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SOIL SURVEY OF WYNDHAM-CARSELAND PROVINCIAL PARK STUDY AREA AND INTERPRETATION FOR RECREATIONAL USE

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CONTENTS

	Page
Preface	ii
Acknowledgments	ii
Summary	iii
Introduction	1
Size and location	1
Physiography and surficial deposits	1
Climate	1
Vegetation	1
Soils	3
Map Unit 1	6
Map Unit 2	7
Map Unit 3	7
Map Unit 4	8
Map Unit 5	9
Map Unit 6	10
Special Features	11
Miscellaneous Symbol	13
Soil Interpretations	13
References	22

MAPS

Soil Map of Wyndham-Carseland Provincial Park Study Area	Pocket
Landform Map of Wyndham-Carseland Provincial Park Study Area	Pocket
Soil Limitations for Recreation in Wyndham-Carseland Provincial Park Study Area	Pocket

LIST OF FIGURES

Figure 1.	Map showing location of study area	2
Figure 2.	Map showing soil zones of Alberta	12

LIST OF TABLES

Table 1.	Key to the Soils	4
Table 2.	Chemical Analyses of Selected Map Units	14
Table 3.	Physical Analyses of Selected Map Units	15
Table 4.	Soil Limitations for Fully Serviced Campgrounds	16
Table 5.	Soil Limitations for Picnic Areas	17
Table 6.	Soil Limitations for Lawns and Landscaping	18
Table 7.	Soil Limitations for Paths	19
Table 8.	Soil Limitations for Buildings with Basements	20
Table 9.	Soil Limitations for Road Location	21

PREFACE

This report is one of a series describing detailed and semi-detailed soil surveys, which were conducted in the following Alberta Provincial Parks during the summer of 1976: Cypress Hills, Writing-on-Stone, Dry Island Buffalo Jump, Jarvis Bay, Wabamun Lake, Thunder Lake, Moose Lake and Moonshine Lake. Also included were the Blue Lake Centre in William A. Switzer Provincial Park; as well as areas in the vicinities of Carseland and Hilliard's Bay (on the northwestern shore of Lesser Slave Lake). The total area mapped was approximately 30 000 ha.

A general guidebook has been prepared to accompany soil survey reports written for Alberta Provincial Parks and recreation areas (Greenlee, 1981). It includes general discussions of the following: soil formation; the Canadian soil classification system; soil characteristics and other factors that affect the use of soils for recreational and related purposes; Luvisolic, Organic, and Solonetzic soils; soil erosion; methodology; soil and landform maps that accompany the soil survey reports; an explanation of soil interpretations and guidelines for developing them; chemical and physical properties of soils; and the landform classification system used by Canadian soil pedologists. Also included is a glossary. Specific results and interpretations for the areas covered by this study are presented in the ensuing report.

ACKNOWLEDGMENTS

The Alberta Research Council provided the staff, and the Outdoor Recreation Planning Branch of Alberta Recreation and Parks contributed the funds for the 1976-77 provincial parks soil survey program. Costs included field, office, laboratory, drafting, editing, and printing; as well as equipment and supplies. Office and laboratory space were provided by The University of Alberta. Mrs. Kathy Gates typed and assisted in compiling and proof reading the report. Mrs. J. Dlask drafted the soil, landform, and soil limitations for recreation maps, while Mr. J. Beres determined the soil physical properties. The soil chemical analyses were determined by the Alberta Soil and Feed Testing Laboratory. Able field assistance was given by Mr. M. Hennie.

Special acknowledgment is given to the Park Rangers and other park employees, who cooperated by allowing soil investigations to be conducted throughout the park, and who invariably offered assistance when needed.

SUMMARY

The mapped area comprises about 110 ha; and is located about 5 km southeast of Carseland, adjacent to Highway 24 on the west side and adjacent to the Bow River on the south side. Surficial deposits throughout the study area consist of medium textured fluvial sediments, overlying very coarse textured fluvial sediments (gravel) at various depths. This region has a cold snow-forest climate with humid winters, characterized by frozen ground and a snow cover of several months duration. Summers are cool with average temperatures of the warmest month between 10 and 22°C, and the average temperature of the coldest month is less than -3°C. The mapped area is situated in the grasslands region, and the vegetation type is the needle-and-thread/blue grama/wheatgrass type.

Six map units were recognized in the study area. The key profile types are Orthic Regosols and Rego Gleysols. These are distributed over the landscape in relation to landform, parent material, and drainage. Each map unit is a soil series, and the distribution is shown on the soil map.

Soil interpretations of each map unit are made for fully serviced campgrounds, picnic areas, lawns and landscaping, paths, buildings without basements, and road location. Most of the soils in the study area have moderate limitations for recreational development because of a flooding hazard (overflow), but are otherwise well suited. Map Unit 5 soils have moderate limitations because they may be slippery or sticky when wet if vegetation is lacking; and Map Unit 6 soils have severe limitations because of seasonally high groundwater tables or surface ponding. The soils best suited to road construction are those of Map Unit 5. Most others have a moderate limitation due to a flooding hazard (overflow), but are otherwise well suited. An exception is Map Unit 6 soils, which have severe limitations due to seasonally high groundwater tables or surface ponding. Careful study of the soil map and tables 4 to 9 inclusive (soil limitation tables) will reveal areas suitable for particular uses.

A soil survey properly interpreted can be one of the most useful tools management has in making a proper design for a recreational area. However, all soil differences which occur in the field cannot be shown on the soil map. Thus for design and construction of specific recreational facilities, an on-site investigation is usually required.

INTRODUCTION

SIZE AND LOCATION

The mapped area comprises about 110 ha; and is located about 5 km southeast of Carseland, adjacent to Highway 24 on the west side and adjacent to the Bow River on the south side (figure 1). Carseland in turn is about 55 km southeast of Calgary. The study area includes a small part of the east half of section 31; part of the southwest quarter, most of the north half, and part of the southeast quarter of section 32; township 21, range 25, west of the fifth meridian.

PHYSIOGRAPHY AND SURFICIAL DEPOSITS

The study area is situated in the Western Alberta Plains Division of the Interior Plains Physiographic Region (Government and the University of Alberta, 1969), in the Bow River Valley. The bedrock has been classified as the Paleocene and Upper Cretaceous Paskapoo Formation, which is nonmarine (Green, 1972). Surface elevations are slightly more than 880 m, and very little local relief occurs. The study area is relatively flat, with only a very gradual slope from south to north toward the river; and is drained by the Bow River to the east.

Surficial deposits throughout the study area consist of medium textured fluvial sediments, overlying very coarse textured fluvial sediments (gravel) at various depths.

CLIMATE

The climate in the mapped area is designated as humid microthermal in Koppen's climatic classification (Trewartha and Horn, 1980). This is described as a cold snow-forest climate with humid winters, characterized by frozen ground and a snow cover of several months duration. Summers are cool with average temperatures of the warmest month between 10 and 22°C. The average temperature of the coldest month is less than -3°C.

Weather records from 1951 through 1980 for Calgary about 55 km northwest of the study area and at an elevation of 1084 m show the following values (Environment Canada, 1982): the mean annual temperature is 3.4°C. July is the warmest month of the year with a mean temperature of 16.4°C, and January is the coldest with a mean temperature of -11.8°C. The mean annual precipitation is 424 mm and 64% falls as rain. The average frost-free period is 112 days.

VEGETATION

The mapped area is situated in the grasslands region, as classified by Hosie (1969). Trembling aspen forms groves or bluffs around wet depressions, and several other species of poplar are usually found along rivers and in moist locations with willows and some white spruce. The natural vegetation type in the vicinity of the study area is the needle-and-thread/blue grama/wheatgrass type as classified by Wroe et al (1979). Mid-grasses are abundant in these grasslands. About 70 percent of

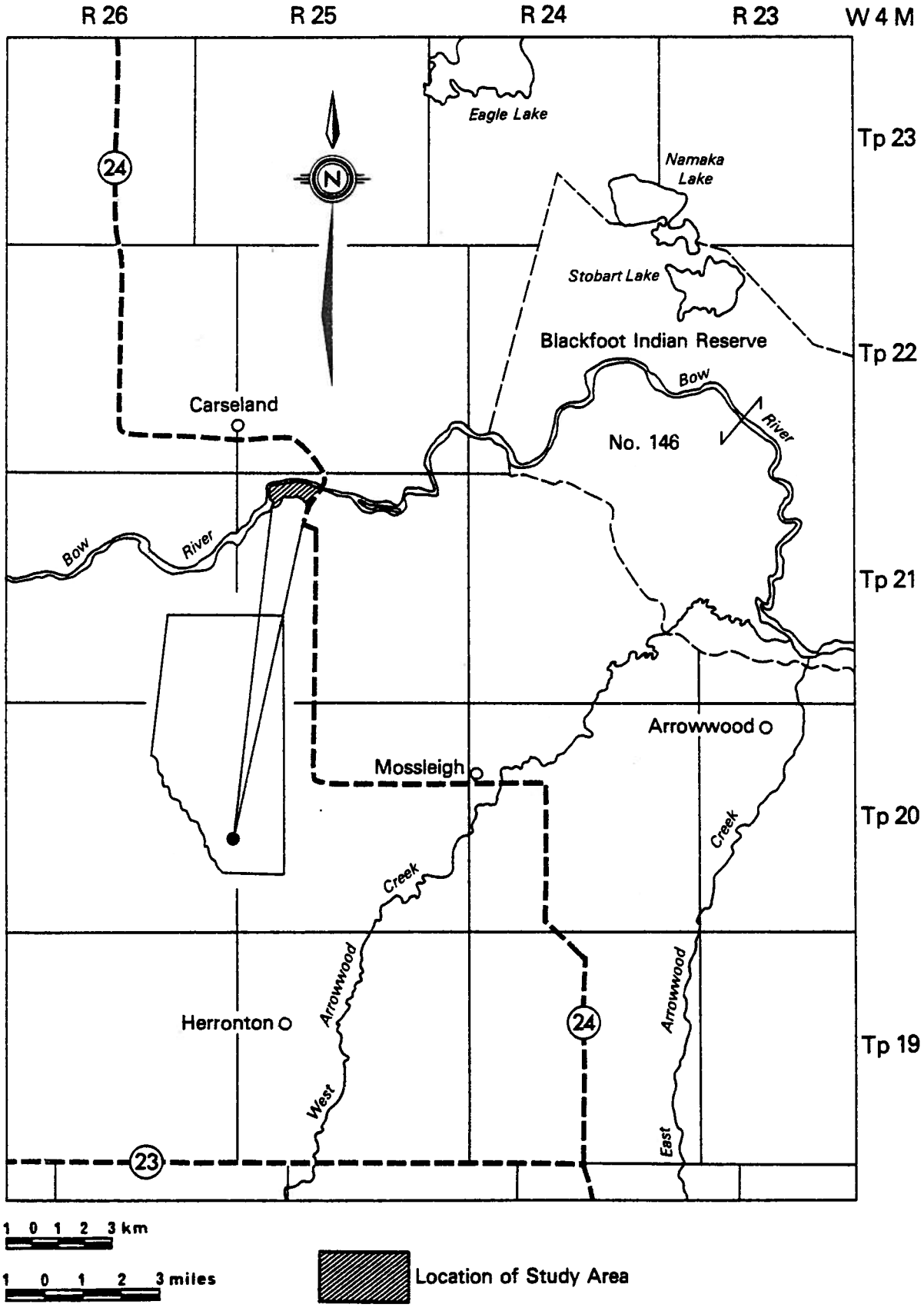

Figure 1. Map showing location of study area.

the total vegetation is needle-and-thread, western porcupine grass, blue grama, and the wheatgrasses.

Vegetation in the non-wooded portion of the study area, aside from agricultural crops, consists of grass with patches of choke cherry and thorny buffalo-berry. The wooded portion is characterized by balsam poplar. Since the Outdoor Recreation Planning Branch of Alberta Recreation and Parks conducts biological studies of provincial parks and recreation areas, the vegetation is not extensively discussed in this report. However, some of the common plants observed growing on different soils are indicated as part of the map unit descriptions, and these are listed as follows (Moss, 1959; Cormack, 1967): balsam poplar (Populus balsamifera), dogwood (Cornus stolonifera), choke cherry (Prunus virginiana), thorny buffalo-berry (Shepherdia argentea), willow (Salix spp), alder (Alnus spp), wild rose (Rosa spp), common bearberry (Arctostaphylos urva-ursi), native grass (various species), tame grasses, weeds, agricultural crops, slough grass (Beckmannia syzigachne), and horsetail (Equisetum spp).

SOILS

Six map units were recognized in the study area. The soils of five were classified in the Regosolic Order, and one in the Gleysolic Order in the Canadian Soil Classification System (Canada Soil Survey Committee, 1978). The system is outlined in Greenlee (1981). Pertinent features of the map units are outlined in table 1.

Soils of the Regosolic Order are rapidly to imperfectly drained mineral soils with profile development too weakly expressed to meet the requirements for classification in any other order. They lack any expression of a B horizon, and therefore, reflect essentially the characteristics of the C horizons and parent materials from which they are formed.

Well drained Regosolic soils developed on medium textured fluvial sediments, overlying very coarse textured fluvial sediments (gravel) at various depths, occur throughout the majority of the study area. These floodplain deposits are of relatively recent origin, and insufficient time has elapsed for any marked soil profile development.

Soils of the Gleysolic order are poorly drained mineral soils whose profiles reflect the influence of waterlogging for significant periods. Water saturation causes reducing conditions due to a lack of aeration. These conditions result in gleyed horizons having dull gray to olive, greenish or bluish-gray moist colours, frequently accompanied by prominent usually rust-coloured mottles resulting from localized oxidation and reduction of hydrated iron oxides.

Two narrow bands of Gleysolic soils developed on medium textured fluvial sediments overlying very coarse textured fluvial sediments (gravel) extend from east to west, near the southern boundary of the study area.

TABLE 1. KEY TO THE SOILS

MAP UNIT	CLASSIFICATION	PARENT MATERIAL	SURFACE TEXTURE	SLOPE (CLASS AND GRADIENT)	SURFACE STONINESS	DRAINAGE	COMMENTS AND LIMITATIONS
1	Orthic Regosol	medium textured fluvial sediments	very fine sandy loam	b, c (>0.5 to 5%)	0	well drained	Frequent sand lenses in the soil profile below the 25 - 30 cm depth. Slight to severe limitations - flooding hazard (overflow), high lime content (soil nutrient imbalance), lack of Ah horizon.
2	Orthic Regosol	medium textured fluvial sediments, overlying very coarse textured fluvial sediments (gravel)	very fine sandy loam	b (>0.5 to 2%)	1	rapid	Occasional small patches of gravel occur at soil surface, also occasional small patches occur 75 - 100 cm below surface. Slight to severe limitations - flooding hazard (overflow), rapid permeability (droughtiness), high lime content (soil nutrient imbalance), lack of Ah horizon.
3	Orthic Regosol	very coarse textured fluvial sediments (gravel)	gravel	b (>0.5 to 2%)	5	rapid	Slight to very severe limitations - surface stoniness, flooding hazard (overflow), rapid permeability (droughtiness), high lime content (soil nutrient imbalance), lack of Ah horizon.
4	Orthic Regosol	medium textured fluvial sediments, overlying very coarse textured fluvial sediments (gravel)	loam	b (>0.5 to 2%)	2	well drained	Depth to gravel ranges from 60 to 120 cm below soil surface. Slight to severe limitations - flooding hazard (overflow), surface stoniness, high lime content (soil nutrient imbalance), lack of Ah horizon.

TABLE 1 (CONTINUED)

5	Orthic Regosol	medium textured fluvial sediments, overlying very coarse textured fluvial sediments (sand)	silt loam to loam	b (>0.5 to 2%)	0	well drained	Gravel sometimes occurs within 45 cm of the surface. Slight to moderate limitations - slippery or sticky when wet, high lime content (soil nutrient imbalance), lack of Ah horizon.
6	Rego Gleysol	medium textured fluvial sediments, overlying very coarse textured fluvial sediments (gravel)	very fine sandy loam to silt loam	a (0 to 0.5%)	0	poor	(1) Numerous sand lenses common in these soil profiles, (2) Gravel usually occurs 90 - 120 cm below surface. Severe limitations - seasonally high groundwater table or surface ponding, high lime content (soil nutrient imbalance), lack of Ah horizon.

Very minor differences exist among some map units. However, the differences are usually significant with regard to a particular recreational or engineering use, and thus justify separation of different map units. They are described in chronological order, and horizon thicknesses represent averages. Thicknesses of comparative horizons in identical soil profiles often vary as much as 10 to 40 percent from the norm at different points in the landscape.

The dominant plant species are listed using common names. These are very general lists, and not purported to be complete.

Map Unit 1

Classification: Orthic Regosol

Parent material: medium textured fluvial sediments.

Landform: level fluvial (Fl), undulating fluvial (Fu).

Slope: gently undulating to undulating (>0.5 to 5%).

Surface stoniness: nonstony (0).

Drainage: well drained.

Vegetation: balsam poplar, dogwood; some thorny buffalo-berry, willow, wild rose; some patches of grass.

Profile description: Orthic Regosol.

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
Ck	100	very fine sandy loam	amorphous	very friable, moist; slightly hard, dry.

Comment: Frequent sand lenses occur in the soil profile below the 25 to 30 cm depth. They range from 5 to 10 cm thick, and 3 to 20 cm apart.

Limitations: slight to severe-slight for picnic areas, and paths; moderate for campgrounds, lawns and landscaping, and road location; severe for buildings. Specific limitations include flooding hazard (overflow), high lime content (soil nutrient imbalance), and lack of Ah horizon.

Map Unit 2

Classification: Orthic Regosol

Parent material: medium textured fluvial sediments, overlying very coarse textured fluvial sediments (gravel).

Landform: level fluvial (F1).

Slope: gently undulating (>0.5 to 2%).

Surface stoniness: slightly stony (1).

Drainage: rapid.

Vegetation: grass, with patches of choke cherry, and thorny buffalo-berry; also scattered patches of balsam poplar, dogwood, and wild rose.

Profile description: Orthic Regosol

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
Ck1	20-30	very fine sandy loam	amorphous	very friable, moist
Ck2	70-80	gravel	amorphous	loose, moist

Comment: Occasional small patches of gravel are found at the soil surface; and also occasional small patches occur 75 to 100 cm below the surface.

Limitations: Slight to severe-slight for picnic areas, and paths; moderate for campgrounds, and road location; severe for lawns and landscaping, and buildings. Specific limitations include flooding hazard (overflow), rapid permeability (droughtiness), high lime content (soil nutrient imbalance), and lack of Ah horizon.

Map Unit 3

Classification: Orthic Regosol

Parent material: very coarse textured fluvial sediments (gravel).

Landform: level fluvial (F1).

Slope: gently undulating (>0.5 to 2%).

Surface stoniness: excessively stony (5).

Drainage: rapid

Vegetation: scattered small balsam poplar; very sparse grass; patches of common bearberry.

Profile description: Orthic Regosol

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
Ck	100	gravel	amorphous	loose, dry or moist

Limitations: Slight to very severe-moderate for road location; very severe due to surface stoniness but otherwise slight for picnic areas, and paths; very severe due to surface stoniness but otherwise moderate for campgrounds; very severe due to surface stoniness but otherwise severe for lawns and landscaping, and buildings. Other limitations include flooding hazard (overflow), rapid permeability (droughtiness), high lime content (soil nutrient imbalance), and lack of Ah horizon.

Map Unit 4

Classification: Orthic Regosol

Parent material: medium textured fluvial sediments, overlying very coarse textured fluvial sediments (gravel).

Landform: level fluvial (F1).

Slope: gently undulating (>0.5 to 2%).

Surface stoniness: moderately stony (2).

Drainage: well drained.

Vegetation: various weeds, and sparse grass.

Profile description: Orthic Regosol.

Horizon	Thickness (cm)	Field Texture	Structure	Consistence

Ck1	60–100	loam	amorphous	very friable, moist
Ck2	0–40	gravel	amorphous	loose, dry or moist

Comments: 1) Map Unit 4 soil areas appear to have been disturbed; the soil surface appears to have been removed by construction activities.

2) The depth to gravel ranges from 60 to 120 cm below the surface.

Limitations: Slight to severe–slight for picnic areas; moderate due to surface stoniness but otherwise slight for paths; moderate for campgrounds, lawns and landscaping, and road location; severe for buildings. Specific limitations include flooding hazard (overflow), surface stoniness, high lime content (soil nutrient imbalance), and lack of Ah horizon.

Map Unit 5

Classification: Orthic Regosol

Parent material: medium textured fluvial sediments, overlying very coarse textured fluvial sediments (sand).

Landform: fluvial terraces (Ft).

Slope: gently undulating (>0.5 to 2%).

Surface stoniness: nonstony (0).

Drainage: well drained.

Vegetation: agricultural crops.

Profile description: Orthic Regosol

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
Ck1	75–100	silt loam to loam	amorphous	very friable, moist; slightly hard, dry
Ck2	0–25	loamy fine sand to sand	amorphous	very friable to loose, moist.

Comments: 1) If the Ck2 horizon does not occur within the control section, it occurs immediately below.

2) Gravel sometimes occurs within 45 cm of the surface.

Limitations: Slight to moderate-slight for buildings, and road location; moderate for campgrounds, picnic areas, lawns and landscaping, and paths. Specific limitations include slippery or sticky when wet, high lime content (soil nutrient imbalance), and lack of Ah horizon.

Map Unit 6

Classification: Rego Gleysol

Parent material: medium textured fluvial sediments, overlying very coarse textured fluvial sediments (gravel).

Landform: level fluvial (F1).

Slope: nearly level (0 to 0.5%).

Surface stoniness: nonstony (0).

Drainage: poor.

Vegetation: willow, alder, dogwood; some balsam poplar; some patches of slough grass, and horsetail.

Profile description: Rego Gleysol.

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
Ckg1	90-100	very fine sandy loam to silt loam.	amorphous	very friable to friable, moist.
Ckg2	0-10	gravel	amorphous	loose, moist

Comments: 1) Numerous sand lenses usually occur in these soil profiles. They begin about 10 to 25 cm below the surface, range from 1 to 3 cm thick, and from 5 to 10 cm apart.

2) Gravel usually commences 90 to 120 cm below the surface, but is sometimes deeper.

Limitations: Severe for all uses. Specific limitations include seasonally high groundwater table or surface ponding, high lime content

(soil nutrient imbalance), and lack of Ah horizon.

Special Features

The soils in Alberta have been classified into broad general zones (figure 2) as established by Alberta Soil Survey during the normal course of soil surveys, and correlated with temperature and precipitation records. Annual precipitation amounts change gradually from one soil zone to another, and are not abrupt changes at the point where a zone boundary has been located. Thus a zone boundary is a broad transitional belt, which can be many kilometres across. Topsoil colours reflect this gradual change. For example, in the centre of the Brown Soil Zone (annual precipitation about 30 to 33 cm), topsoil colours are brown. Similarly in the centre of the Dark Brown Soil Zone (annual precipitation about 38 cm), topsoil colours are dark brown. Between these two zones, topsoil colours are brown to dark brown, and annual precipitation is about 35 cm. The boundary between the two soil zones has been placed approximately at that midpoint.

Zonal soils are soils with well developed soil characteristics that reflect the zonal or normal influences of climate and living organisms, mainly vegetation, as active factors of soil genesis. Examples are Brown, Dark Brown, or Black soils of the Brown, Dark Brown, or Black Soil Zones respectively. Intrazonal soils are soils with morphology that reflects the influence of some local factor of relief, parent material, or age; rather than of climate and vegetation. An example is Solonetzic soils, which develop as a result of salinization. This may originate internally from a saline parent material, or from saturation by external saline waters. Solonetzic soils are found across many soil zones (figure 2). Azonal soils are soils without distinct genetic horizons, and are represented by Regosolic soils in Canada. These occur across all the soil zones in the province.

The study area is situated in the Dark Brown soil zone; however the soils throughout the majority of the area are classified as Orthic Regosols, which are azonal. An exception is the Gleysolic soils, which are intrazonal. Regosolic and Gleysolic soils occur across all the soil zones. Soils of the study area can be considered normal locally, but not regionally, as Chernozemic soils are prevalent in uplands throughout the region (Wyatt et al, 1942; revised by Peters and Bowser, 1960).

Special features of soils in the mapped area are their high lime content, and the lack of Ah horizons. High lime contents may restrict the availability of certain nutrients to plants, resulting in deficiencies and imbalances in plant nutrition (Greenlee, 1981). High rates of certain fertilizers may be required to attain desired levels of plant growth. Ah horizons generally have relatively high contents of organic matter and available nutrients, are well aggregated, and resilient to compaction. These desirable features of surface soils are absent wherever Ah horizons are lacking, and plant growth is difficult to maintain in park use areas.

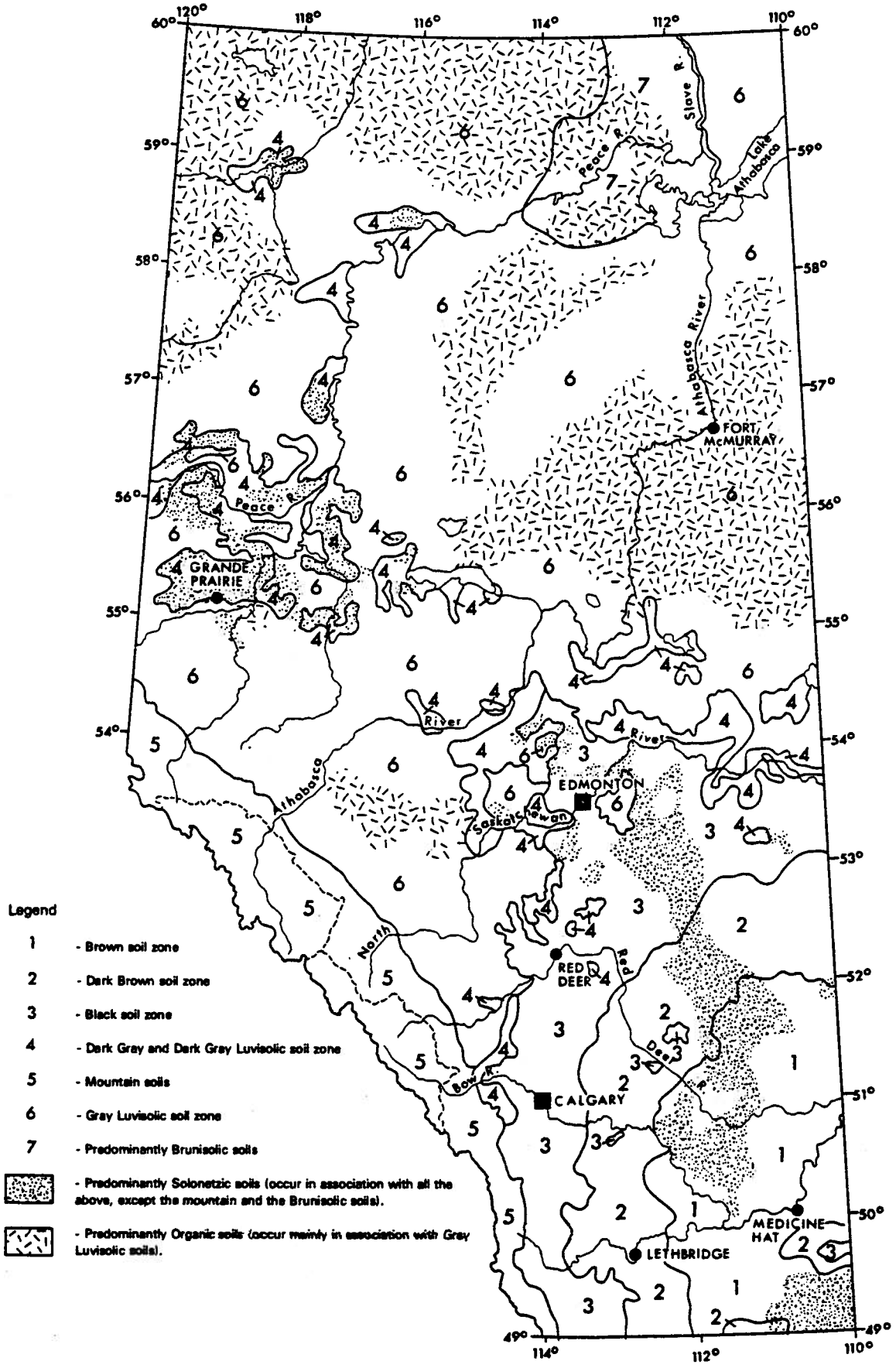

Figure 2. Map showing soil zones of Alberta. (From Soil Group Map of Alberta, Alberta Institute of Pedology, undated).

MISCELLANEOUS SYMBOL

This symbol indicates the location of a meander scar. These range from 1 to 3 m deep, and 2 to 8 m wide, are flat-bottomed, and have escarpments on both sides. They contain intermittent pools of water, and alder grows along the edges. These have severe limitations for all uses because of seasonally high groundwater tables or surface ponding.

SOIL INTERPRETATIONS

An explanation of soil interpretations and definitions of the soil limitation and suitability ratings are given in Greenlee (1981). The results of soil chemical and physical analyses are given in tables 2 and 3.

Most of the soils in the study area have moderate limitations for recreational development because of a flooding hazard (overflow), but are otherwise well suited. Map Unit 5 soils, which occur in the southern portion, have moderate limitations because they may be slippery or sticky when wet if vegetation is lacking. As well, Map Unit 3 soils have a very severe limitation due to surface stoniness; however, only one small patch of these soils occurs adjacent to the river. Map Unit 6 soils have severe limitations because of seasonally high groundwater tables or surface ponding.

The soils best suited to road construction are those of Map Unit 5. Most others have a moderate limitation due to a flooding hazard (overflow), but are otherwise well suited. An exception is Map Unit 6 soils, which have severe limitations due to seasonally high groundwater tables or surface ponding.

Specific limitations and suitabilities of the various soils for selected uses are shown in tables 4 to 9 inclusive. The ratings were determined on the basis of morphological, physical and chemical properties of the soils, as well as steepness of slope. The principal limiting properties are indicated, and are generally listed in decreasing order of importance. The soil limitations for various uses have been designated as none to slight, moderate, severe, and very severe.

Table 2. Chemical Analysis of Selected Map Units[1]

Map Unit	Depth cm	pH H_2O	[2] EC	[3] Na	[3] SO_4	[3] OM	[3] $CaCO_3$
1	0 - 15	7.9	0.3	L-	[4]nd	M-	H+
	15 - 30	8.0	0.3	L-	nd	M-	H+
2	0 - 15	8.1	0.3	L-	nd	M-	H+
	15 - 30	8.3	0.3	L-	nd	M-	H+
4	0 - 15	8.3	0.7	L+	nd	M-	H+
	15 - 30	8.3	0.6	L-	nd	M-	H+
5	0 - 15	8.2	0.9	L+	nd	M-	H+
	15 - 30	8.4	0.3	L-	nd	M-	H+

[1]Chemical Analyses done by Alberta Soil and Feed Testing Laboratory, [2]EC - electrical conductivity, millimhos/cm, [3]These tests are rated into 4 categories: High (H), Medium (M), Low (L), and none (-). The degree within each category is indicated by a + or - sign. The test for OM (organic matter) and $CaCO_3$ (free lime) are visual estimates only, [4]nd - not determined.

Table 3. Physical Analyses of Selected Map Units (1)

Map Unit	Depth cm	Field Moisture %	Mechanical Analysis											Liquid Limit	Plasticity Index	Optimum Moisture %(2)	Maximum Dry Density lb/ft.^{3} (2)	Classification		
			Percentage Passing Sieve							Percentage Smaller Than										
			1 inch	3/4 inch	5/8 inch	#4 (4.7 mm.)	#10 (2.0 mm.)	#40 0.42 mm.)	#200 (0.074 mm.)	0.05 mm.	0.005 mm.	0.002 mm.	0.001 mm.					AASHO	Unified	USDA
5	60-90	(3) nd	100	100	100	100	100	100	77	68	19	12	11	30	9	.21	101.0	A-4(8)	CL	SiL

(1) Map Units developed on similar parent material: 4 and 5

(2) These values are obtained from charts worked out by the Highways Testing Laboratory, Alberta Transportation, (3) nd - not determined.

Table 4. Soil Limitations for Fully Serviced Campgrounds

MAP SYMBOL [1]	DEGREE OF LIMITATION [2]	MAP SYMBOL	DEGREE OF LIMITATION
$\frac{1}{bo}$ $\frac{1}{co}$	M - Flood		
$\frac{2}{b1}$	M - Flood		
$\frac{3}{b5}$	VS - Stony M - Flood		
$\frac{4}{b2}$	M - Flood, Stony		
$\frac{5}{bo}$	M - Slip		
$\frac{6}{ao}$	S - Wet		

1. For explanation, see Soil Map
2. SL - None to slight, M - Moderate, S - Severe, VS - Very severe

Abbreviations

BR - Shallow depth to bedrock
Clay - High clay content
Er - Erosion hazard
Flood - Flooding hazard (overflow)
Org - Organic soil
Org Surf - Organic surface layer >15 cm thick
Sandy - Sandy surface texture
Slip - Slippery or sticky when wet
Slope - Excessive slope
Sl Perm - Slow permeability
Solz - Solonetzic soil
Stony - Surface stoniness
Wet - Seasonally high groundwater table or surface ponding

Table 5. Soil Limitations for Picnic Areas

MAP SYMBOL [1]	DEGREE OF LIMITATION [2]	MAP SYMBOL	DEGREE OF LIMITATION
$\frac{1}{bo}$ $\frac{1}{co}$	SL		
$b\frac{2}{1}$	SL		
$b\frac{3}{5}$	VS - Stony, otherwise SL		
$b\frac{4}{2}$	SL		
$\frac{5}{bo}$	M - Slip		
$\frac{6}{ao}$	S - Wet		

1. For explanation, see Soil Map
2. SL - None to slight, M - Moderate, S - Severe, VS - Very severe

Abbreviations

BR - Shallow depth to bedrock
Clay - High clay content
Er - Erosion hazard
Flood - Flooding hazard (overflow)
Org - Organic soil
Org Surf - Organic surface layer >15 cm thick
Sandy - Sandy surface texture
Slip - Slippery or sticky when wet
Slope - Excessive slope
Sl Perm - Slow permeability
Solz - Solonetzic soil
Stony - Surface stoniness
Wet - Seasonally high groundwater table or surface ponding

Table 6. Soil Limitations for Lawns and Landscaping

MAP SYMBOL [1]	DEGREE OF LIMITATION [2]	MAP SYMBOL	DEGREE OF LIMITATION
$\frac{1}{bo}$ · $\frac{1}{co}$	M - Lime, Thin Ah	$\frac{6}{ao}$	S - Wet, Lime, Thin Ah
$\frac{2}{b1}$	S-R Perm, Lime, Thin Ah		
$\frac{3}{b5}$	S-R Perm, Lime, Thin Ah VS - Stony		
$\frac{4}{b2}$	M - Lime, Thin Ah, Stony		
$\frac{5}{bo}$	M - Lime, Thin Ah		

1. For explanation, see Soil Map
2. SL - None to slight, M - Moderate, S - Severe, VS - Very severe

Abbreviations

BR - Shallow depth to bedrock
Clay - High clay content
Er - Erosion hazard
Flood - Flooding hazard (overflow)
Lime - High lime content (soil nutrient imbalance)
Org - Organic soil
Org Surf - Organic surface layer >15 cm thick
R Perm - Rapid permeability (droughtiness)
Saline - Surface soil salinity
Sandy - Sandy surface texture
Slope - Excessive slope
Sl Perm - Slow permeability
Solz - Solonetzic soil
Stony - Surface stoniness
Thin Ah - Thin or no Ah horizon
Wet - Seasonally high groundwater table or surface ponding

Table 7. Soil Limitations for Paths

MAP SYMBOL [1]	DEGREE OF LIMITATION [2]	MAP SYMBOL	DEGREE OF LIMITATION
$\frac{1}{bo}$ $\frac{1}{co}$	SL		
$\frac{2}{b1}$	SL		
$\frac{3}{b5}$	VS - Stony, otherwise SL		
$\frac{4}{b2}$	M - Stony, otherwise SL		
$\frac{5}{bo}$	M - Slip		
$\frac{6}{ao}$	S - Wet		

1. For explanation, see Soil Map
2. SL - None to slight, M - Moderate, S - Severe, VS - Very severe.

Abbreviations

Clay - High clay content
Er - Erosion hazard
Flood - Flooding hazard (overflow)
Org - Organic soil
Org Surf - Organic surface layer >15 cm thick
Sandy - Sandy surface texture
Slip - Slippery or sticky when wet
Slope - Excessive slope
Solz - Solonetzic soil
Stony - Surface stoniness
Wet - Seasonally high groundwater table or surface ponding

Table 8. Soil Limitations for Buildings Without Basements

MAP SYMBOL [1]	DEGREE OF LIMITATION [2]	MAP SYMBOL	DEGREE OF LIMITATION
$\frac{1}{bo}$ $\frac{1}{co}$	S - Flood		
$\frac{2}{b1}$	S - Flood		
$\frac{3}{b5}$	S - Flood VS - Stony		
$\frac{4}{b2}$	S - Flood, Stony		
$\frac{5}{bo}$	SL		
$\frac{6}{ao}$	S - Wet		

1. For explanation, see Soil Map
2. SL - None to slight, M - Moderate, S - Severe, VS - Very severe

Abbreviations

BR - Shallow depth to bedrock
Flood - Flooding hazard (overflow)
Org - Organic soil
Slope - Excessive slope
Stony - Surface stoniness
Wet - Seasonally high groundwater table or surface ponding

Table 9. Soil Limitations for Road Location

MAP SYMBOL [1]	DEGREE OF LIMITATION [2]	MAP SYMBOL	DEGREE OF LIMITATION
$\frac{1}{bo}$ $\frac{1}{co}$	M - Flood		
$\frac{2}{b1}$	M - Flood		
$\frac{3}{b5}$	M - Flood		
$\frac{4}{b2}$	M - Flood		
$\frac{5}{bo}$	SL		
$\frac{6}{ao}$	S - Wet		

1. For explanation, see Soil Map
2. SL - None to slight, M - Moderate, S - Severe, VS - Very severe

Abbreviations

BR - Shallow depth to bedrock
Clay - High clay content
Er - Erosion hazard
Flood - Flooding hazard (overflow)
Frost - Susceptibility to frost heave
M Sh-Sw-Moderate to shrink-swell potential
Org - Organic soil
Sh-Sw-High shrink-swell potential
Slope - Excessive slope
Stony - Surface stoniness
Wet - Seasonally high groundwater table or surface ponding

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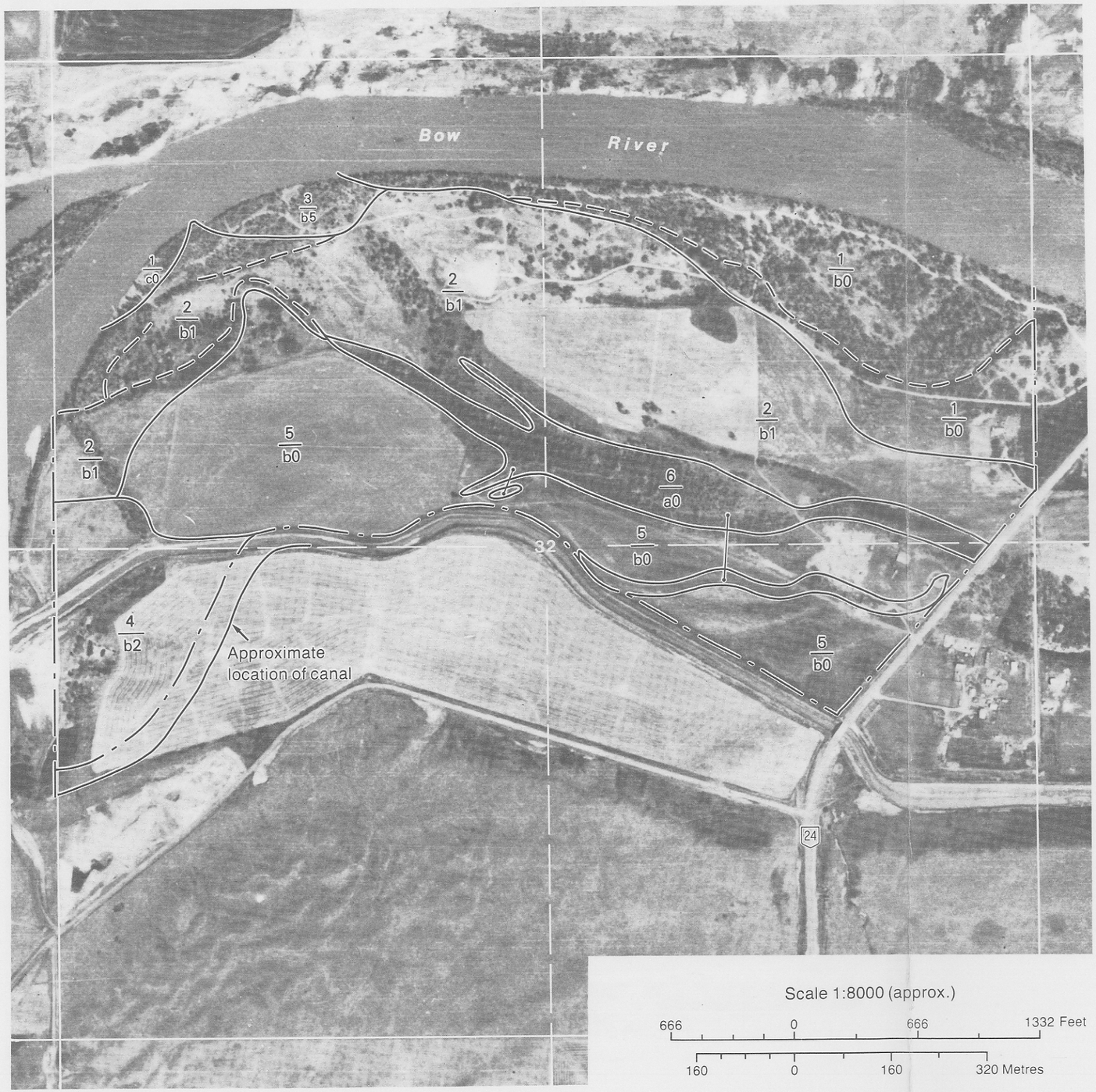

Scale 1:8000 (approx.)

666 0 666 1332 Feet

160 0 160 320 Metres

SOIL CLASSIFICATION			
MAP UNIT	SOIL ORDER	SOIL SUBGROUP	SOIL PARENT MATERIAL
1	Regosolic	Orthic Regosol	medium textured fluvial sediments
2	Regosolic	Orthic Regosol	medium textured fluvial sediments, overlying very coarse textured fluvial sediments (gravel).
3	Regosolic	Orthic Regosol	very coarse textured fluvial sediments (gravel)
4	Regosolic	Orthic Regosol	medium textured fluvial sediments, overlying very coarse textured fluvial sediments (gravel)
5	Regosolic	Orthic Regosol	medium textured fluvial sediments, overlying very coarse textured fluvial sediments (sand).
6	Gleysolic	Rego Gleysol	medium textured fluvial sediments, overlying very coarse textured fluvial sediments (gravel).

LEGEND: Map Symbol

5/b 0 ← map unit
← surface stoniness rating
← topographic class

- soil line
- boundary of mapped area
- location of meander scar

N

Soil Map, Wyndham-Carseland Provincial Park Study Area

Tp 21, R 25, W4M

G.M. Greenlee

Published 1985
Fieldwork conducted in 1976

Cartography by Alberta Research Council, Graphics Services.

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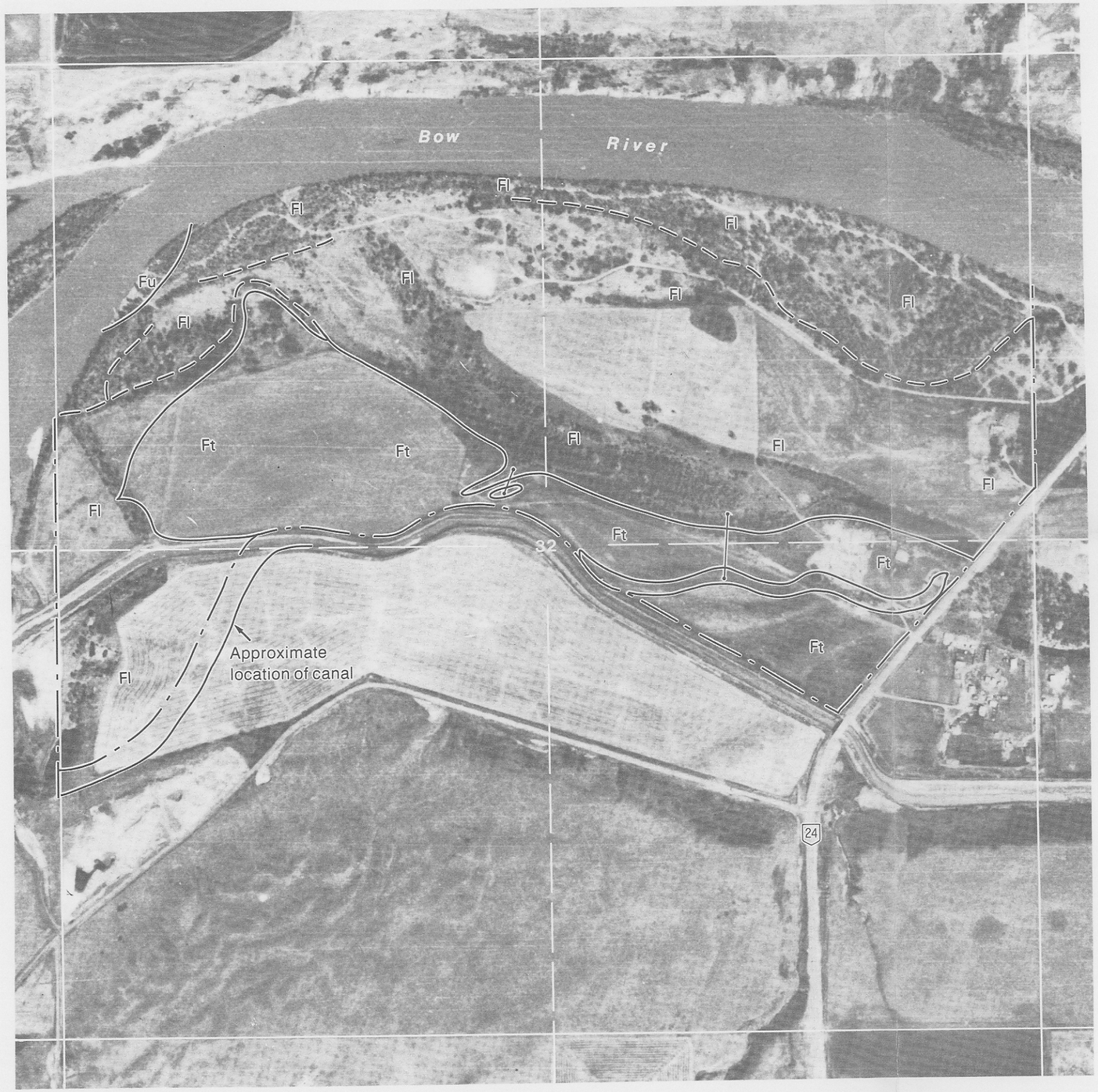

LEGEND:

F - Fluvial

Fl	- level fluvial
Ft	- fluvial terraces
Fu	- undulating fluvial

- landform line
- boundary of mapped area
- location of meander scar

N

Scale 1:8000 (approx.)

666 0 666 1332 Feet

160 0 160 320 Metres

Landform Map, Wyndham-Carseland Provincial Park Study Area

Tp 21, R 25, W4M

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Published 1985
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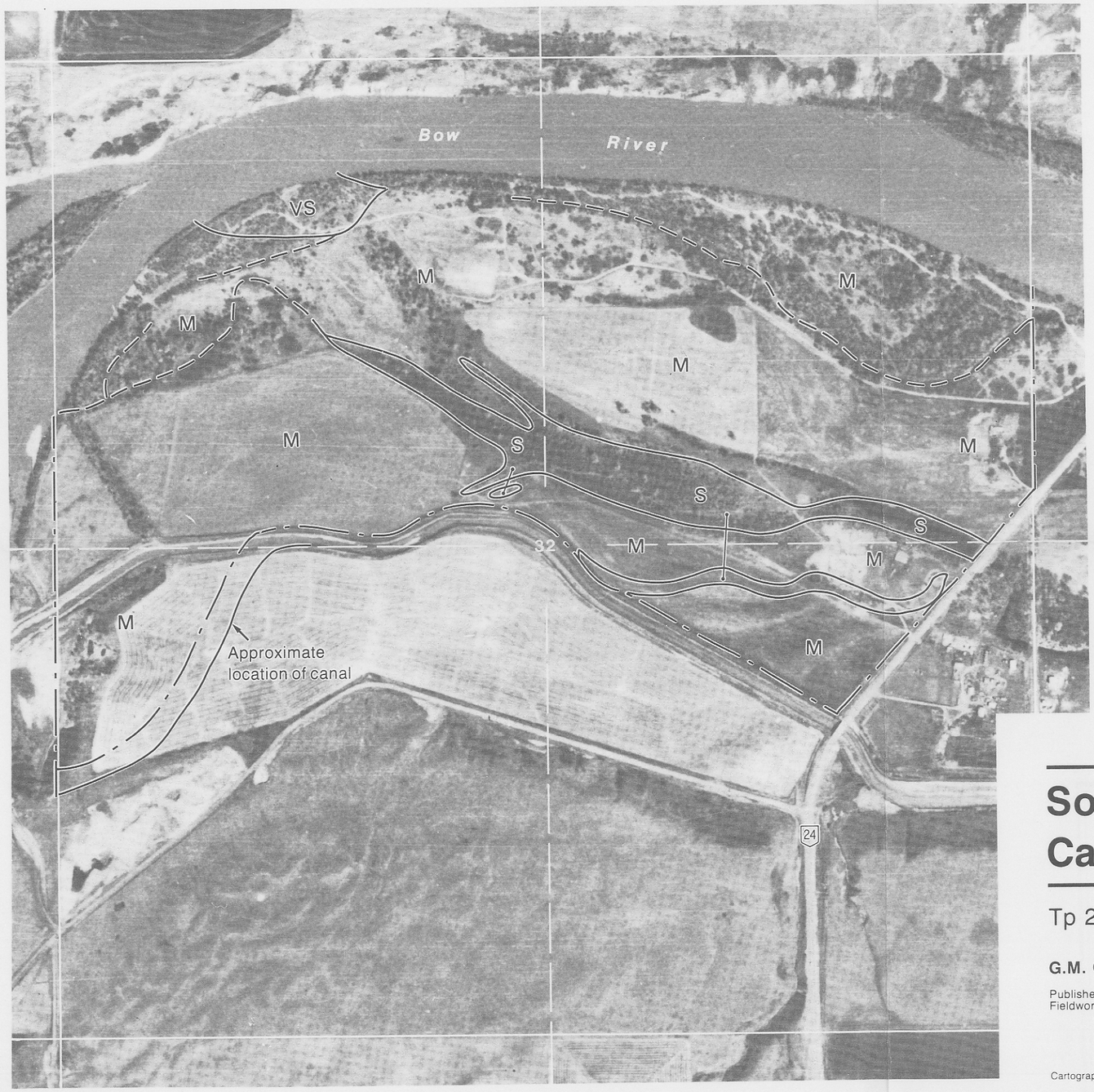

LEGEND:

SL - none to slight soil limitations

M - moderate soil limitations

S - severe soil limitations

VS - very severe soil limitations

- soil limitation line
- boundary of mapped area
- location of meander scar

N

Scale 1:8000 (approx.)

666 0 666 1332 Feet

160 0 160 320 Metres

Soil Limitation for Recreation, Wyndham-Carseland Provincial Park Study Area

Tp 21, R 25, W4M

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