Soil Survey of

CARSON-PEGASUS LAKES AREA

and Interpretation for Recreational Use

G.M. Greenlee

Alberta Institute of Pedology
Number M-81-3

Alberta Research Council
1983

Acknowledgments

The Alberta Research Council provided the staff, and the Outdoor Recreation Planning Branch of Alberta Recreation and Parks contributed the funds for the 1980-81 provincial parks soil survey program. Costs included field, office, laboratory, drafting, editing, and printing, as well as equipment and supplies. Office space was provided by the Research Council, and laboratory space by the University of Alberta.

B. Chong typed and assisted in compiling and proof reading the report. Z. Widtman and J. Dlask drafted the soil and landform maps. J. Beres determined the soil physical properties. The soil chemical analyses were determined by A. Schwarzer and W. McKean. Able field assistance was given by K. Bessie.

Copies of this report are available from:

Alberta Research Council
Editing and Publications Department
5th Floor, Terrace Plaza
4445 Calgary Trail South
Edmonton, Alberta
T6H 5R7
phone: 438-1666

Alberta Research Council
Industrial and Engineering Services
Petroleum Recovery Institute
2nd Floor, 3512 - 33 St. NW
Calgary, Alberta
T2L 2A6
phone: 282-9136

Preface

This report is one of a series describing detailed and semi-detailed soil surveys conducted in Alberta provincial parks and recreation areas. The Carson-Pegasus Lakes region, and the Whitney-Laurier-Borden-Ross Lakes region east of Elk Point were both surveyed during the summer of 1980. Approximately 3290 ha were surveyed.

A general guidebook is available to accompany soil survey reports written for Alberta provincial parks and recreation areas (Greenlee, 1981). This guidebook includes general discussions of: 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 landscape maps that accompany the soil survey reports; soil interpretations and guidelines for developing them; chemical and physical properties of soils; and the landform classification system used by Canadian soil pedologists. A glossary is also included.

This report presents specific results and interpretations for the Carson-Pegasus Lakes area.

Table of Contents

Maps

Figures

Tables

Summary

The mapped area comprises about 1130 ha adjacent to the southern and eastern shores of Carson and Pegasus Lakes, about 16 km north of Whitecourt. The study area is situated in the Swan Hills Upland, which is characterized by rugged, hilly topography. Most of the mapped area is covered by fine-textured till. Two very small patches of very coarse- to moderately fine-textured glaciolacustrine veneers and blankets overlying till occur adjacent to the southern and southeastern shores of Carson Lake; and a very small patch of moderately coarse- to very coarse-textured glaciofluvial sediments occurs in the northwestern corner of the study area. The study area has a cold snowy forest climate with humid winters, characterized by frozen ground and a snow cover of several months duration. Summers are cool;the temperature of the warmest month is under 22°C. The mapped area is situated in the mixedwood section of the boreal forest region.

Eight map units were recognized in the study area. The key profile types are Orthic Gray Luvisols, Brunisolic Gray Luvisols, Gleyed Eutric Brunisols, Gleyed Cumulic Eutric Brunisols peaty phase, Eluviated Eutric Brunisols, Orthic Gleysols peaty phase, Orthic Gleysols, Humisols, and Terric Humisols. These soils are distributed over the landscape in relation to landform, parent material, and drainage. Map units consist of single soil series, groupings of series (complexes), or catenas; the soil map shows their distribution.

Soil interpretations are made for each map unit for primitive camping areas, fully serviced campgrounds, picnic areas, paths, trails, lawns and landscaping, buildings with basements, buildings without basements, septic tank absorption fields, trench type sanitary landfills, road location, source of roadfill, and source of sand or gravel. Soil erodibility ratings (K values) and predicted erosion hazards of selected map units are also presented. The soils of map units 1 and 2 are the best suited for recreational development and buildings without basements, when found on favorable topography; the soils of all map units have severe limitations for buildings with basements. The soils of most map units have severe to very severe limitations for septic tank absorption fields, trench type sanitary landfills, and road construction purposes. Map unit 6 soils constitute a fair source of sand; no source of gravel was found in the study area. The soil map and tables 6 through 18 inclusive (soil limitation and suitability tables) indicate areas suitable for particular uses.

A soil survey properly interpreted can be one of the most useful tools for designing recreational areas. All soil differences found in the field cannot, however, be shown on the soil map, so for design and construction of specific recreational facilities, an on-site investigation is usually required.

Introduction

Size and location

The mapped area comprises about 1130 ha adjacent to the southern and eastern shores of Carson and Pegasus Lakes, about 16 km north of Whitecourt (figure 1). It includes the S 1/2 and part of N 1/2 Sec 19; all of Sec 20; S 1/2, NE 1/4, and part of NW 1/4 Sec 29; part of Sec 30; part of NW 1/4, and NE 1/4 Sec 32, Tp 61, R 11, W 5th Mer; part of S 1/2, and part of NW 1/4 Sec 24, Tp 61, R 12, W 5th Mer.

Physiography and surficial deposits

The study area is situated in the Swan Hills Upland, which is characterized by rugged hilly topography (Tokarsky, 1977). Green (1972) classified the bedrock as the Paleocene and Upper Cretaceous Scollard member of the Paskapoo Formation. The maximum elevation within the mapped area is just over 930 m, between Pegasus Lake and the small unnamed lake about 1/2 km to the east. The lowest elevation is

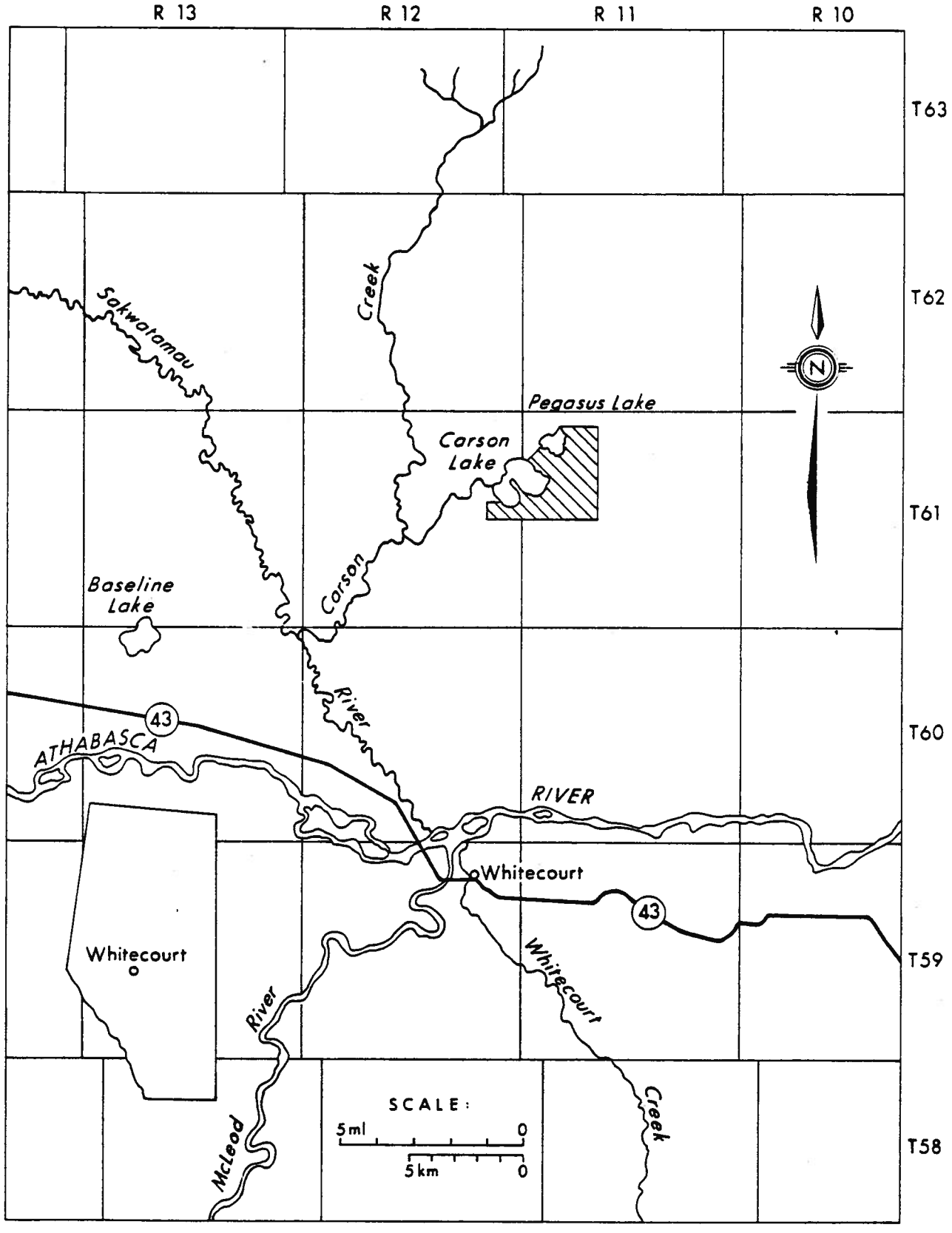


Figure 1. Map showing location of mapped area

slightly less than 870 m near the southern and southeastern shores of Carson Lake, for a difference of approximately 60 m. Drainage of the mapped area is via a short unnamed creek which flows from the western side of Carson Lake into Carson Creek to the southwest. Carson Creek flows into the Sakwatamau River further to the southwest, and this outlets into the Athabasca River to the south. These are all part of the Mackenzie River system which drains into the Arctic Ocean.

Most of the mapped area is covered by fine-textured till. Two very small patches of very coarse- to moderately fine-textured glaciolacustrine veneers and blankets overlying till are found adjacent to the southern and southeastern shores of Carson Lake. A very small patch of moderately coarse- to very coarse-textured glaciofluvial sediments occurs in the norththwestern corner of the study area. Sporadic small organic soil deposits are found in depressional locations throughout the study area.

Climate

The climate of the mapped area is designated in Koeppen's climatic classification as humid continental (Trewartha, 1954). This is described as a cold snowy forest climate with humid winters, characterized by frozen ground and a snow cover of several months duration. Summers are cool, with an average temperature of the warmest month betwen 22 °C and 10 °C. The average temperature of the coldest month is below -3 °C.

Weather records for 1970 through 1979 from Whitecourt, at an elevation of 780 m, were used to compile the following information (Environment Canada, 1970-1979): the mean annual temperature is 1.5 °C. July is the warmest month of the year with a mean temperature of 15.2 °C; January is the coldest month with a mean temperature of -15.4 °C. The mean annual precipitation is 611 mm, and 70 percent falls as rain. The average frost free period is 85 days.

Vegetation

The study area is situated in the mixedwood section of the boreal forest region, as classified by Rowe (1972). The characteristic forest association of well-drained uplands is a mixture in varying proportions of trembling aspen, balsam poplar, white birch, white spruce, and balsam fir. The last two species are especially prominent in old stands; the type covering the greatest area, however, is the trembling aspen. In addition to its usual dominance in sandy areas, jack pine is found in the forest composition on the drier till soils, and is mixed with black spruce on plateau-like tops of the higher hills. Black spruce and larch muskeg have developed in lower positions and the upper water catchment areas.

Since the Outdoor Recreation Planning Branch of Alberta Recreation and Parks conducts biological studies of provincial parks and proposed park areas, the vegetation is not extensively discussed in this report. Some of the more common plant species observed, however, are indicated as part of the map unit descriptions: (Moss 1959, Cormack, 1967): aspen *(Populus tremuloides)*, white spruce *(Picea glauca)*, white birch *(Betula papyrifera)*, balsam fir *(Abies balsamea)*, jack pine *(Pinus banksiana)*, balsam poplar *(Populus balsamifera)*, black spruce *(Picea mariana)*, tamarack *(Larix laricina)*, low-bush cranberry *(Viburnum edule)*, willow *(Salix* spp.*)*, dogwood *(Cornus stolonifera)*, saskatoon-berry *(Amelanchier alnifolia)*, alder *(Alnus* spp.*)*, swamp birch *(Betula pumila* var *glandulifera)*, wild rose *(Rosa* spp.*)*, wild gooseberry *(Ribes* spp.*)*, dwarf raspberry *(Rubus acaulis)*, bracted honeysuckle *(Lonicera involucrata)*, wild currant *(Ribes* spp.*)*, wild sarsaparilla (Aralia nudicaulis), baneberry *(Actaea rubra)*, bunchberry *(Cornus canadensis)*, twinflower *(Linnaea borealis* var *americana)*, common pink wintergreen *(Pyrola asarifolia)*, one-sided wintergreen *(Pyrola secunda)*, wild sweet pea *(Lathyrus ochroleucus)*, wild strawberry *(Fragaria* spp.*)*, wild lily-of-the-valley *(Maianthemum canadense* var *interius)*, fairy-bells *(Disporum trachycarpum)*, common nettle *(Urtica gracilis)*, grass (various species), palmate-leaved coltsfoot *(Petasites palmatus)*, horsetail *(Equisetum* spp.*)*, sedge*(Carex* spp.*)*, feathermoss, Labrador tea *(Ledum groenlandicum)*, bog cranberry *(Oxycoccus quadripetalus)*, small bog cranberry *(Oxycoccus microcarpus)*, marsh marigold *(Caltha palustris)*, cotton grass *(Eriophorum* spp.*)*, and cloudberry *(Rubus chamaemorus)*.

Soils

Eight map units were recognized in the study area. Four belong to the Luvisolic Order, two to the Organic Order, one to the Brunisolic Order, and one to the Gleysolic Order in the Canadian system of soil classification (Canada Soil Survey Committee, 1978). Greenlee (1981) outlines this system. Pertinent features of the map units are outlined in table 1.

As is the case throughout most of the forested regions of Alberta, the most common soils found in the study area are those classified in the Luvisolic Order. These are well to imperfectly drained mineral soils characterized by an Ae horizon near the surface, and it generally varies from 7.5 to 30 cm in thickness. It is a leached gray-colored horizon, very low in organic matter (humus) content and in plant nutrients. Luvisolic soils in their natural state commonly have surface L-H and Ah horizons as well. The L-H horizon ranges from 2.5 to 12.5 cm or more in thickness; however, the Ah horizon below is usually less than 5 cm thick, and often absent altogether. When Luvisolic soils are cultivated, the L-H and Ah horizons quickly mix with the Ae, resulting in gray-colored fields. The L-H and Ah horizons rapidly break down under conditions of heavy foot traffic in recreation areas, and often disappear completely from a combination of physical destruction and soil erosion. When thoroughly dried out, the Ae horizon is often baked and hard, so that plant seedlings may be unable to push up through the crust. The entry of moisture from rainfall may also be hampered and runoff increased, thereby enhancing soil erosion. This problem is especially serious on steep slopes.

Soils of the Organic order include all soils that have developed largely from organic deposits, contain more than 30 percent organic matter by weight, and meet minimum specifications of depth and thickness within a defined control section. The majority of Organic soils are either water saturated or nearly so for much of the year unless artificially drained. The organic deposits are derived primarily from the decomposition of hydrophytic or mesohydrophytic vegetation. The further classification and naming of the great groups into Fibrisols, Mesisols and Humisols depends on the occurrence and identification of three major diagnostic layers: Fibric, Mesic and Humic. Fibric layers are the least decomposed of all the organic soil materials and have large amounts of well preserved fibers, which are readily identifiable as to botanical origin. The organic matter of humic layers is in a highly decomposed state, and often has a smooth greasy feel when moist. It has the least amount of recognizable plant fiber, and is usually darker in color than fibric or mesic materials. It is relatively stable and changes little in physical or chemical composition with time. The organic matter of mesic layers is in an intermediate stage of decomposition between that of fibric and humic layers, and is partially altered both chemically and physically. Management problems in areas of cultivated Organic soils involve the maintenance of controlled drainage, adequate fertilization, and tillage practices necessary to maintain a firm bed for seed germination and root development. Overdrainage and dessication of peat are detrimental to crop production and to the maintenance of the organic layers in a desirable physical condition. Under cultivation, many Organic soils show deficiencies in macro and micro mineral nutrients, and most require the application of phosphorus and potassium to obtain maximum productivity. Special problems also exist in using Organic soils for construction purposes. These are their low bearing strength, high shrink-swell potential and susceptibility to frost heaving.

Organic soils are found in depressional locations and along drainage courses throughout the mapped area. Many of these areas are outlined on the soil map. Numerous small patches which are not extensive enough to be outlined are included as minor components of map units 1 and 5.

Soils of the Brunisolic order are rapidly to imperfectly drained mineral soils with sufficient profile development to exclude them from the Regosolic order, but that lack the degrees or kinds of horizon development specified for soils of other orders. Their common characteristic of identification is the development in situ of a prominent brownish Bm horizon with sufficient alteration by hydrolysis, oxidation or solution to produce significant changes in color, structure and composition different from those of an A or C horizon. Because the processes of leaching and weathering are relatively weakly developed in Brunisolic soils, they tend to reflect the chemical characteristics, particularly the base status and acidity, of parent materials from which they have been derived.

Table 1. Key to the Soils.

Map Unit	Classification	Parent Material	Surface Texture	Slope (class & gradient)	Surface Stoniness	Drainage	Comments and Limitations
1	Orthic Gray Luvisol — 60%; Orthic Gleysol, peaty phase — 20% Terric Humisol — 20%	fine-textured till	L	c,d,e,f (> 2 to 30%)	1 to 2	Luvisols — well drained, Gleysols — poorly drained, Humisols — very poorly drained	The Gleysols and Terric Humisols occur in numerous small enclosed depressions and along drainage courses. Luvisols have slight to severe limitations, are poor sources of roadfill, and unsuitable as sources of sand or gravel — high clay content of subsoil and parent material, slow permeability, lack of Ah horizon, excessive slopes, erosion hazard on steep slopes, surface stoniness, high shrink-swell potential, and susceptibility to frost heave. The Gleysols have severe limitations, are poor sources of roadfill, and unsuitable as sources of sand or gravel. The Terric Humisols are described under the T.H. map unit.
2	Orthic Gray Luvisol	fine-textured till	L	c,E (>2 to 15%)	1	well drained	These soils are the same as the Luvisolic soils of map unit 1. Slight to severe limitations, poor source of roadfill, unsuitable as a source of sand or gravel — high clay content of subsoil and parent material, slow permeability, lack of Ah horizon, excessive slopes, erosion hazard on steep slopes, high shrink-swell potential, susceptibility to frost heave.
3	Orthic gleysol, peaty phase and Orthic Gleysol	moderately fine-textured glacio-lacustrine sediments.	L to SL	b (>0.5 to 2%)	0	poorly drained	1. Textures of the Bg horizon range from loam to sandy loam. 2. A water table is common at 45 to 50 cm below the surface. Severe to very severe limitations, poor source of roadfill, very poor source of sand, unsuitable as a source of gravel — seasonally high groundwater table, organic surface layer >15 cm thick, flooding hazard (overflow), lack of Ah horizon, susceptibility to frost heave, moderate shrink-swell potential, groundwater contamination hazard.

Table 1. Key to the Soils *continued*

Map Unit	Classification	Parent Material	Surface Texture	Slope (class & gradient)	Surface Stoniness	Drainage	Comments and Limitations
4	Gleyed Eutric Brunisol and Gleyed Cumulic Eutric Brunisol, peaty phase	moderately fine-textured glacio-lacustrine sediments, overlying moderately fine textured till	CL	b (>0.5 to 2%)	0	imperfectly drained	1. A water table is common at 75 to 105 cm below the surface. 2. Discontinuous Ahb horizons often occur in the Bmg1 horizon. Moderate to severe limitations, fair source of roadfill, unsuitable as a source of sand or gravel — seasonally high groundwater table, high clay content, slippery or sticky when wet, lack of Ah horizon, flooding hazard (overflow), susceptibility to frost heave, moderate shrink-swell potential, slow permeability, groundwater contamination hazard.
5	Orthic and Brunisolic Gray Luvisol — 40%; Eluviated Eutric Brunisol — 30% Orthic Gray Luvisol — 20% Terric Humisol — 10%	predominantly moderately fine textured till containing a high proportion of weathered shale and sandstone, also about 20% pockets of fine textured till	L, SiL, SiC	f,g (>15 to 60%	0	Luvisols and Brunisols — well drained, Humisols — very poorly drained	1. The Terric Humisols occur in small closed depressions, and along drainage courses 2. The Bm horizon in Brunisolic Gray Luvisols does not occur in Orthic Gray Luvisols. 3. Some sandy layers occur in the BC and Cca horizons of the Luvisols and Brunisols 4. Shale and sandstone fragments often occur in the BC and Cca horizons of the Luvisols and Brunisols. Severe to very severe limitations, poor source of roadfill, unsuitable as a source of sand or gravel — excessive slopes, high clay content, slippery or sticky when wet, lack of Ah horizon, susceptibility to frost heave, moderate shrink-swell potential.
6	Orthic Gray Luvisol	moderately coarse-textured to very coarse textured glacio-fluvial sediments	L	f,g (>15 to 60%)	0	rapidly drained	Textures are variable in the Bt, BC, and Cca horizons. Moderate to very severe limitations, fair to poor source of roadfill, fair source of sand, unsuitable as a source of gravel — excessive slopes, erosion hazard, slow permeability of subsoil, lack of Ah horizon, rapid permeability of parent material, groundwater contamination hazard.

Map Unit	Classification	Parent Material	Surface Texture	Slope (class & gradient)	Surface Stoniness	Drainage	Comments and Limitations
H	Humisol	predominantly humic peat	fibric peat (Of) humic peat (Oh)	a (0 to 0.5%)	0	very poorly drained	1. The Of horizons constitute micro hummocks on the bog surfaces. The Of and Om horizons do not occur on the fen surfaces. 2. The water table occurs at the surface in the fens. Very severe limitations, very poor source of roadfill, unsuitable as a source of sand or gravel — organic soil, high groundwater table or surface ponding, lack of Ah horizon, high shrink-swell potential, groundwater contamination hazard.
TH	Terric Humisol	predominantly humic peat, overlying fine-textured till	fibric peat (Of) humic peat (Oh)	a (0 to 0.5%)	0	very poorly drained	1. The Of horizons constitute micro hummocks on the bog surfaces. The Of and Om horizons do not occur on the fen surfaces. 2. The water table occurs at the surface in the fens. 3. The soils can be classified as peaty phases of Gleysols near the edges of these areas, where the peat thickness is often less than 40 cm. Very severe limitations, very poor source of roadfill, unsuitable as a source of sand or gravel — organic soil, high groundwater table or surface ponding, lack of Ah horizon, high shrink-swell potential, groundwater contamination hazard; high clay content, slow permeability and susceptibility to frost heave of underlying till.

A small patch of imperfectly drained Brunisolic soils occurs adjacent to the southeastern shore of Carson Lake. The weak soil profile development is a reflection of a fluctuating water table, which results in an absence of any overall net downward leaching. Well-drained Brunisolic soils also occur as a minor component of map unit 5 in the northeastern portion of the study area. Here, steep slopes result in a high incidence of surface water runoff, and downward leaching has not been sufficient to cause strong soil profile development.

Soils of the Gleysolic order are poorly drained mineral soils whose profiles reflect the influence of water-logging 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 colors, frequently accompanied by prominent, usually rust-colored, mottles resulting from localized oxidation and reduction of hydrated iron oxides.

Only one small patch of Gleysolic soils was mapped adjacent to the southern shore of Carson Lake.

Gleysolic soils are also found in numerous small enclosed depressions throughout most of the study area, as a minor component of map unit 1.

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 are not attempts at complete or exhaustive species lists.

Map unit 1

Classification: Orthic Gray Luvisol - 60%; Orthic Gleysol, peaty phase - 20%; Terric Humisol - 20%
Parent Material: fine-textured till
Landform: undulating morainal (Mu), hummocky morainal (Mh)
Slope: >2 to 30%
Surface Stoniness: slightly to moderately stony (1 to 2)
Drainage: Luvisols - well-drained; Gleysols - poorly drained; Humisols - very poorly drained
Vegetation: Luvisols - predominantly aspen and white spruce, some white birch, patches of balsam fir, occasional jack pine; some patches of exclusively aspen; understory consists of variable combinations of low-bush cranberry, bracted honeysuckle, wild rose, wild sarsaparilla, bunchberry, twinflower, wild lily-of-the-valley, one-sided wintergreen, common pink wintergreen, and other forbs Gleysols - grass, horsetail, bracted honeysuckle, wild currant; scattered alder, willow, balsam poplar, white spruce, and balsam fir. Humisols - listed under the TH map unit
Profile Description: Orthic Gray Luvisol

Horizon	Thickness (cm)	Texture (lab)	Structure	Consistence	pH $CaCl_2$	OM[1] %
L-H	10	plentiful, very fine to coarse, horizontal roots			5.6	56.3
Ae	20	loam	platy	very friable, moist	5.0	1.87
Bt	30	clay loam	subangular blocky	firm, moist	4.7	nd[2]
BC	50+	clay	amorphous	very firm, moist	4.7	nd

[1]OM — organic matter, [2]nd — not determined

Profile Description: Orthic Gleysol, peaty phase

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
OM	18	predominantly mesic peat		
Oh	17	predominantly humic peat		
Bg	100+	clay loam	amorphous	very firm, moist

Profile Description: Terric Humisol

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
Oh	40 - 155	predominantly humic peat		
Cg	at 0+	clay loam	amorphous	very firm, moist

Comments: The Gleysols are found in numerous small enclosed depressions throughout the landscape, and the Terric Humisols are found in similar positions as well as along drainage courses.

Limitations: (for the Luvisols) Slight on suitable topography for picnic areas, paths, trails, and buildings without basements; moderate on suitable topography for camping areas, lawns and landscaping; severe for buildings with basements, septic tank absorption fields, and road location, very severe for trench type sanitary landfills. Poor source of roadfill, unsuitable as a source of sand or gravel due to unsuitable texture. Specific limitations include high clay content of subsoil and parent material, slow permeability, lack of Ah horizon, excessive slopes, erosion hazard on steep slopes, surface stoniness, high shrink-swell potential, and susceptibility to frost heave. The Gleysols have severe limitations for all uses, and are poor sources of roadfill due to wetness. They are unsuitable as sources of sand or gravel due to unsuitable texture. Limitations for the Terric Humisols are given under the TH map unit.

Map unit 2

Classification: Orthic Gray Luvisol
Parent Material: fine-textured till
Landform: undulating morainal (Mu), inclined morainal (Mi)
Slope: undulating and strongly sloping (>2 to 15%)
Surface Stoniness: slightly stony (1)
Drainage: well-drained
Vegetation: mostly aspen; some balsam poplar, white spruce, and white birch; understory is dominantly low-bush cranberry, wild rose, wild sarsaparilla, bunchberry, and twinflower; with some dogwood, saskatoon-berry, grass, and other forbs

Profile Description: Orthic Gray Luvisol

Horizon	Thickness (cm)	Texture (lab)	Structure	Consistence	pH $CaCl_2$	OM[1] %
L-H	10	plentiful, very fine to coarse, horizontal roots			5.6	56.3
Ae	20	loam	platy	very friable, moist	5.0	1.87
Bt	30	clay loam	subangular blocky	firm, moist	4.7	nd[2]
BC	50+	clay	amorphous	very firm, moist	4.7	nd

[1]OM — organic matter, [2]nd — not determined

Comments: The soils of map unit 2 are the same as the Luvisolic component of map unit 1.
Limitations: Slight on suitable topography for picnic areas, paths, trails, and buildings without basements; moderate for camping areas, lawns and landscaping; severe for buildings with basements, septic tank absorption fields, and road location; very severe for trench type sanitary landfills. Poor source of roadfill, unsuitable as a source of sand or gravel due to unsuitable texture. Specific limitations include high clay content of subsoil and parent material, slow permeability, lack of Ah horizon, excessive slopes, erosion hazard on steep slopes, high shrink-swell potential, and susceptibility to frost heave.

Map unit 3

Classification: Orthic Gleysol peaty phase, and Orthic Gleysol (these two soils are randomly and unpredictably associated)
Parent Material: moderately fine-textured glaciolacustrine sediments
Landform: glaciolacustrine blanket overlying level morainal ($L^{G}b/Ml$)
Slope: gently undulating (>0.5 to 2%)
Surface Stoniness: stone free (0)
Drainage: poorly drained
Vegetation: mostly white birch, some balsam fir and white spruce; understory consists of feathermoss, low-bush cranberry, bracted honeysuckle, wild currant, horsetail, twin-flower, bunchberry, some other forbs, and some grass
Profile Description: Orthic Gleysol peaty phase, and Orthic Gleysol

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
Om-Oh	10-30	mesic and humic peat		
Bg	35-50	loam to loamy sand	amorphous	very friable to loose, moist
BCg	50-65	sandy clay loam to clay loam	amorphous	firm to very firm, moist

Comments: 1) The Bg horizon consists of layers and pockets of different-textured sediments, ranging from loam to loamy sand.
2) A water table is commonly found at 45 to 50 cm below the surface.

Limitations: Very severe for septic tank absorption fields, and trench type sanitary landfills; severe for all other uses. Poor source of roadfill, very poor source of sand due to unsuitable textures and very thin deposits of sand (loamy sand), unsuitable as a source of gravel. Specific limitations include seasonally high groundwater table, organic surface layer >15 cm thick, flooding hazard (overflow), lack of Ah horizon, susceptibility to frost heave, moderate shrink-swell potential, and groundwater contamination hazard.

Map unit 4

Classification: Gleyed Eutric Brunisol and Gleyed Cumulic Eutric Brunisol peaty phase (these two subgroups are randomly and unpredictably associated)
Parent Material: moderately fine-textured glaciolacustrine sediments overlying moderately fine-textured till
Landform: glaciolacustrine veneer and blanket overlying level morainal ($L^{G}vb/Ml$)
Slope: gently undulating (>0.5 to 2%)
Surface Stoniness: stone free (0)
Drainage: imperfectly drained
Vegetation: aspen, white spruce, balsam poplar, some white birch; understory consists of feather-moss, low-bush cranberry, bracted honeysuckle, wild gooseberry, wild rose, twinflower, baneberry, wild sarsaparilla, dwarf raspberry, bunchberry, wild lily-of-the-valley, common pink wintergreen, fairy-bells, horsetail, palmate-leaved coltsfoot, some other forbs, and some dogwood
Profile Description: Gleyed Cumulic Eutric Brunisol peaty phase

Horizon	Thickness (cm)	Texture (lab)	Structure	Consistence	pH $CaCl_2$	OM[1] %
L-H	18	abundant, very fine to coarse, horizontal roots			5.6	65.3
Bmg1	15-40	clay loam	amorphous	friable, moist	5.5	7.31
Bmg2	0-60+	clay loam	amorphous	friable, moist	5.6	nd[2]
IICcag	at 15 to 100+	sandy clay loam to clay loam	amorphous	friable to very firm, moist	nd	nd

[1]OM — organic matter, [2]nd — not determined

Comments: 1) A water table is commonly found at 75 to 105 cm below the surface.
2) Discontinuous Ahb horizons often occur in the Bmg1 horizon. These range from 2 to 4 cm in thickness, 5 to 15 cm apart, have a field texture of silt loam, a granular structure, and a very friable moist consistence.

Limitations: Moderate for camping areas, picnic areas, paths, trails, lawns and landscaping, road location; severe for buildings, septic tank absorption fields, and trench type sanitary landfills. Fair source of roadfill, unsuitable as a source of sand or gravel due to unsuitable texture. Specific Limitations include seasonally high groundwater table, high clay content, slippery or sticky when wet, lack of Ah horizon, flooding hazard (overflow), susceptibility to frost heave, moderate shrink-swell potential, slow permeability, and groundwater contamination hazard.

Map unit 5

Classification: Orthic and Brunisolic Gray Luvisol - 40%; Eluviated Eutric Brunisol - 30%; Orthic Gray Luvisol -20%; Terric Humisol - 10%; (the Luvisolic and Brunisolic soils are randomly and unpredictably associated)

Parent Material: predominantly moderately fine-textured till containing a high proportion of weathered shale and sandstone; also about 20% pockets of fine-textured till, of random and unpredictable occurrence

Landform: hummocky morainal (Mh), and ridged morainal (Mr)

Slope: strongly rolling to hilly (>15 to 60%)

Stoniness: stone free (0)

Drainage: Luvisols and Brunisols - well-drained; Humisols - very poorly drained

Vegetation: Luvisols and Brunisols - mixed forest; various combinations of white spruce, aspen, balsam fir, white birch; some jack pine and balsam poplar; understory consists of low-bush cranberry, wild rose, wild sarsaparilla, bunchberry, twinflower, some other forbs, and feathermoss. Humisols - listed under the TH map unit

Profile Description: Orthic and Brunisolic Gray Luvisol

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
L-H	7-10			
Ae	2-13	loam to silt loam	platy	very friable, moist
Bm	0-20	loam to silt loam	platy	very friable, moist
Bt	30-50	silty clay loam, clay loam, or sandy clay loam	subangular blocky	firm to friable, moist
BC	at 40+ (layers, 10-40 cm thick)	loam, clay loam, silty clay loam	amorphous	very friable to firm, moist
Cca	at 90-100+ (layers, 10-40 cm thick)	loam, clay loam, silty clay loam	amorphous	very friable to firm, moist

Profile Description: Eluviated Eutric Brunisol

Horizon	Thickness (cm)	Texture (lab)	Structure	Consistence	pH $CaCl_2$	OM[1] %
L-H	8	abundant, fine to coarse, horizontal roots			5.7	48.1
Aej	6	silty clay	granular	very friable, moist	5.8	7.48
Bm1	22	silty clay to clay	subangular blocky	firm, moist	6.1	2.38

Horizon	Thickness (cm)	Texture (lab)	Structure	Consistence	pH $CaCl_2$	OM[1] %
Bm2	32	silty clay	subangular blocky	friable to firm, moist	5.0	nd[2]
BC1	20	silt loam	amorphous	very friable, moist	4.6	nd
BC2	20+	silty clay loam	amorphous	very friable, moist	4.5	nd

[1]OM — organic matter, [2]nd — not determined

Profile Description: Orthic Gray Luvisol

Horizon	Thickness (cm)	Texture (lab)	Structure	Consistence	pH $CaCl_2$	OM[1] %
L-H	10	plentiful, very fine to coarse, horizontal roots			5.6	56.3
Ae	20	loam	platy	very friable, moist	5.0	1.87
Bt	30	clay loam	subangular blocky	firm, moist	4.7	nd[2]
BC	50+	clay	amorphous	very firm, moist	4.7	nd

[1]OM — organic matter, [2]nd — not determined

Profile Description: Terric Humisol

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
Oh	40-55	predominantly humic peat		
Cg	at 0+	clay loam	amorphous	very firm, moist

Comments: 1) The Terric Humisols occur in small enclosed depressions, and along drainage courses.
2) The Bm horizon, found below the Ae in Brunisolic Gray Luvisols, does not occur in Orthic Gray Luvisols.
3) Some sandy layers, 10 to 25 cm thick and loamy sand to sand in texture, are found in the BC and Cca horizons of the Luvisolic and Brunisolic soils.
4) Numerous shale fragments and some sandstone fragments often occur in the BC and Cca horizons of the Luvisolic and Brunisolic soils.

Limitations: Moderate to severe for trench type sanitary landfills; severe for trails; severe to very severe for all other uses. Poor source of roadfill, unsuitable as a source of sand or gravel due to unsuitable texture. Specific limitations include excessive slopes, high clay content, slippery or sticky when wet, lack of Ah horizon, susceptibility to frost heave, and moderate shrink-swell potential.

Map unit 6

Classification: Orthic Gray Luvisol
Parent Material: moderately coarse-textured to very coarse-textured glaciofluvial sediments
Landform: hummocky glaciofluvial ($F^{G}h$), ridged glaciofluvial ($F^{G}r$)
Slope: strongly rolling to hilly (15 to 60%)
Surface Stoniness: stone free (0)
Drainage: rapidly drained
Vegetation: white spruce, aspen, balsam fir, white birch, low-bush cranberry, wild sarsaparilla, bunchberry, twinflower, and feathermoss
Profile Description: Orthic Gray Luvisol

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
L-H	10			
Ae	7-10	loam	platy	very friable, moist
Bt	50	clay loam to sandy clay loam	subangular blocky	firm to friable, moist
BC	30	sandy loam to loamy sand	amorphous	very friable to loose, moist
Cca	at 90-100	sandy loam to loamy sand	amorphous	very friable to loose, moist

Comments: Pockets of variable-textured sediments occur in the Bt, BC, and Cca horizons.
Limitations: Moderate to severe for primitive camping areas, and trails; very severe for trench type sanitary landfills; severe to very severe for all other uses. Fair to poor source of roadfill, fair source of sand, unsuitable as a source of gravel due to unsuitable texture. Specific limitations include excessive slopes, erosion hazard, slow permeability of subsoil, lack of Ah horizon, rapid permeability of parent material, and groundwater contamination hazard.

Map unit H

Classification: Humisol
Parent Material: predominantly humic peat
Landform: horizontal bog (Bh), horizontal fen (Nh)
Slope: nearly level (0 to 0.5%)
Surface Stoniness: stone free (0)
Drainage: very poorly drained
Vegetation: bogs — black spruce, sphagnum moss, Labrador tea, feathermoss; some sedge, horsetail, bog cranberry, cloudberry, cotton grass, and tamarack. fens — mostly alder; some white

birch, white spruce, and willow; understory consists mainly of grass, and marsh marigold; also some horsetail, wild currant, common nettle, other forbs, and feathermoss

Profile Description: Humisol

Horizon	Thickness (cm)	Field Description
Of	0-30	predominantly fibric peat
Om	0-20	predominantly mesic peat
Oh	110+	predominantly humic peat

Comments: 1) The Of horizons consitute micro hummocks on the bog surfaces. The Of and Om horizons do not occur on the fen surfaces.
2) The water table occurs at the surface in the fens.

Limitations: Very severe for all uses. Very poor source of roadfill, unsuitable as a source of sand or gravel. Specific limitations include organic soil, high groundwater table or surface ponding, lack of Ah horizon, high shrink-swell potential, and groundwater contamination hazard.

Map unit TH

Classification: Terric Humisol
Parent Material: predominantly humic peat overlying fine-textured till
Landform: horizontal bog (Bh), horizontal fen (Nh)
Slope: nearly level (0 to 0.5%)
Surface Stoniness: stone free (0)
Drainage: very poorly drained
Vegetation: bogs — black spruce, sphagnum moss, feathermoss, Labrador tea, sedge, bog cranberry, small bog cranberry; patches of swamp birch, some horsetail, and some willow. fens — mostly alder; some white birch, white spruce, and willow; understory consists mainly of grass, and marsh marigold; also some horsetail, wild currant, common nettle, other forbs, and feathermoss
Profile Description: Terric Humisol

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
Of	0-40	predominantly fibric peat		
Om	0-50	predominantly mesic peat		
Oh	25-160	predominantly humic peat		
Cg	at 0+	clay loam	amorphous	very firm, moist

Comments: 1) The Of horizons constitute micro hummocks on the bog surfaces. The Of and Om horizons do not occur on the fen surfaces.
2) The water table occurs at the surface in the fens.
3) The soils can be classified as peaty phases of Gleysols near the edges of these areas, where

the peat thickness is often less than 40 cm.

Limitations: Very severe for all uses. Very poor source of roadfill, unsuitable as a source of sand or gravel. Specific limitations include organic soil, high groundwater table or surface ponding, lack of Ah horizon, high shrink-swell potential, groundwater contamination hazard; high clay content, slow permeability and susceptibility to frost heave of underlying till.

Miscellaneous symbols

This symbol indicates escarpments

P This symbol indicates the location of a parking area for vehicles

SR This symbol indicates areas where the soil solum has been removed by construction activities, such as road building, exposing the C horizon at the surface. These areas are usually flat, gravelled, and devoid of vegetation; except for occasional patches of grass and weeds. Soil characteristics similar to C horizons of adjacent soils can be expected.

Soil interpretations

An explanation of soil interpretations and definitions of the soil limitation and suitability ratings are given in Greenlee (1981). Tables 2 and 3 give results of soil chemical and physical analyses. Engineering properties of some map units sampled were extrapolated to other map units not sampled, where soils of the different map units were developed on like or very similar parent materials. Map units developed on similar parent materials are shown at the bottom of table 3.

Soil erodibility ratings (K values) and predicted erosion hazards of selected map units are presented in tables 4 and 5. As well as for surface horizons, values have been worked out for soil parent materials, because these materials may be exposed along roads or in other construction sites.

The soils of map units 1 and 2 are the best suited for recreational development when found on suitable topography, and they have slight to moderate limitations. Map unit 2 soils occur only on the long peninsula, which extends into Carson Lake from the southeast, while map unit 1 soils are widespread throughout most of the mapped area. Map unit 4 soils have moderate limitations due to a seasonally high groundwater table, high clay content, and the property of a slippery or sticky surface when wet. Only one small patch of these soils is found adjacent to the southeastern shore of Carson Lake. Soils of the remaining map units have severe limitations due to the above factors, as well as slow permeabilities, surface stoniness, excessive slopes, erosion hazards, organic surface layers >15 cm thick, flooding hazard (overflow), and lack of Ah horizons. The soils of map units 5 and 6 have very severe limitations for some recreational uses because of excessive slopes.

Soils of all the map units have severe limitations for buildings with basements because of high clay contents, moderate to high shrink-swell potentials, susceptibility to frost heave, seasonally high groundwater tables, flooding hazards (overflow), and excessive slopes. However, for buildings without basements, map unit 1 and 2 soils have only slight limitations, when found on favorable topography.

Soils for most map units have severe to very severe limitations for both septic tank absorption fields and trench type sanitary landfills due to high clay contents, slow permeabilities, excessive slopes, seasonally high groundwater tables, flooding hazards (overflow), groundwater contamination hazards; and for map unit 6 soils, rapid permeability. The only exception is map unit 5 soils, which have moderate limitations for trench type sanitary landfills, where these soils occur on 15 to 30 percent slopes.

Soils of most map units have severe to very severe limitations for road construction purposes as well because of high clay contents, moderate to high shrink-swell potentials, susceptibility to frost heave, excessive slopes, seasonally high groundwater tables, and flooding hazards (overflow). Map unit 4 soils have moderate limitations, but are of very limited occurrence in the study area. Map unit 6 soils constitute only a fair source of sand due to somewhat unsuitable textures, while soils of all other map units are unsuitable for the same reason. A source of gravel was not found in the study area.

The organic soil map units (H and TH) have very severe limitations for all uses due to extreme wetness, and the inherent properties of organic soils (see Greenlee, 1981).

Specific limitations and suitabilities of the various soils for selected uses are shown in tables 6 to 18 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. In tables 6 to 16 inclusive the soil limitations for various uses have been designated as none to slight, moderate, severe, and very severe. In tables 17 and 18, the suitability of soils as sources of roadfill and as sources of sand or gravel respectively, have been designated as good, fair, poor, and very poor.

References

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

Cormack, R.G.H. (1967): Wild flowers of Alberta; Government of Alberta, Department of Industry and Development; Edmonton: Queen's Printer, 415 pages.

Environment Canada (1970-1979): Monthly record meteorological observations in Canada; Ottawa: Information Canada.

Green, R. (1972): Geological Map of Alberta; scale 1:1 267 000; Edmonton: Alberta Research Council.

Greenlee, G.M. (1981): Guidebook for use with soil survey reports of Alberta provincial parks and recreation areas; Earth Sciences Report 81-1; Edmonton: Alberta Research Council. 66 pages.

Moss, E.H. (1959): Flora of Alberta; Toronto: University of Toronto Press. 546 pages.

Rowe, J.S. (1972): Forest regions of Canada; Publication No. 1300, Canadian Forestry Service; Ottawa: Department of the Environment. 172 pages.

Tokarsky, O. (1977): Hydrogeology of the Whitecourt area, Alberta; Earth Sciences Report 76-3; Edmonton: Alberta Research Council. 10 pages.

Trewartha, G.J. (1954): An introduction to climate, 3rd ed.; Toronto: McGraw-Hill, Toronto, Canada. Plate 1 and p. 383.

Table 2. Chemical and Physical Analyses of Selected Map Units.

Map Unit	Horizon	Depth cm	pH $CaCl_2$	pH H_2O	Exchangeable cations [1]meq/100 gm soil				[2]CEC meq/100 g
					Na^+	K^+	Ca^{++}	Mg^{++}	
1	L-H	10-0	5.6	5.9	[6]nd	nd	nd	nd	nd
	Ae	0-20	5.0	5.6	0.02	0.23	4.5	1.4	8.7
	Bt	20-50	4.7	5.0	0.08	0.34	12.8	4.0	21.7
	BC	50-100	4.7	4.7	0.51	0.47	23.5	10.5	37.9
4	L-H	18-0	5.6	6.0	nd	nd	nd	nd	nd
	Bmg 1	0-40	5.5	5.9	0.06	1.1	26.6	7.6	40.8
	Bmg 2	40-100	5.6	5.8	0.30	0.22	23.6	7.6	32.0
5	L-H	8-0	5.7	6.3	nd	nd	nd	nd	nd
	Aej	0-6	5.8	6.3	0.02	2.8	38.0	9.2	50.8
	Bm 1	6-28	6.1	6.6	0.03	1.5	32.0	9.7	42.5
	Bm 2	28-60	5.0	5.5	0.10	0.80	26.8	10.5	42.5
	BC 1	60-80	4.6	4.9	0.33	0.29	15.2	4.5	26.7
	BC 2	80-100	4.5	4.8	0.35	0.45	21.4	8.7	36.1

[1]meq - milliequivalents, [2]CEC - cation exchange capacity, [3]OC - organic carbon, [4]VFS - very fine sand, [5]CF-coarse fragments (>2 mm diam) (field estimate), [6]nd - not determined, [7]vgv - very gravelly

Table 3. Physical Analyses of Selected Map Units[1]

Map Unit	Depth cm	Field Moisture %	Mechanical Analysis: 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
1	120-150	24	100	100	100	100	99	92	77	75	57	49	45
5	120-150	25	100	100	100	100	100	100	99	98	33	23	17

[1] Map units developed on similar parent material: 1 and 2
[2] These values are obtained from charts worked out by the Highways Testing Laboratory, Alberta Transportation.

[3]OC %	$CaCO_3$ equiv %	Mech. Analysis % from frac < 2 mm diam. sand	silt	clay	[4]VFS %	[5]% CF	Texture Lab det	Field est	Free Fe + Al %
33.1	nd	-	-	-	-	0	-	-	nd
1.1	nd	44	48	8	13	15	L	FSL	nd
nd	nd	34	35	31	9	10	CL	CL	nd
nd	0	21	35	44	8	10	C	SiCL	nd
38.4	nd	-	-	-	-	0	-	-	nd
4.3	nd	21	45	34	9	0	CL	SiCL	nd
nd	0.11	26	44	30	11	0	CL	SiCL	nd
28.3	nd	-	-	-	-	0	-	-	nd
4.4	nd	5	46	49	nd	0	SiC	SiL	0.09
1.4	nd	6	40	54	nd	0	SiC-C	SiCL	0.15
nd	nd	1	53	46	nd	0	SiC	SiCL	0.04
nd	0.17	27	60	13	24	10	SiL	VFSL	nd
nd	0.15	1	71	28	nd	90	SiCL	vgv[7] CL	nd

Liquid Limit	Plasticity Index	Optimum Moisture %[2]	Maximum Dry Density [2]lb/ft[3]	Classification AASHO	Unified	USDA
58	28	31	87.5	A-7-5(19) to A-7-6(19)	CH-MH	C
45	17	29	90.0	A-7-6(12)	ML	SiL

Table 4. Soil Erodibility Ratings (K values) of Selected Map Units

Map Unit	Horizon	K value[1]
1	Ae	0.50
	BC	0.33
2	Ae	0.50
	BC	0.38
4	[2]Bmg 1	0.25
	Bmg 2	0.42
5	Aej	0.15
	BC 1	0.62

[1]The K values were determined from data provided in this report using the soil erodibility nomograph presented in figure 5 of Greenlee (1981). The percentages of organic carbon and very fine sand were taken as zero where these values were not determined.

[2]Where the percent organic matter was more than 4, it was taken as 4 for the purposes of the nomograph.

Table 5. Predicted Water Erosion Hazards of Selected Map Units

Map Unit		Horizon	Erosion Risk[1]
1/c1		Ae	M
		BC	L
1/d1		Ae	M-H
		BC	M
1/e1	1/e2	Ae	H
		BC	M
1/f1,	1/f2	Ae	H
		BC	M-H
2/c1		Ae	M
		BC	L
2/E1		Ae	H
		BC	M
4/b0		Bmg 1	L
		Bmg 2	L
5/f0		Aej	L-M
		BC 1	H
5/g0		Aej	M
		BC 1	H

[1] L = Low erosion risk, M = Moderate erosion risk, H = High erosion risk. These ratings were derived by applying the K values from table 4 to the graph presented in figure 6 of Greenlee (1981).

Table 6. Soil Limitations for Primitive Camping Areas

Map Symbol[1]			Degree of Limitation[2]
[3]1/c1	1/d1	1/e1	M—Clay, SI Perm
1/e2			M—Clay, SI Perm, Stony
1/f1	1/f2		M—Slope, Er, SI Perm
2/c1	2/E1		M—Clay, SI Perm
3/b0			S—Wet, Org Surf, Flood
4/b0			M—Wet, Clay, Slip
5/f0			S—Clay, Slip, Slope
5/g0			S—Slope, Clay, Slip
6/f0			M—Slope, Er, SI Perm
6/g0			S—Slope, Er, SI Perm
H/a0			VS—Org, Wet
TH/a0			VS—Org, Wet

[1] For explanation see soil map

[2] SL — None to slight, M — Moderate, S — Severe, VS — Very severe

[3] These ratings are for the Luvisolic soils. The Gleysolic soils have severe limitations due to wetness. The Terric Humisol soils are rated under the TH map unit.

Abbreviations

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

Table 7. Soil Limitations for Fully Serviced Campgrounds

Map Symbol[1]		Degree of Limitation[2]
[3]1/c1	1/d1	M—Clay, SI Perm
1/e1	1/e2	M—Slope, Er, SI Perm
1/f1	1/f2	S—Slope, Er, SI Perm
2/c1		M—Clay, SI Perm
2/E1		M—Slope, Er, SI Perm
3/b0		S—Wet, Org Surf, Flood
4/b0		M—Wet, Clay, Slip
5/f0		S—Slope, Clay, Slip
5/g0		VS—Slope, Clay, Slip
6/f0		S—Slope, Er, SI Perm
6/g0		VS—Slope, Er, SI Perm
H/a0		VS—Org, Wet
TH/a0		VS—Org, Wet

[1] For explanation see soil map
[2] SL — None to slight, M — Moderate, S — Severe, VS — Very severe
[3] These ratings are for the Luvisolic soils. The Gleysolic soils have severe limitations due to wetness. The Terric Humisol soils are rated under the TH map unit.

Abbreviations

Clay - High clay content
Er - Erosion hazard
Flood - Flooding hazard (overflow)
Org - Organic soil
Org Surf - Organic surface layer >15 cm thick
Slip - Slippery or sticky when wet
Slope - Excessive slope
SI Perm - Slow Permeability
Wet - Seasonally high groundwater table or surface ponding

Table 8. Soil Limitations for Picnic Areas

Map Symbol[1]		Degree of Limitation[2]
[3]1/c1	1/d1	SL
1/e1	1/e2	M—Slope, Er
1/f1	1/f2	S—Slope, Er
2/c1		SL
2/E1		M—Slope, Er
3/b0		S—Wet, Org Surf
4/b0		M—Wet, Clay, Slip
5/f0		S—Slope, Clay, Slip
5/g0		VS—Slope, Clay, Slip
6/f0		S—Slope, Er
6/g0		VS—Slope, Er
H/a0		VS—Org, Wet
TH/a0		VS—Org, Wet

[1] For explanation see soil map
[2] SL — None to slight, M — Moderate, S — Severe, VS — Very severe
[3] These ratings are for the Luvisolic soils. The Gleysolic soils have severe limitations due to wetness. The Terric Humisol soils are rated under the TH map unit.

Abbreviations

Clay - High clay content
Er - Erosion hazard
Org - Organic soil
Org Surf - Organic surface layer >15 cm thick
Slip - Slippery or sticky when wet
Slope - Excessive slope
Wet - Seasonally high groundwater table or surface ponding

Table 9. Soil Limitations for Paths

Map Symbol[1]	Degree of Limitation[2]
3/1 c1 1/d1	SL
1/e1	M—Slope, Er
1/e2	M—Slope, Er, Stony
1/f1	S—Slope, Er
1/f2	S—Slope, Er, Stony
2/c1	SL
2/E1	M—Slope, Er
3/b0	S—Wet, Org Surf
4/b0	M—Wet, Clay, Slip
5/f0	S—Slope, Clay, Slip
5/g0	VS—Slope, Clay, Slip
6/f0	S—Slope, Er
6/g0	VS—Slope, Er
H/a0	VS—Org, Wet
TH/a0	VS—Org, Wet

[1] For explanation see soil map
[2] SL — None to slight, M — Moderate, S — Severe, VS — Very severe
[3] These ratings are for the Luvisolic soils. The Gleysolic soils have severe limitations due to wetness. The Terric Humisol soils are rated under the TH map unit.

Abbreviations

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

Table 10. Soil Limitations for Trails

Map Symbol[1]	Degree of Limitation[2]
3/1 c1 1/d1 1/e1	SL
1/e2	
1/f1 1/f2	M—Slope, Er
2/c1 2/E1	SL
3/b0	S—Wet, Org Surf
4/b0	M—Wet, Clay, Slip
5/f0	S—Clay, Slip, Slope
5/g0	S—Slope, Clay, Slip
6/f0	M—Slope, Er
6/g0	S—Slope, Er
H/a0	VS—Org, Wet
TH/a0	VS—Org, Wet

[1] For explanation see soil map
[2] SL — None to slight, M — Moderate, S — Severe, VS — Very severe
[3] These ratings are for the Luvisolic soils. The Gleysolic soils have severe limitations due to wetness. The Terric Humisol soils are rated under the TH map unit.

Abbreviations

Clay - High clay content
Er - Erosion hazard
Org - Organic soil
Org Surf - Organic surface layer > 15 cm thick
Slip - Slippery or sticky when wet
Slope - Excessive slope
Wet - Seasonally high groundwater table or surface ponding

Table 11. Soil Limitations for Lawns and Landscaping

Map Symbol[1]	Degree of Limitation[2]
3 1 / c1 1 / d1	M—Thin Ah
1 / e1 1 / e2	M—Thin Ah, Slope, Er
1 / f1 1 / f2	S—Slope, Er, Thin Ah
2 / c1	M—Thin Ah
2 / E1	M—Thin Ah, Slope, Er
3 / b0	S—Wet, Org Surf, Thin Ah
4 / b0	M—Wet, Clay, Thin Ah
5 / f0	S—Slope, Clay, Thin Ah
5 / g0	VS—Slope, Clay, Thin Ah
6 / f0	S—Slope, Er, Thin Ah
6 / g0	VS—Slope, Er, Thin Ah
H / a0	VS—Wet, Org, Thin Ah
TH / a0	VS—Wet, Org, Thin Ah

[1] For explanation see soil map
[2] SL — None to slight, M — Moderate, S — Severe, VS — Very severe
[3] These ratings are for the Luvisolic soils. The Gleysolic soils have severe limitations due to wetness. The Terric Humisol soils are rated under the TH map unit.

Abbreviations

Clay - High clay content
Er - Erosion hazard
Org - Organic soil
Org Surf - Organic surface layer >15 cm thick
Slope - Excessive slope
Thin Ah - Thin or no Ah horizon
Wet - Seasonally high groundwater table or surface ponding

Table 12. Soil Limitations for Buildings with Basements

Map Symbol[1]	Degree of Limitation[2]
3 1 / c1 1 / d1	S—Clay, Sh-Sw, Frost
1 / e1 1 / e2	S—Sh-Sw, Frost, Slope
1 / f1 1 / f2	S—Slope, Sh-Sw Frost
2 / c1	S—Clay, Sh-Sw, Frost
2 / E1	S—Sh-Sw, Frost, Slope
3 / b0	S—Wet, Flood, Frost
4 / b0	S-Wet, Flood, Frost
5 / f0	S—Slope, Frost, M Sh-Sw
5 / g0	VS—Slope, Frost, M Sh-Sw
6 / f0	S—Slope
6 / g0	VS—Slope
H / a0	VS—Org, Wet, Sh-Sw
TH / a0	VS—Org, Wet, Sh-Sw

[1] For explanation see soil map
[2] SL — None to slight, M — Moderate, S — Severe, VS — Very severe
[3] These ratings are for the Luvisolic soils. The Gleysolic soils have severe limitations due to the additional factor of wetness. The Terric Humisol soils are rated under the TH map unit.

Abbreviations

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

Table 13. Soil Limitations for Buildings Without Basements

Map Symbol[1]	Degree of Limitation[2]
3/c1 1/d1	SL
1/e1	M—Slope
1/e2	M—Slope, Stony
1/f1	S—Slope
1/f2	S—Slope, Stony
2/c1	SL
2/E1	M—Slope
3/b0	S—Wet, Flood
4/b0	S—Flood, Wet
5/f0	S—Slope
5/g0	VS—Slope
6/f0	S—Slope
6/g0	VS—Slope
H/a0	VS—Org, Wet
TH/a0	VS—Org, Wet

[1] For explanation see soil map
[2] SL — None to slight, M — Moderate, S — Severe, VS — Very severe
[3] These ratings are for the Luvisolic soils. The Gleysolic soils have severe limitations due to wetness. The Terric Humisol soils are rated under the TH map unit.

Abbreviations

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

Table 14. Soil Limitations for Septic Tank Absorption Fields

Map Symbol[1]	Degree of Limitation[2]
3/c1 1/d1	S—Clay, SI Perm
1/e1 1/e2	S— Clay, SI Perm, Slope
1/f1 1/f2	S—Slope, Clay, SI Perm
2/c1	S—Clay, SI Perm
2/E1	S—Clay, SI Perm, Slope
3/b0	VS—Wet, GW, Flood
4/b0	S—Wet, SI Perm, GW
5/f0	S—Slope
5/g0	VS—Slope
6/f0	S—Slope, R Perm, GW
6/g0	VS—Slope, R Perm, GW
H/a0	VS—Org, Wet, GW
TH/a0	VS—Org, Wet, GW

[1] For explanation see soil map
[2] SL — None to slight, M — Moderate, S — Severe, VS — Very severe
[3] These ratings are for the Luvisolic soils. The Gleysolic soils have very severe limitations due to wetness. The Terric Humisol soils are rated under the TH map unit.

Abbreviations

Clay - High clay content
Flood - Flooding hazard (overflow)
GW - Groundwater contamination hazard
Org - Organic soil
R Perm - Rapid permeability
Slope - Excessive slope
SI Perm - Slow Permeability
Wet - Seasonally high groundwater table or surface ponding

Table 15. Soil Limitations for Trench Type Sanitary Landfills

Map Symbol[1]	Degree of Limitation[2]
[3]1/c1 1/d1	[4]VS—Text, Clay
1/e1 1/e2	[4]VS—Text, Clay, Slope
1/f1 1/f2	
2/c1 2/E1	[4]VS—Text, Clay
3/b0	VS—Wet, Flood, GW
4/b0	S—Wet, Flood, GW
5/f0	M—Slope, Text, Clay
5/g0	S—Slope, Text, Clay
6/f0	[4]VS—R Perm, GW
6/g0	[4]VS—R Perm, GW, Slope
H/a0	VS—Org, Wet, GW
TH/a0	VS—Org, Wet, GW

[1] For explanation see soil map
[2] SL — None to slight, M — Moderate, S — Severe, VS — Very severe
[3] These ratings are for the Luvisolic soils. The Gleysolic soils have very severe limitations due to the additional factor of wetness. The Terric Humisol soils are rated under the TH map unit.
[4] Probably very severe to a depth of 4 m.

Abbreviations

Clay - High clay content
Flood - Flooding hazard (overflow)
GW - Groundwater contamination hazard
Org - Organic soil
R Perm - Rapic Permeability
Slope - Excessive slope
Text - Unsuitable Texture
Wet - Seasonally high groundwater table or surface ponding

Table 16. Soil Limitations for Road Location

Map Symbol[1]	Degree of Limitation[2]
[3]1/c1 1/d1	S—Clay, Sh-Sw, Frost
1/e1 1/e2	S—Sh-Sw, Frost, Slope
1/f1 1/f2	S—Slope, Sh-Sw, Frost
2/c1	S—Clay, Sh-Sw, Frost
2/E1	S—Sh-Sw, Frost, Slope
3/b0	S—Wet, M Sh-Sw, Frost
4/b0	M—Wet, Flood, M Sh-Sw
5/f0	S—Slope, Frost, M Sh-Sw
5/g0	VS—Slope, Frost, M Sh-Sw
6/f0	S—Slope
6/g0	VS—Slope
H/a0	VS—Wet, Org, Sh-Sw
TH/a0	VS—Wet, Org, Sh-Sw

[1] For explanation see soil map
[2] SL — None to slight, M — Moderate, S — Severe, VS — Very severe
[3] These ratings are for the Luvisolic soils. The Gleysolic soils have severe limitations due to the additional factor of wetness. The Terric Humisol soils are rated under the TH map unit.

Abbreviations

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

Table 17. Soil Suitability for Source of Roadfill

Map Symbol[1]	Degree of Suitability[2]
3/c1, 1/d1, 1/e1, 1/e2	P—Clay, Sh-Sw, Frost
1/f1, 1/f2	P—Sh-Sw, Frost, Slope
2/c1, 2/E1	P—Clay, Sh-Sw, Frost
3/b0	P—Wet, M Sh-Sw, Frost
4/b0	F—Wet, M Sh-Sw, Frost
5/f0	P—Frost, Slope, M Sh-Sw
5/g0	P—Slope, Frost, M Sh-Sw
6/f0	F—Slope
6/g0	P—Slope
H/a0	VP—Org, Wet, Sh-Sw
TH/a0	VP—Org, Wet, Sh-Sw

[1] For explanation see soil map
[2] G — Good, F — Fair, P — Poor, VP — Very poor
[3] These ratings are for the Luvisolic soils. The Gleysolic soils are poorly suited due to the additional factor of wetness. The Terric Humisol soils are rated under the TH map unit.

Abbreviations

Clay - High clay content
Frost - Susceptibility to frost heave
M Sh-Sw - Moderate shrink-swell potential
Org - Organic soil
Sh-Sw - High shrink-swell potential
Slope - Excessive slope
Wet - Seasonally high groundwater table or surface ponding

Table 18. Soil Suitability for Source of Sand or Gravel

Map Symbol[1]	Degree of Suitability[2]
3/c1, 1/d1, 1/e1, 1/e2, 1/f1, 1/f2	VP—Text
2/c1, 2/E1	VP—Text
3/b0	VP—Thin, Text, Wet
4/b0	VP—Text, Wet
5/f0, 5/g0	VP—Text
6/f0, 6/g0	F—Text
H/a0	VP—Org, Wet, Text
TH/a0	VP—Org, Wet, Text

[1] For explanation see soil map
[2] G — Good, F — Fair, P — Poor, VP — Very poor
[3] These ratings are for the Luvisolic soils. The Gleysolic soils are poorly suited due to the additional factor of wetness. The Terric Humisol soils are rated under the TH map unit.

Abbreviations

Org - Organic soil
Text - Unsuitable texture
Thin - Thin deposit of sand or gravel
Wet - Seasonally high groundwater table or surface ponding

LANDFORM MAP OF CARSON-PEGASUS LAKES AREA

Tp 61 ; R 11 - 12 ; W 5

LEGEND:

F - Fluvial

$F^{G}h$ - hummocky glaciofluvial

$F^{G}r$ - ridged glaciofluvial

L - Lacustrine

$L^{G}b/Ml$ - glaciolacustrine blanket overlying level morainal

$L^{G}vb/Ml$ - glaciolacustrine veneer and blanket overlying level morainal

M - Morainal

Mh - hummocky morainal

Mi - inclined morainal

Mr - ridged morainal

Mu - undulating morainal

B - Bog

Bh - horizontal bog

N - Fen

Nh - horizontal fen

- escarpment
P - parking area for vehicles
SR - surface removed
- landform line
- boundary of mapped area

Compiled on uncontrolled mosaic

Mapped and Compiled by:

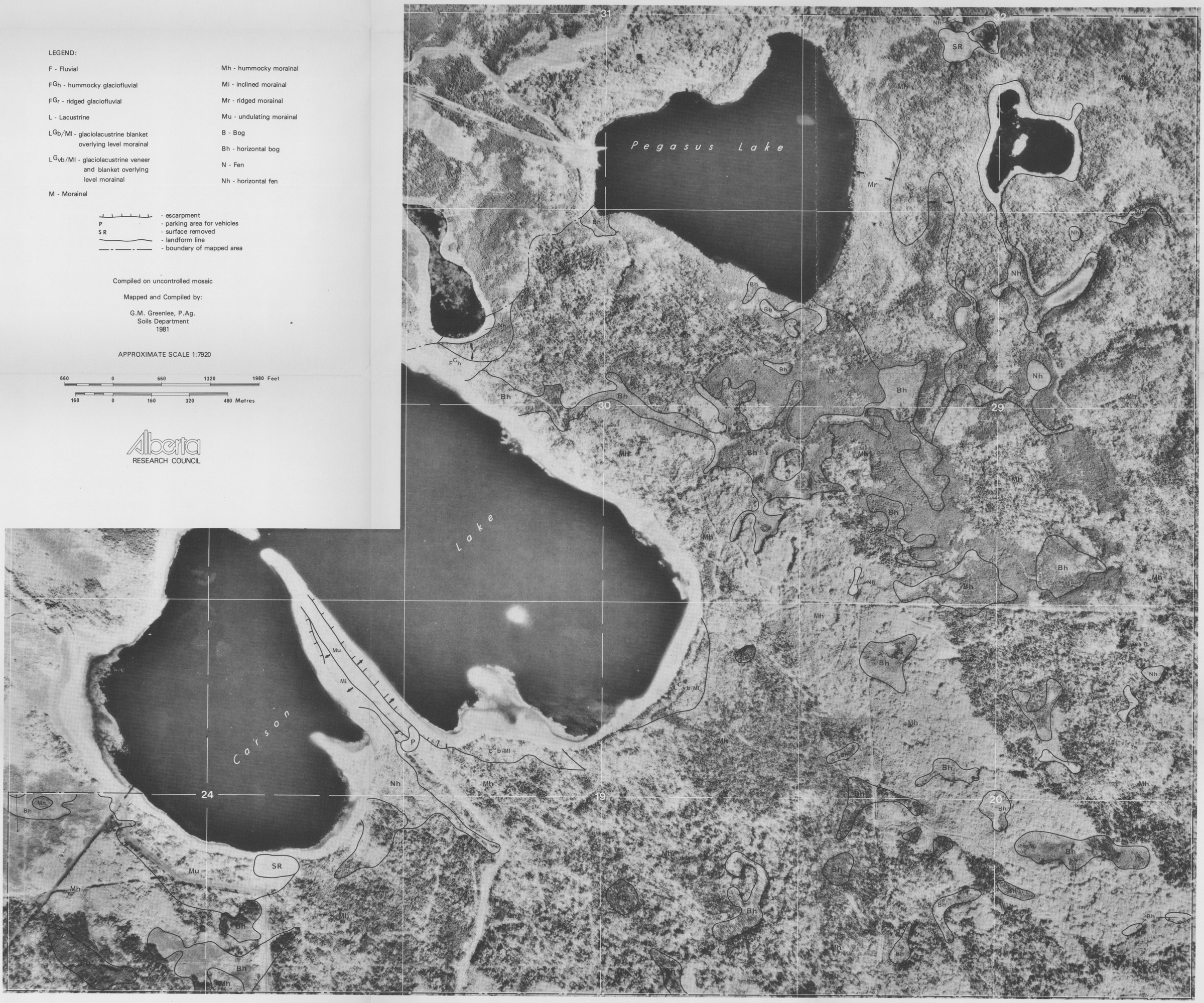
G.M. Greenlee, P.Ag.
Soils Department
1981

APPROXIMATE SCALE 1:7920

660 0 660 1320 1980 Feet

160 0 160 320 480 Metres

Alberta
RESEARCH COUNCIL



SOIL MAP OF CARSON–PEGASUS LAKES AREA

Tp 61 ; R 11 - 12 ; W 5

SOIL CLASSIFICATION			
MAP UNIT	SOIL ORDER	SOIL SUBGROUP	SOIL PARENT MATERIAL
1	Luvisolic-60%	Orthic Gray Luvisol	fine-textured till
	Gleysolic-20%	Orthic Gleysol peaty phase	
	Organic-20%	Terric Humisol	
2	Luvisolic	Orthic Gray Luvisol	fine-textured till
3	Gleysolic	Orthic Gleysol peaty phase Orthic Gleysol	moderately fine-textured glaciolacustrine sediments
4	Brunisolic	Gleyed Eutric Brunisol Gleyed Cumulic Eutric Brunisol peaty phase	moderately fine-textured glaciolacustrine sediments overlying moderately fine-textured till
5	Luvisolic-60%	Orthic Gray Luvisol-20%	fine-textured till
		Orthic and Brunisolic Gray Luvisol-40%	moderately fine-textured till containing a high proportion of weathered shale and sandstone
	Brunisolic-30%	Eluviated Eutric Brunisol	
	Organic-10%	Terric Humisol	humic peat overlying till
6	Luvisolic	Orthic Gray Luvisol	moderately coarse-textured to very coarse-textured glaciofluvial sediments
H	Organic	Humisol	predominantly humic peat
TH	Organic	Terric Humisol	predominantly humic peat overlying fine textured till

APPROXIMATE SCALE 1:7920

660 0 660 1320 1980 Feet

160 0 160 320 480 Metres

Legend:

- escarpment
- P - parking area for vehicles
- SR - surface removed
- soil line
- boundary of mapped area

Map Symbol:

map unit / surface stoniness rating / topographic class

Compiled on uncontrolled mosaic

Mapped and Compiled by:

G.M. Greenlee, P.Ag.
Soils Department
1981

Alberta
RESEARCH COUNCIL

Pegasus Lake

Carson Lake

31 32 30 29 24 19 20