Saskatchewan
Soil Resource Database
User's Manual
for
SKSIDv4

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SKSIDv4.3pdf

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PREFACE

This manual is intended as an interim document to assist the user of the digital Saskatchewan Detailed Soil Information Database, **SKSIDv4** (Saskatchewan Soil Information Database Ver. 4), by providing a brief background on soil survey in Saskatchewan, descriptions and illustrations of common landscapes and surface geologic deposits, an introduction to soils, and descriptions of the different attribute codes.

The main purpose of a soil survey is to inventory the soil resources of an area, to provide a map which will show the location and extent of the different soils and landscapes, and an accompanying report which will describe the properties of the soils; most often, soil reports will also contain a number of interpretations as well. Saskatchewan has a diversity of soils and landscapes, at times, existing in a rather complex relationship with each other. It is important to know the characteristics of the soils being used so one is better able to gauge the suitability and potential impact of a particular use or management practice on a soil landscape, whether that use be agricultural or non-agricultural. Soil landscapes have different productive capabilities and sensitivities, and consequently, the capability and sensitivity of a soil landscape should in turn determine land use and management practices, and facilitate addressing the concerns of productivity, sustainability and conservation of our soil landscapes for present and future generations.

The re-survey of the soil resources in the agricultural area of the province at a semi-detailed scale began in 1958, in response to an ever-growing need for more detailed soil survey maps and reports to address both agricultural and non-agricultural land use issues. There are some significant differences in the format of soil survey reports and maps created between 1958 and 1998. The major advantage of the present seamless 1:100,000 digital soil resource data however, is that it represents an amalgamation of all soil survey information, gathered between 1958 and 1996, into a unified and correlated data framework, registered to a digital base map standard. The digital Detailed Soil Information Database is essentially for the agricultural area of the province and covers an area of approximately 29,789,000 hectares (73,578,830 acres) throughout 298 RM's. This database provides basic soil information such as soil type, surface texture, percent slope, surface expression and soil capability for agriculture along with other interpretive information that is based on the soil inventory data along with well-accepted algorithms.

It is of interest to note that agricultural production in Canada relies mainly on 45.5 million hectares of improved cropland (cropland + summerfallow + improved pature) (Acton 1995). Of this, approximately 80% occurs in the prairies and 45% in Saskatchewan alone (Dumanski et al. 1991, Shields and Ferguson 1975).

Please see the Licensing Documentation, and Disclaimer following this section, and the section on "Mapping the Soil Resource" for further important information.

DIGITAL SOIL RESOURCE DATA LICENSING

Disclaimer:

The digital soil resource data set supplied for the agricultural area of Saskatchewan, has been compiled by the Saskatchewan Soil Survey (includes the Saskatchewan Land Resource Unit, Agriculture and Agri-Food Canada and previous soil survey members of the Soil Science Dept., University of Saskatchewan); it is suitable for use at 1:100,000 scale. The recommended scale of use is directly related to the detail at which data was collected in the field. It should be recognized that anomalies of small areas of highly contrasting soils could occur within a soil area or polygon, however, these areas are typically too small to show on a map at a scale of 1:100,000. Using this digital soil resource data in a GIS environment at scales larger than 1:100,000 (such as 1:50,000 or 1:20,000) pushes the data beyond it's capability and renders the data unreliable. Soil inventory data has been collected during semi-detailed soil mapping, and while every effort has been made to ensure the accuracy of the compiled data, the Saskatchewan Land Resource Unit of Agriculture and Agri-Food Canada (AAFC), Saskatchewan Centre for Soil Research, and Saskatchewan Agriculture and Food (SAF), and their agents, do not accept responsibility for any errors. Liability is limited to replacement of defective media or electronic files. Under no circumstances shall the above-mentioned agencies responsible for compiling the data or it's employees be liable for special, consequential or indirect damages, or claim by any other party. This includes, but is not limited to lost profits, lost savings or damage to property. Use of this digital dataset by an individual or agency to whom the data was supplied constitutes acceptance of the terms within the "Digital Soil Resource Data Licensing" section of this document.

When using this information in maps, reports or publications, please recognize the source of soil resource information as:

Saskatchewan Land Resource Unit, 2009 SKSIDv4, Digital Soil Resource Information for Agricultural Saskatchewan, 1:100,000 scale. Agriculture and Agri-Food Canada, Saskatoon, Sask.

ACKNOWLEDGEMENTS

Soil Survey in Saskatchewan, for the majority of years since Soil Survey began in 1921, has been a close and cooperative effort between Agriculture and Agri-Food Canada, the Saskatchewan Department of Agriculture and the University of Saskatchewan. This cooperation has been key in developing a uniform soil resource database for Saskatchewan.

INTRODUCTION

Between 1958 and 1996, approximately 35 % of the agricultural area of the province was mapped on a map sheet basis (an area equal in size to a 1:250,000 NTS map sheet) and 65% was mapped on an RM basis. After the soil survey was completed and maps and reports were published, a project was initiated to re-digitize and re-compile on an RM basis, those areas that had originally been mapped on a map sheet basis. There was also a need to populate, in particular, interpretative database fields for those areas originally mapped on a map sheet basis, and to convert older symbology to the most recent format so that a uniform database was created for all of the agricultural area. Although the RM soil maps were published at 1:100,000 scale and the original mapsheet maps were published at 1:126,720 or 1:125,000 scale, all of the mapping was undertaken at a similar inspection density and all of this survey data makes up the final digital 1:100,000 soil resource data coverage.

The soil surveys from 1958 and on were conducted using a national system of soil classification. The National System of Soil Classification in Canada has undergone several revisions since 1958, and each new Soil Survey undertaken would apply the criteria of the most recent Edition in mapping and in map and report compilation. The digital 1:100,000 soil resource data as made available in 2004 is based on the Canadian System of Soil Classification, 3rd Edition, 1998. The user of this digital soil resource data should be aware that there will be a few differences in soil classification from the most recent digital data which is based on the 3rd Edition of the Canadian System of Soil Classification in comparison to hard copy soil reports based on earlier editions of the Canadian System of Soil Classification. One of the most noteworthy changes in the 3rd Edition, is the inclusion of the Vertisolic Soil Order. This new order greatly impacts how we classify the heavy clay soils in the province such as the Sceptre heavy clay soils that occur in the Brown Soil Zone and the Regina heavy clay soils that occur in the Dark Brown Soil Zone.

The digital 1:100,000 soil resource database for Saskatchewan has been matched to 1:50,000 digital hydrography, has had all attribute information tied in along original RM map borders, and is now seamless in that all RM boundaries have been removed. This type of standardized data coverage facilitates maximum utility in a modern Geographic Information System by allowing a diverse client base to utilize a variety of interpretations created by the Saskatchewan Land Resource Unit, or to use additional interpretations created from the original data, seamlessly across the entire agricultural area of the province.

The digital data supplied is considered semi-detailed and is suitable for use at a scale of 1:100,000. The recommended scale of use is directly related to the detail at which data was collected in the field (inspection density). It should be recognized that anomalies of small areas (2 - 15% of a soil polygon) of highly contrasting soils could occur within a soil area or polygon, however, these areas are typically too small to show on a map at a scale of 1:100,000. The intention is to recognize and describe, at a minimum, soil series that comprise at least 15% of the landscape; soils that occupy 5 - 15% of a landscape singly, often may not be recognized at a scale of 1:100,000. Use of this data at a scale larger than 1:100,000 (such as 1:50,000 or 1:20,000) pushes this data beyond its limits and renders the data unreliable. Please see the Licensing Documentation, and Disclaimer following this section, and the section on "Mapping the Soil Resource" for further important information.

Digital base map data is not included with the digital soils information. This data can be obtained from:

Information Services Corporation,
Regina, Sask.
Ph: 1-866-275-4721
Web Site: www.isc.ca

Digital Soil Resource Data Coverage for Agricultural Saskatchewan

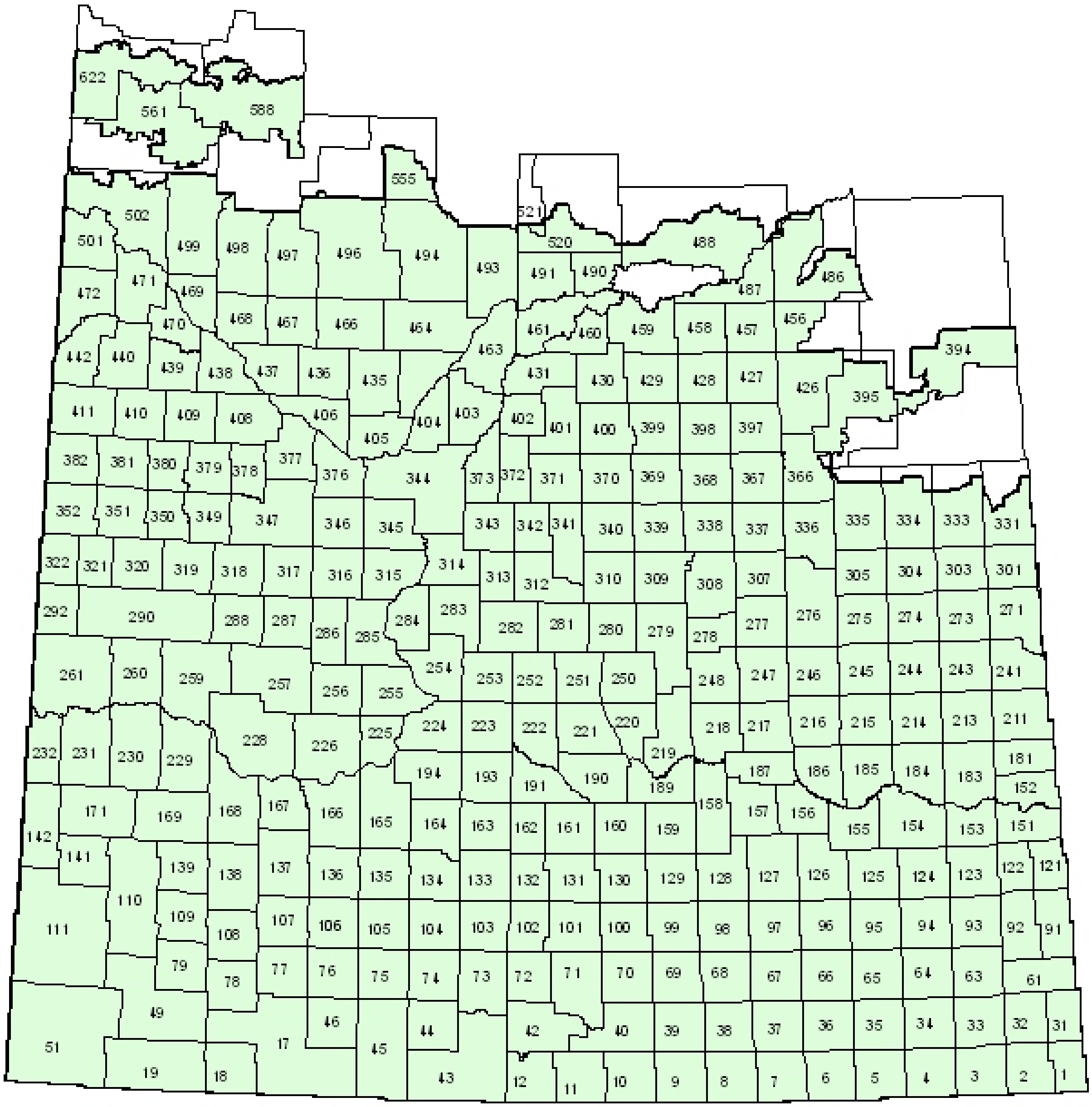

Figure 1. The shaded area shows the extent of the digital seamless 1:100,000 Soil Resource Data Coverage for agricultural Saskatchewan.

<u>Note:</u> Full map unit descriptions are not available for inclusion in this manual as of April 2004. It is intended that map unit descriptions will become an integral part of the digital 1:100,000 Soil Resource Database for Saskatchewan when this data is accessible in an internet environment.

Saskatchewan Detailed Soil Information Database Content Summary

The Saskatchewan Soil Resource Database is presently supplied as a line coverage along with several supporting databases and a User's Manual. This soil resource information is an interim product until such time as this data can be supplied as an integrated and multi-functional product through a Land Resource Viewer on a WEB service.

Data supplied:

SKSIDv4.e00 - An ArcInfo Export file of the soil line/soil polygon coverage for the agricultural area of Saskatchewan. Each polygon has a unique identifier POLYNUMB that provides a link to the unique Sask. Attribute databases PED_SK_SOIL_SKSID_100K.dbf and SKSISv3a.dbf and PED_SK_SOIL_SKSIDCMP_100K .dbf.

Projection	UTM
Units	Meters
Datum	NAD27
Zone	13

All soil line data has been adjusted to digital NTS 1:50,000 hydrography. Digital 1:50,000 contours were used to adjust soil lines along major topographic breaks in the landscape.

PED_SK_SOIL_SKSID_100K.dbf and SKSISv3a.dbf - Unique Sask. attribute databases created by the Saskatchewan Land Resource Unit, Agriculture and Agri-Food Canada. Attributes include Mapunit_SK (the Mapunit mapped in the field), SLOPE_RG (slope class mapped in field), SURFEX (surface expression, e.g. hummocky, undulating, etc), CAPBLTY (CLI Soil Capability for Agriculture), SALSYM (Soil Salinity rating), WIND (potential wind erosion rating), WATER (potential water erosion rating), IRRIG (Irrigation Suitability rating) See pages 41 and 42.

PED_SK_SOIL_SKSIDCMP_100K.dbf - Detailed Component database for Saskatchewan.
- See pages 43- 47

PED_SK_SOIL_SKSIDSNF_100K.dbf - Detailed Soil Names File for Saskatchewan.
- See pages 47, 48

PED_SK_SOIL_SKSIDSLF_100K.dbf - Detailed Soil Layer File for Saskatchewan.
- See page 49.

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The following list shows symbols that were used for non-soil entities in the MAPUNIT_SK field of PED_SK_SOIL_SKSID_100K.dbf, SKSISv3a.dbf and PED_SK_SOIL_SKSIDCMP_100K.dbf:

UR	City or town	IS	Industrial site
MS	Mine spoils	GP	Gravel Pit
FR	Forest Reserve		Lakes (named and unnamed), rivers

Please address any questions or comments to:
Alvin Anderson: Ph: (306) 975-5640, Email: alvin.anderson@agr.gc.ca

LANDFORMS

The last glacier retreated from the agricultural area of the province between 10,000 and 15,000 years ago. The majority of parent materials within the agricultural area of Saskatchewan, with the exception of those in the bottom of drainage channels, or exposed bedrock, were laid down as a result of glaciation.

The term landform refers to the shape imparted to the land surface by the surface geologic materials and the way in which they were deposited. Generally, three classes of landforms are recognized: glacial landforms whose formation was directly influenced by the ice sheet; landforms that resulted from lakes and streams near the melting ice sheet; and, landforms formed under the influence of wind and water after the ice and glacial meltwater disappeared.

1. SURFACE DEPOSITS

The following section outlines some of the common surface deposits.

Alluvial Deposits

Alluvial deposits are materials laid down by streams and rivers in valley bottoms and collection basins since glaciation. These deposits are stratified and often contain beds or layers that are oblique to the main planes of stratification, indicative of their river or stream origin.

Figure 2. Alluvial deposits in the Qu"Appelle Valley

Bedrock Deposits

Bedrock refers to preglacial sediments, exclusive of stratified deposits in preglacial valleys, that underlie the surficial glacial sediments. These bedrock materials may or may not be consolidated into solid rock and may be exposed at the surface.

Figure 3. Exposed bedrock deposits

Eolian Deposits

Eolian deposits are sandy or silty deposits that have been moved and re-deposited by the wind, often in the form of sand dunes or silty loessial veneers or blankets. Eolian deposits are well-sorted, poorly compacted and may contain beds or layers.

Figure 4. Partially active sand dune area

Fluvial Deposits
Fluvial deposits are materials laid down in rivers and streams carrying glacial meltwater. They are usually sandy or gravelly and may contain beds or layers that are inclined or oblique to the main planes of stratification. These deposits are usually thick but occasionally are thin and underlain by glacial till. Materials laid down in direct contact with the glacier are termed **glaciofluvial deposits**

Figure 5. This gravelly deposit has a very large-size stone component.

Lacustrine Deposits
Lacustrine deposits are materials laid down in a glacial lake. These deposits are often stratified and characterized by dark- and light-colored beds or layers reflecting summer and winter depositional cycles in a glacial lake. Lacustrine deposits usually have a high content of very fine sand-, silt- or clay- sized particles and are typically stone-free. Those dominated by sand sized particles are termed **loamy lacustrine** while those dominated by silt and clay sized particles are termed **silty** and **clayey lacustrine**, respectively. Materials laid down in close contact with the glacier are termed **glaciolacustrine deposits**.

Figure 6. Bands of dark- and light-colored layers are common, at depth, in lacustrine deposits. They reflect alternating summer and winter depositional sequences in former glacial lakes.

Morainal Deposits
Morainal deposits, often referred to as glacial till, are materials laid down by the glacial ice. These deposits are generally comprised of stones and gravels embedded in a matrix of sand, silt and clay sized materials. When this matrix contains nearly equal amounts of sand, silt and clay they are called **loamy morainal** deposits. When there are larger amounts of sand, they are referred to as **sandy morainal**.

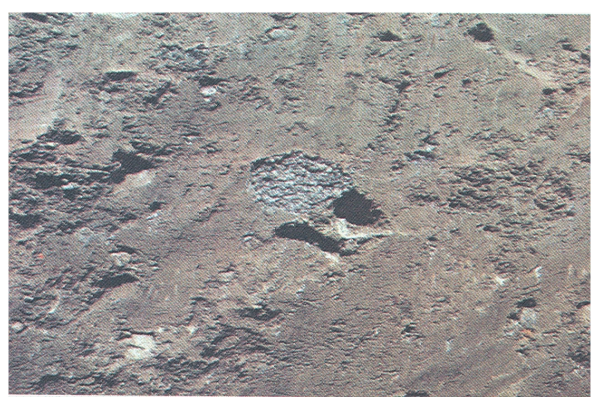


Figure 7. Morainal deposits typically have stones and pebbles of various sizes embedded in a matrix of sand-, silt- and clay-sized materials.

Organic Deposits

Organic deposits are the partially decayed remains of plants that have accumulated in wet or very poorly drained depressions and by the gradual in-filling of lakes by aquatic vegetation. They are generally comprised of either the remains of mosses, or sedges and grasses, and often have inclusions of woody materials.

Figure 8. Organic deposits occupy the central area of this photograph.

Undifferentiated Deposits

Where the origin of the materials for the purpose of mapping has not been specified, they are called undifferentiated deposits. These deposits often consist of a mix of materials in areas of steeply sloping land.

2. SURFACE FORMS

MINERAL SOILS

Aprons and Fans (a, f)

A fan is a gently sloping fan-shaped area resulting from the accumulation of sediments brought down by a stream descending through a deep ravine. A series of adjacent fans is called an apron. Fans and aprons are common in the Qu'Appelle Valley.

Hummocky (h)

Landscapes with a complex pattern of generally short steep slopes extending from prominent knolls to somewhat rounded depressions or kettles are termed hummocky. They are called **hummocky dissected (hd)** shallow gullies join one low area or kettle to the next and **hummocky gullied (hg)** numerous narrow ravines interrupt the hummocky features of the landscape. Occasionally, areas have a complex of ridged and hummocky features and are called **hummocky ridged (hr).**

Figure 9. Hummocky landscapes have a very irregular surface form.

Inclined (i)
Landscapes in which the general slope is in one direction, only, are called inclined. Where shallow gullies occur along the slope, the areas are called **inclined dissected (id)**. Where a series of deep gullies or ravines occur, they are called **inclined gullied (ig)**.

Figure 10. Landscapes with a prevailing slope in one direction are called inclined.

Level (l)
Landscapes that are flat or have very gently sloping surfaces are said to be level. Along flood plains of rivers and streams where the level surface is broken by abandoned river channels they are called **level channelled (lc)**.

Figure 11. The above photograph illustrates a typical level landscape.

Ridged (r)
Landscapes that have a linear pattern, usually of short and straight, parallel ridges but sometimes a single, sinuous ridge are called ridged. Some landscapes may have intersecting ridges.

Figure 12. This landscape has occasional ridges in an otherwise undulating landscape with gentle slopes.

Rolling (m)
Landscapes that are characterized by a sequence of long (often 1.6 km or greater), moderate to strong slopes extending from rounded, sometimes confined depressions to broad, rounded knolls, that impart a wavelike pattern to the land surface are called rolling. They are called **rolling dissected (rd)** where shallow gullies join one low area or kettle to the next.

Figure 13. A rolling landscape with large macro-relief.

Terraced (t)
Areas, usually along a valley, that have a steep, short scarp face and a horizontal or gently inclined surface (tread) above it are called terraced.

Undulating (u)
Landscapes that are characterized by a sequence of gentle slopes extending from smooth rises to gentle hollows, that impart a wave-like pattern to the land surface are called undulating. Where shallow gullies extend from one low area to the next in these landscapes they are called **undulating dissected (ud)** and where the undulating surface is broken by abandoned river channels they are called **undulating channelled (uc)**.

Figure 14. The crop field edge shows a wave-like pattern characteristic of an undulating landscape.

_______2a. **Erosional Modifiers (mineral soils)**

An erosional modifier indicates a modifying erosional process that has occurred within the landscape since retreat of the glaciers. Three different erosional modifiers are used, and one of these modifiers may be added to the code designation for a specific surface form (such as hummocky, undulating, inclined and others)

Channelled (c) : refers to abandoned meander channels or meander scars in the floodplain of a river. These abandoned meander channels may or may not be wet, and in many cases, tend to chop up otherwise valuable floodplains into small, tracts of land that are difficult or impossible to access and farm with machinery.

Dissected (d) : dissected: refers to relatively shallow surface drainageways or drainage networks that have developed on some landscapes. These subtle drainageways may be recognized in some landscapes, while in others, they can only be identified on aerial photographs. Numerous dissections in a landscape are a clear indication of the potential for rainfall to exit the landscape quickly into lakes or major streams, and in addition, to facilitate water erosion with the potential for significant soil to be moved from upper to lower slopes. Dissections are usually comparatively subtle landscape features and can be crossed readily with field implements.

Gullied - (g): gullied: refers to parallel and subparallel steep-sided, and narrow ravines that have developed from fluvial erosion on landscapes with strong to steep slopes. The gullies are typically deeply incised into the landscape so as to prevent farm implements from crossing such features.

ORGANIC SOILS

Blanket (B)
A mantle of organic materials that is thick enough to mask minor irregularities in the underlying material but still conforms to the general underlying topography.

Horizontal (H)
A flat peat surface that is not broken by marked elevations and depressions.

Bowl (O)
A bog or fen occupying concave-shaped depressions.

Ribbed (R)
A pattern of parallel low ridges associated with fens.

SOIL TEXTURE

Mineral soil is a mixture of various-sized mineral particles, decaying organic matter, air and water. The mineral particles, exclusive of stones and gravel, may be grouped into three particle-size fractions: sands (soil particles between 0.05 and 2 mm in diameter), silts (soil particles between 0.002 and 0.05 mm in diameter), and clays (soil particles less than 0.002 mm in diameter). The relative proportions of these particle-size fractions in a soil determine its **texture**. The textural triangle is used to illustrate the proportion of sand, silt and clay in the main textural classes. The vertical axis is percent clay, the horizontal axis is percent sand, while the remainder of each class is percent silt. Thus, when sand is dominant, it yields a sandy- or coarse-textured soil, whereas a fine-textured soil is made up largely of silt and clay. The terms "light" and "heavy" are often used to refer to sandy- and clayey-textured soils, respectively, and are actually a measure of the power required to till the soil. These terms have nothing to do with the actual weight of soil, as a given volume of dry sand actually weighs slightly more than that of clay.

Textural class names such as sandy loam, clay loam, heavy clay, etc., are given to soils based upon the relative proportions of sand, silt and clay. Three broad, fundamental textural groups are recognized: sands, loams and clays.

SANDS - The sand group includes soils in which the sand particles make up at least 70% of the material by weight. Two main classes are recognized: sand and loamy sand. Sands are further broken down into different sand sizes such as fine sand or coarse sand.

LOAMS - The loam group is intermediate in texture between the coarse-textured sands and the fine-textured clays, and usually contain a significant proportion of each particle-size fraction. Class names include: sandy loam, silt loam, silty clay loam, sandy clay loam, clay loam and loam.

CLAYS - The clay group includes soils that contain at least 35% clay-sized particles, and, in most cases, more than 40%. Class names are: sandy clay, silty clay, clay and heavy clay. Soils of this group are often referred to as "gumbo".

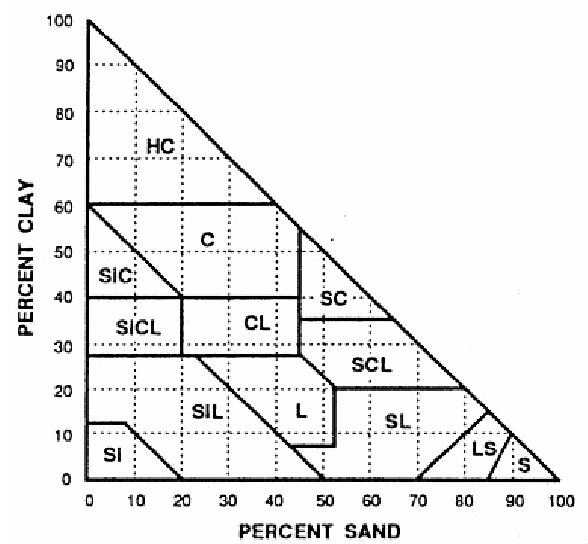


Figure 15. Textural triangle.

There are two fields Text1 and Text2 specified in the SKSISv3a.dbf. When there is one soil association specified in the Mapunit field, and a texture value in Text1 and Text2, the dominant texture is placed in Text1 and the subdominant texture is placed in Text2. If there are two soil associations specified in the field Mapunit, the general convention is that the texture value specified in Text1 refers to the first soil association and the texture value specified in Text2 refers to the second soil association. An example would be a soil association complex of WrAq (Weyburn soils formed in glacial till, and Asquith soils formed in sandy fluvial materials, in the Dark Brown soil zone). The value in Text1 would most likely be L (loam) and the value in Text2 would either be SL (sandy loam) or LS (loamy sand). This is generally the rule, although not always. In the case of a Mapunit of SuKd (Sutherland Chernozemic Dark Brown soils, and Kindersley Solonetzic Dark Brown soils, formed in clay lacustrine materials), Text1 may have a value of CL (clay loam) and Text2 may have a value of C (clay). It is quite common for the surface texture of clay lacustrine soils to range from clay loam to clay, and in this case, the values in Text1 and Text2 indicate a textural range for these soils.

There are two non-texture entries. The **"o" class** is used for organic soils. By definition, these soils do not contain any mineral component and, therefore, do not have a surface texture as defined and described above. The symbol “o” merely identifies the surface as being organic. The **“U” or unclassified class** is used for areas in which surface texture has not been determined. These include areas that have been greatly altered (such as gravel pits or mines), most wetlands and lakes, areas that have not been examined (such as towns and cities), and areas of extremely variable texture (such as Hillwash or Runway soils).

Soil Texture Classes

The following table lists the soil surface textures and associated symbols that may be used in this report, grouped into Surface Texture Groups.

Table 1. Soil textural groups and codes

Surface Texture Groups	Soil Texture Classes
Coarse	CS - Coarse sand S - Sand FS - Fine Sand LS - Loamy sand LFS - Loamy fine sand GS - Gravelly sand GLS - Gravelly loamy sand
Moderately Coarse	VL - Very fine sandy loam FL - Fine sandy loam SL - Sandy loam GSL - Gravelly sandy loam
Medium	L - Loam SI - Silt SIL - Silt loam GL - Gravelly loam
Moderately Fine	CL- Clay loam SICL - Silty clay loam SCL - Sandy clay loam FCL - Fine sandy clay loam VCL - Very fine sandy clay loam
Fine	HC - Heavy Clay C - Clay SIC - Silty clay SC - Sandy clay
Miscellaneous	
O	Organic
U	Unclassified

SLOPE (SLOPE_RG)

The term slope relates to the steepness of the slopes occurring in the landscape. Slope is expressed in percentages defined as the vertical rise over a horizontal distance.

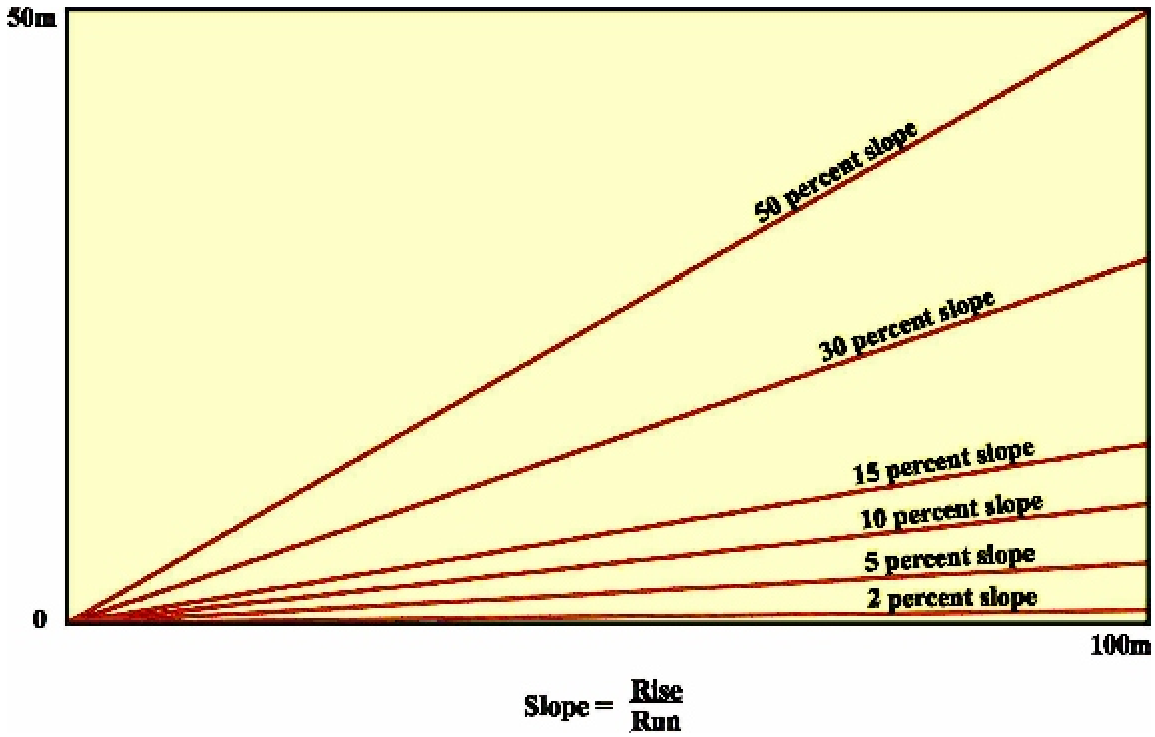


Figure 16. Slope is a key factor for separating out different landscapes when mapping soils in Saskatchewan.

Detailed soil maps in Saskatchewan will often express slope as a range defined within slope classes (e.g. 4 - 5). The slope classes defined for Saskatchewan are as follows:

Table 2. Slope Classes used for mapping soil landscapes.

Slope Class	Definition
1	0 to 0.5% slopes - Nearly level to level
2	0.5 to 2.0 % slopes. - Very gentle slopes
3	2.0 to 5.0 % slopes. - Gentle slopes
4	5.0 to 10.0 % slopes - Moderate slopes
5	10 to 15 % slopes - Strong slopes
6	15 to 30 % slopes - Steep slopes
7	30 to 45 % slopes - Very steep slopes.
U	Unclassified.

SLOPE LENGTH (SLPL)

Slope length refers to the average slope length in the soil polygon, from the top of the upper slope to the bottom of the lower slope. Slope lengths have been visually estimated in the field for approximately 70% of the agricultural area of the propvince. For some of the areas mapped on a map sheet basis, slope lengths were estimated for polygons by averaging the slope length over a large number of polygons with the same surface form for those areas that were mapped on a Rural Municipality basis and for which slope lengths had been estimated and mapped in the field.

Table 3. Slope Length Classes used for mapping soil landscapes.

Slope Class	**Slope Length (meters)**
1	0 - 25
2	25 - 50
3	50 - 100
4	100 - 500
5	500 - 1000
6	> 1000

INTRODUCTION TO SOILS

Much of the present section, has been adopted from H.C Moss, in a Guide to Understanding Saskatchewan Soils, and deals with features common to most prairie soils.

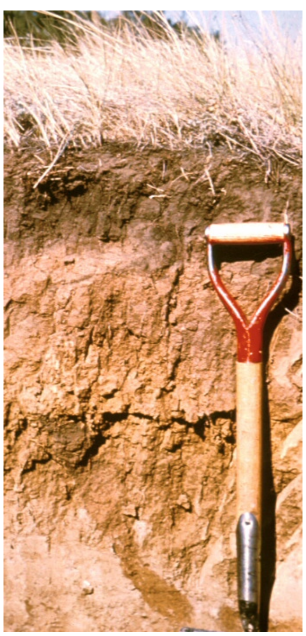
1. THE SOIL PROFILE

A soil is a natural body that occupies a relatively thin section (usually less than a meter) of the earth's surface and consists of several layers or horizons which differ in appearance and composition from the underlying material.

The formation of soil from the original geological deposit involves: the physical breakdown of rock fragments; the chemical weathering of these particles; biological activities including the growth of plants; the decomposition of plant remains, and the production of humus; the transfer of certain materials from one part of the soil to another; and the development of soil structure. As a result of these processes, which have been operative since deglaciation, changes appear in the original geological deposit in the form of visible layers extending from the surface downwards. The whole succession of layers down to and including the original geological deposit is called the **soil profile**. Each individual layer is called a **soil horizon**. A particular soil is recognized and separated from other soils by identifying the various layers or horizons which make up its profile. The recognition of soil profiles forms the basis of soil classification and soil mapping.

The soils of Saskatchewan are classified according to a national system of soil classification and the names given to the soils are derived, in part, from this system. For example, an orthic profile is a soil whose characteristics are defined as an Orthic Chernozemic soil of the National system.

Typically, three main horizons are recognized in the profiles of mineral soils. From the surface downward, these are designated by the letters **A**, **B**, and **C**. The arrangement and general properties of these soil horizons is presented below.



A - All or part of the surface soil. It may be dark coloured representing an accumulation of humus, or a light colored horizon from which clay, humus and other materials have been removed.

B - Occurs immediately below the A horizon. It may have an accumulation of clay and may have been altered to give a change in colour or structure.

C - Occupies the lower portion of the soil profile and usually represents the parent material. It is relatively unaffected by soil forming processes operative in the **A** and **B** horizons.

Figure 17. Above is a photograph of a soil profile that would be commonly encountered in the Black Soil Zone in Saskatchewan, and a description of the general characteristics of the major soil horizons.

2. SOIL FORMING FACTORS

All soils are formed as the result of the combined effects of several natural factors, and in many instances, the activities of man as well. These factors are *parent material, topography, drainage, climate, vegetation, time and man*. These factors are discussed to help our understanding of why soils differ from place to place.

Parent Material

Parent material, which is the name given to the geological deposit on which soils develop, largely determines soil texture and the original supply of minerals required by plants. It may also contribute to undesirable soil conditions such as salinity, acidity and alkalinity. It is also partly responsible for the topographic and drainage characteristics of a soil.

Soil texture, which is the proportion of sand, silt and clay sized particles present in a soil, is governed by the soil parent material. Textural classes are defined by means of a textural triangle (see page 9).

Topography and Drainage

These factors are discussed together because they are closely related in their effects on the formation of soils. Topography refers to the features of the surface of the land: differences in relief or height between one place and another, the direction, steepness and frequency of slopes, and the comparative roughness of the surface. Various combinations of these features occur from place to place, forming distinctive landscape patterns. Surface form, erosional patterns and slope gradients, the key elements of topography, are described in the Landform section of this manual.

Drainage refers to the conditions of water movement, both over the surface of the land and within the soil. Drainage is influenced by the climate, the kind of soil and parent materials, and the topography. This factor is discussed more completely in the Surface Drainage and Wetlands section.

Climate and Vegetation

Soils throughout Saskatchewan are closely related to the climatic conditions and to the type of vegetation that has prevailed since glacial times. Soils in southwestern Saskatchewan, having developed under a more or less arid climate with sparse grassland vegetation, are characterized by a brown surface horizon reflecting relatively low amounts of organic matter. To the north and east, the climate becomes less arid and the grassland vegetation more luxuriant and the surface layers of the soil become progressively darker due to the corresponding increase in organic matter. In northern Saskatchewan, where the climate is more suited to the growth of trees than grasses, the surface layers of the soil exhibit a light, grayish color reflecting an almost total lack of organic matter. These gradual changes in the organic matter content of the surface horizons of Saskatchewan soils, reflected by their color, forms the basis of soil zonal separations in the province (see illustration on page 15).

Time and Man

Time, as a factor in soil formation, is considered to be a combination of the actual length of time during which a soil has been forming, and the intensity or speed with which the physical, chemical, and biological activities responsible for changing raw parent material into a recognizable soil profile have proceeded. Perhaps the most compelling reason for knowing how long it has taken our soils to form, comes from the desire to predict the extent or rate of change of soil properties induced by the activities of man.

Man may act as a favorable or unfavorable factor in soil formation. By good management, he may maintain or even improve soil quality; by neglect or improper management, he may undo activities of soil formation or even destroy the productive capacity of the soil.

Soil Zones In Saskatchewan

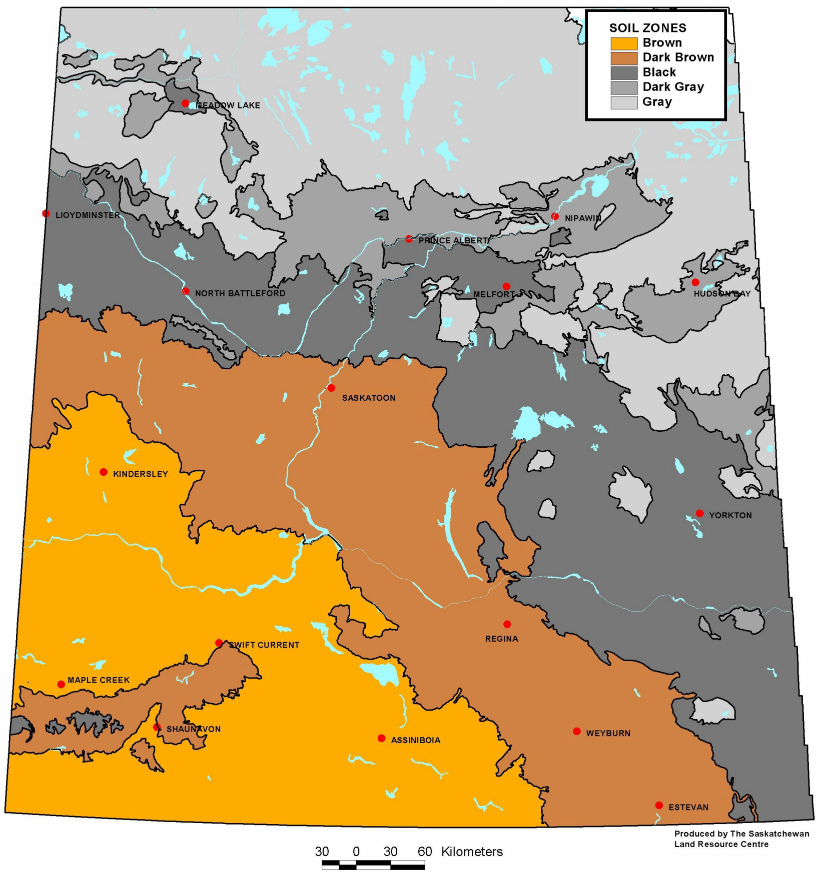


Figure 18. A map of the major soil zones of Saskatchewan.

3. KINDS AND DISTRIBUTION OF SOIL PROFILES

An understanding of how soils form and the factors involved in their formation is important if we are to understand why soils differ from place to place and if we are to successfully predict the extent and distribution of the various soil types within the landscape. In this regard, it is important to keep in mind that a soil at a particular site in the landscape is essentially the result of the combined effects of the soil forming factors, and it is thus said to be in equilibrium with the environment in which it was formed. Thus, if one or more of the soil forming factors at a particular site differs from that at another site, the soils at those sites will also differ.

The influence of climate and vegetation in creating broad, regional differences in soil characteristics (Brown, Dark Brown , Black, Dark Gray, Gray) has been mentioned earlier as has the influence of topography and drainage in determining differences in a local area. For instance, within a few metres on a single slope, a succession of soil profiles may be encountered, each reflecting the particular environment in which it was formed. A cross-section from a knoll through an adjacent depression to another knoll, in areas where the virgin vegetation was comprised of grasses and light stands of aspen, would reveal a succession of mainly Black profiles. In other areas unique drainage conditions have favored a heavier stand of aspen on the lower slopes. This has led to the formation of Dark Gray soils in this portion of the landscape with Black soils prevailing on the original grass-covered upper slopes. In some areas the entire landscape was covered by a heavy stand of aspen. This has led to the formation of Dark Gray soils on the upper slopes and knolls, and Gray Wooded soils in more moist and strongly leached portions of the landscape. These sequences of soils may be repeated time after time throughout a soil landscape. Not all soil areas, however, are comprised of a single geological deposit. Quite often, two or more deposits occur in close association within an area. One material may overly another regularly, for instance in a glacial till landscape where a silt overlies the till on lower slopes, or, one material may overlie the second in an irregular pattern, sometimes on the tops of hills, sometimes on the sideslopes, and at other times on lower slopes. Thus, a sequence of soils is present whose properties depend not only on relief and drainage aspects, but also on the distribution of materials within the landscape and the broad, regional climatic and vegetation influences previously referred to.

4. MAPPING THE SOIL RESOURCE

Soil survey uses a systematic and standardized method of examining, classifying and rating soil resources. Parent material (hence texture), surface expression of the landform, degree of slope, drainage, climatic zone and soil profile development are key factors considered in mapping soils. Other important factors taken into consideration are damage from wind and water erosion, salinity, stoniness, adverse soil structure, wetness, and susceptibility to inundation (flooding) from major rivers. There is a close relationship between the landform, the degree of slope, the parent material (whether a lacustrine silt or clay, a fluvial gravel or glacial till), the climatic zone and the type of soil profile that will develop. A detailed landscape classification is used in conjunction with a national system of soil classification in mapping soils. Typically, a unique landform, for example hummocky, with a particular slope range, will be separated out using a combination of air photo interpretation and visual verification. If through several site examinations (inspection pits), the same profile distribution is encountered on the same parent material(s) from the crest of a slope to the toe of the slope, then the soil surveyor is quite confident that the dominant soils are being described in that particular soil landscape. The soil profile is typically examined to a depth of one metre, which is referred to as the "control section"; this is the major rooting zone for common field crops. Soil lines then, are boundaries of areas that have a similar range of soil and landscape properties. It is important to recognize that soil mapping is done on a soil landscape basis and not on a quarter section basis.

Ideally, the area represented by each soil profile should be shown on the map. It is often the exception to find large uniform areas of a single parent material with only one type of profile development; such an exception would be an extensive clayey lacustrine deposit from a glacial lake. It is common to encounter several different profile types in a specific landscape, with two different parent materials (such as glacial till and silt). It is then necessary, at the map scale used of 1:100,000, to group different profiles and parent materials and portray these combinations on a soil map. These groupings combine small areas of several soils into a larger area. These larger areas are represented on the map, by a map unit that identifies the kinds and distribution of the component soil profiles.

The soil association is a term used to show the association or relationship between different soil profiles (i.e. different soil profiles developed at different slope positions) that have formed on the same geological deposit within a particular soil climatic zone. The Oxbow Association, for instance, is the name given to a group of soil profiles formed on loamy glacial till occurring in the Black soil zone; these profiles may include orthic, calcareous and eluviated. The various **map units** of the Oxbow Association (e.g Ox 1, Ox 2, Ox 12 etc.) reflect variations in the kind and distribution of Oxbow soil profiles, or more specifically, Oxbow **soil series** from one area to the next. Thus, in the description for the Ox 7 map unit, one would find that it contains the orthic Oxbow series and the calcareous Oxbow series. All map units are defined in terms of the occurrence of soil series. The soil series are divided into those that are **Dominant** (occupy over 40% of a given map unit) and those that are significant (occupy between 15 - 40% of a map unit). In cases where no single series is dominant, but two or more somewhat similar series, considered collectively, are dominant, they are referred to as a **Dominant Combination** of series. Similarly, several series which individually represent less than 15%, but collectively occupy greater than 15% of a map unit may be considered to represent a **Significant Combination** of series. In either type of "combination", all series included in the combination are typically enclosed by brackets in a map legend or database.

Where two geological deposits occur within a delineated area on the map, two associations are used in what is referred to as a complex map unit. The first association listed in the map unit is considered the dominant soil association and the second map unit is considered the sub-dominant or significant soil association. As an example, Mayfair-Cut Knife is the name given to a group of soils of the Mayfair and Cut Knife soil associations (Mayfair soils are Black soils that have formed in loamy glacial till, and Cut Knife soils are Black soils that have formed in shallow silty materials, less than one metre thick, overlying glacial till). Different map units of this complex are used to reflect variations in the kind and distribution of Mayfair and Cut Knife soils or series, from one area to the next. The soil- landscape relationship here is that the thin silty Cut Knife soils have been deposited in the lower slope areas of a glacial till landscape. As an exception, areas in which several geological deposits occur in a somewhat chaotic and unpredictable pattern throughout the landscape are often given a single association name. For example, Keppel is the name given to Dark Brown soils formed in a highly complex mixture of loamy glacial till, silty water-modified glacial till and silty glaciolacustrine materials. Whenever a complex map unit is used, there are usually two textures listed. In the majority of cases, the first texture listed will refer to the first association in the complex map unit, and the second texture will refer to the second map unit.

It is quite common for a thin geologic deposit (commonly 20 - 80 cm. thick) to overlie another deposit that is of a contrasting texture and sedimentary or depositional origin. We refer to the two deposits as two different parent materials. In some cases the first parent material may overlie the second parent material regularly and the Soil Association may be described as a thin parent material of one type overlying a second contrasting parent material; these soils have typically been mapped over extensive areas. In other cases, the first parent material may overlie the second parent material quite uniformly as a blanket throughout the entire landscape that has been mapped, but may not cover extensive enough area to be set up as a new soil association. In this case, the first parent material will typically be the named soil map unit and the second parent material will be indicated by a **substrate modifier** in the MAPUMOD field of **PED_SK_SOIL_SKSID_100K.dbf**, such as described below.

Table 4. Substrate modifiers for field mapping

MAPUMOD Symbol	Description
B	Bedrock
C	Clay
CL	Clay Loam
ET	Eroded Till
G	Gravel
GT	Gravel and Till
L	Loam
S	Sand
SG	Sand and Gravel
T	Glacial Till
TS	Till and Sand
TC	Till and Clay

It is also possible to find soils reflecting the characteristics of two soil zones within a local area. Under these circumstances, two associations are used to reflect these different soil properties. For example, Black Chernozemic and Dark Gray Chernozemic soils that have formed in loamy glacial till and that occur together in the same landscape, may be mapped in the Oxbow-Whitewood complex, with Oxbow referring to the Black soils and Whitewood to the

Dark Gray soils. Each of these soil associations will occupy a different slope position.

A hard copy soil map in Saskatchewan will typically show the location and extent of the different named soil types as reflected in the map unit, together with the associated texture, slope and surface form. The map legend provides a brief description of these features. The soil report describes the properties of the different soil types.

It is important to appreciate the concept of map scale. Map scale, by definition, infers the level of detail of the information portrayed on a map, whether the map is showing highways, hydrographic features such as lakes and streams, or soil types. In comparing two different map scales, a 1:50,000 map is a large scale map (greater detail) compared to a 1:250,000 map which is a small scale map (lesser detail). Most road maps will not show all the details of every minor change of direction or turn in the road, but rather the major direction changes. Likewise, a 1:50,000 scale topographic map shows much greater detail on stream shape and lake boundary shape than a 1:250,000 scale map; some hydrographic features that are on a 1:50,000 scale map will only show up as a generalized feature boundary on a 1:250,000 scale map.

The same conventions apply to soil maps. Soil maps produced at a small scale of 1:1,000,000 show only general soil properties and regional trends; these maps may often be a generalization of more detailed large scale maps at a scale of 1:100,000. The 1:1,000,000 maps are created for regional use such as at a provincial or prairie-wide scale of application or analysis. 1:100,000 maps on the other hand, lend themselves to be used at a local scale such as on a rural municipality or township basis. The detail of inspection employed in the field renders the soil information suitable for use at a scale of 1:100,000.

Soil survey data compiled at a scale of 1:100,000 may be used for a variety of applications, a few of which are listed below:

i) extrapolating fertility trials from one soil type to other areas in the province where the same soil type occurs;

ii) showing the soil capability for agriculture of different soil types;

iii) showing areas with different levels of soil degradation or potential degradation due to wind and water erosion or salinity, and hence target areas for soil conservation initiatives;

iv) showing the landscape suitability for specific crops in combination with other climate and crop requirement criteria;

v) providing information to farmers on the characteristics of land that may be desired for rent or for ownership;

v) providing a first evaluation of different soil landscape areas for Intensive Livestock Operation (ILO) sites. The 1:100,000 scale soil information is not of sufficient detail for very specific site application in cases such as site selection for sewage lagoons; minor amounts (1 - 10 acres) of highly contrasting soils (for example, a stony ridge or sandy area) will in all likelihood not be indicated on a soil map. The final decision to use an area for ILO operations will commonly require additional detailed information such as through soil examinations and mapping, perhaps at a scale of 1:5,000, along with deep drilling.

It is most important for the land manager to understand the scale, hence detail of the data, to not only extract the most information from the data, but also to recognize the limits of the data and not push the data beyond it's capability. The digital seamless 1:100,000 soil resource data for Saskatchewan is the most detailed soil inventory data available for the province and covers the entire agricultural area.

SOIL CAPABILITY FOR AGRICULTURE

The Canada Land Inventory, established in 1963 under the A.R.D.A. program, provides a framework by which we can utilize soil survey information, apply specific criteria or rules, and interpret or create Soil Capability Ratings for different soil types. Many factors, including climate, steepness of slope, complexity of landform, soil structure, salinity, wetness, water-holding capacity, adverse fertility characteristics, stoniness, susceptibility to flooding, and damage from wind and water erosion are considered in making a final interpretation for a Soil Capability for Agriculture rating.

The Soil Capability Classification is an interpretive classification of soils based on limitations affecting their agricultural use. In consideration of the Soil Capability Rating, the degree of limitation is expressed through the capability class and the kind of limitation is expressed through the subclass.

Fourteen different kinds of limitations are recognized as a result of climate, the soil and the landscape. The limiting effects of climate are considered first as they affect the initial capability class of soils on a broad subregional basis. The agricultural area of Saskatchewan has been divided into six climatic subregions. Three climatic subregions 1Cm, 2Cm and 3Cm are recognized on the basis of increasing aridity; three more climatic subregions 1Cs, 2Cs and 3Cs are recognized on the basis of frost incidence and heat units expressed as degree days. These are followed by the limitations characteristic of the Soil Association and textural types within a subregion. The subclass limitations related to adverse physical, chemical and /or morphological soil properties include water-holding capacity, poor structure, low natural fertility and salinity. The final limitations to be evaluated are related to the characteristics of the landscape itself. Landscape limitations include adverse topography, excess water, excess stoniness, erosion damage from wind or water, inundation (flooding from streams or lakes), and shallowness to bedrock.

Capability Class (Degree of Limitation)

The mineral soils of the province have been divided into seven capability classes (degree of limitation). Soils within Classes 1 to 3 are considered suitable for the sustained production of common field crops; soils within Class 4 are considered physically marginal for the sustained production of common field crops; soils within Class 5 are not suitable for the production of field crops and should be utilized for producing tame or native species of perennial forages (improvement practices are feasible); soils within Class 6 are suitable for native grazing only (improvement practices are not feasible); Class 7 areas are not suitable for agricultural use.

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

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

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

Class 4: Soils in this class have severe limitations that restrict the range of crops or require special conservation practices or both.

Class 5: Soils in this class have very severe limitations that restrict their use to the production of native or tame species of perennial forage crops. Improvement practices are feasible.

Class 6: Soils in this class are capable of producing native forage crops only. Improvement practices are not feasible.

Class 7: Soils in this class have no capability for arable agriculture or permanent pasture.

Class O: Unimproved or virgin organic soils are not rated for soil capability. They are not included in classes 1 to 7, and are designated by the letter ‘O’.

As a general rule, in rating each of the soils, those considered feasible of improvement by practices that can be made economically by the individual farm operator are classified according to their limitations after the improvements are made. Land requiring improvement beyond the means of the individual farmer, is classified according to its present condition.

As a general ranking of soil capabilities, Class 1 can be considered as excellent, Class 2 as good, Class 3 as fair and Class 4 as poor, for the production of common field crops. With a high level of management, it is entirely possible to reduce the risk of farming some Class 4 lands and obtain reasonable yields over the long term..

Capability Subclass (Kind of Limitation)

The capability subclass represents a grouping of soils that have the same kind of limitations for crop production. If more than one limiting condition is recognized in a particular area, the subclasses are listed in order of their importance.

Subclasses

i) Climatic Limitations

Limitations due to climate are caused by deficiencies in the amount and distribution of precipitation, length of growing season, frost free period and amount of heat units available for plant growth.

Subclass Cm: Moisture deficiency due to insufficient precipitation.

Subclass Cs: Heat deficiency expressed in terms of length of growing season and frost free period.

ii) Soil Limitations

Limitations due to soil deficiencies are caused by adverse physical, chemical and morphological properties of the soil.

Subclass D: Depicts adverse soil structure in the upper layers (A and B horizons) that affects the condition of the seed bed, prevents or restricts root growth and penetration, and adversely affects moisture permeability or percolation.

Figure 19. The above profile demonstrates adverse (dense) soil structure in the subsoil of a Solodized Solonetz. This structure occurs within the rooting zone and inhibits water infiltration, as well as plant root development and exploration for nutrients and subsoil moisture. Such a soil area would be rated as Class 4D.

Figure 20. The above photograph illustrates the impact of adverse soil structure of a Solodized Solonetz soil on a cereal crop. The crop is shortest where the soil structure is most severe (hardest).

Subclass F: Adverse fertility characteristics of soils having naturally low inherent fertility due to lack of available nutrients, high acidity or alkalinity, high calcium carbonate content or inadequate cation exchange capacity.

ii) Soil Limitations (con't)

Subclass M: Depicts an insufficient soil water-holding capacity due to the combined effects of the textural characteristics of the top 1 meter and by the organic matter content of the surface horizon.

Figure 21. The above photograph illustrates a typical Class 2M area with significant wet depressional areas that would be rated as Class 5W.

Subclass N: Depicts excessive soil salinity and applies to soils with either high alkalinity or a sufficient content of soluble salts to adversely affect crop growth or the range of crops which can be grown.

Figure 22. The above field of Canola has a significant area that is affected by severe salinity, which would be rated as Class 5N. Tolerance to a certain level of salinity varies from one crop type to another. Cereal grains, particularly barley and oats, are more tolerant than Canola; some forages are more tolerant than cereals.

Subclass S: Adverse soil characteristics. It is used in a collective sense in place of subclasses m, d, f, and n where more than two of them are present or where two of these occur in addition to some other limitation. For example, areas of dune sand are characterized by limitations due to insufficient water-holding capacity (M) and low fertility (F) coupled with erosion damage (E). The capability for these areas is often expressed as 6SE.

iii) Landscape Limitations

Limitations due to adverse characteristics of the soil landscape.

Subclass E: Depicts a limitation caused by actual damage from wind and/or water erosion.

Figure 23. Severe water erosion has occurred in this hummocky-dissected landscape after a heavy rainfall. Grassed water runways are required to prevent loss of large volumes of nutrient-rich top soil. The area damaged by water erosion would be rated as Class 5E.

iii) Landscape Limitations (con't)

Figure 24. The sandy soils in this field have very little clay content and have been subject to moderately severe wind erosion. The area damaged by wind erosion would be rated as Class 4E.

Subclass I: Depicts a limitation due to inundation and applies to soils subjected to flooding by lakes or streams, but does not include local ponding in undrained depressions.

Subclass P: Depicts a limitation caused by excess stones. It applies to soils that are sufficiently stony that the difficulty of tillage, seeding and harvesting are significantly increased.

Figure 25. The gently sloping landscape in the foreground above, if comprised of a loam soil in the Black soil zone, would normally be rated as Class 2M. The density of stones present would, however, cause this landscape to be downgraded to Class 3P.

Subclass R: Shallowness to bedrock. This applies to soils where the rooting zone is restricted by solid bedrock. This limitation has limited application within the agricultural area of Saskatchewan as most soils are developed on various forms of unconsolidated glacial deposits or on weathered shale and sandstone.

Subclass T: Depicts a limitation in agricultural use of the soil as the result of unfavorable topography. It includes hazards to cultivation and cropping imposed by increasing degree of slope as well as by the irregularity of field pattern and lack of soil uniformity.

Figure 26. The above soil landscape would be rated as Class 4T due to a moderately severe slope limitation. This area would be considered marginal for the production of common field crops.

Figure 27. The above soil landscape would be rated as Class 5T due to a severe topography (slope) limitation, and is not considered suitable for the production of common field crops. Such landscapes are at best suited to use for improved forage or else for native grazing.

iii) Landscape Limitations (con't)

Subclass W: Depicts a limitation due to excess water caused by either poor soil drainage, a high groundwater table or to seepage and local runoff. This does not include limitations that are the result of flooding.

Figure 28. The above wetland would be rated as Class 6W due to severe wetness. Under normal climatic conditions, water will remain in such a wetland well into the fall. Some native grazing might be possible around the perimeter of this wetland in late summer.

Subclass X: Soils having a moderate limitation due to the accumulative effect of two or more adverse characteristics of the soil and the landscape which singly are not serious enough to affect the class rating.

Example of Soil Capability symbols.

Simple symbol

3(10)M

This means that all of the soils in this area have been rated as Class 3 (Fair) due to a moderate moisture limitation.

Complex Symbol

2(5)M4(3)N5(2)W

This means that 50% of this soil polygon (soil area) is Class 2 (Good) due to a slight moisture limitation (2M); 30% of the soil area is Class 4 (poor) with a moderately severe limitation due to salinity (4N); and, 20% of the soil polygon is Class 5 soils (very poor) with a very severe limitation due to wetness (5W).

It is important to note that Soil Capability Ratings are based on the 1:100,000 soil polygon information which describes the dominant soils that occur in a delineated soil area. Individual fields are not rated and may have somewhat different properties from the general soil area. It is possible that highly contrasting soil or landscape features of minor areal extent (usually less than 5%) may occur in a soil area but will not be represented at the publication scale. A field specific examination and evaluation may be advisable as a final check before a decision is made to utilize a field for a crop that requires very narrow or specific soil characteristics.

SALINITY

Saline soils occur sporadically throughout the agricultural area of Saskatchewan. These soils contain sufficient water soluble salts to inhibit the uptake of moisture by plants, resulting in moisture stress and reduced plant growth. The presence of saline soils can often be recognized by bare spots in the crop or by uneven stands of grain or forage. Very strongly saline soils usually develop a white surface crust during dry weather. Where less salt is present, the soil is grayish in color when dry and the subsoil often has streaks or specks of salt at a depth of 5 to 25 cm or deeper. In weakly saline or moderately saline soils that are very wet, it may not be possible to see the salt.

Development of Saline Soils

Saline soils result almost invariably from the movement of salts carried by groundwater and subsequent concentration in the soil upon evaporation of this water at or near the soil surface.

Soluble salts are present in the parent materials of all soils as the result of on-going natural and physical weathering processes. When the amount of water evaporating from the soil is greater than the amount infiltrating, salts may accumulate and this may result in saline soils. Areas are subject to soil salinization where the water tables are high and the amount of infiltration of precipitation is limited. In most cases, this is a natural process which has been going on since the time of deglaciation. Agriculture has, however, aggravated the problem in some areas by the use of cropping systems that are not as water efficient as the natural prairie.

Management of Saline Soils

Management of saline soils requires the effective management of soil water in both the saline and nonsaline parts of the landscape. In terms of water management for soil salinity control this means making the most effective use of soil moisture possible. Extending the cropping rotation or continuous cropping in nonsaline areas will cycle more precipitation through crops rather than allowing it to reach the water table where it may contribute to salinity in some other location. Leaving stubble standing promotes a move even distribution of snow cover reducing the amount that blows off the land into large snow drifts or depressions where, upon melting, it has a greater chance of infiltrating to the watertable. Saline soils should be seeded to long-term forage or continuously cropped with crops having the appropriate degree of salt tolerance. The objective in saline areas is to reduce the amount of evaporation from the soil surface, lower the watertable level and move salts downward with infiltrating precipitation.

Table 5. The relative tolerance of common field crops to soil salinity . (Differences of one or two places in the ranking may not be significant.)

	Degree of Salinity Tolerated		
	Nonsaline	**Moderately Saline**	**Strongly to Very Strongly Saline**
		Annual Field Crops	
Increasing ↓ Tolerance	Soybeans Field Beans Faba Beans Peas Corn Sunflowers	Canola Mustard Wheat Flax Fall Rye[a] Oats Barley[a] Sugar Beets	Barley may produce some crop but this land is best suited to tolerant forages
		Forage Crops	
Increasing ↓ Tolerance	Red Clover Alsike Timothy	Reed Canary Meadow Fescue Intermediate Wheat Crested Wheat Brome Alfalfa Sweetclover[a]	Altai Wild Rye Russian Wild Rye Slender Wheatgrass[a] Tall Wheatgrass[b]

a These crops not tolerant of flooding, which is common in some saline areas.

b Under dry conditions slender wheatgrass is more tolerant than tall wheatgrass.

For more information on saline soils and their management, see the publication **The Nature and Management of Salt Affected Land in Saskatchewan** by Saskatchewan Agriculture, Soils and Crops Branch.

Explanation of the Salinity Symbol

The soil salinity symbol is made up of three components indicating the extent of saline soils, the degree of the salts in the saline soils, and the position in the landscape occupied by the saline soils within the delineation, and is based on field observation alone.

Example: 1WPA	1 - Extent Class W - Degree Class PA - Landscape

Salinity Classification

A new salinity classification system for field mapping was developed and implemented in 1982. A three or four character code was used to describe the presence of salinity in a soil polygon. The first character, a number, gives the extent class for percent of area affected; the second character, a letter, indicates a degree class, whether the salinity was weak, moderate, strong or very strong; the third and/or fourth character indicates where the salinity occurrs in the landscape. This new salinity classification system was applied to all areas mapped on an R.M. basis, from about 1980 to 1997, which constituted approximately 65% of the agricultural area of the province.

For that area of the province that was mapped on a map sheet basis, information for salinity was obtained from assessment information and a single character number extent class was applied to each polygon; all salinity was assumed to be moderate. The extent classes used for salinity in map sheet soil map areas is the same as that used for R.M. soil map areas.. The salinity rating for soil polygons originally in Map Sheet areas is the **best estimate** which can be done from the office, using existing information.

Soil Salinity Extent Class Limits

Table 6. Soil salinity extent class limits

Extent Class	% Of Area Affected
0	0
1	0 - 3
2	3 - 10
3	10 - 20
4	20 - 40
5	40 - 70
6	> 70

Soil Salinity Degree

Table 7. Description of soil salinity degree classes

Salinity degree	Electrical Conductivity of 0-60 cm depth (mS/cm)	Effect on Crop Growth and Estimate of Potential Yield Loss
Nonsaline	0 - 2	There are no visible effects of salts on the growth of crops. No yield loss.
(W) Weak	2 - 4	Yields of very sensitive crops may be restricted. Cereals are generally unaffected.
(M) Moderate	4 - 8	Yields of many crops are restricted. Wheat yields may be reduced by 30%.
(S) Strong	8 - 16	Only tolerant crops yield satisfactorily. Wheat yields may be reduced by 60%.
(V) Very Strong	16+	Only a few very tolerant crops yield satisfactorily. Wheat yields may be reduced by 80-100%.

Note: Electrical conductivity values based on a saturated paste extract
Yield loss estimates are based on recent research and only apply to the saline soils, not to the entire delineated area.

Landscape Position

The landscape position describes where in the landscape saline soils occur. In some areas, saline soils occur in more than one landscape position. These situations are indicated by the use of two letters.

Table 8. Description of landscape position symbol.

Symbol	Description
P	Saline soils occur on the edges of depressions, sloughs or runways. All soils in the bottoms of the depressions are leached and nonsaline.
A	Saline soils occur throughout the bottoms of depressions and sloughs.
D	Saline soils occur throughout the bottoms of dissections and small runways.
S	Saline soils occur on the sides of hills and slopes well above any slough or depression.
I	Saline soil parent materials within 60 cm of the soil surface generally occur on knolls and upper slopes.

Irrigation Suitability

The irrigation suitability rating is based on soil and landscape characteristics. The suitability rating uses limiting factors to predict the potential landscape-water-crop-interaction. It also considers the potential long-term consequences of irrigation such that the soil will remain permanently productive while being irrigated. It does not consider water availability and quality, climate, or economics. Within any one map delineation there may be smaller soil areas that have a higher or lower irrigation suitability than that indicated by the map symbol. **Any decision regarding irrigation should be made only after a field-specific examination is made.**

Symbol Interpretation

The combination of soil and landscape categories (Table 9), based upon the most limiting features present (Tables 10 and 11), determine the irrigation class and suitability rating (Table 12).

A maximum of three limitations are shown in the symbol. An ideal soil area to be used for irrigation will have the following characteristics:

- medium texture
- uniform texture vertically and horizontally
- uniformly drained
- nonsaline
- permeable
- nearly level
- nonstony

Table 9. Soil and landscape categories

Soil Category	Landscape Category	Description
1	**A**	**nonlimiting**
2	**B**	**slightly limiting**
3	**C**	**moderately limiting**
4	**D**	**severely limiting**

Irrigation Symbol
example 2Cmvt

2C - Irrigation class
m - Soil limitations
v,t_1 - Landscape limitations

The example above indicates that the area in question has slight limitations (2) due to soil factors (m) and moderate limitations (C) due to landscape factors (v, t_1). This area, therefore, has a fair suitability rating (Table 12).

Symbol Evaluation

Excellent to good areas (Table 12) can usually be considered irrigable. Fair areas are marginally suitable for irrigation providing adequate management exists such that the soil and adjacent areas are not affected adversely by water application. Poor soils can usually be considered nonirrigable. The rating is given for the area based on soil characteristics in the upper 1.2m and the main landscape features in the area. Depending on the type and severity of the limitation, it may be advisable to investigate an area further. Portions of the total area may also be significantly better or poorer than the general rating would indicate. For example, within poor area with steep slopes, there may be areas of gentler topography that may be suitable for small scale irrigation if the detailed examination indicates that this smaller area is otherwise suitable.

Decision to Irrigate

The cost of irrigation development can be expected to increase with less suitable soils. The suitability rating does not take into account important factors such as climate, agronomy, availability of water, or economics in determining the feasibility of an irrigation project. If a field is indicated to be suitable for irrigation based on the information presented in this report, then an onsite inspection should be made. Other factors not used in this rating should also be considered during a site specific examination. These include geological uniformity to 3 m, local relief, depth to bedrock, drainability, sodicity, organic matter content and surface crusting potential. These factors may affect the suitability to some degree in terms of the type of irrigation system that can be used, the type and amount of surface preparation needed, the response of the soil and crop to applied water, and the type of management needed. A decision can then be made whether to irrigate if economic conditions are suitable and an adequate source of water is available.

Irrigation can lead to improved stability and flexibility in farm production through improved reliability of water application. Although maximum yields may be attainable only through irrigation, assuming adequate management, other climatic considerations may affect the feasibility. Climatic factors may limit the range of crops that can be grown due to heat or growing season limitations. In higher rainfall areas of the province, irrigation water may only be, in many years a minor supplemental source of water that may not be needed every year. In these cases, the increased returns through higher yields, in some years, may not justify the expense of development. In dry regions where the risk of crop failure due to drought is relatively high and the range of crops that can be grown is lower, irrigation water may be a potentially important source of moisture needed for crop growth.

Table 10. Landscape limitations.

Symbol	Description
a	**Impact on target areas -** refers to the hazard resulting from the impact of applied irrigation water to the irrigated area. Impacts may include such effects as higher water tables, wetter soils, and increases in soil salinity.
c	**Impact on Nontarget Areas -** refers to the hazard resulting from the impact of applied irrigation water on an adjacent nonirrigated area. The hazard may include such effects as higher water tables, wetter soils, development or buildup of saline areas, or flooding and sedimentation caused by runoff.
i	**Inundation -** refers to the frequency of flooding. The inundation hazard is used mainly on areas adjacent to rivers.
p	**Stones -** refers to the amount of stones present on the surface and in the soil. Stones may reduce the available water-holding capacity of the soil, increase development costs and restrict the types of crops that may be grown.
t	**Slope -** refers to the presence of simple slopes (t_1) in undulating landscapes, or complex slopes (t_2) in hummocky or inclined landscapes. Complex slopes are often more limiting than simple slopes. Topography may affect the type of irrigation system, design and management required.
v	**Horizontal Variability -** refers to the horizontal variations caused by texture, soil structure, and landscape pattern that may result in the surface ponding of irrigated soils.

Table 11. Soil limitations

Symbol	Description
d	**Structure -** soil structure properties that restrict root and water penetration. Commonly used with soils that have a dense B horizon and an A horizon that is subject to crusting.
g	**Geological Uniformity -** the uniformity of the soil texture with depth. The greater the textural difference between the surface and subsoil, the greater the potential for the development of perched water tables and lateral water movement.
k	**Hydraulic Conductivity -** the rate at which water moves through a saturated soil. Used mainly on soil areas that swell upon wetting, restricting water movement through the soil.
m	**Available Water-Holding Capacity -** the amount of water held by a soil that can be absorbed by plants. Coarse-textured soils with a low water holding capacity are considered to be relatively inefficient for irrigation, as compared to medium-textured soils. Soils with this limitation also have relatively high hydraulic conductivities and intake rates.
q	**Intake Rate -** the rate of movement of water into the soil. It is closely associated with hydraulic conductivity which controls the rate at which water moves through the soil, and thus affects the rate at which water is able to enter the soil. Usually used on fine-textured soils that have relatively low intake rates requiring relatively light water application rates.
r	**Depth to Bedrock -** the presence of near-surface bedrock. Perched water tables may form, resulting in poor drainage and lateral movement of water and salts.
s	**Salinity -** the presence of soluble salts that may affect the growth of crops. The potential exists for lower yields, or for lateral salt movement into adjacent areas.
w	**Drainage -** the rate of removal of water from a soil in relation to supply. Indicates areas of mainly poorly drained soils.

Table 12. Irrigation suitability classes.

Class	Rating	Degree of Limitation	Description
0	Excellent	No soil or landscape limitations	These soils are medium textured, well drained and hold adequate available moisture. Topography is level to nearly level. Gravity irrigation methods may be feasible.
2A **2B** **1B**	Good	Slight soil and/or landscape limitations.	The range of crops that can be grown may be limited. As well, higher development inputs and management skills are required. Sprinkler irrigation is usually the only feasible method of water application.
3A **3B** **3C** **1C** **2C**	Fair	Moderate soil and/or landscape limitations.	Limitations reduce the range of crops that may be grown and increase development and improvement costs. Management may include special conservation techniques to minimize soil erosion, limit salt movement, limit water table build-up or flooding of depressional areas. Sprinkler irrigation is usually the only feasible method of water application.
4A **4B** **4C** **4D** **1D** **2D** **3D**	Poor	Severe soil and/or landscape limitations.	Limitations generally result in a soil that is unsuitable for sustained irrigation. Some lands may have limited potential when special crops, irrigation systems, and soil and water conservation techniques are used.

WIND EROSION

Wind Erosion Potential

The calculation of wind erosion potential is based on the following formula:

E(p) = C x T x I x K

E(p) **Potential annual soil loss**

C **Climatic factor** (based on average wind velocity and temperature).Values are compiled from weather stations and are presented on a rural municipality basis.

T **Landscape factor** (based on slope class and surface form). Topography, includ - ing the differences in relief between one location and another, the direction, steepness and frequency of slopes, and the comparative roughness of the land's surface, has a pronounced effect on the potential erodibility of soils.

I **Soil erodibility factor** (based on texture).
The relative proportions of sand, silt and clay present influence a soil's ability to absorb and retain moisture and, consequently, to form aggregates resistant to wind erosion. Coarse-textured soils have a "single grain" structure lacking sufficient amounts of silt and clay to bind individual sand particles together. Consequently, these soils are readily broken down and eroded by wind. Fine and medium-textured soils have a higher water-holding capacity and stronger surface attraction. This results in a good soil structure with a high degree of resistance to wind erosion.

K **Soil ridge roughness factor** (based on texture). The E(p) values from the formula are used to predict a soil's susceptibility to wind erosion if the soil surface is bare (i.e. it is summerfallow with no growth and no organic residue on the surface). Management practices and the actual amount of past wind erosion that has occurred are not considered.

Table 13. Wind erosion susceptibility classes.

Class	Susceptibility	Description
1	Very Low	Good soil management and average growing conditions will produce a crop with sufficient residue to protect these soils against wind erosion.
2	Low	Good soil management and average growing conditions may produce a crop with sufficient residue to protect these soils against wind erosion.
3	Moderate	Average growing conditions may not supply adequate residue to protect these soils against wind erosion. Enhanced soil management practices are necessary to control wind erosion.
4	High	Average growing conditions will not supply adequate residue to protect these soils against wind erosion. Coarse-textured soils may be seeded to grasses or legumes for forage production to prevent severe degradation of the soil.
5	Very High	These soils should not be used for annual cropping, but rather for pasture and forage crops which will protect the surface from severe degradation.
6	Extremely High	These soils must be left in permanent pasture and are not capable of sustaining arable agriculture.
U	Unclassified	Unclassified areas (e.g. Wetlands).

WATER EROSION

Water Erosion Potential

The potential water erosion classes obtained by using the Universal Soil Loss Equation. This equation is an erosion model developed in the United States to predict long term soil loss from runoff. The equation is:

$$A = R \times K \times L \times S \times C \times P$$

A Computed loss per unit area (tons per acre per year).

R Rainfall erosivity factor (the amount and intensity of rainfall an area receives).

K Soil erodibility factor (calculated using several physical soil properties: texture, organic matter, infiltration rate and structure).

L Slope length factor

S Slope steepness factor

C Cover and management factor

P Support practice factor

Assessment of potential water erosion for a particular area is independent of current management practices and therefore the C and P factors in the equation are held constant.

When using this information, it should be remembered that the class assigned to an area is an estimation of potential erosion for the entire area and that individual soils may occur within the area that vary significantly from the assigned class.

Table 14. Water erosion susceptibility classes.

Class	Susceptibility	Description
1	Very Low	Conventional soil management will produce sufficient residue to protect the soil from water erosion.
2	Low	Conventional soil management and average growing conditions should produce sufficient residue to protect the soil from water erosion
3	Moderate	Conventional farming practices will result in a steady loss of soil due to water erosion. Conservation practices should be instituted to prevent degradation of these soils.
4	High	Rapid loss of soil will occur unless conservation practices are instituted. All gullies in these areas should be grassed.
5	Very High	These soils should not be broken due to their water erosion hazard. If broken, perennial crops or permanent forage should replace annual crops.
U	Unclassified	Unclassified areas (e.g. wetlands).
D or G Modifiers		If an area was observed to be gullied (G) or dissected (D) (dissections being shallow gullies that can be crossed with farm implements), these symbols were added to the erosion class symbol to indicate that higher rates of erosion may occur on the steeper slopes along the edges of the dissection or gully if they are left unprotected.

STONINESS

The stones rating is an estimation of the average severity of stoniness in a delineation. The estimation is based on the amount of stone clearing activity and is related to the number and size of stones on the soil surface, number and size of stone piles, and the soil parent material observed. The amount of stone clearing activity required is categorized into one of six stone severity classes listed in the table below.

Table 15. Stone classes.

Symbol	Description
0	**Nonstony**
1	**Slightly stony** - stones seldom hinder cultivation. Light clearing is occasionally required.
2	**Moderately stony** - Stones are a moderate hindrance to cultivation. Annual clearing is usually required.
3	**Very stony** - stones cause a serious hindrance to cultivation. Sufficient stones to require clearing on an annual basis.
4	**Excessively stony** - Stones prohibit cultivation or make clearing a major task. Cultivation is usually severely hindered, even after regular, heavy clearing.
U	**Unclassified.**

Note: For soil polygons in areas originally mapped on an R.M basis, stone ratings for mineral soils were established in the field. In the case of mapsheet areas, stone ratings for mineral soil polygons were made in the field for only three out of the seven Map Sheet areas. For those Map Sheet areas without stone ratings, stoniness values were estimated based on knowledge of typical stone ratings expected on a range of parent naterials. Stone ratings were not always made for miscellaneous soils such as Hw (Hillwash), Mw (Meadow) or Rw (Runway) for all of the agricultural area of the province. Mineral soil polygons that do not have stone ratings are classified as U (unclassified).

DATA FILE STRUCTURES AND DESCRIPTIONS

PED_SK_SOIL_SKSID_100K and SKSISv3a.dbf are unique attribute databases created by the Saskatchewan Land Resource Unit, Agriculture and Agri-Food Canada, Saskatoon, that contain soil information and interpretations in addition to the NSDB (National Soil Database) files. The NSDB files for the Sask. Detail Dataset (1:100,000 scale) include:

PED_SK_SOIL_SKSIDCMP_100K (Soil Component File for Sask.),
PED_SK_SOIL_SKSIDSLF_100K (Soil Layer File for Sask.),
PED_SK_SOIL_SKSIDSNF_100K (Soil Name File for Sask.).

The information from each of the attributes in the non-NSDB databases applies to the whole polygon and not to each component of the Component File PED_SK_SOIL_SKSIDCMP_100K.dbf

Table 16. Saskatchewan Attribute Data File PED_SK_SOIL_SKSID_100K.dbf
(The following fields of interest are described**)**

Field Name	Description
MAPUNIT	Provides link to Component Table PED_SK_SOIL_SKSIDCMP_100K.dbf. MAPUNIT field was generated for each polygon by appending the PROVINCE and NSDB ID codes with POLYNUMB (a unique identifier for each soil polygon)
POLYNUMB	Unique polygon number (link between digital map coverage & database). Can be used as link to PED_SK_SOIL_SKSIDCMP_100K.dbf.
MAPUNIT_SK	Soil Association(s) (groups of related soil series developed on a specific parent material in a given soil climatic region) + number) (indicates soil series identified in field). Can correlate MAPUNIT_SK with series in CMP field of component database PED_SK_SOIL_SKSIDCMP_100K.dbf for specific soil polygon number or POLYNUMB
MAPUMOD	Code used when field mapping to show soil variations. Refers to Soil Association(s) in field MAPUNIT_SK. (see page 21)
SLOPE_RG	Slope class (see page 15)
SURFEX	Surface expression (see pgs 9 - 12)
SLPL	Slope length from crest to bottom of lower slope (meters)
SALSYM	Salinity rating (see page 28 - 30)
CAPBLTY	Soil Capability for Agriculture (see page 23 - 27)
WIND	Wind Erosion, potential (page 34)
WATER	Water Erosion, potential (page 35)
IRRIG	Soil Landscape Suitability for Irrigation (page 31-33)
NONSOIL	L - Lakes, named and unnamed, and rivers; GP - gravel pit; IS - industrial site; UR - Urban area; MS - mine spoils; FR - Forest Reserve

Note: Fields MAPUNIT_SK, MAPUMOD, SLOPE_RG, SURFEX, SLPL, SALSYM, CAPBLTY represent data that has been mapped in field. Fields WIND, WATER, IRRIG are calculated fields based on Sask. Soil Information.

The Soil Component, Soil Layer and Soil Name files are closely related NSDB files. In the past, a number of soils were mapped in a more general manner, and were not classified to the detail of the Subgroup level. As a result, the protocol is that these particular soils, or soil names are recorded in the Soil Names File, but are not represented in the Soil Layer File. If the particular soil series is not in the Soil Layer File, consequently, a texture for this specific soil series will not be present in the TEXTURE field of the Component File. SKSISv3a.dbf has been included in this Saskatchewan Detailed Data set so that the user may use the texture information in TEXT1 and TEXT2 which were mapped in the field. It should be noted that the values in the TEXTURE field of the Component File can be linked to the Soil Layer File and the associated particle size distribution, whereas the texture values in the TEXT1 and TEXT2 fields of SKSIv3a.dbf are not meant to be linked to the Soil Layer File. The information from each of these attributes applies to the whole polygon and not to each component of the Component file PED_SK_SOIL_SKSIDCMP_100K.dbf. In contrast, the texture values in the field TEXTURE in the Component File refer to each component, and were derived from the texture values in the TEXT1 and TEXT2 fields of SKSISv3a.dbf. Some of the values in the TEXTURE field of the Component File have been changed from the texture values in TEXT1 of SKSISv3a to narrow the range of acceptable surface textures as related to the central concept for a particular soil series.

SKSISv3a.dbf can be linked to PED_SK_SOIL_SKSID_100K.dbf through field POLYNUMB__

Table 17. Saskatchewan Attribute Data File SKSISv3a.DBF

Field Name	Description
POLYNUMB	Unique polygon number (link between digital map coverage & database)
MAPUNIT_SK	Soil Map Unit used in field mapping (indicates soil series present in soil polygon)
MAPUMOD	Substrate modifier used in field mapping, applies to field MAPUNIT_SK (see page 21)
TEXT1	Texture, dominant (see pgs 13 & 14)
TEXT2	Texture, subdominant (see pgs 13 & 14)

Note: Texture information is not indicated for soil polygons for miscellaneous soils such as Ex (Exposure), Hw (Hillwash), Mw (Meadow), Rw (Runway), Sx (Short Creek), Wz (Wetland).

Table 18. Soil Component Table PED_SK_SOIL_SKSIDCMP_100K.dbf

The SKSID Detailed Soil Component File (CMP) is a table containing the soil and landscape elements required to characterize a soil landscape polygon. The location of these components within the polygon is not defined.

The Component Table and landscape combinations allow linkage to the Soil NamesFile and the Soil Layer File.

Field Name	Description
MAPUNIT	Polygon identifier used to relate soil polygons to the CMP tables. The MAPUNIT field was generated for each polygon by appending the PROVINCE and NSDB ID codes with POLYNUMB (POLYNUMB is a unique identifier for each soil polygon)
CMP	An arbitrarily assigned number that uniquely identifies the soil series within the polygon.
PERCENT	Area of the soil map unit occupied by a specific component.
SLOPE	Predominant slope of the landscape. This value is a form of midpoint in relation to the SLOPE_RG value from PED_SK_SOIL_SKSID_100K.dbf (used in modelling applications for example)
STONINESS	Occurrence of stones at the surface of the soil.
SOILTYPE	Linkage key used to relate between the CMP, SNF and SLF tables. This field was concatenated from PROVINCE, SOIL_CODE, MODIFIER, LU
POLYNUMB	A unique identifier for each soil polygon on the soil map. Link between digital map coverage & database). Can be used as link to PED_SK_SOIL_SKSID_100K.dbf.
LU	Land Use
SOIL_CODE	Three character code representing the soil names found in the Soil Names File (SNF)
MODIFIER	Five character code used to show soil variations.
MAPUNIT_SK	Soil Association(s) (groups of related soil series developed on a particular parent material in a given soil climatic region) + number (indicates soil series identified in field). Can correlate MAPUNIT_SK with series in CMP field of component database PED_SK_SOIL_SKSIDCMP_100K.dbf for specific soil polygon number or POLYNUMB
MAPUMOD	Code used when soil mapping to show soil variations. Refers to the associated Soil Association(s) in MAPUNIT_SK.
TEXTURE	Soil texture class code that applies to each component of a soil polygon.

Table 19. MODIFIER field codes (For Soil Component File, Soil Layer File, Soil Names File)

i) Alpha Modifier Codes

Code	Description
A	Till substrate
B	Sand Substrate
C	Clay substrate
D	Gravel substrate
E	Eroded
F	Clay loam substrate
G	Gleyed[1]
H	Carbonated
K	Eroded till
L	Lithic
M	Weakly saline
N	Moderately saline
O	Strongly saline
P	Peaty
R	Bedrock substrate
S	Saline
T	Thick

The above alpha codes may occur in column 1, 2 or 3 of the 5 character MODIFIER field. Alpha codes are left justified.

Table 20. MODIFIER field codes (For Soil Component File, Soil Layer File, Soil Names File)

_______ **i) Numeric Modifier Codes**

Numeric Modifier Code	Texture Symbol	Texture Variant and related Mode of Deposition Parent Material 1
11	S	Sand surface texture variant, for MDEP1=COLL. FLUV, LACU, TILL, RESD
13	GS	Gravelly sand surface texture variant, for MDEP1=FLUV, TILL
14	CSL	Coarse sandy loam (< 15% clay) surface texture variant, for MDEP1=FLUV
15	CSL	Coarse sandy loam (>= 15% clay) surface texture variant, for MDEP1=GLFL
16	FS	Fine sand surface texture variant, for MDEP1=FLEO
17	GLS	Gravelly loamy sand surface texture variant, for MDEP1=FLUV
18	LS	Loamy sand surface texture variant, for MDEP1=COLL, FLEO, FLLC, FLUV, LACU, TILL, LATL, RESD, UNDM
19	LFS	Loamy fine sand surface texture variant, for MDEP1=FLUV
21	L	Loam (<15% clay) surface texture variant, for MDEP1=FLUV
22	SL	Sandy loam (< 15% clay) surface texture variant, for MDEP1=TILL
23	GSL	Gravelly sandy loam surface texture variant, for MDEP1=FLUV, TILL, RESD
24	SL	Sandy loam (< 15% clay) surface texture variant, for MDEP1=FLUV, LATL, RESD
25	SL	Sandy loam (>= 15% clay) surface texture variant, for MDEP1=FLLC, FLUV, LACU, UNDM
26	SL	Sandy loam (> 15% clay) surface texture variant, for MDEP1=COLL, LATL, TILL, RESD
27	FL	Fine sandy loam (< 15% clay) surface texture variant, for MDEP1=FLUV
28	FL	Fine sandy loam (>= 15% clay) surface texture variant, for MDEP1=FLLC, FLUV
29	FL	Fine sandy loam surface texture variant, for MDEP1=LATL, TILL
31	L	Loam (>= 15% clay) surface texture variant, for MDEP1=FLUV, GLFL

i) Numeric Modifier Codes

Numeric Modifier Code	Texture Symbol	Texture Variant and related Mode of Deposition Parent Material 1
32	L	Loam surface texture variant, for MDEP1=COLL, TILL, LATL
33	L	Loam surface texture variant, for MDEP1=EOLI, GLLC, LACU, UNDM
34	SIL	Silt loam surface texture variant, for MDPE1=EOLI, GLLC, LACU, LATL
35	GL	Gravelly loam surface texture variant, for MDEP1=FLUV, TILL, LACU
36	L	Loam surface texture variant, for MDEP1=FLLC
37	VL	Very fine sand loam (>= 15% clay) surface texture variant, for MDEP1 = FLUV, FLLC
38	SCL	Sandy clay loam surface texture variant, for MDEP1=EOLI, LACU
39	SCL	Sandy clay loam surface texture variant, for MDEP1 = TILL
41	SICL	Silty clay loam surface texture variant, for MDEP1=EOLI, GLLC, LACU
42	CL	Clay loam surface texture variant, for MDEP1=EOLI, FLUV, GLFL, GLLC, LACU
43	CL	Clay loam surface texture variant, for MDEP1=COLL, LATL, RESD, TILL, UNDM
44	L	Loam surface texture variant, for MDEP1=RESD
45	SICL	Silty clay loam surface texture variant, for MDEP1=LATL
47	SIC	Silty clay surface texture variant, for MDEP1=LACU
48	C	Clay surface texture variant, for MDEP1=FLUV, GLLC, LACU, UNDM
49	C	Clay surface texture variant, for MDEP1=COLL, LATL, TILL
51	HC	Heavy clay surface texture variant, for MDEP1= COLL, LACU, GLLC.
52	HC	Heavy clay surface texture variant, for MDEP1=RESD
54	VL	Very fine sandy loam (<15% clay) surface texture variant, for MDEP1=FLUV
55	VL	Very fine sandy loam (>= 15% clay) surface texture variant, for MDEP1=LATL

_______Numeric Code Explanation:

The above 2 character numeric codes may occur in columns 1 to 5 of the 5 character MODIFIER field. Numeric codes occur left-justified. If one or more alpha codes occur, the numeric code follows after the alpha code.

Table 21. Soil Name File   SKSNF.dbf PED_SK_SOIL_SKSIDSNF_100K.dbf

The SKSID Detailed Soil Survey Soil Names File (SNF) contains a listing of all soil names and their acceptable abbreviations in use un Saskatchewan., their status, along with characteristics and principal attributes of the soil. Soil Order, Great Group asnd Subgroup are listed, along with attributes such as mode of deposition and drainage class.

The Soil Names File describes and summarizes the characteristics of the entire soil profile.

See the following link for descriptions of fields in the Soil Names File:

http://sis.agr.gc.ca/cansis/nsdb/detailed/name/intro.html

http://sis.agr.gc.ca/cansis/nsdb/detailed/name/order3.html

http://sis.agr.gc.ca/cansis/nsdb/detailed/name/group3.html

Note PMCHEM / PMCALC correlation in table below.

Field Name	Description
SOIL_TYPE	Linkage key used to relate between the CMP, SNF and SLF files. This field was concatenated from PROVINCE, SOIL_CODE, MODIFIER, LU
PMCHEM1	See PMCALC1 field explanation in http://sis.agr.gc.ca/cansis/nsdb/detailed/name/intro.html for Parent Material Chemical Property 1
PMCHEM2	See PMCALC2 field explanation in http://sis.agr.gc.ca/cansis/nsdb/detailed/name/intro.html for Parent Material Chemical Property 2
PMCHEM3	See PMCALC3 field explanation in http://sis.agr.gc.ca/cansis/nsdb/detailed/name/intro.html for Parent Material Chemical Property 3

Table 22. PMTEX Descriptions:

PMTEX value	Definition
VC	Very coarse
C	Coarse
MC	Modeately Coarse
M	Medium
MF	Moerately fine
F	Fine
VF	Very fine
CS	Coarse skeletal
MS	Medium skeletal
FS	Fine skeletal
FR	Fragmental
SM	Stratified (Mineral)
SU	Stratified (Mineral and Organic)
FI	Fibric
ME	Mesic
HU	Humic
UD	Undifferentiated

Table 23. PMCHEM Descriptions:

PMCHEM Value	Definition
UD	Undifferentiated
EA	Extremely / Strongly Acidic
AN	Medium Acid to Neutral
WC	Weakly Calcareous
VC	Moderately / Very Strongly Calcareous
EC	Extremely Calacareous
SA	Calcareous and Saline
-	Not applicable

Table 24. Soil Layer File PED_SK_SOIL_SKSIDSLF_100K.dbf

The SKSID Detailed Soil Survey Layer File (SLF) is a table containing field descriptions as well as field and laboratory analyses of soil profiles necessary to interpret a soil for various purposes. This table contains attributes which vary in a vertical direction: textural or structural characteristics such as percentage of sand, silt and clay; water permeability, or chemical characteristics such as pH and cation exchange capacity.

The Soil Layer File describes the chemical and physical properties for each layer (horizon) associated with each soil listed in the Soil Names File.

Field Name	Description
SOILTYPE	Linkage key used to relate between the CMP, SNF and SLF files. This field was concatenated from PROVINCE, SOIL_CODE, MODIFIER, LU

See the following link for descriptions of fields in the Soil Layer File:

http://sis.agr.gc.ca/cansis/nsdb/detailed/layer/intro.html

Please see the following URLs for more information:

http://sis.agr.gc.ca/cansis/intro.html

http://sis.agr.gc.ca/cansis/nsdb/detailed/intro.html

http://sis.agr.gc.ca/cansis/publications/manuals/