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Maps

DETAILED SOIL SURVEY
of
BRAGG CREEK AREA

M. D. Scheelar and C. F. Veauvy
ALBERTA RESEARCH COUNCIL

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ABSTRACT

As an aid to urban planning, a detailed soil survey was conducted in the summer of 1976 in the vicinity of the hamlet of Bragg Creek, Alberta. The area is within the jurisdiction of the Calgary Regional Planning Commission.

Sixteen soil units were mapped as indicated in the map legend. These soils represent the Chernozemic, Luvisolic, Regosolic, Gleysolic and Organic Orders in the Canadian System of Soil Classification.

Many of these soils present severe limitations for most urban uses due to such soil and topography characteristics as steep slopes, poor drainage, shallow depth to bedrock, gravelly textures or flooding hazard. Other soils have only slight to moderate limitations for most uses.

The area has low capability for agriculture, due to climate, soils and topography limitations and the better land is presently used only for forage crop production and pasture.

SECTION 1

INTRODUCTION

Soils are one of our most important natural resources. Man bases his activities on soils and depends on their productivity. They are the natural medium for the growth of plants; their properties and life serve to stabilize waste and purify water; and they serve as foundations for buildings, roads and all other man-made, land based structures. Mounting pressures upon land are constantly making soils more and more valuable.

Soils have been subject to grave abuse and misuse through improper land use development. Serious health, safety and pollution problems have been created by failure to consider the capabilities and limitations of soils during the planning and design stages of rural or urban development projects (Bauer, K.W. 1973). Such problems include malfunctioning septic tank sewage disposal systems, surface and groundwater pollution, flood damage, soil erosion, soil slumping, and footing and foundation failures. Knowledge of the soils and their ability to sustain development not only helps to avoid such problems but can also contribute to reducing development costs.

A need exists, therefore, in any planning program for a detailed soil survey which delineates the geographical location of various kinds of soils; identifies their chemical and engineering properties; and interprets their properties for the uses which are planned for the area.

USE OF THE REPORT

This report consists of a written text and a map. The written part includes introductory and background information on soils, soil mapping, and soil interpretations in the first section and descriptions of the soils, analytical results, and interpretations for various uses in the second section.

The soils map is presented on an aerial photo-mosaic base. The photo base aids in identification and location of areas, however the linear and spatial

distortion inherent in a photo mosaic must be appreciated. The soil-landscape units delineated on the map are described briefly in the map legend and in greater detail in the written report. The map and the report should be used together.

THE SOILS

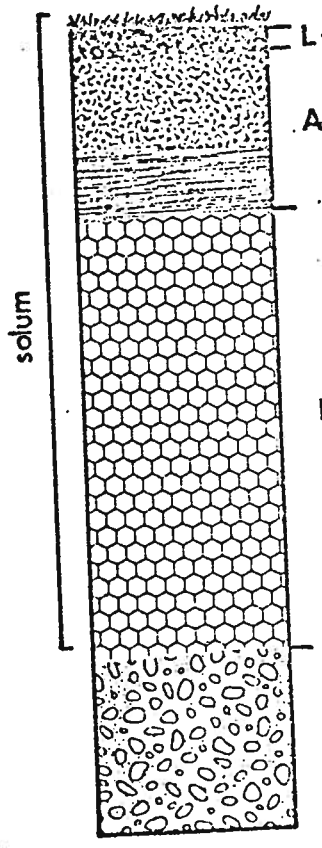
Soil Formation

Soil is a three dimensional natural body of unconsolidated matter on the immediate surface of the earth that has been subjected to, and influenced by, genetic and environmental factors of parent material, climate, biotic influences and topography all acting over a period of time to produce a product that differs in physical, chemical, biological and morphological properties and characteristics from the material from which it was derived and is capable of supporting the growth of land plants (Lavkulich, L.M. 1969).

Soil formation is defined in terms of degree of expression of a given set of properties; it is considered to be composed of two overlapping steps, (1) the accumulation of parent materials, and (2) the differentiation of horizons within the profile. The latter is attributed to additions, removals, transfers and transformations within the soil system.

These horizons differ from one another in such properties as color, texture, structure, consistence and chemical and biological activity. The major horizons are designated O for organic layers developed mainly from mosses, rushes and woody materials; L, F and H for organic layers developed mainly from leaves, twigs, woody materials and a minor component of mosses; and A, B and C for mineral horizons. Subdivisions of the master horizons are denoted by suffix letters appended to the master horizon symbol (see Figure 1, Table 3 and glossary).

FIGURE 1. DIAGRAM OF A SOIL PROFILE



--Organic layer which may be subdivided into L, F, H or Of, Om, and Oh.

--A mineral horizon at or near the surface. It may be a dark colored horizon in which there is an accumulation of humus (Ah), or a light colored horizon from which clay, iron, and humus have been leached (Ae).

--Mineral horizon that (1) may be altered to give a change in color or structure (Bm) or (2) may have an enrichment of clay (Bt) or (3) may have significant amounts of exchangeable Na and exhibit a columnar structure with pronounced stainings (Bn).

--Mineral horizon comparatively unaffected by the soil forming process operative in the A and B horizons except for the process of gleying (Cg) or the accumulation of carbonates and soluble salts (Cca, Csa, Ck, Cs, Csk).

Soil Classification

Through observation of differences in soil characteristics in soil horizons it is possible to classify soils into taxonomic units. In this report the Canadian System of Soil Classification (Canada Soil Survey Committee. 1976) is used (see the Soil Key, Table 2 and the Soil Unit Descriptions).

This system classifies the soils in their natural state and thus indicates relationships between soils and their environment. These relationships are often important for assessing limitations of soils for various uses. However, the soil classification system does not use soil interpretations for uses as a basis for soil classification.

Soil classification systems are not truths that can be discovered but contrivances to organize information and ideas in ways that seem logical and useful (Soil Survey Manual. 1960). The general purpose of soil classification in Canada may be stated as follows: To organize the knowledge of soils so that it can be recalled systematically and communicated, and so that relationships may be seen; among kinds of soils; among soil properties and environmental factors; among soil properties and suitabilities of soils for various uses.

A taxonomic unit in the classification has specified limits of variation and should be thought of as consisting of (1) a single modal profile representing the most usual condition of each property (2) many other closely related profiles that vary from the modal profile within precisely defined limits.

Soil Mapping

Since soil is a continuum, and adjacent soils seldom have sharp boundaries, soil units are often defined in terms of two or more taxonomic units that are geographically associated on a landscape. These taxonomic units must be included in soil units because of the limitations imposed by the scale of mapping and the number of points that can be examined.

The notations on the soil map consist of numbers and letters: for example

$$\frac{1 - 3}{bc}$$

The first digit in the number represents a geological parent material and landform; the second digit denotes the taxonomic unit or units (and sometimes textural

differences); and the letters denotes the range in topography classes. The topographical classes are as follows:

Simple topography Single slopes (regular surface)		Slope %	Complex topography Multiple slopes (irregular surface)	
A	depressional to level	0 to 0.5	a	nearly level
B	very gently sloping	0.5+to2	b	gently undulating
C	gently sloping	2+ to 5	c	undulating
D	moderately sloping	5+ to 9	d	gently rolling
E	strongly sloping	9+ to 15	e	moderately rolling
F	steeply sloping	15+ to 30	f	strongly rolling
G	very steeply sloping	30 to 60	g	hilly
H	extremely sloping	over 60	h	very hilly

The soils were mapped in the field by making observations at selected sites using a shovel or auger. These point observations were extrapolated to an area basis through the use of aerial photograph interpretation and field checking. The principal soils were sampled to depths of 1 metre for chemical and engineering properties.

Soil Texture

Throughout the report reference is made to soil texture and to soil drainage classes. Soil texture is according to the United States Department of Agriculture (USDA) textural classification which is described below. The soil drainage classes, according to the Canada Soil Survey Committee (1976) are outlined following the textural classification.

Soil Separates (Particle Size) on which textural classes are based.

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

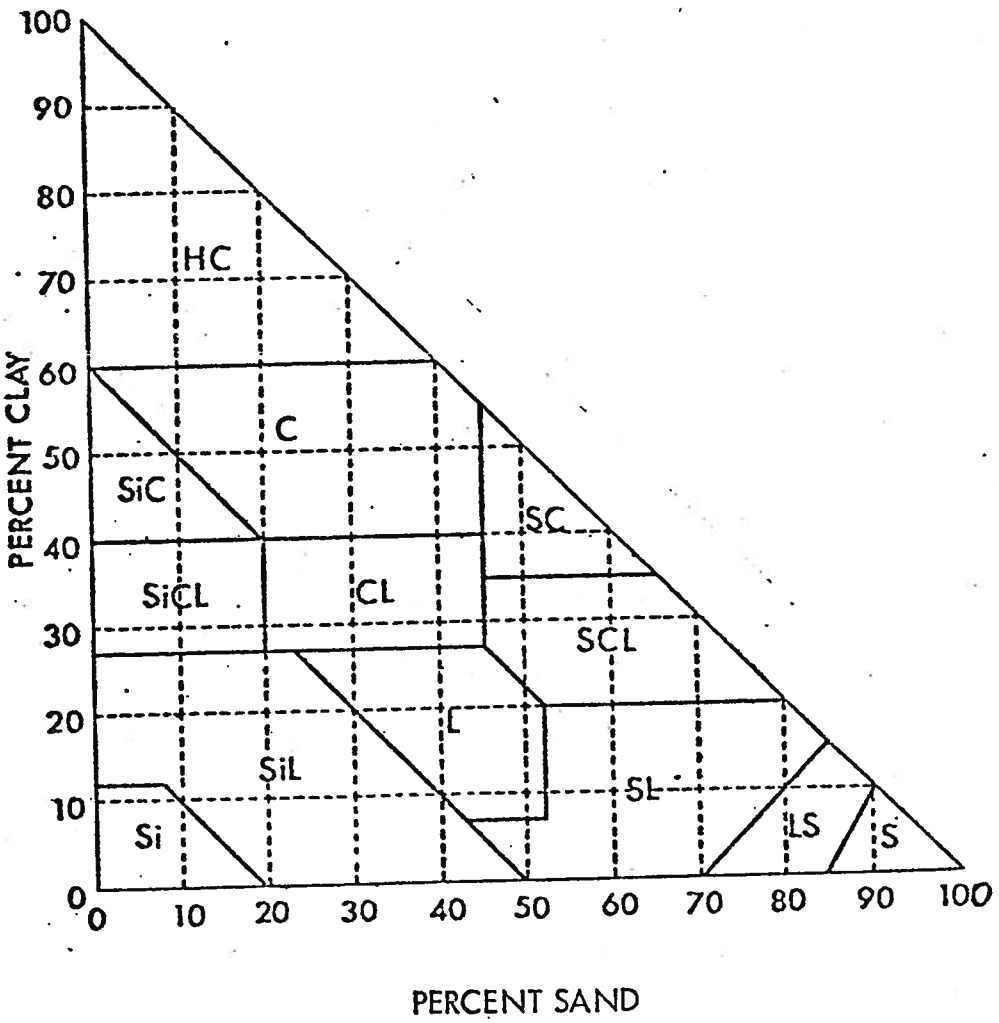


Figure 2. Soil textural classes. Percentages of clay and sand in the main textural classes of soils; the remainder of each class is silt.

The soil textural classes are grouped according to the Canada Soil Survey Committee as follows:

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

The gravelly class names are added to the textural class names according to the following rule:

% gravel by volume	
less than 20	- use textural class only
20 to 50	- gravelly and texture
50 - 90	- very gravelly and texture
more than 90 in surface 8 inches	- cobble land type.

Soil Drainage Classes

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

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

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

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

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

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

Very poorly drained - free water remains at or within 12 inches of the surface most of the year.

Specific reference to surface drainage may be designated in terms of run-off and described as high, medium, low or ponded. Similarly, specific reference to the characteristics of horizons within the profile may be designated in terms of permeability or percolation and described as rapid, moderate, slow, very slow, and none.

SOIL AND LAND USE

The soils of the area have been interpreted for limitations to roads, buildings with basements, sewage lagoons, septic tank absorption fields, trench-type sanitary landfills, shallow excavations, camp areas, picnic areas and playing fields and for suitability as a source of gravel, roadfill and topsoil. The soils have also been assigned capability ratings for agriculture in order to evaluate the area in terms of potential agricultural production.

These interpretations not only consider such soil properties as texture, depth to water table and depth to consolidated bedrock which affect many of the designated uses but also topography and flooding hazard.

Soil interpretations are included so that soils information may be more easily understood. These interpretations should be treated as evaluations of performance of soils not as recommendations for the use of soils. Many other factors are involved in the recommended use of soils. They are, however, valuable tools that can be used to assist the planner. Through their use, the planner can predict the type and degree of problem likely to be encountered, and plan the kind and amount of on-site investigations needed to determine corrective measures. Also, because soil boundaries are not precise, soil interpretations do not eliminate on-site investigations. They are, however, intended as an aid in planning these investigations, to reduce the amount of investigations and minimize the cost. For each use, the soils are rated in terms of degree of - slight, moderate or severe, or in terms of suitability as a source of material - good, fair or poor.

A slight soil limitation is the rating given soils that have properties favourable for the use. Good performance and low maintenance can be expected.

A moderate soil limitation is the rating given soils that have properties moderately favourable for the use. This limitation can be overcome or modified by - planning, design, or maintenance.

A severe soil limitation is the rating given soils that have one or more properties that are seriously unfavourable for the use. This limitation generally requires major soil reclamation, special design or intensive maintenance. In most situations, it is difficult and costly to alter the soil or to design a structure so as to compensate for the severe degree of limitation but using these soils without employing corrective measures could result in failure.

The decision as to whether or not a soil will be utilized for a specific use, regardless of the soil limitation is beyond the scope of this report.

SECTION 11

Location and Extent of Study Area

The area described in this report covers 78 square kilometers (32 square miles) or approximately 8300 hectares (20,560 acres) within Township 23, Range 5, West of the 5th Meridian. The hamlet of Bragg Creek is on the east side of the area in section 12 and is approximately 40 kilometers (25 miles) southwest of Calgary via highways 1 and 22.

Physiography of Area

The area is within the foothills associated with the Front Ranges of the Rocky Mountains. These foothills are bedrock controlled and are oriented in a northwesterly - southeasterly direction. The terrain consists of steeply sloping foothills; gently rolling to rolling morainal areas; gently rolling to hilly morainal veneer and blanket areas; gently undulating to undulating lacustrine areas; level glacio-fluvial terraces; gently undulating to rolling fluvial lacustrine terraces; and level to undulating fluvial flood-plains.

The surface bedrock in the area is mainly sandstone and mudstone, except for some shale in the southeastern portion of the area. These sediments belong to the Brazeau, Blackstone, Cardium, and Wapiabi Formations and the Mesozoic Groups. (Green, R. 1970). The Brazeau Formation outcrops in the western portion and is Tertiary and Upper Cretaceous in age. The Blackstone, Cardium and Wapiabi Formations (the Alberta Group) outcrop in the eastern portion and are Upper and Lower Cretaceous in age. The Mesozoic Group outcrops in the northeastern portion and consists of four different formations and groups of formations which are Lower Cretaceous, Jurassic and Triassic in age.

During the Pleistocene Epoch the Cordilleran ice sheet filled the Interior Valleys of the Rocky Mountains and extended eastwards into the foothills (Wyatt et al. 1942). When the ice melted varying depths of till was deposited on the existing landscape at higher elevations. The meltwater was ponded at the lower elevations by the Keewatin ice sheet to form temporary lakes in which lacustrine sediments were deposited. The alternate action of entrapped and fast moving water resulted in areas of fluvial lacustrine deposits and the action of fast moving water gave rise

to areas of gravelly glacio-fluvial deposits. As the ice sheets melted, former meltwater channels were abandoned and the annual discharge of water followed a new route coincident with the present channel of the Elbow River. In recent times, fluvial floodplains have been formed along the major streams.

In summary, the resulting surficial deposits consist of medium to moderately fine textured till; medium to moderately fine textured lacustrine deposits; fluvial lacustrine deposits with alternate layers of coarse and fine materials; glacio-fluvial gravels with minor silty and sandy overlays; recent fluvial deposits of varying texture and undifferentiated till-like deposits over bedrock.

THE SOILS OF THE AREA

Soil development in the area reflects the influence of parent materials, climate, drainage and vegetation.

Dark Gray Chernozemic soils have developed in areas of transitional grassland-forest vegetation where the climate is warm and dry. These soils are characterized by Ahe horizons that are darker in color than the Ae horizons of Luvisolic soils but not as dark as Ah horizons of Black Chernozemic soils. They have developed on moderately fine textured lacustrine deposits and on medium to moderately fine textured till.

Luvisolic soils are the most prevalent in the area and have developed in areas of heavy tree cover where the climate is cool and moist and there is sufficient leaf litter to promote the process of leaching. Leaching is attributed, in part, to the action of organic acids. They induce dispersion and suspension of colloidal material in the upper horizons which facilitates downward translocation of this fine material within the soil profile. The layer of clay accumulation is known as the Bt horizon if sufficient to meet certain defined limits (CSSC 1976). Gray Luvisols occur as dominant soils on medium to moderately fine textured till, undifferentiated till-like deposits overlying till, and fluvial lacustrine deposits. Dark Gray Luvisols differ from Gray Luvisols in having Ahe horizons greater than 8 cm thick. They occur as the dominant soil in fluvial lacustrine areas.

Brunisolic soils have developed in areas of steeply sloping bedrock and in gravelly glacio-fluvial areas where there is minimum translocation of clay in the profile. This minimal horizon development may be due to a low initial clay content of the parent material, thin vegetation and low additions of organic matter and organic acids to the soil or disruption of profile development by mixing of the soil during downslope creep. There is, however, a Bm horizon with either a very thin Ae horizon or no sharp demarcation between the A and B horizons.

Regosolic soils with little or no soil horizon development occur on recent fluvial floodplains. Soil formation is often interrupted by deposition of new materials.

Gleysolic soils occur in depressional areas with seasonally high water levels or in seepage areas on hillsides above impermeable bedrock. They are characterized by dull, matrix colors indicative of reducing conditions and localized points of high chroma (mottles) indicative of periodic oxidation. These soils usually have organic surface horizons less than 40 cm thick and vegetation consisting of willows, ground-birch and sedges in depressions or black poplar and sedges on hillside seepage areas.

Organic soils occur in depressions that have a permanently high water table and include all organic material more than 40 cm thick. In this area they are classified according to their degree of decomposition and the depth to mineral soil. Typic Mesisols (the dominant Organic soil) have intermediate decomposition below 60 cm and no mineral soil contact within 160 cm. Terric Mesisols differ only in having a mineral soil contact above 160 cm.

Sixteen soil units have been mapped; two on fluvial lacustrine materials; two on glacio-fluvial materials; three on medium to moderately fine textured till; two on undifferentiated till-like deposits; three on lacustrine materials; two on bedrock; one on recent fluvial floodplains and one on organic material.

The soil key in Table I and the soil unit descriptions indicate the classification, texture and drainage of the soils in the area. Tables 2 and 3 give brief descriptions of the classification and horizon designations. In the following soil unit descriptions, comments refer to the dominant soil subgroups unless otherwise indicated. Refer to pages 4 to 7 for the explanation of texture, topography and drainage classes. Colors are indicated as dry (d) or moist (m).

Table 1 - Key to the Soils of the Bragg Creek Area

LANDFORM (2)	PARENT MATERIAL (2)	SOIL UNIT	SURFACE TEXTURE (1)	SLOPE CLASSES(1)	DRAINAGE CLASSES (1)	DOMINANT SOIL SUBGROUP (2)	SIGNIFICANT SOIL SUBGROUP (2)
Fluvial Lacustrine Terrace	gravelly stratified fluvial lacustrine	1-1	GL-L	b,c,d,e	well	Dark Gray Luvisol	Orthic Sombric Brunisol
		1-2	GL-L	b,c	well	Orthic Gray Luvisol	Brunisolic Gray Luvisol
Glaciofluvial Terrace	gravelly glaciofluvial	2-1	GSL	A,B,C	well to rapidly	Eluviated Eutric Brunisol	Orthic Gray Luvisol
	loam over gravelly glaciofluvial	2-2	L	A,B,C	well	Eluviated Eutric Brunisol	Orthic Gray Luvisol
Recent Fluvial Floodplain	variable textured fluvial	3-1	var.	b,c	var.	Cumulic Regosol	Orthic Regosol
Morainal	medium to moderately fine textured till	4-1	L	d,e,f	well	Orthic Gray Luvisol	Brunisolic Gray Luvisol
		4-2	L	b,c	well	Orthic Dark Gray Chernozem	Dark Gray Luvisol
		4-3	L	A,d,e	poorly	Orthic Humic Gleysol (peaty)[3]	Orthic Humic Gleysol
Morainal Veneer	medium textured undifferentiated deposit over mudstone	5-1	L	d,e,f	well	Orthic Gray Luvisol	Eluviated Eutric Brunisol
Morainal Blanket	fine textured undifferentiated deposit over shale	6-1	CL	b,c,d,e,f	moderately well	Orthic Gray Luvisol	
Lacustrine Plain	medium to moderately fine textured lacustrine	7-1	SiL	b,c	well	Orthic Dark Gray Chernozem	Dark Gray Luvisol
		7-2	SiL	b,c	well	Orthic Gray Luvisol	Orthic Humic Gleysol
		7-3	SiL	A	poorly	Orthic Humic Gleysol	Orthic Humic Gleysol (peaty)[3]
Steeply Sloping Rock	mudstone and sandstone shale	8-1	SL	G,H	rapidly	Eluviated Eutric Brunisol (lithic)[3]	Eluviated Eutric Brunisol
		8-2	CL	G,H	rapidly	Eluviated Eutric Brunisol	Orthic Eutric Brunisol
Horizontal Fen	organic material	9-1	org.	A	very poorly	Typic Mesisol	Terric Mesisol

(1) Refer to pages 4 to 7 in Section 1 of the report
(2) Refer to "The Canadian System of Soil Classification, 1976"
(3) "peaty" and "lithic" are phases of soil subgroups

TABLE 2. CANADIAN SOIL CLASSIFICATION SYSTEM

ORDER	GREAT GROUP	DISTINGUISHING CHARACTERISTICS
1. Chernozemic (Developed under grassland and transitional grassland-forest communities)	Brown	Light Brown Ah horizon
	Dark Brown	Light Brown Ah horizon
	Black	Black Ah horizon
	Dark Gray	Have L-H surface horizons typical of forest vegetation
2. Solonetzic (Columnar or prismatic B horizon and a saline C horizon; Ca/Na ratio of B horizon is less than 10)	Solonetz	Ah horizon ----- Bnt horizon
	Solodized Solonetz	Ah ----- Ae ----- Bnt
	Solod	Ah ----- Ae ----- Bnt
3. Luvisolic (Developed in forest areas; accumulation of clay in the B horizon)	Gray Brown Luvisol	(L-H) ----- Ah ----- Ae ----- Bt; Mull-like Ah horizon
	Gray Luvisol	L-H ----- (Ah) ----- Ae ----- Bt
4. Podzolic (Accumulation of Fe+Al and/or organic matter in the B horizon)	Humic Podzol	Bh > 10 cm which contains > 1% O.C. < 0.3%Fe
	Ferro-Humic Podzol	Bhf >10 cm which contains > 5%O.C. > 0.6%Fe+Al
	Humo-Ferric Podzol	Bhf ≥ 5 cm which contains < 5%O.C. > 0.6% Fe+Al
5. Brunisolic (Generally weakly developed B horizons)	Melanic Brunisol	Ah > 5 cm, Bm > 5 cm; pH > 5.5
	Eutric Brunisol	Ah < 5 cm, Bm > 5 cm; pH > 5.5
	Sombric Brunisol	Ah > 5 cm, Bm > 5 cm; pH < 5.5
	Dystric Brunisol	Ah < 5 cm, Bm > 5 cm; pH < 5.5
6. Regosolic (Weakly developed or young soils; no B horizon)	Regosol	(L-H) ----- Ah ----- C; no B horizon
7. Gleysolic (Poorly drained and show mottling and gleying)	Humic Gleysol	Ah > 8 cm
	Gleysol	Ah < 8 cm
	Luvic Gleysol	Have Aeg and Btg horizons
8. Organic (Contains > 17% organic carbon are > 60 cm in depth if dominantly fibric or > 40 cm if dominantly mesic or humic)	Fibrisol	Large amount of well preserved fiber
	Mesisol	Partially decomposed fiber
	Humisol	Well decomposed fiber (Black)
	Folisol	

TABLE 3. DEFINITION OF SOIL HORIZON SYMBOLS
(after Canada Soil Survey Committee, 1976)

Organic Layers

Organic layers are found at the surface of some mineral soils, and may occur at any depth beneath the surface in buried soils, or overlying geologic deposits. They contain more than 17% organic carbon by weight. Two groups of these layers are recognized.

O -This is an organic layer developed mainly from mosses, rushes, and woody materials.

Of -The fibric layer is the least decomposed of all the organic soil materials. It has large amounts of well-preserved fibre that are readily identifiable as to botanical origin.

Om -The mesic layer is the intermediate stage of decomposition with intermediate amounts of fibre, bulk density and water-holding capacity. The material is partly altered both physically and biochemically. A mesic layer is one that fails to meet the requirements of fibric or of humic.

Oh -The humic layer is the most highly decomposed of the organic soil materials. It has the least amount of fibre, the highest bulk density, and the lowest saturated water-holding capacity. It is very stable and changes very little physically or chemically with time unless it is drained.

L-F-H -These organic layers develop primarily from leaves, twigs, woody materials, and a minor component of mosses.

L -This is an organic layer characterized by an accumulation of organic matter in which the original structures are easily discernible.

F -This is an organic layer characterized by an accumulation of partly decomposed organic matter. The original structures in part are difficult to recognize. The layer may be partly comminuted by soil fauna as in moder[1], or it may be partly decomposed mat permeated by fungal hyphae, as in mor[1].

H -This is an organic layer characterized by an accumulation of decomposed organic matter in which the original structures are indiscernible. This material differs from the F layer by its greater humification chiefly through the action of organisms. This layer is a zoogenous humus form consisting mainly of spherical or cylindrical droppings of microarthropods. It is frequently intermixed with mineral grains, especially near the junction with a mineral layer.

Master Mineral Horizons and Layers

Mineral horizons are those that contain less organic matter than that specified for organic layers.

[1]Bernier, B. 1968. Soils under forest. Proceedings of the Seventh Meeting of the National Soil Survey Committee of Canada. p. 145 and 147.

(TABLE 3 - cont'd)

A -This is a mineral horizon or horizons formed at or near the surface in the zone of removal of materials in solution and suspension, or of maximum in situ accumulation of organic matter or both. Included are:

(1) horizons in which organic matter has accumulated as a result of biological activity (Ah);

(2) horizons that have been eluviated of clay, iron, aluminum, or organic matter, or all of these (Ae).

B -This is a mineral horizon or horizons characterized by one or more of the following:

(1) an enrichment in silicate clay (Bt).
(2) an alteration of hydrolysis, reduction, or oxidation to give a change in color or structure from horizons above or below (Bm and Bg).
(3) a prismatic or columnar structure that exhibits pronounced coatings or stainings or significant amounts of Na (Bn).

C -This is a mineral horizon or horizons comparatively unaffected by the pedogenic processes operative in A and B, excepting the process of gleying or the accumulation of carbonates and soluble salts.

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

Lowercase Suffixes

b -A buried soil horizon.

e -A horizon characterized by the removal of clay, iron, aluminum, or organic matter alone, or in combination. When dry, it is higher in color value by 1 or more units than an underlying B horizon. It is used with A (Ae, Ahe).

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

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

(TABLE 3 - cont'd)

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

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

n -A horizon in which the ratio of exchangeable Ca to exchangeable Na is 10 or less. When used with B it must also have the following properties; prismatic or columnar structure, dark coatings on ped surfaces, and hard to very hard consistence when dry.

s -A horizon with salts which may be detected as crystals or veins, as surface crusts, by distressed crop growth or by presence of salt-tolerant plants. It is most commonly used with C and k.

t -A horizon enriched with silicate clay. It is used with B (Bt, Btg).

SOIL UNIT DESCRIPTIONS

1. Soils developed on gravelly stratified fluvial lacustrine deposits on late glacial fluvial lacustrine terraces: These acidic soils occur in the western portion of the area along Bragg Creek.

Soil Unit: 1 - 1

Soil Classification: Dark Gray Luvisols with significant Orthic Sombric Brunisols

Parent Material: Gravelly stratified fluvial lacustrine

Topography: Gently undulating to rolling

Drainage: Well drained

Profile description of dominant soil subgroup:

Horizon	Color	Thickness (cm)	pH	Consistence when dry	USDA texture
Ap	Dark grayish brown (d)	10	4.5-5.5	soft	L-GL
Ae	Light brownish gray (d)	10	4.5-5.5	slightly hard	FSL
Bt	Brown (d)	15	4.5-5.5	hard	CL
C	Grayish brown (d)	15	4.5-5.5		GLS-SL
IIC	Grayish brown (d)	50+	4.5-5.5		SiCL

Comments: The parent materials of these soils have alternate coarse textured and fine textured layers. The fine textured layers usually consist of 20-30 percent stones.

Soil Unit: 1 - 2

Soil Classification: Orthic Gray Luvisol with significant Brunisolic Gray Luvisols

Parent Material: Gravelly stratified fluvial lacustrine

Topography: Gently undulating to undulating

Drainage: Well drained

Profile description of dominant soil subgroup:

Horizon	Color	Thickness (cm)	pH	Consistence when dry	USDA texture
LFH	Dark brown (d)	10	4.5-5.5		
Ae	Light brownish gray (d)	15	4.5-5.5	slightly hard	FSL
Bt	Brown (d)	20	4.5-5.5	hard	CL
C	Grayish brown (d)	25	4.5-5.5		GLS-SL
IIC	Grayish brown (d)	60+	4.5-5.5		SiCL

Comments: Same as for 1 - 1. Brunisolic Gray Luvisols have a brownish Bm horizon developed within the Ae horizon.

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2. Soils developed on glaciofluvial terraces.

Soil Unit: 2 - 1

Soil Classification: Eluviated Eutric Brunisols with significant Orthic Gray Luvisols

Parent Material: Gravelly glaciofluvial materials

Topography: Level to gently sloping

Drainage: Well to rapidly drained

Profile description of dominant soil subgroup:

Horizon	Color	Thickness (cm)	pH	Consistence when dry	USDA texture
LFH	Dark brown (d)	8	5.5-6.5		
Ae	Light gray (d)	5	5.5-6.5	soft	GLFS
Bm	Brown (d)	30	5.5-6.5	soft	GLS
Ck	Gray brown (d)	35+	7.0-8.0		G

Comments: Gravel in Ck effervesences on under side of pebbles.

Soil Unit: 2 - 2

Soil Classification: Eluviated Eutric Brunisols with significant Orthic Gray Luvisols

Parent Material: Fine sandy loam over gravelly glaciofluvial materials

Topography: Level to gently sloping

Drainage: Well drained

Profile description of dominant soil subgroup:

Horizon	Color	Thickness (cm)	pH	Consistence when dry	USDA texture
LFH	Dark brown (d)	8	6.5-5.0		
Ae	Light gray (d)	5	5.5-6.5	soft	LVFS
Bm	Brown (d)	25	5.5-6.5	soft	VFSL
IIBm	Brown (d)	10	5.5-6.5		GLFS
IICk	Gray brown (d)	40+	7.0-8.0		GLFS

3. Soils developed on variable textured fluvial deposits on recent fluvial floodplains.

Soil Unit: 3 - 1

Soil Classification: Cumulic Regosols with significant Orthic Humic Gleysols and Orthic Regosols

Parent Material: Variable textured recent fluvial

Topography: Gently undulating to undulating

Drainage: Poorly to rapidly drained

Profile description of dominant soil subgroup:

Horizon	Color	Thickness (cm)	pH	Consistence when dry	USDA texture
Ah	Dark gray brown (m)	3	6.5-7.0	soft	GL-L
C	Gray brown (m)	20	6.5-7.0	soft	G-CL
Ahb	Dark gray brown (m)	3	6.5-7.0	soft	GL-L
C	Gray brown (m)	26+	6.5-7.0	soft	G-CL

Comments: This unit is actually a soil complex.

4. Soils developed on medium to moderately fine textured till on morainal landforms.

Soil Unit: 4 - 1

Soil Classification: Orthic Gray Luvisols with significant Brunisolic Gray Luvisols

Parent Material: Medium to moderately fine textured till

Topography: Gently to strongly rolling

Drainage: Well drained

Profile description of dominant soil subgroup:

Horizon	Color	Thickness (cm)	pH	Consistence when dry	USDA texture
LFH	Brown (d)	4	5.5-6.0		
Ae	Light yellowish brown (d)	15	5.5-6.5	soft	L
Bt	Dark yellowish brown (d)	20	5.5-6.5	slightly hard	CL
BC	Dark grayish brown (d)	32	6.0-7.0	slightly hard	L-CL
Ck	Dark grayish brown	67+	7.5-8.5		C-CL

Comments: Brunisolic Gray Luvisols have a brown Bm horizon developed within the Ae horizon. Stones occur throughout the profile.

Soil Unit: 4 - 2

Soil Classification: Orthic Dark Gray Chernozem with significant Dark Gray Luvisols

Parent Material: Medium to moderately fine textured till

Topography: Gently undulating to undulating

Drainage: Well drained

Profile description of dominant soil subgroup:

Horizon	Color	Thickness (cm)	pH	Consistence when dry	USDA texture
Ahe	Dark gray (d)	18	6.0-6.5	soft	L
Ae	Light yellowish brown (d)	5	6.0-6.5	soft	VFSL
Bt	Dark yellowish brown (d)	20	5.5-6.5	slightly hard	CL
BC	Dark grayish brown (d)	20	6.5-7.0	slightly hard	L-CL
Ck	Grayish brown (d)	63+	7.5-8.5		C-CL

Comments: These soil units occur as very small areas along the edges of depressional areas. Stones occur throughout the profile.

Soil Unit: 4 - 3

Soil Classification: Orthic Humic Gleysol-peaty with significant Orthic Humic Gleysol

Parent Material: Medium to moderately fine textured till

Topography: Depressional and gently rolling to rolling

Drainage: Poorly drained

Profile description of dominant soil subgroup:

Horizon	Color	Thickness (cm)	pH	Consistence when dry	USDA texture
Om	Brown (m)	25	5.0-6.0		
Ahg	Black (m)	10	5.0-6.0	soft	L
Bg	Gray Brown (m)	30	5.5-6.5	hard	CL
Ckg	Gray (m)	40+	7.5-8.5		C-CL

Comments: A, B and C horizons are strongly gleyed and mottled

---

5. Soils developed on medium textured undifferentiated till-like deposits over mudstone or sandstone in morainal veneer areas. These deposits range between 10 cm and 1 metre in thickness.

Soil Unit: 5 - 1

Soil Classification: Orthic Gray Luvisol with significant Eluviated Eutric Brunisols

Parent Material: Medium textured undifferentiated till-like deposits

Topography: Gently to strongly rolling

Drainage: Well drained

Profile description of dominant soil subgroup:

Horizon	Color	Thickness (cm)	pH	Consistence when dry	USDA texture
LFH	Brown (d)	8	5.0-5.5		
Ahe	Dark gray (d)	2	5.5-6.0	soft	L
Ae	Light gray (d)	8	5.5-6.0	soft	L
Bt	Dark yellowish brown (d)	10	5.0-6.0	slightly hard	CL
IIC	Yellowish brown (d)	20+	7.0-7.5	soft	SL

Comments: Stones and sandstone fragments occur throughout the top 20 cm of the profile.

---

6. Soils developed on fine textured undifferentiated till-like deposits overlying shale in morainal blanket areas.

Soil Unit: 6 - 1

Soil Classification: Orthic Gray Luvisol

Parent Material: Fine textured undifferentiated till-like deposits

Topography: Gently undulating to strongly rolling

Drainage: Moderately well drained

Profile description of dominant soil subgroup:

Horizon	Color	Thickness (cm)	pH	Consistence when dry	USDA texture
LFH	Dark brown (d)	10	5.0-5.5		
Ae	Light gray (d)	8	5.5-6.5	slightly hard	SiL
Bt1	Dark yellowish brown (d)	15	5.5-6.5	hard	HvC
Bt2	Dark brown (d)	30	6.0-6.5	hard	HvC
Ck	Dark Gray (d)	75	7.5-8.5		HvC
R	Gray (d)	128+			C

Comments: These deposits range from 1 metre to 10 metres and are thick enough to mask minor irregularities in the underlying shale. Stones and shale fragments occur throughout the top 1 metre of the profile.

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7. Soils developed on medium to moderately fine textured lacustrine materials

Soil Unit: 7 - 1

Soil Classification: Orthic Dark Gray Chernozems with significant Dark Gray Luvisols

Parent Material: Medium to moderately fine textured lacustrine

Topography: Gently undulating to undulating

Drainage: Well drained

Profile description of dominant soil subgroup:

Horizon	Color	Thickness (cm)	pH	Consistence when dry	USDA texture
LFH	Dark brown (d)	10	5.5-6.0		
Ahe	Dark gray (d)	15	5.5-6.5	soft	SiL
AB	Brown and pale brown (d)	8	5.0-6.0	slightly hard	SiCL

Bt	Dark brown (d)	30	5.5-6.5	hard	SiC
Ck	Olive gray (m)	53+	7.5-8.5		SiCL

Comments: Ck is highly stratified. Bt often has dark surface coatings.

Soil Unit: 7 - 2

Soil Classification: Orthic Gray Luvisol with significant Orthic Humic Gleysol

Parent Material: Medium to moderately fine textured lacustrine

Topography: Gently undulating to undulating

Drainage: Well drained

Profile description of dominant soil subgroup:

Horizon	Color	Thickness (cm)	pH	Consistence when dry	USDA texture
LFH	Dark brown (d)	10	5.0-5.5	soft	SiL
Ahe	Dark gray (d)	2	5.0-6.0	soft	SiL
Ae	Light gray (d)	25	5.0-6.0	slightly hard	SiL
Bt	Dark yellowish brown (d)	20	5.0-6.0	soft	CL
BC1	Brown (d)	25	6.0-6.5	soft	SiCL
BC2	Grayish brown (m)	20	6.5-7.0	soft	FSL
Ck	Gray (m)	92+	7.5-8.5		SiCL

Comments: Orthic Humic Gleysols occur in small depressions throughout the area.

Soil Unit: 7 -3

Soil Classification: Orthic Humic Gleysols with significant Orthic Humic Gleysols - peaty

Parent Material: Medium to moderately fine textured lacustrine

Topography: Depressional

Drainage: Poorly drained

Profile description of dominant soil subgroup:

Horizon	Color	Thickness (cm)	pH	Consistence when dry	USDA texture
Om	Dark brown (m)	15	5.0-5.5		
Ah	Black (m)	10	5.0-5.5	soft	SiL

Bg	Dark gray brown (m)	30	5.5-6.5	hard	CL
Ckg	Gray brown (m)	40+	7.5-8.5		SiCL

Comments: A, B & C horizons are strongly gleyed and mottled

---

8. Soils developed on unconsolidated bedrock overlying consolidated bedrock in steeply sloping rock landform areas.

Soil Unit: 8 - 1

Soil Classification: Eluviated Eutric Brunisols - lithic phase with significant Eluviated Eutric Brunisols

Parent Material: Unconsolidated mudstone/consolidated mudstone

Topography: Very steeply to extremely sloping

Drainage: Rapidly drained

Profile description of dominant soil subgroup:

Horizon	Color	Thickness (cm)	pH	Consistence when dry	USDA texture
LFH	Dark brown (d)	8	5.5-6.0		
Aej	Pale brown (d)	8	5.5-6.0	soft	FSL
Bm	Yellowish brown (d)	10	5.5-6.0	soft	L
C	Brown (d)	10	5.5-6.0	soft	L
R	Brown (d)	28+			

Comments: Top 28 inches of profile high in quartzite content and mudstone fragments.

Soil Unit: 8 - 2

Soil Classification: Eluviated Eutric Brunisols with significant Orthic Eutric Brunisols

Parent Material: Unconsolidated shale overlying consolidated shale

Topography: Very steeply to extremely sloping

Drainage: Rapidly drained

Profile description of dominant soil subgroup:

Horizon	Color	Thickness (cm)	pH	Consistence when dry	USDA texture
LFH	Dark brown (d)	3	5.0-5.5		
Aej	Grayish brown (d)	3	5.0-6.0	soft	CL
Bm	Dark grayish brown (d)	20	5.5-6.5	slightly hard	C
Ck	Dark gray (d)	20	7.5-8.5		C
R	Gray (d)	43+			

Comments: Grayish brown Aej horizon may or may not occur in profile.

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9. Soils developed on organic material.

Soil Unit: 9 - 1

Soil Classification: Typic Mesisols with significant Terric Mesisols

Parent Material: Fennic peat

Topography: Depressional

Drainage: Very poorly drained

Profile description of dominant soil subgroup:

Horizon	Color	Thickness (cm)	pH	Consistence when dry	USDA texture
Of	Dark brown (m)	20	5.0-5.5		
Om	Dark yellowish brown (m)	200	5.0-5.5		
Oh	Black (m)	50	5.0-5.5		
Cg	Gray				

Comments: Terric Mesisols have mineral Cg horizons within 160 cm of the surface.

Engineering Properties of the Soils

Engineering test data determined on representative soil samples are presented in Table 4. The samples analyzed were taken from subsoils of the soil units at representative sites. Depth of sampling generally ranged between 0.75 and 1.25 metres below the surface. A brief description of the significance of each engineering parameter follows:

1. Atterberg Limits

In soil mechanics, plasticity is defined as that property of a material which allows it to be deformed rapidly, without rupture, without rebound, and without volume change (Means and Parcher. 1964).

Tests have been devised to determine the moisture content of a soil at which it changes from one major physical condition to another (PCA Soil Primer, 1962). These tests conducted on the material passing the no. 40 sieve (0.42 mm) have been used as key factors in classifying soils for structural purposes.

The tests used for estimating plasticity are plastic limit, liquid limit, and plasticity index. The plastic limit is the moisture content at which the soil passes from a semisolid to a plastic state. The liquid limit is the moisture content at which the soil passes from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid and plastic limits. These three are known as Atterberg limits.

The plasticity index gives the range in moisture content at which a soil is in a plastic condition. A small plasticity index, such as 5, indicates that a small change in moisture content will change the soil from a semisolid to a liquid condition. A large plasticity index, such as 20, shows that a considerable amount of water can be added before a soil changes to a liquid condition.

2. Textural Classification

(a) AASHO Classification System (PCA Soil Primer, 1962).

The American Association of State Highway Officials system is an engineering property classification based on field performance of highways. In the AASHO system, the sieve analyses and the Atterberg limits are used to separate the soil material into seven basic groups A-1 to A-7. The best soils for road subgrades are classified as

TABLE 4. Engineering and Chemical Soil Data of Representative Soil Samples from the Bragg Creek Area

Soil Unit	Horizon	(cm) Depth from surface	pH	%N	%C	$CaCO_3$ equiv.	GRAIN ANALYSIS											TEXTURAL CLASSIFICATION		
							% Passing Sieve							% smaller than		Atterberg Limits				
							1"	3/4"	5/8"	#4	#10	#40	#200	.05 mm	.002 mm	L.L	P.I	AASHO	Unified	USDA
1 - 1	Ahe	3-10	6.0	0.17	2.0															
	Bt	10-20	5.5																	
	BC	20-40	5.5																	
	C	40	5.5			0.0	87	82	65	65	62	52	45	42	23	20	10	A4(3)	CL	GSCL
2 - 1	CK	90-120					64	55	52	30	19	10	5			NP	NP	A1(0)	GM	VGLS
2 - 2	CK	30-40	7.5			35.6	100	100	100	100	99	98	88	72	14	29	7	A4(8)	ML	SiL
4 - 1	Ae	3-10	5.9	0.12	1.5															
	Bt	10-33	6.3																	
	BC	33-73	7.0																	
	CK	73	8.1			5.2	91	87	81	64	64	58	48	48	22	26	10	A4(3)	CL-ML	GL
6 - 1	Ae	0-5	5.4	0.11	1.9		100	100	100	100	100	100	92	71	34	32	8	A4(8)	ML	SiCL
	Bt1	5-20	5.1				100	100	100	100	100	100	99	97	63	61	32	A7-6(20)	CH	HvC
	Bt2	20-50	5.7				100	100	100	100	100	100	100	100	84	68	32	A7-6(20)	CH	HvC
	CK	50	8.0			30.3	100	100	99	99	99	98	95	90	70	57	30	A7-6(18)	CH	HvC
7 - 1	Ah	0-12	5.7	0.66	7.2															
	Btj	18-40	5.2																	
	BC1	40-105	6.0																	
	BC2	105-135	7.0																	
	CK	135	8.0			23.8	100	100	100	100	100	100	98	94	50	43	22	A7-6(17)	CL	SiC

N.P. non-plastic

A-1, the poorest as A-7.

In recent years these seven basic groups have been divided into subgroups with a group index that was devised to approximate within group evaluations. Group indices range from 0 for the best subgrade material to 20 for the poorest.

(b) Unified Soil Classification System (PCA Soil Primer, 1962).

In this system, the soils are identified according to their sieve analyses and Atterberg limits, and are grouped according to their performance as engineering construction materials. Soil materials are divided into coarse grained soils, fine grained soils and highly organic soils. The coarse grained soils are subdivided into eight classes; the fine grained into six classes; and there is one class of highly organic soils.

Coarse grained soils are those that have 50% or less of material passing the number 200 sieve; fine grained soils have more than 50% of material passing the number 200 sieve. The letters G, S, C, M, W, P, L and H stand for gravel, sand, clay, silt, well graded, poorly graded, low liquid limit and high liquid limit, respectively.

The designation CL for example, indicates inorganic clays of low liquid limit; SW indicates well graded sand; and SC indicates clayey sands.

(c) United States Department of Agriculture Classification System

The system is defined on page 7 in section 1 of this report. A comparison of the different systems is given in the PCA Soil Primer.

SOIL INTERPRETATIONS

Slight, moderate and severe limitations of mapping units for selected uses are indicated in Tables 5 to 30 accompanied by the guides used for assessing these limitations.

Well drained, gently undulating to gently rolling soils on lacustrine, fluvial lacustrine and till parent materials have slight to moderate limitations for most urban uses. Rapidly drained soils on gravelly glaciofluvial deposits have severe limitations for those uses dealing with sewage and refuse disposal due to the possibility of groundwater contamination. Soils in morainal veneer and those occurring on steep slopes are severely limited by slope and shallow depth to bedrock. Steeply sloping soils on morainal blankets over unconcolidated shale have severe limitations for building and

roads due to a possible slumping hazard caused by low soil stability. Poorly and very poorly drained soils have severe limitations for all urban uses due to a seasonally or permanently high water level (United States Dept. of Agriculture, Soil Conservation Service. 1971). The better soils in the area are rated as Class 5 for agricultural capability as indicated in Table 30. Climatic limitations together with steepness of slope, poor drainage, droughtiness and possible flooding hazard limit the area in terms of agricultural development (Bowser. 1967).

TABLE 5. GUIDES FOR ASSESSING SOIL LIMITATIONS FOR ROAD LOCATION

Properties that affect design and construction of roads are (1) those that affect the load supporting capacity and stability of the subgrade; and (2) those that affect the workability and amount of cut and fill. The AASHO and Unified Classification, and the shrink-swell potential give an indication of the traffic supporting capacity. Wetness and flooding affect stability. Slope, depth of bedrock, stoniness, rockiness, and wetness affect the ease of excavation and the amount of cut and fill to reach an even grade.

Soil limitation ratings do not substitute for basic soil data or for onsite investigations.

Item Affecting Use	Degree of Soil Limitation		
	NONE TO SLIGHT	MODERATE	SEVERE
Soil drainage class[1]	Rapidly[1], well and moderately well drained	Imperfectly drained	Poorly and very poorly drained
Flooding	None	Once in 5 years	More than once in 5 years
Slope	0 to 9% (AD)	9 to 15% (E)	More than 15% (>E)
Depth to Bedrock	More than 100 cm	50 to 100 cm	Less than 50 cm
Subgrade[2]			
a. AASHO Group Index[3]	0 to 4	5 to 8	more than 8
b. Unified soil classes	GW, GP, SW, GM, SM, and GC[4] and SC[4]	CL(with PI[5] less than 15), ML, SP	CL(with PI[5] 15 or more), CH, MH, OH, OL, Pt
Shrink-swell[6] potential	Low (PI[5] less than 15)	Moderate (PI[5] 10 to 15)	High (PI[5] greater than 20)
Susceptibility to frost heave[7]	Low (F1, F2)	Moderate (F3)	High (F4) (silty & peaty soils)
Stoniness	Stones greater than 1.5 m apart	Stones 0.5 to 1.5 m apart	Stones less than 0.5 m apart
Consolidated Bedrock exposures	Rock exposures greater than 90 m apart and cover less than 2% of the surface	Rock exposures 30 to 90 m apart and cover 2 to 10% of the surface	Rock exposures less than 30 m apart and cover greater than 10% surface

1. For an explanation of soil drainage classes see page
2. This item estimates the strength of a soil as it applies to roadbeds. When available, AASHO Group Index values from laboratory tests were used; otherwise the estimated Unified classes were used. On unsurfaced roads, rapidly drained, very sandy poorly graded soils may cause washboard or rough roads.
3. Group Index values were estimated from information published by the Portland Cement Assn. 1962. pp 23 - 25.
4. Downgrade to moderate if content of fines (less than 200 mesh) is greater than about 30%.
5. PI means plasticity index.
6. Inherent swelling capacity is estimated as low when the plasticity index is less than 15, medium when the plasticity index is 10 to 15 and high when the plasticity index is greater than 20 (Terzaghi and Peck. 1967) Gravelly and stony soils may not exhibit shrink-swell as estimated by the plasticity index because of dilution of the fines with coarse fragments. In these situations decrease a severe limitation to moderate and a moderate limitation to slight.
7. Frost heave is important where frost penetrates below the hardened surface layer and moisture transportable by capillary movement is sufficient to form ice lenses at the freezing front. The susceptibility classes are taken from the United States Army Corps of Engineers (1962), pp. 5 - 8. (See table 6)

TABLE 6. FROST DESIGN SOIL CLASSIFICATION

Frost Group	Kind of Soil	% by weight finer than 0.02 mm	Unified Soil Classification System Soil Texture Type
F1	Gravelly soils	3-10	GW, GP, GW-GM, GP-GM
F2	Gravelly soils	10-20	GM, GW-GM, GP-GM
	Sands	3-15	SW, SP, SM, SW-SM, SP-SM
F3	Gravelly soils	>20	GM, GC
	Sands (except very fine silty sands)	>15	SM, SC
	Clays Pl > 12		CL, CH
	All silts		ML, MH
F4	Very fine silty sands	>15	SM
	Clays Pl < 12		CL, CL-ML
	Varved clays and other fine grained banded sediments		CL and ML; CL, ML and SM; CL, CH and ML; CL, CH, CL and SM

Potential frost action refers to the probable effects on structures, resulting from the freezing of soil material and its subsequent thawing. The action not only pertains to the heaving of soil as freezing progresses but also to the excessive wetting and loss of soil strength during thaw. Damage to structures from frost action results not from the freezing of the soil itself but from the formation of ice lenses in the soil. In turn, the formation of ice lenses depends on the capacity of the soil to deliver water to a stationary or slowly moving freezing front. Thus poorly drained soils with a high water content are more subject to frost action than well drained soils.

TABLE 7. LIMITATION OF SOILS FOR ROAD LOCATION

Mapping Units	Degree of Limitation	Limiting Property (from Table 5)
1-1/bc	Slight	
1-1/de	Moderate	Steep Slopes
1-2/bc	Slight	
2-1/AC	Moderate	Flooding hazard
2-2/AC	Moderate	Flooding hazard
3-1/bc	Severe	Flooding hazard
4-1/de	Moderate	Moderately steep slopes, moderate subsoil texture limitation
4-1/f	Severe	Very steep slopes, moderate subsoil texture limitation
4-2/bc	Moderate	Moderate subsoil texture limitation
4-3/A	Severe	Very shallow depth to seasonally high water table, high susceptibility to frost heave
4-3/de	Severe	Very shallow depth to seasonally high water table, high susceptibility to frost heave, steep slopes
5-1/de	Severe	Shallow depth to bedrock, moderately steep slopes
5-1/f	Severe	Shallow depth to bedrock, very steep slopes
6-1/bc	Severe	Severe subsoil texture limitation, high shrink-swell potential
6-1/de	Severe	Severe texture limitation, high shrink-swell potential, moderately steep slopes, low soil stability
6-1/f	Severe	Severe subsoil texture limitation, high shrink-swell potential, very steep slopes, low soil stability
7-1/bc	Moderate	Moderate subsoil texture limitations
7-2/bc	Moderate	Moderate subsoil texture limitation
7-3/A	Severe	Very shallow depth to seasonally high water table, high susceptibility to frost heave
8-1/GH	Severe	Extremely steep slopes, shallow depth to bedrock
8-2/GH	Severe	Extremely steep slopes, shallow depth to bedrock
9-1/A	Severe	Very shallow depth to permanently high water table

TABLE 8. GUIDES FOR ASSESSING SOIL LIMITATIONS FOR PERMANENT BUILDINGS[1]

This guide provides ratings for undisturbed soils evaluated for single storey buildings and other structures with similar foundation requirements. The emphasis for rating soils for buildings is on foundations; but soil slope, and susceptibility to flooding and other hydrologic conditions, such as seasonal wetness, that have effects beyond those related exclusively to foundations are considered. Also considered are soil properties, particularly depth to bedrock, which influence excavation and construction costs, both for the building itself and for the installation of utility lines. Excluded are limitations for soil corrosivity, landscaping and spetic tank absorption fields. On site investigations are needed for specific placement of buildings and utility lines, and for detailed design of foundations. All ratings are for undisturbed soils based on information gained from observations to a depth of 4 to 6 feet.

Item Affecting Use	Degree of Soil Limitation		
	NONE TO SLIGHT	MODERATE	SEVERE
Wetness[3]	With basements: Rapidly drained and well drained. Without basements: Rapidly, well and moderately well drained.	With basements: Moderately well drained Without basements: Imperfectly drained.	With basements: Imperfectly, poorly & very poorly drained. Without basements: Poorly & very poorly drained.
Depth to seasonal water table (seasonal means 1 month or more)	With basements: Below 150 cm Without basements: Below 75 cm	With basements: Below 75 cm Without basements: Below 75 cm	With basements: Above 75 cm Without basements: Above 60 cm
Flooding	None	None	Subject to flooding
Slope	0 to 9% (AD).	9 to 15% (E).	More than 15% (>E).
Shrink-swell Potential	Low	Moderate	High
Unified soil group[5]	GW,GP,SW,SP,GM, GC,SM,SC	ML,CL	CH,MH,OL,OH,Pt.
Potential frost action[6]	Low (F1,F2).	Moderate (F3).	High (F4).
Stoniness	Stones greater than 8 m apart	Stones 1.5 to 8 apart	Stones less than -1.5 m apart
Potential Concrete Corrosion	0.00 to 0.10% sulphate	0.10 - 0.50% sulphate	greater than 0.50% sulphate
Depth to Bedrock	With basements: More than 150 cm Without basements: More than 100 cm	With basements: 100 to 150 cm Without basements: 50 to 100 cm	With basements: Less than - 100 cm Without basements: Less than 50 cm

1. By reducing the slope limits by ½, this table can be used for evaluating soil limitations for buildings with large floor areas but with foundation requirements not exceeding those of ordinary 3-storey dwellings.
2. Some soils rated as having moderate or severe limitations may be good sites for an aesthetic or use standpoint but require more preparation or maintenance.
3. For an explanation of soil drainage classes see page
4. Reduce slope limits by ½ for those soils subject to hillside slippage.
5. This item estimates the strength of the soil, that is its ability to withstand applied loads.
6. The potential frost action classes are taken from the United States Army Corps of Engineers (1962), pp. 5 - 8. See Table 6.

TABLE 9. LIMITATIONS OF SOILS FOR PERMANENT BUILDINGS

Mapping Units	Degree of Limitation	Limiting Property (from Table 8)
1-1/bc	Slight	
1-1/de	Moderate	Moderately steep slopes
1-2/bc	Slight	
2-1/AC	Moderate	Moderate flooding hazard
2-2/AC	Moderate	Moderate flooding hazard
3-1/bc	Severe	Severe flooding hazard
4-1/de	Moderate	Moderate texture limitation, moderately steep slopes
4-1/f	Severe	Very steep slopes, moderate texture limitation
4-2/bc	Moderate	Moderate texture limitation
4-3/A	Severe	Very shallow depth to seasonally high water table, high susceptibility to frost heave
4-3/de	Severe	Very shallow depth to seasonally high water table, high susceptibility to frost heave
5-1/de	Severe	Very shallow depth to bedrock, moderately steep slopes
5-1/f	Severe	Very shallow depth to bedrock, very steep slopes
6-1/bc	Severe	Severe texture limitation, high shrink-swell potential
6-1/de	Severe	Severe texture limitation, high shrink-swell potential, low soil stability (slumping hazard)
6-1/f	Severe	Severe texture limitation, high shrink-swell potential, low soil stability (slumping hazard), very steep slopes
7-1/bc	Moderate	Moderate texture limitation
7-2/bc	Moderate	Moderate texture limitation
7-3/A	Severe	Very shallow depth to seasonally high water table
8-1/GH	Severe	Extremely steep slopes, low soil stability, very shallow depth to bedrock
8-2/GH	Severe	Extremely steep slopes, low soil stability, very shallow depth to bedrock
9-1/A	Severe	Very shallow depth to seasonally high water table

TABLE 10. GUIDES FOR ASSESSING SOIL LIMITATIONS FOR SEWAGE LAGOONS

A sewage lagoon (aerobic) is a shallow lake used to hold sewage for the time required for bacterial decomposition. Soils have two functions, (1) as an impounding vessel and (2) as material for the impounding embankment. When the lagoon is properly constructed it must be capable of holding water with minimum seepage.

Item Affecting Use	Degree of Soil Limitation		
	SLIGHT	MODERATE	SEVERE
Depth to water table[1] (seasonal or year round)	more than 150 cm	100-150 cm	less than 100 cm
Flooding[2]	None	None	Soils subject to flooding
Depth to Consolidated Bedrock	more than 150 cm	100-150 cm	less than 100 cm
Slope	less than 2%	2 - 9%	more than 9%
Organic Matter[4]	less than 2%	2 - 15%	more than 15%
Unified Soil Group[3]	GC,SC,CL,CH	GM,ML,SM,MH	GP,GW,SW,SP,[5] OL,OH,Pt

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

2. Disregard flooding if it is not likely to enter to damage the lagoon (low velocity and depth less than five feet).

3. Rated mainly for the floor of the lagoon.

4. Organic matter promotes growth of aquatic plants which are detrimental to the proper functioning of the lagoon.

5. Coarse textures constitute a possibility of groundwater contamination if floor of lagoon is not lined with impermeable material.

TABLE 11. LIMITATIONS OF SOILS FOR SEWAGE LAGOONS

Mapping Units	Degree of Limitation	Limiting Property (from Table 10)
1-1/bc	Moderate	Moderate slope limitation
1-1/de	Severe	Severe slope limitation
1-2/bc	Moderate	Moderate slope limitation
2-1/AC	Severe	Severe texture limitation, high groundwater contamination hazard
2-2/AC	Severe	Severe texture limitation, high groundwater contamination hazard
3-1/bc	Severe	High flooding hazard
4-1/de	Severe	Very steep slopes
4-1/f	Severe	Very steep slopes
4-2/bc	Moderate	Moderate slopes
4-3/A	Severe	Very shallow depth to seasonally high water table, high groundwater contamination hazard
4-3/de	Severe	Very shallow depth to seasonally high water table, high groundwater contamination hazard
5-1/de	Severe	Shallow depth to bedrock, steep slopes
5-1/f	Severe	Shallow depth to bedrock, very steep slopes
6-1/bc	Moderate	Moderately steep slopes
6-1/de	Severe	Very steep slopes
6-1/f	Severe	Very steep slopes
7-1/bc	Slight	
7-2/bc	Slight	
7-3/A	Severe	Very shallow depth to seasonally high water table, high groundwater contamination hazard
8-1/GH	Severe	Extremely steep slopes, very shallow depth to bedrock
8-2/GH	Severe	Extremely steep slopes, very shallow depth to bedrock
9-1/A	Severe	Very shallow depth to seasonally high water table, high groundwater contamination hazard

TABLE 12. GUIDES FOR ASSESSING SOIL LIMITATIONS FOR SEPTIC TANK ABSORPTION FIELDS

Item Affecting Use	Degree of Soil Limitation		
	SLIGHT	MODERATE	SEVERE
Permeability Class	Moderately rapid (approx. 4-12 cm/hr)	Moderate (approx. 2-4 cm/hr)	Slow (less than 2 cm/hr)
Percolation rate [1]	Approx. 8-18 min/cm	18-24 min/cm	Slower than 24 min/cm
Depth to seasonal water table	More than 180 cm	120 - 180 cm	Less than 120 cm
Flooding hazard	Not subject to flooding	Not subject to flooding	Subject to flooding
Slope	0 - 9 percent	9 - 15 percent	15 to 30 percent
Depth to bedrock or other impervious materials	More than 180 cm	120 - 180 cm	Less than 120 cm

[1] Field percolation test results are reliable only if the moisture is at or near field capacity when the test is run. In fact, nearly impermeable soils on which absorption fields have failed can give high percolation test results after periods of drought.

These guides apply to soils to be used as an absorption and filtering medium for effluent from septic tanks. A rating of severe need not mean that a septic tank system should not be installed but rather it indicates the difficulty and cost to be expected in installation and maintenance.

Permeability ratings are for soil layers at and below the depth of the tile line. Soils having a permeability rate greater than about 12 cm/hr or percolation rate less than about 8 min/cm are likely to present a pollution hazard to adjacent waters (Alberta Department of Manpower and Labour. 1972). The degree of hazard must however, be assessed by examining the proximity of the proposed installation to water bodies or the water table.

A seasonal water table, i.e. one persisting for more than one month, should be at least 120 cm below the bottom of the trench for soils having a slight to moderate limitation (United States Department of Health, Education and Welfare. 1969). It may, with caution, be possible to make some adjustment for the severity of a water table limitation in those cases where seasonal use of the facility does not coincide with the period of high water table.

The typical homeowner regards a soil absorption system as satisfactory as long as it can receive all the wastewater being generated without overflowing in the house itself (hydraulic failure). Soil absorption systems which are adequate hydraulically may fail by: (a) delivering excessive numbers of potentially pathogenic bacteria and viruses to private or public water supplies; (b) causing increased nitrogen and phosphorus inputs in ground or surface water supplies, which may in turn enhance eutrophication of surface water or cause potentially toxic nitrate levels in drinking water supplies (Beatty, M.T. and J. Bouma. 1973).

Failures due to inadequate removal of pathogens, nitrogen and phosphorus occur when there is inadequate soil (due to lack of thickness or to coarse texture) between a soil absorption system and highly porous material such as creviced bedrock or gravel (Bouma et al. 1972). Failure due to excessive build up of nitrogen or phosphorus in ground and surface waters may occur when there are too many homesites per unit area, even though the individual systems may each be functioning adequately to remove pathogens and absorb the liquid waste (Walker et al. 1973a, 1973b).

TABLE 13. LIMITATIONS OF SOILS FOR SEPTIC TANK SOIL ABSORPTION SYSTEMS

Mapping Units	Degree of Limitation	Limiting Property (from Table 12)
1-1/bc	Severe	Excessive stoniness
1-1/de	Severe	Excessive stoniness
1-2/bc	Severe	Excessive stoniness
2-1/AC	Severe	Rapid permeability, high groundwater contamination hazard
2-2/AC	Severe	Rapid permeability, high groundwater contamination hazard
3-1/bc	Severe	High flooding hazard
4-1/de	Moderate	Moderate permeability and slopes
4-1/f	Severe	Steep slopes
4-2/bc	Moderate	Moderate permeability
4-3/A	Severe	Very shallow depth to seasonally high water table, high groundwater contamination hazard
4-3/de	Severe	Very shallow depth to seasonally high water table, high groundwater contamination hazard, steep slopes
5-1/de	Severe	Shallow depth to bedrock
5-1/f	Severe	Shallow depth to bedrock, steep slopes
6-1/bc	Severe	Slow permeability
6-1/de	Severe	Slow permeability
6-1/f	Severe	Slow permeability, steep slopes
7-1/bc	Slight	
7-2/bc	Slight	
7-3/A	Severe	Very shallow depth to seasonally high water table, high groundwater contamination hazard
8-1/GH	Severe	Extremely steep slopes, very shallow depth to bedrock
8-2/GH	Severe	Extremely steep slopes, very shallow depth to bedrock
9-1/A	Severe	Very shallow depth to seasonally high water table, high groundwater contamination hazard

TABLE 14. GUIDES FOR ASSESSING SOIL LIMITATIONS FOR TRENCH-TYPE SANITARY LANDFILLS

The trench-type sanitary landfill is a dug trench in which refuse is placed and covered daily with a layer of soil material. The daily depths of cover should be at least 15 cm and the final depth of top layer at least 60 cm. Because trenches are 5 metres or more deep, geological investigation is needed to determine the potential for pollution of groundwater as well as to ascertain the design. The presence of hard non-rippable bedrock or gravelly strata in or immediately underlying the trench bottom is undesirable from the stand points of excavation and potential pollution of groundwater.

Item Affecting Use	Degree of Soil Limitation		
	SLIGHT	MODERATE	SEVERE
Depth to seasonal water table	Not class determining if more than 180 cm		Less than 180 cm
Soil drainage class	Rapidly, well and moderately well drained	Imperfectly drained	Poorly and very poorly drained
Flooding	None	Rare	Occasional
Permeability	Less than 5 cm/hr	Less than 5 cm/hr	More than 5 cm/hr
Slope	0 - 15 percent	15 - 25 percent	More than 25 percent
Soil Texture[1] (dominant to a depth of 150 cm)	Sandy loam, loam silt loam, sandy clay loam	Silty clay loam, Clay loam, sandy clay, loamy sand	Silty clay, clay, muck peat, gravel sand
Depth to bedrock Hard	More than 180 cm	More than 180 cm	Less than 180 cm
non-rippable	More than 150 cm	Less than 150 cm	Less than 150 cm
Stoniness class	Slightly stony	Moderately	Very to excessively stony
Rockiness class	None	None	Slightly to extremely rocky

1. Soil texture reflects ease of digging and moving and trafficability in the area.

TABLE 15. LIMITATION OF SOILS FOR TRENCH-TYPE SANITARY LANDFILLS

Mapping Units	Degree of Limitation	Limiting Property (from Table 14)
1-1/bc	Severe	Excessive stoniness
1-1/de	Severe	Excessive stoniness
1-2/bc	Severe	Excessive stoniness
2-1/AC	Severe	Severe texture limitation, high groundwater contamination hazard
2-2/AC	Severe	Severe texture limitation, high groundwater contamination hazard
3-1/bc	Severe	High flooding hazard
4-1/de	Moderate	Moderate stoniness texture limitations
4-1/f	Moderate	Moderate texture stoniness and slope limitations
4-2/bc	Moderate	Moderate texture and stoniness limitations
4-3/A	Severe	Very shallow depth to seasonal water table, high groundwater contamination hazard
4-3/de	Severe	Very shallow depth to seasonal water table, high groundwater contamination hazard
5-1/de	Severe	Very shallow depth to bedrock
5-1/f	Severe	Very shallow depth to bedrock
6-1/bc[1]	Severe	Very shallow depth to bedrock
6-1/de[1]	Severe	Very shallow depth to bedrock
6-1/f	Severe	Very shallow depth to bedrock
7-1/bc	Moderate	Moderate texture limitation
7-2/bc	Moderate	Moderate texture limitation
7-3/A	Severe	Very shallow depth to seasonal water table, high groundwater contamination hazard
8-1/GH	Severe	Extremely steep slopes, very shallow depth to bedrock
8-2/GH	Severe	Extremely steep slopes, very shallow depth to bedrock
9-1/A	Severe	Very shallow depth to seasonal water table, high groundwater contamination hazard

[1] Requires on-site investigation

TABLE 16. GUIDES FOR ASSESSING SOIL LIMITATIONS FOR SHALLOW EXCAVATIONS

Shallow excavations are those that require digging or trenching to a depth of less than 2 metres for pipelines, sewer lines, utility lines and basements. Desirable soil properties are good drainage, good workability, moderate resistance to sloughing, gentle slopes, absence of rock outcrops or large stones and freedom from flooding. Additional interpretations concerning shrink-swell potential and corrosivity are needed for ultimate uses of the excavation. Texture is used as an index to workability and sidewall stability. If the bedrock is soft enough so that it can be dug out with ordinary handtools or light equipment, reduce ratings from severe to moderate.

Item Affecting Use	Degree of Limitation		
	SLIGHT	MODERATE	SEVERE
Soil drainage class	Rapidly and well drained	Moderately well drained	Imperfectly to very poorly drained
Depth to seasonal water table	Below 150 cm	From 75 - 150 cm	Above 75 cm
Flooding	None	Rare	Occasional
Slope	0 - 8 percent	8 - 15 percent	More than 15 percent
Texture of soil to depth of excavation	Fine sandy loam, sandy loam, silt loam, silty clay loam, sandy clay loam	Silt, clay loam, sandy clay, all gravelly types	Clay, silty clay, loamy sand, organic soils, all very gravelly types
Depth to bedrock	More than 150 cm	100 to 150 cm	Less than 100 cm
Stoniness class	Slightly stony	Moderately stony	Very stony
Rockiness class	None	Slightly rocky	Moderately to very rocky

TABLE 17. LIMITATIONS OF SOILS FOR SHALLOW EXCAVATIONS

Mapping Units	Degree of Limitation	Limiting Property (from Table 16)
1-1/bc	Severe	Excessive stoniness
1-1/de	Severe	Excessive stoniness, steep slopes
1-2/bc	Severe	Excessive stoniness
2-1/AC	Severe	Low sidewall stability, occasional flooding
2-2/AC	Severe	Low sidewall stability, occasional flooding
3-1/bc	Severe	High flooding hazard
4-1/de	Moderate	Moderate slopes and stoniness
4-1/f	Severe	Steep slopes
4-2/bc	Moderate	Moderate stoniness
4-3/A	Severe	Very shallow depth to seasonal water table
4-3/de	Severe	Very shallow depth to seasonal water table
5-1/de	Severe	Shallow depth to non-rippable bedrock, steep slopes
5-1/f	Severe	Shallow depth to non-rippable bedrock, steep slopes
6-1/bc	Moderate	Shallow depth to rippable bedrock
6-1/de	Moderate	Shallow depth to rippable bedrock, moderately steep slopes
6-1/f	Severe	Steep slopes
7-1/bc	Slight	
7-2/bc	Slight	
7-3/A	Severe	Very shallow depth to seasonal water table
8-1/GH	Severe	Steep slopes
8-2/GH	Severe	Steep slopes
9-1/A	Severe	Very shallow depth to seasonal water table

TABLE 18. GUIDES FOR ASSESSING SOIL LIMITATIONS FOR CAMP AREAS (Montgomery and Edminster. 1966)

This guide applies to soils to be used intensively for trailers and tents and the accompanying activities of outdoor living. It is assumed that little site preparation will be done other than shaping and leveling for campsites and parking areas. The soil should be suitable for heavy foot traffic and for limited vehicular traffic.[1] Soil suitability for growing and maintaining vegetation is not part of this guide, except as influenced by moisture, but is an important item to consider in the final evaluation of site.

Item Affecting Use	Degree of Limitation		
	NONE TO SLIGHT	MODERATE	SEVERE
Wetness	Rapidly, well and moderately well drained soils. Water table below 75 cm during season of use	Moderately well and imperfectly drained soils. Water table below 50 cm during season of use	Imperfectly, poorly, and very poorly drained soils. Water table above 50 cm during season of use
Flooding	None	None during season of use	Floods during season of use
Permeability	Very rapid to moderate	Moderately slow and slow	Very slow
Slope	0 to 9 percent (AD)	9 to 15 percent (E)	Greater than 15 percent (greater than E)
Surface soil texture	SL,FSL,VFSL,L	SiL,CL,SCL,SiCL,LS and sand other than loose sand	SC,SiC,C, loose sand subject to severe blowing, organic soils
Coarse fragments[3] on surface	0 to 20 percent[4]	20 to 50 percent	Greater than 50 percent
Stoniness (stony)	Stones greater than 8 metres apart	Stones 8 to 1.5 metres apart	Stones less than 1.5 metres apart
Rockiness (rock)	No rock exposures	Rock exposures greater than 9 metres apart and cover less than 25 percent of the area	Rock exposures less than 9 metres apart and cover greater than 25 percent of the surface[5]

[1] For information specific to roads and parking lots see Table 5.

[2] Surface soil texture influences soil ratings as it affects foot trafficability, dust, soil permeability and erosion hazard.

[3] Coarse fragments include both gravels and cobbles. Gravels 2 - 80 mm, Cobbles 80 - 250 mm, Stones >250 mm.

[4] Some gravelly soils may be rated as slight if content of gravel exceeds 20 percent by only a small margin providing (a) the gravel is imbedded in the soil matrix or (b) the fragments are less than 20 mm in size.

[5] Very shallow soils are rated as having a severe soil limitation for rockiness or stoniness. See also definitions of rockiness and stoniness in the Canadian System of Soil Classification (Canada Soil Survey Committee. 1976) pp. 139 - 140.

TABLE 19. LIMITATIONS OF SOILS FOR CAMP AREAS

Mapping Units	Degree of Limitation	Limiting Property (from Table 18)
1-1/bc	Severe	Excessive stoniness
1-1/de	Severe	Excessive stoniness
1-2/bc	Severe	Excessive stoniness
2-1/AC	Severe	Excessive coarse fragments
2-2/AC	Slight	
3-1/bc	Severe	High flooding hazard
4-1/de	Moderate	Moderate stoniness and slopes
4-1/f	Severe	Steep slopes
4-2/bc	Moderate	Moderate stoniness
4-3/A	Severe	Poor drainage
4-3/de	Severe	Poor drainage
5-1/de	Moderate	Moderate stoniness and slopes
5-1/f	Severe	Steep slopes
6-1/bc	Slight	
6-1/de	Moderate	Moderate slopes
6-1/f	Severe	Steep slopes
7-1/bc	Moderate	Moderate texture limitation
7-2/bc	Moderate	Moderate texture limitation
7-3/A	Severe	Poor drainage
8-1/GH	Severe	Steep slopes
8-2/GH	Severe	Steep slopes
9-1/A	Severe	Poor drainage

TABLE 20. GUIDES FOR ASSESSING SOIL LIMITATIONS FOR PICNIC AREAS (Montgomery and Edminster. 1966)

This guide applies to soils considered for intensive use as park-type picnic areas. It is assumed that most vehicular traffic will be confined to access roads.[1] Soil suitability for growing and maintaining vegetation is not part of this guide, except as influenced by moisture, but is an important item to consider in the final evaluation of site.

Items Affecting Use	Degree of Soil Limitation		
	NONE TO SLIGHT	MODERATE	SEVERE
Wetness	Rapidly, well and moderately well drained soils. Water table below 50 cm during season of use	Moderately well and imperfectly drained soils. Water table during season of use may be less than 50 cm for short periods	Poorly and very poorly drained soils. Water table above 50 cm and often near the surface for a month or more during season of use
Flooding	None during season of use	May flood once a year for short period during season of use	Floods more than once a year during season of use
Slope	0 to 9 percent (AD)	9 to 15 percent (E)	Greater than 15 percent (greater than E)
Surface soil texture[2]	SL,FSL,VFSL,L	SiL,CL,SCL, SiCL,LS, and sand other than loose sand	SC,SiC,C, loose and subject to severe blowing, organic soils
Coarse fragments[3] on surface	0 to 20 percent[4]	20 to 50 percent	More than 50 percent
Stoniness[3]	Stones greater than 1.5 metres apart	Stones 0.5 to 1.5 metres apart	Stones less than 0.5 metres apart
Rockiness	Rock exposures roughly 30 to 90 or more metres apart and cover less than 10% of the surface	Rock exposures 10 to 30 metres apart and cover about 10 to 25 percent of the surface	Rock exposures less than 10 metres apart and cover greater than 25 percent of the surface

[1] For information specific to roads or parking lots see Table 5.

[2] Surface soil texture influences soil ratings as it affects foot trafficability, dust, soil permeability and erosion hazard.

[3] See also definitions for gravel, rockiness and stoniness in the Canadian System of Soil Classification (Canada Soil Survey Committee. 1976) pp 139 - 140. Coarse fragments include both gravel and cobbles. Gravels 2 - 80 mm, Cobbles 80 - 250 mm, Stones more than 250 mm.

[4] Some gravelly soils may be rated as slight if the content of gravel exceeds 20 percent by only a small margin providing (a) the gravel is embedded in the soil matrix or (b) the fragments are less than 20 mm in size.

TABLE 21. LIMITATIONS OF SOILS FOR PICNIC AREAS

Mapping Units	Degree of Limitation	Limiting Property (from Table 20)
1-1/bc	Moderate	Moderate stoniness limitation
1-1/de	Moderate	Moderate stoniness and slope limitation
1-2/bc	Moderate	Moderate stoniness limitation
2-1/AC	Moderate	Moderate coarse fragments limitation
2-2/AC	Slight	
3-1/bc	Severe	High flooding hazard
4-1/de	Moderate	Moderate stoniness and slope limitation
4-1/f	Severe	Severe slope limitation
4-2/bc	Moderate	Moderate stoniness limitation
4-3/A	Severe	Poor drainage
4-3/de	Severe	Poor drainage
5-1/de	Moderate	Moderate stoniness and slopes
5-1/f	Severe	Steep slopes
6-1/bc	Slight	
6-1/de	Moderate	Moderate slopes
6-1/f	Severe	Steep slopes
7-1/bc	Moderate	Moderate texture limitation
7-2/bc	Moderate	Moderate texture limitation
7-3/A	Severe	Poor drainage
8-1/GH	Severe	Steep slopes
8-2/GH	Severe	Steep slopes
9-1/A	Severe	Poor drainage

TABLE 22. GUIDES FOR ASSESSING SOIL LIMITATIONS FOR PLAYING FIELDS. (Montgomery and Edminster. 1966)

This guide applies to soils considered for intensive use as playing fields for organized games such as baseball or football. Soil suitability for growing and maintaining vegetation is not a direct consideration in this guide, but is an important item to consider.

Item Affecting Use	Degree of Soil Limitation		
	SLIGHT	MODERATE	SEVERE
Flooding	none during season of use	subject to occasional flooding. Not more once in 3 years	subject to more than occasional flooding
Wetness	rapidly to moderately well drained	imperfectly drained soils subject to occasional ponding	poorly and very poorly drained
Depth to water table	more than 75 cm during season of use	50 to 75 cm during season of use	less than 50 cm during season of use
Permeability	very rapid to moderate 50 cm/hr to 15 mm/hr	moderately slow 15 - 5 mm	slow and very slow (less than 5 mm/hr)
Slope	0 - 2 percent	2 - 5 percent	more than 5 percent
Surface Texture	SL,FSL,VFSL,L	CL,SCL,SiCL,SiL LS and S other than loose sand	SC,SiC,C, loose sand, organic
Depth to Bedrock	more than 100 cm	60 to 100 cm	less than 50 cm
Surface stoniness	slightly stony	moderately stony	very to excessively stony

TABLE 23. LIMITATIONS OF SOILS FOR PLAYING FIELDS

Mapping Units	Degree of Limitation	Limiting Property (from Table 22)
1-1/bc	Severe	Surface stoniness limitation
1-1/de	Severe	Surface stoniness and slopes
1-2/bc	Severe	Surface stoniness
2-1/AC	Severe	Surface stoniness
2-2/AC	Slight	
3-1/bc	Severe	Flooding
4-1/de	Severe	Surface stoniness and slope
4-1/f	Severe	Slope and surface stoniness
4-2/bc	Moderate	Surface stoniness and slope
4-3/A	Severe	Poor drainage
4-3/de	Severe	Poor drainage and slope
5-1/de	Severe	Slope
5-1/f	Severe	Slope
6-1/bc	Moderate	Texture, slope and permeability
6-1/de	Severe	Slope
6-1/f	Severe	Slope
7-1/bc	Moderate	Texture and slope
7-2/bc	Moderate	Texture and slope
7-3/A	Severe	Poor drainage
8-1/GH	Severe	Slope
8-2/GH	Severe	Slope
9-1/A	Severe	Poor drainage

TABLE 24. SUITABILITY RATINGS OF SOILS AS SOURCES OF GRAVEL

The main purpose of these ratings is to indicate local sources of gravel. The ratings are based on the probability that soils contain sizable quantities of gravel.

Item Affecting Use	Degree of Soil Suitability		
	GOOD	FAIR	POOR
Unified Soil Group	GW, GP	GP-GM GW-GM	GM, GP-GC GW-GC (all other groups unsuited)
Flooding	none or occasional		frequent or constant
Wetness	better than poorly drained [1]		
Depth of overburden	less than 60 cm	60 to 150 cm	more than 15 cm

[1] See page 7 for an explanation of drainage classes

TABLE 25. SUITABILITY OF SOILS AS A SOURCE OF GRAVEL

Mapping Units	Degree of Suitability	Limiting Property (from Table 24)
1-1/bc	Unsuited	Unified soil group [1]
1-1/de	Unsuited	
1-2/bc	Unsuited	
2-1/AC	Good	
2-2/AC	Good	
3-1/bc	Poor	Flooding
4-1/de	Unsuited	
4-1/f	Unsuited	
4-2/bc	Unsuited	
4-3/A	Unsuited	
4-3/de	Unsuited	
5-1/de	Unsuited	
5-1/f	Unsuited	
6-1/bc	Unsuited	
6-1/de	Unsuited	
6-1/f	Unsuited	
7-1/bc	Unsuited	
7-2/bc	Unsuited	
7-3/A	Unsuited	
8-1/GH	Unsuited	
8-2/GH	Unsuited	
9-1/A	Unsuited	

[1] This refers to the remainder of the soil units that are listed as unsuited

TABLE 26. SUITABILITY RATINGS OF SOILS AS SOURCES OF ROADFILL

The ratings in this table indicate the performance of a soil after it is placed in a road embankment and also the degree of difficulty in excavating the fill material. Ratings of the material are the same as for road location (Table 3) however ratings of factors governing excavation differ.

Item Affecting Use	Degree of Suitability[1] GOOD	FAIR	POOR
	Rapidly to moderately well drained[2]	Imperfectly drained	Poorly and very poorly drained
Engineering Groups Unified Group	GW, GP, GC, SW, SP, SM, SC	ML, CL with P.I.[3] less than 15	CH, MH, OL, OH, Pt, and CL with P.I. more than 15
AASHO Group Index	0 - 4	5 - 8	greater than 8
Stoniness	none to moderately stony	very stony	exceedingly stony
Depth to consolidated bedrock	more than 2 m	1 to 2 m	less than 1 m
Slope	0 - 15%	15 - 30%	more than 30%

[1] A rating of unsuited (u) is applied to land units, such as bedrock (R), where no conventional fill material is present.

[2] See page 7 for an explanation of drainage classes.

[3] P.I. means plasticity index.

TABLE 27. SUITABILITY OF SOILS AS A SOURCE OF ROADFILL

Mapping Units	Degree of Suitability	Limiting Property (from Table 25)
1-1/bc	Good	
1-1/de	Good	
1-2/bc	Good	
2-1/AC	Good	
2-2/AC	Good	
3-1/bc	Variable	Needs on-site investigation
4-1/de	Fair	Unified soil classification
4-1/f	Fair	Unified soil classification
4-2/bc	Fair	Unified soil classification
4-3/A	Poor	Poor drainage
4-3/de	Poor	Poor drainage
5-1/de	Poor	Depth to consolidated bedrock
5-1/f	Poor	Depth to consolidated bedrock
6-1/bc	Poor	Unified soil classification
6-1/de	Poor	Unified soil classification
6-1/f	Poor	Unified soil classification
7-1/bc	Fair	Unified soil classification
7-2/bc	Fair	Unified soil classification
7-3/A	Poor	Poor drainage
8-1/GH	Poor	Depth to consolidated bedrock
8-2/GH	Poor	Depth to consolidated bedrock
9-1/A	Poor	Poor drainage

TABLE 28. SUITABILITY RATINGS OF SOILS AS SOURCES OF TOPSOIL

Topsoil, for these ratings, refers essentially to Ah horizon material. In some cases the B, and even C horizon materials could be used for dressing disturbed land. These ratings are intended for use by engineers, landscapers, planners and others who make decisions about selecting, stockpiling and using topsoil. These ratings are based on quality of topsoil and ease of excavation. In addition to the Good, Fair, and Poor ratings described below, an Unsuited (U) rating is used.

Item Affecting Use	Degree of Suitability [1]		
	GOOD	FAIR	POOR
Texture	SL, FSL, VFSL, L, SiL	CL, SCL, SiCL	LS, S, SC, SiC, C, Organic
Depth of topsoil	more than 15 cm	8 - 15 cm	less than 8 cm
Flooding	none	may flood occasionally	frequently or constantly flooded
Wetness	Drainage class not determining if better than poorly drained		poorly and very poorly drained
Coarse fragments % by volume	less than 3%	3 - 15%	more than 15%
Slope	less than 9%	9 - 15%	more than 15%
Stoniness	none to slightly stony	moderately stony	very to excessively stony
Salinity of topsoil	E.C.[2] 0 - 1[3]	E.C. 1 - 3	E.C. more than 3
Permeability of upper subsoil	moderate	slow	very slow

[1] A rating of unsuited (U) is used for soil and land units that do not have topsoil present.

[2] E.C. - electrical conductivity of a saturation extract in mmhos/cm.

[3] These are the limits suggested by the Alberta Soil and Feed Testing Laboratory when considering lawn growth.

TABLE 29. SUITABILITY OF SOILS AS A SOURCE OF TOPSOIL

Mapping Units	Degree of Suitability	Limiting Property (from Table 28)
1-1/bc	Poor	Stoniness, depth of topsoil
1-1/de	Poor	Stoniness, depth of topsoil
1-2/bc	Poor	Stoniness, depth of topsoil
2-1/AC	Poor	Coarse fragments
2-2/AC	Fair	Depth of topsoil
3-1/bc	Poor	Flooding
4-1/de	Poor	Depth of topsoil
4-1/f	Poor	Depth of topsoil
4-2/bc	Fair	Depth of topsoil
4-3/A	Poor	Wetness
4-3/de	Poor	Wetness
5-1/de	Poor	Depth of topsoil
5-1/f	Poor	Depth of topsoil
6-1/bc	Poor	Depth of topsoil
6-1/de	Poor	Depth of topsoil
6-1/f	Poor	Depth of topsoil
7-1/bc	Fair	Depth of topsoil
7-2/bc	Poor	Depth of topsoil
7-3/A	Poor	Wetness
8-1/GH	Poor	Depth of topsoil
8-2/GH	Poor	Depth of topsoil
9-1/A	Poor	Wetness

Agricultural Capability

These ratings are made using the Soil Capability for Agriculture (Canada Land Inventory. 1965). The CLI capability for agriculture is described using classes and subclasses. The classes indicate the relative degree of limitation, whereas the subclasses indicate the type of limitation. Seven classes are recognized in the system and are described as follows:

Class 1 - Soils in this class have no significant limitations in use for crops.

Class 2 - Soils in this class have moderate limitations that restrict the range of crops or require moderate conservation practices.

Class 3 - Soils in this class have moderately severe limitations that restrict the range of crops or require special conservation practices.

Class 4 - Soils in this class have severe limitations that restrict the range of crops.

Class 5 - Soils in this class have very severe limitations that restrict their capability to producing perennial forage crops, and improvement practices are feasible.

Class 6 - Soils in this class are capable of only producing perennial forage crops and improvement practices are not feasible.

Class 7 - Soils in this class have no capability for arable culture or permanent pasture.

The following subclasses are recognized in the system and are described as follows:

A - the length of the frost-free period is usually adequate but the amount of precipitation is a limiting factor to crop growth.

D - the depth of the rooting zone is restricted by soil conditions other than wetness or consolidated bedrock.

F - low fertility.

H - the amount of precipitation is usually adequate but the length of frost-free period is limiting to the growth of cereal crops.

I - inundation by streams or lakes.

M - low moisture-holding capacity .

N - presence of enough soluble salts to adversely affect crop growth or restrict the range of crops that can be grown.

P - stoniness.

S - used in a collective sense for one or more subclasses.

T - adverse topography.

W - excess water other than from flooding.

According to the Agro-Climatic Map of Alberta (Bowser, W.E. 1967) the Bragg Creek area is in Climatic subregion 5H and is characterized by having a frost-free period of less than 60 days. The area is therefore unsuitable for the growth of cereal crops and is limited to the production of forage crops or use as pasture. The highest agricultural capability rating given to any of the soil areas is 5H. Soils with other very severe limitations that will not make improvement practices feasible or render the area unsuitable for even pasture will be placed in Classes 6 or 7.

TABLE 30. SOIL CAPABILITY FOR AGRICULTURE

Mapping Units	Class and Subclass	Limiting Property (from page 57)
1-1/bc	5H	Climate
1-1/de	5H	Climate
1-2/bc	5H	Climate
2-1/AC	5H	Climate
2-2/AC	5H	Climate
3-1/bc	6I	Inundation by streams
4-1/de	5H	Climate
4-1/f	6T	Adverse topography
4-2/bc	5H	Climate
4-3/A	6W	Excess water other than from flooding
4-3/de	6W	Excess water other than from flooding
5-1/de	5H	Climate
5-1/f	6T	Adverse topography
6-1/bc	5H	Climate
6-1/de	5H	Climate
6-1/f	6T	Adverse topography
7-1/bc	5H	Climate
7-2/bc	5H	Climate
7-3/A	6W	Excess water
8-1/GH	7T	Adverse topography
8-2/GH	7T	Adverse topography
9-1/A	0	Not classified

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GLOSSARY

This is included to define terms commonly used in the report; it is not a comprehensive soil glossary.

aeolian (eolian) deposit - material deposited by wind, includes both loess and dune sand.

aggregate - a group of soil particles cohering so as to behave mechanically as a unit.

alluvial deposit - material deposited by moving water.

aspect - orientation of the land surface with respect to compass direction.

Atterberg limits - see plastic limit, liquid limit.

available plant nutrients - that portion of any element or compound in the soil that can be readily absorbed and assimilated by growing plants.

bearing capacity - the average load per unit area that is required to rupture a supporting soil mass.

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

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

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

colluvium - a heterogeneous mixture of material that has been deposited mainly by gravitational action.

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

edaphic - (i) of or pertaining to the soil, (ii) resulting from, or influenced by, factors inherent in the soil or other substrate rather than by climatic factors.

eluviation - the removal of soil material in suspension or in solution from a layer or layers of the soil.

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

field capacity - the percentage of water remaining in a soil after having been saturated and after free drainage has practically ceased.

fluvial deposit - accumulations of sediment (sand, gravel, silt, etc.) produced by the action of a stream or river.

glacio-fluvial deposits - material moved by glaciers and subsequently deposited by streams flowing from the melting ice.

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

grain-size analysis - the determination of the various amounts of sand, silt, clay, gravel and cobbles in a soil sample.

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

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

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

infiltration - the downward entry of water into the soil.

lacustrine deposit - material deposited in lake water and later exposed either by a lowering of the water or by uplift of the land.

landforms - the various shapes of the land surface resulting from a variety of actions, such as deposition, erosion, etc.

liquid limit (upper plastic limit) - the water content at which a pat of soil, cut by a groove of standard dimensions, will flow together for a distance of 12 mm under the impact of 25 blows in a standard liquid limit apparatus.

lithic - a soil subgroup modifier that indicates a bedrock contact within 50 cm (20 in.) of the soil surface.

loamy - intermediate in texture between fine-textured and coarse textured.

loess - material transported and deposited by wind and consisting of predominately silt-sized particles.

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

miscellaneous land type - a mapping unit for areas of land that have little or no natural soil - e.g. rough mountainous land.

morainal - accumulations of unsorted, unstratified till deposited by direct action of glacier ice in a variety of topographic landforms.

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

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

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

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

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

pedology - those aspects of soil science involving the constitution, distribution, genesis and classification of soils.

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

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

pH - a notation used to designate the relative acidity or alkalinity of soils and other materials. A pH of 7.0 indicates neutrality, higher values indicate alkalinity, and lower values acidity.

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

plastic limit - water content at which a soil will just begin to crumble when rolled into a thread approximately 3 mm in diameter.

plasticity index - the numerical difference between the liquid and the plastic limit.

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

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

residual material - unconsolidated and partly weathered mineral material accumulated by disintegration of consolidated rock in place.

saline soil - a soil containing enough soluble salts in such quantities that they interfere with the growth of most crop plants.

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

soil consistency - (i) the resistance of a soil material to deformation or rupture. (ii) the degree of cohesion or adhesion of the soil mass. Terms used for describing consistency at various soil moisture conditions are:
wet soil - non-plastic, slightly plastic, plastic, very plastic.
moist soil - loose, friable, firm, very firm, extremely firm.
dry soil - loose, soft, hard, very hard, extremely hard.

soil structure - the combination or arrangement of primary soil particles into secondary particles, units or peds, e.g. prismatic, columnar, blocky, platy.

soil unit - a defined aggregrate of soil bodies occurring together in an individual and characteristic pattern over the land surface.

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

terrace - a nearly level, usually narrow, plain bordering a river, lake or sea.

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

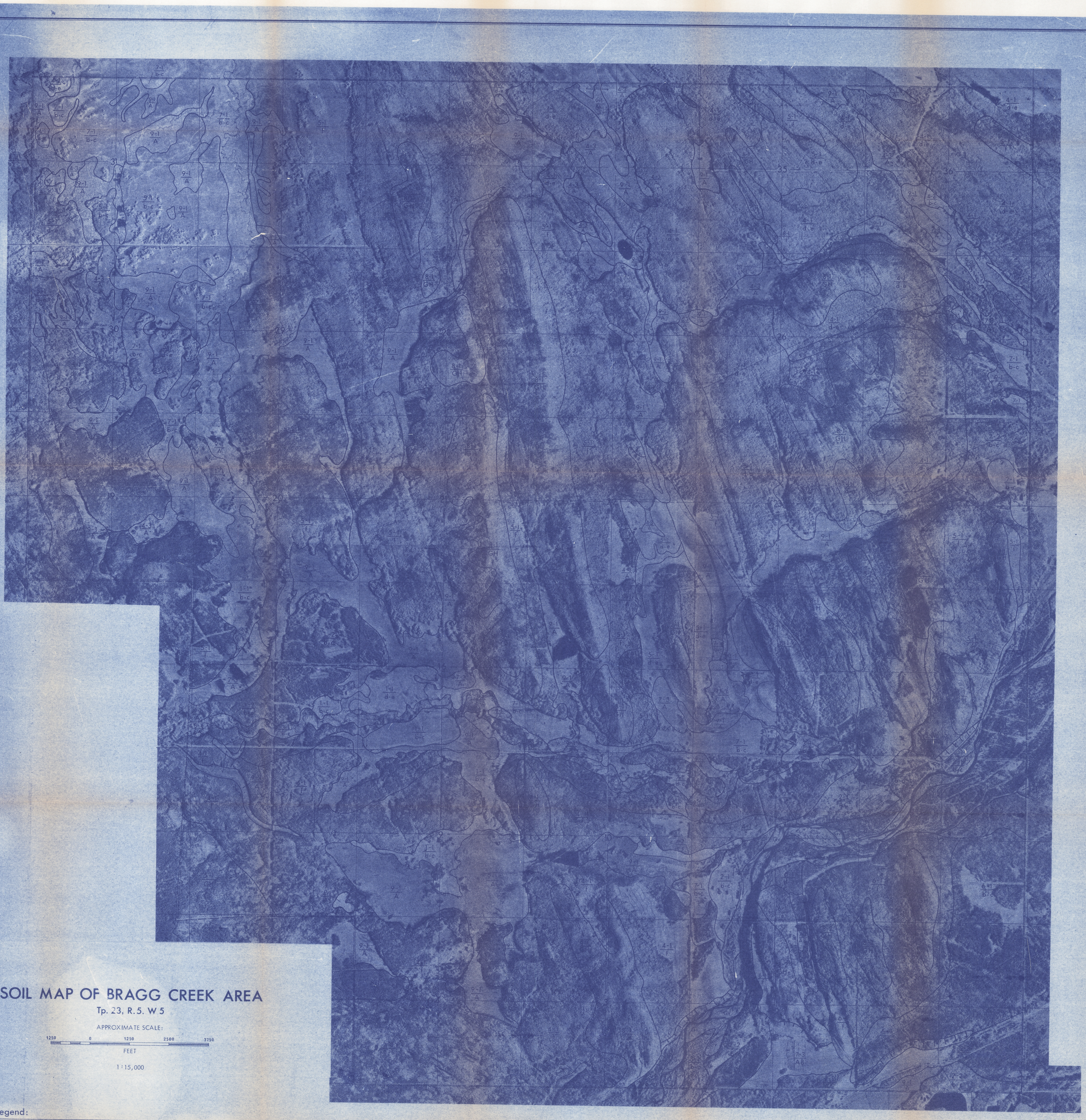
till - unstratified glacial drift deposited directly by ice and consisting of non-sorted clay, silt, sand and boulders.

topsoil - (i) the layer of soil moved in cultivation, (ii) the A horizon, (iii) the Ah horizon, (iv) presumably fertile soil material used to topdress roadbanks, gardens and lawns.

undifferentiated deposit - accumulations of unconsolidated deposits where differentiation into one of the other classes of deposits is impractical.

veneer - surface form in areas of very thin surficial deposits (10 cm to 1 metre in thickness) which is strongly influenced by subsurface deposits.

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



SOIL MAP OF BRAGG CREEK AREA

Tp. 23, R. 5. W 5

APPROXIMATE SCALE:

1250 0 1250 2500 3750

FEET

1 : 15,000

Legend:

LANDFORM (2)	PARENT MATERIAL (2)	SOIL UNIT	SURFACE TEXTURE (1)	SLOPE CLASSES(1)	DRAINAGE CLASSES (1)	DOMINANT SOIL SUBGROUP (2)	SIGNIFICANT SOIL SUBGROUP (2)
Fluvial Lacustrine Terrace	gravelly stratified fluvial lacustrine	1-1	GL-L	b,c,d,e	well	Dark Gray Luvisol	Orthic Sombric Brunisol
		1-2	GL-L	b,c	well	Orthic Gray Luvisol	Brunisolic Gray Luvisol
Glaciofluvial Terrace	gravelly glaciofluvial	2-1	GSL	A,B,C	well to rapidly	Eluviated Eutric Brunisol	Orthic Gray Luvisol
	loam over gravelly glaciofluvial	2-2	L	A,B,C	well	Eluviated Eutric Brunisol	Orthic Gray Luvisol
Recent Fluvial Floodplain	variable textured fluvial	3-1	var.	b,c	var.	Cumulic Regosol	Orthic Regosol
Morainal	medium to moderately fine textured till	4-1	L	d,e,f	well	Orthic Gray Luvisol	Brunisolic Gray Luvisol
		4-2	L	b,c	well	Orthic Dark Gray Chernozem	Dark Gray Luvisol
		4-3	L	A,d,e	poorly	Orthic Humic Gleysol (peaty)[3]	Orthic Humic Gleysol
Morainal Veneer	medium textured undifferentiated deposit over mudstone	5-1	L	d,e,f	well	Orthic Gray Luvisol	Eluviated Eutric Brunisol
Morainal Blanket	fine textured undifferentiated deposit over shale	6-1	CL	b,c,d,e,f	moderately well	Orthic Gray Luvisol	
Lacustrine Plain	medium to moderately fine textured lacustrine	7-1	SiL	b,c	well	Orthic Dark Gray Chernozem	Dark Gray Luvisol
		7-2	SiL	b,c	well	Orthic Gray Luvisol	Orthic Humic Gleysol
		7-3	SiL	A	poorly	Orthic Humic Gleysol	Orthic Humic Gleysol (peaty)[3]
Steeply Sloping Rock	mudstone and sandstone shale	8-1	SL	G,H	rapidly	Eluviated Eutric Brunisol (lithic)[3]	Eluviated Eutric Brunisol
		8-2	CL	G,H	rapidly	Eluviated Eutric Brunisol	Orthic Eutric Brunisol
Horizontal Fen	organic material	9-1	org.	A	very poorly	Typic Mesisol	Terric Mesisol

(1) Refer to pages 4 to 7 in Section 1 of the report
(2) Refer to "The Canadian System of Soil Classification, 1976"
(3) "peaty" and "lithic" are phases of soil subgroups

SYMBOLS AND ABBREVIATIONS:

W -	water	CL -	clay loam
Gv -	gravelly river wash	GL -	gravelly loam
L -	loam	GSL -	gravelly sandy loam
SL -	sandy loam	var. -	variable
SiL -	silt loam	org. -	organic

- soil line
- boundary of mapped area
- escarpment

SLOPE CLASSES:

	Simple slopes	Slope %		Complex slopes
A	depressional to level	0	to 0.5	a nearly level
B	very gently sloping	0.5+	to 2	b gently undulating
C	gently sloping	2 +	to 5	c undulating
D	moderately	5 +	to 9	d gently rolling
E	strongly	9 +	to 15	e moderately rolling
F	steeply sloping	15 +	to 30	f strongly rolling
G	very steeply sloping	30 +	to 60	g hilly
H	extremely sloping	over 60		h very hilly

Alberta RESEARCH COUNCIL

Compiled from uncontrolled mosaic.

Mapped and Compiled by: M.D. Scheelar
Soils Division

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