



ACQ 9133

Soil survey of
**Designated areas
in the
Kakwa Falls region**
and
interpretation for recreational use

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PREFACE

This report is one of a series describing detailed, semi-detailed, and reconnaissance soils surveys which have been conducted in Alberta provincial parks and recreation areas. A soil survey was conducted in the Kakwa Falls-Deadhorse Meadows-Sherman Meadows study area during the summer of 1979, and the total area mapped was approximately 2130 ha.

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

ACKNOWLEDGEMENTS

The Alberta Research Council provided the staff, and the Outdoor Recreation Planning Branch of Alberta Recreation and Parks contributed the funds for the 1979-80 provincial parks soil survey program. Costs included field, office, laboratory, drafting, and printing; as well as equipment and supplies. Office space was provided by the Research Council, and laboratory space by the University of Alberta. Mrs. Sharon DeFelice typed and assisted in compiling and proof reading the report. Mrs. J. Dlask drafted the soil, landform, and soil limitations for recreation maps, while Mr. J. Beres determined the soil physical properties. The soil chemical analyses were determined by Messrs. A. Schwarzer and W. McKean. Able field assistance was given by Mr. R. Shopik.

SUMMARY

Three separate portions were mapped within the overall study area, and collectively they comprise about 2130 ha. The study area is located about 115 km southwest of Grande Prairie, or about 55 km northwest of Grande Cache; and is only about 4 km east of the Alberta-British Columbia boundary. The majority of the study area is covered by till. In the Sherman Meadows portion most is moderately fine textured, and very stony and gravelly; in the Deadhorse Meadows portion it is medium textured and gravelly. In the Kakwa Falls portion a thin veneer of medium textured very gravelly bouldery till overlies conglomerate or sandstone on the north side of the river; while on the south side the till is medium textured and gravelly. The floodplain of the Torrens River in the Sherman Meadows portion is comprised dominantly of medium to very coarse textured glacio-fluvial sediments (gravel). Patches of thin Organic soil deposits are found

throughout the study area. The climate of the study area is designated as highland, where the most important climatic effects of increased elevation are the decrease in air temperature and increased precipitation. The mean annual temperature at Grande Cache, about 55 km southeast of the study area, is 2.1° C. July is the warmest month of the year with a mean temperature of 13.8° C, and January is the coldest with a mean temperature of -12.3° C. The study area is situated in the east slope Rockies section of the sub-alpine forest region. This section is characterized by a coniferous forest consisting of the Engelmann spruce-white spruce hybrid complex, and an important associated species is the lodgepole pine.

Twenty-two map units were recognized in the study area. The key profile types are Brunisolic Gray Luvisols, Orthic Gray Luvisols, Gleyed Eutric Brunisols, Orthic Eutric Brunisols, Orthic Melanic Brunisols, Eluviated Dystric Brunisols, Eluviated Dystric Brunisols Lithic phase, Eluviated Eutric Brunisols, Brunisolic Gray Luvisols Lithic phase, Orthic Gray Luvisols Lithic phase, Eluviated Eutric Brunisols Lithic phase, Gleyed Gray Luvisols, Gleyed Melanic Brunisols, Terric and Typic Humisols, Terric Mesisols, Orthic Gleysols Peaty phase, Orthic Humic Gleysols Peaty phase, Orthic Regosols, Orthic Gleysols, Orthic Humic Gleysols, and Typic Humisols Lithic phase. These are distributed over the landscape in relation to landform, parent material, and drainage. Map units consist of single soil series or groupings of series (complexes), and their distribution is shown on the soil map. Soil interpretations of each map unit are made for primitive camping areas, fully serviced campgrounds, picnic areas, paths, trails, lawns and landscaping, buildings, septic tank absorption fields, trench type sanitary landfills, road location, source of roadfill, and source of sand or gravel.

Soils of Map Units 1, 2 and 3; all widespread in the Sherman Meadows portion of the study area, have only moderate limitations for recreational development when found on suitable topography and where surface stoniness is not a limitation. Soils of Map Units 6, 7, and 17 also have only moderate limitations; while soils of most other map units have severe to very severe limitations. Map Unit 18 soils are widespread in the Deadhorse Meadows portion and on suitable topography have only moderate limitations for recreational development, except for severe limitations due to surface stoniness. The most common soils in the Kakwa Falls portion are those of Map Unit 15, but these have severe limitations for recreational development because of surface stoniness, and shallow depths to bedrock. Two small patches of Map Units 2 and 6 soils, with only moderate limitations, also occur. Map Unit 1 soils are well suited for road construction when found on suitable topography, and where surface stoniness is not a limitation. Map Units 2 and 3 soils have only moderate limitations; Map Units 6, 7, 17, and 15 soils have severe limitations; and Map Unit 18 soils have severe to very severe limitations. Soils of most other map units also have severe to very severe limitations. The soils of Map Units 1, 2, and 13; all found in the Sherman Meadows portion; can provide good sources of gravel. Careful study of the soil map and Tables 6 to 18 inclusive (soil limitation and suitability tables) will reveal areas suitable for particular uses.

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

an on-site investigation is usually required.

INTRODUCTION

SIZE AND LOCATION

Three separate portions were mapped within the overall study area, and collectively they comprise about 2130 ha. The study area is located about 115 km southwest of Grande Prairie, or about 55 km northwest of Grande Cache; and is only about 4 km east of the Alberta-British Columbia boundary (Figure 1). The largest portion of about 1970 ha is in the vicinity of Sherman Meadows and includes part of the north half of section 3; most of the southeast quarter, part of the southwest quarter, most of the northwest quarter, and the northeast quarter of section 10; part of the west half of section 11, part of the south half, part of the northeast quarter, and the northwest quarter of section 14; the southeast quarter, most of the southwest quarter, and the north half of section 15; part of the east half of section 16; part of the east half of section 21; section 22; most of the southwest quarter, part of the east half, and the northwest quarter of section 23; part of the north half of section 24; part of the east half, and the west half of section 25; section 26; the southeast quarter, most of the southwest quarter, and part of the north half of section 27; part of the southeast quarter of section 28; part of the southeast quarter of section 34; part of the southwest quarter, most of the southeast quarter, and part of the northeast quarter of section 35; the southwest quarter and part of the southeast quarter of section 36; township 61; range 13; west of the sixth meridian. The smallest portion of only 30 ha is adjacent to the Kakwa River and includes part of the southwest quarter, and part of the southeast quarter of section 19; township 59; range 13; west of the sixth meridian. The third portion of about 130 ha is in the vicinity of Deadhorse Meadows about 2 km north of the smallest portion and includes part of the northeast quarter of section 30; most of the southeast quarter, part of the west half, and part of the northeast quarter of section 31; and part of the southwest quarter of section 32; township 59; range 13; west of the sixth meridian.

PHYSIOGRAPHY AND SURFICIAL DEPOSITS

The study area is situated in the Rocky Mountain Foothills division of the Western Cordillera physiographic region (Twardy and Corns, 1980). Structurally this division is a series of distinct, predominantly razor-back, approximately parallel ridges which are aligned in a northwestern to southeastern direction. Local relief is commonly less than 35 m but may be as much as a few hundred metres. The highest elevation in the study area is slightly more than 1530 m along the western boundary of the Deadhorse Meadows portion, and the lowest is about 1070 m at the northern end of the Sherman Meadows portion in the bottom of the Torrens River valley, for a difference of nearly 500 m. The bedrock has been classified as the Cretaceous Alberta group for the southern part of the Sherman Meadows portion; and as Lower Cretaceous, Jurassic, and Triassic for the remainder of the Sherman Meadows portion, as well as the Deadhorse Meadows and Kakwa Falls portions (Green, 1972). The Sherman Meadows portion is drained by the Torrens River to the north; the Deadhorse Meadows portion is drained by Mouse Cache Creek into the Kakwa River to the southeast; and the Kakwa Falls portion is drained by the Kakwa River to the east.

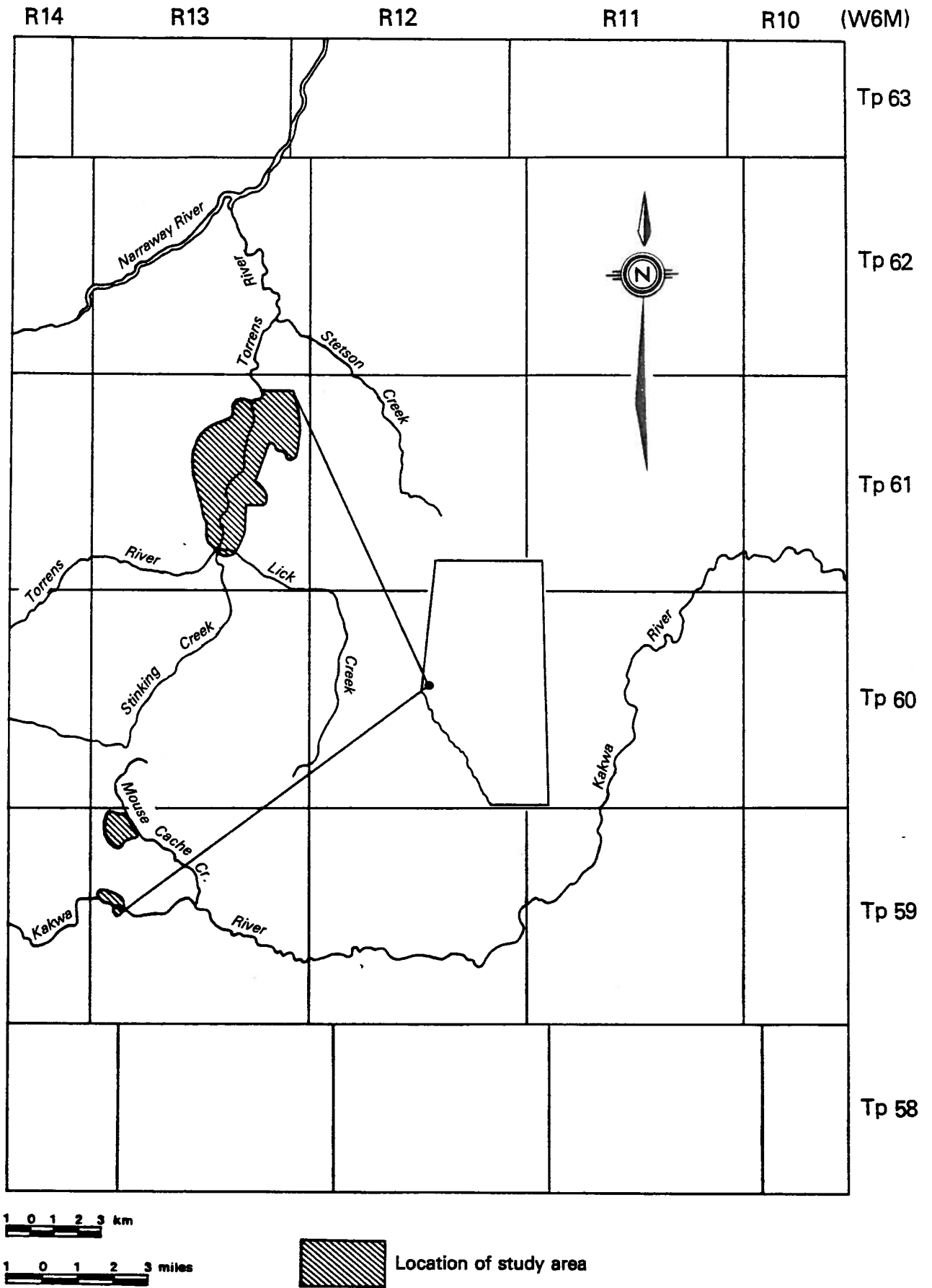


Figure 1. Map showing location of study area.

The majority of the study area is covered by till. In the Sherman Meadows portion most is moderately fine textured, and very stony and gravelly; in the Deadhorse Meadows portion it is medium textured and gravelly. In the Kakwa Falls portion a thin veneer of medium textured very gravelly bouldery till overlies conglomerate or sandstone on the north side of the river. On the south side the till is medium textured and gravelly. A few patches of medium textured gravelly cobbly till overlying hard sandstone or shale also occur in the Sherman Meadows portion near the northeastern and northwestern boundaries. The floodplain of the torrens River in the Sherman Meadows portion is comprised dominantly of medium to very coarse textured glaciofluvial sediments (gravel). A thin strip of medium to moderately coarse textured glaciofluvial sediments occurs as both a veneer and blanket overlying medium to moderately fine textured till in Sherman Meadows on the eastern side of the river. Medium to moderately fine textured glaciofluvial sediments are found in Old Sherman Meadows on the western side of the river. Patches of thin Organic soil deposits are found throughout the study area. Occasional very small patches of medium to very coarse textured glaciofluvial sediments (gravel) and thin Organic soil deposits occur in the Kakwa River floodplain of the Kakwa Falls portion.

CLIMATE

The climate of the study area is designated as highland by Trewartha and Horn (1980). Highland climates in many ways are low temperature variants of those at low elevation in similar latitudes. Mountain country has an almost endless variety of local climates, as atmospheric conditions change markedly with altitude and exposure. The most important climatic effects of increased elevation are the decrease in air temperature and increased precipitation. Distinctive features of highland climates are large diurnal temperature ranges and erratic daily weather. Striking changes from hot sun to cool shade, from chill wind to calm, from sudden gusts of rain or snow to intense sunlight are characteristic.

Weather records for 1973 through 1980 from Grande Cache, about 55 km southeast of the study area and at an elevation of 1250 m, were used to compile the following information (Environment Canada, 1982): the mean annual temperature is 2.1° C. July is the warmest month of the year with a mean temperature of 13.8° C, and January is the coldest with a mean temperature of -12.3° C. The mean annual precipitation is 602 mm and only 54% falls as rain. The average frost-free period is 86 days.

VEGETATION

The study area is situated in the east slope Rockies section of the sub-alpine forest region as classified by Rowe (1972). This section is characterized by a coniferous forest consisting of the Engelmann spruce-white spruce hybrid complex and at the higher altitudes by Engelmann spruce alone. An important associated species is the lodgepole pine, whose powers of prolific regeneration following fire have resulted in its replacing the spruce over great areas. Trembling aspen, balsam poplar, and white birch are relatively unimportant in the Subalpine; and black spruce is also of limited importance.

Lodgepole pine is the dominant vegetation throughout most of the study area, patches of white or Engelmann spruce are common, and small amounts of balsam fir are usually present. Small amounts of balsam poplar are often found, especially in low places, and only occasional patches of aspen are present. Black spruce is common in forested portions of bogs; some white or Engelmann spruce and balsam poplar also occur.

The Outdoor Recreation Planning Branch of Alberta Recreation and Parks conducts biological studies of provincial parks and recreation areas, so the vegetation is not extensively discussed in this report. However, some of the more common plant species observed growing on different soils are indicated as part of the map unit descriptions, and these are listed as follows (Moss, 1959; Cormack, 1967; Cunningham, 1975):

lodgepole pine (*Pinus contorta* var *latifolia*), white spruce (*Picea glauca*) or engelmann spruce (*Picea engelmannii*), balsam fir (*Abies balsamea*), balsam poplar (*Populus balsamifera*), trembling aspen (*Populus tremuloides*), black spruce (*Picea mariana*), willow (*Salix* spp), alder (*Alnus* spp), swamp birch (*Betula pumila* var *glandulifera*), Canadian buffalo-berry (*Shepherdia canadensis*), low-bush cranberry (*Viburnum edule*), saskatoon-berry (*Amelanchier alnifolia*), mountain ash (*Sorbus scopulina*), wild rose (*Rosa* spp), raspberry (*Rubus pedatus*), wild gooseberry (*Ribes* spp), wild currant (*Ribes* spp), tall huckleberry (*Vaccinium membranaceum*), false huckleberry (*Menziesia glabella*), white-flowered rhododendron (*Rhododendron albiflorum*), white meadowsweet (*Spiraea lucida*), bracted honeysuckle (*Lonicera involucrata*), juniper (*Juniperus* spp), wild strawberry (*Fragaria* spp), blueberry (*Vaccinium myrtilloides*), dwarf raspberry (*Rubus acaulis*), fireweed (*Epilobium* spp), cow parsnip (*Heracleum lanatum*), common nettle (*Urtica gracilis*), tall larkspur (*Delphinium glaucum*), low larkspur (*Delphinium nuttallianum*), tall buttercup (*Ranunculus* spp), false Solomon's seal (*Smilacina racemosa* var *amplexicaulis*), water avens (*Geum rivale*), meadow rue (*Thalictrum* spp), baneberry (*Actaea* spp), lungwort (*Mertensia* spp), purple wild pea vine (*Lathyrus venosus* var *intonsus*), wild lupine (*Lupinus* spp), goldenrod (*Solidago* spp), wild vetch (*Vicia americana*), bunchberry (*Cornus canadensis*), common pink wintergreen (*Pyrola asarifolia*), twinflower (*Linnaea borealis* var *americana*), Western Canada violet (*Viola rugulosa*), common bearberry (*Arctostaphylos uva-ursi*), indian paint-brush (*Castilleja* spp), arnica (*Arnica* spp), yellow mountain avens (*Dryas drummondii*), northern bedstraw (*Galium boreale*), star-flowered Solomon's seal (*Smilacina stellata*), twisted stalk (*Streptopus amplexifolius*), fairy bells (*Disporum trachycarpum*), common yarrow (*Achillea millefolium*), orange-flowered false dandelion (*Agoseris aurantiaca*), ferns (various species), club-moss (various species), showy loco-weed (*Oxytropis splendens*), cut-leaved anemone (*Anemone multifida*), aster (*Aster* spp), native grass (various species), alsike clover (*Trifolium hybridum*), common dandelion (*Taraxacum officinale*), common plantain (*Plantago major*), western dock (*Rumex occidentalis* var *fenestratus*), palmate-leaved coltsfoot (*Petasites palmatus*), horsetail (*Equisetum* spp), grass of parnassus (*Parnassia fimbriata*), sedge (*Carex* spp), Labrador tea (*Ledum groenlandicum*), sphagnum moss (*Sphagnum* spp), and feathermoss (various species).

SOILS

Twenty-two map units were recognized in the study area. The soils of nine were classified in the Brunisolic Order, six in the Luvisolic Order, three in each of the Gleysolic and Organic Orders, and one in the Regosolic Order in the Canadian soil classification system (Canada Soil Survey Committee, 1978). The system is outlined in Greenlee (1981). Pertinent features of the map units are outlined in Table 1.

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

Well-drained Luvisolic soils developed on very stony and gravelly moderately fine textured till are prevalent throughout most of the upland in the Sherman Meadows portion of the study area. A few patches of these soils near the northwestern boundary are lithic, where the till overlies hard sandstone or shale. Well to rapidly drained Luvisolic soils developed on medium to very coarse textured glaciofluvial sediments (gravel) are dominant in the floodplain of the Torrens River also. Only occasional small patches of well drained Luvisolic soils developed on very stony and gravelly moderately fine textured till occur in the Deadhorse Meadows and Kakwa Falls portions. As well, a few patches of well drained Lithic Luvisolic soils overlying hard sandstone or shale and developed on gravelly cobbly medium textured till occur in the northeastern corner of the Sherman Meadows portion; and one patch occurs in the southwestern corner of the Deadhorse Meadows portion.

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

TABLE 1. Key to the Soils

MAP UNIT	CLASSIFICATION	PARENT MATERIAL	SURFACE TEXTURE	SLOPE (class & gradient)	SURFACE STONINESS	DRAINAGE	COMMENTS AND LIMITATIONS
1	Brunisolic Gray Luvisol - 70% Eluviated Eutric Brunisol - 30%	medium to very coarse textured glacio-fluvial sediments (gravel)	silt loam to fine sandy loam	b, C, c, D, f (>0.5 to 30%)	0 to 5	rapid	Gravel often occurs at surface, finer textured overlays common. Slight to very severe limitations, good source of roadfill and gravel, unsuitable as a source of sand - excessive slopes, surface stoniness, slippery or sticky when wet, erosion hazard, lack of Ah horizon, rapid permeability (droughtiness), groundwater contamination hazard.
2	Gleyed Eutric Brunisol	medium to very coarse textured glacio-fluvial sediments (gravel)	silt loam	b, C, c, d (>0.5 to 9%)	0 to 5	imperfect	(1) Occasional horizons of loamy sand, sand, or fine gravel occur. (2) Gravel common at 40 to 75 cm below surface, sometimes at surface. Moderate to very severe limitations, good source of roadfill and gravel, unsuitable as a source of sand-surface stoniness, seasonally high groundwater table, flooding hazard (overflow), slippery or sticky when wet, erosion hazard, lack of Ah horizon, rapid permeability, groundwater contamination hazard.
3	Brunisolic Gray Luvisol	moderately fine textured very stony and gravelly till	gravelly silt loam	C, c, D, d, E, e, F, f, G, g (>2 to 60%)	1 to 4	well drained	Soil profiles often very stony and gravelly. Slight to very severe limitations, fair source of roadfill, unsuitable as a source of sand or gravel - excessive slopes, surface stoniness, erosion hazard, slippery or sticky when wet, lack of Ah horizon, susceptibility to frost heave, high clay content, moderate shrink-swell potential, slow permeability.
4	Gleyed Gray Luvisol	moderately fine textured very stony and gravelly till	silt loam	b, c, e, F, g (>0.5 to 60%)	2 to 3	imperfect	(1) A few patches of peaty phase occur. (2) Soil profiles often very stony and gravelly. Moderate to very severe limitations, fair source of roadfill, unsuitable as a source of sand or gravel - excessive slopes, surface stoniness, seasonally high groundwater table, slippery or sticky when wet, erosion hazard, lack of Ah horizon, susceptibility to frost heave, slow permeability, groundwater contamination hazard, moderate shrink-swell potential.

TABLE 1. Key to the Soils

MAP UNIT	CLASSIFICATION	PARENT MATERIAL	SURFACE TEXTURE	SLOPE (class & gradient)	SURFACE STONINESS	DRAINAGE	COMMENTS AND LIMITATIONS
5	Orthic Gleysol, Peaty phase and Orthic Humic Gleysol, Peaty phase	moderately fine textured very stony and gravelly till	silt loam to gravelly silt loam, gravelly clay loam or gravelly sandy clay loam	a, C, c, D, d, E, F, f (0 to 30%)	1 to 5	poor	Thickness of Ah horizon highly variable. Severe to very severe limitations, poor source of roadfill, unsuitable as a source of sand or gravel - seasonally high groundwater table, organic surface layer more than 15 cm thick, slippery or sticky when wet, surface stoniness, excessive slopes, susceptibility to frost heave, moderate shrink-swell potential, slow permeability, groundwater contamination hazard.
6	Gleyed Eutric Brunisol	medium textured glaciofluvial sediments, overlying medium to moderately fine textured very stony till	silt loam	b, C, E (>0.5 to 15%)	0	imperfect	Moderate to severe limitations, poor source of roadfill, unsuitable as a source of sand or gravel - excessive slopes, seasonally high groundwater table, slippery or sticky when wet, erosion hazard, lack of Ah horizon, susceptibility to frost heave, slow permeability, groundwater contamination hazard, moderate shrink-swell potential.
7	Orthic Eutric Brunisol	medium textured glaciofluvial sediments, overlying medium to moderately fine textured very stony till	silt loam	b (>0.5 to 2%)	0	well drained	Slight to severe limitations, poor source of roadfill, unsuitable as a source of sand or gravel - slippery or sticky when wet, lack of Ah horizon, susceptibility to frost heave, slow permeability, moderate shrink-swell potential.
8	Orthic Gray Luvisol-80% Orthic Eutric Brunisol-20%	medium to moderately fine textured very stony and gravelly till	gravelly silt loam to gravelly clay loam	D, E, F, G (>5 to 60%)	1 to 4	well drained	Moderate to very severe limitations, poor source of roadfill, unsuitable as a source of sand or gravel - excessive slopes, surface stoniness, erosion hazard, slippery or sticky when wet, lack of Ah horizon, susceptibility to frost heave, high clay content, slow permeability, moderate shrink-swell potential.
9	Gleyed Eutric Brunisol and Gleyed Melanic Brunisol	medium to moderately fine textured gravelly stony till	silty clay loam	D, E, F, f (>5 to 30%)	0 to 3	moderately well to imperfectly drained	(1) Peaty phase occurs erratically, covers about 30% of Map Unit 9 areas. (2) Ah occurs in discontinuous pockets. (3) Water table sometimes found 100 cm below surface. Moderate to severe limitations, poor source of roadfill, unsuitable as a source of sand or gravel - excessive slopes, surface stoniness, slippery or sticky when wet, erosion hazard, susceptibility to frost heave, seasonally high groundwater table, slow permeability, groundwater contamination hazard, moderate shrink-swell potential.

TABLE 1. Key to the Soils

MAP UNIT	CLASSIFICATION	PARENT MATERIAL	SURFACE TEXTURE	SLOPE (class & gradient)	SURFACE STONINESS	DRAINAGE	COMMENTS AND LIMITATIONS
10	Orthic Gleysol and Orthic Gleysol, Peaty phase	medium to very coarse textured glaciofluvial sediments (gravel)	loam, silt loam, or fine sandy loam	a, b, C, D (0 to 9%)	0 to 5	poor	The Fera subgroup occasionally found. Severe to very severe limitations, poor source of roadfill, poor source of gravel, unsuitable as a source of sand - organic surface layer more than 15 cm thick, surface stoniness, rapid permeability, groundwater contamination hazard.
11	Brunisolic Gray Luvisol, Lithic phase	moderately fine textured very stony gravelly till, overlying shale or sandstone	gravelly silt loam	d, F, f, G (>5 to 60%)	3 to 4	well drained	(1) Soil profiles sometimes gleyed (2) Soil profiles often very stony and gravelly. Moderate to very severe limitations, fair source of roadfill, unsuitable as a source of sand or gravel - excessive slopes surface stoniness, shallow depth to bedrock, erosion hazard, lack of Ah horizon, high clay content, slow permeability, moderate shrink-swell potential, susceptibility to frost heave.
12	Orthic and Brunisolic Gray Luvisol, Lithic phase - 70% Eluviated Eutric Brunisol, Lithic phase - 30%	medium to moderately fine textured till containing a high proportion of weathered sandstone and shale, overlying hard sandstone or shale	silt loam to gravelly silt loam	d, e, F, G, g (>5 to 60%)	1 to 4	well to moderately well drained	(1) Soil profiles usually contain numerous small sandstone and shale fragments. (2) Soil profiles occasionally gleyed. (3) High incidence of tree blowdown on steep slopes in some of these soil areas. Moderate to very severe limitations, poor source of roadfill, unsuitable as a source of sand or gravel - excessive slopes, surface stoniness, shallow depth to bedrock, erosion hazard, slow permeability.
13	Orthic Eutric Brunisol	very coarse textured glaciofluvial sediments (gravel)	very gravelly sandy loam	b, c, D (>0.5 to 9%)	4 to 5	rapid	Moderate to very severe limitations, good source of roadfill and gravel, unsuitable as a source of sand - surface stoniness, sandy surface texture, flooding hazard (overflow), rapid permeability (droughtiness), groundwater contamination hazard.

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TABLE 1. Key to the Soils

MAP UNIT	CLASSIFICATION	PARENT MATERIAL	SURFACE TEXTURE	SLOPE (class & gradient)	SURFACE STONINESS	DRAINAGE	COMMENTS AND LIMITATIONS
14	Orthic Regosol	very coarse textured fluvial sediments (gravel)	gravel	b (>0.5 to 2%)	3 to 5	rapid	(1) These soils occur on gravel and sand bars adjacent to the Torrens River. (2) Soil surface often bouldery. Moderate to very severe limitations, fair source of roadfill and gravel, poor source of sand - surface stoniness, flooding hazard (overflow), thin deposits of sand, sandy surface texture, rapid permeability (droughtiness), groundwater contamination hazard.
15	Eluviated Dystric Brunisol, Lithic phase	medium textured very gravelly bouldery till, overlying conglomerate or sandstone	gravelly silt loam	b, d, e, f (>0.5 to 30%)	4	well drained	Soil solum commonly very gravelly and bouldery. Moderate to very severe limitations, poor source of roadfill, unsuitable as a source of sand or gravel - excessive slopes, surface stoniness, shallow depth to bedrock, slippery or sticky when wet, erosion hazard, lack of Ah horizon, slow permeability, susceptibility to frost heave.
16	Orthic Humic Gleysol	medium textured glaciofluvial sediments, overlying moderately fine textured gravelly bouldery till	silt loam	b (>0.5 to 2%)	0	poor	Severe to very severe limitations, poor source of roadfill, unsuitable as a source of sand or gravel - seasonally high groundwater table or surface ponding, flooding hazard (overflow), slippery or sticky when wet, susceptibility to frost heave, groundwater contamination hazard, moderate shrink-swell potential.
17	Orthic Eutric Brunisol and Orthic Melanic Brunisol	medium textured glaciofluvial sediments	silt loam to silty clay loam	B, b, D (>0.5 to 9%)	0	well drained	(1) Only occasional patches of Melanic Brunisols are found. (2) Gravel is occasionally found 60 to 75 cm below the surface. Slight to severe limitations, poor source of roadfill, unsuitable as a source of sand or gravel - slippery or sticky when wet, thin or no Ah horizon, susceptibility to frost heave, slow permeability, moderate shrink-swell potential, erosion hazard.
18	Eluviated Dystric Brunisol	medium textured gravelly till	silt loam	c, D, F, f, G (>2 to 60%)	2 to 4	well drained	Lithic phase occasionally found. Moderate to very severe limitations, poor source of roadfill, unsuitable as a source of sand or gravel - erosion hazard, slippery or sticky when wet, excessive slopes, lack of Ah horizon, slow permeability, surface stoniness, susceptibility to frost heave, moderate shrink-swell potential.

TABLE 1. Key to the Soils

MAP UNIT	CLASSIFICATION	PARENT MATERIAL	SURFACE TEXTURE	SLOPE (class & gradient)	SURFACE STONINESS	DRAINAGE	COMMENTS AND LIMITATIONS
19	Orthic Melanic Brunisol	medium to moderately fine textured till	silt loam	b, C, D, F (>0.5 to 30%)	0 to 2	well drained	The BC2 and Cca horizons occasionally are very bouldery. Slight to severe limitations, poor source of roadfill, unsuitable as a source of sand or gravel - slippery or sticky when wet, surface stoniness, excessive slopes, erosion hazard, susceptibility to frost heave, slow permeability, moderate shrink-swell potential.
TH	Terric Humisol and Typic Humisol	predominantly humic peat, overlying moderately fine textured till or medium to moderately fine textured glaciofluvial sediments.	fibric peat or mesic peat	a, b, C, c, D,d, E, e, F, f (0 to 30%)	0	very poor	Terric Humisols are dominant, with only a few patches of Typic Humisols present. Very severe limitations, unsuitable as a source of roadfill, sand or gravel - Organic soil, extreme wetness, excessive slope, lack of Ah horizon, high shrink-swell potential, groundwater contamination hazard.
TM	Terric Mesisol	predominantly mesic peat, overlying moderately fine textured till	fibric peat or mesic peat	a, b, C, D (0 to 9%)	0	very poor	Occasional patch of Typic Mesisol. Very severe limitations, unsuitable as a source of roadfill, sand or gravel - Organic soil, extreme wetness, lack of Ah horizon, high shrink-swell potential, groundwater contamination hazard.
LH	Typic Humisol, Lithic phase	predominantly humic peat, overlying sandstone or shale	fibric peat	a (0 to 0.5%)	0	very poor	Very severe limitations, unsuitable as a source of roadfill, sand or gravel - Organic soil, extreme wetness, shallow depth to bedrock, high shrink-swell potential, groundwater contamination hazard.

Well drained Brunisolic soils are dominant in both the Deadhorse Meadows and Kakwa Falls portions of the study area. They have developed on gravelly medium textured till in the Deadhorse Meadows portion, and on the south side of the river in the Kakwa Falls portion. On the north side of the river in the Kakwa Falls portion, the soils are lithic and have developed on very gravelly bouldery medium textured till. These soils are acidic in reaction, appear strongly weathered, and resemble Humo-Ferric Podzols in appearance. However the percentage free iron and aluminum accumulated in the B horizons is less than values required to meet the definition of Podzolic B horizons. Consequently, the soils have been classified as Eluviated Dystric Brunisols.

Only a few patches of imperfectly drained Brunisolic soils developed on gravelly medium textured till occur in the upland of the Sherman Meadows portion along the eastern and western boundaries. The relatively weak soil profile development is probably due in part to the relatively low clay content in the parent material, and in part to a lack of net downward leaching because of fluctuating water tables. Several patches of Brunisolic soils occur in the floodplain of the Torrens River. Some are imperfectly drained and developed on medium to very coarse textured glaciofluvial sediments (gravel). These are adjacent to the river, have a high lime content; and the minimal soil profile development is probably due to the relatively recent deposition of these sediments, as well as the lack of fines available for leaching. Others are well drained and developed on medium to moderately fine textured glaciofluvial sediments, in both Old and New Sherman Meadows. These Brunisolic soils resemble grassland or Chernozemic soils in appearance and may be a reflection of the native vegetation, which consists dominantly of grass and forbs.

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

A few patches of rapidly drained Regosolic soils developed on very coarse textured fluvial sediments occur adjacent to the Torrens River in the Sherman Meadows portion of the study area. The lack of soil profile development probably reflects the recent deposition of these sediments, and the lack of fines available for leaching.

Soils of the Organic order include all soils that have developed largely from organic deposits, contain more than 30% organic matter by weight, and meet minimum specifications of depth and thickness within a defined control section. The majority of Organic soils are either water saturated or nearly so for much of the year unless artificially drained. The organic deposits are derived primarily from the decomposition of hydrophytic or mesohydrophytic vegetation. The further classification and naming of the great groups into Fbrisols, Mesisols and Humisols depends on the occurrence and identification of three major diagnostic layers: Fibric, Mesic and Humic. Fibric layers are the least decomposed of all the organic soil materials and have large amounts of well preserved fibres, which are readily identifiable as to botanical origin. The organic matter of humic layers is in a highly decomposed state, and often has a smooth greasy feel when moist. It has the least amount of recognizable plant fibre, and is usually darker in color than fibric or mesic materials. It is relatively stable and changes little

in physical or chemical composition with time. The organic matter of mesic layers is in an intermediate stage of decomposition between that of fibric and humic layers, and is partially altered both chemically and physically. Management problems in areas of cultivated Organic soils involve the maintenance of controlled drainage, adequate fertilization, and tillage practices necessary to maintain a firm bed for seed germination and root development. Over drainage and dessication of peat are detrimental to crop production and to the maintenance of the organic layers in a desirable physical condition. Under cultivation, many Organic soils show deficiencies in macro and micro mineral nutrients, and most require the application of phosphorus and potassium to obtain maximum productivity. Special problems also exist in using Organic soils for construction purposes. These are their low bearing strength, high shrink-swell potential and susceptibility to frost heaving.

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

Numerous patches of Organic and Gleysolic soils are found throughout the study area, both in depressional locations and on steep slopes. Organic soils are the more common.

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

The dominant plant species are listed using common names. These are general lists only, and are incomplete.

Map Unit 1

- Classification: Brunisolic Gray Luvisol - 70%
Eluviated Eutric Brunisol - 30%
(These two soils are intimately and unpredictably associated).
- Parent Material: medium to very coarse textured glaciofluvial sediments (gravel).
- Landform: hummocky glaciofluvial (Fh^G), inclined glaciofluvial (Fi^G), glaciofluvial terraces (Ft^G), undulating glaciofluvial (Fu^G).
- Slope: gently undulating to strongly rolling (>0.5 to 30%).
- Surface stoniness: nonstony to exceedingly stony (0 to 5).

Drainage: rapid

Vegetation: dominantly lodgepole pine; usually some white spruce; occasional balsam fir, and aspen; feathermoss; Labrador tea, bunchberry, twinflower, common bearberry, common pink wintergreen, Canadian buffalo-berry, and bracted honeysuckle are all common; some wild rose; willow and swamp birch; often sparse grass; variable amounts of blueberry, purple wild pea vine, fireweed, arnica, palmate-leaved coltsfoot, northern bedstraw, and alsike clover.

Profile description: Brunisolic Gray Luvisol

Horizon	Thickness (cm)	Lab Texture	Structure	Consistence	pH CaCl ₂	OM ¹ %
L-H	8	plentiful, very fine to coarse, oblique and horizontal roots			3.6	57
Ae	4	silt loam	platy	very friable, moist	3.6	3.9
Bmfj	11	gravelly loam	platy	very friable, moist	4.7	3.2
Bt	30	very gravelly loam	subangular blocky	very friable, moist	6.5	nd ²
BC	10	gravel	amorphous	loose, moist	nd	nd
Cca	at 55	gravel	amorphous	loose, moist	nd	nd

¹OM - organic matter, ²nd - not determined

Eluviated Eutric Brunisol

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
L-H	5-10	leaf litter		
Ae	5-10	silt loam to fine sandy loam (often gravelly)	platy	very friable, moist
Bmfj	7-13	very gravelly	amorphous	very friable,

		loam to very gravelly fine sandy loam		moist
Bm	7-45	very gravelly loam to very gravelly fine sandy loam	amorphous	very friable, moist
BC	at 25-65	gravel	amorphous	loose, moist
Cca	at 75-100	gravel	amorphous	loose, moist

- Comments:
- (1) Gravel often occurs at the surface in these soil areas, but overlays of finer-textured sediments, 15 to 60 cm thick are common. Occasionally the thickness is 90 to 120 cm. The textures are commonly silt loam to fine sandy loam, and occasionally sandy loam to loamy sand.
 - (2) Occasional pockets of L-H horizon, up to 20 cm thick occur, and the underlying soil profiles are sometimes gleyed.
 - (3) Pockets of Ae horizon, 15 to 20 cm thick often occur.
 - (4) Cca horizons usually occur below the 100 cm depth.

Limitations: Slight to very severe - slight on suitable topography for buildings and road location except for surface stoniness; severe for lawns and landscaping, and septic tank absorption fields; very severe for trench type sanitary landfills; moderate on suitable topography for all other uses except for surface stoniness; good source of roadfill on suitable topography except for surface stoniness; good source of gravel; unsuitable as a source of sand due to unsuitable textures. Other limitations include slippery or sticky when wet, excessive slopes, erosion hazard, lack of Ah horizon, rapid permeability (droughtiness), and groundwater contamination hazard.

Map Unit 2

- Classification: Gleyed Eutric Brunisol
- Parent Material: medium to very coarse textured glaciofluvial sediments (gravel)
- Landform: hummocky glaciofluvial (Fh^G), inclined glaciofluvial (Fi^G), level glaciofluvial (Fl^G), glaciofluvial terraces (Ft^G), undulating glaciofluvial (Fu^G)
- Slope: gently undulating to gently rolling (>0.5 to 9%)
- Surface stoniness: nonstony to excessively stony (0 to 5)

Drainage: imperfect

Vegetation: same as for Map Unit 1 in some areas; also areas of predominantly white spruce, with some balsam poplar and balsam fir; understory of willow, alder, low-bush cranberry, raspberry, wild rose, wild gooseberry, bracted honeysuckle, wild currant, cow parsnip, tall larkspur, low larkspur, lungwort, wild strawberry, fireweed, common yarrow, baneberry, arnica, dwarf raspberry, common pink wintergreen, purple wild pea vine, fairy bells, and palmate-leaved coltsfoot; some Labrador tea, blueberry, common bearberry, and club-moss; in some areas mainly willow and swamp birch, with an understory of numerous forbs and grass.

Profile description: Gleyed Eutric Brunisol

Horizon	Thickness (cm)	Lab Texture	Structure	Consistence	pH CaCl ₂	OM ¹ %
L-H	2	plentiful, very fine to coarse, horizontal and oblique roots			6.5	32
Bm	12	silt loam	amorphous	very friable, moist	6.8	9.9
Fb	1	partly decomposed organic matter (not sampled)				
Bmg1	39	silt loam	amorphous	very friable, moist	7.1	4.6
Bmg2	8	silt loam	amorphous	very friable, moist	7.1	nd ²
Bmg3	10	loam	amorphous	very friable, moist	7.2	nd
BCg	at 70	gravel	amorphous	loose, moist	nd	nd

¹OM - organic matter, ²nd - not determined

- Comments: (1) Occasional horizons of loamy sand, sand or fine gravel textures, varying from 5 to 50 cm thick, occur in these soil profiles.
- (2) Gravel is often found 40 to 75 cm below the surface, and sometimes at the surface. Where it occurs at the surface, numerous pockets of loam to sandy loam-textured sediments are usually found throughout the soil profile.

Limitations: Moderate to very severe - severe for septic tank absorption fields; severe to very severe for buildings; very severe for trench type sanitary landfills; moderate for all other uses except for surface stoniness; good source of roadfill except for surface stoniness; good source of gravel; unsuitable as a source of sand due to unsuitable textures. Other limitations include seasonally high groundwater table, flooding hazard (overflow), slippery or sticky when wet, erosion hazard, lack of Ah horizon, rapid permeability, and groundwater contamination hazard.

Map Unit 3

Classification: Brunisolic Gray Luvisol

Parent Material: moderately fine textured, very stony and gravelly till

Landform: hummocky morainal (Mh), inclined morainal (Mi), ridged morainal (Mr), undulating morainal (Mu)

Slope: gently sloping to hilly (>2 to 60%)

Surface stoniness: slightly to exceedingly stony (1 to 4)

Drainage: well drained

Vegetation: dominantly lodgepole pine and white spruce; some balsam fir; Canadian buffalo-berry, alder, saskatoon-berry, bracted honeysuckle, feathermoss, bunchberry, twinflower, common pink wintergreen, palmate-leaved coltsfoot, fireweed, common bearberry, blueberry, white meadowsweet; some wild rose, Labrador tea, club-moss; very little grass; occasional patch of aspen and balsam poplar, with some white spruce and balsam fir; understory of grass and numerous forbs including fairy bells, false Solomon's seal, cow parsnip, meadow rue, Western Canada violet, and others.

Profile description: Brunisolic Gray Luvisol

Horizon	Thickness (cm)	Lab Texture	Structure	Consistence	pH CaCl ₂	OM ¹ %
L-H	6	plentiful, very fine to coarse, horizontal and oblique roots			3.8	77
Ae	10	gravelly silt loam	platy	very friable, moist	3.5	1.39
Bmfj	7	gravelly silt loam	platy	very friable, moist	4.0	1.55
Bm	9	very gravelly silt loam	subangular blocky	very friable, moist	4.4	1.04
Bt	29	very gravelly clay loam	subangular blocky	very firm, moist	5.6	1.87
BC	15	very gravelly clay loam	amorphous	firm, moist	7.0	nd ²
Cca	at 70	very gravelly clay loam	amorphous	firm, moist	7.4	nd

¹OM - organic matter, ²nd - not determined

Comments: (1) The L-H horizon is often 10 to 15 cm thick.

(2) Some pockets of Ae horizon, up to 15 cm thick, are found.

(3) The soil profiles are often very stony and gravelly (sometimes bouldery), containing numerous angular and sub-rounded fragments of sandstone (predominantly) and shale.

Limitations: Slight to very severe-slight on suitable topography for buildings without basements except for surface stoniness; severe to very severe for septic tank absorption fields; moderate on suitable topography for all other uses except for surface stoniness; fair source of roadfill on suitable topography except for surface stoniness; unsuitable as a source of sand or gravel due to unsuitable textures. Other limitations include erosion hazard, slippery or sticky when wet, excessive slopes, lack of Ah horizon, susceptibility to frost heave, high clay content, moderate shrink-swell potential, and slow permeability.

Map Unit 4

Classification: Gleyed Gray Luvisol

Parent Material: moderately fine textured very stony and gravelly till

Landform: hummocky morainal (Mh), inclined morainal (Mi), level morainal (Ml), undulating morainal (Mu)

Slope: gently undulating to hilly (>0.5 to 60%)

Surface stoniness: moderately to very stony (2 to 3)

Drainage: imperfect

Vegetation: mostly lodgepole pine; some white spruce, balsam fir, and balsam poplar; feathermoss, Labrador tea, common bearberry, palmate-leaved coltsfoot, cow parsnip, bunchberry, twinflower; some wild gooseberry, wild rose, and grass; some patches of mainly white spruce, willow and forbs; including bracted honeysuckle, meadow rue, false Solomon's seal, low larkspur, arnica, common pink wintergreen, wild strawberry, common yarrow, fireweed, ferns, horsetail, and grass of parnassus.

Profile description: Gleyed Gray Luvisol

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
L-H	10-15	leaf litter and moss		
Ae	5-8	silt loam	platy	very friable, moist
Btg	20-30	gravelly clay loam	subangular blocky	friable, moist
BCg	55-75	very gravelly clay loam	amorphous	firm to very firm, moist
Ccag	at 90-100	very gravelly clay loam	amorphous	firm to very firm, moist

Comments: (1) The peaty phase of this soil is found in a few patches, where the L-H horizon is 20 to 25 cm thick.

(2) Some pockets of Ae horizon, 10 to 15 cm thick, occur.

(3) The soil profiles are often very stony and gravelly (some-

times bouldery) containing numerous angular and sub-rounded fragments of sandstone (predominantly) and shale.

Limitations: Moderate to very severe - severe to very severe for buildings with basements, septic tank absorption fields, and trench type sanitary landfills; moderate on suitable topography for all other uses except for surface stoniness; fair source of roadfill on suitable topography; unsuitable as a source of sand or gravel due to unsuitable textures. Other limitations include seasonally high groundwater table, slippery or sticky when wet, excessive slopes, erosion hazard, lack of Ah horizon, susceptibility to frost heave, slow permeability, groundwater contamination hazard, and moderate shrink-swell potential.

Map Unit 5

Classification: Orthic Gleysol, Peaty phase and Orthic Humic Gleysol, Peaty phase (These two great groups are intimately and unpredictably associated)

Parent Material: moderately fine textured very stony and gravelly till.

Landform: hummocky morainal (Mh), inclined morainal (Mi), level morainal (Ml), undulating morainal (Mu)

Slope: nearly level to steeply sloping (0 to 30%)

Surface stoniness: slightly to excessively stony (1 to 5)

Drainage: poor

Vegetation: white spruce or black spruce; some balsam fir, balsam poplar, lodgepole pine, and alder; feathermoss, palmate-leaved coltsfoot, horsetail, cow parsnip, wild gooseberry, low-bush cranberry, bracted honey-suckle, wild rose, bunchberry, twinflower, wild strawberry, false Solomon's seal, fairy bells, twisted stalk, baneberry, tall larkspur, low larkspur, meadow rue, northern bedstraw, indian paint-brush, water avens, and some grass; some patches of willow, swamp birch, sedge, grass, and forbs.

Profile description: Orthic Gleysol, Peaty phase and Orthic Humic gleysol, Peaty phase

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
Of	0-10	dominantly fibric peat		
Om	0-5	dominantly mesic peat		

Oh	10-25	dominantly humic peat		
Ah	0-20	silt loam	granular	very friable, moist
Bg	25-50	gravelly silt loam, gravelly clay loam, or gravelly sandy clay loam	subangular blocky	very friable to firm, moist
BCg	0-25	very gravelly silt loam to very gravelly sandy clay loam	amorphous	friable to firm moist
Ccag	at 50 to 90+	very gravelly silt loam to very gravelly sandy clay loam	amorphous	friable to firm moist

- Comments: (1) The thickness of Ah horizon varies unpredictably. If it is less than 10 cm, the soils are classified as Gleysols; if it is 10 cm or more, the soils are classified as Humic Gleysols. Soils with 15 cm or more of peat on the surface are classified as peaty phases.
- (2) Numerous variable-textured pockets occur in these soil profiles.

Limitations: Severe to very severe - very severe for septic tank absorption fields and trench type sanitary landfills; severe to very severe for all other uses; poor source of roadfill; unsuitable as a source of sand or gravel due to unsuitable textures. Other limitations include seasonally high ground water table, organic surface layer more than 15 cm thick, slippery or sticky when wet, surface stoniness, excessive slopes, susceptibility to frost heave, moderate shrink-swell potential, slow permeability, and groundwater contamination hazard.

Map Unit 6

Classification: Gleyed Eutric Brunisol

Parent Material: medium textured glaciofluvial sediments, overlying medium to moderately fine textured very stony till

Landform: glaciofluvial veneer, overlying inclined morainal (Fv^G/Mi); glaciofluvial veneer and blanket, overlying level morainal (Fv^G_b/Mi)

Slope: gently undulating to strongly sloping (>0.5 to 15%)
 Surface stoniness: nonstony (0)
 Drainage: imperfect
 Vegetation: Forested areas - mainly white spruce; some balsam fir, and lodgepole pine; understory of willow, horsetail, feathermoss, cow parsnip, wild rose, wild gooseberry, bracted honeysuckle, tall larkspur, wild vetch, palmate-leaved coltsfoot, fireweed, northern bedstraw, wild strawberry, common yarrow, orange-flowered false dandelion, and grass; Cleared areas - mainly grass with patches of forbs including common dandelion, common yarrow, common plantain, fireweed, meadow rue, wild strawberry, and some sedge.

Profile description: Gleyed Eutric Brunisol

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
L-H	5-10	leaf litter (present under forest)		
Bmg	75-105	silt loam	amorphous	very friable to firm, moist
11BCg (till)	at 75 to 105	very gravelly loam to very gravelly clay loam	amorphous	friable to firm moist

Comment: (1) A layer of fine gravel usually occurs in the soil profile from 25 to 60 cm below the surface, and 10 to 20 cm thick.

(2) The till is sometimes more than 120 cm below the surface.

Limitations: Moderate to severe - severe for buildings with basements, septic tank absorption fields, trench type sanitary landfills, and road location; moderate on suitable topography for all other uses; poor source of roadfill; unsuitable as a source of sand or gravel due to unsuitable textures. Other limitations include seasonally high groundwater table, slippery or sticky when wet, excessive slopes, erosion hazard, lack of Ah horizon, susceptibility to frost heave, slow permeability, groundwater contamination hazard, and moderate shrink-swell potential.

Map Unit 7

Classification: Orthic Eutric Brunisol

Parent Material: medium textured glaciofluvial sediments, overlying medium to moderately fine textured very stony till

Landform: glaciofluvial veneer, overlying level morainal (Fv^G/M1); glaciofluvial veneer and blanket, overlying level morainal (Fv^G_b/M1)

Slope: gently undulating (>0.5 to 2%)

Surface stoniness: nonstony (0)

Drainage: well drained

Vegetation: (cleared airstrip) mainly grass; numerous forbs including common dandelion, common yarrow, wild strawberry, alsike clover, cow parsnip, wild rose, fireweed, lungwort, meadow rue, tall larkspur, bracted honeysuckle, common nettle, western dock, northern bedstraw, and wild vetch; small amount of sedge and horsetail; some patches of willow and swamp birch, with small amount of white spruce; forbs more abundant than grass in natural areas.

Profile description: Orthic Eutric Brunisol

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
L-H	0-5	plant litter - turf, compact		
Bm	45-110	silt loam	amorphous	very friable to firm, moist
IIBC (till)	at 45-110	very gravelly loam to very gravelly clay loam	amorphous	firable to firm moist

Comments: (1) Occasional patches of Ah horizon are found, ranging from 7 to 12 cm thick; and having silt loam texture, granular structure, and very friable moist consistence. These soils are classified as Melanic Brunisols.

(2) A layer of fine gravel usually occurs in the soil profile, from 45 to 60 cm below the surface, and 10 to 20 cm thick.

(3) The till occasionally occurs more than 120 cm below the surface, and the occasional small pocket occurs at the surface.

- (4) An occasional small pocket of till is found on the surface, apparently as fill to level the airstrip, and varying from 10 to 90 cm thick.

Limitations: Slight to severe - slight for buildings without basements, and trench type sanitary landfills; severe for buildings with basements, and road location; moderate for all other uses; poor source of roadfill; unsuitable as a source of sand or gravel due to unsuitable textures. Other limitations include slippery or sticky when wet, lack of Ah horizon, susceptibility to frost heave, slow permeability, and moderate shrink-swell potential.

Map Unit 8

Classification: Orthic Gray Luvisol - 80%
Orthic Eutric Brunisol - 20%

Parent Material: medium to moderately fine textured very stony and gravelly till.

Landform: inclined morainal (Mi)

Slope: moderately to very steeply sloping (>5 to 60%)

Surface stoniness: slightly to exceedingly stony (1 to 4)

Drainage: well drained

Vegetation: fairly open forest - variable combinations of white spruce, aspen, balsam poplar, and lodgepole pine; some alder; profuse grass; Canadian buffalo-berry, low-bush cranberry, wild rose, wild gooseberry, bracted honeysuckle, Western Canada violet, wild strawberry, feathermoss, horsetail, cow parsnip, fireweed, tall larkspur, purple wild pea vine, ferns, twinflower, bunchberry, baneberry, indian paint-brush, common pink wintergreen, common bearberry, and arnica.

Profile description: Orthic Gray Luvisol

Horizon	Thickness (cm)	Lab Texture	Structure	Consistence	pH CaCl ₂	OM ¹ %
L-H	5	abundant,	fine to coarse,	oblique roots	5.7	38
Ae	10	gravelly silt loam	platy	soft, dry	4.8	3.6

AB	12	gravelly clay loam	subangular blocky	slightly hard, dry	5.7	2.4
Bt	26	gravelly clay loam	subangular blocky	hard, dry; firm, moist	5.9	nd ²
BC	18	very gravelly silty clay loam	amorphous	slightly hard, dry	7.0	nd
Cca	at 66	very gravelly silt loam	amorphous	slightly hard, dry	7.4	nd

¹OM - organic matter, ²nd - not determined

Orthic Eutric Brunisol

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
L-H	10-15	leaf litter		
Bm	15-45	gravelly silt loam to gravelly clay loam	amorphous to subangular blocky	very friable to firm, moist
BC or Cca	at 15-45	very gravelly silt loam to very gravelly clay loam	amorphous	very friable to firm, moist

- Comments: (1) Only occasional unpredictable occurrences of the Brunisolic soils are found.
- (2) The Cca horizons sometimes occur at depths of more than 90 cm below the surface.

Limitations: Moderate to very severe - moderate on suitable topography for buildings without basements and trench type sanitary landfills, except for surface stoniness; severe to very severe for buildings with basements, septic tank absorption fields, and road location; moderate on suitable topography for all other uses except for surface stoniness; poor source of roadfill; unsuitable as a source of sand or gravel due to unsuitable textures. Other limitations include erosion hazard, slippery or sticky when wet, excessive slopes, lack of Ah horizon, susceptibility to frost heave, high clay

content, slow permeability, and moderate shrink-swell potential.

Map Unit 9

Classification: Gleyed Eutric Brunisol and Gleyed Melanic Brunisol

(These two subgroups are intimately and unpredictably associated).

Parent Material: medium to moderately fine textured gravelly and stony till.

Landform: hummocky morainal (Mh), inclined morainal (Mi)

Slope: moderately sloping to strongly rolling (>5 to 30%)

Surface stoniness: nonstony to very stony (0 to 3)

Drainage: moderately well to imperfectly drained

Vegetation: white spruce, lodgepole pine, balsam fir; some balsam poplar; alder, willow, low-bush cranberry, wild gooseberry, wild currant, wild rose, bracted honeysuckle, feathermoss, horsetail, bunchberry, twinflower, common pink wintergreen, palmate-leaved coltsfoot, baneberry, wild strawberry, tall larkspur, cow parsnip, ferns, common nettle, fireweed, twisted stalk, lungwort, purple wild pea vine, arnica, and grass.

Profile description: Gleyed Melanic Brunisol, Peaty phase

Horizon	Thickness (cm)	Lab Texture	Structure	Consistence	pH CaCl ₂	OM ¹ %
L-H	15	plentiful,	very fine to coarse,		5.9	69
		horizontal and oblique roots				
Ah	10	silty clay loam	amorphous	very friable, moist	6.2	16.3
Bmg	30	gravelly silt loam	subangular blocky	very friable, moist	6.4	4.4
BCg	at 40	very gravelly silt loam	subangular blocky	friable, moist	6.8	nd ²

¹OM - organic matter, ²nd - not determined

- (2) The Ah horizon occurs in discontinuous pockets, ranging from 0 to 20 cm in thickness.
- (3) Numerous pockets of fine gravelly small angular fragments of shale and sandstone occur in these soil profiles.
- (4) A water table is sometimes found 100 cm below the surface.

Limitations: Moderate to severe - severe for buildings with basements, and road location; moderate on suitable topography for all other uses except for surface stoniness; poor source of roadfill; unsuitable as a source of sand or gravel due to unsuitable textures. Other limitations include slippery or sticky when wet, erosion hazard, excessive slopes, susceptibility to frost heave, seasonally high groundwater table, slow permeability, groundwater contamination hazard, and moderate shrink-swell potential.

Map Unit 10

Classification: Orthic Gleysol and Orthic Gleysol, Peaty phase (The peaty and non-peaty phases are intimately and unpredictably associated).

Parent material: medium to very coarse textured glaciofluvial sediments (gravel).

Landform: inclined glaciofluvial (Fi^G), level glaciofluvial (Fl^G), glaciofluvial terraces (Ft^G).

Slope: nearly level to moderately sloping (0 to 9%)

Surface stoniness: nonstony to excessively stony (0 to 5)

Drainage: poor

Vegetation: willow, feathermoss; usually white spruce; often black spruce, balsam poplar, Labrador tea; sometimes alder, swamp birch, lodgepole pine, balsam fir; various shrubs and forbs including wild rose, bracted honeysuckle, horsetail, cow parsnip, tall larkspur, lungwort, palmate-leaved coltsfoot, dwarf raspberry, common bearberry, blueberry, bunchberry, twinflower, purple wild pea vine, and wild strawberry; sometimes sphagnum moss, and sedge; sometimes common dandelion, common yarrow, and northern bedstraw.

Profile description: Orthic Gleysol and Orthic Gleysol, Peaty phase

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
Of	0-12	predominantly fibric peat		
Om	0-8	predominantly mesic peat		
Oh	0-10	predominantly humic peat		
Bg	50-75	loam, silt loam, or fine sandy loam	amorphous	very friable to firm, moist
BC	at 50-75	gravel	amorphous	loose, moist

Fera Gleysol and Fera Gleysol, Peaty phase

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
Of	0-12	predominantly fibric peat		
Om	0-8	predominantly mesic peat		
Oh	0-10	predominantly humic peat		
Aeg	5-10	loam	platy	very friable, moist
Bgf	30	loam	amorphous	firm, moist
BC	at 35-40	gravel	amorphous	loose, moist

- Comments:
- (1) The Fera subgroup is only occasionally found.
 - (2) The Bg horizon commonly consists of layers of variable textured sediments, ranging from 25 to 45 cm thick. Clay loam textures are occasionally found, and a 10 cm fine gravel lense often occurs from 15 to 50 cm below the surface.
 - (3) Gravel is often found at the surface, and sometimes below 100 cm.

Limitations: Severe to very severe - very severe for septic tank absorption fields and trench type sanitary landfills; severe to very severe for all other uses; poor to very poor source of roadfill; poor source of gravel due to wetness and a

flooding hazard (overflow); unsuitable as a source of sand due to unsuitable textures. Other limitations include organic surface layer more than 15 cm thick, surface stoniness, rapid permeability, and groundwater contamination hazard.

Map Unit 11

- Classification:** Brunisolic Gray Luvisol, Lithic phase.
- Parent Material:** moderately fine textured very stony till, overlying shale or sandstone.
- Landform:** morainal veneer overlying hummocky bedrock (Mv/Rh); morainal veneer overlying inclined bedrock (Mv/Ri)
- Slope:** gently rolling to very steeply sloping (>5 to 60%)
- Surface stoniness:** very stony to exceedingly stony (3 to 4)
- Drainage:** well drained
- Vegetation:** dominantly lodgepole pine and alder; some aspen and balsam poplar; Canadian buffalo-berry, saskatoon-berry, bracted honeysuckle, feathermoss, bunchberry, twin-flower, common pink wintergreen, palmate-leaved colts-foot, fireweed, common bearberry, blueberry, white meadowsweet; some wild rose, Labrador tea, club-moss; very little grass.
- Profile description:** Brunisolic Gray Luvisol, Lithic phase

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
L-H	10-15	leaf litter		
Ae	5-8	gravelly silt loam	platy	very friable, moist
Bmfj	7-20	gravelly silt loam	platy	very friable, moist
Bt	12-25	very gravelly clay loam	subangular blocky	friable to firm, moist
BC	5-27	very gravelly clay loam	amorphous	firm to very firm, moist
IIBC	at 30-80	weathered fragmental shale or hard sandstone		

- Comments: (1) The L-H horizon is often 10 to 15 cm thick.
- (2) The soil profiles are sometimes gleyed.
- (3) The soil profiles are often very stony and gravelly (sometimes bouldery), containing numerous angular and sub-rounded fragments of sandstone (predominantly) and shale.

Limitations: Moderate to very severe - slight to moderate on suitable topography for buildings except for surface stoniness; moderate on suitable topography for road location except for surface stoniness; severe for trench type sanitary landfills; very severe for septic tank absorption fields; severe to very severe for all other uses; fair source of roadfill on suitable topography except for surface stoniness; unsuitable as a source of sand or gravel due to unsuitable textures. Other limitations include shallow depth to bedrock, erosion hazard, excessive slopes, lack of Ah horizon, high clay content, slow permeability, moderate shrink-swell potential, and susceptibility to frost heave.

Map Unit 12

Classification: Orthic and Brunisolic Gray Luvisol, Lithic phase - 70%
Eluviated Eutric Brunisol, Lithic phase - 30%

(These soils are all intimately and unpredictably associated).

Parent material: medium to moderately fine textured till containing a high proportion of weathered sandstone and shale, overlying hard sandstone or shale.

Landform: morainal veneer overlying hummocky bedrock (Mv/Rh);
morainal veneer overlying inclined bedrock (Mv/Ri);
morainal veneer overlying ridged bedrock (Mv/Rr).

Slope: gently rolling to hilly (>5 to 60%).

Surface stoniness: slightly to exceedingly stony (1 to 4).

Drainage: well to moderately well drained.

Vegetation: lodgepole pine, white spruce; some balsam fir; occasionally some aspen and balsam poplar; alder, white-flowered rhododendron, bracted honeysuckle, Canadian buffalo-berry, tall huckleberry, false huckleberry, wild rose; often some willow and mountain ash; wild currant, white meadowsweet, Labrador tea, bunchberry, twinflower, palmate-leaved coltsfoot, arnica, common bearberry, false Solomon's seal, common pink wintergreen, meadow rue, blueberry, feathermoss, club-moss, and grass.

L-H	9	plentiful, very fine to coarse, horizontal and oblique roots			3.6	76	
Ae	7	gravelly silt loam	platy	very friable, moist	3.7	2.2	
Btj	25	very gravelly silt loam	subangular blocky	very friable, moist	4.1	1.5	
Bt	13	very gravelly silt loam	subangular blocky	very friable, moist	4.4	nd ²	
IIBC	at 45	hard shale					

¹OM - organic matter, ²nd - not determined

Orthic and Brunisolic Gray Luvisol, Lithic phase

Horizon	Thickness (cm)	Field Texture	Structure	Consistence	
L-H	5-12	leaf litter			
Ae	2-12	silt loam to gravelly silt loam	platy	very friable, moist; soft to slightly hard, dry	
Bmfj	0-25	gravelly silt loam	amorphous to platy	very friable to friable, moist	
Bt	10-30	gravelly silty clay loam	subangular blocky	friable to firm, moist	
BC	0-50	gravelly silty clay loam	amorphous	firm, moist	
IIBC	at 15-75	hard sandstone or shale			

Eluviated Eutric Brunisol, Lithic phase

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
L-H	2-5	leaf litter (loose and fragile - high proportion of pine needles)		
Ae	0-8	silt loam to gravelly silt loam	platy	soft to slightly hard, dry
Bmfj	0-25	gravelly silt loam	platy	very friable, moist
Bm	5-15	gravelly silt loam	subangular blocky	very friable, moist
IBC	at 15-35	hard sandstone or fragmental shale		

- Comments:
- (1) The soil profiles usually contain numerous small sandstone and shale fragments.
 - (2) The soil profiles are occasionally gleyed.
 - (3) A high incidence of tree blowdown has occurred on steep slopes (>30 to 60%) in some of these soil areas.

Limitations: Moderate to very severe - moderate on suitable topography for buildings without basements except for surface stoniness; moderate on suitable topography for road location except for susceptibility to frost heave; severe for trench type sanitary landfills; very severe for septic tank absorption fields; severe to very severe for all other uses; poor source of roadfill; unsuitable as a source of sand or gravel due to unsuitable textures. Other limitations include shallow depth to BR, erosion hazard, excessive slopes and slow permeability.

Map Unit 13

- Classification: Orthic Eutric Brunisol
- Parent Material: very coarse textured glaciofluvial sediments (gravel).
- Landform: inclined glaciofluvial Fi^G), glaciofluvial terraces (Ft^G).
- Slope: gently undulating to moderately sloping (>0.5 to 9%)
- Surface stoniness: exceedingly to excessively stony (4 to 5)
- Drainage: rapid

Vegetation: mostly lodgepole pine (open forest); some white spruce, aspen, balsam poplar; some willow; Canadian buffalo-berry, low-bush cranberry, wild rose, grass; numerous forbs including common bearberry, wild strawberry, purple wild pea vine, showy loco-weed, fireweed, indian paint-brush, common yarrow, northern bedstraw, cut-leaved anemone, twinflower, and goldenrod.

Profile description: Orthic Eutric Brunisol

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
L-H	2-5	leaf and root litter - turf		
Bm	10-20	very gravelly sandy loam	amorphous	loose, moist or dry
Cca	at 10-20	gravel	amorphous	loose, moist or dry

Comments: (1) Occasionally the texture of the Bm horizon is loamy sand.

Limitations: Moderate to very severe - severe for septic tank absorption fields; severe to very severe for lawns and landscaping, and buildings; very severe for trench type sanitary landfills; moderate for all other uses except for surface stoniness; good source of roadfill except for surface stoniness; good source of gravel; unsuitable as a source of sand due to unsuitable textures. Other limitations include sandy surface texture, flooding hazard (overflow), rapid permeability (droughtiness), and groundwater contamination hazard.

Map Unit 14

Classification: Orthic Regosol

Parent Material: very coarse textured fluvial sediments (gravel)

Landform: level fluvial (F1)

Slope: gently undulating (>0.2 to 2%)

Surface stoniness: very stony to excessively stony (3 to 5)

Drainage: rapid

Vegetation: very sparse with patches of bare ground - very scattered balsam poplar, white spruce, lodgepole pine, willow, Canadian buffalo-berry, wild gooseberry; sparse grass; numerous forbs, including common bearberry,

common yarrow, fireweed, wild strawberry, yellow mountain avens, common dandelion, and goldenrod.

Profile description: Orthic Regosol

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
CK	at 0+	gravel	amorphous	loose, dry or moist

- Comments:
- (1) These soils are found adjacent to the Torrens River, on gravel and sand bars which are only partially vegetated.
 - (2) The soil surface is often bouldery.
 - (3) Some patches of sandy overlays as thick as 60 cm are found, ranging from loamy sand to sand in texture. Occasional sandy loam textured lenses, 5 to 12 cm thick, also occur.

Limitations: Moderate to very severe - moderate for picnic areas except for surface stoniness; severe for lawns and landscaping; severe to very severe for camping areas, paths, trails, and road location; very severe for buildings, septic tank absorption fields, and trench type sanitary landfills; fair source of roadfill except for surface stoniness; only a fair source of gravel because of flooding hazard (overflow), poor source of sand for the same reason, and because of thin sand deposits. Other limitations include sandy surface texture, rapid permeability (droughtiness), and groundwater contamination hazard.

Map Unit 15

- Classification: Eluviated Dystric Brunisol, Lithic phase
- Parent Material: medium textured very gravelly bouldery till, overlying conglomerate or sandstone
- Landform: morainal veneer overlying hummocky bedrock (Mv/Rh), morainal veneer overlying level bedrock (Mv/R1)
- Slope: gently undulating to strongly rolling (>0.5 to 30%)
- Surface stoniness: exceedingly stony (4)
- Drainage: well drained
- Vegetation: fairly open forest - mostly lodgepole pine; occasional white spruce; sparse understory, including Canadian buffalo-berry, willow, swamp birch, wild rose, juniper, bracted honeysuckle, bunchberry, twinflower, lungwort,

wild strawberry, meadow rue, northern bedstraw, arnica, common yarrow, fireweed, tall larkspur, common pink wintergreen, grass, feathermoss, and club moss.

Profile description: Eluviated Dystric Brunisol, Lithic phase

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
L-H	2-3	leaf litter		
Ae	5-10	gravelly silt loam	platy	slightly hard, dry; very friable, moist
Bmfj	15-50	very gravelly silt loam	amorphous	slightly hard, dry; very friable, moist
BC	0-60	very gravelly silt loam	amorphous	friable to firm, moist
IIBC	at 25-75	conglomerate or sandstone		

- Comments:
- (1) the Ae horizon is sometimes discontinuous, and also sometimes tongues to depths of 45 cm.
 - (2) The soil solum is commonly very gravelly and bouldery.
 - (3) The depth to bedrock is sometimes greater than 100 cm.

Limitations: Moderate to very severe - moderate on suitable topography for buildings without basements except for surface stoniness; very severe for septic tank absorption fields and trench type sanitary landfills; severe for all other uses; poor source of roadfill; unsuitable as a source of sand or gravel due to unsuitable textures. Other limitations include shallow depth to bedrock, slippery or sticky when wet, erosion hazard, lack of Ah horizon, slow permeability, and susceptibility to frost heave.

Map Unit 16

Classification: Orthic Humic Gleysoil

Parent Material: medium textured glaciofluvial sediments, overlying moderately fine textured gravelly bouldery till.

Landform: glaciofluvial veneer overlying level morainal (Fv^G/M1).

Slope: gently undulating (>0.2 to 2%)

Surface stoniness: nonstony (0)
 Drainage: poor
 Vegetation: willow, grass; some sedge; wild strawberry, meadow rue, palmate-leaved coltsfoot, water avens, and orange-flowered false dandelion.
 Profile description: Orthic Humic Gleysol

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
Ah	55	silt loam	amorphous	very friable, moist
Bg	15	silt loam	amorphous	firm, moist
IIBCg	at 70	very gravelly sandy clay loam	amorphous	firm, moist

Limitations: Severe to very severe - very severe for septic tank absorption fields and trench type sanitary landfills; severe for all other uses; poor source of roadfill; unsuitable as a source of sand or gravel due to unsuitable textures. Other limitations include seasonally high groundwater table or surface ponding, flooding hazard (overflow), slippery or sticky when wet, susceptibility to frost heave, groundwater contamination hazard, and moderate shrink-swell potential.

Map Unit 17

Classification: Orthic Eutric Brunisol and Orthic Melanic Melanic Brunisol.
 Parent Material: medium textured glaciofluvial sediments.
 Landform: inclined glaciofluvial (Fi^G), level glaciofluvial (F1^G)
 Slope: very gently sloping to moderately sloping (>0.5 to 9%)
 Surface stoniness: nonstony (0)
 Drainage: well drained
 Vegetation: meadow areas - thick grass and forbs including meadow rue, tall larkspur, tall buttercup, northern bedstraw, common yarrow, wild strawberry, common nettle, aster, common dandelion, fireweed, western dock, cow parsnip, lungwort, wild vetch, and sedge.

forested patches - white spruce, willow; some lodgepole pine; grass, wild currant, bracted honeysuckle, fireweed, cow parsnip, meadow rue, palmate-leaved coltsfoot, tall larkspur, bunchberry, common bearberry, horsetail, wild strawberry, and twinflower; some patches of mainly willow.

Profile description: Orthic Melanic Brunisol

Horizon	Thickness (cm)	Lab Texture	Structure	Consistence	pH CaCl ₂	OM ¹ %
L-H	5 (turfy)	abundant, micro to fine; medium; oblique and horizontal roots			5.2	42
Ah	9	silt loam to silty clay loam	platy to granular	very friable, moist	4.6	11.0
Bm	25	silty clay loam	prismatic, breaking to platy	very friable, moist	5.1	7.1
BC1	14	silt loam	platy	friable, moist	5.4	nd ²
BC2	8	silt loam	platy	very friable, moist	5.5	nd
BC3	20	silt loam	platy	firm, moist	5.7	nd
BC4	at 76	silt loam	amorphous	very friable, moist	5.8	nd

¹OM - organic matter, ²nd - not determined

- Comments:
- (1) Most of the Map Unit 17 soils are Eutric Brunisols, and only occasional patches of Melanic Brunisols are found where Ah horizons more than 5 cm thick occur.
 - (2) Often one to two lenses of coarser textured sediments occur in the soil profile. These range from loam to fine gravel, and are 10 to 25 cm thick.
 - (3) Occasionally gravel is found 60 to 75 cm below the surface.

Limitations: Slight to severe - slight for buildings without basements, and trench type sanitary landfills; severe for buildings with basements, and road location; moderate for all other uses; poor source of roadfill; unsuitable as a source of sand or gravel due to unsuitable textures. Other limitations include slippery or sticky when wet, thin or no Ah horizon, susceptibility to frost heave, slow permeability,

moderate shrink-swell potential, and erosion hazard.

Map Unit 18

Classification: Eluviated Dystric Brunisol

Parent Material: medium textured gravelly till

Landform: hummocky morainal (Mh), inclined morainal (Mi), undulating morainal (Mu)

Slope: undulating to very steeply sloping (>2 to 60%)

Surface stoniness: moderately to exceedingly stony (2 to 4)

Drainage: well drained

Vegetation: mainly lodgepole pine; some balsam fir, white spruce, and mountain ash; white-flowered rhododendron, Canadian buffalo-berry, tall huckleberry, false huckleberry, bracted honeysuckle, wild currant, bunchberry, wild lupine, false Solomon's seal, arnica, common pink wintergreen, blueberry, feathermoss, club-moss; sparse grass

Profile description: Eluviated Dystric Brunisol

Horizon	Thickness (cm)	Lab Texture	Structure	Consistence	pH CaCl ₂	OM ¹ %
L-H	5	plentiful, very fine to coarse, horizontal and oblique roots			3.4	56
Ae	23	silt loam	platy	very friable, moist	3.5	0.99
Bfj	22	gravelly silt loam	amorphous	very friable, moist	4.1	1.5
BC	at 45	gravelly silt loam	amorphous	very friable, moist	4.3	nd ²

¹OM - organic matter, ²nd - not determined

- Comments:**
- (1) A Cca horizon occasionally occurs within 90 to 100 cm of the surface, but is usually deeper than 100 cm.
 - (2) The BC horizon sometimes contains a few sand pockets.
 - (3) A lithic phase is occasionally found, where shale occurs 60 to 90 cm below the surface.

Limitations: Moderate to very severe - slight on suitable topography for trench type sanitary landfills except for surface stoniness; moderate on suitable topography for septic tank absorption fields; severe to very severe for buildings and road location; moderate on suitable topography for all other uses except for surface stoniness; poor source of roadfill; unsuitable as a source of sand or gravel due to unsuitable textures. Other limitations include erosion hazard, slippery or sticky when wet, excessive slopes, lack of Ah horizon, slow permeability, susceptibility to frost heave, and moderate shrink-swell potential.

Map Unit 19

Classification: Orthic Melanic Brunisol

Parent material: medium to moderately fine textured till

Landform: inclined morainal (Mi), level morainal (Ml)

Slope: gently undulating to steeply sloping (>0.5 to 30%)

Surface stoniness: nonstony to moderately stony (0 to 2)

Drainage: well drained

Vegetation: lodgepole pine, balsam fir, white spruce, Canadian buffalo-berry, wild currant, feathermoss, bunchberry, common pink wintergreen, arnica, false Solomon's seal, cow parsnip, aster, and grass.

Some areas of mainly willow, and grass; some swamp birch; understory comprised of bracted honeysuckle, lungwort, northern bedstraw, wild vetch, tall larkspur, fireweed, wild strawberry, common yarrow, meadow rue, and orange-flowered false dandelion.

Profile description: Orthic Melanic Brunisol

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
L-H	2-7	leaf litter		
Ah	7-12	silt loam	amorphous to granular	slightly hard, dry; very friable to friable, moist
Bm	20-25	silt loam	prismatic	very friable to

				firm, moist
BC1	12-35	silt loam	amorphous	very friable to firm, moist
BC2	15-60	sandy clay loam	amorphous	firm, moist
Cca	at 90-100	sandy clay loam	amorphous	firm, moist

Comment: (1) The BC2 and Cca horizons occasionally are very bouldery, and occasionally contain frequent sand pockets.

Limitations: Slight to severe - slight on suitable topography for lawns and landscaping, buildings without basements, and trench type sanitary landfills; severe for buildings with basements, and road location; moderate on suitable topography for all other uses; poor source of roadfill; unsuitable as a source of sand or gravel due to unsuitable textures. Other limitations include slippery or sticky when wet, surface stoniness, excessive slopes, erosion hazard, susceptibility to frost heave, slow permeability, and moderate shrink-swell potential.

TH (Organic Soil)

Classification: Terric Humisol and Typic Humisol
(These two subgroups are intimately and unpredictably associated).

Parent Material: predominantly humic peat, overlying moderately fine textured till or medium to moderately fine textured glaciofluvial sediments

Landform: blanket bog (Bb), horizontal bog (Bh), sloping bog (Bs)

Slope: nearly level to strongly rolling (0 to 30%)

Surface stoniness: nonstony (0)

Drainage: very poor

Vegetation: mostly black spruce; some white spruce, balsam poplar, lodgepole pine, and balsam fir; willow, feathermoss, Labrador tea, palmate-leaved coltsfoot; sparse grass; some sedge, horsetail, wild rose, common bearberry, bunchberry, bracted honeysuckle, and twinflower; some patches of sphagnum moss; water avens bordering small streams.
Some open areas of mainly feathermoss, sedge; willow, or swamp birch.

Profile description: Terric Humisol

Horizon	Thickness (cm)	Field Description		
Of	0-50	predominantly fibric peat		
Om	15-30	predominantly mesic peat		
Oh	35-75	predominantly humic peat		
		<u>Field Texture</u>	<u>Structure</u>	<u>Consistence</u>
Cg	at 60-90+	silt loam to silty clay loam	amorphous	firm to very firm, moist

- Comments: (1) Terric Humisols comprise the majority of this map unit, but a few patches of Typic Humisols occur where the peat thickness is more than 160 cm.
- (2) Textures and other characteristics of terric layers and adjacent mineral soil parent materials are expected to be similar.

Limitations: Very severe for all uses; unsuitable as a source of roadfill, sand or gravel due to unsuitable textures and extreme wetness. Other limitations include Organic soil, excessive slope, lack of Ah horizon, high shrink-swell potential, and groundwater contamination hazard.

TM (Organic Soil)

Classification: Terric Mesisol

Parent Material: predominantly mesic peat, overlying moderately fine textured till

Landform: horizontal bog (Bh), sloping bog (Bs)

Slope: nearly level to moderately sloping (0 to 9%)

Surface stoniness: nonstony (0)

Drainage: very poor

Vegetation: feathermoss, sphagnum moss, sedge, willow, swamp birch; some black spruce, and occasional clumps of white spruce; some forbs including indian paint-brush, star-flowered Solomon's seal, low larkspur.

Profile description: Terric Mesisol

Horizon	Thickness (cm)	Field Description		
Of	0-30	predominantly fibric peat		
Om	30-120	predominantly mesic peat		
		<u>Field Texture</u>	<u>Structure</u>	<u>Consistence</u>
Cg	at 60-120+	sandy clay loam to clay loam	amorphous	firm to very firm, moist

- Comments: (1) An Oh horizon, about 30 cm thick, sometimes occurs above the terric layer.
- (2) An occasional patch of Typic Mesisol occurs, where the peat thickness is more than 160 cm.

Limitations: Very severe for all uses; unsuitable as a source of road-fill, sand or gravel due to unsuitable textures and extreme wetness. Other limitations include Organic soil, lack of Ah horizon, high shrink-swell potential, and groundwater contamination hazard.

LH (Organic Soil)

Classification: Typic Humisol, Lithic phase

Parent Material: predominantly humic peat, overlying sandstone or shale

Landform: horizontal bog (Bh)

Slope: nearly level (0 to 0.5%)

Surface stoniness: nonstony (0)

Drainage: very poor

Vegetation: mainly willow; some alder; some patches of black spruce and balsam poplar; feathermoss, sedge, Labrador tea, northern bedstraw, wild rose, wild strawberry, dwarf raspberry, and water avens.

Profile description: Typic Humisol, Lithic phase

Horizon	Thickness (cm)	Field Description
Of	2-10	predominantly fibric peat

Om	2-5	predominantly mesic peat
Oh	35-45	predominantly humic peat
IIC	at 50+	sandstone or shale

Limitations: Very severe for all uses; unsuitable as a source of road-fill, sand or gravel due to unsuitable textures and extreme wetness. Other limitations include Organic soil, shallow depth to bedrock, high shrink-swell potential, and ground-water contamination hazard.

Special Features

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

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

The study area is situated in the Gray Luvisolic soil zone and the soils throughout most of the Sherman Meadows portion are classified as Brunisolic Gray Luvisols, which are zonally normal. The most prevalent soils in the Deadhorse Meadows and Kakwa Falls portions are Eluviated Dystric Brunisols, which are intrazonal. Other soils found in the study area are Regosols, which are azonal; and Organics and Gleysols, which are also intrazonal. Regosolic and Gleysolic soils occur across all the soil zones, while Brunisolic and Organic soils occur in most. Soils of the study area can be considered typical, both locally and regionally (Twardy and Corns, 1980).

Special features of soils in the study area are first the gravelly stony nature of the parent materials; second the inherent properties of Luvisolic

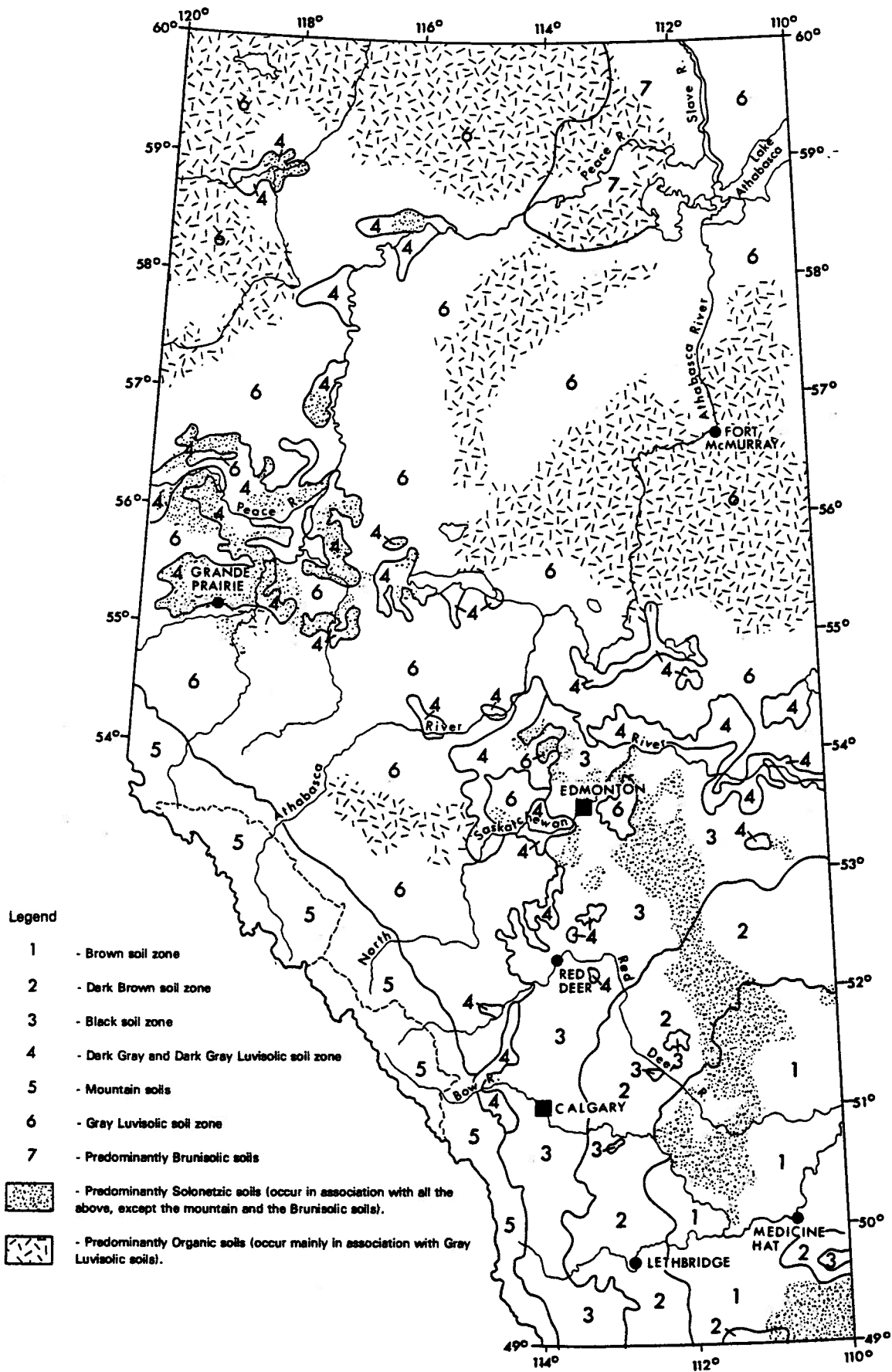


Figure 2. Map showing soil zones of Alberta (From Soil Group Map of Alberta, Alberta Institute of Pedology, undated)

and Organic soils; and third the relatively high iron content and acidity of the Brunisolic Gray Luvisols and Eluviated Dystric Brunisols.


The gravelly stony nature of the soil parent materials is normal for mountain and foothill regions, where gravel and stone contents are characteristically much higher than in the plains regions of Alberta.


The Luvisolic soils in their natural state exhibit surface leaf litter (L-H) and leached light gray coloured Ae horizons, typical of soils developed under forest vegetation. The Ae horizons are underlain by much finer textured Bt horizons of clay accumulation. In addition, the Brunisolic Gray Luvisols, common in the Sherman Meadows portion, have strong brown to yellowish red Bmfj horizons below the Ae horizons. The characteristic feature is enrichment with amorphous materials, principally aluminum and iron, combined with organic matter.

The Eluviated Dystric Brunisols are similar in appearance to Orthic Gray Luvisols, but have reddish yellow Bfj horizons instead of Bt horizons below the Ae horizons, and these also represent an enrichment with amorphous materials. The Brunisolic Gray Luvisols and Eluviated Dystric Brunisols exhibit colorful soil profiles, and are intergrades between Orthic Gray Luvisols and Orthic Humo-Ferric Podzols. In general, Podzolic soils are rare in Alberta, except at high elevations below tree line in mountain regions.

The Organic soil profiles do not display well developed distinctive horizons that depict mineral soils. Organic soils are soft and spongy to walk over, and readily absorb water which can easily be squeezed out in the hand. These soils act as natural reservoirs that store vast quantities of water, thereby delaying runoff and releasing water slowly to natural water courses.

MISCELLANEOUS SYMBOLS

 This symbol indicates bedrock outcrops, most of which occur as steep sandstone cliffs along the banks of the Torrens River.

 This symbol indicates escarpments. These have very severe limitations for all uses because of extreme slopes and erosion hazard.

F. This symbol indicates an area of fill material, presumably gravel, similar to the parent material of surrounding soils. The topography is gently undulating (>0.5 to 2% slopes), and the surface is exceedingly to excessively stony (4 to 5). The area is nearly devoid of vegetation, with only occasional small patches of grass; and some alsike clover and common dandelions. The material appears very hard and compacted, and is extremely difficult to dig with a shovel. Assuming the material is gravel, the area has only slight limitations for camping areas, picnic areas, paths, trails, buildings, and road location, except severe to very severe because of surface stoniness; moderate limitations for lawns and landscaping due to lack of an Ah horizon and high lime content (soil nutrient imbalance), except severe to very severe because of surface stoniness; severe limitations for septic tank absorption fields because of rapid permeability and groundwater contamination hazard; and very severe limitations for trench type sanitary landfills because of rapid permeability, groundwater contamination hazard, and surface

stoniness. The material constitutes a poor to very poor source of roadfill because of stoniness, and otherwise would be a good source; however it should be a good source of gravel.

Gv. This symbol indicates gravel bars along river and stream courses. They consist of fluvial gravel deposits, devoid of vegetation, and are classified as Orthic Regosols. They have very severe limitations for all uses; and are very poor sources of roadfill, sand or gravel due to the extreme flooding hazard.

0 This symbol indicates patches of open water.

↗ This symbol indicates slope direction.

SR This symbol indicates areas where the soil solum has been removed by construction activities, exposing the C horizon or soil parent material at the surface. These areas are usually nearly level and devoid of vegetation, except for occasional patches of grass and weeds. Soil characteristics similar to C horizons of adjacent soils can be expected.

SOIL INTERPRETATIONS

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

Soil erodibility ratings (K values) and predicted water erosion hazards of selected map units are presented in Tables 4 and 5. As well as surface horizons, values have been worked out for soil parent materials, because they may be exposed during construction activities.

Soils of Map Units 1, 2 and 3; all widespread in the Sherman Meadows portion of the study area, have only moderate limitations for recreational development when found on suitable topography and where surface stoniness is not a limitation. However, the two factors of excessive slope and surface stoniness both are common. Other limitations include slippery or sticky when wet, erosion hazard, seasonally high groundwater tables, and flooding hazard (overflow). Soils of Map Units 6 and 7 in Sherman Meadows also have only moderate limitations, including slippery or sticky when wet; and seasonally high groundwater table for Map Unit 6 soils. Map Unit 17 soils, in Old Sherman Meadows, have only moderate limitations due to the factor slippery or sticky when wet. Soils of some other less common map units have only moderate limitations, but most have severe to very severe limitations, including excessive slope, surface stoniness, seasonally high groundwater table or surface ponding, flooding hazard (overflow), erosion hazard, organic surface layer more than 15 cm thick, shallow depth to bedrock, and Organic soil.

Map Unit 18 soils are widespread in the Deadhorse Meadows portion and on suitable topography have only moderate limitations for recreational development, except for severe limitations due to surface stoniness. Other limitations include erosion hazard, and slippery or sticky when wet. Occasional patches of Map Units 9 and 19 soils, also with only moderate limitations, also occur.

Table 2. Chemical and Physical Analyses of Selected Map Units

Map Unit	Horizon	Depth cm	pH CaCl ₂	pH H ₂ O	Exchangeable cations ¹ meq/100 gm soil				² CEC meq/100 gm	³ OC %	CaCO ₃ equiv %	Mech. Analysis % from frac <2 mm diam.			⁴ % VFS	⁵ % CF	Texture		Free Fe + Al %
					Na ⁺	K ⁺	Ca ⁺⁺	Mg ⁺⁺				sand	silt	clay			Lab det	Field est	
1	L-H	8-0	3.6	4.2	⁶ nd	nd	nd	nd	nd	33.5	nd	nd	nd	nd	0	nd	nd	nd	
	Ae	0-4	3.6	4.3	0	0.21	2.6	0.46	11.1	2.3	nd	35	52	13	19	0	SiL	FSL	nd
	Bmfj	4-15	4.7	5.4	0	0.15	4.9	0.87	11.6	1.9	nd	36	49	15	18	40	L	⁷ gv L	0.38
	Bt	15-45	6.5	7.0	0	0.17	11.2	2.4	15.0	nd	nd	50	31	19	nd	80	L	⁷ vgv CL	nd
2	L-H	2-0	6.5	6.8	nd	nd	nd	nd	nd	18.7	nd	nd	nd	nd	nd	0	nd	nd	nd
	Bm	0-12	6.8	7.2	0.01	0.24	23.5	5.3	32.2	5.9	nd	29	51	20	18	0	SiL	FSL	nd
	Bmg1	12-52	7.1	7.5	0.04	0.11	15.1	2.9	14.6	2.7	nd	25	60	15	14	0	SiL	FSL	nd
	Bmg2	52-60	7.1	7.6	nd	nd	nd	nd	nd	nd	nd	16	62	22	nd	0	SiL	SiL	nd
	Bmg3	60-70	7.2	7.8	nd	nd	nd	nd	nd	nd	3.2	43	45	12	10	0	L	L	nd
3	L-H	6-0	3.8	4.4	nd	nd	nd	nd	nd	45.5	nd	nd	nd	nd	nd	0	nd	nd	nd
	Ae	0-10	3.5	4.2	0.01	0.06	1.0	0.10	5.9	0.82	nd	37	58	5	15	30	SiL	^{gv} FSL	nd
	Bmfj	10-17	4.0	4.7	0	0.08	1.7	0.26	5.9	0.91	nd	31	57	12	11	30	SiL	^{gv} FSL	0.25
	Bm	17-26	4.4	5.2	0	0.10	2.7	0.46	3.5	0.61	nd	29	57	14	nd	50	SiL	^{vgv} L	0.15

¹meq - milliequivalents, ²CEC - cation exchange capacity, ³OC - organic carbon, ⁴VFS - very fine sand, ⁵CF - coarse fragments (>2 mm diam) (field estimate),

⁶nd - not determined, ⁷gv - gravelly, vgv - very gravelly

Table 2. Chemical and Physical Analyses of Selected Map Units

Map Unit	Horizon	Depth cm	pH CaCl ₂	pH H ₂ O	Exchangeable cations ¹ meq/100 gm soil				² CEC meq/100 gm	³ OC %	CaCO ₃ equiv %	Mech. Analysis % from frac <2 mm diam.			⁴ % VFS	⁵ % CF	Texture		Free Fe + Al %
					Na ⁺	K ⁺	Ca ⁺⁺	Mg ⁺⁺				sand	silt	clay			Lab det	Field est	
3	Bt	26-55	5.6	6.3	0.02	0.16	12.1	2.8	5.4	1.1	nd	22	45	33	nd	70	CL	⁷ vgv CL	nd
	BC	55-70	7.0	7.6	⁶ nd	nd	nd	nd	nd	nd	2.4	28	43	29	nd	80	CL	vgv CL	nd
	Cca	70-100	7.4	7.9	nd	nd	nd	nd	nd	nd	7.6	30	41	29	nd	80	CL	vgv CL	nd
8	L-H	5-0	5.7	6.0	nd	nd	nd	nd	nd	23.4	nd	nd	nd	nd	nd	0	nd	nd	nd
	Ae	0-10	4.8	5.4	2.7	0.14	7.2	1.2	14.3	1.8	nd	29	60	11	11	30	SiL	⁷ gv FSL	0.14
	AB	10-22	5.7	6.4	0.09	0.16	10.9	2.9	7.0	1.2	nd	23	49	28	nd	30	CL	gv CL	nd
	Bt	22-48	5.9	6.6	0.02	0.16	12.3	3.1	19.1	nd	nd	22	48	30	nd	40	CL	gv CL	nd
	BC	48-66	7.0	7.5	0.05	0.17	17.6	3.7	18.5	nd	3.4	19	50	31	nd	50	SiCL	vgv CL	nd
	Cca	66-100	7.4	7.9	nd	nd	nd	nd	nd	nd	15.9	21	56	23	nd	70	SiL	vgv CL	nd
9	L-H	15-0	5.9	6.3	nd	nd	nd	nd	nd	40.7	nd	nd	nd	nd	nd	0	nd	nd	nd
	Ah	0-10	6.2	6.8	0.16	0.15	36.6	14.8	55.7	9.6	nd	18	53	29	nd	15	SiCL	L	nd
	Bmg	10-40	6.4	6.8	0.08	0.12	17.0	6.9	24.6	2.6	nd	21	56	23	nd	30	SiL	gv L	nd
	BCg	40-100	6.8	7.4	0.11	0.11	10.3	3.0	14.9	nd	0.34	17	60	23	nd	50	SiL	vgv CL	nd

¹meq - milliequivalents, ²CEC - cation exchange capacity, ³OC - organic carbon, ⁴VFS - very fine sand, ⁵CF - coarse fragments (>2 mm diam) (field estimate),

⁶nd - not determined, ⁷gv - gravelly, vgv - very gravelly

Table 2. Chemical and Physical Analyses of Selected Map Units

Map Unit	Horizon	Depth cm	pH CaCl ₂	pH H ₂ O	Exchangeable cations ¹ meq/100 gm soil				² CEC meq/100 gm	³ OC %	CaCO ₃ equiv %	Mech. Analysis % from frac <2 mm diam.			⁴ % VFS	⁵ % CF	Texture		Free Fe + Al %
					Na ⁺	K ⁺	Ca ⁺⁺	Mg ⁺⁺				sand	silt	clay			Lab det	Field est	
12	L-H	9-0	3.6	4.2	⁶ nd	nd	nd	nd	nd	44.8	nd	nd	nd	nd	0	nd	nd	nd	
	Ae	0-7	3.7	4.5	0.05	0.12	2.6	0.61	9.4	1.3	nd	18	66	16	7	35	SiL	⁷ gv L	nd
	Btj	7-32	4.1	4.1	0.08	0.11	3.1	0.62	5.5	0.90	nd	21	63	16	nd	50	SiL	⁷ v gv L	nd
	Bt	32-45	4.4	5.1	0.04	0.17	5.3	1.2	7.9	nd	nd	17	59	24	nd	80	SiL	v gv L	nd
17	L-H	5-0	5.2	5.6	nd	nd	nd	nd	nd	24.8	nd	nd	nd	nd	nd	0	nd	nd	nd
	Ah	0-9	4.6	5.2	0.01	0.24	15.3	2.9	32.4	6.5	nd	2	71	27	nd	0	SiL- SiCL	SiL	nd
	Bm	9-34	5.1	5.7	0.03	0.11	16.7	3.3	24.7	4.2	nd	4	66	30	nd	0	SiCL	SiL	nd
	BC1	34-48	5.4	6.0	0.06	0.10	11.9	2.9	20.9	nd	nd	5	70	25	nd	0	SiL	SiCL	nd
	BC2	48-56	5.5	6.3	0.01	0.08	8.4	2.4	8.2	nd	nd	28	54	18	18	0	SiL	SL	nd
	BC3	56-76	5.7	6.3	0.01	0.10	12.0	3.3	17.6	nd	0.21	7	70	23	nd	0	SiL	SiL	nd
	BC4	76-100	5.8	6.6	0.01	0.09	9.4	2.3	8.2	nd	0.15	23	60	17	16	0	SiL	LS	nd
18	L-H	5-0	3.4	4.0	nd	nd	nd	nd	nd	33.2	nd	nd	nd	nd	nd	0	nd	nd	nd
	Ae	0-23	3.5	4.2	0	0.06	0	0	7.9	0.58	nd	30	65	5	13	20	SiL	VFSL	nd

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

Table 2. Chemical and Physical Analyses of Selected Map Units

Map Unit	Horizon	Depth cm	pH CaCl ₂	pH H ₂ O	Exchangeable cations ¹ meq/100 gm soil				² CEC meq/100 gm	³ OC %	CaCO ₃ equiv %	Mech. Analysis % from frac <2 mm diam.			⁴ % VFS	⁵ % CF	Texture		Free Fe + Al %	
					Na ⁺	K ⁺	Ca ⁺⁺	Mg ⁺⁺				sand	silt	clay			Lab det	Field est		
18	Bfj	23-45	4.1	4.7	0	0.06	0	0	7.0	0.91	nd	32	59	9	9	30	SiL	⁷ gv L	0.48	
	BC	45-100	4.3	5.1	0.02	0.06	0.72	0	5.8	nd	0.04	32	62	6	10	40	SiL	⁷ gv SL	nd	

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

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

Map Unit	Depth cm	Field Moisture %	Mechanical Analysis											Liquid Limit	Plasticity Index	Optimum Moisture % (2)	Maximum Dry Density lb/ft. ³ (2)	Classification		
			Percentage Passing Sieve							Percentage Smaller Than								AASHO	Unified	USDA
			1 inch	3/4 inch	5/8 inch	#4 (4.7 mm.)	#10 (2.0 mm.)	#40 (0.42 mm.)	#200 (0.074 mm.)	0.05 mm.	0.005 mm.	0.002 mm.	0.001 mm.							
3	90-120	9	83	75	73	62	57	50	37	36	24	19	15	28	12	14	115.0	A-6(1)	CL	CL
8	90-120	6	89	80	77	69	66	60	45	44	22	15	12	23	8	12	118.5	A-4(2)	CL	L
9	90-120	14	100	98	98	95	88	78	59	58	24	17	13	22	6	13	115.0	A-4(5)	CL-ML	L
17	100-130	31	100	100	100	100	100	100	68	55	19	11	7	23	3	19	104.0	A-4(7)	CL	L
18	90-120	17	100	98	96	95	92	82	53	52	16	10	10	20	4	12	117.5	A-4(4)	CL-ML	L

- (1) Map Units developed on similar parent material: 3, 4, 5, and 11; 6, 7, and 17; 8, and 9.
- (2) These values are obtained from charts worked out by the Highways Testing Laboratory, Alberta Transportation.

TABLE 4 Soil Erodibility Ratings (k-values)
of Selected Map Units

Map Unit	Horizon	K-value (1)
1	Ae	0.45
	Bmfj	0.49
	(2)Bt	0.25
2	(3)Bm	0.42
	Bmg1	0.43
	Bmg3	0.53
3	Ae	0.68
	BC	0.36
8	Ae	0.49
	BC	0.41
	Cca	0.44

Map Unit	Horizon	K-value (1)
9	Ah	0.26
	Bmg	0.27
	BCg	0.47
12	Ae	0.51
	Btj	0.47
17	Ah	0.27
	Bm	0.34
	BC1	0.53
	BC2	0.68
18	Ae	0.70
	BC	0.70

- (1) The K-values were determined from data provided in this report using the soil erodibility nomograph presented in Figure 5 of Greenlee (1981).
- (2) Where the percent very fine sand was not determined, it was taken as zero for the purpose of the nomograph.
- (3) Where the percent organic matter was more than 4, it was taken as 4 for the purposes of the nomograph; and where it was not determined it was assumed to be 0.

Table 5. PREDICTED WATER EROSION HAZARDS OF SELECTED MAP UNITS

Map Unit	Horizon	Erosion Risk (1)	Map Unit	Horizon	Erosion Risk (1)
$\frac{1}{b0}$ $\frac{1}{b3}$ $\frac{1}{b4}$	Ae Bmfj Bt	L L L	$\frac{3}{E3}$ $\frac{3}{e3}$ $\frac{3}{E4}$ $\frac{3}{e4}$	Ae BC	H M
$\frac{1}{c0}$ $\frac{1}{c0}$ $\frac{1}{c3}$ $\frac{1}{c4}$ $\frac{1}{c5}$	Ae Bmfj Bt	L-M L-M L	$\frac{3}{F2}$ $\frac{3}{F3}$ $\frac{3}{F3}$ $\frac{3}{F4}$	Ae BC	H M-H
$\frac{1}{D4}$	Ae Bmfj Bt	M M L	$\frac{3}{G3}$ $\frac{3}{g3}$ $\frac{3}{G4}$ $\frac{3}{g4}$	Ae BC	H H
$\frac{1}{F0}$ $\frac{1}{F4}$	Ae Bmfj Bt	H H L-M	$\frac{8}{D4}$	Ae BC Cca	M M M
$\frac{2}{b0}$	Bm Bmg1 Bmg3	L L L-M	$\frac{8}{E2}$	Ae BC Cca	H M-H M-H
$\frac{2}{c0}$ $\frac{2}{c0}$	Bm Bmg1 Bmg3	L-M L-M M	$\frac{8}{E4}$	Ae BC Cca	M-H M-H M-H
$\frac{2}{c5}$	Bm Bmg1 Bmg3	L-M L-M L-M	$\frac{8}{F2}$ $\frac{8}{F3}$ $\frac{8}{F4}$	Ae BC Cca	H H H
$\frac{2}{d0}$ $\frac{2}{d2}$ $\frac{2}{d5}$	Bm Bmg1 Bmg3	M M M-H	$\frac{8}{G1}$ $\frac{8}{G3}$ $\frac{8}{G4}$		
$\frac{3}{C2}$ $\frac{3}{C3}$ $\frac{3}{C4}$	Ae BC	M L	$\frac{9}{D3}$	Ah Bmg BCg	L L M
$\frac{3}{D1}$ $\frac{3}{D3}$ $\frac{3}{d3}$ $\frac{3}{D4}$	Ae BC	M-H L-M	$\frac{9}{E0}$	Ah Bmg BCg	L-M L-M M-H
			$\frac{9}{F3}$ $\frac{9}{f3}$	Ah Bmg BCg	M M H

(1) L = Low erosion risk, M = Moderate erosion risk, H = High erosion risk. These ratings were derived by applying the K-values from Table 4 to the graph presented in Figure 6 of Greenlee (1981). Coarse Fragments are assumed to be $\leq 20\%$ where surface stoniness is reported as 2 or less, and $> 20\%$ where surface stoniness is reported as 3 or more; or are as reported in Table 2.

Table 5 (cont.)

Map Unit	Horizon	Erosion Risk (1)	Map Unit	Horizon	Erosion Risk (1)
$\frac{12}{d3}$	Ae Btj	M M	$\frac{17}{D0}$	Ah Bm BC1 BC2	L-M M M-H M-H
$\frac{12}{e3}$	Ae Btj	M-H M-H	$\frac{18}{c4}$	Ae BC	M M
$\frac{12}{e2}$	Ae Btj	H M-H	$\frac{18}{D4}$	Ae BC	M-H M-H
$\frac{12}{F1}$ $\frac{12}{F2}$ $\frac{12}{F3}$	Ae	H	$\frac{18}{f2}$ $\frac{18}{f4}$ $\frac{18}{f4}$ $\frac{18}{g4}$	Ae BC	H H
$\frac{12}{F4}$ $\frac{12}{G3}$ $\frac{12}{g3}$	Btj	H			
$\frac{17}{B0}$ $\frac{17}{b0}$	Ah Bm BC1 BC2	L L L-M M			

(1) L = Low erosion risk, M = Moderate erosion risk, H = High erosion risk. These ratings were derived by applying the K-values from Table 4 to the graph presented in Figure 6 of Greenlee (1981). Coarse Fragments are assumed to be $\leq 20\%$ where surface stoniness is reported as 2 or less, and $> 20\%$ where surface stoniness is reported as 3 or more; or are as reported in Table 2.

The most common soils in the Kakwa Falls portion are those of Map Unit 15, but these have severe limitations for recreational development because of surface stoniness, and shallow depths to bedrock. Other limitations include slippery or sticky when wet, excessive slope, and erosion hazard. Two small patches of Map Units 2 and 6 soils, with only moderate limitations, also occur. The limitations include a seasonally high groundwater table or surface ponding, flooding hazard (overflow), and slippery or sticky when wet.

Map Unit 1 soils are well suited for road construction when found on suitable topography, and where surface stoniness is not a limitation. Map Units 2 and 3 soils have only moderate limitations due to seasonally high groundwater tables, flooding hazard (overflow), moderate shrink-swell potential, and susceptibility to frost heave. Map Unit 6 soils have severe limitations due to susceptibility to frost heave, seasonally high groundwater table, and moderate shrink-swell potential. Map Units 7 and 17 soils have severe limitations for the same reasons, except for wetness. Map Unit 15 soils have severe limitations because of surface stoniness, susceptibility to frost heave, shallow depth to bedrock, erosion hazard, and excessive slope; while Map Unit 18 soils have severe to very severe limitations for the same reasons except for shallow depth to bedrock. Soils of some other less common Map Units have only moderate limitations for road construction, but most have severe to very severe limitations, including Organic soil and high shrink-swell potential.

The soils of Map Units 1, 2, and 13; all found in the Sherman Meadows portion of the study area; can provide good sources of gravel. One small patch of Map Unit 2 soils occurs in the Kakwa Falls portion as well. Soils of most other map units are unsuitable as sources of sand or gravel because of unsuitable textures.

Specific limitations and suitabilities of the various soils for selected uses are shown in Tables 6 to 18 inclusive. The ratings were determined on the basis of morphological, physical, and chemical properties of the soils, as well as steepness of slope. The principal limiting properties are indicated, and are generally listed in decreasing order of importance. In Tables 6 to 16 inclusive, the soil limitations for various uses have been designated as none to slight, moderate, severe, and very severe. In Tables 17 and 18, the suitability of soils as sources of roadfill and as sources of sand or gravel respectively, have been designated as good, fair, poor, and very poor.

TABLE 6. Soil Limitations for Primitive Camping Areas

Map 1 Symbol	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
$\frac{1}{bo}$ $\frac{1}{Co}$ $\frac{1}{co}$	M - Slip	$\frac{3}{c3}$ $\frac{3}{c4}$ $\frac{3}{D3}$	M - Er, Slip S - Stony	$\frac{5}{D2}$ $\frac{5}{E2}$	S - Wet, Org Surf, Slip
$\frac{1}{b3}$ $\frac{1}{b4}$	M - Slip S - Stony	$\frac{3}{d3}$ $\frac{3}{D4}$	S - Er, Stony, Slip	$\frac{5}{a3}$ $\frac{5}{c3}$ $\frac{5}{c4}$	S - Wet, Org Surf, Stony
$\frac{1}{c3}$ $\frac{1}{c4}$		$\frac{3}{E3}$ $\frac{3}{e3}$		$\frac{5}{c4}$ $\frac{5}{D3}$	
$\frac{1}{D4}$	M - Er, Slip S - Stony	$\frac{3}{E4}$ $\frac{3}{e4}$	S - Er, Slope, Slip	$\frac{5}{E3}$ $\frac{5}{F3}$	S - Wet, Org Surf, Slope
$\frac{1}{c5}$	VS - Stony M - Slip	$\frac{3}{F2}$	S - Er, Stony, Slope	$\frac{5}{F1}$ $\frac{5}{F2}$	
$\frac{1}{fo}$	S - Er, Slope, Slip	$\frac{3}{F3}$ $\frac{3}{F3}$ $\frac{3}{F4}$	S - Slope, Er, Stony	$\frac{5}{d5}$	S - Wet, Org Surf, Slip VS - Stony
$\frac{1}{F4}$	S - Er, Stony, Slope	$\frac{3}{G3}$ $\frac{3}{g3}$	M - Wet, Sl Perm, Slip	$\frac{6}{bo}$ $\frac{6}{Co}$	M - Wet, Slip
$\frac{2}{bo}$ $\frac{2}{Co}$ $\frac{2}{co}$	M - Wet, Flood, Slip	$\frac{3}{G4}$ $\frac{3}{g4}$		$\frac{6}{Eo}$	S - Er, Wet, Slip
$\frac{2}{do}$ $\frac{2}{d2}$	M - Wet, Flood, Er	$\frac{4}{b2}$	M - Er, Wet, Sl Perm	$\frac{7}{bo}$	M - Slip
$\frac{2}{c5}$	M - Wet, Flood, Slip VS - Stony	$\frac{4}{c3}$	S - Stony	$\frac{8}{D4}$	M - Er, Slip S - Stony
$\frac{2}{d5}$	M - Wet, Flood, Er VS - Stony	$\frac{4}{e3}$	S - Er, Stony, Wet	$\frac{8}{E2}$	S - Er, Slip, Stony
$\frac{3}{D1}$	M - Er, Slip	$\frac{4}{F3}$	S - Er, Stony, Slope	$\frac{8}{E4}$	S - Er, Stony, Slip
$\frac{3}{C2}$	M - Er, Stony, Slip	$\frac{4}{g3}$	S - Slope, Er, Stony	$\frac{8}{F2}$	S - Er, Slope, Slip
		$\frac{5}{a2}$ $\frac{5}{C2}$ $\frac{5}{D1}$	S - Wet, Org Surf, Slip		

¹ For explanation, see Soil Map

² SL - None to slight, M - Moderate, S - Severe, VS - Very severe

Abbreviations

BR - Shallow depth to bedrock
 Clay - High clay content
 Er - Erosion hazard
 Flood - Flooding hazard (overflow)
 Org - Organic soil
 Org Surf - Organic surface layer
 layer > 15 cm thick

Sandy - Sandy surface texture
 Slip - Slippery or sticky when wet
 Slope - Excessive slope
 Sl Perm - Slow permeability
 Solz - Solonetzic soil
 Stony - Surface stoniness
 Wet - Seasonally high groundwater table or
 surface ponding

TABLE 6. Soil Limitations for Primitive Camping Areas

Map 1 Symbol	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation						
8 F3	8 F4	12 d3	12 e3	17 Bo	17 bo	17 Do	M - Slip				
	8 G1						12 e2	18 c4	18 D4	M - Er, Slip S - Stony	
	8 G3						12 F1	12 F2	18 F2	S - Er, Slope, Stony	
9 D3	M - Slip S - Stony	12 F3	12 F4	18 F4	18 F4		S - Er, Stony, Slope				
		9 Eo	12 G3				12 g3	18 G4	S - Slope, Er, Stony		
	9 F3	9 F3	13 b4	13 c4	19 bo	19 C1		M - Slip			
10 ao	S - Wet, Flood, Org Surf	13 D5		19 C2	19 D2		M - Stony, Slip				
							10 Co	10 Do	19 F2		M - Slope, Er, Stony
	10 a4	S - Wet, Flood, Stony	14 b3	S - Flood, Stony, Sandy	TH ao	TH bo	TH Co	VS - Org, Wet			
	10 a5	10 b5	S - Wet, Flood, Org Surf VS - Stony	14 b5	S - Flood VS - Stony	TH co	TH Do		TH do		
11 d4	S - Stony, BR, Er	15 b4	15 d4	TH Eo	TH fo	TH eo	VS - Org, Wet, Slope				
	11 F4						11 F4	S - Stony, BR, Er	TH Fo	TH fo	
	11 G3						S - BR, Er, Stony	15 e4	15 F4	S - Er, Stony, BR	TH ao
	S - Slope, Er, BR	16 b0	S - Wet, Flood, Slip	TH Co	TH Do						
				LH ao			VS - Org, Wet, BR				

¹ For explanation, see Soil Map

² SL - None to slight, M - Moderate, S - Severe, VS - Very severe

Abbreviations

BR - Shallow depth to bedrock
 Clay - High clay content
 Er - Erosion hazard
 Flood - Flooding hazard (overflow)
 Org - Organic soil
 Org Surf - Organic surface layer
 layer > 15 cm thick

Sandy - Sandy surface texture
 Slip - Slippery or sticky when wet
 Slope - Excessive slope
 Sl Perm - Slow permeability
 Solz - Solonetzic soil
 Stony - Surface stoniness
 Wet - Seasonally high groundwater table or
 surface ponding

TABLE 7. Soil Limitations for Fully Serviced Campgrounds

Map 1 Symbol	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
$\frac{1}{bo}$ $\frac{1}{co}$ $\frac{1}{co}$	M - Slip	$\frac{3}{c2}$	M - Er, Stony, Slip	$\frac{5}{D1}$	S - Wet, Org Surf, Slip
$\frac{1}{b3}$ $\frac{1}{b4}$	M - Slip S - Stony	$\frac{3}{c3}$ $\frac{3}{c4}$ $\frac{3}{D3}$	M - Er, Slip S - Stony	$\frac{5}{a2}$ $\frac{5}{c2}$ $\frac{5}{D2}$	S - Wet, Org Surf, Slip
$\frac{1}{c3}$ $\frac{1}{c4}$		$\frac{3}{d3}$ $\frac{3}{D4}$		$\frac{5}{a3}$ $\frac{5}{c3}$ $\frac{5}{c4}$	S - Wet, Org Surf, Stony
$\frac{1}{D4}$	M - Er, Slip S - Stony	$\frac{3}{E3}$ $\frac{3}{e3}$	S - Er, Stony, Slope	$\frac{5}{c4}$ $\frac{5}{D3}$ $\frac{5}{E3}$	
$\frac{1}{c5}$	M - Slip VS - Stony	$\frac{3}{E4}$ $\frac{3}{e4}$		$\frac{5}{E2}$ $\frac{5}{f1}$	S - Wet, Org Surf, Slope
$\frac{1}{fo}$	S - Slope, Er, Slip	$\frac{3}{f2}$	S - Slope, Er, Slip	$\frac{5}{F2}$ $\frac{5}{F3}$	
$\frac{1}{f4}$	S - Slope, Er, Stony	$\frac{3}{F3}$ $\frac{3}{f3}$ $\frac{3}{f4}$	S - Slope, Er, Stony	$\frac{5}{d5}$	S - Wet, Org Surf, Slip VS - Stony
$\frac{2}{bo}$ $\frac{2}{co}$ $\frac{2}{co}$	M - Wet, Flood, Slip	$\frac{3}{G3}$ $\frac{3}{g3}$	VS - Slope, Er, Stony	$\frac{6}{bo}$ $\frac{6}{co}$	M - Wet, Slip
$\frac{2}{do}$ $\frac{2}{d2}$	M - Wet, Flood, Er	$\frac{3}{G4}$ $\frac{3}{g4}$		$\frac{6}{Eo}$	S - Er, Slope, Wet
$\frac{2}{c5}$	M - Wet, Flood, Slip VS - Stony	$\frac{4}{b2}$	M - Wet, Sl Perm, Stony	$\frac{7}{bo}$	M - Slip
$\frac{2}{d5}$	M - Wet, Flood, Er VS - Stony	$\frac{4}{c3}$	M - Er, Wet, Sl Perm S - Stony	$\frac{8}{D4}$	M - Er, Slip S - Stony
$\frac{3}{D1}$	M - Er, Slip	$\frac{4}{e3}$	S - Er, Stony, Slope	$\frac{8}{E2}$	S - Er, Slope, Slip
		$\frac{4}{F3}$	S - Slope, Er, Stony	$\frac{8}{E4}$	S - Er, Stony, Slope
		$\frac{4}{g3}$	VS - Slope, Er, Stony	$\frac{8}{F2}$	S - Slope, Er, Slip

¹ For explanation, see Soil Map

² SL - None to slight, M - Moderate, S - Severe, VS - Very severe

Abbreviations

BR - Shallow depth to bedrock
 Clay - High clay content
 Er - Erosion hazard
 Flood - Flooding hazard (overflow)
 Org - Organic soil
 Org Surf - Organic surface layer
 layer > 15 cm thick

Sandy - Sandy surface texture
 Slip - Slippery or sticky when wet
 Slope - Excessive slope
 Sl Perm - Slow permeability
 Solz - Solonchic soil
 Stony - Surface stoniness
 Wet - Seasonally high groundwater table or
 surface ponding

TABLE 7. Soil Limitations for Fully Serviced Campgrounds

Map ¹ Symbol	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
$\frac{8}{F3}$ $\frac{8}{F4}$	S - Slope, Er, Stony	$\frac{12}{d3}$	S - BR, Stony, Er	$\frac{15}{f4}$	S - Slope, Er, BR
$\frac{8}{G1}$	VS - Slope, Er, Slip	$\frac{12}{e2}$	S - Er, BR, Slope	$\frac{16}{bo}$	S - Wet, Flood, Slip
$\frac{8}{G3}$ $\frac{8}{G4}$	VS - Slope, Er, Stony	$\frac{12}{e3}$	S - BR, Er, Slope	$\frac{17}{Bo}$ $\frac{17}{bo}$ $\frac{17}{Do}$	M - Slip
$\frac{9}{D3}$	M - Slip S - Stony	$\frac{12}{F1}$ $\frac{12}{F2}$	S - Slope, Er, BR	$\frac{18}{c4}$ $\frac{18}{D4}$	M - Er, Slip S - Stony
$\frac{9}{Eo}$	M - Slope, Slip, Er	$\frac{12}{F3}$ $\frac{12}{F4}$		$\frac{18}{f2}$ $\frac{18}{f4}$ $\frac{18}{f4}$	S - Slope, Er, Stony
$\frac{9}{F3}$ $\frac{9}{f3}$	S - Slope, Stony, Er	$\frac{12}{G3}$ $\frac{12}{g3}$	VS - Slope, Er, BR	$\frac{18}{G4}$	VS - Slope, Er, Stony
$\frac{10}{ao}$ $\frac{10}{bo}$	S - Wet, Flood, Org Surf	$\frac{13}{b4}$ $\frac{13}{c4}$	M - Sandy, Flood S - Stony	$\frac{19}{bo}$ $\frac{19}{C1}$	M - Slip
$\frac{10}{Co}$ $\frac{10}{Do}$		$\frac{13}{D5}$	M - Sandy, Flood VS - Stony	$\frac{19}{C2}$ $\frac{19}{D2}$	M - Stony, Slip
$\frac{10}{a4}$	S - Wet, Flood, Stony			$\frac{19}{F2}$	S - Slope, Er, Stony
$\frac{10}{a5}$ $\frac{10}{b5}$	S - Wet, Flood, Org Surf VS - Stony	$\frac{14}{b3}$	S - Flood, Stony, Sandy	$\frac{TH}{ao}$ $\frac{TH}{bo}$ $\frac{TH}{Co}$	VS - Org, Wet
		$\frac{14}{b5}$	S - Flood VS - Stony	$\frac{TH}{co}$ $\frac{TH}{Do}$ $\frac{TH}{do}$	
$\frac{11}{d4}$	S - Stony, BR, Er	$\frac{15}{b4}$	S - Stony, BR, Slip	$\frac{TH}{Eo}$ $\frac{TH}{eo}$	VS - Org, Wet, Slope
$\frac{11}{F4}$ $\frac{11}{f4}$	S - BR, Slope,	$\frac{15}{d4}$	S - Stony, BR, Er	$\frac{TH}{Fo}$ $\frac{TH}{fo}$	
$\frac{11}{G3}$	VS - Slope, Er, BR	$\frac{15}{e4}$	S - Er, Stony, BR	$\frac{TM}{ao}$ $\frac{TM}{bo}$	VS - Org, Wet
				$\frac{TM}{Co}$ $\frac{TM}{Do}$	
				$\frac{LH}{ao}$	VS - Org, Wet, BR

¹ For explanation, see Soil Map

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Abbreviations

BR - Shallow depth to bedrock
 Clay - High clay content
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 layer > 15 cm thick

Sandy - Sandy surface texture
 Slip - Slippery or sticky when wet
 Slope - Excessive slope
 Sl Perm - Slow permeability
 Solz - Solonetzic soil
 Stony - Surface stoniness
 Wet - Seasonally high groundwater table or
 surface ponding

TABLE 8. Soil Limitations for Picnic Areas

Map 1 Symbol	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
$\frac{1}{b0}$ $\frac{1}{c0}$ $\frac{1}{c0}$	M - Slip	$\frac{3}{c2}$ $\frac{3}{d1}$	M - Er, Slip	$\frac{4}{e3}$	S - Er, Slope, Stony
$\frac{1}{b3}$ $\frac{1}{c3}$	M - Stony, Slip	$\frac{3}{c3}$ $\frac{3}{d3}$ $\frac{3}{d3}$	M - Er, Stony, Slip	$\frac{4}{f3}$	S - Slope, Er, Stony
$\frac{1}{b4}$ $\frac{1}{c4}$	M - Slip S - Stony	$\frac{3}{c4}$ $\frac{3}{d4}$	M - Er, Slip S - Stony	$\frac{4}{g3}$	VS - Slope, Er, Stony
$\frac{1}{d4}$	M - Er, Slip S - Stony	$\frac{3}{e3}$ $\frac{3}{e3}$	S - Er, Slope, Stony	$\frac{5}{a2}$ $\frac{5}{c2}$	S - Wet, Org Surf, Slip
$\frac{1}{c5}$	M - Slip VS - Stony	$\frac{3}{e4}$ $\frac{3}{e4}$	S - Er, Stony, Slope	$\frac{5}{d1}$ $\frac{5}{d2}$	
$\frac{1}{f0}$	S - Slope, Er, Slip	$\frac{3}{f2}$	S - Slope, Er, Slip	$\frac{5}{a3}$ $\frac{5}{c3}$ $\frac{5}{c4}$	S - Wet, Org Surf, Stony
$\frac{1}{f4}$	S - Slope, Er, Stony	$\frac{3}{f3}$ $\frac{3}{f3}$ $\frac{3}{f4}$	S - Slope, Er, Stony	$\frac{5}{c4}$ $\frac{5}{d3}$	
$\frac{2}{b0}$ $\frac{2}{c0}$ $\frac{2}{c0}$	M - Slip	$\frac{3}{g3}$ $\frac{3}{g3}$	VS - Slope, Er, Stony	$\frac{5}{e2}$ $\frac{5}{e3}$ $\frac{5}{f1}$	S - Wet, Org Surf, Slope
$\frac{2}{d0}$ $\frac{2}{d2}$	M - Er, Slip	$\frac{3}{g4}$ $\frac{3}{g4}$		$\frac{5}{f2}$ $\frac{5}{f3}$	S - Wet, Org Surf, Slip VS - Stony
$\frac{2}{c5}$	M - Slip VS - Stony	$\frac{4}{b2}$	M - Slip, Er	$\frac{6}{b0}$ $\frac{6}{c0}$	M - Slip
$\frac{2}{d5}$	M - Er, Slip VS - Stony	$\frac{4}{c3}$	M - Er, Stony, Slip	$\frac{6}{e0}$	S - Er, Slope, Slip

¹ For explanation, see Soil Map

² SL - None to slight, M - Moderate, S - Severe, VS - Very severe

Abbreviations

Clay - High clay content
 Er - Erosion hazard
 Flood - Flooding hazard (overflow)
 Org - Organic soil
 Org Surf - Organic surface layer
 layer > 15 cm thick
 Sandy - Sandy surface texture

Slip - Slippery or sticky when wet
 Slope - Excessive slope
 Sl Perm - Slow permeability
 Solz - Solonetzic soil
 Stony - Surface stoniness
 Wet - Seasonally high groundwater table or
 surface ponding

TABLE 8. Soil Limitations for Picnic Areas

Map ¹ Symbol	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
$\frac{7}{b0}$	M - Slip	$\frac{9}{F3}$ $\frac{9}{F3}$	S - Slope, Er, Stony	$\frac{12}{e3}$	S - BR, Er, Slope
$\frac{8}{D4}$	M - Er, Slip S - Stony	$\frac{10}{a0}$ $\frac{10}{b0}$	S - Wet, Org Surf, Flood	$\frac{12}{F1}$ $\frac{12}{F2}$ $\frac{12}{F3}$	S - Slope, Er, BR
$\frac{8}{E2}$	S - Er, Slope, Slip	$\frac{10}{c0}$ $\frac{10}{D0}$		$\frac{12}{F4}$	S - Slope, Er, Stony
$\frac{8}{E4}$	S - Er, Stony, Slope	$\frac{10}{a4}$	S - Wet, Stony, Org Surf	$\frac{12}{G3}$ $\frac{12}{g3}$	VS - Slope, Er, BR
$\frac{8}{F2}$	S - Slope, Er, Slip	$\frac{10}{a5}$ $\frac{10}{b5}$	S - Wet, Org Surf, Flood VS - Stony	$\frac{13}{b4}$ $\frac{13}{c4}$	M - Sandy S - Stony
$\frac{8}{F3}$ $\frac{8}{F4}$	S - Slope, Er, Stony	$\frac{11}{d4}$	S - Stony, BR, Er	$\frac{13}{D5}$	M - Sandy VS - Stony
$\frac{8}{G1}$	VS - Slope, Er, Slip	$\frac{11}{F4}$ $\frac{11}{F4}$	S - Slope, Er, BR	$\frac{14}{b3}$	M - Flood, Stony Sandy
$\frac{8}{G3}$ $\frac{8}{G4}$	VS - Slope, Er, Stony	$\frac{11}{G3}$	VS - Slope, Er, BR	$\frac{14}{b5}$	M - Flood VS - Stony
$\frac{9}{D3}$	M - Stony, Slip	$\frac{12}{d3}$	S - BR, Stony, Er	$\frac{15}{b4}$	S - Stony, BR, Slip
$\frac{9}{E0}$	M - Slope, Slip Er	$\frac{12}{e2}$	S - Er, BR, Slope	$\frac{15}{d4}$	S - Stony, BR, Er

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Abbreviations

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 Flood - Flooding hazard (overflow)
 Org - Organic soil
 Org Surf - Organic surface layer
 layer > 15 cm thick
 Sandy - Sandy surface texture

Slip - Slippery or sticky when wet
 Slope - Excessive slope
 Sl Perm - Slow permeability
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 Stony - Surface stoniness
 Wet - Seasonally high groundwater table or
 surface ponding

TABLE 8. Soil Limitations for Picnic Areas

Map 1 Symbol	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
$\frac{15}{e4}$	S - Er, Stony, BR	$\frac{19}{F2}$	S - Slope, Er, Slip		
$\frac{15}{F4}$	S - Slope, Er, Stony	$\frac{TH}{a0}$ $\frac{TH}{b0}$ $\frac{TH}{c0}$	$\frac{TH}{b0}$ $\frac{TH}{d0}$ $\frac{TH}{e0}$	VS - Org, Wet	
$\frac{16}{b0}$	S - Wet, Slip, Flood	$\frac{TH}{e0}$ $\frac{TH}{f0}$	$\frac{TH}{e0}$ $\frac{TH}{f0}$	VS - Org, Wet, Slope	
$\frac{17}{B0}$ $\frac{17}{b0}$ $\frac{17}{D0}$	M - Slip				
$\frac{18}{c4}$ $\frac{18}{D4}$	M - Er, Slip S - Stony	$\frac{TM}{a0}$ $\frac{TM}{c0}$	$\frac{TM}{b0}$ $\frac{TM}{d0}$	VS - Org, Wet	
$\frac{18}{f2}$	S - Slope, Er, Slip	$\frac{LH}{a0}$		VS - Org, Wet, BR	
$\frac{18}{F4}$ $\frac{18}{f4}$	S - Slope, Er, Stony				
$\frac{18}{G4}$	VS - Slope, Er, Stony				
$\frac{19}{b0}$ $\frac{19}{c1}$ $\frac{19}{c2}$ $\frac{19}{d2}$	M - Slip				

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Abbreviations

Clay - High clay content
 Er - Erosion hazard
 Flood - Flooding hazard (overflow)
 Org - Organic soil
 Org Surf - Organic surface layer
 layer > 15 cm thick
 Sandy - Sandy surface texture

Slip - Slippery or sticky when wet
 Slope - Excessive slope
 Sl Perm - Slow permeability
 Solz - Solonchic soil
 Stony - Surface stoniness
 Wet - Seasonally high groundwater table or
 surface ponding

TABLE 9. Soil Limitations for Paths

Map ¹ Symbol	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
$\frac{1}{b0}$ $\frac{1}{c0}$ $\frac{1}{c0}$	M - Slip	$\frac{2}{d5}$	M - Er, Slip VS - Stony	$\frac{4}{c3}$	M - Er, Slip S - Stony
$\frac{1}{b3}$ $\frac{1}{b4}$ $\frac{1}{c3}$ $\frac{1}{c4}$	M - Slip S - Stony	$\frac{3}{d1}$	M - Er, Slip	$\frac{4}{e3}$	S - Er, Stony, Slope
$\frac{1}{d4}$	M - Er, Slip S - Stony	$\frac{3}{c2}$	M - Er, Stony, Slip	$\frac{4}{f3}$	S - Slope, Er, Stony
$\frac{1}{c5}$	M - Slip VS - Stony	$\frac{3}{c3}$ $\frac{3}{c4}$ $\frac{3}{d3}$ $\frac{3}{d3}$ $\frac{3}{d4}$	M - Er, Slip S - Stony	$\frac{4}{g3}$	VS - Slope, Er, Stony
$\frac{1}{f0}$	S - Slope, Er, Slip	$\frac{3}{e3}$ $\frac{3}{e4}$	S - Er, Stony, Slope	$\frac{5}{d1}$	S - Wet, Org Surf, Slip
$\frac{1}{f4}$	S - Slope, Er, Stony	$\frac{3}{f2}$	S - Slope, Er, Slip	$\frac{5}{a2}$ $\frac{5}{a3}$ $\frac{5}{c2}$ $\frac{5}{c3}$ $\frac{5}{c4}$ $\frac{5}{c4}$ $\frac{5}{d2}$ $\frac{5}{d3}$ $\frac{5}{e3}$	S - Wet, Org Surf, Stony
$\frac{2}{b0}$ $\frac{2}{c0}$ $\frac{2}{c0}$	M - Slip	$\frac{3}{f3}$ $\frac{3}{f3}$ $\frac{3}{f4}$	S - Slope, Er, Stony	$\frac{5}{e2}$ $\frac{5}{f1}$ $\frac{5}{f2}$ $\frac{5}{f3}$	S - Wet, Org Surf, Slope
$\frac{2}{d0}$	M - Er, Slip	$\frac{3}{g3}$ $\frac{3}{g4}$ $\frac{3}{g3}$ $\frac{3}{g4}$	VS - Slope, Er, Stony	$\frac{5}{d5}$	S - Wet, Org Surf, Slip VS - Stony
$\frac{2}{d2}$	M - Er, Stony, Slip				
$\frac{2}{c5}$	M - Slip VS - Stony	$\frac{4}{b2}$	M - Stony, Slip, Er		

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Abbreviations

Clay - High clay content
 Er - Erosion hazard
 Flood - Flooding hazard (overflow)
 Org - Organic soil
 Org Surf - Organic surface layer
 layer > 15 cm thick
 Sandy - Sandy surface texture

Slip - Slippery or sticky when wet
 Slope - Excessive slope
 Solz - Solonetzic soil
 Stony - Surface stoniness
 Wet - Seasonally high groundwater table or
 surface ponding

TABLE 9. Soil Limitations for Paths

Map 1 Symbol	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
$\frac{6}{b0}$ $\frac{6}{c0}$	M - Slip	$\frac{9}{d3}$	M - Slip S - Stony	$\frac{12}{d3}$	S - BR, Stony, Er
	S - Er, Slope, Slip		M - Slope, Slip Er		$\frac{12}{e2}$
$\frac{7}{b0}$	M - Slip	$\frac{9}{f3}$ $\frac{9}{f3}$	S - Slope, Stony, Er	$\frac{12}{e3}$	S - BR, Er, Slope
$\frac{8}{d4}$	M - Er, Slip S - Stony		$\frac{10}{a0}$ $\frac{10}{b0}$ $\frac{10}{c0}$ $\frac{10}{d0}$		S - Wet, Org Surf, Flood
	$\frac{8}{e2}$	S - Er, Slope, Slip		S - Wet, Stony, Org Surf	$\frac{12}{f4}$
$\frac{8}{e4}$	S - Er, Stony, Slope	$\frac{10}{a4}$	S - Wet, Org Surf, Flood	$\frac{12}{g3}$ $\frac{12}{g3}$	VS - Slope, Er, BR
$\frac{8}{f2}$	S - Slope, Er, Slip		$\frac{10}{a5}$ $\frac{10}{b5}$		S - Stony, BR, Er
$\frac{8}{f3}$ $\frac{8}{f4}$	S - Slope, Er, Stony	$\frac{11}{d4}$	S - Slope, Er, Stony	$\frac{13}{d5}$	M - Sandy VS - Stony
$\frac{8}{g1}$	VS - Slope, Er, Slip		$\frac{11}{f4}$ $\frac{11}{f4}$		VS - Slope, Er, BR
$\frac{8}{g3}$ $\frac{8}{g4}$	VS - Slope, Er, Stony	$\frac{11}{g3}$		$\frac{14}{b5}$	M - Flood VS - Stony

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Abbreviations

Clay - High clay content
 Er - Erosion hazard
 Flood - Flooding hazard (overflow)
 Org - Organic soil
 Org Surf - Organic surface layer
 layer > 15 cm thick
 Sandy - Sandy surface texture

Slip - Slippery or sticky when wet
 Slope - Excessive slope
 Solz - Solonetzic soil
 Stony - Surface stoniness
 Wet - Seasonally high groundwater table or
 surface ponding

TABLE 9. Soil Limitations for Paths

Map 1 Symbol	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
$\frac{15}{b4}$	S - Stony, BR, Slip	$\frac{19}{F2}$	S - Slope, Er, Stony		
$\frac{15}{d4}$	S - Stony, BR, Er	$\frac{TH}{a0}$ $\frac{TH}{b0}$ $\frac{TH}{c0}$ $\frac{TH}{c0}$ $\frac{TH}{d0}$ $\frac{TH}{d0}$	VS - Org, Wet		
$\frac{15}{e4}$	S - Er, Stony, BR	$\frac{TH}{e0}$ $\frac{TH}{e0}$ $\frac{TH}{f0}$ $\frac{TH}{f0}$	VS - Org, Wet, Slope		
$\frac{15}{f4}$	S - Slope, Er, Stony	$\frac{TM}{a0}$ $\frac{TM}{b0}$ $\frac{TM}{c0}$ $\frac{TM}{d0}$	VS - Org, Wet		
$\frac{16}{b0}$	S - Wet, Slip, Flood				
$\frac{17}{b0}$ $\frac{17}{b0}$ $\frac{17}{d0}$	M - Slip	$\frac{LH}{a0}$	VS - Org, Wet		
$\frac{18}{c4}$ $\frac{18}{d4}$	M - Er, Slip S - Stony				
$\frac{18}{f2}$ $\frac{18}{f4}$ $\frac{18}{f4}$	S - Slope, Er, Stony				
$\frac{18}{g4}$	VS - Slope, Er, Stony				
$\frac{19}{b0}$ $\frac{19}{c1}$ $\frac{19}{c2}$ $\frac{19}{d2}$	M - Slip M - Stony, Slip				

¹ For explanation, see Soil Map

² SL - None to slight, M - Moderate, S - Severe, VS - Very severe

Abbreviations

Clay - High clay content
 Er - Erosion hazard
 Flood - Flooding hazard (overflow)
 Org - Organic soil
 Org Surf - Organic surface layer
 layer > 15 cm thick
 Sandy - Sandy surface texture

Slip - Slippery or sticky when wet
 Slope - Excessive slope
 Solz - Solonetzic soil
 Stony - Surface stoniness
 Wet - Seasonally high groundwater table or
 surface ponding

TABLE 10. Soil Limitations for Trails

Map ¹ Symbol	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
$\frac{1}{b0}$ $\frac{1}{c0}$ $\frac{1}{c0}$	M - Slip	$\frac{3}{c2}$ $\frac{3}{d1}$	M - Er, Slip	$\frac{4}{c3}$	M - Er, Stony, Slip
$\frac{1}{b3}$ $\frac{1}{c3}$	M - Stony, Slip	$\frac{3}{c3}$ $\frac{3}{d3}$ $\frac{3}{d3}$	M - Er, Stony, Slip	$\frac{4}{e3}$	S - Er, Stony, Slip
$\frac{1}{b4}$ $\frac{1}{c4}$	M - Slip S - Stony	$\frac{3}{c4}$ $\frac{3}{d4}$	M - Er, Slip S - Stony	$\frac{4}{f3}$	S - Er, Slope, Stony
$\frac{1}{d4}$	M - Er, Slip S - Stony	$\frac{3}{e3}$ $\frac{3}{e3}$	S - Er, Stony, Slip	$\frac{4}{g3}$	S - Slope, Er, Stony
$\frac{1}{c5}$	M - Slip VS - Stony	$\frac{3}{e4}$ $\frac{3}{e4}$			
$\frac{1}{f0}$	S - Er, Slope, Slip	$\frac{3}{f2}$	S - Er, Slope, Slip	$\frac{5}{a2}$ $\frac{5}{c2}$ $\frac{5}{d1}$	S - Wet, Org Surf, Slip
$\frac{1}{f4}$	S - Er, Stony, Slope	$\frac{3}{f3}$ $\frac{3}{f3}$	S - Er, Slope, Stony	$\frac{5}{d2}$ $\frac{5}{e2}$	
		$\frac{3}{f4}$		$\frac{5}{a3}$ $\frac{5}{c3}$ $\frac{5}{c4}$	S - Wet, Org Surf, Stony
$\frac{2}{b0}$ $\frac{2}{c0}$ $\frac{2}{c0}$	M - Slip		S - Er, Stony, Slope	$\frac{5}{d3}$ $\frac{5}{e3}$	
$\frac{2}{d0}$ $\frac{2}{d2}$	M - Er, Slip	$\frac{3}{g3}$ $\frac{3}{g3}$	S - Slope, Er, Stony	$\frac{5}{f1}$ $\frac{5}{f2}$ $\frac{5}{f3}$	S - Wet, Org Surf, Slope
$\frac{2}{c5}$	M - Slip VS - Stony	$\frac{3}{g4}$ $\frac{3}{g4}$		$\frac{5}{d5}$	S - Wet, Org Surf, Slip VS - Stony
$\frac{2}{d5}$	M - Er, Slip VS - Stony	$\frac{4}{b2}$	M - Er, Slip	$\frac{6}{b0}$ $\frac{6}{c0}$	M - Slip

¹ For explanation, see Soil Map

² SL - None to slight, M - Moderate, S - Severe, VS - Very severe

Abbreviations

Clay - High clay content
 Er - Erosion hazard
 Flood - Flooding hazard (overflow)
 Org - Organic soil
 Org Surf - Organic surface layer
 layer > 15 cm thick
 Sandy - Sandy surface texture

Slip - Slippery or sticky when wet
 Slope - Excessive slope
 Solz - Solonetzic soil
 Stony - Surface stoniness
 Wet - Seasonally high groundwater table or
 surface ponding

TABLE 10. Soil Limitations for Trails

Map 1 Symbol	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
$\frac{6}{E0}$	S - Er, Slip	$\frac{9}{E0}$	M - Slip, Er	$\frac{12}{e2}$	S - Er, BR, Slip
$\frac{7}{b0}$	M - Slip	$\frac{9}{F3}$ $\frac{9}{F3}$	M - Slope, Er, Stony	$\frac{12}{F1}$ $\frac{12}{F2}$ $\frac{12}{F3}$	S - Er, BR, Slope
$\frac{8}{D4}$	M - Er, Slip S - Stony	$\frac{10}{a0}$ $\frac{10}{b0}$	S - Wet, Org Surf, Flood	$\frac{12}{F4}$	S - Er, Stony, BR
$\frac{8}{E2}$	S - Er, Slip, Stony	$\frac{10}{10}$ $\frac{10}{D0}$			
$\frac{8}{E4}$	S - Er, Stony, Slip	$\frac{10}{a4}$	S - Wet, Stony Org Surf	$\frac{12}{G3}$ $\frac{12}{g3}$	S - Slope, Er, BR
$\frac{8}{F2}$	S - Er, Slope, Slip	$\frac{10}{a5}$ $\frac{10}{b5}$	S - Wet, Org Surf, Flood VS - Stony	$\frac{13}{b4}$ $\frac{13}{c4}$	M - Sandy S - Stony
$\frac{8}{F3}$	S - Er, Slope, Stony				
$\frac{8}{F4}$	S - Er, Stony, Slope	$\frac{11}{d4}$	S - Stony, BR, Er	$\frac{13}{D5}$	M - Sandy VS - Stony
$\frac{8}{G1}$	S - Slope, Er, Slip	$\frac{11}{F4}$ $\frac{11}{F4}$	S - Er, Stony, BR	$\frac{14}{b3}$	S - Sandy, Stony, Flood
$\frac{8}{G3}$ $\frac{8}{G4}$	S - Slope, Er, Stony	$\frac{11}{G3}$	S - Slope, Er, BR	$\frac{14}{b5}$	M - Flood VS - Stony
$\frac{9}{D3}$	M - Stony, Slip	$\frac{12}{d3}$ $\frac{12}{e3}$	S - BR, Er, Stony	$\frac{15}{b4}$	S - Stony, BR, Slip
				$\frac{15}{d4}$	S - Stony, BR, Er

¹ For explanation, see Soil Map

² SL - None to slight, M - Moderate, S - Severe, VS - Very severe

Abbreviations

Clay - High clay content
 Er - Erosion hazard
 Flood - Flooding hazard (overflow)
 Org - Organic soil
 Org Surf - Organic surface layer
 layer > 15 cm thick
 Sandy - Sandy surface texture

Slip - Slippery or sticky when wet
 Slope - Excessive slope
 Solz - Solonetzic soil
 Stony - Surface stoniness
 Wet - Seasonally high groundwater table or
 surface ponding

TABLE 10. Soil Limitations for Trails

Map ¹ Symbol	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
$\frac{15}{e4}$ $\frac{15}{f4}$	S - Er, Stony, BR	$\frac{TH}{a0}$ $\frac{TH}{b0}$ $\frac{TH}{c0}$	VS - Org, Wet		
$\frac{16}{b0}$	S - Wet, Slip, Flood	$\frac{TH}{c0}$ $\frac{TH}{d0}$ $\frac{TH}{e0}$			
$\frac{17}{B0}$ $\frac{17}{b0}$ $\frac{17}{D0}$	M - Slip	$\frac{TH}{F0}$ $\frac{TH}{f0}$	VS - Org, Wet, Slope		
$\frac{18}{c4}$ $\frac{18}{D4}$	M - Er, Slip S - Stony	$\frac{TM}{a0}$ $\frac{TM}{b0}$	VS - Org, Wet		
$\frac{18}{f2}$	S - Er, Slope, Slip	$\frac{TM}{c0}$ $\frac{TM}{d0}$			
$\frac{18}{F4}$ $\frac{18}{f4}$	S - Er, Stony, Slope	$\frac{LH}{a0}$	VS - Org, Wet		
$\frac{18}{G4}$	S - Slope, Er, Stony				
$\frac{19}{b0}$ $\frac{19}{c1}$	M - Slip				
$\frac{19}{C2}$ $\frac{19}{D2}$					
$\frac{19}{F2}$	M - Slope, Er, Slip				

¹ For explanation, see Soil Map

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Abbreviations

Clay - High clay content
 Er - Erosion hazard
 Flood - Flooding hazard (overflow)
 Org - Organic soil
 Org Surf - Organic surface layer
 layer > 15 cm thick
 Sandy - Sandy surface texture

Slip - Slippery or sticky when wet
 Slope - Excessive slope
 Solz - Solonetzic soil
 Stony - Surface stoniness
 Wet - Seasonally high groundwater table or
 surface ponding

TABLE 11. Soil Limitations for Lawns and Landscaping

Map ¹ Symbol	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
$\frac{1}{b0}$ $\frac{1}{c0}$ $\frac{1}{c0}$	S - R Perm, Thin Ah	$\frac{3}{c2}$	M - Thin Ah, Stony	$\frac{4}{e3}$	M - Slope, Er, Thin Ah S - Stony
$\frac{1}{b3}$ $\frac{1}{b4}$ $\frac{1}{c3}$ $\frac{1}{c4}$ $\frac{1}{d4}$	S - Stony, R Perm, Thin Ah	$\frac{3}{c3}$ $\frac{3}{c4}$ $\frac{3}{d3}$ $\frac{3}{d3}$ $\frac{3}{d4}$	M - Thin Ah S - Stony	$\frac{4}{f3}$	S - Slope, Er, Stony
$\frac{1}{c5}$	S - R Perm, Thin Ah VS - Stony	$\frac{3}{e3}$ $\frac{3}{e3}$ $\frac{3}{e4}$ $\frac{3}{e4}$	M - Slope, Er S - Stony	$\frac{4}{g3}$	VS - Slope, Er, Stony
$\frac{1}{f0}$	S - Slope, Er, R Perm	$\frac{3}{f2}$	S - Slope, Er, Thin Ah	$\frac{5}{d1}$	S - Wet, Org Surf
$\frac{1}{f4}$	S - Slope, Er, Stony	$\frac{3}{f3}$ $\frac{3}{f3}$ $\frac{3}{f4}$	S - Slope, Er, Stony	$\frac{5}{a2}$ $\frac{5}{a3}$ $\frac{5}{c2}$	S - Wet, Org Surf, Stony
$\frac{2}{b0}$ $\frac{2}{c0}$ $\frac{2}{c0}$ $\frac{2}{d0}$	M - Thin Ah	$\frac{3}{g3}$ $\frac{3}{g3}$ $\frac{3}{g4}$ $\frac{3}{g4}$	VS - Slope, Er, Stony	$\frac{5}{c3}$ $\frac{5}{c4}$ $\frac{5}{c4}$ $\frac{5}{d2}$ $\frac{5}{d3}$ $\frac{5}{e3}$	S - Wet, Org Surf, Slope
$\frac{2}{d2}$	M - Thin Ah, Stony	$\frac{4}{b2}$	M - Thin Ah, Stony	$\frac{5}{e2}$ $\frac{5}{f1}$ $\frac{5}{f2}$ $\frac{5}{f3}$	S - Wet, Org Surf VS - Stony
$\frac{2}{c5}$ $\frac{2}{d5}$	M - Thin Ah VS - Stony	$\frac{4}{c3}$	M - Thin Ah S - Stony	$\frac{5}{d5}$	M - Thin Ah
$\frac{3}{d1}$	M - Thin Ah			$\frac{6}{b0}$ $\frac{6}{c0}$	

¹ For explanation, see Soil Map

² SL - None to slight, M - Moderate, S - Severe, VS - Very severe

Abbreviations

BR - Shallow depth to bedrock
 Clay - High clay content
 Er - Erosion hazard
 Flood - Flooding hazard (overflow)
 Lime - High lime content (soil nutrient imbalance)
 Org - Organic soil
 Org Surf - Organic surface layer
 layer > 15 cm thick
 R Perm - Rapid permeability (droughtiness)

Saline - Surface soil salinity
 Sandy - Sandy surface texture
 Slope - Excessive slope
 Sl Perm - Slow permeability
 Solz - Solonchic soil
 Stony - Surface stoniness
 Thin Ah - Thin or no Ah horizon
 Wet - Seasonally high groundwater table or
 surface ponding

TABLE 11. Soil Limitations for Lawns and Landscaping

Map ¹ Symbol	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
$\frac{6}{E0}$	M - Slope, Er, Thin Ah	$\frac{9}{D3}$	S - Stony, otherwise SL	$\frac{12}{d3}$ $\frac{12}{e3}$	S - BR, Stony, Er
$\frac{7}{b0}$	M - Thin Ah	$\frac{9}{E0}$	M - Slope, Er	$\frac{12}{e2}$	S - Er, BR, Slope
$\frac{8}{D4}$	M - Thin Ah S - Stony	$\frac{9}{F3}$ $\frac{9}{F3}$	S - Slope, Stony, Er	$\frac{12}{F1}$ $\frac{12}{F2}$	S - Slope, Er, BR
$\frac{8}{E2}$	M - Slope, Er, Thin Ah	$\frac{10}{a0}$ $\frac{10}{b0}$ $\frac{10}{c0}$ $\frac{10}{d0}$	S - Wet, Org Surf, Flood	$\frac{12}{F3}$ $\frac{12}{F4}$	S - Slope, Er, Stony
$\frac{8}{E4}$	M - Slope, Er, Thin Ah S - Stony	$\frac{10}{a4}$	S - Wet, Stony, Org Surf	$\frac{12}{G3}$ $\frac{12}{g3}$	VS - Slope, Er, Stony
$\frac{8}{F2}$	S - Slope, Er, Thin Ah VS - Stony	$\frac{10}{a5}$ $\frac{10}{b5}$	S - Wet, Org Surf, Flood	$\frac{13}{b4}$ $\frac{13}{c4}$	S - R Perm, Stony, Sandy
$\frac{8}{F3}$ $\frac{8}{F4}$	S - Slope, Er, Stony	$\frac{11}{d4}$	S - Stony, BR, Thin Ah	$\frac{13}{D5}$	S - R Perm, Sandy, Flood VS - Stony
$\frac{8}{G1}$	VS - Slope, Er, Thin Ah	$\frac{11}{F4}$ $\frac{11}{f4}$	S - Slope, Er, Stony	$\frac{14}{b3}$	S - R Perm, Stony, Sandy
$\frac{8}{G3}$ $\frac{8}{G4}$	VS - Slope, Er, Stony	$\frac{11}{G3}$	VS - Slope, Er, Stony	$\frac{14}{b5}$	S - R Perm, Sandy, Flood

¹ For explanation, see Soil Map

² SL - None to slight, M - Moderate, S - Severe, VS - Very severe

Abbreviations

BR - Shallow depth to bedrock
 Clay - High clay content
 Er - Erosion hazard
 Flood - Flooding hazard (overflow)
 Lime - High lime content (soil nutrient imbalance)
 Org - Organic soil
 Org Surf - Organic surface layer layer > 15 cm thick
 R Perm - Rapid permeability (droughtiness)

Saline - Surface soil salinity
 Sandy - Sandy surface texture
 Slope - Excessive slope
 Sl Perm - Slow permeability
 Solz - Solonetzic soil
 Stony - Surface stoniness
 Thin Ah - Thin or no Ah horizon
 Wet - Seasonally high groundwater table or surface ponding

TABLE 11. Soil Limitations for Lawns and Landscaping

Map ¹ Symbol	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation	
$\frac{15}{b4}$	$\frac{15}{d4}$		$\frac{19}{F2}$		S - Slope, Er, Stony	
	$\frac{15}{e4}$		$\frac{TH}{a0}$	$\frac{TH}{b0}$	$\frac{TH}{c0}$	VS - Wet, Org, Thin Ah
	$\frac{15}{f4}$		$\frac{TH}{c0}$	$\frac{TH}{d0}$	$\frac{TH}{d0}$	
			$\frac{TH}{e0}$		$\frac{TH}{e0}$	VS - Wet, Org, Slope
	$\frac{16}{b0}$		$\frac{TH}{f0}$		$\frac{TH}{f0}$	VS - Wet, Slope Org
$\frac{17}{B0}$	$\frac{17}{b0}$	$\frac{17}{D0}$				M - Thin Ah
			$\frac{TM}{a0}$	$\frac{TM}{b0}$	$\frac{TM}{d0}$	VS - Wet, Org, Thin Ah
$\frac{18}{c4}$	$\frac{18}{D4}$		$\frac{TM}{c0}$	$\frac{TM}{d0}$	$\frac{TM}{d0}$	M - Thin Ah, Er S - Stony
	$\frac{18}{f2}$	$\frac{18}{F4}$		$\frac{LH}{a0}$		S - Slope, Er, Stony
	$\frac{18}{G4}$					VS - Slope, Er, Stony
$\frac{19}{b0}$	$\frac{19}{C1}$					SL
$\frac{19}{C2}$	$\frac{19}{D2}$					M - Stony, otherwise SL

¹ For explanation, see Soil Map

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Abbreviations

BR - Shallow depth to bedrock
 Clay - High clay content
 Er - Erosion hazard
 Flood - Flooding hazard (overflow)
 Lime - High lime content (soil nutrient imbalance)
 Org - Organic soil
 Org Surf - Organic surface layer
 layer > 15 cm thick
 R Perm - Rapid permeability (droughtiness)

Saline - Surface soil salinity
 Sandy - Sandy surface texture
 Slope - Excessive slope
 Sl Perm - Slow permeability
 Solz - Solonetzic soil
 Stony - Surface stoniness
 Thin Ah - Thin or no Ah horizon
 Wet - Seasonally high groundwater table or
 surface ponding

TABLE 12. Soil Limitations for Buildings with Basements

Map ¹ Symbol	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
$\frac{1}{bo}$ $\frac{1}{co}$ $\frac{1}{co}$	SL	$\frac{3}{E3}$ $\frac{3}{e3}$	M - Slope, Frost	$\frac{5}{a3}$ $\frac{5}{c3}$ $\frac{5}{c4}$	S - Wet, Stony, Frost
$\frac{1}{b3}$ $\frac{1}{b4}$ $\frac{1}{c3}$	S - Stony, otherwise SL	$\frac{3}{E4}$ $\frac{3}{e4}$	S - Stony	$\frac{5}{c4}$ $\frac{5}{d3}$	
$\frac{1}{c4}$ $\frac{1}{d4}$		$\frac{3}{f2}$	S - Slope, Frost, Stony	$\frac{5}{E2}$ $\frac{5}{f1}$ $\frac{5}{f2}$	S - Wet, Slope, Frost
$\frac{1}{c5}$	VS - Stony, otherwise SL	$\frac{3}{F3}$ $\frac{3}{f3}$ $\frac{3}{f4}$	S - Slope, Stony, Frost	$\frac{5}{E3}$	S - Wet, Stony, Slope
$\frac{1}{fo}$	S - Slope	$\frac{3}{G3}$ $\frac{3}{g3}$	VS - Slope, Stony, Frost	$\frac{5}{F3}$	S - Wet, Slope, Stony
$\frac{1}{f4}$	S - Slope, Stony	$\frac{3}{G4}$ $\frac{3}{g4}$		$\frac{5}{d5}$	S - Wet, Frost VS - Stony
$\frac{2}{bo}$ $\frac{2}{co}$	S - Wet, Flood	$\frac{4}{b2}$	S - Wet, Frost, Stony	$\frac{6}{bo}$ $\frac{6}{co}$	S - Wet, Frost
$\frac{2}{co}$ $\frac{2}{do}$		$\frac{4}{c3}$	S - Wet, Stony Frost	$\frac{6}{Eo}$	S - Wet, Frost, Slope
$\frac{2}{d2}$	S - Wet, Flood, Stony	$\frac{4}{e3}$	S - Wet, Stony Slope	$\frac{7}{bo}$	S - Frost
$\frac{2}{c5}$ $\frac{2}{d5}$	S - Wet, Flood VS - Stony	$\frac{4}{F3}$	S - Slope, Wet, Stony	$\frac{8}{D4}$	S - Stony, Frost
$\frac{3}{D1}$	M - Frost	$\frac{4}{g3}$	VS - Slope, Wet Stony	$\frac{8}{E2}$	S - Frost, Slope Stony
$\frac{3}{C2}$	M - Frost, Stony	$\frac{5}{D1}$	S - Wet, Frost	$\frac{8}{E4}$	S - Stony, Frost Slope
$\frac{3}{c3}$ $\frac{3}{c4}$ $\frac{3}{D3}$	M - Frost S - Stony	$\frac{5}{a2}$ $\frac{5}{c2}$ $\frac{5}{D2}$	S - Wet, Frost, Stony	$\frac{8}{F2}$	S - Slope, Frost, Stony
$\frac{3}{d3}$ $\frac{3}{D4}$				$\frac{8}{F3}$ $\frac{8}{F4}$	S - Slope, Stony, Frost

¹ For explanation, see Soil Map

² SL - None to slight, M - Moderate, S - Severe, VS - Very severe

Abbreviations

BR - Shallow depth to bedrock
 Clay - High clay content
 Er - Erosion hazard
 Flood - Flooding hazard (overflow)
 Frost - Susceptibility to frost heave
 M Sh-Sw - Moderate shrink-swell potential

Org - Organic soil
 Sh-Sw - High shrink-swell potential
 Slope - Excessive slope
 Stony - Surface stoniness
 Sulfate - Possible concrete corrosion hazard
 (soluble sulfate)
 Wet - Seasonally high groundwater table or
 surface ponding

TABLE 12. Soil Limitations for Buildings with Basements

Map ¹ Symbol	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
$\frac{8}{G1}$	VS - Slope, Frost	$\frac{12}{e2}$	S - BR, Slope, Stony	$\frac{18}{c4}$ $\frac{18}{D4}$	S - Frost, Stony, M Sh-Sw
$\frac{8}{G3}$ $\frac{8}{G4}$	VS - Slope, Stony, Frost	$\frac{12}{e3}$	S - BR, Stony, Slope	$\frac{18}{F2}$	S - Slope, Frost, M Sh-Sw
$\frac{9}{D3}$	S - Frost, Stony, Wet	$\frac{12}{F1}$	S - Slope, BR	$\frac{18}{F4}$ $\frac{18}{F4}$	S - Slope, Frost, Stony
$\frac{9}{Eo}$	S - Frost, Slope, Wet	$\frac{12}{F2}$ $\frac{12}{F3}$ $\frac{12}{F4}$	S - Slope, BR, Stony	$\frac{18}{G4}$	VS - Slope, Frost, Stony
$\frac{9}{F3}$ $\frac{9}{F3}$	S - Slope, Frost, Stony	$\frac{12}{G3}$ $\frac{12}{g3}$	VS - Slope, BR, Stony	$\frac{19}{bo}$ $\frac{19}{C1}$	S - Frost
$\frac{10}{ao}$ $\frac{10}{bo}$ $\frac{10}{Co}$ $\frac{10}{Do}$	S - Wet, Flood	$\frac{13}{b4}$ $\frac{13}{c4}$	S - Flood, Stony	$\frac{19}{C2}$ $\frac{19}{D2}$	S - Frost, Stony
$\frac{10}{a4}$	S - Wet, Flood, Stony	$\frac{13}{D5}$	S - Flood VS - Stony	$\frac{19}{F2}$	S - Slope, Frost, Stony
$\frac{10}{a5}$ $\frac{10}{b5}$	S - Wet, Flood VS - Stony	$\frac{14}{b3}$ $\frac{14}{b5}$	VS - Flood, Stony	$\frac{TH}{ao}$ $\frac{TH}{bo}$ $\frac{TH}{Co}$ $\frac{TH}{co}$ $\frac{TH}{Do}$ $\frac{TH}{do}$ $\frac{TH}{Eo}$ $\frac{TH}{eo}$ $\frac{TH}{Fo}$ $\frac{TH}{fo}$	VS - Org, Wet, Sh-Sw
$\frac{11}{d4}$	M - BR S - Stony	$\frac{15}{e4}$	S - BR, Stony, Slope	$\frac{TM}{ao}$ $\frac{TM}{bo}$ $\frac{TM}{Co}$ $\frac{TM}{Do}$	VS - Org, Wet, Sh-Sw
$\frac{11}{F4}$ $\frac{11}{F4}$	S - Slope, Stony, BR	$\frac{15}{F4}$	S - Slope, BR, Stony		
$\frac{11}{G3}$	VS - Slope, Stony, BR	$\frac{16}{bo}$	S - Wet, Flood, Frost		
$\frac{12}{d3}$	S - BR, Stony	$\frac{17}{Bo}$ $\frac{17}{bo}$ $\frac{17}{Do}$	S - Frost	$\frac{LH}{ao}$	VS - Org, Wet, BR

¹ For explanation, see Soil Map

² SL - None to slight, M - Moderate, S - Severe, VS - Very severe

Abbreviations

BR - Shallow depth to bedrock
 Clay - High clay content
 Er - Erosion hazard
 Flood - Flooding hazard (overflow)
 Frost - Susceptibility to frost heave
 M Sh-Sw - Moderate shrink-swell potential

Org - Organic soil
 Sh-Sw - High shrink-swell potential
 Slope - Excessive slope
 Stony - Surface stoniness
 Sulfate - Possible concrete corrosion hazard
 (soluble sulfate)
 Wet - Seasonally high groundwater table or
 surface ponding

TABLE 13. Soil Limitations for Buildings Without Basements

Map Symbol ¹	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
$\frac{1}{bo}$ $\frac{1}{co}$ $\frac{1}{co}$	SL	$\frac{3}{E3}$ $\frac{3}{e3}$	M - Slope S - Stony	$\frac{5}{E2}$ $\frac{5}{F2}$ $\frac{5}{F3}$	S - Wet, Slope, Stony
$\frac{1}{b3}$ $\frac{1}{b4}$ $\frac{1}{c3}$	S - Stony, otherwise SL	$\frac{3}{E4}$ $\frac{3}{e4}$		$\frac{5}{E3}$	S - Wet, Stony, Slope
$\frac{1}{c4}$ $\frac{1}{d4}$		$\frac{3}{F2}$ $\frac{3}{F3}$	S - Slope, Stony	$\frac{5}{F1}$	S - Wet, Slope
$\frac{1}{c5}$	VS - Stony, otherwise SL	$\frac{3}{F3}$ $\frac{3}{F4}$		$\frac{5}{d5}$	S - Wet, Frost VS - Stony
$\frac{1}{fo}$	S - Slope	$\frac{3}{G3}$ $\frac{3}{g3}$	VS - Slope, Stony	$\frac{6}{bo}$ $\frac{6}{co}$	M - Wet
$\frac{1}{f4}$	S - Slope, Stony	$\frac{3}{G4}$ $\frac{3}{g4}$		$\frac{6}{Eo}$	M - Slope, Wet
$\frac{2}{bo}$ $\frac{2}{co}$	S - Flood, Wet	$\frac{4}{b2}$	M - Wet, Stony	$\frac{7}{bo}$	SL
$\frac{2}{co}$ $\frac{2}{do}$		$\frac{4}{c3}$	M - Wet S - Stony	$\frac{8}{D4}$	S - Stony, otherwise SL
$\frac{2}{d2}$	S - Flood, Wet, Stony	$\frac{4}{e3}$	M - Wet, Slope S - Stony	$\frac{8}{E2}$	M - Slope, Stony
$\frac{2}{c5}$ $\frac{2}{d5}$	S - Flood, Wet VS - Stony	$\frac{4}{F3}$	S - Slope, Stony, Wet	$\frac{8}{E4}$	M - Slope S - Stony
$\frac{3}{D1}$	SL	$\frac{4}{g3}$	VS - Slope, Stony, Wet	$\frac{8}{F2}$ $\frac{8}{F3}$ $\frac{8}{F4}$	S - Slope, Stony
$\frac{3}{C2}$	M - Stony, otherwise SL	$\frac{5}{D1}$	S - Wet	$\frac{8}{G1}$	VS - Slope
$\frac{3}{c3}$ $\frac{3}{c4}$ $\frac{3}{D3}$	S - Stony, otherwise SL	$\frac{5}{a2}$ $\frac{5}{a3}$ $\frac{5}{C2}$	S - Wet, Stony	$\frac{8}{G3}$ $\frac{8}{G4}$	VS - Slope, Stony
$\frac{3}{d3}$ $\frac{3}{d4}$		$\frac{5}{c3}$ $\frac{5}{c4}$ $\frac{5}{c4}$			
		$\frac{5}{D2}$ $\frac{5}{D3}$			

¹ For explanation, see Soil Map

² SL - None to slight, M - Moderate, S - Severe, VS - Very severe

Abbreviations

BR - Shallow depth to bedrock
 Clay - High clay content
 Er - Erosion hazard
 Flood - Flooding hazard (overflow)
 Frost - Susceptibility to frost heave
 M Sh-Sw - Moderate shrink-swell potential

Org - Organic soil
 Sh-Sw - High shrink-swell potential
 Slope - Excessive slope
 Stony - Surface stoniness
 Sulfate - Possible concrete corrosion hazard
 (soluble sulfate)
 Wet - Seasonally high groundwater table or
 surface ponding

TABLE 13. Soil Limitations for Buildings Without Basements

Map ¹ Symbol	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
$\frac{9}{D3}$	S - Stony, otherwise SL	$\frac{12}{F1}$	S - Slope, BR	$\frac{18}{F2}$ $\frac{18}{F4}$ $\frac{18}{F4}$	S - Slope, Stony
	M - Slope				
$\frac{9}{E0}$		$\frac{12}{F2}$	S - Slope, BR, Stony		
$\frac{9}{F3}$ $\frac{9}{f3}$	S - Slope, Stony	$\frac{12}{F3}$ $\frac{12}{F4}$	S - Slope, Stony, BR	$\frac{19}{b0}$ $\frac{19}{C1}$	SL
$\frac{10}{a0}$ $\frac{10}{b0}$	S - Wet, Flood	$\frac{12}{G3}$ $\frac{12}{g3}$	VS - Slope, Stony, BR	$\frac{19}{C2}$ $\frac{19}{D2}$	M - Stony
$\frac{10}{c0}$ $\frac{10}{D0}$		$\frac{13}{b4}$ $\frac{13}{c4}$	S - Flood, Stony		$\frac{19}{F2}$
$\frac{10}{a4}$		$\frac{13}{D5}$	S - Flood VS - Stony	$\frac{TH}{a0}$ $\frac{TH}{b0}$ $\frac{TH}{c0}$ $\frac{TH}{co}$ $\frac{TH}{Do}$ $\frac{TH}{d0}$ $\frac{TH}{E0}$ $\frac{TH}{e0}$ $\frac{TH}{F0}$ $\frac{TH}{fo}$	
$\frac{10}{a5}$ $\frac{10}{b5}$	S - Wet, Flood, Stony	$\frac{14}{b3}$ $\frac{14}{b5}$	VS - Flood, Stony		
$\frac{11}{d4}$	S - Stony, otherwise SL	$\frac{15}{b4}$ $\frac{15}{d4}$	M - BR S - Stony	$\frac{TM}{a0}$ $\frac{TM}{b0}$ $\frac{TM}{c0}$ $\frac{TM}{D0}$	VS - Org, Wet, Sh-Sw
$\frac{11}{F4}$ $\frac{11}{f4}$	S - Slope, Stony	$\frac{15}{e4}$	M - Slope, BR S - Stony		
$\frac{11}{G3}$	VS - Slope, Stony	$\frac{15}{F4}$	S - Slope, Stony, BR		
$\frac{12}{d3}$	M - BR S - Stony	$\frac{16}{b0}$	S - Wet, Flood	$\frac{LH}{a0}$	VS - Org, Wet, Sh-Sw
$\frac{12}{e2}$	M - Slope, BR, Stony	$\frac{17}{B0}$ $\frac{17}{b0}$ $\frac{17}{D0}$	SL		
$\frac{12}{e3}$	M - Slope, BR S - Stony	$\frac{18}{c4}$ $\frac{18}{D4}$	S - Stony, otherwise SL		

¹ For explanation, see Soil Map

² SL - None to slight, M - Moderate, S - Severe, VS - Very severe

Abbreviations

BR - Shallow depth to bedrock
 Clay - High clay content
 Er - Erosion hazard
 Flood - Flooding hazard (overflow)
 Frost - Susceptibility to frost heave
 M Sh-Sw - Moderate shrink-swell potential

Org - Organic soil
 Sh-Sw - High shrink-swell potential
 Slope - Excessive slope
 Stony - Surface stoniness
 Sulfate - Possible concrete corrosion hazard
 (soluble sulfate)
 Wet - Seasonally high groundwater table or
 surface ponding

TABLE 14. Soil Limitations for Septic Tank Absorption Fields

Map 1 Symbol	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
$\frac{1}{b0}$ $\frac{1}{b3}$ $\frac{1}{b4}$ $\frac{1}{c0}$ $\frac{1}{c3}$ $\frac{1}{c4}$ $\frac{1}{c5}$ $\frac{1}{d4}$	S - R Perm, GW	$\frac{4}{b2}$ $\frac{4}{c3}$ $\frac{4}{e3}$ $\frac{4}{f3}$ $\frac{4}{g3}$	S - Wet, S1 Perm, GW S - Slope, Wet, S1 Perm VS - Slope, Wet, S1 Perm	$\frac{8}{f2}$ $\frac{8}{f3}$ $\frac{8}{f4}$ $\frac{8}{g1}$ $\frac{8}{g3}$ $\frac{8}{g4}$ $\frac{9}{d3}$ $\frac{9}{e0}$	S - Slope, S1 Perm VS - Slope, S1 Perm M - S1 Perm, Wet, GW M - Slope, S1 Perm, Wet S - Slope, S1 Perm, Wet
$\frac{1}{f0}$ $\frac{1}{f4}$	S - Slope, R Perm, GW				
$\frac{2}{b0}$ $\frac{2}{c0}$ $\frac{2}{c3}$ $\frac{2}{c5}$ $\frac{2}{d0}$ $\frac{2}{d2}$ $\frac{2}{d5}$	S - Wet, R Perm, GW	$\frac{5}{a2}$ $\frac{5}{a3}$ $\frac{5}{c2}$ $\frac{5}{c3}$ $\frac{5}{c4}$ $\frac{5}{c4}$ $\frac{5}{d1}$ $\frac{5}{d2}$ $\frac{5}{d3}$ $\frac{5}{d5}$	VS - Wet, GW, S1 Perm VS - Wet, GW, Slope	$\frac{9}{f3}$ $\frac{9}{f3}$ $\frac{10}{a0}$ $\frac{10}{a4}$ $\frac{10}{a5}$ $\frac{10}{b0}$ $\frac{10}{b5}$ $\frac{10}{c0}$ $\frac{10}{d0}$	VS - Wet, GW, Flood
$\frac{3}{c2}$ $\frac{3}{c3}$ $\frac{3}{c4}$ $\frac{3}{d1}$ $\frac{3}{d3}$ $\frac{3}{d3}$ $\frac{3}{d4}$	S - S1 Perm	$\frac{5}{e2}$ $\frac{5}{e3}$ $\frac{5}{f1}$ $\frac{5}{f2}$ $\frac{5}{f3}$			
$\frac{3}{e3}$ $\frac{3}{e3}$ $\frac{3}{e4}$ $\frac{3}{e4}$	S - S1 Perm, Slope	$\frac{6}{b0}$ $\frac{6}{c0}$ $\frac{6}{e0}$	S - Wet, GW, S1 Perm S - Wet, GW, Slope	$\frac{11}{d4}$ $\frac{11}{f4}$ $\frac{11}{f4}$	VS - BR, S1 Perm VS - BR, Slope, S1 Perm
$\frac{3}{f2}$ $\frac{3}{f3}$	S - Slope, S1 Perm	$\frac{7}{b0}$	M - S1 Perm	$\frac{11}{g3}$	VS - Slope, BR, S1 Perm
$\frac{3}{f3}$ $\frac{3}{f4}$	S - Slope, S1 Perm	$\frac{8}{d4}$	S - S1 Perm	$\frac{12}{d3}$	VS - BR, S1 Perm
$\frac{3}{g3}$ $\frac{3}{g3}$ $\frac{3}{g4}$ $\frac{3}{g4}$	VS - Slope, S1 Perm	$\frac{8}{e2}$ $\frac{8}{e4}$	S - S1 Perm, Slope	$\frac{12}{e2}$ $\frac{12}{e3}$ $\frac{12}{f1}$ $\frac{12}{f2}$ $\frac{12}{f3}$ $\frac{12}{f4}$	VS - BR, Slope, S1 Perm

¹ For explanation, see Soil Map

² SL - None to slight, M - Moderate, S - Severe, VS - Very severe

Abbreviations

BR - Shallow depth to bedrock
 Clay - High clay content
 Flood - Flooding hazard (overflow)
 GW - Groundwater contamination hazard
 Org - Organic soil

R Perm - Rapid permeability
 Slope - Excessive slope
 S1 Perm - Slow permeability
 Wet - Seasonally high groundwater table or surface ponding

TABLE 14. Soil Limitations for Septic Tank Absorption Fields

Map ¹ Symbol	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
$\frac{12}{G3}$ $\frac{12}{g3}$	VS - Slope, BR, SI Perm	$\frac{TH}{ao}$ $\frac{TH}{bo}$ $\frac{TH}{Co}$	VS - Org, Wet, GW		
$\frac{13}{b4}$ $\frac{13}{c4}$ $\frac{13}{D5}$	S - R Perm, GW, Flood	$\frac{TH}{co}$ $\frac{TH}{Do}$ $\frac{TH}{do}$ $\frac{TH}{Eo}$ $\frac{TH}{eo}$ $\frac{TH}{Fo}$			
$\frac{14}{b3}$ $\frac{14}{b5}$	VS - Flood, R Perm, GW	$\frac{TH}{Fo}$			
$\frac{15}{b4}$ $\frac{15}{d4}$	VS - BR, SI Perm	$\frac{TM}{ao}$ $\frac{TM}{bo}$	VS - Org, Wet, GW		
$\frac{15}{e4}$ $\frac{15}{f4}$	VS - BR, Slope SI Perm	$\frac{TM}{Co}$ $\frac{TM}{Do}$			
$\frac{16}{bo}$	VS - Wet, GW, Flood	$\frac{LH}{ao}$	VS - Wet, BR, GW		
$\frac{17}{Bo}$ $\frac{17}{bo}$ $\frac{17}{Do}$	M - SI Perm				
$\frac{18}{c4}$ $\frac{18}{D4}$	M - SI Perm				
$\frac{18}{f2}$ $\frac{18}{F4}$ $\frac{18}{f4}$	S - Slope, SI Perm				
$\frac{18}{G4}$	VS - Slope, SI Perm				
$\frac{19}{bo}$ $\frac{19}{C1}$ $\frac{19}{C2}$ $\frac{19}{D2}$	M - SI Perm				
$\frac{19}{F2}$	S - Slope, SI Perm				

¹ For explanation, see Soil Map

² SL - None to slight, M - Moderate, S - Severe, VS - Very severe

Abbreviations

BR - Shallow depth to bedrock
 Clay - High clay content
 Flood - Flooding hazard (overflow)
 GW - Groundwater contamination hazard
 Org - Organic soil

R Perm - Rapid permeability
 Slope - Excessive slope
 SI Perm - Slow permeability
 Wet - Seasonally high groundwater table or
 surface ponding

TABLE 15. Soil Limitations for Trench Type Sanitary Landfills

Map 1 Symbol	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
$\frac{1}{bo}$ $\frac{1}{Co}$ $\frac{1}{co}$	VS - R Perm, GW	$\frac{3}{G3}$ $\frac{3}{g3}$	S - Slope, Stony, Clay	$\frac{8}{F2}$	M - Slope, Clay, Stony
$\frac{1}{b3}$ $\frac{1}{b4}$ $\frac{1}{C3}$	VS - R Perm, GW, Stony	$\frac{3}{G4}$ $\frac{3}{g4}$	S - Wet, GW, Stony	$\frac{8}{F3}$ $\frac{8}{F4}$	M - Slope, Clay, S - Stony
$\frac{1}{c4}$ $\frac{1}{D4}$ $\frac{1}{F4}$		$\frac{4}{b2}$ $\frac{4}{c3}$		$\frac{8}{G1}$	S - Slope, Clay
$\frac{1}{c5}$	VS - Stony, R Perm, GW	$\frac{4}{e3}$ $\frac{4}{F3}$	S - Slope, Wet, GW	$\frac{8}{G3}$ $\frac{8}{G4}$	S - Slope, Stony, Clay
$\frac{1}{fo}$	VS - R Perm, GW, Slope	$\frac{4}{g3}$	VS - Wet, GW	$\frac{9}{D3}$	M - Wet, GW S - Stony
$\frac{2}{bo}$ $\frac{2}{Co}$ $\frac{2}{co}$	VS - R Perm, GW, Wet	$\frac{5}{D1}$	VS - Wet, GW, Stony	$\frac{9}{Eo}$	M - Wet, GW
$\frac{2}{do}$ $\frac{2}{d2}$		$\frac{5}{a2}$ $\frac{5}{a3}$ $\frac{5}{C2}$		$\frac{9}{F3}$ $\frac{9}{F3}$	M - Slope, Wet, GW S - Stony
$\frac{2}{c5}$ $\frac{2}{d5}$	VS - R Perm, GW, Stony	$\frac{5}{C3}$ $\frac{5}{C4}$ $\frac{5}{c4}$			
		$\frac{5}{D2}$ $\frac{5}{D3}$ $\frac{5}{d5}$			
		$\frac{5}{E2}$ $\frac{5}{E3}$ $\frac{5}{F3}$		$\frac{10}{ao}$ $\frac{10}{a4}$ $\frac{10}{a5}$	VS - Wet, R Perm, GW
$\frac{3}{D1}$	M - Clay	$\frac{5}{F1}$ $\frac{5}{F2}$	VS - Wet, GW, Slope	$\frac{10}{bo}$ $\frac{10}{b5}$ $\frac{10}{Co}$	
$\frac{3}{C2}$	M - Clay, Stony			$\frac{10}{Do}$	
$\frac{3}{c3}$ $\frac{3}{c4}$ $\frac{3}{D3}$	M - Clay S - Stony	$\frac{6}{bo}$ $\frac{6}{Co}$ $\frac{6}{Eo}$	S - Wet, GW	$\frac{11}{d4}$	S - BR, Stony, Clay
$\frac{3}{d3}$ $\frac{3}{D4}$ $\frac{3}{E3}$		$\frac{7}{bo}$	SL		
$\frac{3}{e3}$ $\frac{3}{E4}$ $\frac{3}{e4}$				$\frac{11}{F4}$ $\frac{11}{F4}$	S - BR, Stony, Slope
$\frac{3}{F2}$	M - Slope, Clay, Stony	$\frac{8}{D4}$ $\frac{8}{E4}$	M - Clay S - Stony	$\frac{11}{G3}$	S - BR, Slope, Stony
$\frac{3}{F3}$ $\frac{3}{F3}$ $\frac{3}{F4}$	M - Slope, Clay S - Stony	$\frac{8}{E2}$	M - Clay, Stony		

¹ For explanation, see Soil Map

² SL - None to slight, M - Moderate, S - Severe, VS - Very severe

Abbreviations

BR - Shallow depth to bedrock
 Clay - High clay content
 Flood - Flooding hazard (overflow)
 GW - Groundwater contamination
 Org - Organic soil

R Perm - Rapid permeability
 Slip - Slippery or sticky when wet
 Slope - Excessive slope
 Stony - Surface Stoniness
 Text - Unsuitable texture
 Wet - Seasonally high groundwater table or surface ponding

TABLE 15. Soil Limitations for Trench Type Sanitary Landfills

Map ¹ Symbol	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
$\frac{12}{d3}$ $\frac{12}{e2}$ $\frac{12}{e3}$	S - BR, Stony	$\frac{18}{G4}$	S - Slope, Stony		
$\frac{12}{F1}$	S - BR, Slope	$\frac{19}{bo}$ $\frac{19}{CT}$	SL		
$\frac{12}{F3}$ $\frac{12}{F4}$	S - BR, Stony, Slope	$\frac{19}{C2}$ $\frac{19}{D2}$	M - Stony, otherwise SL		
$\frac{12}{F2}$ $\frac{12}{G3}$ $\frac{12}{g3}$	S - BR, Slope, Stony	$\frac{19}{F2}$	M - Slope, Stony		
$\frac{13}{b4}$ $\frac{13}{c4}$ $\frac{13}{D4}$	VS - R Perm, GW, Stony	$\frac{TH}{ao}$ $\frac{TH}{bo}$ $\frac{TH}{Co}$	VS - Org, Wet, GW		
$\frac{14}{b3}$ $\frac{14}{b5}$	VS - Flood, R Perm, GW	$\frac{TH}{co}$ $\frac{TH}{Do}$ $\frac{TH}{do}$			
$\frac{15}{b4}$ $\frac{15}{d4}$ $\frac{15}{e4}$	VS - BR, Stony	$\frac{TH}{Eo}$ $\frac{TH}{eo}$ $\frac{TH}{Fo}$			
$\frac{15}{F4}$	VS - BR, Stony, Slope	$\frac{TH}{fo}$			
$\frac{16}{bo}$	VS - Wet, GW, Flood	$\frac{TM}{ao}$ $\frac{TM}{bo}$	VS - Org, Wet, GW		
		$\frac{TM}{Co}$ $\frac{TM}{Do}$			
$\frac{17}{Bo}$ $\frac{17}{bo}$ $\frac{17}{Do}$	SL	$\frac{LH}{ao}$	VS - Wet, BR, GW		
$\frac{18}{c4}$ $\frac{18}{D4}$	S - Stony, otherwise SL				
$\frac{18}{F2}$	M - Slope, Stony				
$\frac{18}{F4}$ $\frac{18}{F4}$	M - Slope S - Stony				

¹ For explanation, see Soil Map

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Abbreviations

BR - Shallow depth to bedrock
 Clay - High clay content
 Flood - Flooding hazard (overflow)
 GW - Groundwater contamination
 Org - Organic soil

R Perm - Rapid permeability
 Slip - Slippery or sticky when wet
 Slope - Excessive slope
 Stony - Surface Stoniness
 Text - Unsuitable texture
 Wet - Seasonally high groundwater table or
 surface ponding

TABLE 16. Soil Limitations for Road Location

Map 1 Symbol	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
$\frac{1}{bo}$ $\frac{1}{co}$ $\frac{1}{co}$	SL	$\frac{3}{E3}$ $\frac{3}{e3}$	M - Slope, Stony, M Sh-Sw	$\frac{5}{a2}$ $\frac{5}{a3}$ $\frac{5}{c2}$	S - Wet, M Sh-Sw, Frost
$\frac{1}{b3}$ $\frac{1}{c3}$	M - Stony, otherwise SL	$\frac{3}{E4}$ $\frac{3}{e4}$	M - Slope, M Sh-Sw, Frost	$\frac{5}{c3}$ $\frac{5}{D1}$ $\frac{5}{D2}$	
$\frac{1}{b4}$ $\frac{1}{c4}$ $\frac{1}{D4}$	S - Stony, otherwise SL		S - Stony	5 D3	S - Wet, Stony, M Sh-Sw
$\frac{1}{c5}$	VS - Stony, otherwise SL	$\frac{3}{f2}$	S - Slope, Er, M Sh-Sw	$\frac{5}{c4}$ $\frac{5}{c4}$	S - Wet, Stony, M Sh-Sw
$\frac{1}{fo}$	S - Slope, Er	$\frac{3}{f3}$ $\frac{3}{f3}$	S - Slope, Er, Stony	$\frac{5}{E2}$ $\frac{5}{E3}$	S - Wet, M Sh-Sw, Slope
$\frac{1}{f4}$	S - Slope, Stony, Er	$\frac{3}{f4}$	S - Slope, Stony, Er	$\frac{5}{f1}$ $\frac{5}{f2}$ $\frac{5}{f3}$	S - Wet, Slope Er
$\frac{2}{bo}$ $\frac{2}{co}$ $\frac{2}{co}$	M - Wet, Flood	$\frac{3}{g3}$ $\frac{3}{g3}$	VS - Slope, Er, Stony	$\frac{5}{d5}$	S - Wet, M Sh-Sw, Frost, VS - Stony
$\frac{2}{do}$ $\frac{2}{d2}$		$\frac{3}{g4}$ $\frac{3}{g4}$			
$\frac{2}{c5}$ $\frac{2}{d5}$	M - Wet, Flood VS - Stony	$\frac{4}{b2}$	M - Wet, M Sh-Sw, Frost	$\frac{6}{bo}$ $\frac{6}{co}$	S - Frost, Wet, M Sh-Sw
$\frac{3}{c2}$ $\frac{3}{D1}$	M - M Sh-Sw, Frost	$\frac{4}{c3}$	M - Wet, Stony, M Sh-Sw	$\frac{6}{Eo}$	S - Frost, Slope Wet
$\frac{3}{c3}$ $\frac{3}{D3}$ $\frac{3}{d3}$	M - Stony, M Sh-Sw, Frost	$\frac{4}{e3}$	M - Wet, Stony, M Sh-Sw	$\frac{7}{bo}$	S - Frost, M Sh-Sw
$\frac{3}{c4}$ $\frac{3}{D4}$	M - M Sh-Sw, Frost S - Stony	$\frac{4}{f3}$	M - Wet, Slope, Stony	$\frac{8}{D4}$	S - Stony, Frost, M Sh-Sw
		$\frac{4}{g3}$	S - Slope, Er, Wet	$\frac{8}{E2}$	S - Frost, Slope, Er
			VS - Slope, Er, Wet	$\frac{8}{E4}$	S - Stony, Frost, Slope
				$\frac{8}{f2}$ $\frac{8}{f3}$	S - Slope, Frost, Er

¹ For explanation, see Soil Map

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Abbreviations

BR - Shallow depth to bedrock
 Clay - High clay content
 Er - Erosion hazard
 Flood - Flooding hazard (overflow)
 Frost - Susceptibility to frost heave
 M Sh-Sw - Moderate shrink-swell potential

Org - Organic soil
 Sh-Sw - High shrink-swell potential
 Slope - Excessive slope
 Stony - Surface stoniness
 Wet - Seasonally high groundwater table or surface ponding

TABLE 16. Soil Limitations for Road Location

Map ¹ Symbol	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
$\frac{8}{F4}$	S - Slope, Stony Frost	$\frac{12}{d3}$	M - BR, Er, Stony S - Frost	$\frac{16}{b0}$	S - Wet, Frost, Flood
$\frac{8}{G1}$ $\frac{8}{G3}$	VS - Slope, Frost, Er	$\frac{12}{e2}$ $\frac{12}{e3}$	S - Frost, Er, BR	$\frac{17}{B0}$ $\frac{17}{b0}$	S - Frost, M Sh-Sw, Er
$\frac{8}{G4}$	VS - Slope, Stony, Er	$\frac{12}{F1}$ $\frac{12}{F2}$ $\frac{12}{F3}$	S - Slope, Er, Frost	17 Do	S - Frost, Er, M Sh-Sw
$\frac{9}{D3}$	S - Frost, Stony Wet	$\frac{12}{F4}$	S - Slope, Er, Stony	$\frac{18}{c4}$ $\frac{18}{D4}$	S - Stony, Frost, Er
$\frac{9}{E0}$	S - Frost, Slope, Er	$\frac{12}{G3}$ $\frac{12}{g3}$	VS - Slope, Er, Frost	$\frac{18}{F2}$	S - Slope, Er, Frost
$\frac{9}{F3}$ $\frac{9}{f3}$	S - Slope, Frost, Er	$\frac{13}{b4}$ $\frac{13}{c4}$	M - Flood S - Stony	$\frac{18}{F4}$ $\frac{18}{f4}$	S - Slope, Er, Stony
$\frac{10}{a0}$ $\frac{10}{b0}$ $\frac{10}{C0}$ $\frac{10}{D0}$	S - Wet, Flood	$\frac{13}{D5}$	M - Flood VS - Stony	$\frac{18}{G4}$	VS - Slope, Er, Stony
$\frac{10}{a4}$	S - Wet, Flood, Stony	$\frac{14}{b3}$	S - Flood, Stony	$\frac{19}{b0}$ $\frac{19}{C1}$ $\frac{19}{C2}$	S - Frost, M Sh-Sw, Er
$\frac{10}{a5}$ $\frac{10}{b5}$	S - Wet, Flood VS - Stony	$\frac{14}{b5}$	S - Flood VS - Stony	$\frac{19}{D2}$	S - Frost, Er, M Sh-Sw
$\frac{11}{d4}$	M - M Sh-Sw, Frost S - Stony	$\frac{15}{b4}$	S - Stony, Frost, BR	$\frac{19}{F2}$	S - Slope, Er, Frost
$\frac{11}{F4}$ $\frac{11}{f4}$	S - Slope, Stony, Er	$\frac{15}{d4}$	S - Stony, Frost, Er	$\frac{TH}{a0}$ $\frac{TH}{b0}$ $\frac{TH}{C0}$ $\frac{TH}{c0}$ $\frac{TH}{D0}$ $\frac{TH}{d0}$ $\frac{TH}{E0}$ $\frac{TH}{e0}$	VS - Wet, Org, Sh-Sw
$\frac{11}{G3}$	VS - Slope, Er, Stony	$\frac{15}{e4}$	S - Er, Stony, Frost	$\frac{TH}{F0}$ $\frac{TH}{f0}$	VS - Wet, Org, Slope
		$\frac{15}{f4}$	S - Slope, Er, Stony		

¹ For explanation, see Soil Map

² SL - None to slight, M - Moderate, S - Severe, VS - Very severe

Abbreviations

BR - Shallow depth to bedrock
 Clay - High clay content
 Er - Erosion hazard
 Flood - Flooding hazard (overflow)
 Frost - Susceptibility to frost heave
 M Sh-Sw - Moderate shrink-swell potential

Org - Organic soil
 Sh-Sw - High shrink-swell potential
 Slope - Excessive slope
 Stony - Surface stoniness
 Wet - Seasonally high groundwater table or
 surface ponding

TABLE 16. Soil Limitations for Road Location

Map ¹ Symbol	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
$\frac{TM}{ao}$ $\frac{TM}{bo}$ $\frac{TM}{Co}$ $\frac{TM}{Do}$	VS - Wet, Org, Sh-Sw				
$\frac{LH}{ao}$	VS - Wet, Org, BR				

¹ For explanation, see Soil Map

² SL - None to slight, M - Moderate, S - Severe, VS - Very severe

Abbreviations

BR - Shallow depth to bedrock
 Clay - High clay content
 Er - Erosion hazard
 Flood - Flooding hazard (overflow)
 Frost - Susceptibility to frost heave
 M Sh-Sw - Moderate shrink-swell potential

Org - Organic soil
 Sh-Sw - High shrink-swell potential
 Slope - Excessive slope
 Stony - Surface stoniness
 Wet - Seasonally high groundwater table or
 surface ponding

TABLE 17. Soil Suitability for Source of Roadfill

Map ¹ Symbol	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
$\frac{1}{b_0}$ $\frac{1}{c_0}$ $\frac{1}{c_0}$	G	$\frac{3}{f_2}$	F - Slope,Er, M Sh-Sw	$\frac{5}{f_1}$ $\frac{5}{f_2}$ $\frac{5}{f_3}$	P - Wet,Slope, Er
$\frac{1}{b_3}$ $\frac{1}{c_3}$	F - Stony, otherwise G	$\frac{3}{f_3}$ $\frac{3}{f_3}$	F - Slope,Er, Stony	$\frac{5}{d_5}$	P - Wet, M Sh-Sw,Frost
$\frac{1}{b_4}$ $\frac{1}{c_4}$ $\frac{1}{d_4}$	P - Stony, otherwise G	$\frac{3}{f_4}$	F - Slope,Er, M Sh-Sw P - Stony	$\frac{6}{b_0}$ $\frac{6}{c_0}$ $\frac{6}{e_0}$	P - Frost, M Sh-Sw
$\frac{1}{c_5}$	VP - Stony, otherwise G	$\frac{3}{g_3}$ $\frac{3}{g_3}$	P - Slope,Er, Stony	$\frac{7}{b_0}$	P - Frost, M Sh-Sw
$\frac{1}{f_0}$	F - Slope,Er	$\frac{3}{g_4}$ $\frac{3}{g_4}$		$\frac{8}{d_4}$	P - Stony,Frost M Sh-Sw
$\frac{1}{f_4}$	F - Slope,Er P - Stony	$\frac{4}{b_2}$	F - M Sh-Sw, Frost	$\frac{8}{e_2}$	P - Frost,Er, M Sh-Sw
$\frac{2}{b_0}$ $\frac{2}{c_0}$ $\frac{2}{c_0}$	G	$\frac{4}{c_3}$ $\frac{4}{e_3}$	F - Stony, M Sh-Sw, Frost	$\frac{8}{e_4}$	P - Stony,Frost, Er
$\frac{2}{d_0}$ $\frac{2}{d_2}$		$\frac{4}{f_3}$	F - Slope,Er, Stony	$\frac{8}{f_2}$ $\frac{8}{f_3}$	P - Frost, Slope,Er
$\frac{2}{c_5}$ $\frac{2}{d_5}$	VP - Stony, otherwise G	$\frac{4}{g_3}$	P - Slope,Er, Stony	$\frac{8}{f_4}$	P - Stony, Frost,Er
$\frac{3}{c_2}$ $\frac{3}{d_1}$	F - M Sh-Sw, Frost	$\frac{5}{a_2}$ $\frac{5}{a_3}$ $\frac{5}{c_2}$	P - Wet, M Sh-Sw, Frost	$\frac{8}{g_1}$ $\frac{8}{g_3}$	P - Slope, Frost,Er
$\frac{3}{c_3}$ $\frac{3}{d_3}$ $\frac{3}{d_3}$	F - Stony, M Sh-Sw, Frost	$\frac{5}{c_3}$ $\frac{5}{d_1}$ $\frac{5}{d_2}$		$\frac{8}{g_4}$	P - Slope, Stony,Er
$\frac{3}{e_3}$ $\frac{3}{e_3}$		$\frac{5}{d_3}$ $\frac{5}{e_2}$ $\frac{5}{e_3}$		$\frac{9}{d_3}$	P - Frost, Stony, M Sh-Sw
$\frac{3}{c_4}$ $\frac{3}{d_4}$	F - M Sh-Sw, Frost P - Stony	$\frac{5}{c_4}$ $\frac{5}{c_4}$	P - Wet,Stony, M Sh-Sw	$\frac{9}{e_0}$	P - Frost,Er, M Sh-Sw
$\frac{3}{e_4}$ $\frac{3}{e_4}$					

¹ For explanation, see Soil Map

² SL - None to slight, M - Moderate, S - Severe, VS - Very severe

Abbreviations

BR - Shallow depth to bedrock
 Clay - High clay content
 Er - Erosion hazard
 Flood - Flooding hazard (overflow)
 Frost - Susceptibility to frost heave
 M Sh-Sw - Moderate shrink-swell potential

Org - Organic soil
 Sh-Sw - High shrink-swell potential
 Slope - Excessive slope
 Stony - Surface stoniness
 Wet - Seasonally high groundwater table or
 surface ponding

TABLE 17. Soil Suitability for Source of Roadfill

Map ¹ Symbol	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
$\frac{9}{F3}$ $\frac{9}{F3}$	P - Frost,Er, Slope	$\frac{13}{B4}$ $\frac{13}{C4}$	P - Stony, otherwise G	$\frac{19}{B0}$ $\frac{19}{C1}$ $\frac{19}{C2}$	P - Frost, M Sh-Sw,Er
$\frac{10}{a0}$ $\frac{10}{b0}$ $\frac{10}{C0}$ $\frac{10}{D0}$	P - Wet,Flood	$\frac{13}{D5}$	VP - Stony, otherwise G	$\frac{19}{D2}$	P - Frost,Er, M Sh-Sw
$\frac{10}{a4}$	P - Wet,Stony, Flood	$\frac{14}{B3}$	F - Flood, Stony	$\frac{19}{F2}$	P - Frost,Er, Slope
$\frac{10}{a5}$ $\frac{10}{b5}$	P - Wet,Flood VP - Stony	$\frac{14}{b5}$	F - Flood VP - Stony	$\frac{TH}{a0}$ $\frac{TH}{b0}$ $\frac{TH}{C0}$ $\frac{TH}{C0}$ $\frac{TH}{D0}$ $\frac{TH}{D0}$ $\frac{TH}{E0}$ $\frac{TH}{e0}$ $\frac{TH}{F0}$ $\frac{TH}{fo}$	VP - Wet,Org, Sh-Sw
$\frac{11}{d4}$	F - BR,M Sh-Sw, P - Stony,Frost	$\frac{15}{b4}$	P - Stony, Frost,BR		
$\frac{11}{F4}$ $\frac{11}{F4}$	F - Er,Slope, M Sh-Sw P - Stony	$\frac{15}{d4}$	P - Stony, Frost,Er		
$\frac{11}{G3}$	P - Slope,Er, BR	$\frac{15}{e4}$ $\frac{15}{F4}$	P - Er,Stony, Frost	$\frac{TM}{a0}$ $\frac{TM}{b0}$ $\frac{TM}{C0}$ $\frac{TM}{D0}$	VP - Wet,Org, Sh-Sw
$\frac{12}{d3}$	P - Frost,BR, Er	$\frac{16}{B0}$	P - Wet,Frost, M Sh-Sw	$\frac{LH}{a0}$	VP - Wet,Org, Sh-Sw
$\frac{12}{e2}$ $\frac{12}{e3}$	P - Frost,Er, BR	$\frac{17}{B0}$ $\frac{17}{b0}$ $\frac{17}{D0}$ $\frac{17}{D0}$	P - Frost, M Sh-Sw,Er P - Frost,Er, M Sh-Sw		
$\frac{12}{F1}$ $\frac{12}{F2}$ $\frac{12}{F3}$	P - Er,Frost, Slope	$\frac{18}{c4}$ $\frac{18}{D4}$	P - Stony, Frost,Er		
$\frac{12}{F4}$	P - Er,Frost, Stony	$\frac{18}{F2}$	P - Er,Frost, Slope		
$\frac{12}{G3}$ $\frac{12}{g3}$	P - Slope,Er, Frost	$\frac{18}{F4}$ $\frac{18}{F4}$	P - Er, Stony, Frost		
		$\frac{18}{G4}$	P - Slope,Er, Stony		

¹ For explanation, see Soil Map

² SL - None to slight, M - Moderate, S - Severe, VS - Very severe

Abbreviations

BR - Shallow depth to bedrock
 Clay - High clay content
 Er - Erosion hazard
 Flood - Flooding hazard (overflow)
 Frost - Susceptibility to frost heave
 M Sh-Sw - Moderate shrink-swell potential

Org - Organic soil
 Sh-Sw - High shrink-swell potential
 Slope - Excessive slope
 Stony - Surface stoniness
 Wet - Seasonally high groundwater table or
 surface ponding

TABLE 18. Soil Suitability for Source of Sand or Gravel

Map 1 Symbol	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
$\frac{1}{b_0}$ $\frac{1}{b_3}$ $\frac{1}{b_4}$ $\frac{1}{c_0}$ $\frac{1}{c_0}$ $\frac{1}{c_3}$ $\frac{1}{c_4}$ $\frac{1}{c_5}$ $\frac{1}{d_4}$ $\frac{1}{f_0}$ $\frac{1}{f_4}$	G	$\frac{5}{d_1}$ $\frac{5}{d_2}$ $\frac{5}{d_3}$ $\frac{5}{d_5}$ $\frac{5}{e_2}$ $\frac{5}{e_3}$ $\frac{5}{f_1}$ $\frac{5}{f_2}$ $\frac{5}{f_3}$	VP - Text, Wet	$\frac{12}{d_3}$ $\frac{12}{e_2}$ $\frac{12}{e_3}$ $\frac{12}{f_1}$ $\frac{12}{f_2}$ $\frac{12}{f_3}$ $\frac{12}{f_4}$ $\frac{12}{g_3}$ $\frac{12}{g_3}$	VP - Text
$\frac{2}{b_0}$ $\frac{2}{c_0}$ $\frac{2}{c_0}$ $\frac{2}{c_5}$ $\frac{2}{d_0}$ $\frac{2}{d_2}$ $\frac{2}{d_5}$	G	$\frac{6}{b_0}$ $\frac{6}{c_0}$ $\frac{6}{e_0}$	VP - Text	$\frac{13}{b_4}$ $\frac{13}{c_4}$ $\frac{13}{d_4}$	G
$\frac{3}{c_2}$ $\frac{3}{c_3}$ $\frac{3}{c_4}$ $\frac{3}{d_1}$ $\frac{3}{d_3}$ $\frac{3}{d_3}$ $\frac{3}{d_4}$ $\frac{3}{e_3}$ $\frac{3}{e_3}$ $\frac{3}{e_4}$ $\frac{3}{e_4}$ $\frac{3}{f_2}$ $\frac{3}{f_3}$ $\frac{3}{f_3}$ $\frac{3}{f_4}$ $\frac{3}{g_3}$ $\frac{3}{g_3}$ $\frac{3}{g_4}$ $\frac{3}{g_4}$	VP - Text	$\frac{7}{b_0}$ $\frac{8}{d_4}$ $\frac{8}{e_2}$ $\frac{8}{e_4}$ $\frac{8}{f_2}$ $\frac{8}{f_3}$ $\frac{8}{f_4}$ $\frac{8}{g_1}$ $\frac{8}{g_3}$ $\frac{8}{g_4}$	VP - Text	$\frac{14}{b_3}$ $\frac{14}{b_5}$ $\frac{15}{b_4}$ $\frac{15}{d_4}$ $\frac{15}{e_4}$ $\frac{15}{f_4}$ $\frac{16}{b_0}$	F-P - Flood, Thin VP - Text VP - Text, Wet, Flood
$\frac{4}{b_2}$ $\frac{4}{c_3}$ $\frac{4}{e_3}$ $\frac{4}{f_3}$ $\frac{4}{g_3}$	VP - Text	$\frac{9}{d_3}$ $\frac{9}{e_0}$ $\frac{9}{f_3}$ $\frac{9}{f_3}$	VP - Text	$\frac{17}{b_0}$ $\frac{17}{b_0}$ $\frac{17}{d_0}$	VP - Text
$\frac{5}{a_2}$ $\frac{5}{a_3}$ $\frac{5}{c_2}$ $\frac{5}{c_3}$ $\frac{5}{c_4}$ $\frac{5}{c_4}$	VP - Text, Wet	$\frac{10}{a_0}$ $\frac{10}{a_4}$ $\frac{10}{a_5}$ $\frac{10}{b_0}$ $\frac{10}{b_5}$ $\frac{10}{c_0}$ $\frac{10}{d_0}$	P - Wet, Flood	$\frac{18}{c_4}$ $\frac{18}{d_4}$ $\frac{18}{f_2}$ $\frac{18}{f_4}$ $\frac{18}{f_4}$ $\frac{18}{g_4}$ $\frac{19}{b_0}$ $\frac{19}{c_1}$ $\frac{19}{c_2}$ $\frac{19}{d_2}$ $\frac{19}{f_2}$	VP - Text
		$\frac{11}{d_4}$ $\frac{11}{f_4}$ $\frac{11}{f_4}$ $\frac{11}{g_3}$	VP - Text	$\frac{TH}{a_0}$ $\frac{TH}{b_0}$ $\frac{TH}{c_0}$ $\frac{TH}{c_0}$ $\frac{TH}{d_0}$ $\frac{TH}{d_0}$ $\frac{TH}{e_0}$ $\frac{TH}{e_0}$ $\frac{TH}{f_0}$	VP - Text, Wet, Org

¹ For explanation, see Soil Map
² G - Good, F - Fair, P - Poor, VP - Very poor

Abbreviations

Flood - Flooding hazard (overflow)
 OB - Excessive overburden
 Org - Organic soil
 Text - Unsuitable texture

Thin - Thin deposit of sand or gravel
 Wet - Seasonally high groundwater table or surface ponding

Table 18. (cont'd)

Map ¹ Symbol	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
$\frac{TH}{Fo}$	VP - Text, Wet, Org				
$\frac{TM}{ao}$ $\frac{TM}{Co}$	$\frac{TM}{bo}$ $\frac{TM}{Do}$ VP - Text, Org, Wet				
$\frac{LH}{ao}$	VP - Text, Org, Wet				

¹ For explanation, see Soil Map

² G - Good, F - Fair, P - Poor, VP - Very poor

Abbreviations

Flood - Flooding hazard (overflow)
 OB - Excessive overburden
 Org - Organic soil
 Text - Unsuitable texture

Thin - Thin deposit of sand or gravel
 Wet - Seasonally high groundwater table or
 surface ponding

REFERENCES

- Alberta Institute of Pedology. Undated. Soil Group Map of Alberta, scale 1:3,313,000, Dept. of Extension, U. of Alberta, Edmonton, Canada.
- Canada Soil Survey Committee, Subcommittee on Soil Classification. 1978. The Canadian System of Soil Classification. Canada Dept. of Agric. Publication 1646. Supply and Services Canada, Ottawa, Ontario. 164 pp.
- Cormack, R.G.H. 1967. Wild Flowers of Alberta. Gov't. of Alberta, Dept. of Industry and Development. Queen's Printer, Edmonton, Canada. 415 pp.
- Cunningham, G.C. 1975. Forest Flora of Canada. Bull. 121, Dept. of Northern Affairs and National Resources, Forestry Branch. Ottawa, Ont. 144 pp.
- Environment Canada. 1982. Canadian Climate Normals, Temperature and Precipitation 1951-1980, Prairie Provinces. Atmospheric Environment Service, Downsview, Ontario. 429 pp.
- Environment Canada. 1982. Canadian Climate Normals, Volume 6 Frost 1951-1980. Supply and Services Canada, Ottawa, Ontario. 276 pp.
- Green, R. 1972. Geological Map of Alberta, scale 1:1,267,000. Research Council of Alberta, map 35. Edmonton, Canada.
- Greenlee, G.M. 1981. Guidebook for use with Soil Survey Reports of Alberta Provincial Parks and Recreation areas. Earth Sciences Rep. 81-1. Alberta Research Council, Edmonton, Canada. 66 pp.
- Moss, E.H. 1959. Flora of Alberta. University of Toronto Press, Ontario, Canada. 546 pp.
- Rowe, J.S. 1972. Forest Regions of Canada. Canadian Forestry Service, Department of Environment, Publ. No. 1300, Ottawa, Ontario. 172 pp.
- Trewartha, G.T. and Horn, L.H. 1980. An Introduction to Climate. 5th Ed. McGraw-Hill Book Co., New York, U.S.A. 416 pp.
- Twardy, A.G. and Corns, I.G.W. 1980. Soil Survey and Interpretations of the Wapiti Map Area, Alberta. Bull. 39, Alberta Research Council, Edmonton, Canada. 134 pp.

LEGEND:

- SL - none to slight soil limitations
- M - moderate soil limitations
- S - severe soil limitations
- VS - very severe soil limitations



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 1983



- F - fill material
- Gv - gravel bar
- SR - surface removed
- ~ - bedrock exposure
- ~ - escarpment
- ~ - soil limitation line
- - - - - boundary of mapped area



LANDFORM MAP OF DESIGNATED AREAS IN KAKWA FALLS REGION

Tp 61, R 13, W6 M

(Map 1)

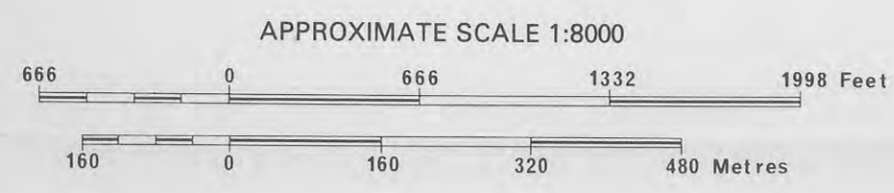
LEGEND:

- B - Bog (predominantly sphagnum peat)
- Bb - blanket bog
- Bh - horizontal bog
- Bs - sloping bog

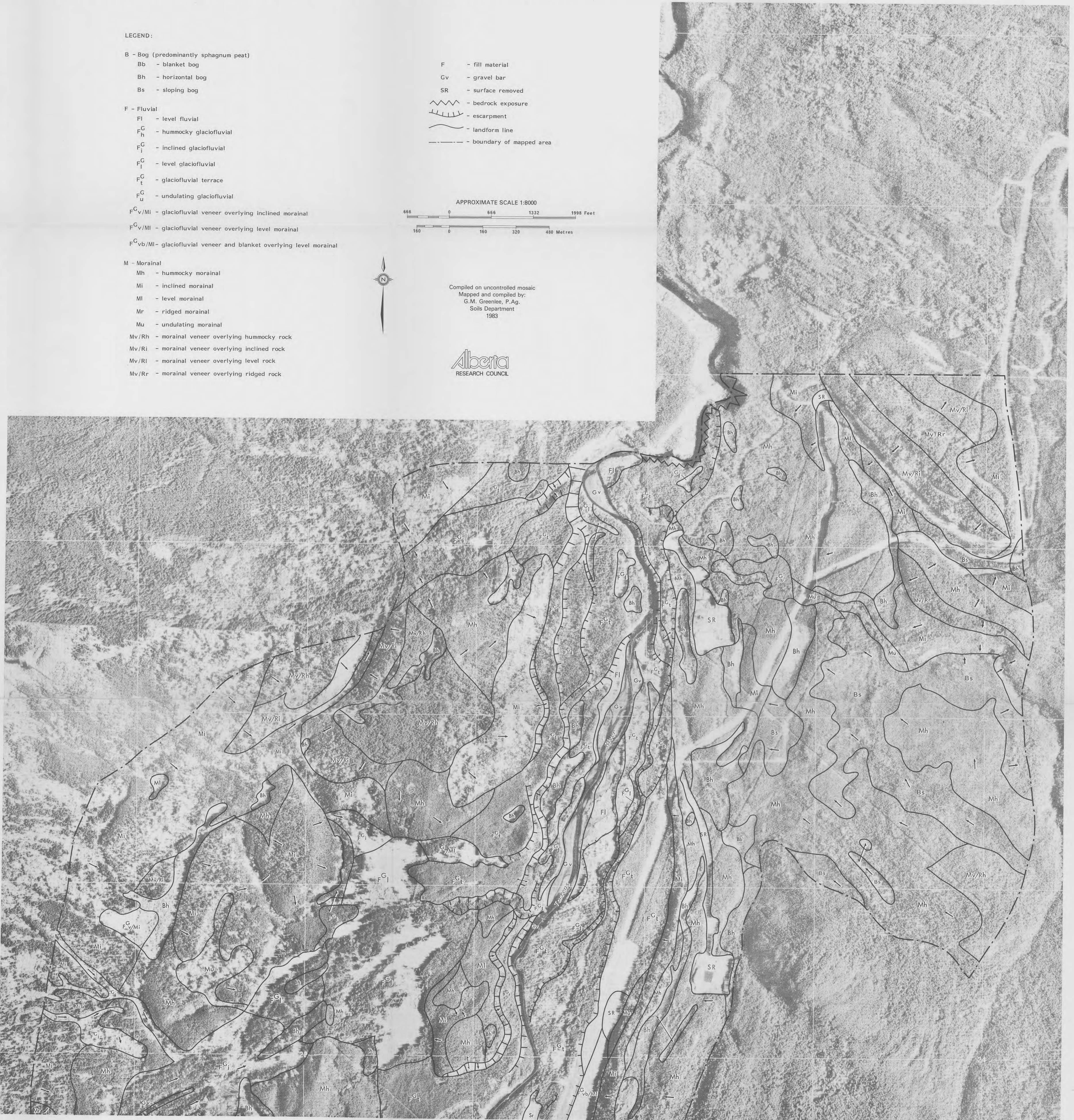
- F - Fluvial
- Fl - level fluvial
- F_h^G - hummocky glaciofluvial
- F_i^G - inclined glaciofluvial
- F_l^G - level glaciofluvial
- F_t^G - glaciofluvial terrace
- F_u^G - undulating glaciofluvial
- F_v^G/Mi - glaciofluvial veneer overlying inclined morainal
- F_v^G/Ml - glaciofluvial veneer overlying level morainal
- F_{vb}^G/Ml - glaciofluvial veneer and blanket overlying level morainal

- M - Morainal
- Mh - hummocky morainal
- Mi - inclined morainal
- Ml - level morainal
- Mr - ridged morainal
- Mu - undulating morainal
- Mv/Rh - morainal veneer overlying hummocky rock
- Mv/Ri - morainal veneer overlying inclined rock
- Mv/RI - morainal veneer overlying level rock
- Mv/Rr - morainal veneer overlying ridged rock

- F - fill material
- Gv - gravel bar
- SR - surface removed
- ~ - bedrock exposure
- ~ - escarpment
- - landform line
- - - - - boundary of mapped area



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SOILS MAP OF DESIGNATED AREAS IN KAKWA FALLS REGION

Tp 61, R 13, W 6M

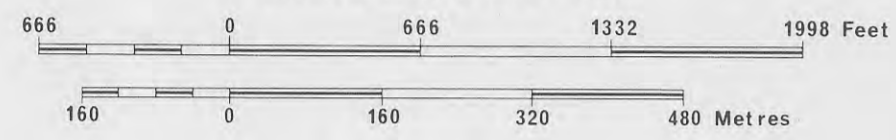
(Map 1)

Soil Classification:

MAP UNIT	SOIL ORDER	SOIL SUBGROUP	SOIL PARENT MATERIAL
1	Luviosolic - 70% Brunisolic - 30%	Brunisolic Gray Luvisol Eluviated Eutric Brunisol	very coarse textured fluvial sediments (gravel).
2	Brunisolic	Gleyed Eutric Brunisol	medium to moderately coarse textured fluvial sediments overlying very coarse textured fluvial sediments (gravel).
3	Luviosolic	Brunisolic Gray Luvisol	moderately fine textured till
4	Luviosolic	Gleyed Gray Luvisol	moderately fine textured till
5	Gleysolic	Orthic Gleysol peaty phase Orthic Humic Gleysol peaty phase	moderately fine textured till
6	Brunisolic	Gleyed Eutric Brunisol	medium textured glaciofluvial sediments overlying moderately fine textured till.
7	Brunisolic	Orthic Eutric Brunisol	medium textured glaciofluvial sediments overlying moderately fine textured till.
8	Luviosolic - 80% Brunisolic - 20%	Orthic Gray Luvisol Orthic Eutric Brunisol	moderately fine textured till
9	Brunisolic	Gleyed Eutric Brunisol Gleyed Melanic Brunisol	medium textured till
10	Gleysolic	Orthic Gleysol Orthic Gleysol peaty phase	medium to moderately coarse textured glaciofluvial sediments overlying very coarse textured glaciofluvial sediments (gravel).
11	Luviosolic	Lithic Brunisolic Gray Luvisol	moderately fine textured till overlying shale or sandstone

MAP UNIT	SOIL ORDER	SOIL SUBGROUP	SOIL PARENT MATERIAL
12	Brunisolic - 70% Luviosolic - 30%	Lithic Eluviated Dystric Brunisol Lithic Orthic Gray Luvisol Lithic Brunisolic Gray Luvisol	medium textured till containing a high proportion of weathered sandstone and shale, overlying sandstone or shale.
13	Brunisolic	Orthic Eutric Brunisol	very coarse textured glaciofluvial sediments (gravel).
14	Regosolic	Orthic Regosol	very coarse textured fluvial sediments (gravel)
15	Brunisolic	Lithic Eluviated Dystric Brunisol	very gravelly bouldery medium textured till overlying conglomerate or sandstone.
16	Gleysolic	Orthic Humic Gleysol	medium textured glaciofluvial sediments overlying gravelly bouldery moderately fine textured till.
17	Brunisolic	Orthic Eutric Brunisol Orthic Melanic Brunisol	medium textured glaciofluvial sediments
18	Brunisolic	Eluviated Dystric Brunisol	gravelly medium textured till
19	Brunisolic	Orthic Melanic Brunisol	moderately fine textured till
TH	Organic	undifferentiated Terric Humisol undifferentiated Humisol	predominantly well decomposed peat overlying moderately fine textured till or medium textured glaciofluvial sediments.
TM	Organic	undifferentiated Terric Mesisol	predominantly intermediately decomposed peat overlying fine textured till.
LH	Organic	undifferentiated Lithic Humisol	predominantly well decomposed peat overlying bedrock.

APPROXIMATE SCALE 1:8000



LEGEND:

- Map Symbols:
- 1 - map unit
 - b a - surface stoniness rating
 - topographic class
 - F - fill material
 - Gv - gravel bar
 - SR - surface removed
 - ~ - bedrock exposure
 - |—|—| - escarpment
 - - - - - soil line
 - - - - - boundary of mapped area

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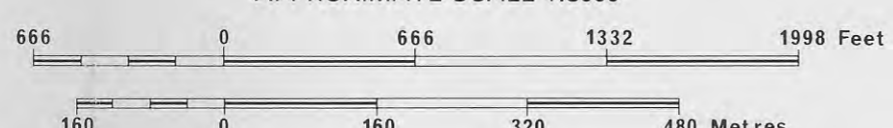


Soil Classification:

MAP UNIT	SOIL ORDER	SOIL SUBGROUP	SOIL PARENT MATERIAL
1	Luvisolic - 70%	Brunisolic Gray Luvisol	very coarse textured fluvial sediments (gravel).
	Brunisolic - 30%	Eluviated Eutric Brunisol	
2	Brunisolic	Gleyed Eutric Brunisol	medium to moderately coarse textured fluvial sediments overlying very coarse textured fluvial sediments (gravel).
3	Luvisolic	Brunisolic Gray Luvisol	moderately fine textured till
4	Luvisolic	Gleyed Gray Luvisol	moderately fine textured till
5	Gleysolic	Orthic Gleysol peaty phase	moderately fine textured till
		Orthic Humic Gleysol peaty phase	
6	Brunisolic	Gleyed Eutric Brunisol	medium textured glaciofluvial sediments overlying moderately fine textured till.
		Orthic Eutric Brunisol	medium textured glaciofluvial sediments overlying moderately fine textured till.
8	Luvisolic - 80%	Orthic Gray Luvisol	moderately fine textured till
	Brunisolic - 20%	Orthic Eutric Brunisol	
9	Brunisolic	Gleyed Eutric Brunisol	medium textured till
		Gleyed Melanic Brunisol	
10	Gleysolic	Orthic Gleysol	medium to moderately coarse textured glaciofluvial sediments overlying very coarse textured glaciofluvial sediments (gravel).
		Orthic Gleysol peaty phase	
11	Luvisolic	Lithic Brunisolic Gray Luvisol	moderately fine textured till overlying shale or sandstone

MAP UNIT	SOIL ORDER	SOIL SUBGROUP	SOIL PARENT MATERIAL
12	Brunisolic - 70%	Lithic Eluviated Dystric Brunisol	medium textured till containing a high proportion of weathered sandstone and shale, overlying sandstone or shale.
	Luvisolic - 30%	Lithic Orthic Gray Luvisol Lithic Brunisolic Gray Luvisol	
13	Brunisolic	Orthic Eutric Brunisol	very coarse textured glaciofluvial sediments (gravel).
14	Regosolic	Orthic Regosol	very coarse textured fluvial sediments (gravel)
15	Brunisolic	Lithic Eluviated Dystric Brunisol	very gravelly bouldery medium textured till overlying conglomerate or sandstone.
16	Gleysolic	Orthic Humic Gleysol	medium textured glaciofluvial sediments overlying gravelly bouldery moderately fine textured till.
17	Brunisolic	Orthic Eutric Brunisol	medium textured glaciofluvial sediments
18	Brunisolic	Eluviated Dystric Brunisol	gravelly medium textured till
19	Brunisolic	Orthic Melanic Brunisol	moderately fine textured till
TH	Organic	undifferentiated Terric Humisol	predominantly well decomposed peat overlying moderately fine textured till or medium textured glaciofluvial sediments.
		undifferentiated Humisol	
TM	Organic	undifferentiated Terric Mesisol	predominantly intermediately decomposed peat overlying fine textured till.
LH	Organic	undifferentiated Lithic Humisol	predominantly well decomposed peat overlying bedrock.

APPROXIMATE SCALE 1:8000



LEGEND:

- Map Symbol: 1 - map unit
- b 4 - surface stoniness rating
- topographic class
- F - fill material
- Gv - gravel bar
- SR - surface removed
- ~ - bedrock exposure
- ~ - escarpment
- - soil line
- - boundary of mapped area

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LEGEND:

- B - Bog (predominantly sphagnum peat)
- Bb - blanket bog
- Bh - horizontal bog
- Bs - sloping bog

- F - Fluvial
- Fl - level fluvial
- F_h^G - hummocky glaciofluvial
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- F_v^G/Mi - glaciofluvial veneer overlying inclined morainal
- F_v^G/Ml - glaciofluvial veneer overlying level morainal
- F_{vb}^G/Ml - glaciofluvial veneer and blanket overlying level morainal

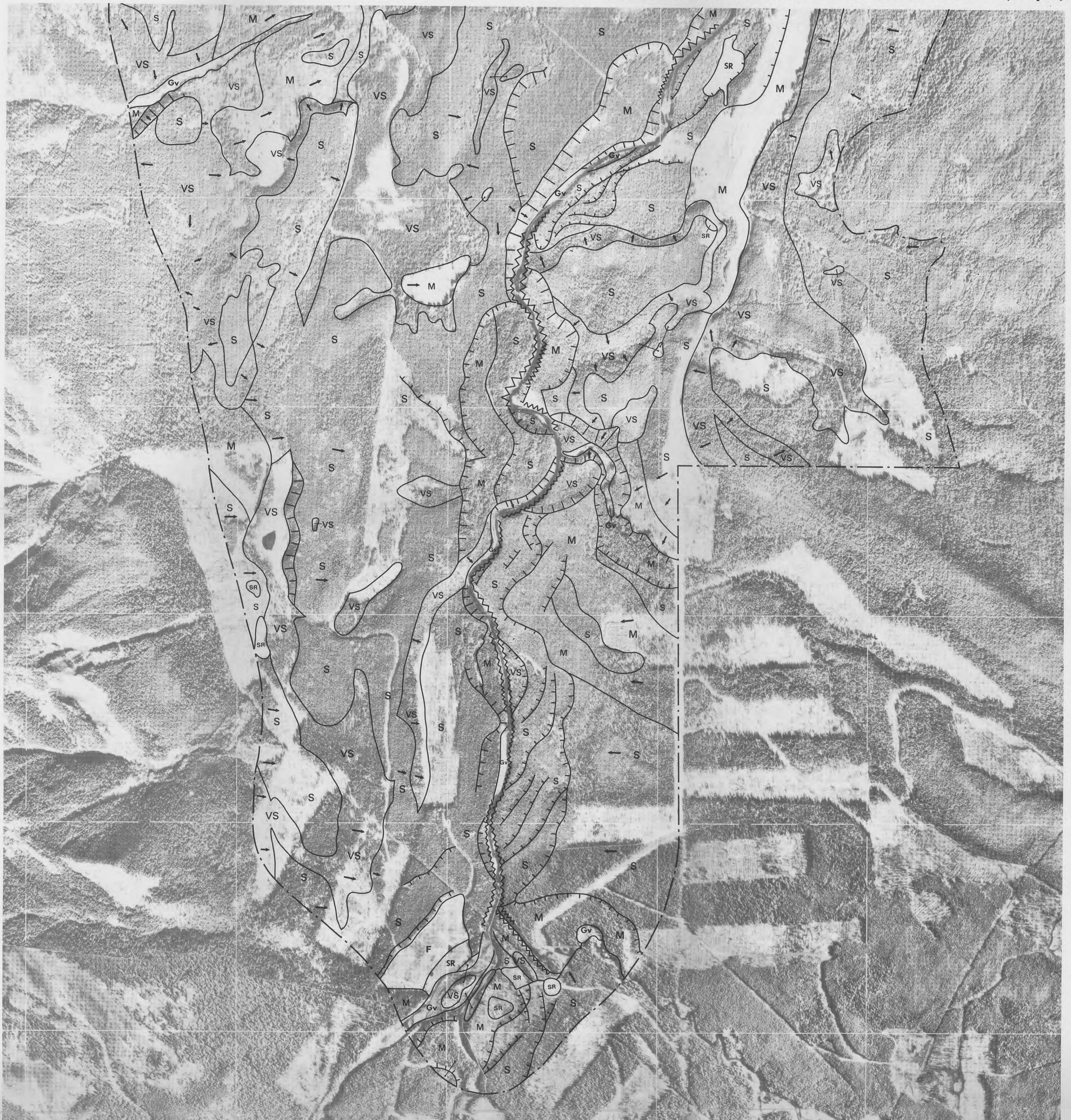
- M - Morainal
- Mh - hummocky morainal
- Mi - inclined morainal
- Ml - level morainal
- Mr - ridged morainal
- Mu - undulating morainal
- Mv/Rh - morainal veneer overlying hummocky rock
- Mv/Ri - morainal veneer overlying inclined rock
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- Mv/Rr - morainal veneer overlying ridged rock

- F - fill material
- Gv - gravel bar
- SR - surface removed
- ~ - bedrock exposure
- |—|—| - escarpment
- - - - - landform line
- - - - - boundary of mapped area



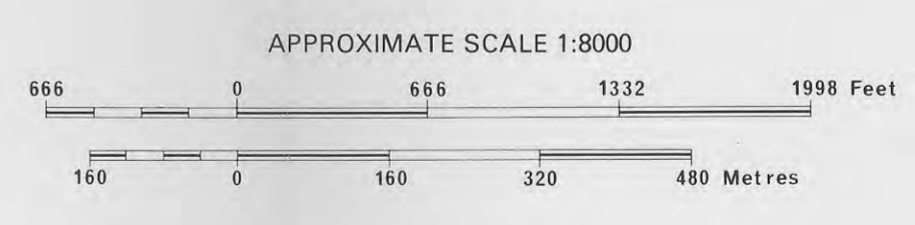
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 RESEARCH COUNCIL



- LEGEND:
- SL - none to slight soil limitations
 - M - moderate soil limitations
 - S - severe soil limitations
 - VS - very severe soil limitations

- F - fill material
- Gv - gravel bar
- SR - surface removed
- ~ - bedrock exposure
- ~ - escarpment
- - - soil limitation line
- - - boundary of mapped area



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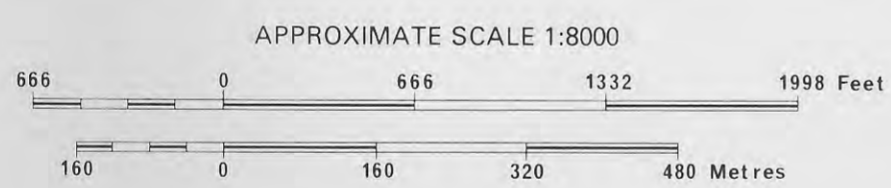
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Soil Classification:

MAP UNIT	SOIL ORDER	SOIL SUBGROUP	SOIL PARENT MATERIAL
1	Luvisolic - 70%	Brunisolic Gray Luvisol	very coarse textured fluvial sediments (gravel).
	Brunisolic - 30%	Eluviated Eutric Brunisol	
2	Brunisolic	Gleyed Eutric Brunisol	medium to moderately coarse textured fluvial sediments overlying very coarse textured fluvial sediments (gravel).
3	Luvisolic	Brunisolic Gray Luvisol	moderately fine textured till
4	Luvisolic	Gleyed Gray Luvisol	moderately fine textured till
5	Gleysolic	Orthic Gleysol peaty phase	moderately fine textured till
		Orthic Humic Gleysol peaty phase	
6	Brunisolic	Gleyed Eutric Brunisol	medium textured glaciofluvial sediments overlying moderately fine textured till.
7	Brunisolic	Orthic Eutric Brunisol	medium textured glaciofluvial sediments overlying moderately fine textured till.
8	Luvisolic - 80%	Orthic Gray Luvisol	moderately fine textured till
	Brunisolic - 20%	Orthic Eutric Brunisol	
9	Brunisolic	Gleyed Eutric Brunisol	medium textured till
		Gleyed Melanic Brunisol	
10	Gleysolic	Orthic Gleysol	medium to moderately coarse textured glaciofluvial sediments overlying very coarse textured glaciofluvial sediments (gravel).
		Orthic Gleysol peaty phase	
11	Luvisolic	Lithic Brunisolic Gray Luvisol	moderately fine textured till overlying shale or sandstone

MAP UNIT	SOIL ORDER	SOIL SUBGROUP	SOIL PARENT MATERIAL
12	Brunisolic - 70%	Lithic Eluviated Dystric Brunisol	medium textured till containing a high proportion of weathered sandstone and shale, overlying sandstone or shale.
	Luvisolic - 30%	Lithic Orthic Gray Luvisol Lithic Brunisolic Gray Luvisol	
13	Brunisolic	Orthic Eutric Brunisol	very coarse textured glaciofluvial sediments (gravel).
14	Regosolic	Orthic Regosol	very coarse textured fluvial sediments (gravel)
15	Brunisolic	Lithic Eluviated Dystric Brunisol	very gravelly bouldery medium textured till overlying conglomerate or sandstone.
16	Gleysolic	Orthic Humic Gleysol	medium textured glaciofluvial sediments overlying gravelly bouldery moderately fine textured till.
17	Brunisolic	Orthic Eutric Brunisol Orthic Melanic Brunisol	medium textured glaciofluvial sediments
18	Brunisolic	Eluviated Dystric Brunisol	gravelly medium textured till
19	Brunisolic	Orthic Melanic Brunisol	moderately fine textured till
TH	Organic	undifferentiated Terric Humisol	predominantly well decomposed peat overlying moderately fine textured till or medium textured glaciofluvial sediments.
		undifferentiated Humisol	
TM	Organic	undifferentiated Terric Mesisol	predominantly intermediately decomposed peat overlying fine textured till.
LH	Organic	undifferentiated Lithic Humisol	predominantly well decomposed peat overlying bedrock.



LEGEND:

- 1 - map unit
- b,4 - surface stoniness rating
- topographic class
- F - fill material
- Gv - gravel bar
- SR - surface removed
- bedrock exposure
- escarpment
- soil line
- boundary of mapped area

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LEGEND:

- B - Bog (predominantly sphagnum peat)
- Bb - blanket bog -
- Bh - horizontal bog
- Bs - sloping bog

F - Fluvial

- F_l - level fluvial
- F_h^G - hummocky glaciofluvial
- F_i^G - inclined glaciofluvial
- F_l^G - level glaciofluvial
- F_t^G - glaciofluvial terrace
- F_u^G - undulating glaciofluvial
- F_v^G/Mi - glaciofluvial veneer overlying inclined morainal
- F_v^G/Ml - glaciofluvial veneer overlying level morainal
- F_{vb}^G/Ml - glaciofluvial veneer and blanket overlying level morainal

M - Morainal

- Mh - hummocky morainal
- Mi - inclined morainal
- Ml - level morainal
- Mr - ridged morainal
- Mu - undulating morainal
- Mv/Rh - morainal veneer overlying hummocky rock
- Mv/Ri - morainal veneer overlying inclined rock
- Mv/Rl - morainal veneer overlying level rock
- Mv/Rr - morainal veneer overlying ridged rock

- F - fill material
- Gv - gravel bar
- SR - surface removed
- ~ - bedrock exposure
- ~ - escarpment
- - landform line
- - - - - boundary of mapped area



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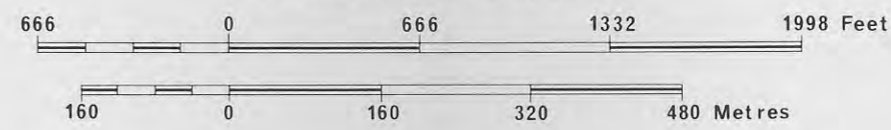


LEGEND:

- SL - none to slight soil limitations
- M - moderate soil limitations
- S - severe soil limitations
- VS - very severe soil limitations

- F - fill material
- Gv - gravel bar
- SR - surface removed
-  - bedrock exposure
-  - escarpment
-  - soil limitation line
-  - boundary of mapped area

APPROXIMATE SCALE 1:8000



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