Agriculture and Agri-Food Canada   Agriculture et Agroalimentaire Canada

Biophysical Land Classification of the Sipiwesk (63P) Map Area
Information Bulletin 2002-1

Soils and Terrain

An introduction to the land resource

Land Resource Group - Manitoba
Semiarid Prairie Agricultural Research Centre, Research Branch,
Agriculture and Agri-Food Canada

Canada

Acknowledgment

These soils and terrain bulletins are published and distributed by Manitoba Hydro. Acknowledgments are hereby extended to recognize Manitoba Hydro for its financial support of the project, and for providing resources for printing and distributing the bulletins; and to Agriculture and Agri-Food Canada for their development and preparation of the bulletins, and for their contribution of baseline resource data and scientific expertise in the compilation of accompanying digital files, maps and databases. As originators of the data, Agriculture and Agri-Food Canada retains ownership of the databases, and the right and responsibility to maintain, enhance, and upgrade the databases when new information becomes available.

Biophysical Land Classification of the Sipiwesk (63P) Map Area

Information Bulletin 2002-1

Prepared by:

Land Resource Group - Manitoba
Semiarid Prairie Agricultural Research Centre, Research Branch,
Agriculture and Agri-Food Canada

for

Manitoba Hydro
Printed November, 2002

List of Figures

List of Plates

PREFACE

This report is one of a new series of information bulletins prepared for individual map areas in northern Manitoba. It serves to introduce the newly digitized soil and terrain data bases and illustrates several typical derived and interpretive map products for land use planning and management applications. The overview provided in this bulletin is derived from available soil and terrain information published in the Bio-Physical Land Classification of selected areas in northern Manitoba and from soil data contained in the Manitoba Soil Data Base. This bulletin serves as an introduction to the land resource information available for the map area. Information in this bulletin may be quoted and utilized with appropriate reference to the originating agencies. The authors and originating agencies assume no responsibility for the misuse, alteration, re-packaging, or re-interpretation of the information. More detailed information, including copies of the original ecological (Biophysical) land classification at larger scales may be obtained by contacting:

Land Resource Group - Manitoba
Room 360 Ellis Building, University of Manitoba
Winnipeg, Manitoba R3T 2N2
Phone: 204 474 6118 FAX: 204 474 7633

CITATION
Land Resource Group - Manitoba, 2002. An Introduction to the Land Resource. Sipiwesk Map Area, NTS 63P. Information Bulletin 02-01, Semiarid Prairie Agricultural Research Centre, Research Branch, Agriculture and Agri-Food Canada

ACKNOWLEDGMENTS

Continuing support for this project has been provided by the Land Resource Group - Manitoba of Agriculture and Agri-Food Canada with financial support from Manitoba Hydro. Original mapping was initiated in 1974 as a joint project between the Canada-Manitoba Soil Survey and the Manitoba Department of Mines, Natural Resources and Environment.

Managerial and administrative support was provided by:

R.G. Eilers, Unit Head, Land Resource Group - Manitoba, Semiarid Prairie Agricultural Research Centre, Research Branch, Agriculture and Agri-Food Canada.

Technical support was provided by:

A. Waddell, Land Resource Group - Manitoba, Semiarid Prairie Agricultural Research Centre, Research Branch, Agriculture and Agri-Food Canada.

Professional expertise for data conversion, correlation and interpretation was provided by:

H. Veldhuis and R. G. Eilers, Land Resource Group - Manitoba, Semiarid Prairie Agricultural Research Centre, Research Branch, Agriculture and Agri-Food Canada.

G. F. Mills, P. Ag., G. F. Mills Consulting, Winnipeg, Manitoba.

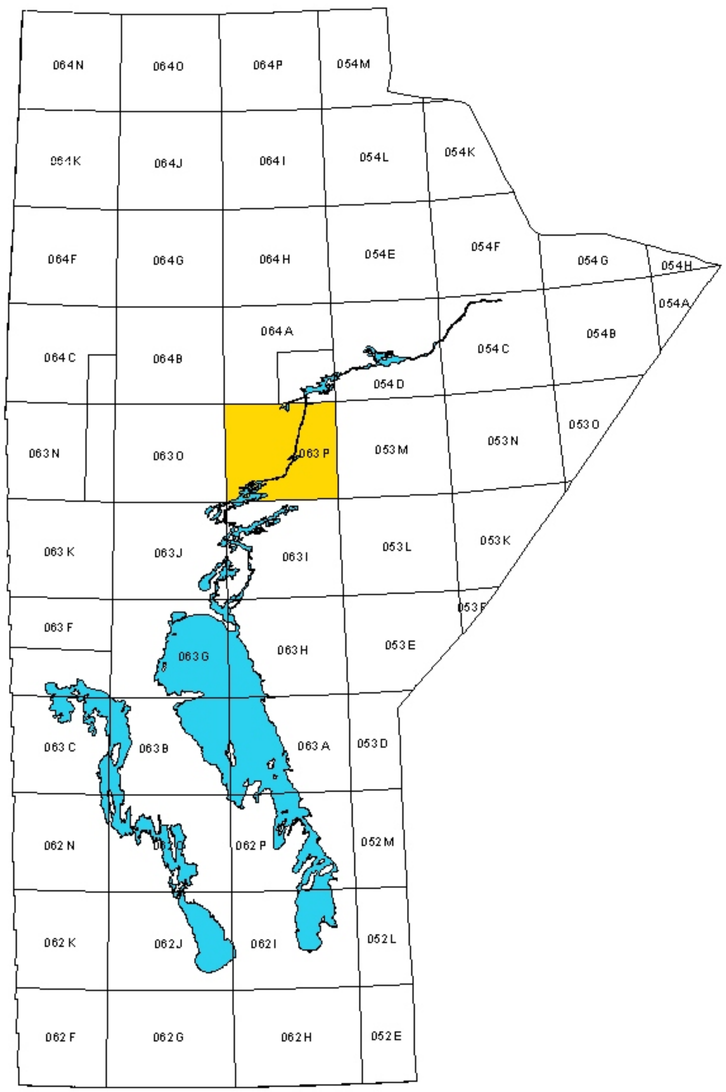


Figure 1. Location of study area

INTRODUCTION

The Sipiwesk map area covers 14 066 square kilometres in north-central Manitoba (Figure 1). A brief description of the database information and general environmental conditions are presented. A series of maps derived from the data describing terrain and soil characteristics are included together with selected management conditions which influence land resource planning. Knowledge of the biological and physical attributes of the northern environment is required to support resource development and to insure sustainable land use. The purpose of these soil and terrain bulletins is to raise awareness of existing land resource information and to demonstrate its application in planning land use and resource development in northern frontier areas.

Basic land resource information is required by resource specialists such as ecologists, forest managers, wildlife biologists and others concerned with sustainable land use. Information about physical characteristics of the landscape is required by engineers involved with geotechnical applications. There is also a need to ensure the involvement of First Nations peoples in achieving the resource potential of the landbase. Their vision is aimed at renewing and enhancing the values of their historical relationship with the land and water, through both traditional activities and the application of new, environmentally sound and appropriately scaled technologies and business models. Development in the resource sector should respect their traditional values of hunting, fishing and trapping and as well support non-traditional uses of the land such as harvest of the forest resource or activities such as recreation, tourism and eco-tourism. Such development can provide continuing sustenance and visibility for First Nation values as well as contribute to local employment and export income (The 2000 Annual Plan: Article 12 Submission, 2000).

The soil map and database were compiled and registered using the Geographic Information System (ArcINFO GIS) facilities of the Manitoba Land Resource Group. These databases were used to create the generalized derived and interpretive maps and statistics in this bulletin.

This bulletin is available in printed or digital format. The digital version is a .pdf file which offers additional display options, including the capability to print any portion of the bulletin. The software for reading .pdf files (Adobe Acrobat Reader) can be downloaded free of charge at www.adobe.com.

LAND RESOURCE DATA

The soil and terrain information presented in this bulletin is part of a larger project to develop a uniform level of land resource information for regional planning purposes throughout northern and eastern Manitoba. This information has been derived from ecological land classification and soil survey data collected under the Northern Resource Information Program (NRIP) in the 1970's.

Base Layer

Digital base map information was obtained from the National Topographic data base, available from Geomatics Canada of the Department of Natural Resources Canada. Base information includes lakes, rivers, streams, roads, highways and related features such as railroads, airports, parks and the location of towns, settlements, and Indian Reserves.

Soil and Terrain Layer

Soil and terrain data available for northern Manitoba is primarily in the form of broadly based ecological land surveys (ELS) at scales of 1:125 000 and 1:250 000 (Canada-Manitoba Soil Survey and Northern Resource Information Program). The original field inventory showing the surficial geology of selected areas of northern Manitoba was available as Open File maps from the Geological Survey of Canada (Klassen and Netterville, 1973). The resulting Biophysical Land Classification (BLC) was photo-mechanically overlain on the National Topographic Series map (NTS, 1975) to produce a single layer geo-referenced map (Figure 2a). Soil and biophysical information, and the distribution of map units was indicated directly on the map in each map polygon. The explanation of codes and additional information was provided in the legend attached to the map. A general discussion of soils, terrain and climate was provided in an accompanying report published for each map sheet.

The newly compiled digital map (Figure 2b) which is based largely on the information provided on the earlier biophysical map (Veldhuis et al., 1979), has been correlated with additional physiographic resource information collected and published since the original ELS was carried out (e.g. Klassen and Netterville, 1980c, and Klassen, 1983) . The polygons on the new map contain only a polygon number. This number links the map to a digital database which contains specific information on soil and terrain for that polygon. This information meets national standards as developed by MacDonald and Valentine (1992). The soil series codes which have been added to the digital file, afford a further linkage to specific databases containing detailed information on properties of particular soil types.

The map polygon is thus linked to soil drainage, surface texture, and many other soil and landscape properties, which allows for the production of derived and interpretive maps as shown in this bulletin.

The soil information at this reconnaissance scale of mapping was compiled on a soil association basis, in which soil landscape patterns are associated with unique surficial geological deposits and textures. Each soil association consists of a range of different soils ("associates") each of which occurs in a repetitive pattern in the landscape.

Modern soil series that best represent the soil association were identified for each polygon. The soil and landscape condition provide a link to additional databases of soil properties. In this way, the map polygon is linked to soil drainage, surface texture, and other soil and landscape properties to produce various interpretive maps.

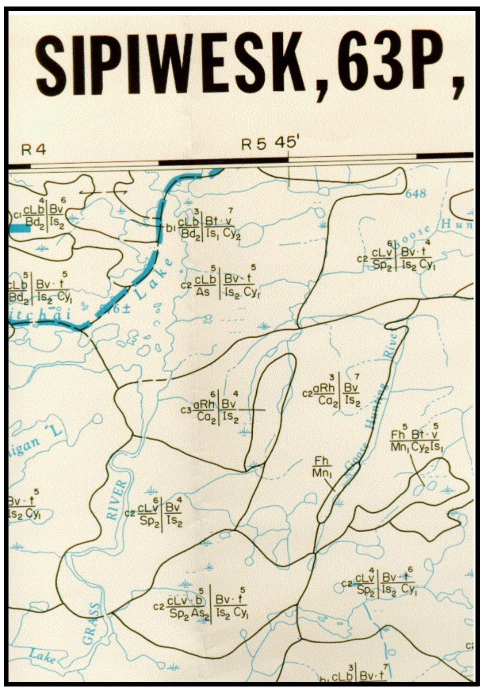


Figure 2a. Portion of the BLC Map of the Sipiwesk Area (1979)

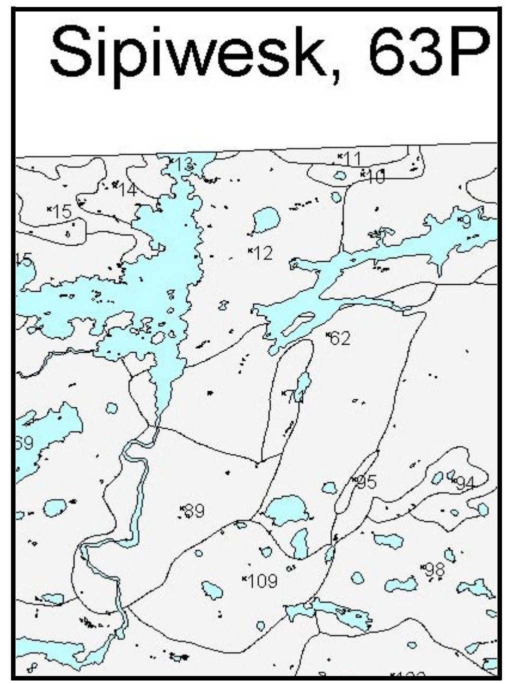


Figure 2b. Portion of the Digital NTS and BLC Map of the Sipiwesk Area (2002)

SOIL AND TERRAIN OVERVIEW

Location and Areal Extent

The Sipiwesk map area (NTS 63P) occupies 14 066 square kilometres in northern Manitoba located between Latitude 55 ^{0} 00' to 56 ^{0} 00' north and Longitude 96 ^{0} 00' to 98 ^{0} 00' west (Figure 1). The land area covers 11 695 km^2 and water bodies cover 2 370 km^2. The City of Thompson, in the northwest corner of the area is the largest community with a population of nearly 14 385 (Statistics Canada, 1996). The remainder of the map area remains relatively inaccessible and unpopulated, although several small settlements are located along the Hudson Bay Railway. In addition to the railway, highway and air connections to Thompson provide access from southern Manitoba.

Climate and Vegetation

The Sipiwesk map area is situated in the Hayes River Upland Ecoregion and a portion of the Churchill River Upland Ecoregion, both within the Boreal Shield Ecozone (Smith et al., 1998 and Figure 3). The entire area is in the Subhumid, High Boreal Ecoclimatic Region (Ecoregions Working Group, 1989) marked by short, cool summers and long, cold winters. Climatic conditions vary slightly from south to north as represented by data from the communities of Wabowden located 35 km. southwest of the area, Thompson in the northwest corner of the area and Gillam representing conditions north of the map area. The mean annual temperature at Wabowden is -2.2C (Environment Canada, 1982), decreasing to -3.4C at Thompson and -4.4C at Gillam (Environment Canada, 2002). The mean seasonal precipitation ranges from 464 mm to 536 mm and varies greatly from year to year. While precipitation is highest during the growing season, moisture deficits average between 40 and nearly 100 mm. The average growing season varies from 160 to 131 days. The growing season is slightly warmer and longer in the southern part of the area and cooler and shorter in areas to the north as indicated by growing degree-days which decrease from 1175 at Wabowden to 1058 at Thompson and 969 at Gillam. These parameters provide an indication of how the length of growing season and the moisture and heat energy available for vegetation growth varies throughout the map area.

Vegetation in the Sipiwesk area is representative of the Northern Coniferous Forest as delineated by Rowe (1972). The forest cover is dominated by medium to tall closed stands of black spruce, jack pine and some paper birch with an understory of feathermoss and ericaceous shrubs such as rock cranberry, Labrador tea, and blueberry and lichen on normal well drained sites. Warmer than normal sites are characterized by black spruce and /or jack pine or mixed stands of pine, birch and aspen with more open canopies. The vegetation on bedrock exposures is sparse with the few trees being restricted to cracks and crevasses in the bedrock surface where pockets of mineral or organic soil are found and the moisture supply is better. Closed to open stands of black spruce with Labrador tea, blueberry, bog rosemary and sphagnum mosses form the dominant vegetation on wetter than normal mineral soils and bogs while fens support sedges and brown mosses, shrubs and open stands of stunted tamarack in varying mixtures.

Productive forests are produced on well and imperfectly drained clayey and silty soils on crests and upper to mid slopes in undulating and hummocky landscapes. Productivity is lower on imperfectly and poorly drained sites due to excess moisture. The potential for forest production is reduced in northern portions of the area due to shorter growing season and cold soils.

Physiography and Surface Deposits

The physiography of the area is described in A Guide to Biophysical Land Classification, Sipiwesk, 63P and Split Lake 64A (SE 1/4), Manitoba (Veldhuis et al., 1979). The location of the map area in relation to the Terrestrial Ecozones, Ecoregions and Ecodistricts of Manitoba (Smith et al., 1998) is shown in Figure 3.

The Sipiwesk map area is located in the Nelson depression or trough on the Precambrian Shield and is underlain entirely by crystalline bedrock of Precambrian age. Elevation of the land surface varies from 240 metres above sea level (m asl) in the southeast to 236 m asl in the northwest, and 183 m asl in the northeast. The terrain slopes gently at a rate of about 0.6 m per km from the northwest and the southeast toward the axis of the Nelson trough. The central axis of this trough in turn slopes very gradually to the northeast at a rate of about 0.2 m per km.

Physical characteristics affecting land use such as topography and

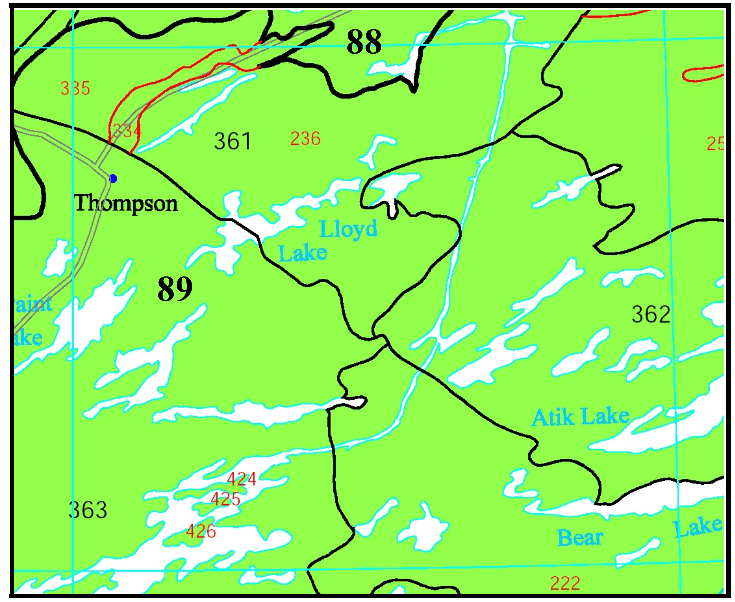


Figure 3. Terrestrial Ecozones, Ecodistricts and Generalized Soil Landscapes in the Sipiwesk Area

89	Ecoregion Line and Number
361	Ecodistrict Line and Number
334	Soil Landscapes of Canada

slope, soil drainage, permafrost and selected management considerations are delineated on an accompanying series of derived and interpretive maps and described with related statistical information. Although the land surface is dominantly level to gently undulating, areas of slightly greater relief are characterized by hummocky and ridged terrain and a repetitive pattern of uplands and lowlands. Local relief is accentuated by rivers and lakes which are commonly entrenched 15-30 m (Manitoba Mineral Resources Division, 1981). The dominant slopes are under 6 percent with local relief between 3 and 20 metres throughout 76 percent of the area (Maximum Slope Map, page 23). Locally prominent areas of glaciofluvial deposits and terrain in which the underlying Precambrian bedrock occurs close to, or at the surface are characterized by higher local relief and steeper slopes ranging from 9 to 15 percent. The highest local relief (20 to 75 m) is associated with the large glaciofluvial deposit northeast of Thompson which appears as a series of steep hills with slopes varying from 16 to 30 percent. The area adjacent to Mystery Lake is characterized by steeper slopes in excess of 30 percent.

Soil materials deposited during the last glaciation and during the time of glacial Lake Agassiz subdue and mask the underlying bedrock topography. Following deglaciation, the area was inundated by Lake Agassiz, resulting in washing and erosion of the topographic highs and at the same time deposition of clayey and silty textured lacustrine sediments. Clayey, moderately calcareous glaciolacustrine sediments are the dominant surface material in 66 percent of the area (Distribution of Geologic Surface Materials Map, page 25). These sediments are stratified with strongly calcareous silty material at depths usually below 1 to 2 metres. Calcareous sandy loam to loam till occurs at the surface in about 11 percent of the area, mainly in the south. The till in the eastern part of the area is covered by a veneer of lacustrine clay whereas in the western portion, glacial till is either absent or is covered by deeper lacustrine sediments. As the ice sheet melted, huge volumes of glaciofluvial meltwater and outwash deposits were released into Lake Agassiz. These deposits occupy about 2 percent of the area but are important sources of aggregate materials. Following final drainage of the lake, vegetation established with the accumulation of extensive areas of shallow to deep organic deposits. Landscapes in which organic (peat) deposits are dominant occupy about 25 percent of the area (Depth of Mineral and Organic Soil Materials Map, page 27). Bedrock outcrops at the surface in about 3 percent of the map area (Distribution of Bedrock Map, page 33) with exposures often occur along lake shores and in river beds. Surface materials exceeding 1 metre in depth cover the bedrock surface in 45 percent of the area whereas thin veneers (< 1 metre depth) cover or partially cover the underlying rock in about 35 percent of the area. These various surface materials form the parent materials for the soils shown on the Generalized Soil Materials and Classification Map (page 35).

Drainage

Drainage of the map area is generally northeasterly and primarily within Nelson River watershed although the southeast corner of the area is part of the Hayes River drainage system Local drainage is facilitated by the Burntwood and Grass River systems and their tributary streams. This intricate network of rivers and streams drains a landscape featuring many small to medium size lakes and several large lakes.

Poor to very poor drainage conditions with only minor inclusions of imperfect and well drained soil dominate about 50 percent of the map area which has low relief and mainly level terrain. A dominance of imperfectly and well drained soils occur in terrain with slightly higher local relief, mainly in the western portion of the area. These landscapes occupy about 22 percent of the map area and are characterized by well to imperfect drainage on crests and upper to mid slopes separated over short distances by significant areas of poor and very poor drainage. Imperfect drainage dominates in areas of intermediate relief. The terrain adjacent to larger lakes and rivers generally experiences slightly better drainage conditions (Soil Drainage Map, page 33).

Soil and Terrain Data (Generalized Soil Materials and Classification)

Soils in the Sipiwesk area have been mapped at a broad reconnaissance 1:125 000 to 1:250 000 scale and published in the Biophysical Land Classification for the Sipiwesk, 63P and Split Lake, 64A (SE1/4) map sheets (Veldhuis et al, 1979). The relationship between soils, vegetation and surficial materials in bedrock controlled, hummocky to undulating terrain is shown in Figure 4. Figure 5 illustrates the distribution of soils and associated vegetation and permafrost in a level to gently sloping landscape characterized by shallow organic landforms.

Limited access to the area and the reduced map scale did not permit, nor does the level of field investigation warrant, the display of small individual areas having a narrowly defined range in landform, vegetation and soil conditions. Consequently, the minimum size of most map units delineated at this scale includes a complexity of terrain conditions.

The Generalized Soil Materials and Classification Map (page 35) depicts the dominant soil type in the landscape. Subdominant soils and minor soil types in the landscape could not be shown at this reduced scale. According to the Canadian System of Soil Classification (Soil Classification Working Group, 1998), Organic soils developed on moderately decomposed forest and fen peat are grouped as mesisols, while those on and undecomposed Sphagnum peat are classified as fibrisols and belong to Isset Lake, Jacam, Machiewan, Nichols Lake, and Rock Island complexes. Organic materials containing near surface permafrost are classified as Organic Cryosols of the Crying Lake and Nekik Lake complexes. Well to imperfectly drained soils developed on deep, clay textured lacustrine sediments are classified as Gray Luvisols in the Wabowden and Arnot Siding associations. Sediments that are thin (<1 m) and underlain by loamy till are classified in the Walker River and Kettle Rapids associations or if underlain by bedrock in the Split Lake and Warren Landing associations. Clayey Luvisols are the dominant soil in 38 percent of the area. Soils developed on calcareous loamy till are classified as Eutric Brunisols in the Billard and Breland associations. Eutric Brunisols classified in the Joint River and Little Limestone associations are dominant on sandy to gravelly glaciofluvial deposits while calcareous silty soils are Gray Luvisols and Eutric Brunisols of the Gillam association. Areas of bedrock outcrop associated with discontinuous veneers of varying materials are classified as the Snow Lake and Carriere complexes. Poorly drained mineral soils (Peaty Gleysols and Gleysolic Cryosols) occur on lower slopes and in shallow depressions in all landscapes.

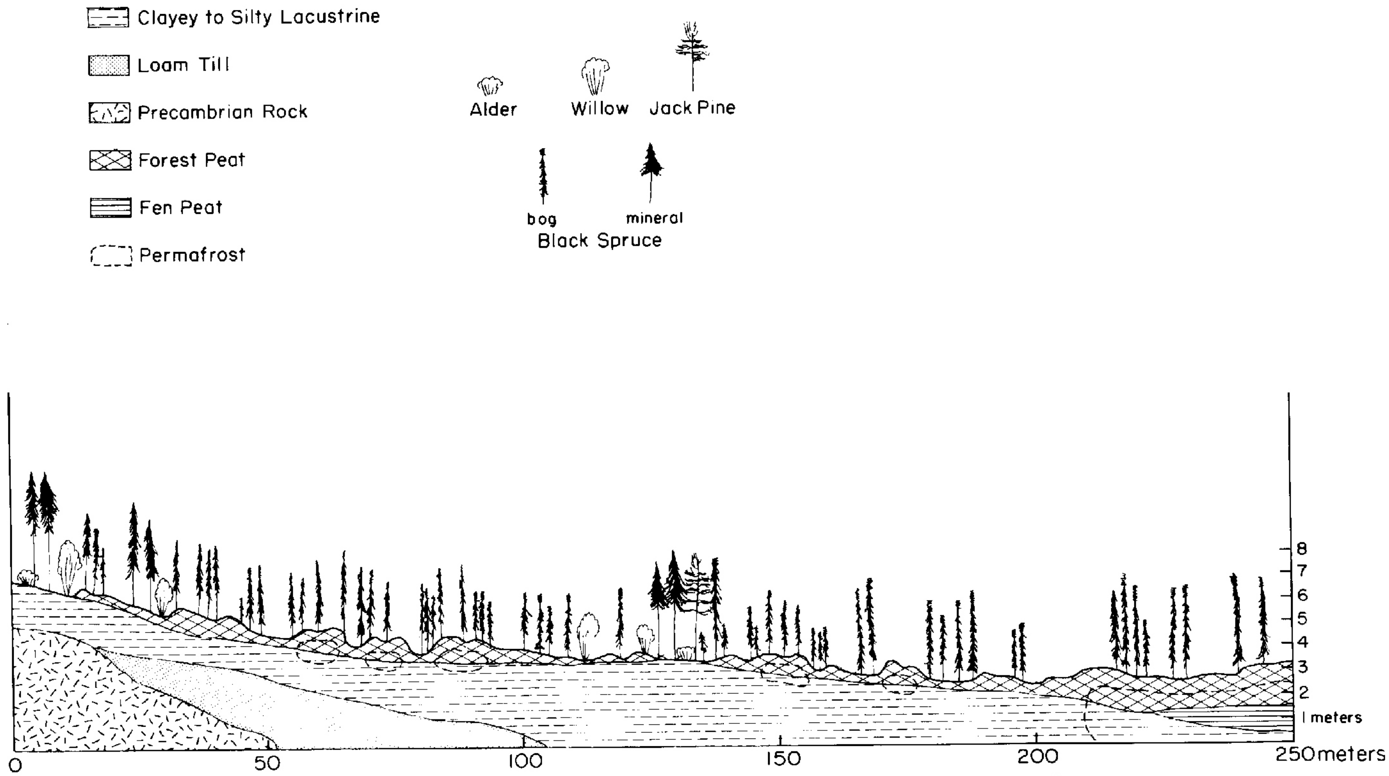


Figure 4. Cross-section through bedrock controlled hummocky to undulating terrain (Sipiwesk Lake Ecodistrict). Precambrian bedrock in the area is overlain by near continuous deposits of deep (> 1m) and shallow (< 1 m) clayey lacustrine sediments. Veneer bogs with shallow deposits of forest and sphagnum peat are underlain by lacustrine clay on the lower slopes. Level to depressional areas of deep (> 1.6 m) organic (peat) deposits occur on Peat Plateau Bogs and Palsas and in the surrounding Horizontal Fen. Permafrost is discontinuous in the Veneer Bogs, near-continuous in the Peat Plateau Bogs and absent in the Fens.

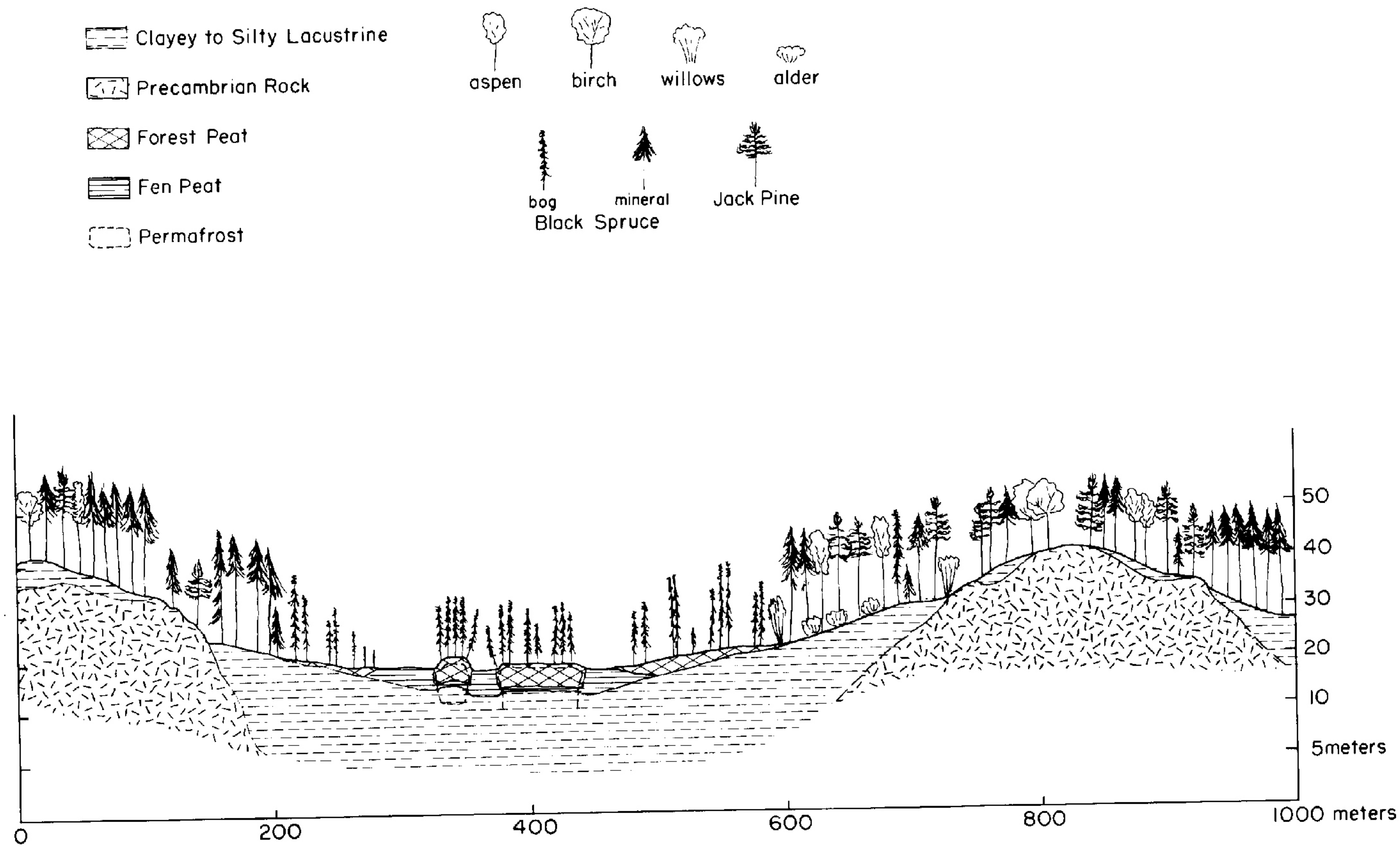


Figure 5. Cross-section through a Veneer Bog consisting of shallow organic (peat) materials, usually < 1 m thick, overlying clayey lacustrine sediments. The peat surface consist of hummocks of fibric sphagnum peat overlying moderately decomposed woody forest peat. Thicker hummocks and shaded areas contain permafrost, which becomes more widespread in northern portions of the map area.

Plate 1a. Solonetzic Gray Luvisol on clay - This well drained soil is a member of the Wabowden association found in the crest and upper to mid slopes of undulating to hummocky terrain in southern portions of the Boreal Shield. The strongly developed soil structure is typical of well drained clay soils throughout the region.

Plate 1b. Eluviated Eutric Brunisol - This soil is a well drained member of the Billard association developed on very strongly calcareous loam and silt loam textured till of dominantly limestone rock origin. These soils are found on the crest and upper to mid-slopes in ridged and hummocky morainal landscapes throughout the Boreal Shield ecozone. The Billard soils often occur with soils of the Nonsuch association, differing only in the dominant texture. The soil surface may be stony and bouldery and if water-worked, layers of cobbles are found in the upper part of the soil.

Plate 1c. Thin clay underlain by thin alternating layers of silt and clay - The upper 30 cm of this soil consists of heavy massive clay. The lower soil material consists of alternating thin layers of silt (light colour) and clay (darker brown colour) resulting from deposition in Lake Agassiz. This well drained soil is part of the Baldock association and is closely related to the Arnot Siding soils

Plate 1d. Rego Gleysol - poorly drained clay soil - The lower slopes bordering clayey upland areas are characterized by veneer bogs with poor drainage and discontinuous permafrost. This soil is a poorly drained member of the Arnot Siding association. The thin peaty surface layers and dull dark soil colours are an indication of poor drainage. Note the water glistening on the soil particles where it is seeping into the bottom of the soil pit.

Plate 1. Representative Soils from the Sipiwesk Area

Plate 1e. Permafrost in veneer bog - Permafrost develops in veneer bogs where the peat layer provides sufficient insulation to prevent complete melting of the seasonal frost. Thickness of the permafrost varies from less than 100 cm to several metres or more. The permafrost in this soil occurs in the highly decomposed organic layer below an insulating layer of non-decomposed sphagnum peat. The mineral soil under the peat is frozen glaciolacustrine clay.

Plate 1f. Eutric Brunisol on stratified sand and gravel deposits - This soil is a member of the Little Limestone association developed on stratified, coarse sand and fine gravel deposits. It is found on the crest of a steeply sloping glaciofluvial ridge

Plate 1g. Churning of soil horizons due to alternate freezing and thawing - The thin peaty surface layer on this poorly drained clay soil is underlain by disturbed and disrupted soil horizons. Disruption of the soil profile results from freeze - thaw cycles that occur in the spring and fall creating cryostatic and hydrostatic pressures that cause the churning or turbation of the soil materials. This soil is common on veneer bogs underlain by medium and fine textured mineral materials.

Plate 1. Continued

Distribution of Organic (Peat) Materials

Approximately one-half of the map area consists of level to near level terrain which is poorly to very poorly drained (Soil Drainage, page 33). As a result, organic soil materials are widely distributed, occurring on the soil surface in some portion of most landscapes (Distribution of Organic Materials, page 29). Forest peat is the dominant material in about 45 percent of the area while Sphagnum peat occurs at the surface in about 34 percent of the area. Fen peat, dominant in a few very poorly drained depressional areas covers about 3 percent of the map area.

Shallow (40 to 160 cm) organic (peaty) veneers accumulate on lower slopes and shallow depressions while poorly drained mineral soils are usually covered by thin (< 40 cm) peaty surface layers. Organic deposits in larger level to depressional areas range in thickness from 1.6 metres to in excess of 4 metres (Depth Mineral and Organic Soil Materials, page 27). Thin organic surface layers usually consist of forest or sphagnum peat although, most deep peat deposits are underlain at depth by peat materials which are more decomposed and of a different origin than the surface peat.

Engineering and Unified Soil Classification

Deep deposits of fine grained lacustrine clay are rated in the **CH** Unified Soil Class in which the engineering properties vary dramatically with moisture regime (Unified Soil Classification, page 39). They are the dominant mineral soil material throughout the area (Distribution of Geologic Surface Material, page 25) and range in drainage from well to poor. The clay materials have low permeability with moderately high shrink-swell properties and are difficult to compact except within a very narrow range of moisture content.

The eastern half of the area is a complex association of shallow lacustrine clay sediments and loamy till deposits which are non- to slightly plastic and rated in the **ML** Unified Soil Class. Many of the clayey soils are underlain by loamy till (**CH/ML**) within 20 to 100 cm of the surface.

Shallow to deep accumulations of organic materials are widely distributed throughout the map area (Depth of Mineral and Organic Soil Materials, page 27) and are rated in the **Pt** Unified Soil Class. Extensive areas of these soils are underlain by fine grained sediments (**CH** Unified Soil Class). It is noteworthy that most of the permafrost affected soils occur in organic terrain, particularly in organic materials developed from forest or sphagnum peat or fen peat overlain with forest or Sphagnum peat (Distribution of Permafrost, page 37).

Local areas of silty glaciofluvial deposits are generally non- to slightly plastic and rated in the **ML** Unified soil class. Poorly drained soils in these silty materials, if affected by permafrost are often cryoturbated and thixotropic (see section on Permafrost Distribution, page 13). Sandy and gravelly deposits are dominantly in the **SM** Unified soil class. and occur in association with silty (**ML** Unified Soil Class) glaciofluvial deposits. They are non plastic and vary from stone-free to moderately stony and bouldery.

Permafrost Distribution

Permafrost is an important factor affecting resource development and land use in northern Manitoba. The Sipiwesk area lies entirely within the southern fringe of the Discontinuous Permafrost Zone in which frozen and unfrozen soil layers occur together (Brown, 1970). In the southern fringe of this zone, permafrost occurs in scattered islands a few square metres to several hectares in size and is confined to certain types of terrain, mainly peatlands dominated by bog landforms. Other occurrences are associated with poorly drained loamy, silty and clayey mineral soils. In southern parts of the area, persistence of permafrost is associated with north facing slopes or areas where more dense vegetation provides shading from summer thawing and/or where there is reduced annual snow cover.

Perennially frozen soil affects 35 to 85 percent of the terrain in some landscapes (Distribution of Permafrost, page 37). Nearly two-thirds of the map area is characterized by sporadic distribution of permafrost in which 10 to 35 percent of the landscape contains permafrost-affected soils, mainly in organic terrain. Organic landforms such as peat plateaus and palsas have active layers (depth of annual thaw) extending from 40 cm to about 100 cm and commonly have a very high ice content with the greatest accumulation at the organic mineral-contact (Zoltai, 1972). Permafrost affected mineral soils have an active layer which varies from 40 cm to below 1 m. The ice content in perennially frozen poorly drained clay soils is greatest immediately below its contact with organic materials where ice lenses 5 - 10 cm in thickness are common. Ice lenses are most abundant in silty mineral soils. Permafrost in poorly drained silty soils results in a thixotropic condition in which the soil material liquefies and becomes unstable if subjected to physical disturbance.

Management Considerations

Management considerations are related to coarse and fine soil textures, topography, wetness, stoniness, bedrock and organic deposits (Plate 2). **Topography** is a concern in areas of hummocky terrain with local relief exceeding 6 metres and slopes in excess of 5 percent. Steeply sloping terrain adjacent to the deeply incised portions of the Nelson, Grass and Burntwood River valleys are unstable and erosive. **Organic terrain** is widely distributed and is dominantly poorly to very poorly drained. The kind of organic deposit and an estimate of their relative proportion (Table 4, page 28) together with the depth of organics (Table 3, page 26) are important management considerations. Peat deposits have low bearing capacity affecting access and trafficability and are also characterized by the widespread distribution of permafrost. **Fine textured lacustrine sediments** occur over extensive areas and are also found as the subsoil under most organic deposits. The lower slopes and depressions associated with upland areas are characterized by **wetness** and thin organic surface layers. A variable degree of **stoniness** is associated with the till soils throughout the area but is of particular concern on the more severely waterworked crest and upper slopes of drumlin ridges. Areas of Precambrian **bedrock** and veneers of till or lacustrine deposits underlain by rock at shallow depths are limited in use due to restricted rooting depth and are a problem for excavation. Another important management consideration relates to **permafrost**. Special measures are required to manage landscapes affected by permafrost as it becomes unstable if the frozen soils degrade following disturbance or alteration of the natural drainage pattern

(Brown, 1970). Insulation can be utilized to prevent thawing of the permafrost in some landscapes and in other cases where frost-susceptible soils occur and large ice content exists, it may be necessary to excavate the frost active soil.

Plate 2a. Organic terrain dominated by peat plateau bogs - Extensive area of organic terrain consisting of a complex of peat plateau bogs characterized by permafrost and collapse areas in which the permafrost has melted. A very early stage of peat plateau development is evident within the large collapse area in the foreground.

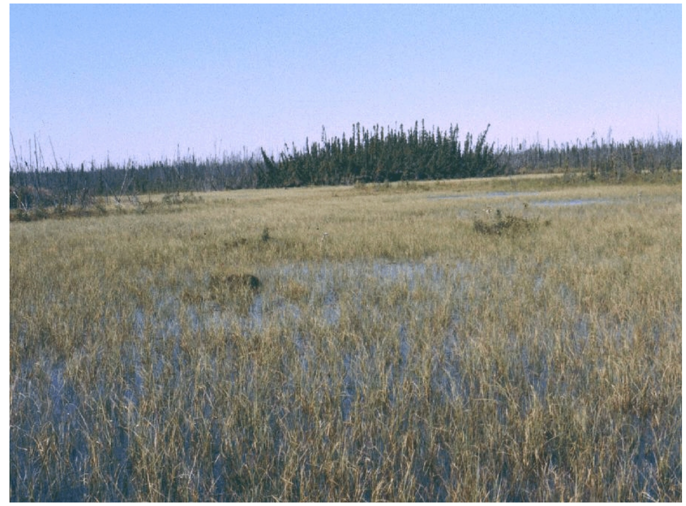


Plate 2b. Horizontal fen - The flat featureless surface of this horizontal fen slopes very gently from right to left permitting very slow surface drainage. The watertable varies from at or just above the surface during wet seasons and following spring melt to 0.5 m or more below the surface during prolonged drought. Wetter fens such as the one shown are dominated by sedges and aquatic mosses. Permafrost is absent in horizontal fens but is present in the raised palsa in the background.

Plate 2. Management Considerations

Plate 2c. Peat plateau bog - Permafrost along the edge of this peat plateau is gradually melting out allowing the peat to subside and the trees to tilt. As the melting continues, the trees will eventually sink into the collapse area.

Plate 2d. Exposure of Precambrian bedrock - This exposure of hummocky bedrock is outcropping through a morainal (glacial till) veneer. The glacial till is thin and discontinuous at this location, incompletely covering the underlying hummocky rock surface.

Plate 2. Continued

LAND USE POTENTIALS AND LIMITATIONS

Nearly two-thirds of the area has little or no development or road access and no permanent residents. The City of Thompson is accessible by highway, railroad and air transport from southern Manitoba. and scattered settlements along the Hudson Bay Railway are accessible by rail. Mineral exploration in the mid 1950's has resulted in the development of a major mining and smelting operation and the City of Thompson as the main service centre for northern Manitoba. A high voltage transmission line from the hydro-electric generating stations on the Nelson River traverses the inaccessible eastern portion of the area en route to southern Manitoba.

The land and water resources of the area are largely untapped except for the diversion of Churchill River water through the Burntwood River to increase the generation capacity of major hydro-electric dams downstream on the Nelson River. Although there is a significant First Nation population in the area, the only land reserve for First Nations is a small area along the Hudson Bay Railway. The First Nation population has traditionally focussed on activities such as hunting and fishing and the operation of registered traplines located throughout the area. Commercial harvest of the forest resource for pulpwood and sawlogs occurs mainly in the western part of the area. Firewood harvest is locally important, especially in areas close to settlements. The many lakes and rivers in the area are a resource for sport fishing and potential commercial ventures related to tourism and recreation. Recreational hunting and water-oriented recreation are important land uses that go hand-in-hand with development of a viable tourism industry. Tourism and recreation activities currently are focussed mainly in Paint Lake Provincial Park and at the Mystery Mountain Ski Resort.

The natural attributes of the land together with the influence of prevailing climatic conditions set limits on the scope and type of land use and effectively control the potential uses of the land and water resource. Use of the land resource is subject to considerations that are not necessarily factors in the management of landscapes in more southerly areas. For example, climatic constraints severely limit potential forest productivity as well as the scope of agriculture activity in most landscapes. Climate influences the occurrence and distribution of permafrost that in turn affects not only biologic uses of the resource but also to varying degrees, the construction and maintenance of nearly all infrastructure required for any kind of economic development.

Forestry: Although the entire area is forested, productivity is limited by climate and soil and terrain conditions. The long rotation age imposed by short growing season and cold soils limit the potential for productive forests on all but the most favourable sites. Well and imperfectly drained clayey and silty soils on crests and upper to mid slopes are capable of producing productive forests whereas productivity is reduced on imperfectly drained soils due to excess moisture. Forest productivity is limited on permafrost affected soils by shallow rooting depth and cold soil temperature. Tree growth is severely restricted on rock outcrops where thin, discontinuous

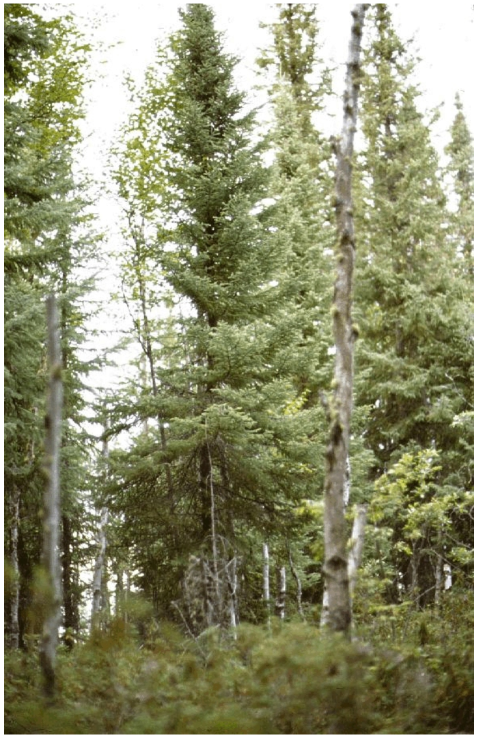


Plate 3a. Productive black spruce on morainal landscape -
This stand of black spruce occurs with scattered paper birch on the crest and upper slopes of sandy loam till with hummocky topography. The productivity of this stand may be reduced by periodic drought resulting from the low moisture holding capacity of the soil

Plate 3b. Bull moose in shrub covered fen -
Shrub covered fens provide a reliable food supply for moose during the summer.

Plate 3c. Rapids on Little Churchill River -
River rapids and associated white water are aesthetically pleasing and provide points of interest for activities related to tourism and recreation. Note that the river provided an effective barrier to the advance of the wildfire on the north side of the river.

Plate 3. Land Use Potentials

Plate 3d. Extensive portions of the map are inaccessible. Travel to and from remote lakes for recreations activities such as hunting and fishing or for purposes of exploration relies heavily on the float plane.

Plate 3e. The many lakes and rivers in the northern landscape are a focus for recreation activities such as fishing, boating and canoeing. Topographic variation and diversity in vegetation adjacent to many water bodies can attract and sustain an attractive wildlife population and at the same time provide a focus for potential recreation activities and eco-tourism.

Plate 3. Continued

soil cover results in lack of moisture and rooting medium. The black spruce forest on poorly drained mineral soils is suited primarily for pulp production as the rate of growth is slow due to poor drainage, cold soil temperature and low natural fertility. Extensive areas of very poorly drained organic soils support stunted stands of black spruce and tamarack which are non-merchantable as the permanent water table very near to the surface effectively limits tree growth. The commercial harvest of the forest resource is largely restricted to landscapes in which productive stands occur in contiguous areas not separated by large expanses of unproductive forest.

Agriculture and Local Fruit Harvest: The short, cool growing season is a major limitation to development of conventional agriculture. However, well and imperfectly drained, stone free, clayey and silty soils have been successfully utilized for production of vegetable root crops for local consumption. The harvest of local native fruit under similar climatic conditions as found in the Sipiwesk area forms the basis for a local cottage industry producing jams, jellies and juices in Scandinavian countries. Similar fruits such as lingonberry, small bog cranberry, squashberry, and blueberry are found in the forests in the Sipiwesk area.

Wildlife and Recreation: The needs of all wildlife are much alike. Each individual and species must have a sufficient quality and quantity of food, protective cover and space to meet its needs for survival, growth and reproduction. Landscapes which provide topographic variation and associated diversity of soils, drainage and vegetation generally have the highest capability for ungulate species. The capability of the land to support large ungulates also varies with fire history and the resulting vegetation succession. Wetlands such as fens provide a much less varied habitat and thus support a much simpler wildlife component. For example, moose prefer the willow browse found in fens. Although few wildlife species make their home in bog wetlands, many pass through them, obtaining food and shelter there. Bogs form an essential part of the habitat for ungulate species such as woodland caribou that range over large areas. Complex associations of marsh and shallow water usually provide the most varied and productive wetland environment for waterfowl and fur bearers. The trapping industry is based on organization of the of the land resource into registered traplines that ideally include a variety of landscapes. Although the water component of the landscape establishes the potential for many fur bearers, productivity is also affected by vegetation succession following wildfire.

The diverse landscape and vegetation associated with areas of rock outcrop, hilly and ridged glaciofluvial deposits and the major river valleys are locally important in providing a focus for potential recreation activities such as eco-tourism and at the same time sustain an attractive wildlife population. Scenic and aesthetically pleasing landscapers associated with rivers and lakes provide opportunity for recreation and tourism. Such areas stand out in marked contrast to extensive landscapes characterized by relatively uniform topographic and vegetation pattern.

Many recreational pursuits are attracted to water based activities such as fishing, boating and canoeing. Scenic and aesthetically pleasing landscapes are often associated with rivers and lakes in the area. Numerous large and small water bodies and streams and rivers in the area contribute a significant, but largely undeveloped recreation and tourism potential. Hunting and fishing based recreation also provide an impetus for development of tourism opportunities.

DERIVED AND INTERPRETIVE MAPS

A large variety of computer derived and interpretive maps can be generated from digital soil and landscape databases. These maps and associated statistical information are based on analysis of selected combinations of database values and assumptions.

Derived maps show information that is given in one or more columns in the computer map legend, (such as soil drainage, slope class, dominant soil type or occurrence of permafrost)

Interpretive maps portray more complex land evaluations based on a combination of soil and landscape information. Interpretations are based on soil and landscape conditions in each polygon. Interpretive maps typically show land capability, suitability or risks related to sustainability.

Several examples of derived and interpretive maps are included in this information bulletin:

Derived maps

- Maximum Slope
- Distribution of Geologic Surface Material
- Depth of Mineral and Organic Soil Materials
- Distribution of Organic Materials
- Distribution of Bedrock
- Soil Drainage
- Generalized Soil Materials and Classification
- Distribution of Permafrost

Interpretive Maps

- Unified Soil Classification

It is also possible to develop additional interpretations of the basic soil and terrain database by combining information from other databases such as forest inventory (yield, mean annual increment and site indices) or utilization of criteria for assessing suitability for wildlife habitat or recreation potential.

These maps have all been reduced in size and generalized (simplified) in order to portray conditions for the entire map area on one page. Such generalized maps provide a useful overview of conditions within the map area, but are not intended to apply to site specific land parcels. On-site evaluations are recommended to meet localized site specific land suitability requirements.

Individual thematic maps were colour coded according to the dominant soil type in each polygon to portray the general pattern of soil conditions in the map area. **It should be noted that this generalization and small map scale do not always permit one-to-one comparison of map and statistical data between**

individual map themes. This is partly because of the complexity of soil and terrain conditions inherent in most map units derived from broad reconnaissance land inventory and partly because the individual maps and associated statistics do not reflect all of the information provided in the original biophysical land classification.

Digital data bases and map information derived from the original biophysical land inventory contain additional information about significant inclusions of soil and slope conditions in each map polygon. This information can be shown at larger map scales than shown in this bulletin.

Information concerning particular interpretive maps and the primary soil and terrain data can be obtained by contacting the Land Resource Group.

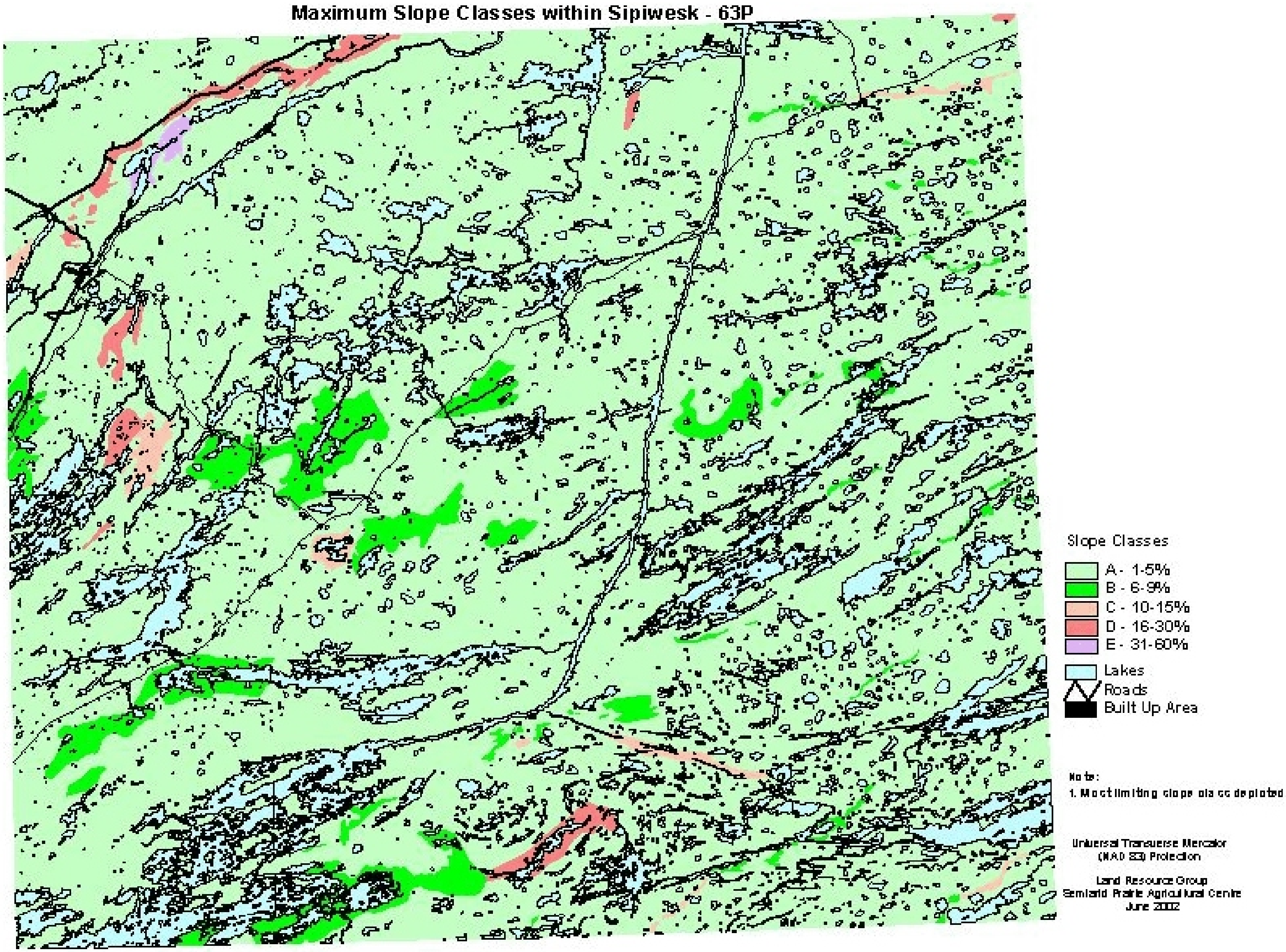
Maximum Slope Classes

Slope describes the steepness of the landscape surface. The slope classes shown on this map are derived from the digital soil and terrain layer databases. Specific colours are used to indicate the dominant slope class for each polygon in the map area. The **Maximum Slope** is portrayed on this map as it is the most limiting for many land use applications. Additional slope classes commonly occur in each polygon but can not be displayed at this reduced map scale.

Table 1. Maximum Slope Classes

Class	Area (Km^2)	% of Mapsheet
A 1-5%	10 822	76.9
B 6-9%	600	4.3
C 10-15%	96	0.7
D 16-30%	158	1.1
E 31-60%	20	0.1
Water	2 370	16.9

The thematic map is colour coded based on the dominant soil and/or landscape characteristics in each map polygon. The accompanying tables of kind and extent of landscape characteristics are based on an analysis and summary of attributes for all polygons in the database.


Maximum Slope Classes within Sipiwesk - 63P
Slope Classes
A - 1-5%
B - 6-9%
C - 10-15%
D - 16-30%
E - 31-60%
Lakes
Roads
Built Up Area
Note:
1. Most limiting slope class depicted.
Universal Transverse Mercator
(NAD 83) Projection
Land Resource Group
Semiarid Prairie Agricultural Centre
June 2002

Distribution of Geologic Surface Materials

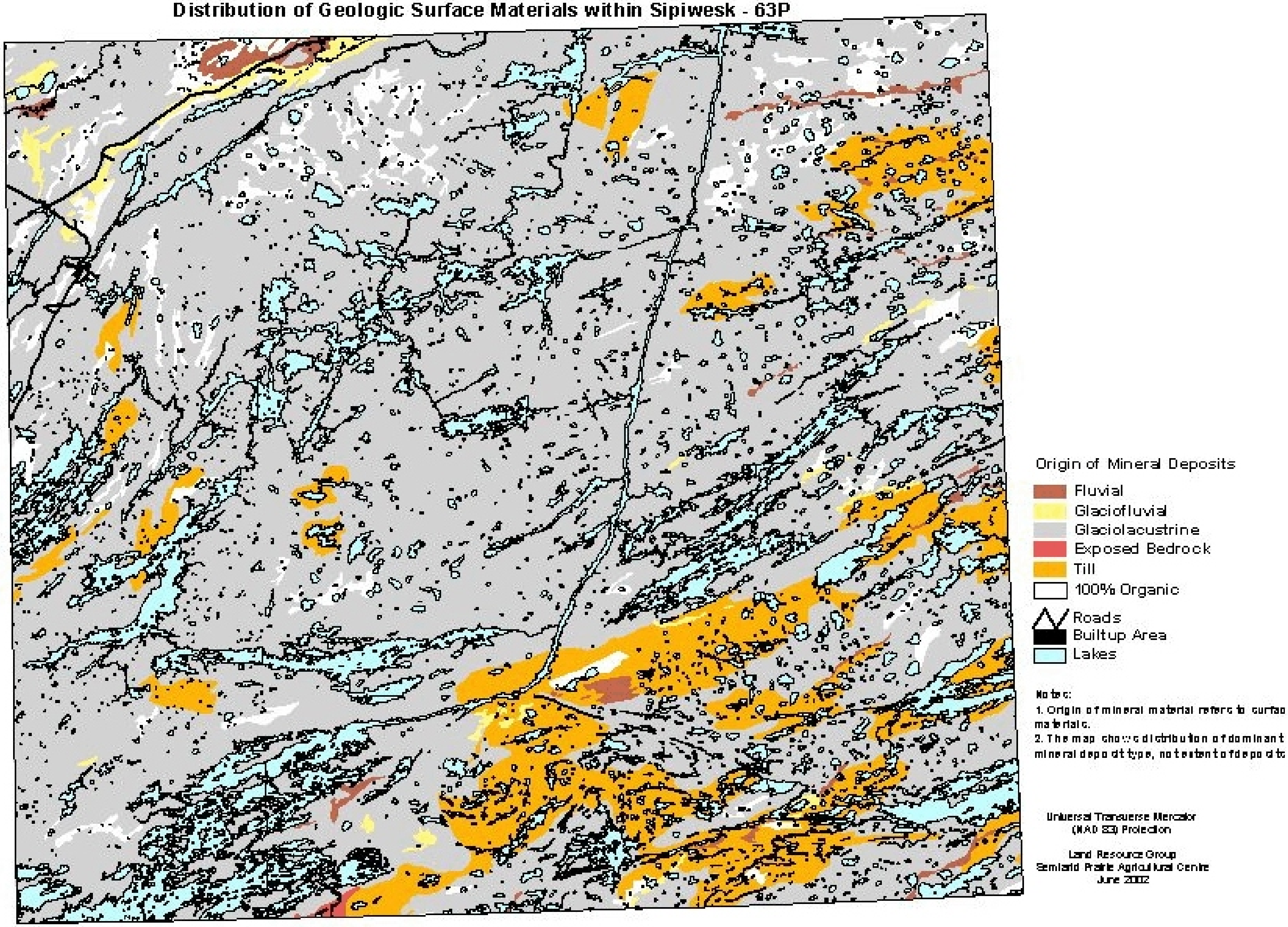
This map shows the distribution of geologic surface materials which form the mineral soil parent materials on the land surface or where organic (peat) deposits occupy the land surface, the underlying mineral materials. The map provides a very simplified overview of the complexity of surface materials found in most landscapes and described in the digital soil and terrain database. The map units are based on the dominant mineral material. Landscapes in which organic (peat) materials are dominant are shown on the Distribution of Organic Materials Map (page 29). More detailed maps showing the proportion of dominant and subdominant mineral and organic materials can be produced at larger map scales.

Table 2. Distribution of Geologic Surface Materials Classes

Class	Area (Km^2)	% of Mapsheet
Fluvial	131	0.9
Glaciofluvial	147	1.0
Glaciolacustrine	9 350	66.5
Till	1 502	10.7
Exposed Bedrock	9	0.1
100% Organic	557	3.9
Water	2 370	16.9

The thematic map is colour coded based on the dominant soil and/or landscape characteristics in each map polygon. The accompanying tables of kind and extent of landscape characteristics are based on an analysis and summary of attributes for all polygons in the database.

Distribution of Geologic Surface Materials within Sipiwesk - 63P



Depth of Mineral and Organic Soil Materials

This map shows the depth of mineral and organic soil materials. It is based on the control section utilized for mapping mineral soils of 1 metre and for organic materials of 1.6 metres. Depth of mineral materials refers to the absence or occurrence of a bedrock substrate within 1 metre of the soil surface. The occurrence of non-conforming mineral or bedrock materials underlying organic surface materials is recognized if shallow (< 1.6 m) and is undefined if below 1.6 m from the soil surface. The depth classes are determined by the dominant components in the landscape so that co-dominant values are not included in the area calculations.

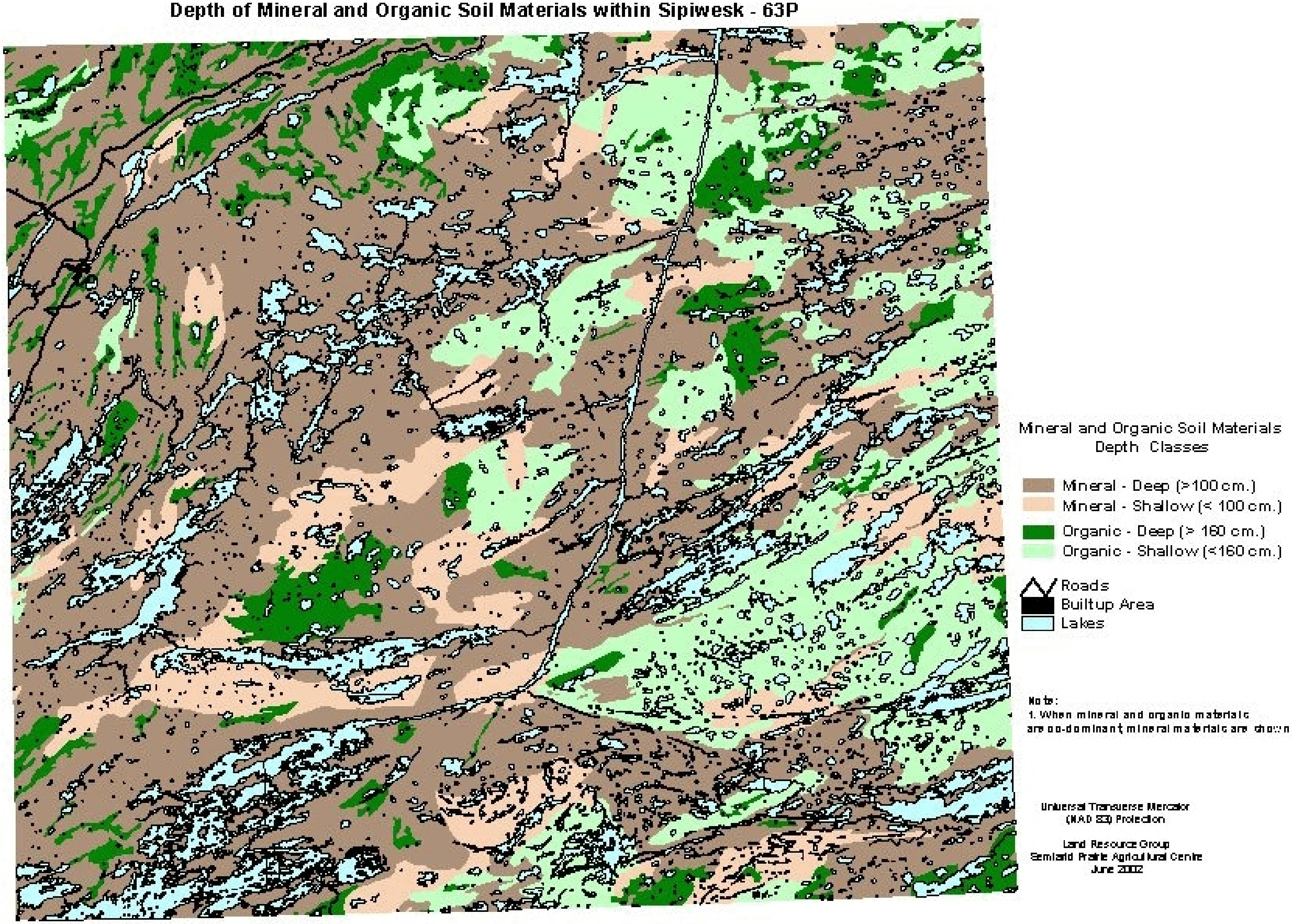
Table 3. Depth of Mineral and Organic Soil Materials Classes

Class		**Area (Km^2)**	**% of Mapsheet**
Mineral - Deep	> 100 cm.	6 663	47.4
Mineral - Shallow	< 100 cm.	1 451	10.3
Organic - Deep	> 160 cm.	1 135	8 .0
Organic - Shallow	< 160 cm.	2 446	17.4
Water		2 370	16.9

Note: The order of the classes determines the dominant map values, therefore, co-dominant values are not included in the calculations.

The thematic map is colour coded based on the dominant soil and/or landscape characteristics in each map polygon. The accompanying tables of kind and extent of landscape characteristics are based on an analysis and summary of attributes for all polygons in the database.

Depth of Mineral and Organic Soil Materials within Sipiwesk - 63P



Distribution of Organic Materials

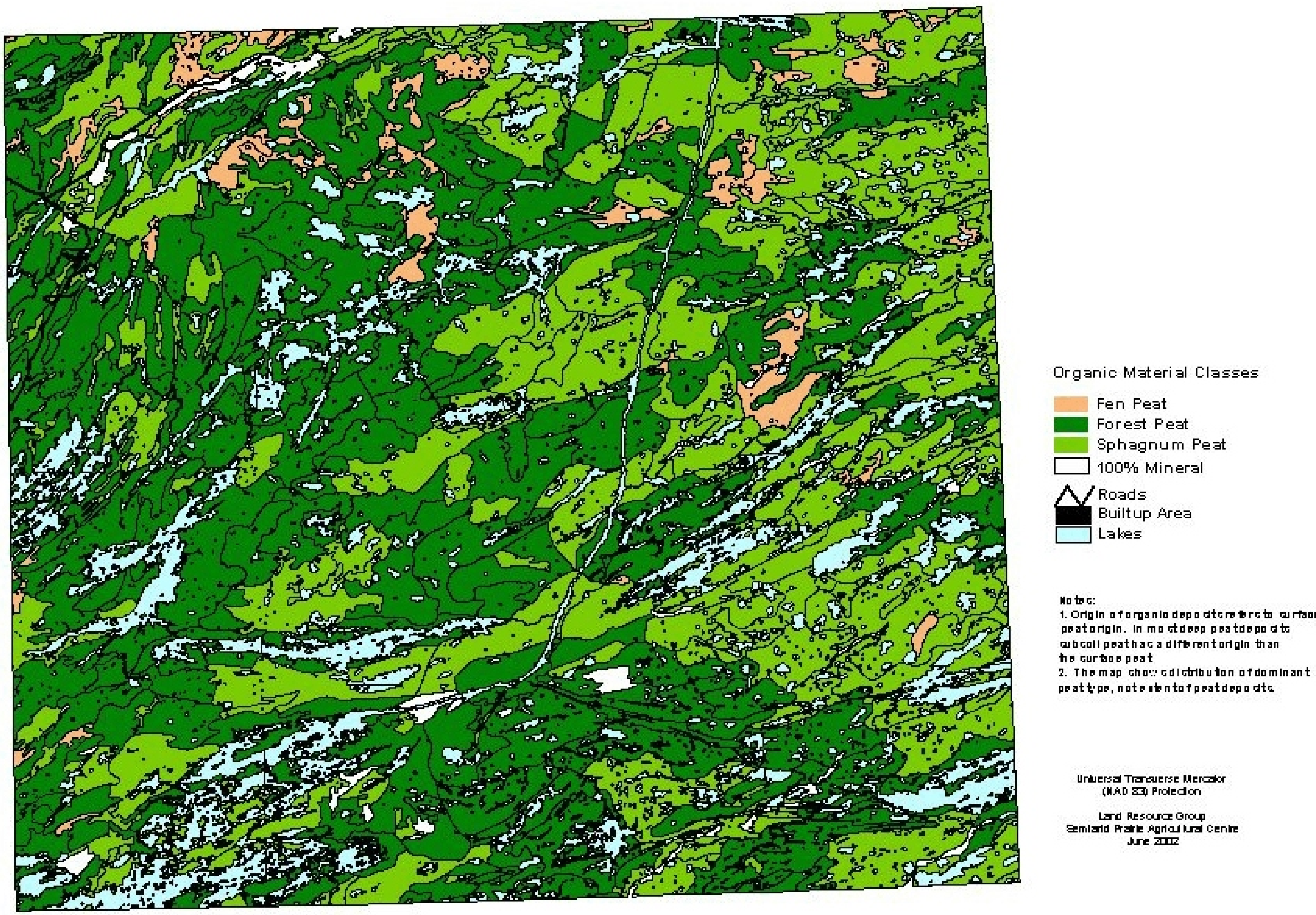
Peatlands provide a domestic environment for various kinds of wildlife as well as playing an important role in the hydrology of a region affecting water catchment and storage. At the same time, the properties of organic soils and the associated permafrost-affected area (Organic Cryosols) present difficulties for utilization and management of the northern landscape. The distribution of organic soils, the nature and depth of peat, the kind of underlying mineral substrate, the natural drainage and the occurrence of permafrost are important factors affecting any intended land use. This map highlights two important attributes of the organic component of the landscape: the kind of peat and approximate extent. A generalized indication of the extent of permafrost is shown on the Permafrost Distribution Map (page 37) and the relative depth of the organic materials is shown on the Depth of Mineral and Organic Material Map (page 27). As with other generalized maps, map units at this small scale focus on the dominant type of peat and do not show the total extent of organic deposits in the landscape. More detailed maps showing the extent of subdominant areas of organic soils can be produced at larger maps scales.

Table 4. Distribution of Organic Materials Classes

Class	Area (Km²)	% of Mapsheet
Fen Peat	464	3.3
Forest Peat	6 336	45.0
Sphagnum Peat	4 707	33.5
100 % Mineral	190	1.3
Water	2 370	16.9

The thematic map is colour coded based on the dominant soil and/or landscape characteristics in each map polygon. The accompanying tables of kind and extent of landscape characteristics are based on an analysis and summary of attributes for all polygons in the database.

Distribution of Organic Materials within Sipiwesk - 63P



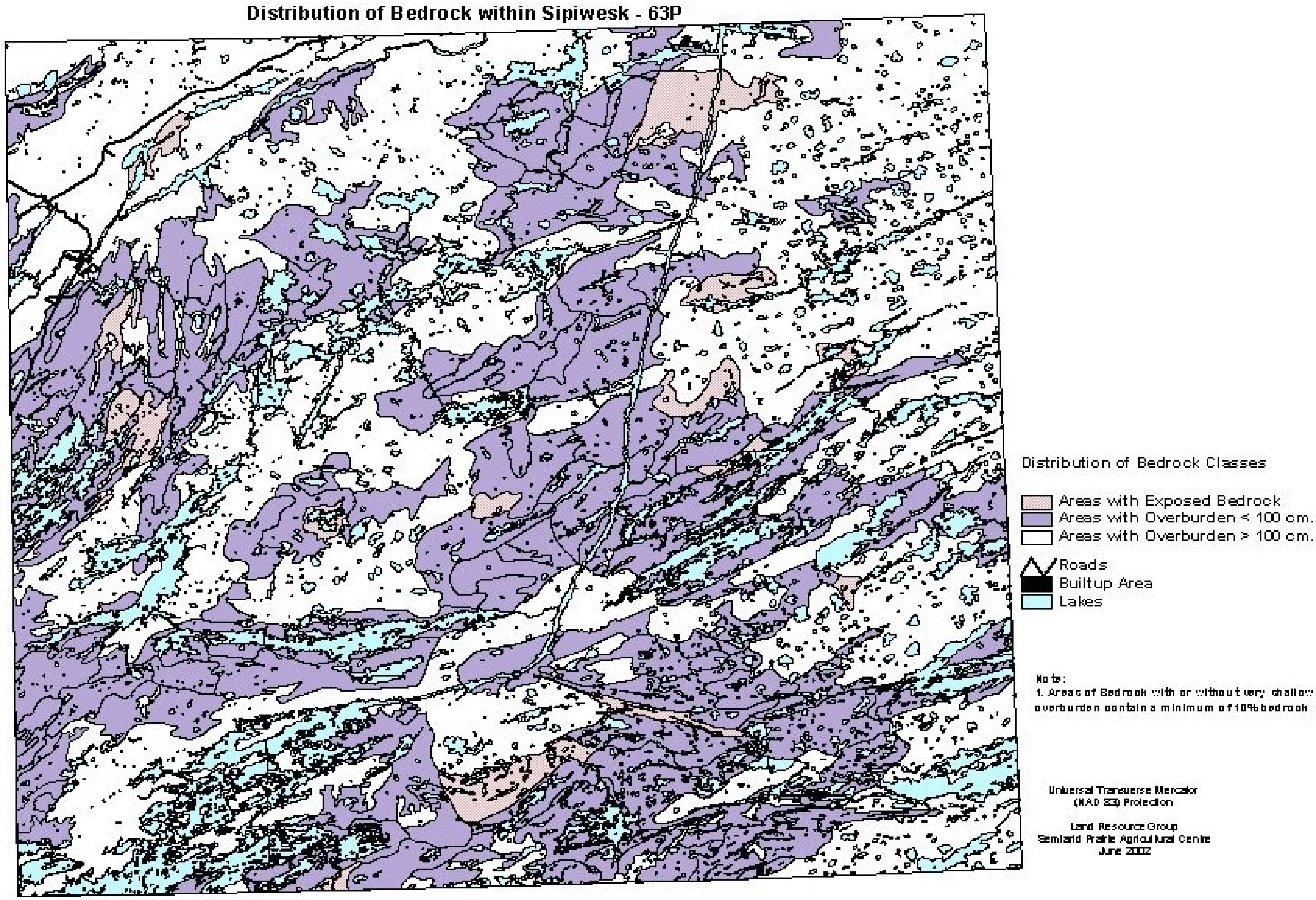
Distribution of Bedrock

The bedrock underlying the map area is exposed at the surface in only a few locations, although small outcrops too small to show at this mapping scale are often noted in river beds and along lake shores. The thickness of the mineral and organic surface materials covering the bedrock is defined in two depth classes. A shallow class recognizes bedrock overlain by veneer deposits which are less than 1 metre thick, and a deep class in which bedrock is overlain by blanket deposits which are greater than 1 metre thick.

Table 5. Distribution of Bedrock Classes

Class	**Area (Km^2)**	**% of Mapsheet**
Exposed Bedrock >= 10%	427	3.0
Overburden < 100 cm. Deep	4 902	34.8
Overburden > 100 cm. Deep	6 367	45.3
Water	2 370	16.9

The thematic map is colour coded based on the dominant soil and/or landscape characteristics in each map polygon. The accompanying tables of kind and extent of landscape characteristics are based on an analysis and summary of attributes for all polygons in the database.


Distribution of Bedrock within Sipiwesk - 63P
Distribution of Bedrock Classes
Areas with Exposed Bedrock
Areas with Overburden < 100 cm.
Areas with Overburden > 100 cm.
Roads
Builtup Area
Lakes
Note:
1. Areas of Bedrock with or without very shallow overburden contain a minimum of 10% bedrock
Universal Transverse Mercator
(NAD 83) Projection
Land Resource Group
Semiarid Prairie Agricultural Centre
June 2002

Soil Drainage

Drainage is described on the basis of actual moisture content in excess of field capacity and the length of the saturation period within the root zone. This map is based on the drainage of the dominant soil series within each map polygon. Five drainage classes, individually or in combination are used to describe soil drainage in the map area.

Very Poor - Water is removed from the soil so slowly that the water table remains at or on the soil surface for the greater part of the time the soil is not frozen. Excess water is present in the soil throughout most of the year.

Poor - Water is removed so slowly in relation to supply that the soil remains wet for a large part of the time the soil is not frozen. Excess water is available within the soil for a large part of the time.

Imperfect - Water is removed from the soil sufficiently slowly in relation to supply to keep the soil wet for a significant part of the growing season. Excess water moves slowly down the profile if precipitation is the major source of water supply.

Well - Water is removed from the soil but not rapidly. Excess water flows downward readily into underlying materials of laterally as subsurface flow.

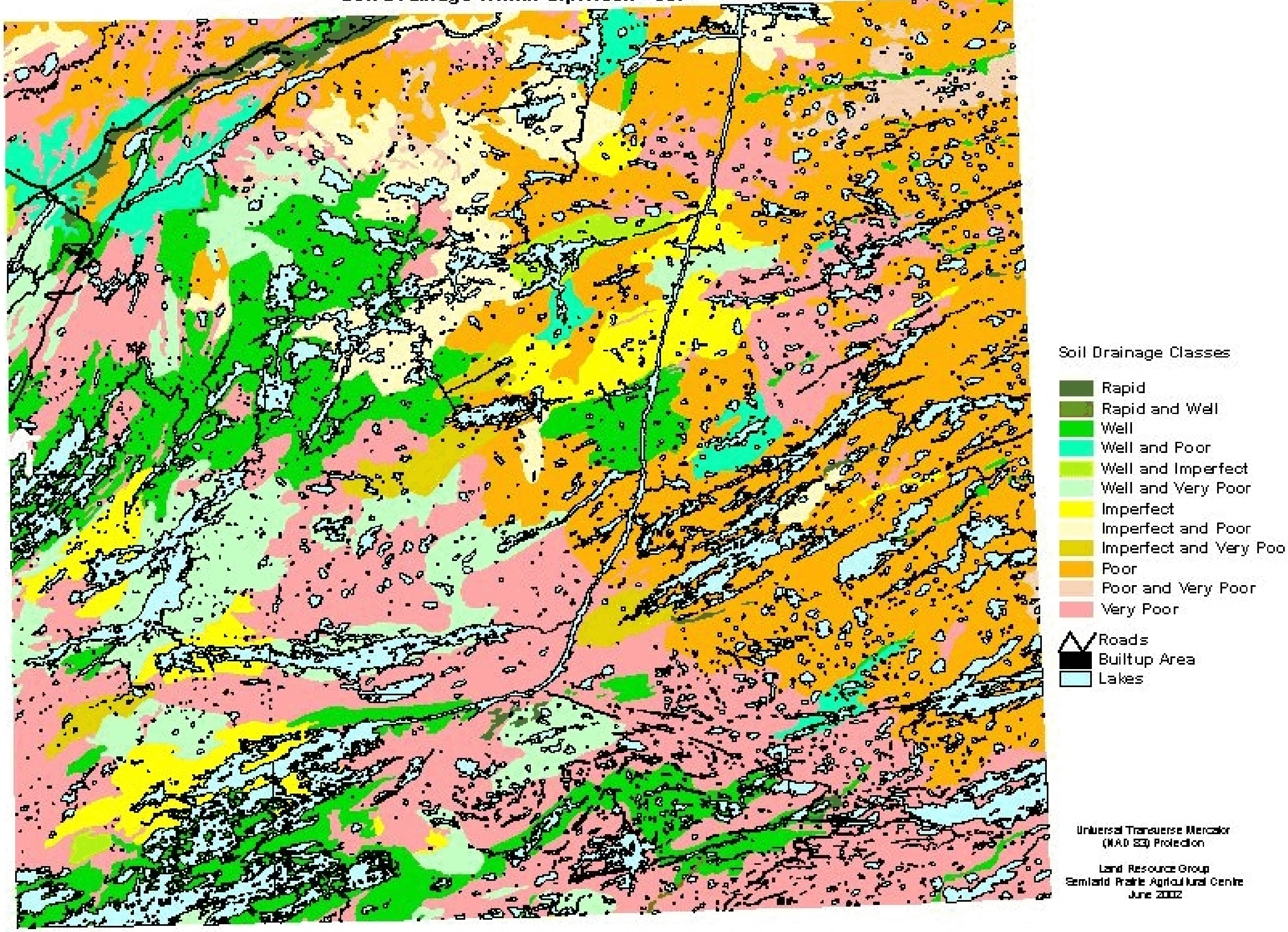
Rapid - Water is removed from the soil rapidly in relation to supply. Excess water flows downward if underlying material is pervious. Subsurface flow may occur on steep slopes during heavy rainfall

Table 6. Soil Drainage Classes

Class	Area (Km²)	% of Mapsheet
Rapid	93	0.7
Rapid and Well	5	0.0
Well	1 646	11.7
Well and Poor	333	2.4
Well and Imperfect	81	0.6
Well and Very Poor	1 016	7.2
Imperfect	630	4.5
Imperfect and Poor	651	4.6
Imperfect and Very Poor	197	1.4
Poor	3 324	23.6
Poor and Very Poor	201	1.4
Very Poor	3 520	25.0
Water	2 370	16.9

The thematic map is colour coded based on the dominant soil and/or landscape characteristics in each map polygon. The accompanying tables of kind and extent of landscape characteristics are based on an analysis and summary of attributes for all polygons in the database.

Soil Drainage within Sipiwesk - 63P



Generalized Soil Materials and Classification

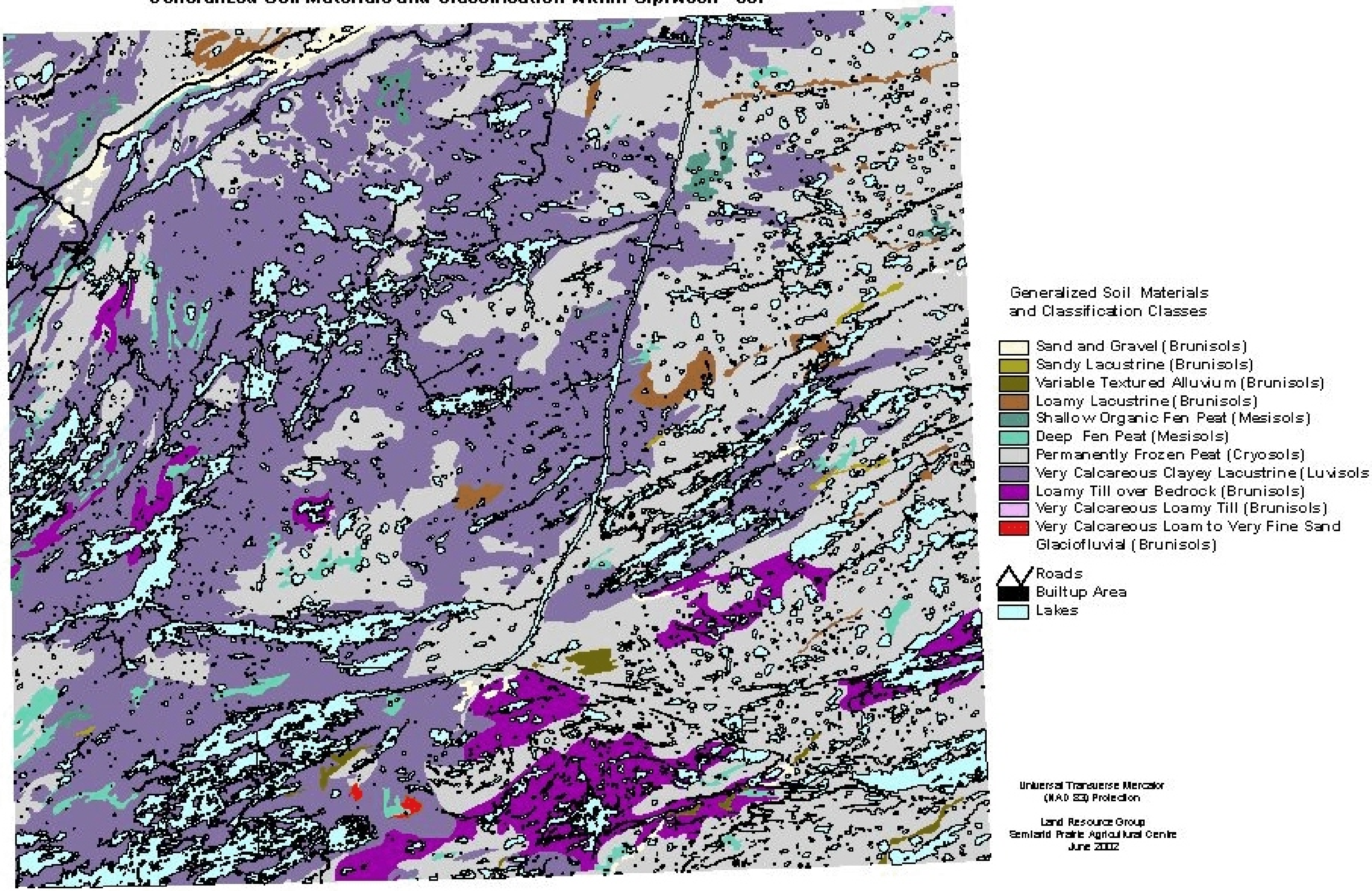
The general soil groups provide a simplified overview of the soil information contained in the digital soil map. The hundreds of individual polygons have been generalized into broad groups of soils with similar parent material origin, texture and drainage classes. Each polygon is described by one or more soil associations, each of which is characterized by a dominant soil series. The soil group, area and map colour are identified by the dominant soil series within each polygon. Mineral soil groups share a range of rapid, well or imperfectly drained soils while associated Gleysolic soils have poor to very poor drainage. Organic soils are typically very poorly to poorly drained. Permafrost affected organic materials have imperfect drainage unless the permafrost degrades and melts. More detailed maps showing the dominant and subdominant soils in each polygon can also be produced at larger map scales.

Table 7. Generalized Soil Materials and Classification Classes

Class	Area (Km^2)	% of Mapsheet
Sand and Gravel (Brunisols)	98	0.7
Sandy Lacustrine (Brunisols)	14	0.1
Variable Textured Alluvium (Brunisols)	43	0.3
Loamy Lacustrine (Brunisols)	137	1.0
Shallow Organic Fen Peat (Mesisols)	84	0.6
Deep Organic Fen Peat (Mesisols)	210	1.5
Permanently Frozen Peat (Cryosols)	5 008	35.6
Very Calcareous Clayey Lacustrine (Luvisols)	5 449	38.7
Loamy Till over Bedrock (Brunisols)	645	4.6
Very Calcareous Loamy Till (Brunisols)	3	0.0
Very Calcareous Loam-Very Fine Sand (Brunisols)	7	0.1
Water	2 370	16.9

The thematic map is colour coded based on the dominant soil and/or landscape characteristics in each map polygon. The accompanying tables of kind and extent of landscape characteristics are based on an analysis and summary of attributes for all polygons in the database.

Generalized Soil Materials and Classification within Sipiwesk - 63P



Distribution of Permafrost

Permafrost describes the thermal condition of earth materials, such as soil and rock, when their temperature remains below 0C continuously for a number of years (Brown, 1970). Although the broad pattern of permafrost distribution is determined by climate, terrain conditions are responsible for local variations. This map provides a generalized overview of the distribution of permafrost and ice content based on the dominant soil series in the landscape affected by permafrost. The distribution of permafrost is shown in three classes in which the ice content varies from high medium and low. On-site investigation is required to determine the nature and location of permafrost in a landscape prior to any kind of development. Permafrost affected soils are classified in the Cryosolic Order in the Canadian System of Soil Classification (Soil Classification Working Group, 1988).

Permafrost Distribution Classes

Continuous Permafrost occurring everywhere (or almost everywhere, > 85 % of the polygon) beneath the exposed land surface throughout a geographic region. (this class does not occur in map area)

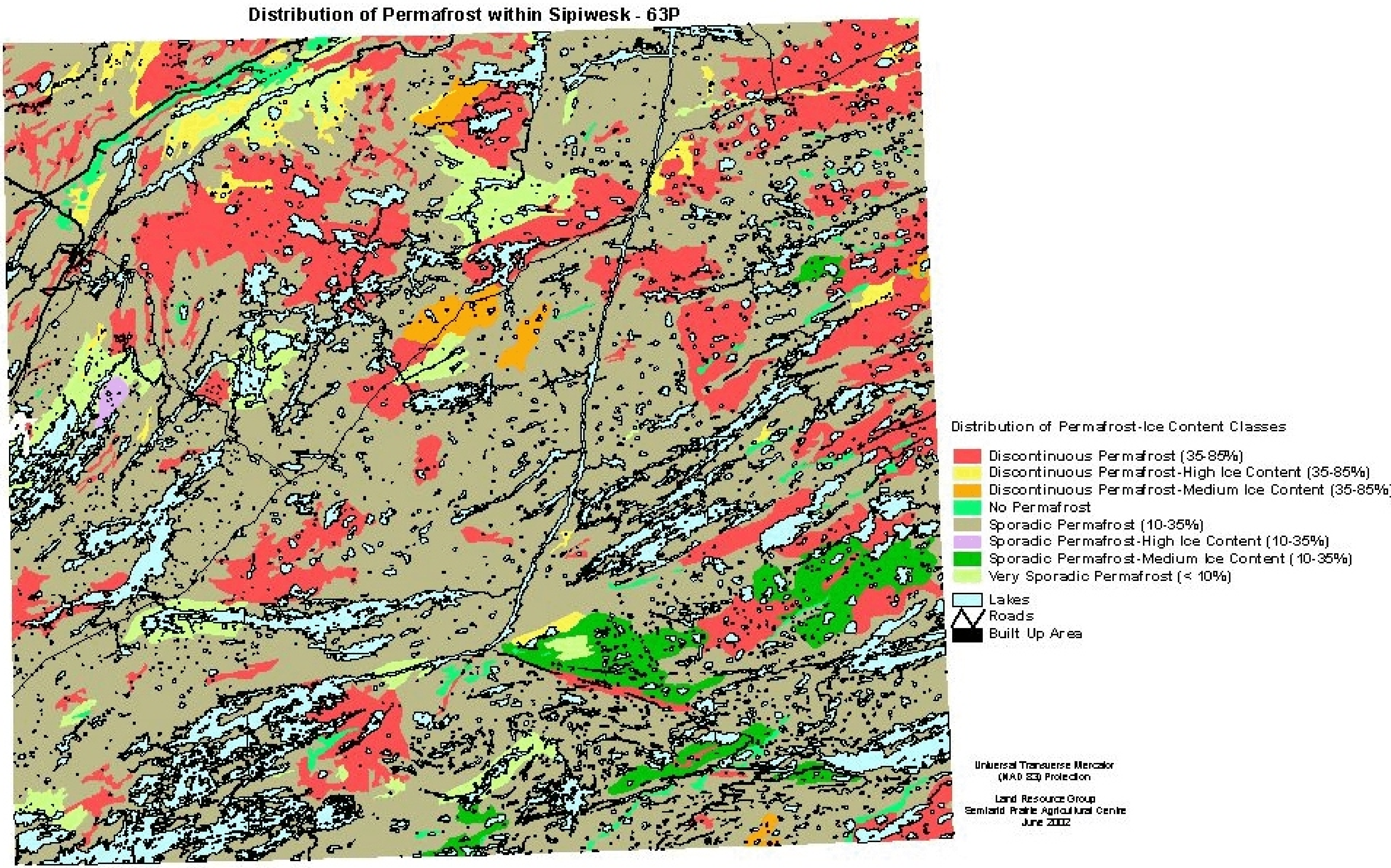
Discontinuous Permafrost occurring in some areas (35 - 85 %) beneath the exposed land surface throughout a geographic area.

Sporadic The occurrence of isolated patches or islands of permafrost (10 - 35 %) near the southern boundary of the discontinuous permafrost zone.

Very sporadic Sparse patches of permafrost (< 10 %) occurring near the southern limit of permafrost occurrence.

Table 8. Distribution of Permafrost Classes

Class	Area (Km²)	% of Mapsheet
Discontinuous Permafrost	2 345	16.6
Discontinuous Permafrost-High Ice	207	1.5
Discontinuous Permafrost-Med Ice	130	1
No Permafrost	155	1.1
Sporadic Permafrost	7 862	55.9
Sporadic Permafrost-High Ice	17	0.1
Sporadic Permafrost-Med Ice	395	2.8
Very Sporadic Permafrost	585	4.1
Water	2 370	16.9


Distribution of Permafrost within Sipiwesk - 63P
Distribution of Permafrost-Ice Content Classes
Discontinuous Permafrost (35-85%)
Discontinuous Permafrost-High Ice Content (35-85%)
Discontinuous Permafrost-Medium Ice Content (35-85%)
No Permafrost
Sporadic Permafrost (10-35%)
Sporadic Permafrost-High Ice Content (10-35%)
Sporadic Permafrost-Medium Ice Content (10-35%)
Very Sporadic Permafrost (< 10%)
Lakes
Roads
Built Up Area
Universal Transverse Mercator
(NAD 83) Projection
Land Resource Group
Semiarid Prairie Agricultural Centre
June 2002

Soil Engineering - Unified Soil Classification

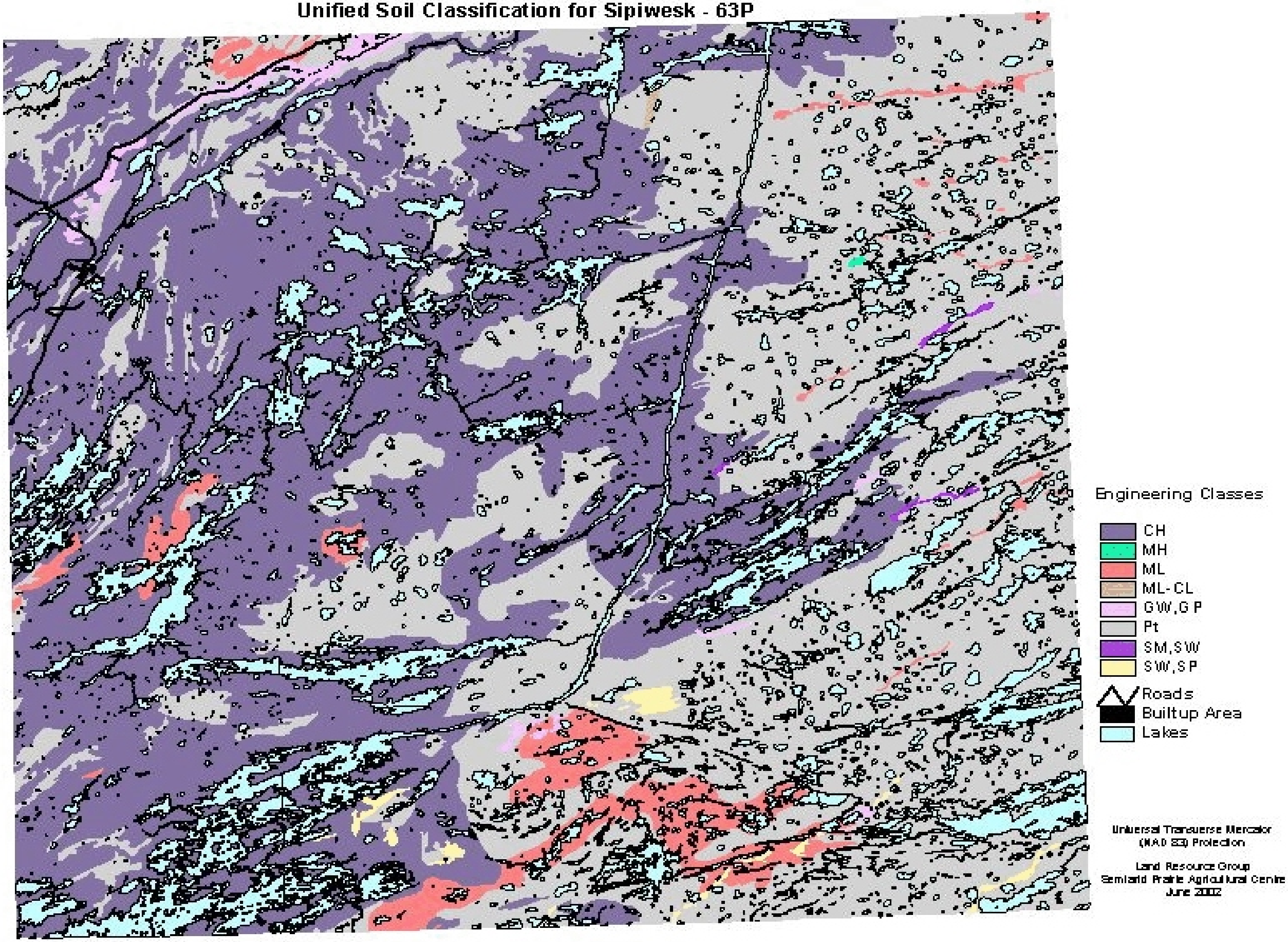
Soil and terrain information and classification may be expressed in terms that are suitable for engineering evaluation and project planning. A general overview of the land resource, soil characteristics and parent material properties in northern Manitoba with an interpretive application to engineering evaluation and project planning is provided by the Unified Soil Classification (Michalyna et al., 1998).

CH - lacustrine deposits; fine grained materials with clay contents of 40 to 80 percent. They have high shrink - swell properties and bearing capacity and compaction densities vary dramatically with moisture content and drainage regime.
MH - fine grained lacustrine deposits with higher silt content (stratified or varved silt and clay) which often occurs with CH material or underlies CH material.
CL - lacustrine deposits, thin, fine grained materials underlain by silty clay of low to medium plasticity, low liquid limit and low bearing capacity when saturated.
GM - morainal deposits, acidic, poorly graded silty gravel and gravel-sand -silt mixtures, non plastic and loose to compact with high stone and boulder content.
ML - morainal deposits; low plasticity with clay contents between 10 to 20 percent. These materials have a high density in their natural state. They have a narrow range in moisture content between the liquid and plastic limit and the high stone content further contributes to the problems of handling these materials for engineering purposes.
SM - morainal and glaciofluvial deposits with silty sands and sand-silt mixtures.
SW,SP - morainal and glaciofluvial deposits; generally well graded non-plastic sandy and gravelly material often with considerable stone and boulder content.
GW,GP - morainal and glaciofluvial deposits with well and poorly graded gravels, gravel-sand mixtures, and little or no fines.
Pt - organic deposits characterized by a variable thickness of peat: veneers (40 to 160 cm) of peat or deep blanket deposits (1.6 to 4 m or more in thickness). Organic (peat) deposits are developed from organic materials (plant residues) that are saturated for most of the year. Peat dominated terrain is commonly wet or has a high moisture content, very low density and poor trafficability. Organic materials vary from undecomposed fibric Sphagnum peat to moderately decomposed mesic woody Forest peat and mesic Fen peat. Forest and Fen peat commonly become more decomposed (humic) with depth.
RK - exposures of Precambrian rock usually associated with discontinuous veneers of CH, GM and Pt material.

Table 9. Soil Engineering - Unified Soil Classification Classes

Class	Area (Km²)	% of Mapsheet
CH	5 632	40
GW,GP	93	0.7
MH/ML	145	1
ML	227	1.6
ML-CL	5	0.1
Pt	5 169	36.6
Pt/CH	320	2.3
Pt/MH	38	0.3
SM,SW	13	0.1
SW,SP	55	0.4
Water	2 370	16.9

Unified Soil Classification for Sipiwesk - 63P



REFERENCES

Brown, R. J. E., 1970. Permafrost in Canada; Its Influence on Northern Development: Toronto, Univ. Toronto Press, 234 p.

Brown, R.J.E. and W. O. Kupsch, 1974. Permafrost Terminology. Technical memorandum No. 111. National Research Council of Canada.

Canada-Manitoba Soil Survey. Detailed, reconnaissance and exploratory soil inventory reports and maps.

Canada Soil Inventory, 1989. Soil Landscapes of Canada - Manitoba. Land Resource Unit, Research Branch, Agriculture and Agri- Food Canada, Ottawa, Canada. Publ. 5242/B. Report and 1:1 000 000 scale map compiled by Canada - Manitoba Soil Survey.

Ecoregions Working Group, 1989. Ecoclimatic Regions of Canada, First Approximation. Ecoregion Working group of the Canada Committee on Ecological Land Classification. Ecological Land Classification Series, No. 23, Sustainable Development Branch, Environment Canada, Ottawa, Canada. 119 p. and map at 1:7.5 M.

Environment Canada, 1982. Canadian Climate Normals 1951 - 1980: Volume 2, Temperature and Volume 3, Precipitation. Atmospheric Environment Service, Environment Canada, Downsview, Ontario

Environment Canada, 2002. Canadian Climate Normals 1971-2000. Meteorological Service of Canada. Environment Canada, Downsview, Ontario. Available on-line at http://www..msc.ec.gc.ca/climate/climate_normals/stnselect_e.cfm

Fedoruk, A. N., 1970. Proposed Watershed Divisions of Manitoba. Man. Dept. Mines and Natural Resources. CLI. Report No 10. Winnipeg, Manitoba. Report and map.

Klassen, R. W. and J. A. Netterville, 1973. Surficial Geology of Sipiwesk Map Area, Manitoba (63P). Open file maps for the Knee Lake Area, Geological Survey of Canada.

Klassen, R. W. and J. A. Netterville, 1980c. Surficial Geology of Sipiwesk, Manitoba: Geological Survey of Canada Map 18-1978. Scale 1; 250 000.

Klassen, R. W., 1983. Lake Agassiz and the Late Glacial History of Northern Manitoba. *in* Teller, J. T. and Lee Clayton, eds., Glacial Lake Agassiz. The Geological Association of Canada, Special Paper 26. University of Toronto Press. p. 97-115.

MacDonald, K. B., and Valentine, K. W. G., 1992. CanSIS Manual 1 CanSIS/NSDB: A General Description. Land Resource Division, Centre for Land and Biological Resources Research, Research Branch, Agriculture Canada, Ottawa.

Manitoba Mineral Resources Division, 1981. Surficial Geological Map of Manitoba, Scale 1:1 000 000 map 81-1.

National Wetlands Working Group, 1997. The Canadian Wetland Classification System, Second Edition. Edited by B. G. Warner and C.D.A Rubec. Wetlands Research Centre. Waterloo, Ontario.

National Wetlands Working Group, 1988. Wetlands of Canada. Ecological Land Classification Series, No. 24. Sustainable Development Branch, Environment Canada, Ottawa, and Polyscience Publications Inc., Montreal, Quebec. 452 p.

NRIP, 1973 - 1978. Northern Resource Information Program, Biophysical Land Classification Reports and Maps:

Veldhuis, H., G. F. Mills and D. B. Forrester, 1979. A Guide to Biophysical Land Classification, Sipiwesk 63P and Split Lake 64A (SE 1/4), Manitoba.

Rowe, J. S., 1972. Forest Regions of Canada. Canadian Forestry Service, Department of the Environment, Publication No. 1300. 172 p and map.

Smith, R. E., H. Veldhuis, G. F. Mills, R. G. Eilers, W. R. Fraser, and G. W. Lelyk, 1998. Terrestrial Ecozones, Ecoregions, and Ecodistricts of Manitoba, An Ecological Stratification of Manitoba's Natural Landscapes. Technical Bulletin 98-9E. Land Resource Unit, Brandon Research Centre, Research Branch, Agriculture and Agri-Food Canada, Winnipeg, Manitoba. Report and map at 1:1 500 000 scale.

Soil Classification Working Group, 1998. The Canadian System of Soil Classification. Agriculture and Agri-Food Canada Publ. 1646 (Revised), Ottawa, Ontario.

The 2000 Annual Plan: Article 12 Submission. Volume I. Submitted by the Tetaskweyak Cree Nation describing the range of activities designed to strengthen and enhance the social and economic development of the people and land resource within the Split Lake Resource Management Area.. Split lake, Manitoba. December 2000.

Zoltai, S. C. 1972. Palsas and peat plateaus in central Manitoba and Saskatchewan. Canadian Journal of Forestry Research 2: 291-302.