout the Reserve. The areas with moderate constraints are generally characterized by materials which have a high shrink-swell potential, slow permeability, and possible concrete corrosion hazard that all require special attention.

Approximately half of the Reserve has severe constraints to settlement due to excessive wetness, flooding or occurrence of organic materials.

. Potential Land Use - Based on the concerns of agriculture and settlement, a Potential Land Use Map is provided for the Reserve which delineates three areas. Sizeable portions are well to moderately suited for settlement and marginally suited for cultivated crops (Area A). A small portion can support limited agricultural forage crop production or improved pasture but has severe limitations for grain crops or settlement uses (Area B). A considerable portion is unsuitable for all uses due to excessive wetness, flooding, or the presence of organic materials (Area C).

6.0 BIGSTONE INDIAN RESERVE #166C

6.1 PRESENT LAND USE

A Present Land Use Map (page 44) was mapped at 1:20,000 and reduced to page size (1:50,000). The background, a photo mosaic, enables one to see the roads, lakes and streams. The Legend for this map lists the main types of land use encountered and the Explanation of Legend below describes the units in more detail.

Explanation of Legend

Settled Lands (S) - These are areas that have been cleared of forest cover and are predominantly occupied by residences.

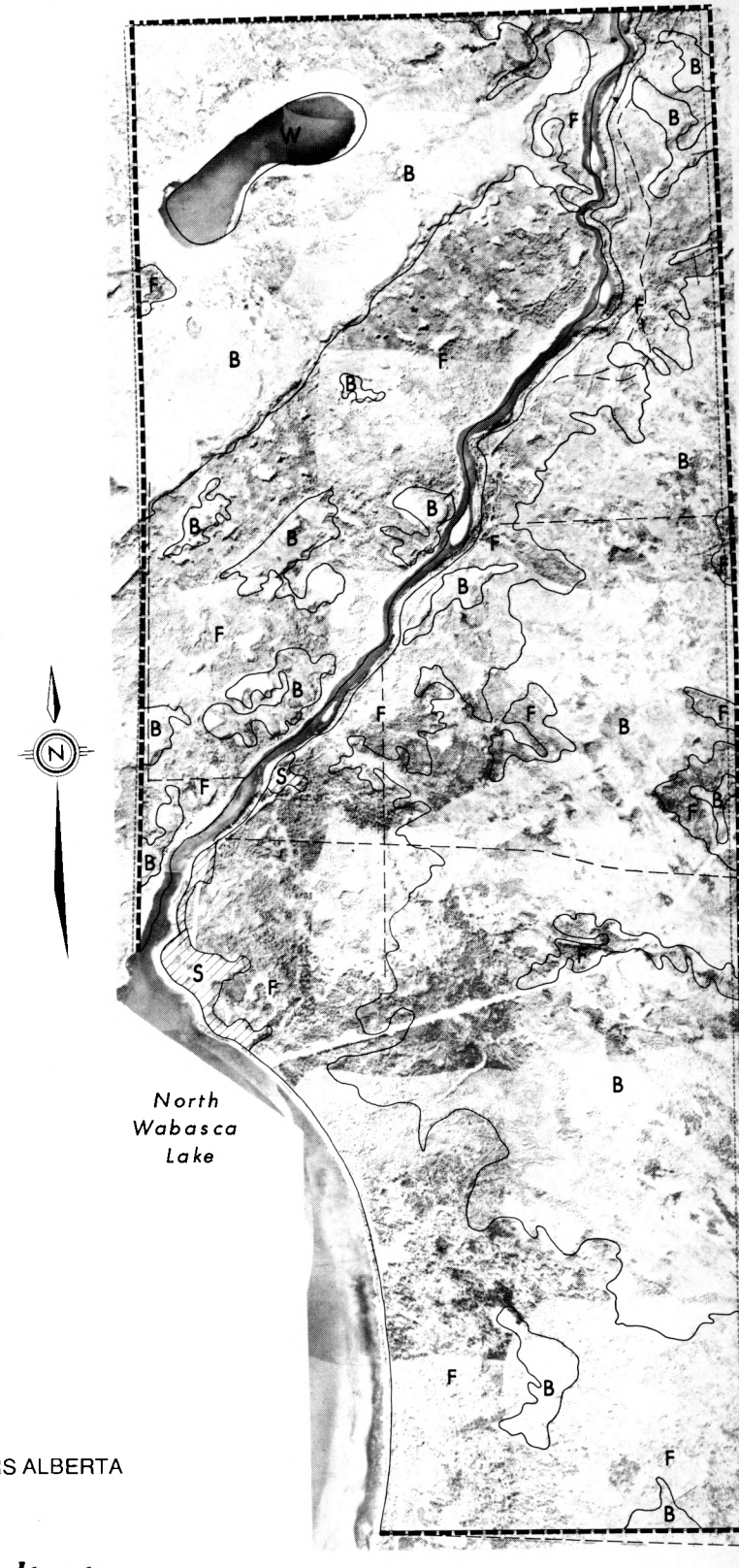
Forested and Rough Pasture (F) - These are areas of forested land where no improvements have been made.

Bogs (B) - These are poorly drained, frequently ponded areas containing Gleysolic and Organic soils. Vegetation consists mainly of black spruce, birch, willow, sedges and mosses.

Water (W) - This symbol indicates open bodies of water.

-------- - Cutlines and trails.

PRESENT LAND USE
BIGSTONE INDIAN RESERVE No. 166 C



LEGEND

S - SETTLED LAND

F - FORESTED

B - BOG

W - OPEN WATER

- - - - CUTLINES AND TRAILS

PREPARED FOR

INDIAN AND NORTHERN AFFAIRS ALBERTA

BY

Pedology Consultants

SCALE

1 : 50,000

0 200 1000 2000

metres

6.2 SOILS

Field investigations revealed the presence of seven major soil forming parent materials in Bigstone Indian Reserve #166C. These were separated into eleven map units due to differences in soils, topography, and drainage as described below. Three miscellaneous units, stream channels, sloughs and open water, are described as well. Detailed profile descriptions of some of the dominant soil profiles are provided in Appendix A.

Soils on Glaciofluvial Deposits

Sandy, non-stony to very stony, glaciofluvial deposits occur on ridged and moderately rolling topography. These soils are classified as SM according to the Unified Classification. The deposits have a rapid permeability, and a low shrink-swell and frost heave potential.

One soil map unit developed on this parent material is recognized in the area. It has the following characteristics.

Map Unit	Dominant Soil Subgroup	Dominant Texture	Drainage	Slope
1	Eluviated Eutric Brunisol	LS-S	rapidly	10-15%

Soils on Till Deposits

Loam to clay loam, slightly to moderately stony till deposits occurring on gently rolling topography. The till material is ML or CL according to the Unified Classification. It is moderately permeable and has a medium shrink-swell potential and frost heave potential. Sulfate content is negligible and should pose no problem to concrete.

Only one map unit on till material was recognized. It has the following distinguishing features:

Map Unit	Dominant Soil Subgroup	Dominant Texture	Drainage	Slope
3	Orthic Gray Luvisols	L-CL	moderately well	6-9%

Soils on Glaciolacustrine Deposits

A large portion of Bigstone Indian Reserve #166C is comprised of soils developed on silty clay to heavy clay, non-stony glaciolacustrine deposits. Topography is characteristically level to undulating and depressional. The glaciolacustrine sediments have slow permeabilities, high shrink-swell potential, and medium frost heave potential. They are rated as CH in the Unified System, as HC in the USDA System and A-7-6(20) in the AASHO Classification System. Sulfate content is sufficient in places to cause a positive attack on concrete, unless corrective measures are taken.

Distinguishing characteristics of the glaciolacustrine map units are:

Map Unit	Dominant Soil Subgroup	Dominant Texture	Drainage	Slope
4	Orthic Gray Luvisols	SiC-C	moderately well	0-5%
5	Gleyed Gray Luvisols	SiC-C	imperfectly	0-5%
6	Orthic Luvic Gleysols	SiC-C	poorly	0-2%
7	peaty Orthic Gleysols	SiC-C	very poorly	0-2%

Soils on Lacustrine Deposits

Silty clay to clay textured, non-stony lacustrine sediments occur on gently undulating topography adjacent to the Wabasca River. These fine textured sediments have similar characteristics as previously described for the glaciolacustrine deposits except for a very low content of soluble sulfates. The lacustrine sediments (deposited after glaciation from non-glacial waters) are classified as CH in the Unified System and have a slow permeability, a high shrink-swell potential and medium frost heave potential.

The one map unit recognized has the following distinguishing features:

Map Unit	Dominant Soil Subgroup	Dominant Texture	Drainage	Slope
8	Gleyed Gray Luvisols	SiC-C	imperfectly	0-2%

Soils on Recent Fluvial Deposits

Non-stony, stratified, silt loam and fine sandy loam recently deposited fluvial materials occurring on nearly level to undulating topography. These areas are subject to flooding during the spring snow-melt and after heavy rains and are affected by a seasonally high water table. They are rapidly to moderately permeable, have a low to medium shrink-swell and frost heave potential and are classified as SM to CL in the Unified Classification System. This parent material only occurs along small terraces of the Wabasca River.

The one map unit is characterized as follows:

Map Unit	Dominant Soil Subgroup	Dominant Texture	Drainage	Slope
13	Gleyed Regosols	SiL-FSL	imperfectly	0-5%

Soils on Beach Deposits

Rapidly and very poorly drained, non-stony beach sands occur adjacent to North Wabasca Lake in Reserve #166C. Topography is gently undulating in rapidly drained areas and depresssional to level in very poorly drained areas. The sands are greater than 1 m thick but in poorly drained areas the sands contain 15 to 70 cm of surface moss or sedge peat. The sands have rapid permeability, low shrink-swell and frost heave potentials and are classified as SW in the Unified Classification System.

Map units recognized have the following distinguishing features:

Map Unit	Dominant Soil Subgroup	Dominant Texture	Drainage	Slope
14	Orthic Regosols	cS	rapidly	0-2%
15	peaty Rego Gleysols	Org/cS	very poorly	0-2%

Soils on Organic Deposits

Very poorly drained depressional and gently sloping areas with accumulations of 0.5 to 1.2 m or more of moss and sedge peat overlying silty clay to clay glaciolacustrine material. The peat is usually moderately decomposed but in some cases, where the topography is gently sloping the peat is well decomposed.

All Organic soils are grouped into one map unit which has the following features:

Map Unit	Dominant Soil Subgroup	Dominant Texture	Drainage	Slope
16	Terric and Typic Mesisols	-	very poorly	0-2%

Miscellaneous Units and Symbols

Stream Channels (SC)

This unit includes the banks, meander scars and channels of streams. The banks are commonly steep, and the valley bottom is affected by seasonal flooding, making these areas unsuitable for most uses. A natural vegetative cover should be maintained to minimize soil and geological erosion.

Open Water ($\bar{O}$)

Bodies of water with little or no surface vegetation.

6.3 LABORATORY ANALYSIS

Laboratory analyses were conducted on representative glaciolacustrine, glaciofluvial, and till samples collected in the Reserve. The results are described in Table 7 (C-25, C-43, C-63). This information is used to aid in characterizing the soil materials and in making soil interpretations.

TABLE 7. Laboratory Test Data and Classification of Selected Soils within the Bigstone Indian Reserves 166B, 166C and 166D.

SOIL MAP UNIT	INSP.* SITE#	DEPTH (cm)	pH (H_2O)	EC	% SO_4	% Passing Sieve				% Smaller than		Atterberg Limits	
						#4	#10	#40	#200	#270 (0.05mm)	0.002mm	Liquid Limit	Plasticity Index (PI)
1	C-43	70-100	6.7	1.3	-	87	81	41	17	16	8	NL	NP
2	B-11	60-100	5.7	0.2	-	100	99	94	32	27	14	22	9
2	D-52	80-100	4.7	0.3	-	100	100	100	98	92	26	34	19
3	C-63	70-100	4.8	0.2	-	100	99	94	69	61	32	29	8
4	B-37	60- 90	4.5	3.0	0.153	100	100	100	98	92	74	83	54
4	B-37	90-120	6.9	6.2	0.502	-	-	-	-	-	-	-	-
4	B-51	70-100	7.2	2.5	0.139	100	100	100	98	94	70	65	40
5	C-25	80-110	6.9	1.4	-	100	100	98	84	76	62	58	37
5	D-7	80-100	6.0	0.2	-	100	100	100	98	92	74	55	29
9	D-33	80-100	6.4	0.4	-	100	100	99	98	88	38	59	34

SOIL MAP UNIT	INSP.* SITE#	DEPTH (cm)	SAT. %	CLASSIFICATION			PERMEABILITY (1)	SHRINK-SWELL POTENTIAL (2)	FROST HEAVE POTENTIAL (3)
				UNIFIED	AASHO	USDA			
1	C-43	70-100	17	SM	A-1-b(0)	LS	R	L	L
2	B-11	60-100	26	SM	A-4(1)	SL	R	L	L
2	D-52	80-100	42	CL	A-6(16)	SiL	M	L-M	M
3	C-63	70-100	37	CL-ML	A-4(7)	CL	M	L-M	M-H
4	B-37	60- 90	78	CH	A-7-6(20)	HC	S	H	M
4	B-37	90-120	73	-	-	-	S	H	M
4	B-51	70-100	74	CH	A-7-6(20)	HC	S	H	M
5	C-25	80-110	63	CH	A-7-6(20)	HC	S	H	M
5	D-7	80-100	71	CH	A-7-6(19)	HC	S	H	M
9	D-33	80-100	73	CH	A-7-6(20)	SiCL	S	H	M

(1) Permeability Classes

S - Slow; less than 0.5 cm/hr
M - Moderate; 0.5 to 1.5 cm/hr
R - Rapid; more than 1.5 cm/hr

(2) Shrink-Swell Potential

L - Low
M - Medium
H - High

(3)+ Frost Heave Potential

L - Low; F1 & F2 frost groups
M - Medium; F3 frost group
H - High; F4 frost group

+ from U.S. Army Corps of Engineers, 1962.

* The letter before the numerical digit indicates Reserve number;
ex B = 166B Reserve
C = 166C Reserve
D = 166D Reserve

6.4 AGRICULTURAL CAPABILITY

Soil capability for agriculture is displayed on the Agricultural Capability Map, Bigstone Indian Reserve #166C (page 52) and in Table 8.

The Reserve lies within Agro-Climatic Zone 3H. Limitations such as undesirable soil structure (D), inundation (I), excessive wetness (W), moisture deficiency problems (M), adverse topography (T) and the presence of Organic soils (O) further limit the agricultural capability to as low as Class 7.

Table 8. Agricultural Capability Ratings of the Bigstone Indian Reserve #166C.

Capability Class	Subclass	Map Unit
4	4D	3, 4
	4^{D}_{W}	5, 8
5	5W	6
	5^{I}_{W}	13*
6	6W	7, 15, ✱
	6^{M}_{T}	1
	6^{I}_{W}	SC
7	7M	14
	7W	O
O	O	16

* This unit has been omitted from the Agricultural Capability Map due to cartographic problems in presenting such small areas; however, it can be seen on the 1:20,000 scale Soil Map.

EXPLANATION OF AGRICULTURAL CAPABILITY MAP LEGEND

NOTATION:

5W Class Subclass

AGRICULTURE CAPABILITY CLASSES

Class 4 - these soils have severe limitations that restrict the range of crops that can be grown or require special conservation practices to overcome or both.

Class 5 - these soils have very severe limitations that restrict their capability to producing perennial forage crops and improvement practices are not feasible.

Class 6 - these soils are capable only of producing perennial forage crops and improvement practices are not feasible.

Class 7 - these soils or land types have no capability for arable culture or permanent pasture.

O - Organic soils not rated for agriculture.

SOIL CAPABILITY SUBCLASSES

Soil Limitations:

Subclass D - undesirable soil structure and/or slow permeability

Subclass M - low moisture holding capacity

Landscape Limitations:

Subclass I - inundation (flooding)

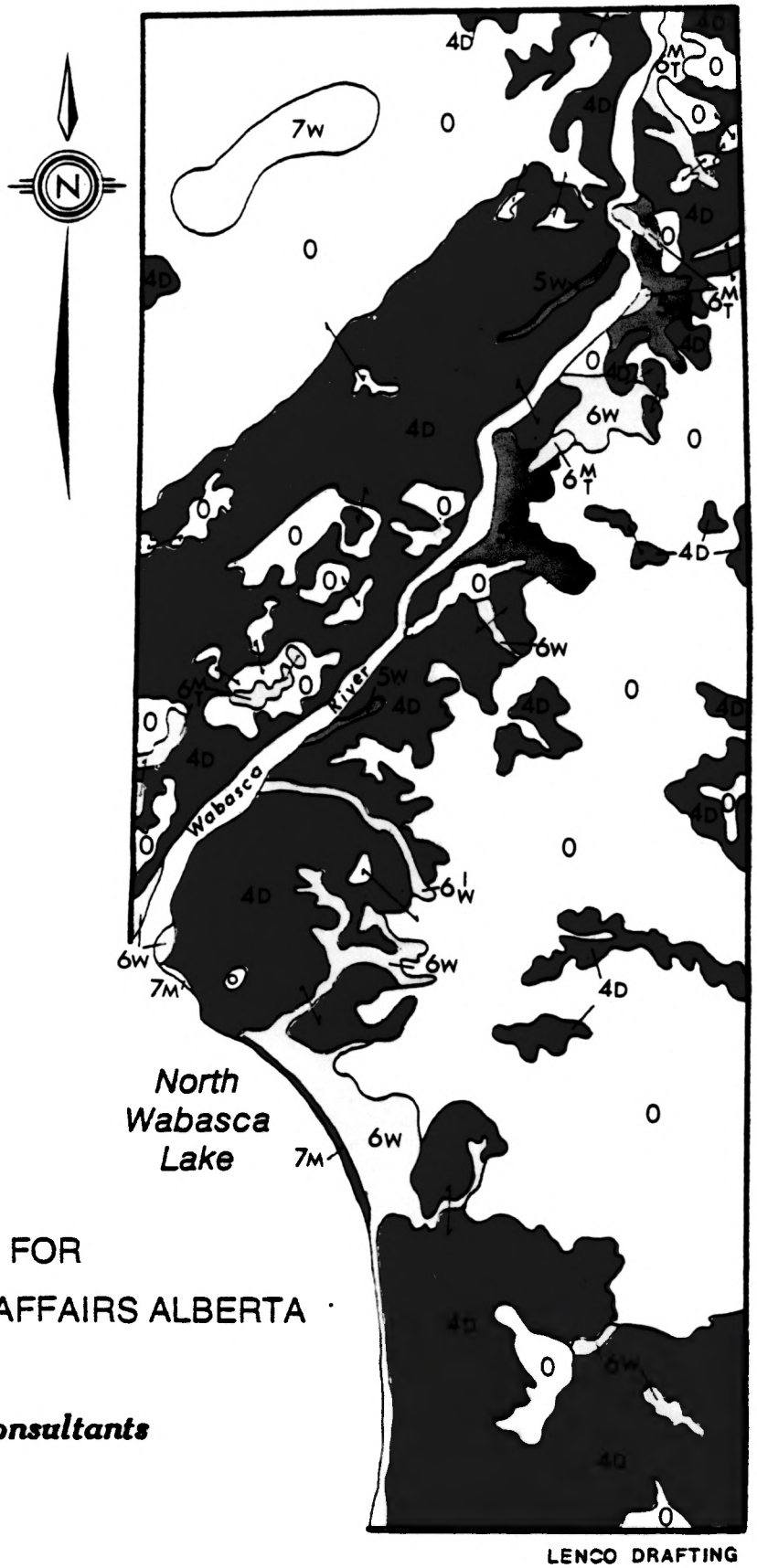
Subclass T - adverse topography, both steepness and pattern

Subclass W - excessive moisture

AGRICULTURAL CAPABILITY

BIGSTONE INDIAN RESERVE

No. 166 C



LEGEND:

- Class 4
- Class 5
- Class 6
- Classes 7 & 0

(see page 51)

SCALE: 1:50,000

PREPARED FOR

INDIAN AND NORTHERN AFFAIRS ALBERTA

BY

Pedology Consultants

6.5 SETTLEMENT SUITABILITY

The settlement uses considered in evaluating Settlement Suitability are: single family dwellings (with and without basements), septic tank absorption fields, road and parking lot location, road subgrade material, and recreation uses. In addition, constraints for sewage lagoons and suitability as a source of sand and gravel are assessed since requirements for these uses differ from those for settlement suitability. Ratings of all Soil Map Units for all the above uses are given in Table 9.

Areas of Low, Moderate and Severe constraints as well as kind of constraints are displayed on the Settlement Suitability Map, page 57.

Low Constraints - Soil Map Units 1, 3 and 14

The areas of low constraints to settlement occur on rapidly drained glaciofluvial and beach sand deposits and on moderately well drained till deposits.

The topography is gently rolling and moderately rolling on the till (Unit 3) and glaciofluvial (Unit 1) deposits, respectively. The beach sand (Unit 14) occurs on level to gently undulating topography adjacent to North Wabasca Lake.

Although the land is generally favorable for development, some site specific problems, such as steep topography, may be encountered and these should be considered prior to construction. Soils of Unit 1 are severely limited for sewage lagoons due to their rapid permeability. The beach sands (Unit 14) have severe constraints for septic tank absorption fields due to their rapid permeability and lake contamination hazard.

TABLE 9. Degrees and Kinds of Constraints for Various Settlement Uses of all Map Units Occurring in the Bigstone Indian Reserves No. 166B, 166C, 166D.

SOIL MAP UNIT	SINGLE FAMILY DWELLINGS		SEPTIC TANK ABSORPTION FIELDS	SEWAGE LAGOONS	ROAD AND PARKING LOT LOCATION	SOURCE OF ROAD SUBGRADE MATERIAL	SOURCE OF SAND AND GRAVEL	RECREATION		
	WITH BASEMENTS	WITHOUT BASEMENTS						CAMP-GROUNDS	PICNIC AREAS	HIKING TRAILS
1	L-M3	L-M3	L-M3	S9,3	L-M3	G	G	M3,5	M3,5	L-M5
o 2	L-M22	L-M22	L-M10	M10	L-M22	G-F	U	L	L	L
3	L-M22	L-M22	L-M10	L-M3	L-M22	F	U	L	L	L
4	M13,23	M13,23	M-S11	L	M-S13	P	U	M6,11	M6,11	M6,11
5	M13,2,23	M13,23	S11,2	L	M-S13,2	P	U	M2,6,11	M2,6,11	M2,6,11
+ 6	S2,13	S2,13	S2,11	S2	S2,13	P	U	S2	S2	S2
7	S2,20	S2,20	S2,11	S2,20	S2,20	P	U	S2,20	S2,20	S2,20
x+ 8	M13,2	M13	S11,2	L	M-S13,2	P	U	M2,6,11	M2,6,11	M2,6,11
o+ 9	M13	M13	M-S11	L	M-S13	P	U	M6,11	M6,11	M6,11
o+ 10	M13,2	M13	S11,2	L	M-S13,2	P	U	M2,6,11	M2,6,11	M2,6,11
o+ 11	S2,13	S2,13	S2,11	S2	S2,13	P	U	S2	S2	S2
o 12	S1,2,20	S1,2,20	S2,11,12	S1,2,20	S1,2,20	U	U	S1,2,20	S1,2,20	S1,2,20
13	S1,2	S1,2	S1,2,12	S1,2,10	S1,2	F-P	P	S1,2	S1,2	S1,2
x+ 14	L	L	S9,12	S9,12	L	G	G	M5	M5	M5
x+ 15	S2,20	S2,20	S2,12	S2,9,20	S2,20	U	P	S2,20	S2,20	S2,20
16	S2,19	S2,19	S2,19	S2,19	S2,19	U	U	S2,19	S2,19	S2,19
SC	S1,2	S1,2	S1,2,12	S1,2,10	S1,2	P	U	S1,2	S1,2	S1,2

DEGREE OF CONSTRAINT:

L - Low
M - Moderate
S - Severe

SUITABILITY AS SOURCES:

G - Good P - Poor
F - Fair U - Unsuitable

KINDS OF CONSTRAINTS:

1: Flooding hazard (overflow)
2: Seasonally high groundwater table or surface ponding
3: Excessive slope
5: Sandy surface texture
6: Slippery or sticky when wet
9: Rapid permeability
10: Moderate permeability
11: Slow permeability
12: Groundwater contamination hazard
13: High shrink-swell potential
19: Organic soil
20: Organic surface layer 15-50 cm thick
22: Moderate shrink-swell potential
23: Possible concrete corrosion hazard (soluble sulfate)

+ Soil Map Unit does not occur in Reserve #166B
o Soil Map Unit does not occur in Reserve #166C
x Soil Map Unit does not occur in Reserve #166D

Moderate Constraints - Soil Map Units 4, 5 and 8

The constraints to settlement for these map units include a high shrink-swell potential (Units 4, 5 and 8) and possible concrete corrosion (Units 4 and 5).

Careful site selection and proper design taking into account these constraints should enable successful development of these lands. Development costs will likely be higher than in areas of low constraints.

Severe Constraints - Soil Map Units 6, 7, 13, 15, 16 and Stream Channels (SC)

Lands in this group are unsuitable for development for one or more reasons. All of them suffer from excessive wetness. Some have a high shrink-swell potential (Units 6 and 7) or a flooding hazard (Unit 13). The stream channel unit has steep banks as well as flood prone valley bottoms. Also included in this group are the Organic soils (Unit 16).

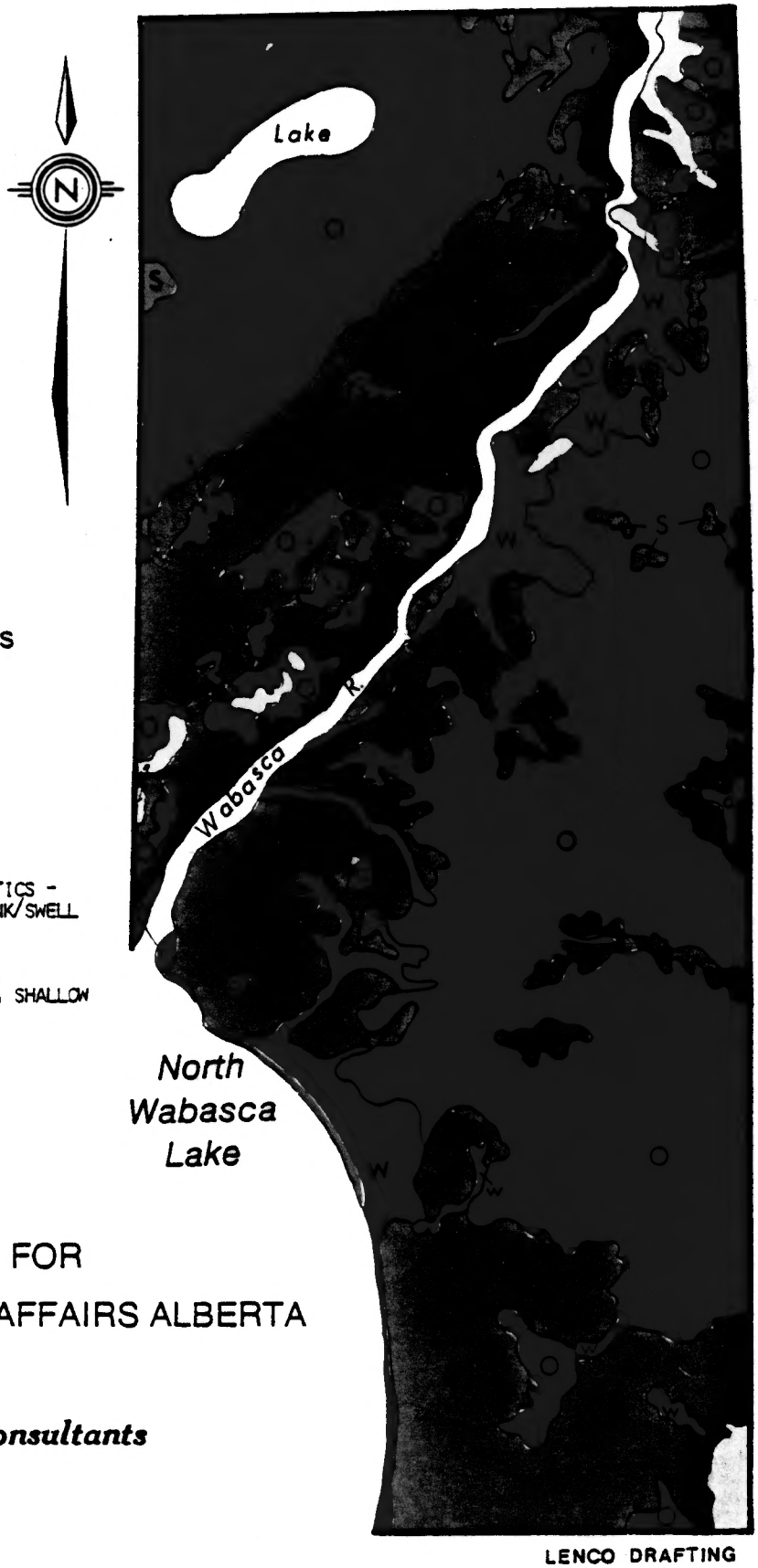
SETTLEMENT SUITABILITY

	Soil Interpretations				Soil Characteristics and Qualities									
	SETTLEMENT USES	SEWAGE LAGOONS	SOURCE OF SAND & GRAVEL	HAZARDS	SOIL MAP UNIT	LANDFORM	PERMEABILITY	WATER TABLE DEPTH	SOIL DRAINAGE CLASS	TOPOGRAPHY (SLOPES)	UNIFIED TEXTURE	SHRINK-SWELL POTENTIAL	FROST HEAVE POTENTIAL
LOW CONSTRAINTS	Favorable Conditions: rapidly to moderately well drained soils, deep water tables Potentially Troublesome Conditions: rapid permeability, sandy surface texture, slope in Unit 1, moderate shrink-swell	severe (permeability)	good	topography and sandy surface texture	1	- sandy glaciofluvial - ridged and moderately rolling	rapid	2 m	rapidly	10-15%	SM	low	low
		moderate (permeability)	unsuitable	moderate shrink-swell	2	- sandy to clayey glaciofluvial - gently undulating to undulating	moderate	2 m	well-moderately well	0-5%	SM-CL	low-medium	low-medium
		low constraints	unsuitable	moderate shrink-swell	3	- loamy to clayey till - gently rolling	moderate	2 m	moderately well	6-9%	CL	medium	medium
		severe (permeability & pollution)	good	sandy surface texture and pollution	14	- sandy recent beach deposits - level to gently undulating	rapid	1-1.5 m	rapidly	0-2%	SW	low	low
MODERATE CONSTRAINTS	Favorable Conditions: moderately well to imperfectly drained soils, water tables below 1.5 m, undulating topography Potentially Troublesome Conditions: high shrink-swell, slow permeability, concrete corrosion hazard in Units 4 and 5, susceptible to occasional flooding in Units 9 and 10	low constraints	unsuitable	high shrink-swell and concrete corrosion	4	- clayey glaciolacustrine - level to undulating	slow	2 m	moderately well	0-5%	CH	high	medium
		low constraints	unsuitable		5		slow	1.5-2 m	imperfectly		CH	high	medium
		low constraints	unsuitable	high shrink-swell	8	- clayey lacustrine - level to gently undulating	slow	1.5-2 m	imperfectly	0-2%	CH	high	medium
		low constraints	unsuitable	high shrink-swell and occasional flooding	9	- silty to clayey fluvial/ lacustrine - level to gently undulating	slow	2 m	moderately well	0-2%	CH	high	medium
		low constraints	unsuitable		10		slow	1.5-2 m	imperfectly		CH	high	medium
SEVERE CONSTRAINTS	Troublesome Conditions: high water table, poor drainage, high shrink-swell	severe (wetness)	unsuitable	wetness and high shrink-swell	6	- clayey glaciolacustrine - depressional to gently undulating	slow	0.5-1 m	poorly	0-2%	CH	high	medium
		severe (wetness)	unsuitable		7		slow	0-0.5 m	very poorly		CH	high	medium
	Troublesome Conditions: high water table, poor drainage, occasional flooding, high shrink-swell	severe (wetness)	unsuitable	wetness, high shrink-swell and occasional flooding	11	- silty to clayey fluvial/ lacustrine - depressional to gently undulating	slow	0.5-1 m	poorly	0-2%	CH	high	medium
		severe (wetness)	unsuitable		12		slow	0-0.5 m	very poorly		CH	high	medium
	Troublesome Conditions: wetness, flooding, pollution	severe (wetness and flooding)	poor	wetness and flooding	13	- silty to sandy recent fluvial - level to undulating	rapid-moderate	1-1.5 m	imperfectly	0-5%	SM-CL	low-medium	low-medium
	Troublesome Conditions: high water table, surface peat, poor drainage, rapid permeability, pollution	severe (wetness & permeability)	poor	wetness	15	- peat overlying sandy recent beach - depressional to gently undulating	rapid	0-0.5 m	very poorly	0-2%	SW	low	low
	Troublesome Conditions: high water table, very poor drainage, deep peat	severe (organic soils)	unsuitable	wetness and depth of peat	16	- peat fens and bogs - depressional to gently sloping	-	0-0.5 m	very poorly	0-2%	—	-	-
	Troublesome Conditions: flooding, erosion	severe (wetness and flooding)	unsuitable	flooding and erosion	SC	- Stream Channel and small fluvial plain	-	0-1 m	imperfectly to very poorly	30%	—	-	-

SETTLEMENT SUITABILITY

BIGSTONE INDIAN RESERVE

No. 166 C



LEGEND:

- Low Constraints
- Moderate Constraints
- Severe Constraints

TYPE OF CONSTRAINTS

- I - INUNDATION FLOODING
- O - ORGANIC MATERIALS
- S - UNFAVORABLE SOIL CHARACTERISTICS - SLOW PERMEABILITY, HIGH SHRINK/SWELL
- T - TOPOGRAPHY
- W - WETNESS - POOR SOIL DRAINAGE, SHALLOW WATER TABLE

SCALE: 1:50,000

PREPARED FOR

INDIAN AND NORTHERN AFFAIRS ALBERTA

BY

Pedology Consultants

LENCO DRAFTING

6.6 POTENTIAL LAND USE

The various settlement uses and agricultural capability have been considered together in preparing a Potential Land Use Map (page 59). It shows three distinctive Areas in terms of development opportunities as outlined below.

Area A - Soil Map Units 1, 3, 4, 5, 8 and 14

This area is the best for settlement and agriculture in the Reserve. Units 1 and 14 have low constraints to settlement and the rest of the Units have low to moderate constraints for settlement. Units 3, 4, 5 and 8 have a marginal Agricultural Capability rating (Class 4). Units 1 and 14 are included in Area 1, even though they are rated as Class 6 or 7 for agriculture because of their small areal extent and their low constraints for settlement.

Area B - Soil Map Units 6 and 13

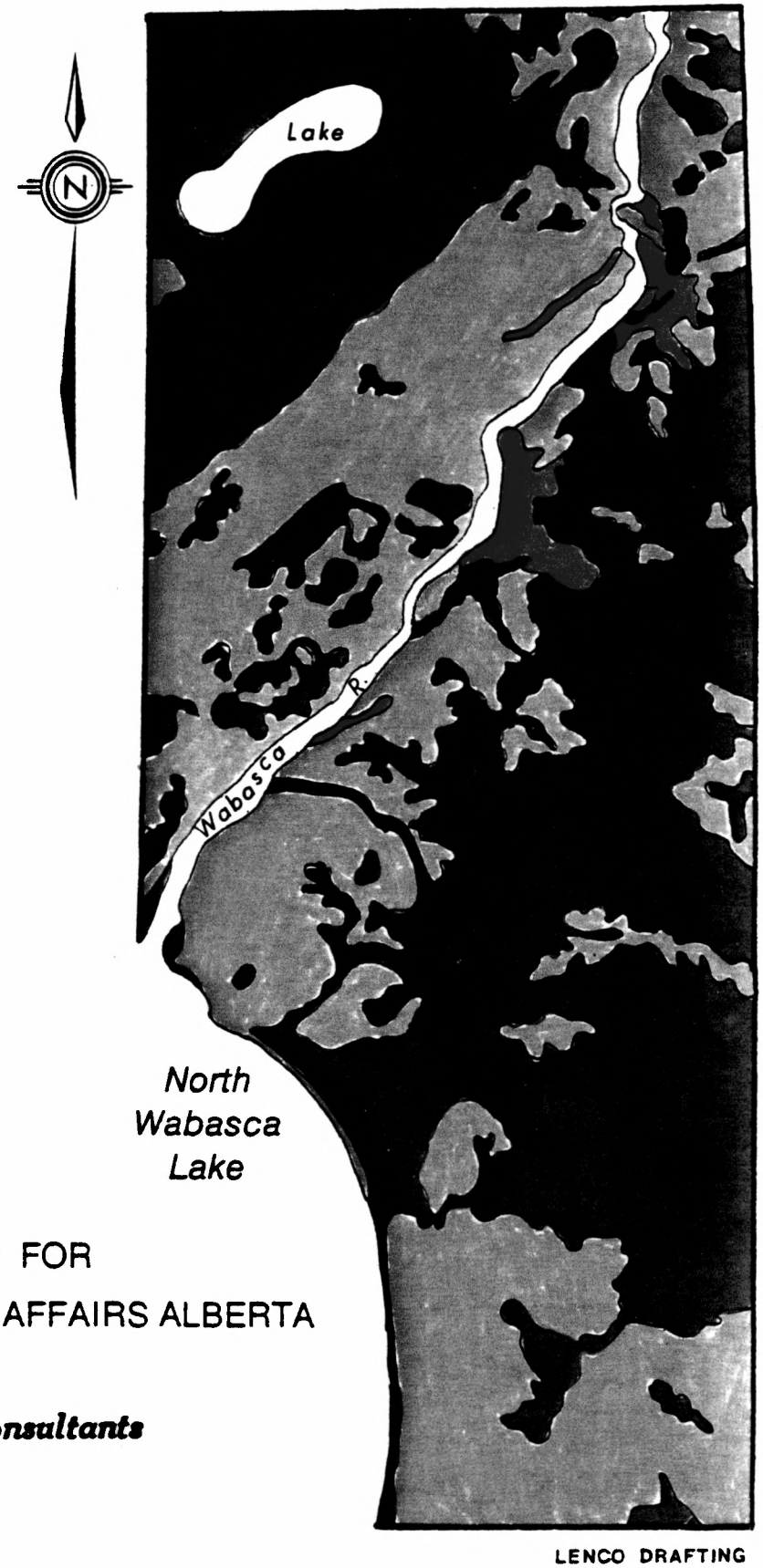
These lands have severe constraints for settlement due to wetness and periodic flooding. They have a Class 5 agricultural capability rating and are suitable for limited forage crop production with potential flooding hazard and wetness limitations.

Area C - Soil Map Units 7, 15, 16, SC and ✱

These lands are generally unsuitable for all uses considered because of excessive wetness or flooding hazards (Unit SC). Constraints to settlement are severe and Agricultural Capability ratings are Class 6 or 7. Also included in this group are the Organic soils (Soil Unit 16).

POTENTIAL LAND USE

BIGSTONE INDIAN RESERVE No. 166 C



LEGEND:

- Area A
- Area B
- Area C

(see page 58)

SCALE: 1:50,000

PREPARED FOR

INDIAN AND NORTHERN AFFAIRS ALBERTA

BY

Pedology Consultants

LENCO DRAFTING

6.7 SUMMARY OF RESERVE #166C

. Present Land Use - A Present Land Use Map, at a scale of 1:20,000, has been prepared based on photo interpretation and field checking during the soil survey.

Almost all of the Reserve is in its native forest and wetland vegetation. A limited amount of clearing has taken place around settlements.

. Semi-Detailed Soil Survey - Soils were inspected at 78 sites. Eleven principal soil map units and three miscellaneous map units were recognized in the area. They are described in the text and legend. The soil map is presented on an aerial photo mosaic at a scale of 1:20,000 (back pocket).

. Parent Materials - Seven parent materials were recognized in the area. Important soil types found on mineral materials include: Orthic Gray Luvisols, Solonetzic Gray Luvisols, Gleyed Gray Luvisols, Gleysols, peaty Gleysols and Regosols. Terric and Typic Mesisols are dominant where organic deposits have accumulated.

The majority of the Reserve is occupied by very poorly drained Organic soils and by moderately well to imperfectly drained Luvisolic soils occurring on glaciolacustrine deposits.

. Agricultural Capability - An Agricultural Capability Map has been prepared at a scale of 1:50,000.

The upland Luvisolic soils are marginally suitable for cultivated crops. Limitations of unfavorable climate (C) and slow permeability (D) restrict the agricultural capability to Class 4.

A few wetter areas, rated as Class 5W are suitable only for improved pasture or forage crops.

The lowlands containing Organic soils, Gleysols and streams are generally unsuitable for agriculture.

. Settlement Suitability - Soil interpretations or estimates of soil performance have been made using field and laboratory data, published guidelines and information from other soil surveys. The soil interpretations for settlement suitability include: constraints to family dwellings, road location, septic tank absorption fields, recreation, sewage lagoon location, and sources of sand, gravel and subgrade materials.

The ratings for specific uses have been considered jointly in preparing a Settlement Suitability Map. For each map area, favorable and potentially troublesome conditions are given, emphasizing topography, drainage, wetness, soil physical properties and erosion hazard.

Very few areas of low constraints to settlement occur in the Reserve.

Sizeable areas with moderate constraints to settlement are found throughout the Reserve. The areas with moderate constraints are characterized by materials which have a high shrink-swell potential, slow permeability and possible concrete corrosion hazard that all require special attention.

Approximately half the Reserve has severe constraints to settlement due to excessive wetness, flooding or the occurrence of organic materials.

. Potential Land Use - Based on the concerns of agriculture and settlement, a Potential Land Use Map is provided for the Reserve which delineates three areas. Sizeable portions are well to moderately suited for settlement and marginally suited for cultivated crops (Area A). A small portion can support limited agricultural forage crop production or improved pasture but has severe limitations for grain crops or settlement uses (Area B). A considerable portion is unsuitable for all uses due to excessive wetness and the presence of organic materials (Area C).

7.0 BIGSTONE INDIAN RESERVE #166D

7.1 PRESENT LAND USE

A Present Land Use Map (page 63) was mapped at 1:20,000 and reduced to page size (scale 1:50,000). The background, a photo mosaic, enables one to see the roads, lakes and streams. The Legend for this map lists the main types of land use encountered and the Explanation of Legend below describes the units in more detail.

Explanation of Legend

Settled Lands (S) - These are areas that have been cleared of forest cover and are predominantly occupied by residences.

Forested and Rough Pasture (F) - These are areas of either forested land or areas where no improvements have been made.

Bogs (B) - These are poorly drained, frequently ponded areas containing Gleysolic and Organic soils. Vegetation consists mainly of black spruce, birch, willow, sedges and mosses.

Delta (D) - These are poorly drained, frequently ponded areas located near North and South Wabasca Lakes that contain Gleysolic and Regosolic soils, and willow, sedge and moss vegetation.

Water (W) - Open bodies of water.

Slough (*) - These are poorly drained, frequently ponded areas that support mainly sedge vegetation.

HF - Hay Field

SP - Sand Pits

-------- - Cutlines and trails.

PRESENT LAND USE
BIGSTONE INDIAN RESERVE No. 166 D

7.2 SOILS

Field investigations revealed the presence of six major soil forming parent materials in Bigstone Indian Reserve #166D. These were separated into 13 map units based on differences in soils, topography and drainage as described below. Five miscellaneous units; stream channels, sloughs, open water, sand pits and escarpments, were also recognized and described. Detailed profile descriptions of some of the dominant soils are provided in Appendix A.

Soils on Glaciofluvial Deposits

Sandy to silty clay loam, non-stony to very stony glaciofluvial deposits. The sandier material tends to occur on ridged, moderately rolling topography whereas the silty material occurs on gently undulating to undulating topography. The sands are rapidly permeable, have a low shrink-swell potential, a low frost heave potential and are classified as SM according to the Unified Classification. The finer textured deposits are moderately permeable, have a low to medium shrink-swell potential, a medium frost heave potential and are classified as CL according to the Unified Classification. Sulfate content is negligible in both the sandy and finer textured deposits.

Differentiating characteristics of the map units on glaciofluvial material are:

Map Unit	Dominant Soil Subgroup*	Dominant Texture	Drainage	Slope
1	Eluviated Eutric Brunisols	LS-S	rapidly	10-15%
2	Orthic Gray Luvisols	FSL-SiCL	well-rapidly	0-5%

Soils on Till Deposits

Loam to clay loam, slightly to moderately stony till deposits occurring on gently rolling topography. The till material is ML or CL according to the Unified Classification. It is moderately permeable and has a medium shrink-swell potential and frost heave potential. Sulfate content is negligible and should pose no problem to concrete.

Only one map unit on till material was recognized. It has the following distinguishing features:

Map Unit	Dominant Soil Subgroup	Dominant Texture	Drainage	Slope
3	Orthic Gray Luvisols	L-CL	moderately well	6-9%

Soils on Glaciolacustrine Deposits

A large portion of Bigstone Indian Reserve #166D is comprised of soils developed on silty clay to heavy clay, non-stony glaciolacustrine deposits. Topography is characteristically level to undulating and depressional. The glaciolacustrine sediments have slow permeabilities, high shrink-swell potential, and medium frost heave potential. They are rated as CH in the Unified System, as HC in the USDA System and A-7-6(20) in the AASHO Classification System. Sulfate content is sufficient in places to cause a positive attack on concrete, unless corrective measures are taken.

Distinguishing characteristics of the glaciolacustrine map units are:

Map Unit	Dominant Soil Subgroup	Dominant Texture	Drainage	Slope
4	Orthic Gray Luvisols	SiC-C	moderately well	0-5%
5	Gleyed Gray Luvisols	SiC-C	imperfectly	0-5%
6	Orthic Luvic Gleysols	SiC-C	poorly	0-2%
7	peaty Orthic Gleysols	SiC-C	very poorly	0-2%

Soils on Fluvial-Lacustrine Deposits

These are non-stony, stratified silty clay loam, silt loam, and silty clay fluvial-lacustrine deposits which originated from the combined actions of moving water and ponded water after glaciation. These materials are subject to periodic flooding (once in 20-50 years) and occur on level to gently undulating topography. Classified as CH in the Unified System, they have slow permeabilities, high shrink-swell and medium frost heave potentials. Sulfates are negligible.

Distinguishing characteristics of the fluvial-lacustrine map units are:

Map Unit	Dominant Soil Subgroup	Dominant Texture	Drainage	Slope
9	Orthic Gray Luvisols	SiCL-SiL-SiC	moderately well	0-2%
10	Gleyed Gray Luvisols	SiCL-SiL-SiC	imperfectly	0-2%
11	Orthic Luvic Gleysols	SiCL-SiC	poorly	0-2%
12	Rego Gleysols	SiC	very poorly	0-2%

Soils on Recent Fluvial Deposits

Non-stony, stratified, silt loam and fine sandy loam recently deposited fluvial materials occurring on nearly level to undulating topography. These areas are subject to flooding during the spring snow-melt and after heavy rains and are affected by a seasonally high water table. They are rapidly to moderately permeable, have a low to medium shrink-swell and frost heave potential and are classified as SM to CL in the Unified Classification System.

The one map unit is characterized as follows:

Map Unit	Dominant Soil Subgroup	Dominant Texture	Drainage	Slope
13	Gleyed Regosols	SiL-FSL	imperfectly	0-5%

Soils on Organic Deposits

Very poorly drained depressional and gently sloping areas with accumulations of 0.5 to 1.2 m or more of moss and sedge peat overlying silty clay to clay glaciolacustrine material. The peat is usually moderately decomposed but in some cases, where the topography is gently sloping the peat is well decomposed.

All Organic soils are grouped into one map unit which has the following features:

Map Unit	Dominant Soil Subgroup	Dominant Texture	Drainage	Slope
16	Terric and Typic Mesisols	-	very poorly	0-2%

Miscellaneous Units and Symbols

Stream Channels (SC)

This unit includes the banks, meander scars and channels of streams. The banks are commonly steep, and the valley bottom is affected by seasonal flooding, making these areas unsuitable for most uses. A natural vegetative cover should be maintained to minimize soil and geological erosion.

Sand Pit (SP)

Areas where sand has been excavated.

Sloughs (✱)

Areas consisting predominantly of sedge and have water tables at or near the surface.

Open Water (Ō)

Bodies of water with little or no surface vegetation.

Escarpment (⊥⊥⊥)

Steeply sloping land subject to soil erosion if the natural vegetation is removed.

7.3 LABORATORY ANALYSIS

Laboratory analyses were conducted on representative glaciolacustrine, glaciofluvial, and fluvial-lacustrine samples collected in the Reserve. The results are described in Table 10 (D-7, D-33, D-52). This information is used to aid in characterizing the soil materials and in making soil interpretations.

TABLE 10. Laboratory Test Data and Classification of Selected Soils within the Bigstone Indian Reserves 166B, 166C and 166D.

SOIL MAP UNIT	INSP.* SITE#	DEPTH (cm)	pH (H_2O)	EC	% SO_4	% Passing Sieve #4	#10	#40	#200	% Smaller than #270 (0.05mm)	0.002mm	Atterberg Limits Liquid Limit	Plasticity Index (PI)
1	C-43	70-100	6.7	1.3	-	87	81	41	17	16	8	NL	NP
2	B-11	60-100	5.7	0.2	-	100	99	94	32	27	14	22	9
2	D-52	80-100	4.7	0.3	-	100	100	100	98	92	26	34	19
3	C-63	70-100	4.8	0.2	-	100	99	94	69	61	32	29	8
4	B-37	60- 90	4.5	3.0	0.153	100	100	100	98	92	74	83	54
4	B-37	90-120	6.9	6.2	0.502	-	-	-	-	-	-	-	-
4	B-51	70-100	7.2	2.5	0.139	100	100	100	98	94	70	65	40
5	C-25	80-110	6.9	1.4	-	100	100	98	84	76	62	58	37
5	D-7	80-100	6.0	0.2	-	100	100	100	98	92	74	55	29
9	D-33	80-100	6.4	0.4	-	100	100	99	98	88	38	59	34

SOIL MAP UNIT	INSP.* SITE#	DEPTH (cm)	SAT. %	CLASSIFICATION UNIFIED	AASHO	USDA	PERMEABILITY (1)	SHRINK-SWELL POTENTIAL (2)	FROST HEAVE POTENTIAL (3)
1	C-43	70-100	17	SM	A-1-b(0)	LS	R	L	L
2	B-11	60-100	26	SM	A-4(1)	SL	R	L	L
2	D-52	80-100	42	CL	A-6(16)	SiL	M	L-M	M
3	C-63	70-100	37	CL-ML	A-4(7)	CL	M	L-M	M-H
4	B-37	60- 90	78	CH	A-7-6(20)	HC	S	H	M
4	B-37	90-120	73	-	-	-	S	H	M
4	B-51	70-100	74	CH	A-7-6(20)	HC	S	H	M
5	C-25	80-110	63	CH	A-7-6(20)	HC	S	H	M
5	D-7	80-100	71	CH	A-7-6(19)	HC	S	H	M
9	D-33	80-100	73	CH	A-7-6(20)	SiCL	S	H	M

(1) **Permeability Classes**
S - Slow; less than 0.5 cm/hr
M - Moderate; 0.5 to 1.5 cm/hr
R - Rapid; more than 1.5 cm/hr

(2) Shrink-Swell Potential
L - Low
M - Medium
H - High

(3)+ Frost Heave Potential
L - Low; F1 & F2 frost groups
M - Medium; F3 frost group
H - High; F4 frost group

+ from U.S. Army Corps of Engineers, 1962.

* The letter before the numerical digit indicates Reserve number;
ex B = 166B Reserve
C = 166C Reserve
D = 166D Reserve

7.4 AGRICULTURAL CAPABILITY

Soil capability for agriculture is displayed on the Agricultural Capability Map, Bigstone Indian Reserve #166D (page 71) and in Table 11.

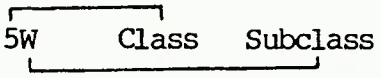
The Reserve lies within Agro-Climatic Zone 3H. Limitations such as undesirable soil structure (D), inundation (I), excessive wetness (W), moisture deficiency problems (M), adverse topography (T) and the presence of Organic soils (O) further limit the agricultural capability to as low as Class 7.

Table 11. Agricultural Capability Rating of the Bigstone Indian Reserve #166D.

Capability Class	Subclass	Map Unit
4	4D	4, 10
	4^{D}_{W}	5, 9
5	5W	6
	5^{I}_{W}	13
6	6T	
	6W	7,
	6^{I}_{W}	SC
	6^{M}_{T}	1
7	7W	O
O	O	16

EXPLANATION OF AGRICULTURAL CAPABILITY MAP LEGEND

NOTATION:



AGRICULTURE CAPABILITY CLASSES

Class 4 - these soils have severe limitations that restrict the range of crops that can be grown or require special conservation practices to overcome or both.

Class 5 - these soils have very severe limitations that restrict their capability to producing perennial forage crops and improvement practices are not feasible.

Class 6 - these soils are capable only of producing perennial forage crops and improvement practices are not feasible.

Class 7 - these soils or land types have no capability for arable culture or permanent pasture.

O - Organic soils not rated for agriculture.

SOIL CAPABILITY SUBCLASSES

Soil Limitations:

Subclass D - undesirable soil structure and/or slow permeability

Subclass M - low moisture holding capacity

Landscape Limitations:

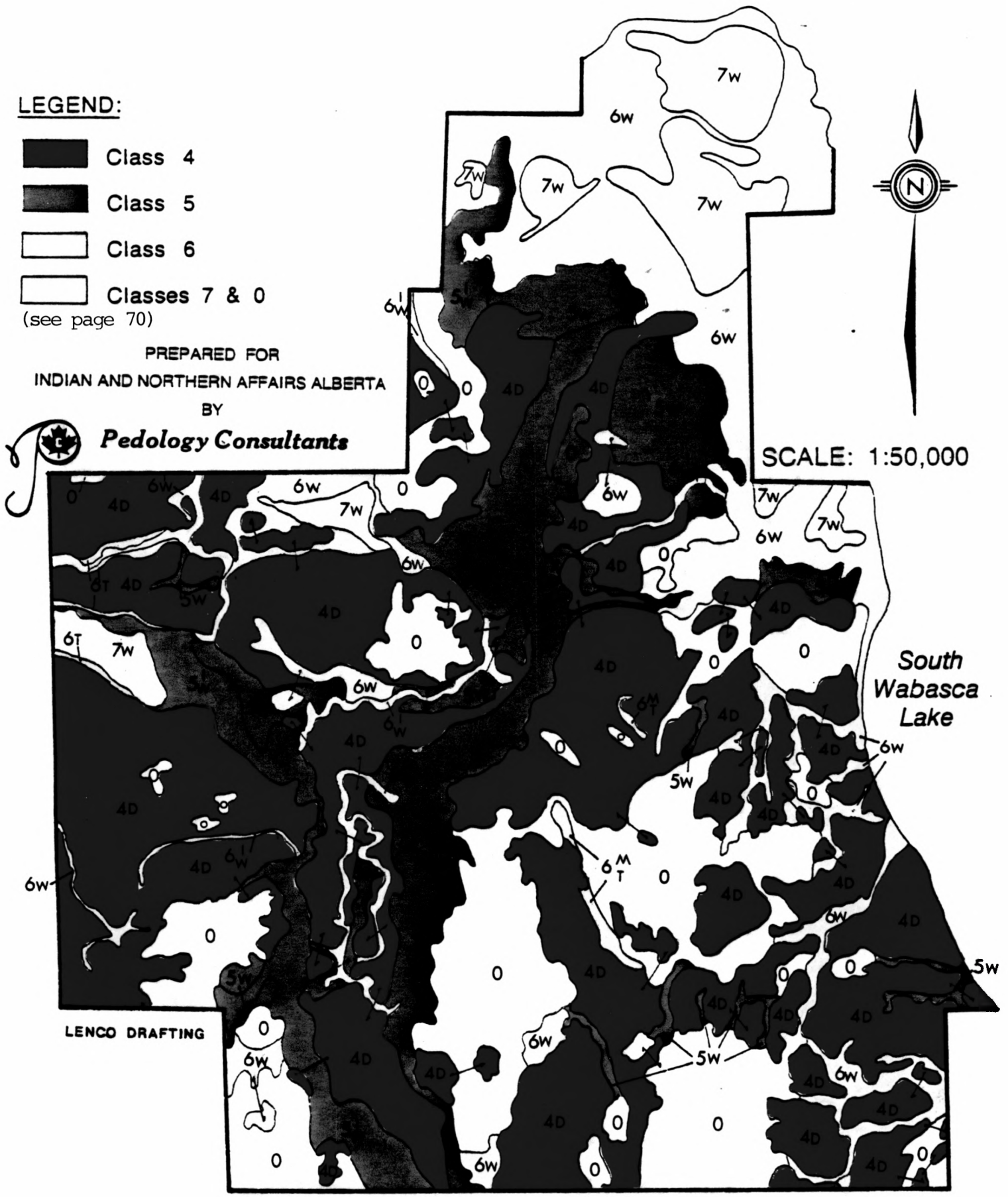
Subclass I - inundation (flooding)

Subclass T - adverse topography, both steepness and pattern

Subclass W - excessive moisture

AGRICULTURAL CAPABILITY

BIGSTONE INDIAN RESERVE No. 166 D



7.5 SETTLEMENT SUITABILITY

The settlement uses considered in evaluating Settlement Suitability are: single family dwellings (with and without basements), septic tank absorption fields, road and parking lot location, road subgrade material, and recreation uses. In addition, constraints for sewage lagoons and suitability as a source of sand and gravel are assessed since requirements for these uses differ from those for settlement suitability. Ratings of all Soil Map Units for all the above uses are given in Table 12.

Areas of Low, Moderate and Severe constraints as well as kind of constraints are displayed on the Settlement Suitability Map, page 76.

Low Constraints - Soil Map Units 1, 2 and 3

The areas of low constraints to settlement occur on moderately well to rapidly drained glaciofluvial deposits and moderately well drained till deposits.

The topography varies from gently undulating (Map Unit 2) to moderately rolling (Map Unit 1). The till deposits (Map Unit 3) occur on gently rolling topography.

Although the land occurring in these map units is generally favorable for development, some site specific problems, such as steep topography, may be encountered and these should be considered prior to construction. Soils of Unit 1 are severely limited for sewage lagoons because of the soils rapid permeability.

Moderate Constraints - Soil Map Units 4, 5, 9 and 10

The constraints to settlement for these map units include a high shrink-swell potential (all of the Units) and possible concrete corrosion (Units 4 and 5). Careful site selection and proper design taking into account these constraints should enable successful development of these lands. Development costs will likely be higher than in areas of low constraints.

TABLE 12. Degrees and Kinds of Constraints for Various Settlement Uses of all Map Units Occurring in the Bigstone Indian Reserves No. 166B, 166C, 166D.

SOIL MAP UNIT	SINGLE FAMILY DWELLINGS		SEPTIC TANK ABSORPTION FIELDS	SEWAGE LAGOONS	ROAD AND PARKING LOT LOCATION	SOURCE OF ROAD SUBGRADE MATERIAL	SOURCE OF SAND AND GRAVEL	RECREATION		
	WITH BASEMENTS	WITHOUT BASEMENTS						CAMP-GROUNDS	PICNIC AREAS	HIKING TRAILS
1	L-M3	L-M3	L-M3	S9,3	L-M3	G	G	M3,5	M3,5	L-M5
o 2	L-M22	L-M22	L-M10	M10	L-M22	G-F	U	L	L	L
3	L-M22	L-M22	L-M10	L-M3	L-M22	F	U	L	L	L
4	M13,23	M13,23	M-S11	L	M-S13	P	U	M6,11	M6,11	M6,11
5	M13,2,23	M13,23	S11,2	L	M-S13,2	P	U	M2,6,11	M2,6,11	M2,6,11
+ 6	S2,13	S2,13	S2,11	S2	S2,13	P	U	S2	S2	S2
7	S2,20	S2,20	S2,11	S2,20	S2,20	P	U	S2,20	S2,20	S2,20
+x 8	M13,2	M13	S11,2	L	M-S13,2	P	U	M2,6,11	M2,6,11	M2,6,11
+o 9	M13	M13	M-S11	L	M-S13	P	U	M6,11	M6,11	M6,11
+o 10	M13,2	M13	S11,2	L	M-S13,2	P	U	M2,6,11	M2,6,11	M2,6,11
+o 11	S2,13	S2,13	S2,11	S2	S2,13	P	U	S2	S2	S2
o 12	S1,2,20	S1,2,20	S2,11,12	S1,2,20	S1,2,20	U	U	S1,2,20	S1,2,20	S1,2,20
13	S1,2	S1,2	S1,2,12	S1,2,10	S1,2	F-P	P	S1,2	S1,2	S1,2
+x 14	L	L	S9,12	S9,12	L	G	G	M5	M5	M5
+x 15	S2,20	S2,20	S2,12	S2,9,20	S2,20	U	P	S2,20	S2,20	S2,20
16	S2,19	S2,19	S2,19	S2,19	S2,19	U	U	S2,19	S2,19	S2,19
SC	S1,2	S1,2	S1,2,12	S1,2,10	S1,2	P	U	S1,2	S1,2	S1,2

DEGREE OF CONSTRAINT:

L - Low
M - Moderate
S - Severe

SUITABILITY AS SOURCES:

G - Good P - Poor
F - Fair U - Unsuitable

KINDS OF CONSTRAINTS:

1: Flooding hazard (overflow)
2: Seasonally high groundwater table or surface ponding
3: Excessive slope
5: Sandy surface texture
6: Slippery or sticky when wet
9: Rapid permeability
10: Moderate permeability
11: Slow permeability
12: Groundwater contamination hazard
13: High shrink-swell potential
19: Organic soil
20: Organic surface layer 15-50 cm thick
22: Moderate shrink-swell potential
23: Possible concrete corrosion hazard (soluble sulfate)

+ Soil Map Unit does not occur in Reserve #166B
o Soil Map Unit does not occur in Reserve #166C
x Soil Map Unit does not occur in Reserve #166D

Severe Constraints - Soil Map Units 6, 7, 11, 12, 13, 16 and Stream Channels (SC)

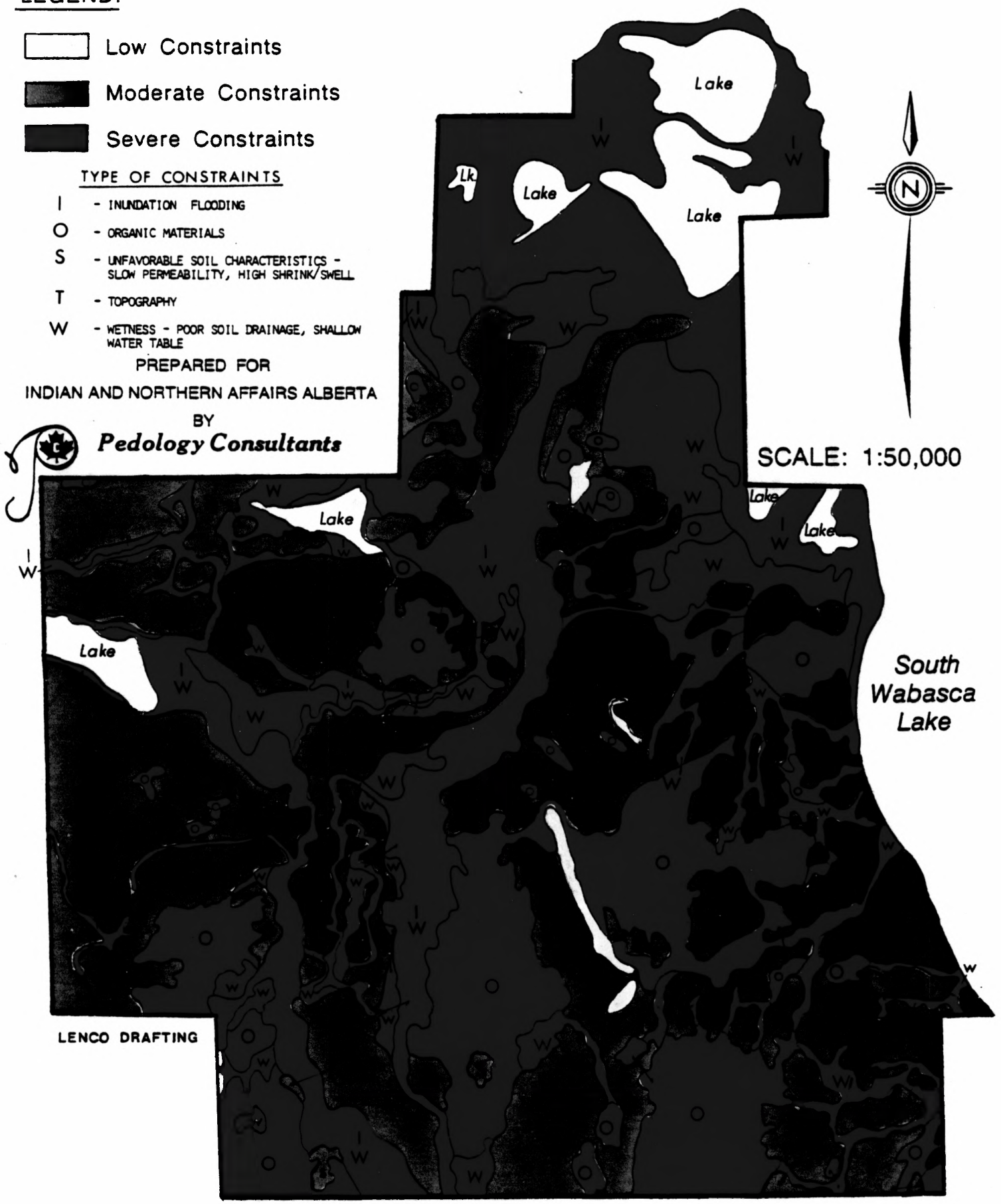
Lands in this group are unsuitable for development for one or more reasons. All of them suffer from excessive wetness. Some have a high shrink-swell potential (Units 6, 7, 11, and 12) or a flooding hazard (Units 12 and 13). The stream channel unit has steep banks as well as flood prone valley bottoms. Also included in this group are the Organic soils (Unit 16).

SETTLEMENT SUITABILITY

	Soil Interpretations				Soil Characteristics and Qualities									
	SETTLEMENT USES	SEWAGE LAGOONS	SOURCE OF SAND & GRAVEL	HAZARDS	SOIL MAP UNIT	LANDFORM	PERMEABILITY	WATER TABLE DEPTH	SOIL DRAINAGE CLASS	TOPOGRAPHY (SLOPES)	UNIFIED TEXTURE	SHRINK-SWELL POTENTIAL	FROST HEAVE POTENTIAL
LOW CONSTRAINTS	Favorable Conditions: rapidly to moderately well drained soils, deep water tables Potentially Troublesome Conditions: rapid permeability, sandy surface texture, slope in Unit 1, moderate shrink-swell	severe (permeability)	good	topography and sandy surface texture	1	- sandy glaciofluvial - ridged and moderately rolling	rapid	2 m	rapidly	10-15%	SM	low	low
		moderate (permeability)	unsuitable	moderate shrink-swell	2	- sandy to clayey glaciofluvial - gently undulating to undulating	moderate	2 m	well-moderately well	0-5%	SM-CL	low-medium	low-medium
		low constraints	unsuitable	moderate shrink-swell	3	- loamy to clayey till - gently rolling	moderate	2 m	moderately well	6-9%	CL	medium	medium
		severe (permeability & pollution)	good	sandy surface texture and pollution	14	- sandy recent beach deposits - level to gently undulating	rapid	1-1.5 m	rapidly	0-2%	SW	low	low
MODERATE CONSTRAINTS	Favorable Conditions: moderately well to imperfectly drained soils, water tables below 1.5 m, undulating topography Potentially Troublesome Conditions: high shrink-swell, slow permeability, concrete corrosion hazard in Units 4 and 5, susceptible to occasional flooding in Units 9 and 10	low constraints	unsuitable	high shrink-swell and concrete corrosion	4	- clayey glaciolacustrine - level to undulating	slow	2 m	moderately well	0-5%	CH	high	medium
		low constraints	unsuitable		5		slow	1.5-2 m	imperfectly		CH	high	medium
		low constraints	unsuitable	high shrink-swell	8	- clayey lacustrine - level to gently undulating	slow	1.5-2 m	imperfectly	0-2%	CH	high	medium
		low constraints	unsuitable	high shrink-swell and occasional flooding	9	- silty to clayey fluvial/lacustrine - level to gently undulating	slow	2 m	moderately well	0-2%	CH	high	medium
		low constraints	unsuitable		10		slow	1.5-2 m	imperfectly		CH	high	medium
SEVERE CONSTRAINTS	Troublesome Conditions: high water table, poor drainage, high shrink-swell	severe (wetness)	unsuitable	wetness and high shrink-swell	6	- clayey glaciolacustrine - depressional to gently undulating	slow	0.5-1 m	poorly	0-2%	CH	high	medium
		severe (wetness)	unsuitable		7		slow	0-0.5 m	very poorly		CH	high	medium
	Troublesome Conditions: high water table, poor drainage, occasional flooding, high shrink-swell	severe (wetness)	unsuitable	wetness, high shrink-swell and occasional flooding	11	- silty to clayey fluvial/lacustrine - depressional to gently undulating	slow	0.5-1 m	poorly	0-2%	CH	high	medium
		severe (wetness)	unsuitable		12		slow	0-0.5 m	very poorly		CH	high	medium
	Troublesome Conditions: wetness, flooding, pollution	severe (wetness and flooding)	poor	wetness and flooding	13	- silty to sandy recent fluvial - level to undulating	rapid-moderate	1-1.5 m	imperfectly	0-5%	SM-CL	low-medium	low-medium
	Troublesome Conditions: high water table, surface peat, poor drainage, rapid permeability, pollution	severe (wetness & permeability)	poor	wetness	15	- peat overlying sandy recent beach - depressional to gently undulating	rapid	0-0.5 m	very poorly	0-2%	SW	low	low
	Troublesome Conditions: high water table, very poor drainage, deep peat	severe (organic soils)	unsuitable	wetness and depth of peat	16	- peat fens and bogs - depressional to gently sloping	-	0-0.5 m	very poorly	0-2%	—	-	-
	Troublesome Conditions: flooding, erosion	severe (wetness and flooding)	unsuitable	flooding and erosion	SC	- Stream Channel and small fluvial plain	-	0-1 m	imperfectly to very poorly	30%	—	-	-

SETTLEMENT SUITABILITY

BIGSTONE INDIAN RESERVE No.166D



7.6 POTENTIAL LAND USE

The various settlement uses and agricultural capability have been considered together in preparing a Potential Land Use Map (page 78). It shows three distinctive Areas in terms of development opportunities as outlined below.

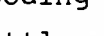
Area A - Soil Map Units 1, 2, 3, 4, 5, 9 and 10

This area is the best for settlement and agriculture in the Reserve. Unit 1 has low constraints to settlement and the rest of the Units have low to moderate constraints for settlement. Units 2, 3, 4, 5, 9 and 10 have a marginal Agricultural Capability rating (Class 4). Unit 1 is included in Area 1, even though it has a Class 6 Agricultural Capability rating because it is the land with the least constraints to settlement and also only occurs in small areas adjacent to Class 4 agricultural land.

Area B - Soil Map Units 6, 11 and 13

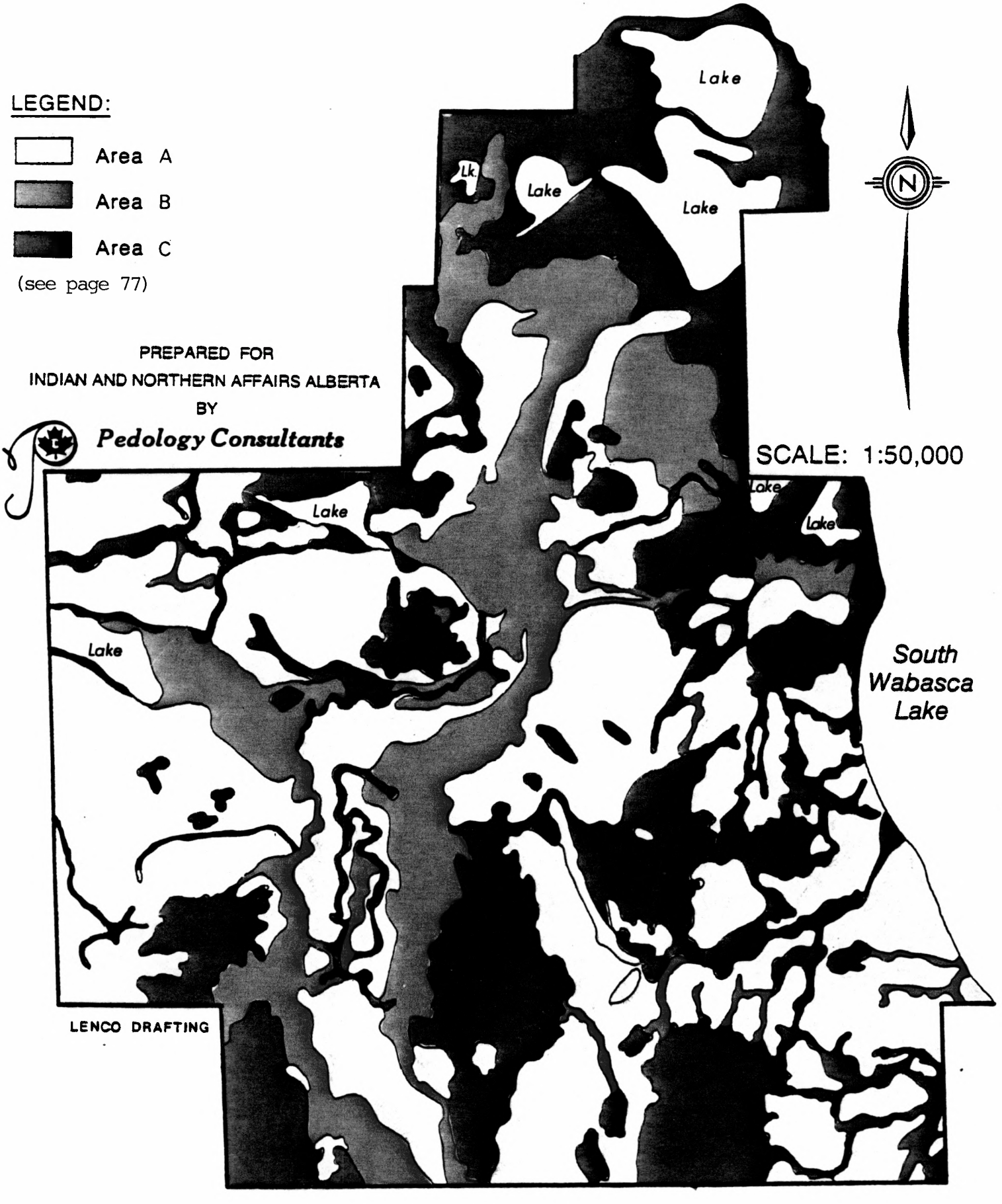
These lands have severe constraints for settlement due to wetness and periodic flooding. They have a Class 5 agricultural capability rating and are suitable for limited forage crop production with potential flooding hazard and wetness limitations.

Area C - Soil Map Units 7, 12, 16, SC,  and 

These lands are generally unsuitable for all uses considered because of excessive wetness (Units 7, 2, 16 and ), a flooding hazard (Unit SC), or steep banks (Units  , SC). Constraints to settlement are severe and Agricultural Capability ratings are Class 6 or 7. Also included in this group are the Organic soils (Soil Unit 16).

POTENTIAL LAND USE

BIGSTONE INDIAN RESERVE No. 166 D



7.7 SUMMARY OF RESERVE #166D

. Present Land Use - A Present Land Use Map, at a scale of 1:50,000, has been prepared, based on photo interpretation and field checking during the soil survey.

Almost all of the Reserve is in its native forest and wetland vegetation. A limited amount of clearing has taken place around settlements.

. Semi-Detailed Soil Survey - Soils were inspected at 125 sites. Thirteen principal soil map units and five miscellaneous map units were recognized in the area. They are described in the text and legend. The soil map is presented on an aerial photo mosaic at a scale of 1:20,000 (back pocket).

. Parent Materials - Six parent materials were recognized in the area. Important soil types found on mineral materials include: Orthic Gray Luvisols, Solonetzic Gray Luvisols, Gleyed Gray Luvisols, Gleysols, peaty Gleysols and Regosols. Terric and Typic Mesisols are dominant where organic deposits have accumulated.

The majority of the Reserve is occupid by very poorly drained Organic soils and by moderately well to imperfectly drained Luvisolic soils occurring on glaciolacustrine deposits.

. Agricultural Capability - An Agricultural Capability Map has been prepared at a scale of 1:50,000.

The well to imperfectly drained Luvisolic soils are marginally suitable for cultivated crops. Limitations of unfavorable climate (C) and slow permeability (D) restrict the agricultural capability to Class 4.

The fluvial-lacustrine flood plains are rated as Class 5 and are suitable only for improved pasture or forage crops.

The lowlands containing Organic soils, Gleysols and streams are generally unsuitable for agriculture.

. Settlement Suitability - Soil interpretations or estimates of soil performance have been made using field and laboratory data, published guidelines and information from other soil surveys. The soil interpretations for settlement suitability include: constraints to family dwellings, road location, septic tank adsorption fields, recreation, sewage lagoon location, and sources of sand, gravel and subgrade materials.

The ratings for specific uses have been considered jointly in preparing a Settlement Suitability Map. For each map area, favorable and potentially troublesome conditions are given, emphasizing topography, drainage, wetness, soil physical properties and erosion hazard.

Very few areas of low constraints to settlement occur in the Reserve.

Sizeable areas with moderate constraints to settlement are found throughout the Reserve. The areas with moderate constraints are characterized by materials which have high shrink-swell potential, slow permeability and possible concrete corrosion hazard that all require special attention.

A large portion of the Reserve has severe constraints to settlement due to excessive wetness, flooding or the occurrence of organic materials.

. Potential Land Use - Based on the concerns of agriculture and settlement, a Potential Land Use Map is provided for the Reserve which delineates three areas. Sizeable portions are well to moderately suited for settlement and marginally suited for cultivated crops (Area A). Portions of the Reserve can support limited agricultural forage crops or improved pasture but have severe limitations for settlement or grain crops (Area B). Large areas are unsuitable for all uses due to excessive wetness and the presence or organic materials (Area C).

8.0 REFERENCES

1. Aandahl, A. R., 1958. Soil Survey Interpretations: Theory and Purpose. Soil Sci. Soc. Amer. Proc. 22:152-154.
2. American Society for Testing and Materials, 1970. Annual Book of Standards, Part II, Amer. Soc. Testing Materials, Philadelphia. 982 pp.
3. Atmospheric Environment, 1975. Canadian Normals Temperatures (1941-1970), Volume I-SI. Env. Canada. Downsview, Ontario.
4. Atmospheric Environment, 1975. Canadian Normals Precipitation (1941-1970), Volume II-SI. Env. Canada. Downsview, Ontario.
5. Bowser, W. E., 1967. Agro-Climatic Areas of Alberta. Map printed by Surveys and Mapping Branch, Dept. of Energy, Mines and Resources, Ottawa.
6. Canada Land Inventory, 1972. Soil Capability Classification for Agriculture. Report No. 2. Environment Canada.
7. _____, 1971. Soil Capability Classification for Agriculture; Lesser Slave Lake Area 830. Canada Dept. of Regional Economic Expansion.
8. Canada Soil Survey Committee, 1978. The Canadian System of Soil Classification. Research Branch, Canada Dept. of Agriculture. Publ. 1646.
9. Coen, G. M. and W. D. Holland, 1976. Soils of Waterton Lakes National Park, Alberta. Canada Dept. Supply and Services, Cat. No. A52-48, 1976, Ottawa.
10. Green, R. and G. B. Mellon, 1962, and Carrigy, M. A. and R. Green, 1965. Bedrock Geology of Northern Alberta. Research Council of Alberta, 1970.
11. Harris, R. E., 1978. Northern Gardening, Agriculture Canada, Publ. 1575.
12. Harris, R. E., et al, 1972. Farming Potential of the Canadian Northwest. Agriculture Canada, Publ. 1466.
13. Lindsay, J. D. and M. D. Scheelar, 1972. Soil Survey for Urban Development, Edmonton, Alberta; Research Council of Alberta; Report 72-7.
14. Maynard, Denny, 1979. Terrain Capability for Residential Settlements: Summary Report. Resource Analysis Branch, Ministry of Environment, Province of British Columbia.

REFERENCES, Continued . . .

15. Montgomery, P. H. and F. C. Edminster, 1966. The use of soil surveys in planning for recreation. In: Soil Surveys and Land Use Planning, Bartelli et al. (ed.) Soil Sci. Soc. Amer. and Amer. Soc. Agron., Madison, Wisconsin. pp. 104-112.

16. Pedology Consultants, 1981. Land Resource Survey; Wabasca Indian Reserve #166A.

17. Pettapiece, W. (in prep.). Physiographic Regions of Alberta; Alberta Institute of Pedology.

18. Strong, W. L. and K. R. Leggat. Ecoregions of Alberta. ENR report 143. March, 1980 (preliminary copy).

19. Swenson, E. G., 1971. Concrete in sulphate environments. Canadian Building Digest, Div. of Building Research, National Research Council of Canada, 136; 4 pp.

20. Takyi, S. K. and D. J. Pluth, 1976 revised. Soil Capability for Agriculture and Potential Crop Production of Indian Reserves in Alberta. Dept. of Soil Science; University of Alberta.

21. United States Bureau of Reclamation, 1966. Concrete Manual; United States Dept. Interior, Bureau of Reclamation; 7th edition, 642 pp.

22. U.S.D.A., 1972. Guide for interpreting engineering uses of soils. Soil Conservation Service. Washington, D.C.

APPENDICES

APPENDIX A

- SOIL INSPECTION SITES -

NOTATIONS:

Soils

CUR - Cumulic Regosol
CURG - Cumulic Rego Gleysol
EEB - Eluviated Eutric Brunisol
FM - Fibric Mesisol
GLCUHR - Gleyed Cumulic Humic Regosol
GLDGL - Gleyed Dark Gray Luvisol
GLGL - Gleyed Gray Luvisol
GLR - Gleyed Regosol
GLSZGL - Gleyed Solonetzic Gray Luvisol
OG - Orthic Gleysol
OGL - Orthic Gray Luvisol
OHG - Orthic Humic Gleysol
OLG - Orthic Luvic Gleysol
OR - Orthic Regosol
ptyG - peaty Gleysol
ptyHG - peaty Humic Gleysol
ptyLG - peaty Luvic Gleysol
ptyRG - peaty Rego Gleysol
RG - Rego Gleysol
SZGL - Solonetzic Gray Luvisol
TF - Terric Fibrisol
TM - Terric Mesisol
TyF - Typic Fibrisol
TyM - Typic Mesisol

Parent Material

BS - Beach Sand
F - Fluvial
FL - Fluvial-Lacustrine
GF - Glaciofluvial
GL - Glaciolacustrine
L - Lacustrine
O - Organic
T - Till

Soil Drainage

R - Rapidly
W - Well
MW - Moderately well
I - Imperfectly
P - Poorly
VP - Very poorly

Topography

Class		% Slope
1	depressional to level	0-0.5
2	nearly level to gently undulating	0.5-2
3	undulating	2-5
4	gently rolling	6-9
5	moderately rolling	10-15
6	strongly rolling	16-30

Stoniness

S0 - Nonstony
S1 - Slightly stony
S2 - Moderately stony
S3 - Exceedingly stony

Textures

S - Sand
Si - Silt
C - Clay
F - Fine
vf - Very fine
L - Loam
c - Coarse
gv - Gravel

INSPECTION SITES FOR BIGSTONE INDIAN RESERVE #166B

Site	Soil	Parent Material	Drainage	Topo-graphy	Surface Stoni-ness	Dominant Textures (Depths in cm) 0-20	20-50	50-100	100-120
1	FM	O	VP	2	S0	O	O	O	O
2	OGL	GF	MW-I	3	S0	SiL	SiCL	LS	
3	ptyLG	GL	P	2	S0	0	SiCL/CL	CL-C	
4	SZGL	GL	MW	2	S0	SiL	C	C	
5	GLSZGL	GL	MW-I	2	S0	SiCL	SiC-C	C	
6	OGL	T	MW	2	S1-2	gvSL	CL	CL	
7	OGL	T	MW	2	S1	LS-SL	CL	CL	
8	GLGL	T	I	2	S0	L	CL-C	CL	
9	TM	O/GL	VP	2	S0	O	O	O	
10	OGL	GF	MW-W	3	S0	SL	SCL	SCL	
11	OGL	GF	MW-W	2	S0-1	FSL	SCL	SCL-L	
12	TyM	O	VP	2	S0	O	O	O	O
13	TyM	O	VP	2	S0	O	O	O	O
14	TyM	O	VP	2	S0	O	O	O	O
15	TyM	O	VP	2	S0	O	O	O	O
16	GLGL	GL	I	2	S0	SiCL	CL-C	CL	
17	SZGL	GL	MW-I	3	S0	SiCL	C-CL	C-CL	C
18	SZGL	GL	MW	4	S0	SiCL	C	C	
19	TM	O/G	VP	2	S0	O	O	SiC	
20	GLGL	GF	I	2	S0	SiL	SiCL	C-CL	
21	TyM	O	VP	2	S0	O	O	O	O
22	OGL	GF	MW	2	S0	vfSL	SCL	CL	
23	OGL	GF	MW	2-3	S0	SL-LS	SL	SL-LS	
24	OGL	GL	MW	2	S0	SiL-L	SiCL	SiCL	
25	SZGL	GL	MW-I	3	S0	SiCL	C	C-CL	
26	ptyLG	GL	P	2	S0	O/SiC	C	C	
27	TM	O/GL	VP	2	S0	O	O	O/C	
28	TyM	O	VP	2	S0	O	O	O	O
29	OGL	GL	MW-I	2	S0	CL	SiC-C	SiC-C	
30	SZGL	GL	MW-I	2-3	S0	SiL	C	CL-C	

Site	Soil	Parent Material	Drainage	Topo-graphy	Surface Stoni-ness	Dominant Textures (Depths in cm) 0-20	20-50	50-100	100-120
31	TyF	O	VP	2	S0	O	O	O	O
32	ptyLG	GL	P	2	S0	O	SiCL/CL	C-CL	
33	OR	F	W	2-3	S0	L	L	SiL-L	
34	SZGL	GL	MW-I	2	S0	SiCL	C	C	
35	OGL	GL	MW	2-3	S0	SiCL	C	C	
36	OGL	GL	MW	2-3	S0	SiCL	C	C	
37	SZGL	GL	MW	2	S0	SiL	CL-C	C	
38	OLG	GL	P	2	S0	SiCL-SiL	SiC-C	SiC	
39	OGL	GL	MW	2	S0	SiCL	C	C	
40	OGL	GL	MW	2-3	S0	SiL	C	C-SiC	
41	ORG	FL	P	2	S0	SiCL	SiCL	L-SiL	
42	SZGL	GL	MW-I	2	S0	SiCL	C	C	
43	TM	O/GL	P	2	S0	O	O	O/SiL	
44	TM	O/GL	VP	2	S0	O	O	O	SiCL-CL
45	OGL	GL	MW	2	S0	CL	CL	C	
46	OGL	GL	MW	3	S0	L	SiC-C	SiC-C	
47	GLGL	GL	I	2	S0	L	C	C	
48	GLGL	GL	I-MW	2	S0	L	C	SiC-C	
49	GLGL	GL	I-MW	2	S0	CL	SiC-C	SiL-C	
50	TyM	O	P	2	S0	O	O	O	
51	GLGL	GL	I	2	S0	L	C-CL	C	
52	OGL	GL	MW	2	S0	CL	C	SiC	

INSPECTION SITES FOR BIGSTONE INDIAN RESERVE #166C

Site	Soil	Parent Material	Drainage	Topo-graphy	Surface Stoni-ness	Dominant Textures (Depths in cm) 0-20	20-50	50-100	100-120
1	OGL	L	MW	2-3	S0	C	C	C	
2	OGL	L	MW	2-3	S0	CL/C	C	C	
3	OGL	L	MW	2-3	S0	SiL	C	SiC-C	
4	ptyRG	BS	P	2	S0	O	LS/cS	cS	
5	ptyRG	BS	VP	2	S0	O	LS/cS	cS	
6	TM	O/BS	VP	2	S0	O	O	cS	
7	OGL	GL	MW	2-3	S0	SiCL/C	C	CL	
8	TM	O/GL	VP	2-3	S0	O	O	C	
9	MH	O	VP	2	S0	O	O	O	O
10	TyM	O	VP	2	S0	O	O	O	O
11	ptyOG	GL	P	2	S0	O	O/C	C	
12	GLGL	GL	I	2-3	S0	SiCL	C	C/CL	
13	OGL	GL	MW	2-3	S0	SiCL	C	C/CL	
14	TyM	O	VP	2	S0	O	O	O	O
15	GLGL	GL	I	2	S0	L	C	C	
16	TM	O/GL	VP	2	S0	O	O	O/CL	
17	TyM	O	VP	2	S0	O	O	O	O
18	GLGL	GL	I-MW	2	S0	SiCL	C	SiC-C	
19	GLGL	GL	I-MW	2	S0	SiCL	C	C	
20	GLDGL	GL	I-MW		S0	SiCL	C	C	
21	OGL	GL	I	2	S0	SiCL	C	C	
22	ptyOG	GL	I	2	S0	O	O/L	C	
23	GLGL	GL	I	2	S0	SiCL	C	C	
24	GLGL	GL	I	2	S0	SiCL	C	C	
25	OGL	GL	MW-I	2	S0	SiCL/C	C	C	C-CL
26	OGL	GL	I	2	S0	SiCL/C	C	C	C-CL
27	OGL	GL	MW	2	S0	SiCL	C	C	
28	GLGL	GL	I	2	S0	SiCL	C	C	
29	GLGL	GL	I	2	S0	SiCL	C	C	
30	OGL	GL	MW	2	S0	CL	C	C	

Site	Soil	Parent Material	Drainage	Topo-graphy	Surface Stoni-ness	Dominant Textures (Depths in cm) 0-20	20-50	50-100	100-120
31	TM	O/GL	VP	2	S0	O	O	O/SiC	
32	GLGL	GL	MW-I	2	S0-1	SiCL	SiC-L	SiC-C	
33	TyM	O	VP	2	S0	O	O	O	
34	OHG	GL	I-P	2	S0-1	SiC	SiC-C	SiC-C	
35	TM	O/GL	P	2	S0	O	O	SiC	
36	OGL	GF	W-R	5	S1	SL-L	SCL-L	SL-LS	
37	TM	O/GL	VP	2	S0	O	O	SiC	
38	OHG	GL	P	2	S0	SiCL	SiC	SiC	
39	OGL	GL	MW	2	S0	SiCL	SiC	SiC	
40	OHG	GL	P	2	S0	O/C	SiC-C	SiC-C	
41	TM	O/GL	VP	2	S0	O	O	SiC	
42	OGL	GL	MW	2	S0	SiCL	SiC-C	C	
43	EEB	GF	R	5	S2	LS	LS	LS	
44	TM	O/GL	VP	2	S0	O	O	O	SiC
45	EEB	GF	R	5	S4	LS	LS	LS	
46	GLGL	GL	I	3	S0	SCL/SiCL	SiC	SiC	
47	TM	O/GL	VP	1	S0	O	O	SiC	
48	OGL	GL	MW	2	S0	SiL	SICL	SiCL	
49	ptyHG	GL	P-I	2	S0	O	SiCL	SiC	
50	OGL	GL	MW	2-3	S0	SiCL	SiCL-CL	SiCL	
51	OGL	GL	MW	2	S0	SiC	SiC	SiC	
52	OGL	GL	MW	3	S0	SiCL	SiC	SiC	
53	TM	O/GL	VP	2	S0	O	O	O/SiC	
54	TM	O/GL	VP	2	S0	O	O	O/SiC	
55	ptyG	GL	P	2	S0	O	O/SiC	SiC	
56	TyM	O	VP	2	S0	O	O	O	O
57	TyM	O	VP	2	S0	O	O	O	O
58	OGL	GL	MW	3	S0	SiCL	SiC-C	SiC-C	
59	GLGL	GL	MW-I	3	S0	SiCL/C	C	C	
60	OGL	GL	MW-I	3	S0	CL	C	C	
61	ptyRG	GL	VP	2	S0	O	O/C	C	
62	OGL	T	MW	4	S1-2	L	CL	CL	

Site	Soil	Parent Material	Drainage	Topo-graphy	Surface Stoni-ness	Dominant Textures (Depths in cm) 0-20	20-50	50-100	100-120
63	OGL	T	MW	3-4	Sl	L-CL	CL	CL	
64	TM	O/GL	VP	2	S0	O	O	O	
65	GLGL	T	I	2-3	Sl	C	C-SiC	vfSCL	
66	GLGL	GL	I	3	Sl	SiC-SiCL	SiC	CL	
67	TM	O/GL	VP	2	S0	O	O	C	
68	TM	O/GL	VP	2	S0	O	O	O/SiC	
69	GLGL	GL	I	2	S0	SiCL	C	C-SiC	
70	TM	O/GL	VP	2	S0	O	O	SiC-C	
71	OGL	GL	MW	2-3	S0	SiCL	C	C	
72	OGL	GL	MW	2-3	S0	SiCL	C	C	
73	ptyOG	GL	P	2	S0	O	SiC/C	C	
74	OGL	GL	MW	3	S0	SiCL	C	C	
75	TM	O/GL	VP	2	S0	O	O	O/SiC-C	
76	EEB	GF	W	5	S2-3	gvSL	gvSL	gvSL	
77	ptyLG	L	I-P	2	S0	O	SiCL	C	
78	GLDGL	L	I	2	S0	SiCL	C	C	

INSPECTION SITES FOR BIGSTONE INDIAN RESERVE #166D

Site	Soil	Parent Material	Drainage	Topo-graphy	Surface Stoni-ness	Dominant Textures (Depths in cm) 0-20	20-50	50-100	100-120
1	OGL	GL	MW	2	S0	SiCL	C	C	
2	OGL	GL	MW	3	S1	SiL	CL	CL	
3	SZGL	GL	MW	2	S0	SiL	C	C	
4	OGL	GL	MW	33	S0	SiL	CL-C	CL-C	
5	OGL	GL	MW	3	S0	SiL	C	C	
6	OGL	GL	MW	3	S0	SiL	C	C	
7	OGL	GL	MW	3	S0	SiL	C	C	
8	GLGL	GL	I	2	S0	SiL	SiC-C	C	
9	GLGL	GL	I	2	S1	SiL	C-SiC	C-SiC	
10	OR	FL	W	2	S0	SiL-SiCL	SiL-FSL	SL/LS	
11	OGL	GL	MW-I	2-3	S0	SiCL-SiL	C	C	
12	TM	O/GL	VP	2	S0	O	O	O/SiC	
13	CUR	FL	I	2	S0	SiCL	SiL-SiCL	SiL	
14	RG	FL	P	2	S0	SiCL	SiL-SiCL	SiL	
15	GLR-RG	FL	I-P	2	S0	SiL-SiCL	SiCL	SiCL	
16	GLR-RG	FL	I-P	2	S0	SiCL	SiCL	SiL	
17	OR	FL	MW	2	S0	L	SiCL	SiL-L	
18	GLR-RG	FL	P-I	2	S0	SiL	SiL	vfSL	
19	GLCUHR	FL	I-P	2	S0	L	L-SiCL	L-SiL	
20	CURG	FL	VP	2	S0	L	L	SiL-L	
21	OGL	GL	MW-I	2-3	S0	SiL	C-SiC	C	
22	GLGL	GL	I	2-3	S0	SiL	SiC-C	C	
23	OGL	GL	MW-I	2	S0	SiL-SiCL	SiC-C	C	
24	OGL	GL	MW-I	2	S0	SiCL	C	C	
25	OGL	GL	MW	2-3	S0	SiCL	SiL-C	C	
26	GLGL	GL	I	2-3	S0	SiL	SiC-C	SiC-C	
27	GLR-GLCUR	FL	I	2	S0	SiL	SiL-SiCL	FSL	
28	GLGL	FL	I-P	2	S0	SiL	SiCL	SiC	
29	GLGL-OLG	FL	I-P	2	S0	SiL-FSL	SiCL	SiL-SiCL	
30	GLGL	FL	I	2	S0	SiL	L-SiCL	SiCL	

Site	Soil	Parent Material	Drainage	Topo-graphy	Surface Stoni-ness	Dominant Textures (Depths in cm) 0-20	20-50	50-100	100-120
31	GLGL	FL	I	2	S0	L	SiCL	FSL	
32	GLGL	FL	I	2	S0	SiCL	SiC	SiC	
33	OLG	FL	VP	2	S0	SiC	SiL	SiCL/SiC	
34	OGL	FL	MW	2	S0	SiCL	SiCL	SiL	
35	GLGL	FL	I	2	S0	SiL	SiCL-SiL	SiCL-SiC	
36	OGL	FL	MW	2	S0	SiL-Si	SiCL	CL	
37	OGL	FL	MW	2	S0	SiL	SiCL	SiCL-SiL	
38	GLGL	FL	I	2	S0	SiCL	CL	CL	
39	EEB	GF	R	4	S0	S	S	LS/S	
40	OGL	F	R	3-4	S0	LS	S	S	
41	OGL	FL	W	3	S0	SL	SiCL	CL	
42	OGL	GF	I	3-4	S0	SiL	SiL	SiL	
43	OGL	GF	MW	3-4	S0	SiCL	CL	CL	
44	OGL	GF	W	3	S0	LS	CL	gvS	
45	OGL	GL	MW	4	S0	SiL	CL	CL	
46	OGL	GL	MW	2	S0	SiL	SiCL-CL	C	
47	OGL	GL	MW	2	S0	SiL	C	C	
48	TyF	O	VP	2	S0	O	O	O	O
49	OGL	GF	MW-W	3-4	S0	vfSL	fSL-L	fSL-LS	
50	TyM	O	VP	2	S0	O	O	O	O
51	OGL	GF	MW-W	2	S0	vfSL	SiCL	SiL	
52	OGL	GF	W	5	S0	SiL	SiCL	vfSL	
53	OGL	GF	W	3-4	S0	SL-LS	SL	LS	
54	EEB	GF	R	5	S0	LS-SL	LS	LS	LS
55	EEB	GF	R	3-4	S0	LS	LS	LS	gvS
56	OGL	GL	MW	2	S0	SiCL	SiC	SiC	
57	OGL	T	MW	4	S0	SiL	SiCL-CL	CL	
58	TyM	O	VP	2	S0	O	O	O	
59	GLGL	GL	I	3	S0	SiL	SiC	SiC	
60	TyM	O	VP	2	S0	O	O	O	O
61	OGL	GL	MW	2	S0	SiL	SiC	SiC	
62	OGL	GL	MW	3	S0	SiL	SiC	SiCL	

Site	Soil	Parent Material	Drainage	Topo-graphy	Surface Stoni-ness	Dominant Textures (Depths in cm) 0-20	20-50	50-100	100-120
63	GLGL	GL	I	2	S0	vfSL	SiC	SiC	
64	GLGL	GL	I	2	S0	SiL	SiC	SiCL	
65	OGL	GL	I-MW	3	S0	SiL	SiC	SiC	
66	TM	O/GL	VP	2	S0	O	O	SiL/C	
67	SZGL	GL	MW-I	3	S0	SiL	SiC	SiC-C	
68	OGL	GL	I-MW	2	S0	fSL	fSL	SiC	
69	OGL	GL	MW	2	S0	vfSL	SiC	SiC	
70	OGL	GL	MW-I	2	S0	vfSL	SiCL-L	C-SiC	
71	SZGL	GL	MW-I	2	S0	SiL	SiCL	SiC	
72	GLGL	GL	I	2	S0	SiL	SiC-C	SiC-C	
73	SZGL	GL	MW-I	2	S0	SiL	SiC	SiC	
74	OGL	GL	MW	3	S0-1	SiL	SiCL	CL	
75	OGL	GL	MW	2	S0-1	SiL	SiCL	SiC/CL	
76	OGL	GL	I	2	S0	SiL-SiCL	SiC	SiC	
77	TM	O/GL	VP	2	S0	O	O	SiL/C	
78	TM	O/GL	VP	2	S0	O	O	O	SiC
79	TF	O/GL	VP	2	S0	O	O	O	SiC
80	GLGL	GL	I	2	S0	SiL	SiC	SiC	
81	OGL	GL	MW	2	S0	vfSL	SiCL	SiCL/SiC	
82	OGL	GL	MW	2	S0	vfSL	SiCL	SiCL/SCL	
83	OG	GL	P	2	S0	SiC	SiC	SiC	
84	GLGL	GL	I	2	S0	SiCL	SiC	SiC	
85	OGL	GL	MW-I	3-4	S0	SiL	SiC	SiC	
86	TyM	O	VP	2	S0	O	O	O	O
87	GLGL	GL	I-MW	2	S0	vfSL	SiCL	SiC	
88	OGL	GL	MW	3-4	S0	SiCL	SiC	SiC	
89	ptyLG	GL	P	2	S0	SiCL	SiC	SiC	
90	ptyLG	GL	VP	2	S0	SiCL	SiC	SiC	
91	GLGL	GL	I-P	2	S0	SiCL	SiC-C	SiC	
92	OGL	FL	MW	2	S0	SiCL	SiC	SiC	
93	TM	GL	VP	2	S0	O	O	O/SiC	
94	OGL	GL	MW-I	2	S0	SiL	SiC	SiC	

Site	Soil	Parent Material	Drainage	Topo-graphy	Surface Stoni-ness	Dominant Textures (Depths in cm) 0-20	20-50	50-100	100-120
95	GLGL	GL	I	2	S0	SiCL	SiC	SiC	
96	OLG	GL	P	2	S0	SiCL	SiC	SiC	
97	OGL	GL	MW	2	S0	SiCL	SiC	SiC	
98	FM	O	VP	2	S0	O	O	O	O
99	OGL	GL	MW	2	S0	SiCL	SiC	SiC	
100	GLGL	GL	I	2	S0	SiCL	SiC	SiC	
101	OGL	GL	MW	3	S1-2	SL-L	CL	CL	
102	TyM	O	VP	2	S0	O	O	O	O
103	OGL	GL	MW	3-4	S0	SiL	SiC	SiC	CL
104	OGL	GL	MW	3	S0	SiCL	SiC	SiC	
105	OGL	GL	MW	2	S0	SiCL	SiC	SiC	
106	OGL	GL	MW	2	S0	SiCL	SiC	SiC	
107	GLGL	FL	I	2	S0	C	C	vfSCL	
108	OGL	T	MW	3	S0	L	C-CL	C-CL	
109	GLDGL	GL	I-MW	2	S0	L	SiCL	C	
110	ptyHG	FL	I	2	S0	O/L	CL-C	C-SiC	
111	GLDGL	GL	I	2-3	S0	SiL	SiCL	SiCL	
112	OG	GL	VP	2	S0	SiCL	SiCL	SiC	
113	GLGL	GL	I	2	S0	SiC	SiC	SiC/SiL	
114	OGL	GL	MW-I	4	S0	CL	CL	SiCL	
115	OGL	GL	MW-I	2	S0	C	C	C	
116	GLGL	GL	I	2	S0	SiL	C	SiCL	
117	ptyG	GL	VP	2	S0	O	SiC	SiC	
118	GLGL	GL	I	2	S0	C-CL	C-CL	CL/SiL	
119	OG	FL	VP	2	S0	CL	C	C	
120	GLGL	GL	I	2	S0	C	C-SiC	C/FSCL	
121	GLGL	FL	I	2	S0	C	C	SiC/C	
122	RG	FL	I	1	S0	SiC	SiC	SiC	
123	ptyG	FL	VP-P	1	S0	Si	Si	SiC	
124	OG	FL	VP	1	S0	SiC	SiC	SiC	
125	OG	FL	VP	1	S0	Si	Si	SiC	

CLASSIFICATION: Eluviated Eutric Brunisol
PARENT MATERIAL: Glaciofluvial
DRAINAGE: rapidly
TOPOGRAPHY: ridged and moderately rolling
DOMINANT IN UNIT: 1

Horizon	Depth (cm)	Description
LH	3- 0	Slightly to well decomposed leaf, needle and moss litter.
Ae	0- 5	Yellowish brown (10YR 5/8) loamy sand to sandy loam; single grain; loose; nonstony.
Bm	5- 40	Dark yellowish brown (10YR 5/6) sandy loam; single grain; loose; nonstony.
C	40-100	Dark yellowish brown (10YR 5/6) loamy sand; single grain; loose; nonstony.

COMMENTS: Where there is definite accumulation of clays in the B horizon (Bt), the profile becomes an Orthic Gray Luvisol.

CLASSIFICATION: Orthic Gray Luvisol
PARENT MATERIAL: Till
DRAINAGE: moderately well
TOPOGRAPHY: gently rolling
DOMINANT IN UNIT: 3

Horizon	Depth (cm)	Description
LFH	10- 0	Moderately decomposed leaf litter.
Ae	0- 10	Grayish brown (10YR 5/2) loam; moderate, medium, platy; friable; moderately stony.
Bt	10- 40	Yellowish brown (10YR 5/4) clay loam; moderate, medium, subangular blocky; very firm; slightly stony.
BC	40-100	Brown (10YR 5/3) clay loam; massive; firm; moderately stony.

CLASSIFICATION: Orthic Gray Luvisol
PARENT MATERIAL: Glaciolacustrine
DRAINAGE: moderately well
TOPOGRAPHY: level to undulating
DOMINANT IN UNIT: 4

Horizon	Depth (cm)	Description
LF	10- 0	Moderately decomposed leaf litter.
Ae	0- 10	Grayish brown (10YR 5/2) silty clay loam; moderate, medium platy; friable; nonstony.
Bt	10- 45	Dark grayish brown (10YR 4/2) clay; moderate, medium subangular blocky; very firm; nonstony.
BC	45- 80	Dark grayish brown (10YR 4/2) silty clay to clay; weak, fine subangular blocky; firm; nonstony.
Cca	80-100	Dark brown (10YR 4/3) silty clay to clay; massive; firm; nonstony.

COMMENTS: The profile becomes a Gleyed Gray Luvisol when mottled and an Orthic Luvic Gleysol when gleyed and poorly drained. Map Unit 8 is very similar but has few salts and is slightly darker in color.

CLASSIFICATION: Orthic Luvic Gleysol
PARENT MATERIAL: Fluvial-Lacustrine
DRAINAGE: poorly
TOPOGRAPHY: level to gently undulating
DOMINANT IN UNIT: 11

Horizon	Depth (cm)	Description
Aheg	0- 5	Very dark grayish brown (10YR 3/2) silt loam; moderate, medium granular; friable; nonstony.
Aeg	5- 15	Very dark grayish brown (10YR 3/2) fine sandy loam; moderate, medium platy; friable; nonstony.
Btg	15- 50	Dark gray (10YR 4/1) silty clay loam; moderate, medium subangular blocky; firm; nonstony.
Cg	50-100	Gray (10YR 5/1) silty clay and silty clay loam; stratified and massive; firm; nonstony.

COMMENTS: The profile would be a Gleyed Gray Luvisol on imperfectly drained fluvial-lacustrine material, and an Orthic Gray Luvisol on a moderately well drained site.

CLASSIFICATION: Gleyed Regosol
PARENT MATERIAL: Fluvial
DRAINAGE: imperfectly
TOPOGRAPHY: nearly level to undulating
DOMINANT IN UNIT: 13

Horizon	Depth (cm)	Description
Ah	0- 5	Very dark grayish brown (10YR 3/2) loam; moderate, fine granular; friable; nonstony.
Cgj1	5- 40	Grayish brown (10YR 5/2) loam to silt loam; stratified and massive; firm.
Cgj2	40- 90	Grayish brown (10YR 5/2) silt loam; stratified and massive; firm.

COMMENTS: Where there are buried A horizons (Ahb), the profile is a Gleyed Cumulic Regosol.

CLASSIFICATION: Peaty Rego Gleysol
PARENT MATERIAL: Beach Deposits
DRAINAGE: very poorly
TOPOGRAPHY: level
DOMINANT IN UNIT: 15

Horizon	Depth (cm)	Description
Om	35- 0	Moderately decomposed moss peat.
Ah	0- 8	Dark brown (10YR 4/3) loamy sand; single grain; loose; nonstony.
Cg	10-100	Yellowish brown (10YR 5/4) coarse sand; single grain; loose; nonstony.

COMMENTS: Where the organic materials are greater than 50 cm, the profile would be a Terric Mesisol.

CLASSIFICATION: Terric Mesisol
PARENT MATERIAL: Organic/glaciolacustrine
DRAINAGE: very poorly
TOPOGRAPHY: depressional to gently sloping
DOMINANT IN UNIT: 16

Horizon	Depth (cm)	Description
Om	0- 70	Dark brown (7.5YR 3/2) layered or matted indiscernable moss peat.
Cg	70-120	Dark gray (10YR 4/1) silty clay to clay; massive; sticky; nonstony.

COMMENTS: Where Om horizon is less than 50 cm thick, the profile becomes a Peaty Rego Gleysol.

APPENDIX B

- Guidelines for Soil Interpretations -

TABLE B1 Guidelines for Assessing Soil Constraints for Single Family Dwellings[1]

This guide provides ratings for undisturbed soils evaluated for single-family dwellings and other structures with similar foundation requirements. The emphasis for these ratings is on foundations, but slope, susceptibility to flooding, and seasonal wetness are also considered. On-site investigations are needed for specific placement of buildings, and for foundation design. All ratings are for undisturbed soils on information obtained from observations to a depth of 1 to 2 metres.

Items Affecting Use	Degree of Soil Constraint[2]		
	Low	Moderate	Severe
Flooding	None	None	Occasional flooding (once in 5 years).
Wetness[3] (soil drainage)	WITH BASEMENTS: Rapidly and well drained soils. Water-table below 1.5 m. WITHOUT BASEMENTS: Rapidly, well and moderately well drained soils. Water-table below 75 cm.	WITH BASEMENTS: Moderately well drained soils. Water-table 75-150 cm. WITHOUT BASEMENTS: Imperfectly drained soils. Water-table 50-75 cm.	WITH BASEMENTS: Imperfectly, poorly and very poorly drained soils. Water-table above 75 cm 1 month or more during the year. WITHOUT BASEMENTS: Poorly and very poorly drained soils. Water-table above 50 cm 1 month or more during the year.
Slope[4]	0 to 9%	9 to 15%	Greater than 15%
Shrink-swell Potential	Low-Unified Groups GW, GP, SW, SP, GM GC, SM, SC, and CL with P.I. < 15	Moderate-Unified Groups ML, and CL with P.I. > 15	High-Unified Groups CH, MH, OL, OH and Peat
Frost Heave[5] Potential	Low (F1, F2)	Moderate (F3)	High (F4)
Depth to[6] Consolidated Bedrock	WITH BASEMENTS: More than 1.5 m WITHOUT BASEMENTS: More than 1 m	WITH BASEMENTS: 1 to 1.5 m WITHOUT BASEMENTS: .5 to 1 m	WITH BASEMENTS: Less than 1 m WITHOUT BASEMENTS: Less than .5 m
Sulphate attack on concrete	0 to 1000 p.p.m.	1000 to 2000 p.p.m.	Greater than 2000 p.p.m.

1. By reducing the slope limits 50%, this table can be used for evaluating limitations for buildings with large floor areas, but with foundation requirements not exceeding those of ordinary three-story buildings.
2. Some soils rated as having moderate or severe constraints may be good sites from an aesthetic or use standpoint, but require higher design and/or maintenance standards.
3. For explanation of soil drainage classes, see Appendix C.
4. Reduce slope limits 50% for those soils subject to hillside slippage.
5. Frost heave applies only where frost penetrates to the depth of the footings and soil is moist.
6. If the bedrock is soft enough so that it can be dug with light power equipment, reduce moderate to slight and severe to moderate.

TABLE B2 Guidelines for Assessing Soil Constraints for On-Site Sewage Disposal (Septic Tank Absorption Fields)

This guide applies to soils to be used as an absorption and filtering medium from septic tank systems. A subsurface tile system laid in such a way that effluent from the septic tank is distributed reasonably uniformly into the natural soil is assumed. Criteria are based on the ability of the soil to absorb effluent. A severe rating does not mean that a septic system should not be installed in a given soil, but rather indicates the difficulty which can be expected during installation and with subsequent maintenance. All ratings are based on soil information to a depth of 1 to 2 metres.

Items Affecting Use	Degree of Soil Constraint		
	Low	Moderate	Severe
Flooding	Not subject to flooding.	Not subject to flooding.	Subject to occasional flooding (once in 5 years).
Wetness[1] (soil drainage)	Rapidly, well and moderately well drained soils not subject to ponding or seepage. Water-table[3] below 3.0 m.	Imperfectly drained soils and soils subject to occasional ponding or seepage. Water-table 2.4 - 3.0 m.	Imperfectly drained soils subject to ponding. Poorly and very poorly drained soils. Rapidly drained soils if groundwater contamination hazard. Water-table[3] less than 2.4 m.
Slope	0 to 9%	9+ to 15%	Greater than 15%
Permeability[2]	Rapid to moderate (greater than 1.5 cm/hour)	Moderately slow (0.5 to 1.5 cm/hour)	Slow and very slow (less than 0.5 cm/hour). Very rapid and rapid if groundwater contamination hazard exists.
Depth to[3] Consolidated Bedrock	More than 3.0 m	2.4 to 3.0 m[4]	Less than 2.4 m

1. For an explanation of soil drainage classes, see Appendix C. It may, with caution, be possible to make some adjustment for the severity of the water-table constraint in those cases where seasonal use of the facility does not coincide with the period of high water-table.
2. Ratings should be related to the permeability of soil layers below the depth of the tile.
3. Depth to bedrock constraints based on an assumed tile depth of 1.8 metres and the need for at least 1.2 metres of soil below the bottom of the tile trench. The same depth constraints apply to water-table.
4. On slopes greater than 9 percent, a depth to bedrock of 2.4 to 3.0 metres becomes a severe constraint.

TABLE B1 Guidelines for Assessing Soil Constraints for Road and Parking Lot Location

This guide applies to soils evaluated for the location and maintenance of local roads and parking lots. These are improved roads and parking lots which have some kind of all-weather surfacing, and they are graded to shed water and have ordinary provisions for drainage.

The properties most affecting these ratings are slope, shrink-swell potential, frost heave potential, flooding hazard, and seasonal wetness.

These ratings do not substitute for on-site investigations for specific developments.

Items Affecting Use	Degree of Soil Constraint		
	Low	Moderate	Severe
Flooding	None	Once in 5 years	More than once in 5 years
Wetness[1] (soil drainage)	Rapidly, well and moderately well drained	Imperfectly drained	Poorly and very poorly drained
Slope	0 to 9%	9+ to 15%	Greater than 15%
Shrink-swell[2] Potential	Low-very to moderately coarse textured soils	Moderate-medium to moderately fine textured soils	High-moderately fine to very fine textured soils
Unified Groups	GW, GP, SW, SP, GM, GC, SM, SC	CL with P.I. less than 15. ML	CL with P.I. 15 or more. CH, MH, OH, OL, Peat
AASHO group index	0 to 4	5 to 8	More than 8
Frost Heave[3] Potential	Low (F1, F2)	Medium (F3)	High (F4)
Depth to[4] Consolidated Bedrock	More than 1 m	0.5 to 1 m	Less than 0.5 m

1. For explanation of soil drainage classes, see Appendix C.
2. For explanation of soil texture classes, see Appendix C. P.I. means plasticity index.
3. Frost heave applies where frost penetrates below the improved surface layer and moisture is sufficient to form ice lens at the freezing point.
4. If bedrock is soft enough so that it can be dug with power equipment, reduce moderate to slight and severe to moderate.

TABLE B4 Guidelines for Assessing the Suitability of Soils as a Source of Road Subgrade Material

This guide applies to rating of soils as a source of road subgrade material. The properties that influence these ratings are those that affect the load supporting capacity and stability of the subgrade (Unified and AASHO classification, wetness) and those that affect the workability (slope, wetness).

These ratings do not substitute for on-site investigations.

Items Affecting Use	Degree of Suitability[1]		
	GOOD (G)	FAIR (F)	POOR (P)
Wetness[2] (soil drainage)	Rapidly to moderately well drained	Imperfectly drained	Poorly and very poorly drained
Engineering[3] Groups			
Unified Group	GW, GP, GC,[4] SW, SP, SM, SC[4]	ML, CL with P.I. less than 15	CH, MH, OL, OH, Pt, and CL with P.I. more than 15
AASHO Group Index	0 to 4	5 to 8	Greater than 8
Slope	0 to 15%	15 to 30%	more than 30%

1. A fourth degree of soil limitation - Unsuitable (U) - is also defined: slopes greater than 50%; permanently wet and organic soils; soils which flood every year; rock outcrops.
2. For explanation of soil drainage classes, see Appendix C.
3. This item estimates the strength of the soil as it applies to roadbeds and assuming the roads would be surfaced. On unsurfaced roads, very sandy soils may cause rough roads.
4. Downgrade to moderate if content of fines is greater than 30%.

TABLE B5 Guidelines for Assessing Soil Constraints for Camping Areas

This guide provides ratings for soils to be used intensively for tents, truck campers, and small trailers as well as the accompanying activities of outdoor living. It is assumed that little site preparation will be done other than shaping and levelling for tent and parking areas. The soil should be suitable for heavy foot traffic. Soil suitability for growing and maintaining vegetation is not a part of this guide, but is an important consideration in the final evaluation of a specific site.

Items Affecting Use	Degree of Soil Constraint		
	Low	Moderate	Severe
Flooding	None	None during season of use	Subject to flooding during season of use
Wetness[1] (soil drainage)	Rapidly, well and moderately well drained soils with no ponding. Water-table below 1 m during season of use	Moderately well and imperfectly drained soils with no ponding. Water-table below 50 cm during season of use	Imperfectly drained soils with occasional ponding of short duration, poorly and very poorly drained soils. Water-table above 50 cm during season of use
Slope	0 to 9%	9+ to 15%	Greater than 15%
Permeability	Very rapid to moderate inclusive (more than 1.5 cm/hour)	Moderately slow (0.5 to 1.5 cm/hour)	Slow and very slow (less than 0.5 cm/hour)
Surface[2] Stoniness	Classes 0 to 2	Class 3	Classes 4 and 5
Surface[3] soil texture	SL, FSL, VFSL, L and LS with textural B horizon. Not subject to soil blowing	CL, SCL, SiCL, SiL, LS and S other than loose sand	SC, SiC, C, loose sand and soils subject to severe blowing. Organic soils

1. For explanation of soil drainage classes, see Appendix C.
2. For explanation of stoniness classes, see Appendix C.
3. Influences ratings as it affects foot trafficability, dust, and soil permeability. See Appendix C for textural class definitions.

TABLE B6 Guidelines for Assessing Soil Constraints for Picnic Areas

This guide provides ratings for soils to be used as park-type picnic areas that are subject to heavy foot traffic. It is assumed that all vehicular traffic will be confined to access roads and parking lots. Soil suitability for growing and maintaining vegetation is not a part of this guide, but is an important item to consider in the final evaluation of site.

Items Affecting Use	Degree of Soil Constraint		
	Low	Moderate	Severe
Flooding	None during season of use	May flood 1 or 2 times for short periods during season of use	Floods more than 2 times during season of use
Wetness[1] (soil drainage)	Rapidly, well and moderately well drained soils. Water-table below 50 cm during season of use	Moderately well drained soils subject to occasional ponding. Imperfectly drained soils not subject to ponding. Water-table above 50 cm for short periods during season of use	Poorly and very poorly drained soils. Imperfectly drained soils subject to ponding. Water-table above 50 cm and often near the surface for a month or more during season of use
Slope	0 to 9%	9+ to 15%	Greater than 15%
Permeability	Very rapid to moderately slow inclusive (more than 0.5 cm/hour)	Slow (0.2 to 0.5 cm/hour)	Very slow (less than 0.2 cm/hour)
Surface[2] Stoniness	Classes 0 to 2	Class 3	Classes 4 and 5
Surface soil[3] texture	SL, FSL, VFSL, L and LS with textural B horizon. Not subject to soil blowing	CL, SCL, SiCL, SiL, LS and sand other than loose sand	SC, SiC, C, sand and soils subject to severe blowing. Organic soils

1. For explanation of soil drainage classes, see Appendix C.
2. For explanation of stoniness classes, see Appendix C.
3. Influences ratings as it affects foot trafficability, dust, and soil permeability. See Appendix C for textural class definitions.

TABLE B7 Guidelines for Assessing Soil Constraints for Hiking Trails

This guide provides ratings for soils to be used for local and cross country hiking trails. It is assumed that these areas will be used as they occur in nature, and that little or no soil will be moved. The steeper the slope upon which a trail is to be built, requires that more soil be moved to obtain a level tread, and the more miles of trail needed to cover a given horizontal distance. Severe constraint does not mean a trail cannot be built, but indicates high design requirements, costs of construction, and maintenance.

Items Affecting Use	Degree of Soil Constraint		
	Low	Moderate	Severe
Flooding	Not subject to flooding during season of use	May flood 1 or 2 times during season of use	Subject to flooding more than 2 times during season of use
Wetness[1] (soil drainage)	Rapidly, well and moderately well drained soils. Water-table below 50 cm during season of use	Moderately well drained soils subject to occasional seepage or ponding, and imparfectly drained soils. Water-table may be above 50 cm for short periods during season of use	Poorly and very poorly drained soils. Water-table above 50 cm and often near the surface for a month or more during season of use
Slope[2]	0 to 15%	15+ to 30%	Greater than 30%
Surface[3] Stoniness	Classes 0 to 2	Class 3	Classes 4 and 5
Surface soil[4] texture	SL, FSL, VFSL, and L	SiL, SiCL, SCL, CL, and LS	SC, SiC, C, Sand and soils subject to severe blowing. All very gravelly, very cherty, very cobbly and very channery soils. Organic soils

1. For explanation of soil drainage classes, see Appendix C.
2. Slope refers to the slope of the ground surface, and not the slope of the tread of the trail.
3. For explanation of stoniness classes, see Appendix C.
4. Influences ratings as it affects foot trafficability, dust, design, or maintenance. See Appendix C for textural class definitions.

TABLE B8 Guidelines for Assessing the Suitability of Soils as a Source of Sand and Gravel

This guide provides ratings of soils related only to their suitability as a source of sand and/or gravel. These ratings do not relate to the quality of the sand and gravel for specific uses such as road subgrade or concrete aggregate. On-site investigations are required to determine quality.

Items Affecting Use	Degree of Suitability[1]		
	GOOD (G)	FAIR (F)	POOR (P)
Unified soil group	SW, SP, GW, GP	SW-SM, SP-SM, GW-GM, GP-GM	SM, SW-SC, SP-SC, GM, GW-GC, GP-GC (all other groups unsuitable)
Thickness of overburden	Less than 0.6 m	0.6 to 1.5 m	More than 1.5 m
Wetness[2] (soil drainage)	Drainage class not determining if better than poorly drained		Poorly and very poorly drained
Flooding	None	May flood occasionally for short periods	Frequent flooding or constantly flooded

1. A fourth degree of soil limitation - Unsuitable (U) - is also defined: organic soils; clayey soils; rock outcrops; steep slopes; permanently flooded soils.
2. For explanation of soil drainage classes, see Appendix C.

TABLE B9 Guidelines for Evaluating Soil Constraints for Sewage Lagoons.

A sewage lagoon (aerobic) is a shallow lake used to hold sewage for the time required for bacterial decomposition. The soils are considered for two functions (1) as a vessel for the impounded area and (2) as soil material for the enclosing embankment. Criteria for each function are given in Charts A and B respectively.

In Chart A the low constraints class includes soils that are effective in functioning as sealed basin floors and that are low in organic matter. Soils in the moderate constraint class are those that require special practices or treatment to modify constraints to their use as sites for sewage lagoons. Soils placed in the severe constraint class are those that are very porous, or that are high in organic matter, or that have other constraints that prevent their use as sites for sewage lagoons.

Chart B indicates properties and major behavior qualities that affect, especially adversely, the performance of soils if used in constructing earthfills intended for holding back water.

Chart A. Soil constraint ratings for sewage lagoons.

Item affecting use	Degree of soil constraint		
	Low	Moderate	Severe
Depth to water table (seasonal or year-round)	More than 150 cm	100-150 cm [1.]	Less than 100 cm [1.]
Permeability	Less than 1.5cm/hr.	1.5-5 cm/hr.	More than 5 cm/hr.
Depth to bedrock	More than 150 cm	100-150 cm	Less than 100 cm
Slope	Less than 5%	5-9%	More than 9%
Coarse fragments, less than 25 cm in dinmeter; percent, by volume	Less than 20%	20-50%	More than 50%
Percent of surface area covered by coarse fragments more than 25 cm in diameter	Less than 3%	3-15%	More than 15%
Organic matter	Less than 2%	2-15%	More than 15%
Flooding [2.]	None	None	Soils subject to flooding
Soil groups (Unified) [3.] (rated for use mainly as floor of sewage)	GC, SC, CL, and CH	GM, ML, SM and ML	GP, GW, SW, SP, OL, OH, and PT

1. If the floor of the lagoon is nearly impermeable material at least 60 cm thick, disregard depth to watertable.

2. Disregard flooding if it is not likely to enter or damage the lagoon. (low velocity and the depth less than about 1.5 m).

3. For interpretations for material for embankments see "Characteristics of Materials for Compacted Embankments".

Chart B. Characteristics of Materials for Compacted Embankments.

Unified Classification	Shear Strength	Compressibility	Permeability of Compacted Soil	Susceptibility to Piping	Compaction Charncteristic
GW	High	Low	High	Low	Good
GP	High	Low	High	Low	Good
GM	High to medium	Low	Medium to low	Medium to low	Fair to good
GC	Medium	Low to medium	Low	Medium to low	Good to fair
SW	High	Low	High	Medium	Good
SP	Medium	Low	High	Medium to high	Good
SM	Medium	Low to medium	Medium to low	Medium to high	Fair to good
SC	Medium to low	Low to medium	Low	Medium to low	Good to fair
ML	Medium to low	Medium	Medium to low	High	Fair to poor
CL	Medium to low	Medium	Low	Low to medium	Fair to good
MH	Low	High	Low to medium	Medium to low	Poor
CH	Medium to low	High	Low	Low	Fair to poor
OL [1.]	Low	High	Low to medium	Medium to high	Fair to poor
OH [1.]	Low	High	Low	Medium to low	Poor
Pt [2.]					

1. Suitable for use in low embankments with very low hazard only.

2. Not suitable for embankments.

APPENDIX C

i Definition of Soil Horizon Symbols

ii Soil Texture Classification

iii Soil Moisture Regime

iv Soil Drainage Classes

v Topographic Classes

vi Surface Stoniness Classes

vii Glossary of Terms

i DEFINITION OF SOIL HORIZON SYMBOLS (CANADA SOIL SURVEY COMMITTEE, 1978)

Organic Horizons

Organic horizons are found in Organic soils and commonly at the surface of mineral soils. They may occur at any depth beneath the surface in buried soils or overlying geologic deposits. They contain more than 17% organic C (approximately 30% organic matter) by weight. Two groups of these horizons are recognized, the O horizons and the L, F, and H horizons.

O - This is an organic horizon developed mainly from mosses, rushes, and materials. It is divided into the following subhorizons.

Of - This is an O horizon consisting largely of fibric materials that are readily identifiable as to botanical origin. A fibric horizon (Of) has 40% or more of rubbed fiber by volume and a pyrophosphate index of 5 or more. If the rubbed fiber volume is 75% or more, the pyrophosphate criterion does not apply. Fiber is defined as the organic material retained on a 100-mesh sieve (0.15mm), except for wood fragments that cannot be crushed in the hand and are larger than 2 cm in the smallest dimension.

Om - This is an O horizon consisting of mesic material,which is at a stage of decomposition intermediate between fibric and humic materials. The material is partly altered both physically and biochemically. It does not meet the requirements of either a fibric or a humic horizon.

Oh - This is an O horizon consisting of humic material, which is at an advanced stage of decomposition. The horizon has the lowest amount of fiber, the highest bulk density, and the lowest saturated waterholding capacity of the O horizons. It is very stable and changes very little physically or chemically with time unless it is drained. The rubbed fiber content is less than 10% by volume and the pyrophosphate index is 3 or less.

L, F, and H - These are organic horizons that developed primarily from the accumulation of leaves, twigs, and woody materials with or without a minor component of mosses. Usually they are not saturated with water for prolonged periods.

L - This is an organic horizon that is characterized by an accumulation of organic matter derived from leaves, twigs, and woody materials in which the original structures are easily discernible.

F - This is an organic horizon that is characterized by an accumulation of partly decomposed organic matter derived mainly from leaves, twigs and woody materials. Some of the original structures are difficult to recognize. The material may be partly comminuted by soil fauna as in moder, or it may be a partly decomposed mat permeated by fungal hyphae as in mor.

H - This is an organic horizon that is characterized by an accumulation of decomposed organic matter in which the original structures are indiscernible. This horizon differs from the F by having greater humification due chiefly to the action of organisms. It is frequently intermixed with mineral grains, especially near the junction with a mineral horizon.

Master Mineral Horizon and Layers

Mineral horizons contain 17% or less organic C (about 30% organic matter) by weight.

A - This is a mineral horizon formed at or near the surface in the zone of leaching or eluviation of materials in solution or suspension, or of maximum in situ accumulation of organic matter or both. The accumulation or organic matter is usually expressed morphologically by a darkening of the surface soils (Ah), and conversely the removal of organic matter is usually expressed by a lightening of the soil color usually in the upper part of the solum (Ae). The removal of clay from the upper part of the solum (Ae) is expressed by a coarser soil texture relative to the underlying subsoil layers. The removal of iron is indicated usually by a paler or less red soil color in the upper part of the solum (Ae) relative to the lower part of the subsoil.

B - This is a mineral horizon characterized by enrichment in organic matter, sesquioxides, or clay; or by the development of soil structure; or by a change of color denoting hydrolysis, reduction, or oxidation. The accumulation in B horizons of organic matter (Bh) is evidenced usually by dark colors relative to the C Horizon. Clay accumulation is indicated by finer soil textures and by clay cutans coating peds and lining pores (Bt). Soil structure developed in B horizons includes prismatic or columnar units with coatings or stainings and significant amounts of exchangeable sodium (Bn) and other changes of structure (Bm) from that of the parent material. Color changes include relatively uniform browning due to oxidation of iron (Bm), and mottling and gleying of structurally altered material associated with periodic reduction (Bg).

C - This is a mineral horizon comparatively unaffected by the pedogenic processes operative in A and B, (C), except the process of gleying (Cg), and the accumulation of calcium and magnesium carbonates (Cca) and more soluble salts (Cs, Csa). Marl, diatomaceous earth, and rock no harder than 3 on Mohs' scale are considered to be C horizons.

R - This is a consolidated bedrock layer that is too hard to break with the hands (>3 on Mohs' scale) or to dig with a spade when moist and does not meet the requirements of a C horizon. The boundary between the R layer and any overlying unconsolidated material is called a lithic contact.

Lowercase Suffixes

b - A buried soil horizon.

ca - A horizon of secondary carbonate enrichment.

e - A horizon characterized by the eluviation of clay, Fe, Al, or organic matter alone or in combination. When dry, it is usually higher in color value by one or more units than an underlying B horizon. It is used with A (Ae).

g - A horizon characterized by gray colors, or prominent mottling, or both, indicative of permanent or periodic intense reduction. Chromas of the matrix are generally 1 or less.

h - A horizon enriched with organic matter. When used with A it must show one Munsell unit of value darker than the horizon below, or have 0.5% more organic matter than the IC. It contains less than 17% organic carbon by weight.

j - Used as a modifier of suffixes, e, f, g, n, and t, to denote an expression of, but failure to meet, the specified limits of the suffix it modifies. It must be placed to the right and adjacent to the suffix it modifies.

k - Denotes the presence of carbonate as indicated by visible effervescence when dilute Hcl is added.

m - A horizon slightly altered by hydrolysis, oxidation, or solution, or all three to give a change in color or structure, or both.

n - A horizon in which the ratio of exchangeable Ca to exchangeable Na is 10 or less. It must also have the following distinctive morphological characteristics: prismatic or columnar structure, dark coatings on ped surfaces, and hard to very hard consistence when dry. It is used with B as Bn or Bnt.

p - A horizon disturbed by man's activities such as cultivation, logging and habitation. It is used with A and O.

s - A horizon with salts, including gypsum, which may be detected as crystals or veins, as surface crusts of salt crystals, by depressed crop growth, or by the presence of salt-tolerant plants. It is commonly used with C and k (Csk), but can be used with any horizon or combination of horizon and lowercase suffix.

sa - A horizon with secondary enrichment of salts more soluble than Ca and Mg carbonates.

t - An illuvial horizon enriched with silicate clay. It is used with B alone (Bt), with B and g (Btg), with B and n (Bnt), etc.

ii

SOIL TEXTURE CLASSIFICATION

Throughout the report reference is made to soil texture and to soil drainage classes. Soil texture is according to the United States Department of Agriculture (USDA) textural classification which is described below.

Soil Separates (Particle Size) on which Textural Classes are based:

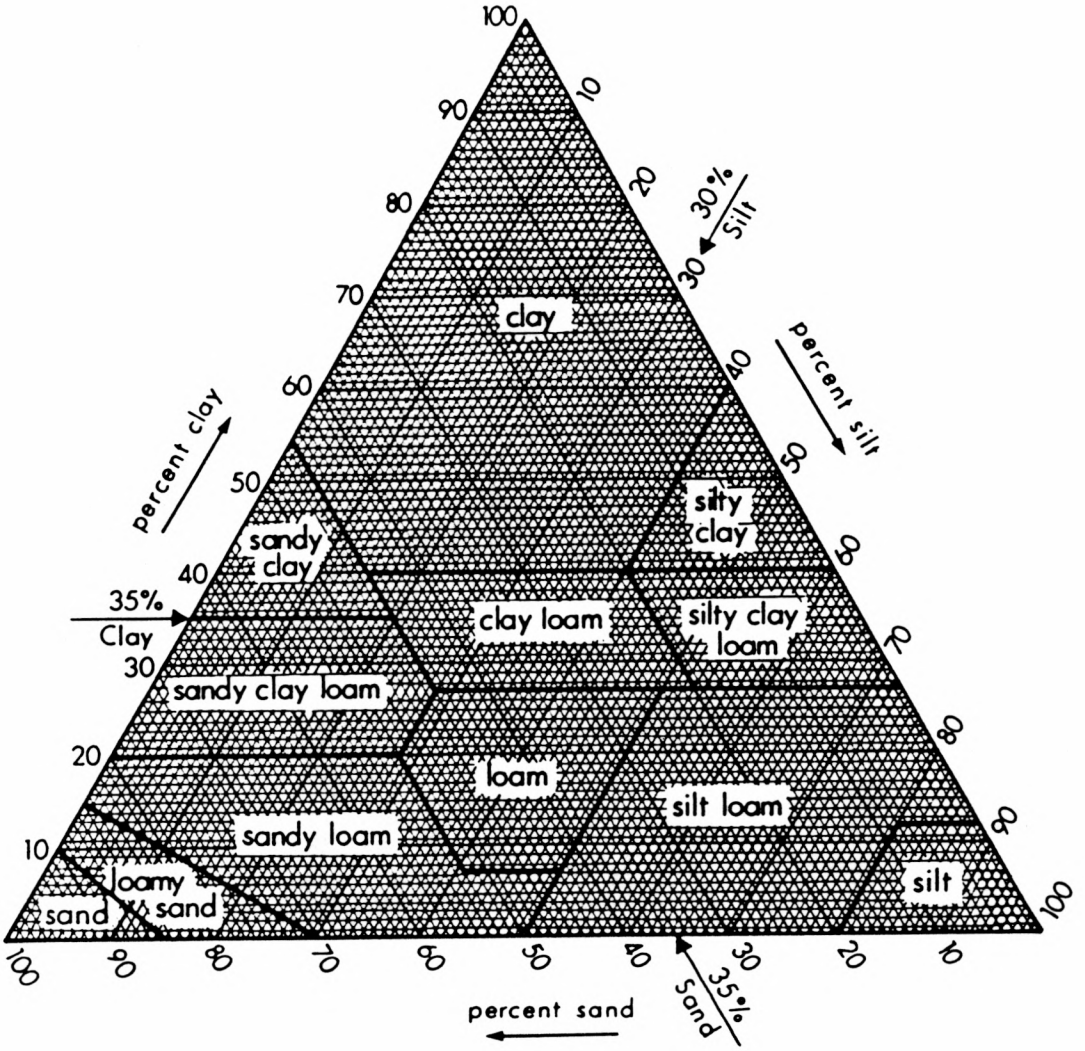
Separates		Diameter in Millimeters
Very Coarse Sand (VCS)	Sand (S)	2.0 - 1.0
Coarse Sand (CS)		1.0 - 0.5
Medium Sand (MS)		0.5 - 0.25
Fine Sand (FS)		0.25 - 0.10
Very Fine Sand (VFS)		0.10 - 0.05
Silt (Si)		0.05 - 0.002
Clay (C)		less than 0.002

By knowing the particle size distribution of the soil separates one can determine the textural class by using the soil textural triangle shown on the following page.

The soil textural classes are grouped according to the Canada Department of Agriculture (1974) as follows:

Very coarse textured:	sands, loamy sands.
Moderately coarse textured:	sandy loam, fine sandy loam.
Medium textured:	very fine sandy loam, loam, silt loam, silt.
Moderately fine textured:	sandy clay loam, clay loam, silty clay loam.
Fine textured:	sandy clay, silty clay, clay (40 to 60% clay)
Very fine textured:	heavy clay (more than 60% clay).

Figure 3.
Guide for USDA soil textural classification (after U.S.D.A., 1972).



Using Materials less than 2.0 mm in size. If approximately 20% or more of the soil material is larger than 2.0 mm the texture term includes a modifier.

EXAMPLE: Gravelly sandy loam.

Example of use: A soil material with 35% clay, 30% silt and 35% sand is a clay loam.

iii SOIL MOISTURE REGIMES

Aquic Regimes

Peraquic - Soil saturated for very long periods. Groundwater level at or within capillary reach of the surface.

Aquic - Soil saturated for moderately long periods.

Subaquic - Soil saturated for short periods.

Moist Unsaturated Regimes

Perhumid - Soil moist all year, seldom dry. No significant water deficits in the growing season. Water deficits less than 2.5 cm. Climatic moisture index (CMI) higher than 84.

Humid - Soil not dry in any part for as long as 90 consecutive days in most years. Very slight deficits, 2.5 - 6.5 cm. CMI 74-84.

Subhumid - Soil dry in some parts when soil temperature is above 5 degrees C in some years. Significant deficits within the growing season. Water deficits 6.5 - 13 cm. CMI 59-73.

Semiarid - Soil dry in some parts when soil temperature is above 5 degrees C in some years. Moderately severe deficits in growing season. Water deficits 13 - 19 cm. CMI 46-58.

Subarid - Soil dry in some parts or all parts most of the time when the soil temperature is above 5 degrees C. Some periods as long as 90 consecutive days when the soil is moist. Severe growing season deficits. Water deficits 19 - 38 cm in cool and cold regimes, 19 - 51 cm in mild regimes. CMI 25-45.

Arid - Soil dry in some or all parts for most of the time when soil temperature is above 5 degrees C. No period as long as 90 consecutive days when soil is moist. Very severe growing season deficits. Water deficits more than 38 cm in cool regimes and more than 51 cm in mild regimes. CMI less than 25.

iv

SOIL DRAINAGE CLASSES

Soil drainage classes are defined in terms of (a) actual moisture content in excess of field moisture capacity, and (b) the extent of the period during which such excess water is present in the plant rootzone (C.D.A., 1974).

Rapidly drained - soil moisture content seldom exceeds field capacity in horizon, except immediately after water addition.

Well drained - soil moisture content does not normally exceed field capacity in any horizon except possibly the C, for a significant part of the year.

Moderately well drained - soil moisture in excess of field capacity remains for a small, but significant period of the year.

Imperfectly drained - soil moisture in excess of field capacity remains in subsurface horizons for moderately long periods during the year.

Poorly drained - soil moisture in excess of field capacity remains in all horizons for a large part of the year.

Very poorly drained - free water remains at or within 30 cm of the surface most of the year.

v TOPOGRAPHIC CLASSES (after C.D.A., 1974)

1: depressional to level - 0 to 0.5% slopes
2: gently undulating - 0.5 to 2% slopes
3: undulating - 2 to 5% slopes
4: gently rolling - 6 to 9% slopes
5: moderately rolling - 10 to 15% slopes
6: strongly rolling - 16 to 30% slopes

vi SURFACE STONINESS CLASSES (after C.D.A., 1974)

S0: non-stony land

S1: slightly stony land - There are some stones, but they offer only slight to no hinderance to cultivation.

S2: moderately stony land - There are enough stones to cause some interference with cultivation.

S3: very stony land - There are enough stones to constitute a serious handicap to cultivation and some clearing is required.

S4: exceedingly stony land - There are enough stones to prevent cultivation until considerable clearing is done.

S5: excessively stony land - This land is too stony to permit any cultivation (Boulder or stone pavement).

GLOSSARY OF TERMS

AASHO classification	- the official classification of soil materials and soil aggregate mixtures for highway construction used by the American Association of State Highway Transportation officials.
Acid soil	- a soil having a pH of less than 7.0.
Aeration	- the process by which air in the soil is replaced by air from the atmosphere.
Aggregate	- a group of soil particles cohering so as to behave mechanically as a unit.
Alkaline soil	- a soil having a pH greater 7.0.
Alluvial deposit	- sediments deposited by moving water.
Atterberg Limits	- various moisture contents of a soil at which it changes from one major physical condition to another. The Atterberg limits, which are most useful for engineering purposes, are liquid limit and plastic limit. The liquid limit is the moisture content at which a soil passes from a plastic to a liquid state. The plastic limit is the moisture content at which a soil changes from a semi-solid to a plastic state. Plasiticity index (P.I.) is defined as the numerical difference between liquid limit and plastic limit.
Available plant nutrients	- that portion of any element or compound in the soil that can be readily absorbed and assimilated by growing plants.
Available water	- that portion of water in a soil that can be readily absorbed by plant roots.
Bearing capacity	- the average load per unit area that is required to rupture a supporting soil mass.
Bedrock	- the solid rock that underlies soil and the regolith or that is exposed at the surface.
Blanket	- herein used as a term to describe a mantle of unconsolidated materials thick enough to mask minor irregularities in the underlying unit but which still conforms to the general underlying topography.

Bulk density, soil - the mass of dry soil per unit bulk volume.

Cation - an ion carrying a positive charge of electricity. The common soil cations are calcium, magnesium, sodium, potassium, and hydrogen.

Cation-exchange capacity (C.E.C.) - a measure of the total amount of exchangeable cations that can be held by the soil. It is expressed in terms of millequivalents per 100 grams of soil.

Coarse fragments - rock or mineral particles greater than 2 mm in diameter.

Concretion - a local concentration of a chemical compound, such as calcium carbonate or iron oxide, in the form of a grain or nodule of varying size, shape, hardness and color.

Consistence - (a) the resistance of a material to deformation or rupture;
(b) the degree of cohesion or adhesion of the soil mass.

Control section - the vertical section upon which soil classification is based.

Creep - a slow mass movement of soil material down rather steep slopes primarily under the influence of gravity, but aided by saturation with water and alternate freezing and thawing.

Droughty soil - sandy or rapidly drained soil with low available moisture capacity.

Electrical Conductivity (EC) - the reciprocal of electrical resistivity. Expressed in millimho/cm (mho=ohm spelled backwards).

Eluviation - the removal of soil material in suspension or in solution form a layer or layers of the soil.

Engineering tests - laboratory tests made to determine the physical properties of soils that affect their uses for various types of engineering construction.

Erosion - the wearing away of the land surface by running water, wind, or other erosive agents. It includes both normal and accelerated soil erosion. The latter is brought about by changes in natural cover or ground conditions and includes those due to human activity.

Fertility - the status of a soil in relation to the amount and availability to plants of elements necessary for plant growth.

Flood plain - the land bordering a stream, built up of sediments from overflow of the stream and subject to inundation when the stream is at flood stage.

Fluvial deposits - all sediments, past and present, deposited by flowing water, including glaciofluvial deposits. Wave worked deposits and deposits resulting from sheet erosion and mass wasting are not included.

Frost-free period - season of the year between the last frost of spring and first frost of fall.

Frost heave - the raising of a surface caused by ice formation in the underlying soil.

Glaciofluvial deposits - material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and may occur in the form of outwash plains, deltas, kames, eskers, and kame terraces.

Gleying - gleying is a reduction process that takes place in soils that are saturated with water for long periods of time. The horizon of most intense reduction is characterized by a gray, commonly mottled appearance, which on drying shows numerous rusty brown iron stains or streaks. Those horizons in which gleying is intense are designated with the subscript "g".

Gleysolic soil - soil developed under wet conditions resulting in reduction of iron and other elements and in gray colors and mottles.

Ground moraine - a glacial landform of low relief plains having gently sloping swells, sags, and enclosed depressions. The materials are predominantly till with some stratified drift.

Groundwater - that portion of the total precipitation which at any particular time is either passing through or standing in the soil and the underlying strata and is free to move under the influence of gravity.

Horizon - a layer in the soil profile approximately parallel to the land surface with more or less well-defined characteristics that have been produced through the operation of soil forming processes. Soil horizons may be organic or mineral.

Hummocky moraine - a landform composed of knobs and depressions with local relief generally in excess of 10 metres. Materials are mostly till but some stratified drift may be included.

Humus - that more or less stable fraction of the soil organic matter remaining after the major portion of added plant and animal residues have decomposed. Usually it is dark colored.

Illuviation - the process of deposition of soil material removed from one horizon to another in the soil, usually from an upper to a lower horizon in the soil profile. Illuviated compounds include silicate clays, iron and aluminum hydrous oxides and organic matter.

Immature soil - a soil having weakly developed horizons.

Infiltraion - the downward entry of water into the soil.

Morphology, soil - the makeup of the soil, including the texture, structure, consistence, color, and other physical, mineralogical and biological properties of the various horizons of the soil profile.

Mottles - spots or blotches of different color or shades of color interspersed with the dominant color. Mottling in soils usually indicates poor aeration and drainage.

Organic matter - the decomposition residues of plant material derived from: (1) plant materials deposited on the surface of the soil, and
(2) roots that decay beneath the surface of the soil.

Parent material - unconsolidated mineral material or peat from which the soil profile develops.

Peat - unconsolidated soil material consisting largely of undecomposed to partially decomposed organic matter accumulated under conditions of excessive moisture.

Ped - a unit of soil structure such as a prism, block, or granule, formed by natural processes (in contrast to a clod, which is formed artificially).

Pedology - those aspects of soil science involving the constitution, distribution, genesis and classification of soils, in terms of their use.

Percolation, soil water - the downward movement of water through soil. Especially the downward flow of water in saturated or nearly saturated soil at hydraulic gradients of the order of 1.0 or less.

Permeability - the ease with which gases, liquids, or plant roots penetrate or pass through a bulk mass of soil or a layer of soil. Since different horizons of soil vary in permeability, the particular horizon under question should be designated.

pH - see soil reaction.

Phase, soil - a subdivision of a taxonomic class based on soil characteristics or combinations thereof which are considered to be potentially significant to man's use or management of the land.

Profile - a vertical section of the soil throughout all its horizons and extending into the parent material.

Relief - the elevations or inequalities of the land surface when considered collectively. Minor configurations are referred to as "microrelief."

Seepage (groundwater) - the emergence of water from the soil over an extensive area in contrast to a spring where it emerges from a local spot.

Shrink-swell potential - tendency of soils to undergo volume changes with sodium ions in exchange reactions with soil.

Sodium-Adsorption Ratio - a ratio used to express the relative activity of sodium ions in exchange reactions with soil.

$$SAR = \frac{Na+}{\sqrt{(Ca++ + Mg++)/2}}$$

where the ionic concentrations are expressed milliequivalents per litre.

Soil reaction - the degree of acidity or alkalinity of a soil, usually expressed as a pH value. Descriptive terms commonly associated with certain ranges in pH are: extremely acid, <4.5; very strongly acid, 4.5 - 5.0; strongly acid, 5.1-5.5; moderately acid, 5.6 - 6.0; slightly acid, 6.1 - 6.5; neutral, 6.6 - 7.3; slightly alkaline, 7.4 - 7.8; moderately alkaline, 7.9 - 8.4; strongly alkaline 8.5 - 9.0; and very strongly alkaline, > 9.0.

Soil structure - the combination or arrangement of primary soil particles into secondary particles, units, or peds. The secondary units are characterized and classified on the basis of size, shape, and degree of distinctness into classes, types and grades.

Solum (plural-sola)- the part of the soil profile that is above the parent material and in which the processes of soil formation are active. It comprises the A and B horizons.

Subsoil - technically, the B horizon; broadly, the part of the profile below plow depth.

Texture (soil) - the relative proportions of the various-sized soil separates in a soil as described by the textural class names.

Till - unstratified glacial drift deposited directly by ice and consisting of nonsorted clay, silt, sand and boulders.

Topsoil - (1) the layer of soil moved in cultivation, (2) the A horizon, (3) the Ah horizon, (4) presumably fertile soil material used to topdress roadbanks, gardens and lawns.

Trafficability - the capacity of a soil to withstand traffic by people, horses, or vehicles.

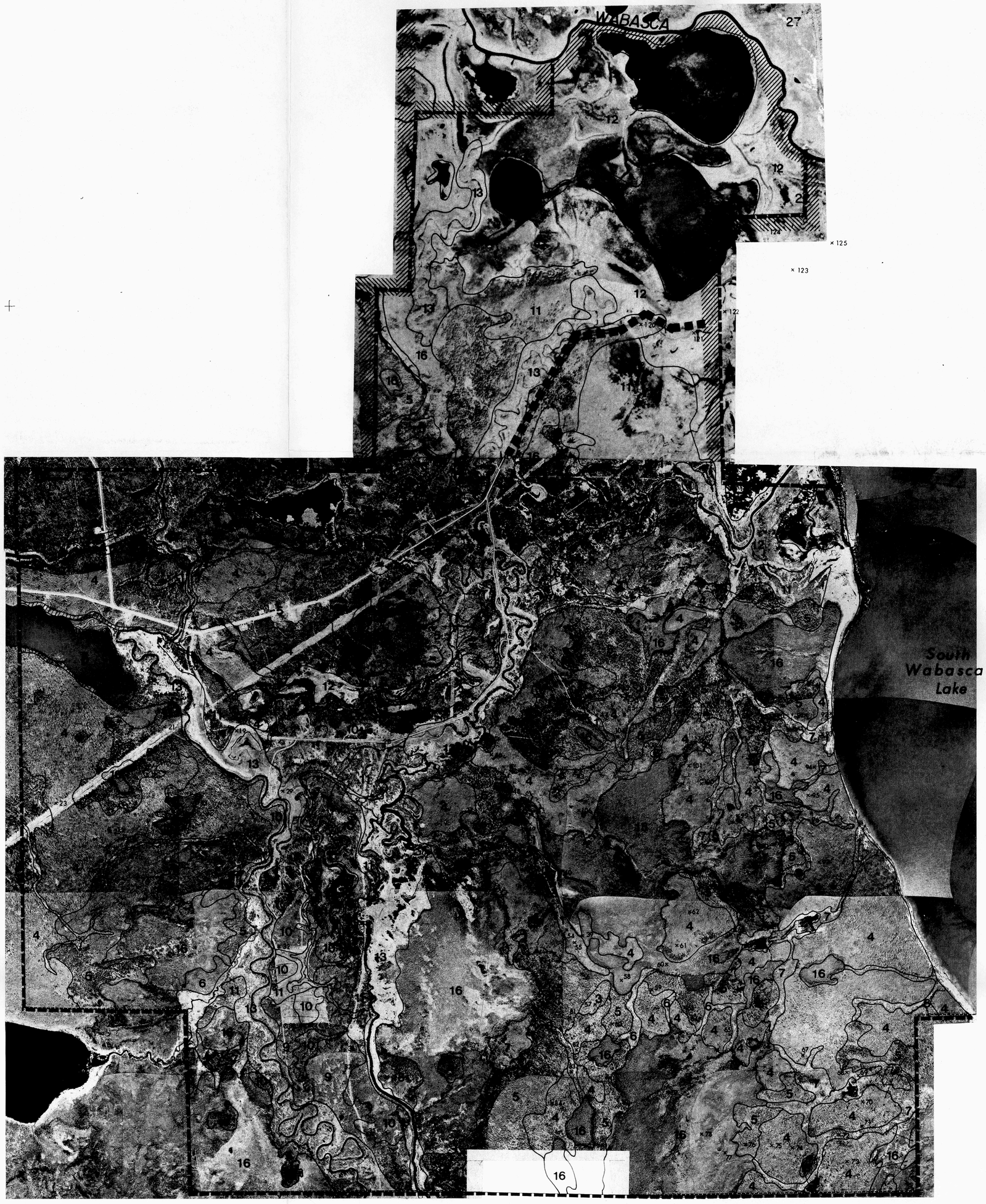
Unified Soil Classification System (Engineering) - a classification system based on the identification of soils according to their particle size, gradation, plasticity index and liquid limit.

Veneer - herein used as a term to describe a mantle of unconsolidated materials too thin to mask the minor irregularities of the underlying unit surface. A veneer will generally be less than 1 m in thickness.

Water-holding capacity - the ability of soil to hold water. The water-holding capacity of sandy soils is usually considered to be low while that of clayey soils is high. Often expressed in mm of water per cm depth of soil.

Watertable - the upper limit of the part of the soil or underlying rock material that is wholly saturated with water.

Weathering - the physical and chemical disintegration, alteration, and decomposition of rocks and minerals at or near the earth's surface by atmospheric agents.



SCALE

1 : 20,000

0 200 1000 2000

metres

LEGEND

MAP UNIT	LANDFORM: Parent Material and Surface Expression	SOILS: Subgroups D= Dominant, S= Significant, I= Inclusions	Drainage Class	Stoniness
SOILS ON GLACIOFLUVIAL DEPOSITS				
1	loamy sand to sand deposits ridged and moderately rolling, 10-15% slopes	D= Eluviated Eutric Brunisols S= Orthic Gray Luvisols	rapidly well-rapidly	non-stony to very stony
2 [2]	sandy to silty clay loam deposits gently undulating to undulating, 0-5% slopes	D= Orthic Gray Luvisols	well-moderately well	non-stony
SOILS ON TILL				
3	loam to clay loam deposits gently rolling, 6-9% slopes	D= Orthic Gray Luvisols	moderately well	slightly stony to moderately stony
SOILS ON GLACIOLACUSTRINE DEPOSITS				
4	silty clay to clay deposits level to undulating, 0-5% slopes	D= Orthic Gray Luvisols S= Gleyed Solonetzic Gray Luvisols	moderately well imperfectly	non-stony
5	silty clay to clay deposits level to undulating, 0-5% slopes	D= Gleyed Gray Luvisols S= Orthic Gray Luvisols	imperfectly moderately well	non-stony
6	silty clay to clay deposits depressional to gently undulating, 0-2% slopes	D= Orthic Luvic Gleysols S= Orthic Gleysols	poorly	non-stony
7	15 to 50 cm of moss or sedge peat overlying silty clay to clay deposits depressional to gently undulating, 0-2% slopes	D= Peaty Orthic Gleysols S= Peaty Orthic Luvic Gleysols	very poorly	non-stony
SOILS ON LACUSTRINE DEPOSITS				
8 [1]	silty clay to clay deposits level to gently undulating, 0-2% slopes	D= Gleyed Gray Luvisols S= Orthic Gray Luvisols	imperfectly moderately well	non-stony
SOILS ON FLUVIAL-LACUSTRINE DEPOSITS				
9 [1,3]	stratified silty clay loam, silt loam and silty clay deposits level to gently undulating, 0-2% slopes	D= Orthic Gray Luvisols	moderately well	non-stony
10 [2,3]	stratified silty clay loam, silt loam and silty clay deposits level to gently undulating, 0-2% slopes	D= Gleyed Gray Luvisols	imperfectly	non-stony
11 [2,3]	stratified silty clay loam and silty clay deposits level to gently undulating, 0-2% slopes	D= Orthic Luvic Gleysols S= Orthic Gleysols	poorly	non-stony
12 [2]	5 to 30 cm of moss or sedge peat overlying silty clay deposits depressional to gently undulating, 0-2% slopes	D= Rego Gleysols S= Peaty Rego Gleysols	very poorly	non-stony
SOILS ON RECENT FLUVIAL DEPOSITS				
13	stratified silt loam and fine sandy loam deposits nearly level to undulating, 0-5% slopes	D= Gleyed Regosols S= Gleyed Cumulic Regosols	imperfectly	non-stony
SOILS ON BEACH DEPOSITS				
14 [1,3]	coarse sand deposits level to gently undulating, 0-2% slopes	D= Orthic Regosols	rapidly	non-stony
15 [1,3]	15 to 70 cm of moss or sedge peat overlying coarse sand deposits depressional to gently undulating, 0-2% slopes	D= Peaty Rego Gleysols S= Terric Mesisols	very poorly	non-stony
SOILS ON ORGANIC DEPOSITS				
16	50 to 120 cm of sedge or moss peat; bogs and fens depressional to gently sloping, 0-2% slopes	D= Terric Mesisols S= Typic Mesisols (Some Humisols on sloping bogs)	very poorly	non-stony
MISCELLANEOUS MAP UNITS				
SC	Intermittent stream channels and small fluvial plains	D= Rego Gleysols S= Gleyed Regosols	very poorly imperfectly	nonstony to slightly stony
SP [2,3]	sand pit	-	-	-
	slough	-	-	-
	open water	-	-	-
[2,3]	escarpment	-	-	-

NOTATIONS

- ×35 soil inspection site
- ⊗63 soil sampling site
- soil boundary

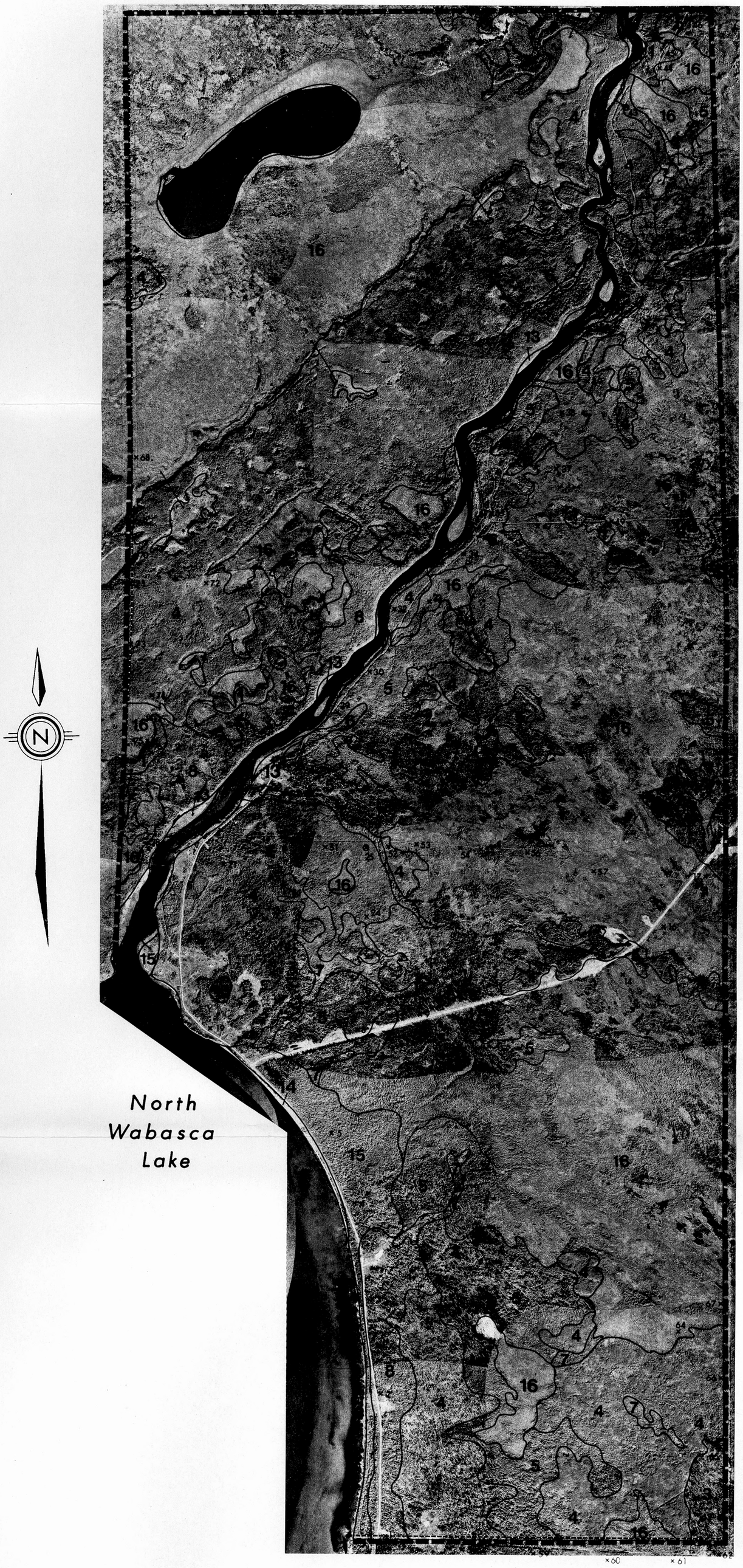
1 unit does not occur in D
2 unit does not occur in C
3 unit does not occur in B

PREPARED FOR Indian and Northern Affairs Alberta Region

BY Pedology Consultants 1982

SOIL MAP

BIGSTONE INDIAN RESERVE No. 166 D



SCALE

1 : 20,000

0 200 1000 2000

metres

LEGEND

MAP UNIT	LANDFORM: Parent Material and Surface Expression	SOILS: Subgroups D= Dominant, S= Significant, I= Inclusions	Drainage Class	Stoniness
SOILS ON GLACIOFLUVIAL DEPOSITS				
1	loamy sand to sand deposits ridged and moderately rolling, 10-15% slopes	D= Eluviated Eutric Brunisols S= Orthic Gray Luvisols	rapidly well-rapidly	non-stony to very stony
2 [2]	sandy to silty clay loam deposits gently undulating to undulating, 0-5% slopes	D= Orthic Gray Luvisols	well-moderately well	non-stony
SOILS ON TILL				
3	loam to clay loam deposits gently rolling, 6-9% slopes	D= Orthic Gray Luvisols	moderately well	slightly stony to moderately stony
SOILS ON GLACIOLACUSTRINE DEPOSITS				
4	silty clay to clay deposits level to undulating, 0-5% slopes	D= Orthic Gray Luvisols S= Gleyed Solonetzic Gray Luvisols	moderately well imperfectly	non-stony
5	silty clay to clay deposits level to undulating, 0-5% slopes	D= Gleyed Gray Luvisols S= Orthic Gray Luvisols	imperfectly moderately well	non-stony
6	silty clay to clay deposits depressional to gently undulating, 0-2% slopes	D= Orthic Luvic Gleysols S= Orthic Gleysols	poorly	non-stony
7	15 to 50 cm of moss or sedge peat overlying silty clay to clay deposits depressional to gently undulating, 0-2% slopes	D= Peaty Orthic Gleysols S= Peaty Orthic Luvic Gleysols	very poorly	non-stony
SOILS ON LACUSTRINE DEPOSITS				
8 [1]	silty clay to clay deposits level to gently undulating, 0-2% slopes	D= Gleyed Gray Luvisols S= Orthic Gray Luvisols	imperfectly moderately well	non-stony
SOILS ON FLUVIAL-LACUSTRINE DEPOSITS				
9 [2,3]	stratified silty clay loam, silt loam and silty clay deposits level to gently undulating, 0-2% slopes	D= Orthic Gray Luvisols	moderately well	non-stony
10 [2,3]	stratified silty clay loam, silt loam and silty clay deposits level to gently undulating, 0-2% slopes	D= Gleyed Gray Luvisols	imperfectly	non-stony
11 [2,3]	stratified silty clay loam and silty clay deposits level to gently undulating, 0-2% slopes	D= Orthic Luvic Gleysols S= Orthic Gleysols	poorly	non-stony
12 [2]	5 to 30 cm of moss or sedge peat overlying silty clay deposits depressional to gently undulating, 0-2% slopes	D= Rego Gleysols S= Peaty Rego Gleysols	very poorly	non-stony
SOILS ON RECENT FLUVIAL DEPOSITS				
13	stratified silt loam and fine sandy loam deposits nearly level to undulating, 0-5% slopes	D= Gleyed Regosols S= Gleyed Cumulic Regosols	imperfectly	non-stony
SOILS ON BEACH DEPOSITS				
14 [1,3]	coarse sand deposits level to gently undulating, 0-2% slopes	D= Orthic Regosols	rapidly	non-stony
15 [1,3]	15 to 70 cm of moss or sedge peat overlying coarse sand deposits depressional to gently undulating, 0-2% slopes	D= Peaty Rego Gleysols S= Terric Mesisols	very poorly	non-stony
SOILS ON ORGANIC DEPOSITS				
16	50 to 120 cm of sedge or moss peat; bogs and fens depressional to gently sloping, 0-2% slopes	D= Terric Mesisols S= Typic Mesisols (Some Humisols on sloping bogs)	very poorly	non-stony
MISCELLANEOUS MAP UNITS				
SC	Intermittent stream channels and small fluvial plains	D= Rego Gleysols S= Gleyed Regosols	very poorly imperfectly	nonstony to slightly stony
SP [2,3]	sand pit	-	-	-
	slough	-	-	-
	open water	-	-	-
[2,3]	escarpment	-	-	-

NOTATIONS

- ×35 soil inspection site
- ⊗63 soil sampling site
- soil boundary

1 unit does not occur in D
2 unit does not occur in C
3 unit does not occur in B

PREPARED FOR Indian and Northern Affairs Alberta Region

BY Pedology Consultants 1982

SOIL MAP

BIGSTONE INDIAN RESERVE No. 166 C

SCALE

1 : 20,000

0 200 1000 2000

metres

SOIL MAP

BIGSTONE INDIAN RESERVE No. 166 B

LEGEND

MAP UNIT	LANDFORM: Parent Material and Surface Expression	SOILS: Subgroups D= Dominant, S= Significant, I= Inclusions	Drainage Class	Stoniness
SOILS ON GLACIOFLUVIAL DEPOSITS				
1	loamy sand to sand deposits ridged and moderately rolling, 10-15% slopes	D= Eluviated Eutric Brunisols	rapidly	non-stony to very stony
		S= Orthic Gray Luvisols	well-rapidly	
2 [3]	sandy to silty clay loam deposits gently undulating to undulating, 0-5% slopes	D= Orthic Gray Luvisols	well-moderately well	non-stony
SOILS ON TILL				
3	loam to clay loam deposits gently rolling, 6-9% slopes	D= Orthic Gray Luvisols	moderately well	slightly stony to moderately stony
SOILS ON GLACIOLACUSTRINE DEPOSITS				
4	silty clay to clay deposits level to undulating, 0-5% slopes	D= Orthic Gray Luvisols	moderately well	non-stony
		S= Gleyed Solonetzic Gray Luvisols	imperfectly	
5	silty clay to clay deposits level to undulating, 0-5% slopes	D= Gleyed Gray Luvisols	imperfectly	non-stony
		S= Orthic Gray Luvisols	moderately well	
6	silty clay to clay deposits depressional to gently undulating, 0-2% slopes	D= Orthic Luvic Gleysols	poorly	non-stony
		S= Orthic Gleysols		
7	15 to 50 cm of moss or sedge peat overlying silty clay to clay deposits depressional to gently undulating, 0-2% slopes	D= Peaty Orthic Gleysols	very poorly	non-stony
		S= Peaty Orthic Luvic Gleysols		
SOILS ON LACUSTRINE DEPOSITS				
8 [1 2]	silty clay to clay deposits level to gently undulating, 0-2% slopes	D= Gleyed Gray Luvisols	imperfectly	non-stony
		S= Orthic Gray Luvisols	moderately well	
SOILS ON FLUVIAL-LACUSTRINE DEPOSITS				
9 [1 3]	stratified silty clay loam, silt loam and silty clay deposits level to gently undulating, 0-2% slopes	D= Orthic Gray Luvisols	moderately well	non-stony
10 [2 3]	stratified silty clay loam, silt loam and silty clay deposits level to gently undulating, 0-2% slopes	D= Gleyed Gray Luvisols	imperfectly	non-stony
11 [2 3]	stratified silty clay loam and silty clay deposits level to gently undulating, 0-2% slopes	D= Orthic Luvic Gleysols	poorly	non-stony
		S= Orthic Gleysols		
12 [2]	5 to 30 cm of moss or sedge peat overlying silty clay deposits depressional to gently undulating, 0-2% slopes	D= Rego Gleysols	very poorly	non-stony
		S= Peaty Rego Gleysols		
SOILS ON RECENT FLUVIAL DEPOSITS				
13	stratified silt loam and fine sandy loam deposits nearly level to undulating, 0-5% slopes	D= Gleyed Regosols	imperfectly	non-stony
		S= Gleyed Cumulic Regosols		
SOILS ON BEACH DEPOSITS				
14 [1 3]	coarse sand deposits level to gently undulating, 0-2% slopes	D= Orthic Regosols	rapidly	non-stony
15 [1 3]	15 to 70 cm of moss or sedge peat overlying coarse sand deposits depressional to gently undulating, 0-2% slopes	D= Peaty Rego Gleysols	very poorly	non-stony
		S= Terric Mesisols		
SOILS ON ORGANIC DEPOSITS				
16	50 to 120 cm of sedge or moss peat; bogs and fens depressional to gently sloping, 0-2% slopes	D= Terric Mesisols	very poorly	non-stony
		S= Typic Mesisols (Some Humisols on sloping bogs)		
MISCELLANEOUS MAP UNITS				
SC	Intermittent stream channels and small fluvial plains	D= Rego Gleysols	very poorly	nonstory to slightly stony
		S= Gleyed Regosols	imperfectly	
SP [2 3]	sand pit	-	-	-
	slough	-	-	-
	open water	-	-	-
[2 3]	escarpment	-	-	-

NOTATIONS

- ×35 soil inspection site
- ⊕63 soil sampling site
- soil boundary

1 unit does not occur in D

2 unit does not occur in C

3 unit does not occur in B

PREPARED FOR Indian and Northern Affairs Alberta Region

BY Pedology Consultants 1982